

AD-A127 215

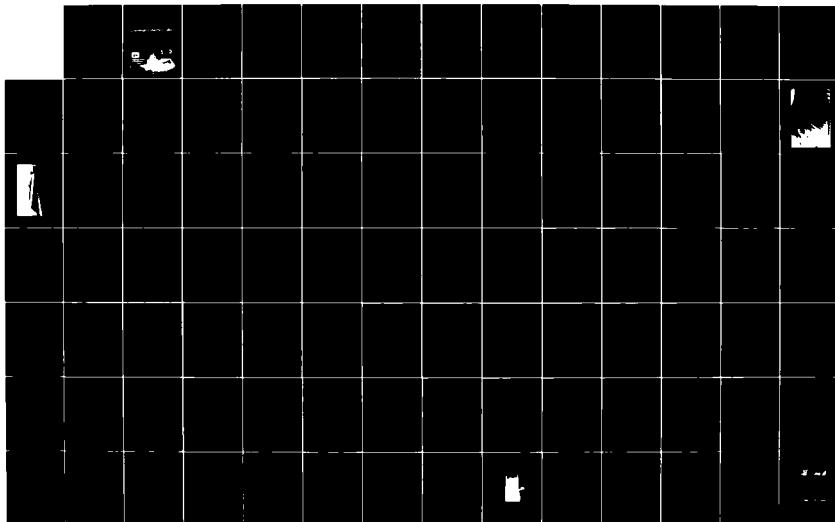
STAGE 2 REPORT FOR REFORMULATION PHASE I GENERAL DESIGN
MEMORANDUM CLEVELAND CORPS OF ENGINEERS BUFFALO NY
BUFFALO DISTRICT F J HENRY ET AL. FEB 83

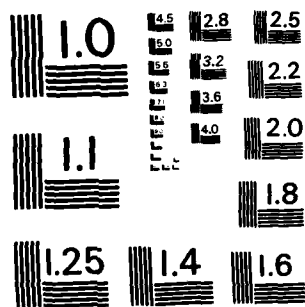
1/3

UNCLASSIFIED

F/O 13/10

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

— AD A127215 —

⑫

Stage 2 Report for
Reformulation Phase I
General Design Memorandum

Cleveland Harbor, Ohio

Volume I, Main Report

DTIC
ELECTE
APR 22 1983
S E D

FILE COPY

July 1982

1982

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A127215	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Cleveland Harbor, Ohio Stage 2 Report for Reformulation Phase I General Design Memorandum. Volume 1: Main Report		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, Buffalo 1776 Niagara Street Buffalo, N.Y. 14207		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Office of the Chief of Engineers Washington, D.C. 20314		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE February 1983
		13. NUMBER OF PAGES 239
		15. SECURITY CLASS. (of this report) N/A
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Cleveland Harbor Commercial Navigation Recreational Fishing Cuyahoga River		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This Reformulation Phase I GDM study is to develop a final plan to modify Cleveland Harbor for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor. The recreational fishing plan recommended in the 1976 Feasibility Report will also be reevaluated. However, as will be discussed in Section II of the Main Report, "Problem Identification," during coordination of the Plan of Study for this study and subsequent correspondence, local interests expressed the need for further modifications to the general navigation features of Clevela-		

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

nd Harbor in the interest of commercial navigation. These additional modifications include: (1) deepening the Cuyahoga River such that the depth of the navigation channel would be compatible with the Great Lakes System's draft of 25.5 feet (Note: The Cuyahoga River is presently authorized for a 23-foot project depth and can accomodate a vessel loaded to about 21 feet. Thus, vessels are forced to lighter (reduse their draft) or come into Cleveland Harbor light-loaded before proceeding upriver.); (2) modify the Cayuhoga River navigation channel at various locations where undue vessel delays are encountered due to physical restrictions in the channel; and (3) completion of the authorized but uncompleted improvements on the Old River (discussed in greater detail in Section II of the Main Report, "Problem Identification"). Therefore, the original scope of this study was expanded to include formulation, assessment and evaluation (both economic and environmental) of these proposed additional modification plans.

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
M. E. B. G. V. M.	
By 4-22/83	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A	



SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

CLEVELAND HARBOR, OH
STAGE 2 REPORT
FOR
REFORMULATION PHASE I GDM

TABLE OF CONTENTS

<u>Paragraph</u>	<u>Description</u>	<u>Page</u>
	ACKNOWLEDGMENTS	
	SECTION I - INTRODUCTION	1
1	GEOGRAPHICAL SETTING	1
2	STUDY AUTHORITY	1
3	PURPOSE OF REFORMULATION PHASE I GDM AND STAGE 2 REPORT	5
4	SCOPE OF STUDY	8
5	STUDY PARTICIPANTS AND COORDINATION	15
6	THE REPORT	22
7	PRIOR STUDIES AND REPORTS	23
	SECTION II - PROBLEM IDENTIFICATION	30
8	EXISTING CONDITIONS	30
9	PROBLEMS, NEEDS, AND OPPORTUNITIES	65
10	PLANNING CONSTRAINTS	89
11	NATIONAL OBJECTIVES	92
12	SPECIFIC PLANNING OBJECTIVES	92
13	CONDITIONS IF NO FEDERAL ACTION TAKEN	93
	SECTION III - FORMULATION OF PRELIMINARY ALTERNATIVE PLANS	95
14	PLAN FORMULATION RATIONALE	95
15	GENERAL FORMULATION AND EVALUATION CRITERIA	103
16	DEVELOPMENT OF ALTERNATIVE PLANS	107
17	PLANS OF OTHERS	112

TABLE OF CONTENTS (Cont'd)

<u>Paragraph</u>	<u>Description</u>	<u>Page</u>
	SECTION IV - ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS	118
18	LAKEFRONT HARBOR MODIFICATION PLANS	119
19	OLD RIVER MODIFICAITON PLANS	143
20	CUYAHOGA RIVER MODIFICATION PLANS	153
21	RECREATIONAL FISHING PLANS	190
22	NO-ACTION PLAN	198
23	SUMMARY EVALUATION OF IMPACTS DURING CONSTRUCTION	199
24	SUMMARY EVALUATION OF IMPACTS FOR FUTURE CONDITIONS	202
25	COMPLIANCE WITH ENVIRONMENTAL PROTECTION STATUTES	203
	SECTION V - COMPARISON OF PRELIMINARY PLANS	206
26	COMPARISON OF PRELIMINARY PLANS	206
27	TRADE-OFF ANALYSIS	206
28	RATIONALE FOR PLANS ELIMINATED FROM FURTHER STUDY	214
29	RATIONALE FOR PLANS WARRANTING FURTHER DETAILED STUDY	215
30	FUTURE ACTIONS ON AUTHORIZED BUT UNCOMPLETED PROJECTS AT CLEVELAND HARBOR	216
31	RATIONALE FOR CANDIDATE NED PLAN(S) AND EQ PLAN(S)	218
32	LOCAL RESPONSE TO STAGE 2 EVALUATION OF ALTERNATIVES	218
	SECTION VI - STUDY MANAGEMENT	220
33	STAGE 3 METHODOLOGY	220
34	PUBLIC INVOLVEMENT AND COORDINATION FOR STAGE 3	223
35	REFORMULATION PHASE I GDM SCHEDULE	223
36	SCHEDULE OF MAJOR ACTIVITIES THROUGH CONSTRUCTION	223

TABLE OF CONTENTS (Cont'd)

<u>Paragraph</u>	<u>Description</u>	<u>Page</u>
	SECTION VII - CONCLUSIONS	224
37	CONCLUSIONS	224
	SECTION VIII - RECOMMENDATIONS	226
	REFERENCES	
	APPENDICES	
<u>Appendix</u>	<u>Description</u>	
A	GEOTECHNICAL	
B	ECONOMIC EVALUATION	
C	COASTAL ENGINEERING DESIGN	
D	DESIGN	
E	COST ESTIMATES	
F	PERTINENT CORRESPONDENCE	
G	PUBLIC INVOLVEMENT	
H	REPORTS OF OTHERS	
I	STUDY MANAGEMENT	
J	PLATES	

TABLE OF CONTENTS (Cont'd)

TABLES

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
1	Prior Corps of Engineers Reports for Cleveland Harbor	24
2	Concentration Ranges of Water Constituents Cleveland Outer Harbor, 1967	36
3	Cuyahoga River Water Quality 1978-1980	37
4	Federal and State Ambient Air Quality Standards	41
5	Number of Days in Which Air Quality Standards Were Exceeded	42
6	Relative Abundance of Fishes Collected in Cleveland Harbor and Adjacent Marinas During 1971-1974	44
7	Fish Species Collected as Fry or Young-of-the-Year in Cleveland Harbor, 1972-1974	46
8	Benthic Macroinvertebrate Taxa Reported in the Lake Erie Nearshore Zone in the Vicinity of Cleveland, OH	47
9	Bridges Spanning the Cuyahoga River and Old River	51
10	Submerged Pipelines, Submerged Cables, Tunnels, and Aerial Cables Crossing the Cuyahoga and Old Rivers Within the Existing Federal Project Limits	52
11	Historical and Projected Employment by Industry in the Cleveland SMSA	55
12	Characteristics of the Great Lakes Fleet, 1981	61
13	Selected Commodity Movements at Cleveland Harbor, OH	66
14	Projected Commodity Tonnages - Cleveland Harbor	67
15	Commercial Dock Data - Cleveland Harbor	69
16	Required Entrance Channel Depths	76
17	Required Cuyahoga River Navigation Channel Depth	80
18	Reported Accidents at Congestion Points on the Cuyahoga River Navigation Channel	84

TABLE OF CONTENTS (Cont'd)

TABLES

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
19	Summary of Costs and Benefits, Four Main Improvement Alternatives (1972-1976 Feasibility Study)	101
20	Estimate of Total Project Costs for Plan 1	122
21	Estimated Investment Cost and Annual Changes for Plan 1	123
22	Summary of Benefits and Costs for Plan 1	124
23	Estimate of Total Project Cost for Plan 2	128
24	Estimated Investment Cost and Annual Changes for Plan 2	129
25	Estimate of Total Project Cost for Plan 3A	131
26	Estimated Investment Cost and Annual Changes for Plan 3A	132
27	Summary of Benefits and Costs for Plan 3A	133
28	Estimate of Total Project Cost for Plan 3B	137
29	Estimated Investment Cost and Annual Changes for Plan 3B	138
30	Summary of Benefits and Costs for Plan 3B	136
31	Estimate of Total Project Cost for Plan 4	141
32	Estimated Investment Cost and Annual Changes for Plan 4	142
33	Estimate of Total Project Cost for Plan 5A	145
34	Estimated Investment Cost and Annual Charges for Plan 5A	146
35	Summary of Benefits and Costs for Plan 5A	147
36	Estimate of Total Project Cost for Plan 5B	150
37	Estimated Investment Cost and Annual Charges for Plan 5B	151

TABLE OF CONTENTS (Cont'd)

TABLES

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
38	Summary of Benefits and Costs for Plan 5B	152
39	Estimate of Total Project Cost for Plan 6A	155
40	Estimated Investment Cost and Annual Charges for Plan 6A	156
41	Summary of Benefits and Costs for Plan 6A	157
42	Estimate of Total Project Cost for Plan 6B	159
43	Estimated Investment Cost and Annual Charges for Plan 6B	160
44	Summary of Benefits and Costs for Plan 6B	161
45	Estimate of Total Project Cost for Plan 7B	164
46	Estimated Investment Cost and Annual Charges for Plan 7B	165
47	Summary of Benefits and Costs for Plan 7B	166
48	Estimate of Total Project Cost for Plan 7C	169
49	Estimated Investment Cost and Annual Charges for Plan 7C	170
50	Summary of Benefits and Costs for Plan 7C	171
51	Estimate of Total Project Cost for Plan 7D	174
52	Estimated Investment Cost and Annual Charges for Plan 7D	175
53	Summary of Benefits and Costs for Plan 7D	173
54	Estimate of Total Project Cost for Plan 7E	178
55	Estimated Investment Cost and Annual Charges for Plan 7E	179
56	Summary of Benefits and Costs for Plan 7E	180
57	Estimate of Total Project Cost for Plan 7F	183

TABLE OF CONTENTS (Cont'd)

TABLES

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
58	Estimated Investment Cost and Annual Charges for Plan 7F	184
59	Summary of Benefits and Costs for Plan 7F	182
60	Estimate of Total Project Cost for Plan 7G	187
61	Estimated Investment Cost and Annual Charges for Plan 7G	188
62	Summary of Benefits and Costs for Plan 7G	186
63	Estimate of Total Project Costs for Plan 8A	192
64	Estimated Investment Cost and Annual Charges for Plan 8A	193
65	Summary of Benefits and Costs for Plan 8A	191
66	Estimate of Total Project Cost for Plan 8B	196
67	Estimated Investment Cost and Annual Charges for Plan 8B	197
68	Summary of Benefits and Cost for Plan 8B	195
69	Summary of Effects for Plans 1 through 6B	207
70	Summary of Effects for Plans 7B through 8B and 10	210
71	Summary of Benefit-Cost Ratios for Alternative Plans No. 1 Through 8B	212a

FIGURES

<u>Number</u>	<u>Description</u>	<u>Page</u>
1	Regional Location Map	2
2	Hydraulic Model Layout	12
3	Overhead Photograph of Hydraulic Model	13
4	Scale Model 1,000-foot Vessel Entering West (Main) Entrance	14
5	Wir Diagram of Cleveland, Ohio	32
6	General Soil Map	34

TABLE OF CONTENTS (Cont'd)

FIGURES

<u>Number</u>	<u>Description</u>	<u>Page</u>
7	Pollution Intensity Zones in the Near Shore Lake Area of Cleveland	35
8	The Great Lakes-St. Lawrence Navigation System Geographic Extent and Profile	59
9	Cereal Food Processors, Inc. Facility	78
10	Conrail Bridge No. 14	83
11	Jefferson Avenue Bridge Abutments	83
12	Cuyahoga Valley National Recreation Area Location Map	87
13	Plan 3 - "All-Weather" West Entrance (1972-1976 Feasibility Study)	99
14	Detached East Arrowhead Extension Concept for "All-Weather" West Entrance Plan	110
15	"L"-Shaped Breakwater Concept for "All-Weather" West Entrance Plan	111
16	Whiskey Island Recommended Development Plan	113
17	Port of Cleveland Recommended Development Plan	114
18	Proposed LEAP Dock 20 Modifications	116

ACKNOWLEDGMENTS

This Stage 2 Report was prepared through the efforts of many individuals on the Interdisciplinary Team within the Buffalo District and Waterways Experiment Station of the Corps of Engineers and from other agencies and industry representatives involved with the Cleveland Harbor project. The following are the Corps personnel who were most instrumental in conducting the investigation and preparing the text presented herein:

Buffalo District:

Frank J. Henry	Former Study Manager, Western Basin
Richard Aguglia	Study Manager, Western Basin
John Zorich	Chief, Western Basin
Henry Gartner	Economist
Roger Haberly	Economist
Michael Smith	Economic Assistant
David Heicher	Biologist
Cynthia Lamothe	Geotechnical Engineer
Thomas Kenna	Geotechnical Engineer
Brian Greene	Geologist
Richard Gorecki	Coastal Engineer
Rodger Repp	Civil Engineering Technician
Robert Johnston	Civil Engineer
Jonathan Koszuta	Survey Technician

Waterways Experiment Station:

Ray Bottin	Project Manager, Wave Processes Branch
C.E. Chatham, Jr.	Chief, Wave Processes Branch
Hugh Acuff	Civil Engineering Technician
Ralph Ankeny	Computer Technician
Lonnie Frair	Electronics Technician

Other agencies have contributed to this report through the preparation of supplemental reports and participation in agency workshops. The individuals involved are numerous and not easily identified. Therefore, recognition is provided by the names of their employing agencies as follows:

North Central Division, Corps of Engineers
Cleveland-Cuyahoga County, Port Authority
U.S. Fish and Wildlife Service, Columbus Field Office
Ohio Department of Natural Resources
United States Coast Guard, Ninth Coast Guard District
Industrial Users of Cleveland Harbor

The report itself was produced through the efforts of many other Corps personnel, including the following who contributed significantly to its preparation:

Roman Bartz	Chief, Drafting Section
Irving Stone	Drafting Section

Christine Kosinski
John Acker
Mary Hamilton
Donna Davis
Paul Ehrensberger
Freda Soper
Lillian Stryczek
Diane Szymkowiak
Mary Ann Schultz
Jeanette Dezaiffe
Mattie Davis
George Key

Drafting Section
Drafting Section
Drafting Section
Drafting Section
Chief, Word Processing Center
Word Processing Center
Word Processing Center
Word Processing Center
Word Processing Center
Word Processing Center
Chief, Reprographics Branch

The Buffalo District Engineer during the initial phase of this Stage 2 study was Colonel George P. Johnson and the District Engineer during the final phase was Colonel Robert R. Hardiman, the Chief of the Engineering Division was Donald M. Liddell and the Chief of the Planning Division was Charles E. Gilbert.

Special thanks go to Captain William J. McSweeney, consultant to the Buffalo District, Captain Alton E. Haynes of American Steamship Company, and Captain G. V. Chamberlain of Hanna Mining Company who conducted ship navigation tests at Waterways Experiment Station in conjunction with the development of west entrance plans for 1,000-foot vessel operation.

Finally, the efforts of other individuals who participated in the study and report preparation but whose names have not been mentioned above, are gratefully acknowledged.

SECTION I

INTRODUCTION

The purpose of this section is to introduce the reader to the Cleveland Harbor study and to explain the content and organization of this report. The section presents information on the geographical setting of the study area, the study authority, the purpose of the study, the scope of the study, study participants and coordination, the organization of the report and prior studies and reports pertinent to this Cleveland Harbor study.

1. GEOGRAPHICAL SETTING

Cleveland Harbor, Ohio (see Figure 1) is located on the south shore of Lake Erie, at the mouth of the Cuyahoga River, approximately 176 miles southwest of Buffalo, New York and 96 miles east of Toledo, Ohio. The harbor includes a breakwater protected Lakefront Harbor and an Inner Harbor consisting of improved navigation channels on the Cuyahoga River and Old River. The harbor area is shown on Plates 1 and 2 in Appendix J, "Plates."

The Cleveland Lakefront Harbor extends for a distance of about 5 miles along the shoreline and varies in width from about 1,600 to 2,400 feet. Entrance into the Lakefront Harbor is provided through either the dredged channel between the arrowhead breakwaters (main or west entrance) or between the easterly end of the east breakwater and the shore (east entrance). The Cleveland Inner Harbor includes improved navigation channels on the lower 5.8 miles of the Cuyahoga River and about 1 mile of the Old River, the former outlet of the Cuyahoga River. Widths in the navigation channels vary from 100 to 325 feet, except at the bends and in the existing turning basin in the Cuyahoga River where a width of 800 feet is available.

Cleveland Harbor accommodates the waterborne movement of bulk and general cargo to and from the city of Cleveland and inland portions of the State of Ohio and adjacent States. During the 10-year period 1969 to 1978, an average of about 20,400,000 net tons of cargo entered the harbor and about 600,000 net tons of cargo were shipped from the harbor, ranking it as one of the major harbors on the Great Lakes. Vessel movement of bulk iron ore, limestone, sand and gravel, and salt accounted for about 92 percent of the total cargo. The configuration of the breakwaters and navigation channels, however, limit the size and effective utilization of the vessels which can move these commodities. Significant transportation savings could be realized if the harbor were modified to permit the use of larger and/or more efficient utilization of existing sized vessels.

2. STUDY AUTHORITY

a. Congressional Authority.

A resolution passed by the Committee on Public Works of the House of Representatives on 2 December 1970, authorized the Corps of Engineers to conduct a feasibility study to determine if modifications to the general

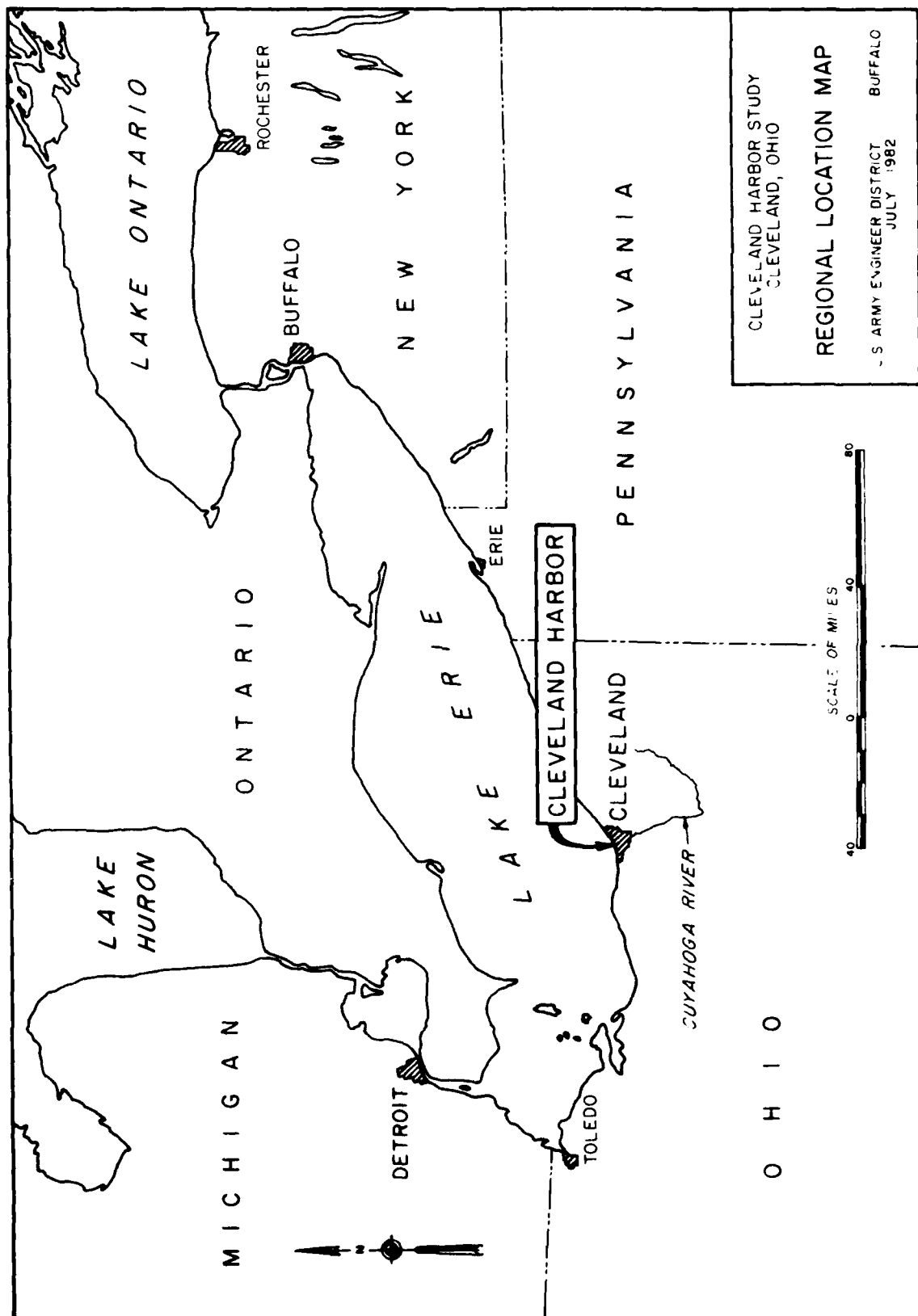


FIGURE 1

FIGURE 1

navigation features of Cleveland Harbor were needed in the interest of commercial navigation and to determine if such improvements were economically justified and environmentally acceptable. In compliance with this authority, the Buffalo District conducted a feasibility study from 1972 to 1976 and the results of this study were documented in the Cleveland Harbor, Ohio Feasibility Report for Harbor Modifications, June 1976. Contained within this report, was the Buffalo District Engineer's recommendation to modify both the west (main) entrance and east entrance of Cleveland Harbor for safe and efficient operation of 1,000-foot bulk cargo vessels in the Lakefront Harbor. The proposed modifications to the west (main) entrance would permit 1,000-foot vessels to use this entrance during relatively calm weather conditions and proposed modifications to the east entrance would permit 1,000-foot vessel operation during storm conditions. The District Engineer also recommended that the existing west breakwater be modified to provide for fishermen access and thus increase the recreational fishing opportunities available for area fishermen. (Note: A detailed summary of the results of the 1972 to 1976 Feasibility Study is provided in Section III of the Main Report, "Formulation of Preliminary Alternative Plans").

Based on the District's 1976 Feasibility Report, this Phase I General Design Memorandum stage of Advanced Engineering and Design was subsequently authorized by Section 175 of the 1976 Water Resources Development Act (Public Law 587, 94th Congress), approved 22 October 1976. The text of this authorization is as follows:

"Sec. 175. The Secretary of the Army, acting through the Chief of Engineers, is authorized to undertake the phase I design memorandum stage of advanced engineering and design of the project for harbor modification at Cleveland Harbor, Ohio, in accordance with the report of the District Engineer, dated June 1976, at an estimated cost of \$500,000. This shall take effect upon submittal to the Secretary of the Army by the Chief of Engineers and notification to Congress of the approval of the Chief of Engineers."

This Phase I study authorization became effective on 26 October 1978, upon notification to Congress of the approval of the District's 1976 Feasibility Report by the Chief of Engineers, as required by the authorizing legislation.

b. Description of Feasibility Study Plan.

The plan, as recommended in the 1976 Feasibility Report, would modify the general navigation features of Cleveland Harbor in the interest of commercial navigation and would provide for increased recreational fishing opportunities at Cleveland Harbor. These proposed modifications, shown on Plate 3 in Appendix J, include:

- (1) Extending and deepening lake approach channels at both entrances to the Lakefront Harbor;
- (2) Deepening the east basin channel and west (main) entrance;

- (3) Removing portions of the west (main) entrance spur breakwaters;
- (4) Constructing a breakwater extension on the east end of the existing east breakwater;
- (5) Constructing a diked disposal area; and
- (6) Installation of recreational fishing facilities on the west breakwater.

c. Items of Local Cooperation in Authorizing Document.

The June 1976 Feasibility Report recommended the above modifications with the provision that non-Federal interests would:

(1) Navigation -

- (a) Provide without cost to the United States all lands, easements and rights-of-way required for construction and maintenance of the harbor entrance improvements and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for the disposal of dredged materials resulting from the proposed modifications to the harbor entrance and lakefront channels.
- (b) Contribute in cash 25 percent of the first cost of construction of required contained spoil disposal facility. This contribution may be waived by the Secretary of the Army based upon a recommendation by the Administrator of the U. S. Environmental Protection Agency.
- (c) Adequately maintain the contained spoil disposal area.
- (d) Comply with the applicable provisions of the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," Public Law 91-646, approved 2 January 1971, in acquiring lands, easements and rights-of-way.
- (e) Accomplish without cost to the United States all utility and other relocations or alterations made necessary by the project, except for aids to navigation.
- (f) Hold and save the United States free from damages due to the construction works, not including damages due to the fault or negligence of the United States or its Contractors.
- (g) Provide and maintain without cost to the United States depths in berthing areas and local access channels commensurate with depths provided in related project areas.

(h) Provide without cost to the United States, terminal, transfer and transshipment facilities in the West Basin. Plans and schedules for construction of these facilities must be approved by the Chief of Engineers.

(i) Comply with the provisions of Section 221 of Public Law 91-611, approved 31 December 1970.

(2) Recreational Fishing -

(a) Pay, contribute in kind, or repay (which may be through user fees) with interest, one-half of the cost of modifications necessary to provide for recreational fishing on the breakwater and one-half of the cost of associated access facilities, parking areas and sanitary facilities, the amount involved being currently estimated at about \$1.3 million (1) subject to final adjustment after actual costs have been determined; and

(b) Bear all costs of maintenance, operation and replacement of the modifications and associated facilities, the amount involved being currently estimated at \$4,000 (2) on an average annual basis.

The local cooperator for the navigation project is the Cleveland-Cuyahoga County Port Authority (Cleveland Port Authority) and the local cooperator for the recreational fishing project is the Ohio Department of Natural Resources (ODNR). Correspondence with the Cleveland Port Authority and ODNR, indicating their willingness to provide the local cooperation, is included as Exhibits F-1, F-2 and F-3 in Appendix F, "Pertinent Correspondence." In addition, these two agencies have repeatedly stated their continued interest in providing the required local cooperation at various workshop meetings and during verbal conversations with District personnel.

3. PURPOSE OF REFORMULATION PHASE I GDM AND STAGE 2 REPORT

a. Reformulation Phase I GDM.

Subsequent to completion of the 1976 Feasibility Report, the Buffalo District conducted additional investigations in late 1976. The purpose of these additional investigations was to compare the harbor entrance improvements recommended in the June 1976 Feasibility Report with options for improving only one of the harbor entrances (i.e.; improving either the west (main) entrance or the east entrance). Based on the results of these additional investigations, the following conclusions were reached:

(1) Proposed modifications to the east entrance, as an added increment to the basic plan of improving the west (main) entrance, could be economically justified, depending on the choice of wind speed criteria limiting the use of

(1) \$2,120,000 on October 1981 price levels.

(2) \$6,100 on October 1981 price levels.

the proposed west (main) entrance. (Note: As previously discussed, the proposed modifications for commercial navigation would permit safe and efficient operation of 1,000-foot bulk cargo vessels in the Lakefront Harbor. These vessels would use the modified west (main) entrance during relatively calm weather conditions and would use the modified east entrance during storm conditions. Depending on the choice of wind speed criteria limiting the use of the west (main) entrance, the east entrance improvements may or may not be incrementally justified.);

(2) If modifications to only one entrance were economically justified, development of the west (main) entrance was the preferred improvement based on the desires of the Lake Carriers Association which represents the majority of the prospective harbor users. However, there was also significant support for modifying the east entrance rather than the west (main) entrance from shipping companies not represented by the Lake Carriers Association and by the U. S. Coast Guard; and

(3) Regardless of which entrance was modified for safe and efficient operation of 1,000-foot vessels, principal navigation interests stated that the channel and breakwater modifications proposed at the west (main) entrance were not totally satisfactory and that the proposed east entrance modifications may not provide the degree of storm protection thought possible during the feasibility study. Therefore, formulation of additional plans would be required before selection of a final harbor modification plan could be made for safe and efficient operation of 1,000-foot vessels. In addition, because of the limited experience with operation of the new generation of 1,000-foot bulk cargo vessels on the Great Lakes, physical modeling of any proposed modifications plans would be required.

Based on the results of these additional investigations, the Buffalo District Engineer issued a supplemental recommendation to his basic recommendation contained in the 1976 Feasibility Report. This supplemental recommendation recommended that a Reformulation Phase I GDM study be undertaken with the purpose of developing a final plan for Congressional authorization for construction.

In addition to the need to reformulate Outer Harbor entrance plans for safe and efficient operation of 1,000-foot vessels, several other events have occurred since 1976 which may impact on the economic feasibility of any proposed modification plan. These events include; (1) the closing of the U. S. Steel Corporation steel mill on the Cuyahoga River; (2) the construction of a new iron ore transshipment facility at Lorain Harbor, Ohio, by Republic Steel Corporation; and (3) the changed position of Jones & Laughlin Steel Corporation in regards to participation in the construction of a new transshipment facility for iron ore in the Lakefront Harbor.

The harbor modifications proposed in the 1976 Feasibility Report were developed assuming, among other things, that the three local steel mills in Cleveland would construct a new iron ore transshipment facility in the Lakefront Harbor, capable of receiving iron ore in 1,000-foot vessels, in-lieu-of receiving their iron ore requirements for their local steel mills directly at their docks adjacent to the Cuyahoga River in less efficient

630-foot vessels. The iron ore delivered to this new transshipment facility would then be trans-shipped to the three local steel mills by either a conveyor system or by barges. However, US Steel closed their steel mill in Cleveland in 1978 and their property is presently up for sale. Further, Republic Steel constructed a new iron ore transshipment facility at Lorain Harbor to service, among other things, the iron ore requirements of their steel mill in Cleveland. Thus, neither company is interested in developing a new transshipment facility in the Cleveland Lakefront Harbor. Also, J & L Steel has indicated that they are no longer interested in participating in the construction of a new iron ore transshipment facility in Cleveland (see Exhibit F-4 in Appendix F). Thus, no new iron ore transshipment facility will be constructed in the Lakefront Harbor for receipt of iron ore destined for local steel mills in Cleveland. Since benefits resulting from operation of 1,000-foot vessels delivering iron ore to this proposed transshipment facility were used, in part, to economically justify the harbor modifications proposed in the 1976 Feasibility Report, a reanalysis of the economic feasibility of any proposed modification plan, reflecting current conditions, would be required before any such modification plan could be authorized for construction.

Therefore, based on the foregoing discussion, the District proposed that a Reformulation Phase I GDM study be undertaken. Approval to conduct a reformulation study was subsequently provided by the Division Engineer, North Central Division, in November 1979.

b. Stage 2 Report.

The purpose of this Stage 2 Report is to present the results of the Stage 2 planning effort conducted to identify and analyze a wide range of alternative measures to modify the general navigation features of Cleveland Harbor in the interest of commercial navigation and to provide for additional recreational fishing opportunities in the Cleveland Harbor area. The alternatives that were formulated were developed in sufficient detail to provide initial choices as to the range of viable resource management options available in the study area. They did not concentrate on detailed engineering or design considerations. However, the alternatives were developed in sufficient detail to: (1) identify all major components of each alternative; (2) to estimate the first cost of construction and the annual operation and maintenance cost associated with each alternative; (3) to estimate the benefits associated with each alternative; and (4) to assess the impacts of each alternative on the environment based on the existing environmental data that was available.

At the conclusion of this Stage 2 Report, a recommendation will be made as to whether or not to continue the study into Stage 3 planning (Development of Detailed Plans). In addition, if the recommendation is to proceed into Stage 3 planning, the most feasible alternative plans that should be investigated will be identified. These recommended alternative plans would then be developed in sufficient detail so that a rational choice could be made among them and, if appropriate, an alternative could be recommended for construction.

4. SCOPE OF STUDY

a. General.

As previously discussed, the main thrust of this Reformulation Phase I GDM study is to develop a final plan to modify Cleveland Harbor for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor. The recreational fishing plan recommended in the 1976 Feasibility Report will also be reevaluated. However, as will be discussed in Section II of the Main Report, "Problem Identification," during coordination of the Plan of Study for this study and subsequent correspondence, local interests expressed the need for further modifications to the general navigation features of Cleveland Harbor in the interest of commercial navigation. These additional modifications included: (1) deepening the Cuyahoga River such that the depth of the navigation channel would be compatible with the Great Lakes System's draft of 25.5 feet (Note: The Cuyahoga River is presently authorized for a 23-foot project depth and can accommodate a vessel loaded to about 21 feet. Thus, vessels are forced to lighter (reduce their draft) or come into Cleveland Harbor light-loaded before proceeding upriver.); (2) modify the Cuyahoga River navigation channel at various locations where undue vessel delays are encountered due to physical restrictions in the channel; and (3) completion of the authorized but uncompleted improvements on the Old River (discussed in greater detail in Section II of the Main Report, "Problem Identification"). Therefore, the original scope of this study was expanded to include formulation, assessment and evaluation (both economic and environmental) of these proposed additional modification plans.

b. Field Investigations.

Several field investigations, as discussed below, were conducted for this Stage 2 study. These investigations included: (1) a bathymetric survey to establish offshore conditions; (2) a topographic survey to establish onshore conditions; and (3) a preliminary real estate appraisal to estimate the value of buildings and lands required for various alternative plans under consideration.

(1) Bathymetric Survey - A bathymetric survey was undertaken by Buffalo District personnel in the spring of 1978 and supplemented by additional survey work completed in the spring of 1980. This information was required in order to estimate the quantity of construction dredging that would be required for various alternatives.

(2) Topographic Survey - A topographic survey of Cuyahoga County was conducted for the Cuyahoga County's Sanitary Engineer in 1978. Although this survey was not conducted for this Stage 2 study, topographic information from this survey was used to establish ground contours in the study area. This information was required in order to prepare excavation quantity estimates used to determine the construction cost of various alternatives.

(3) Preliminary Real Estate Appraisal - A preliminary real estate appraisal was prepared in the winter of 1981-1982 by personnel of North

Central Division. The purposes of this preliminary real estate appraisal were to estimate: the value of the land that would be acquired in fee title for various alternatives; the cost of obtaining temporary construction easements; and the cost of purchasing several buildings that would have to be demolished or relocated for various alternatives. This information was then included in the cost estimates prepared for each alternative. Results of this preliminary real estate appraisal are presented in Appendix E, "Cost Estimates."

c. Office Investigations.

Several office investigations, as discussed below, were also conducted for this Stage 2 study. These studies included: (1) a geotechnical study to evaluate subsurface conditions and their impact on various alternatives; (2) a fishing demand analysis to establish recreational fishing needs in the area; (3) development of a traffic flow computer model to simulate traffic movement on the Cuyahoga River; (4) fleet and tonnage forecasts to project future commodity movements at Cleveland Harbor and the fleet that would carry this future cargo; (5) a wave refraction analysis to establish deep-water wave conditions used for design of the breakwaters for several alternatives; (6) a hydraulic model study of the west (main) entrance to Cleveland Harbor used in formulating various entrance alternatives and assessing their impact on existing wave conditions in the Lakefront Harbor; (7) a literature search of existing fish and wildlife resources data in the study area used to evaluate the environmental impacts of the alternatives; (8) a review of the U. S. Coast Guard accident reports for Cleveland Harbor from 1972 to 1981; (9) an analysis of channel depth requirements for bulk cargo vessels; and (10) a review of available Department of The Army permits for existing bulkheads along the Cuyahoga and Old Rivers.

(1) Geotechnical Study - A survey was conducted to collect available information on soil and rock data in the Cleveland Harbor area in order to evaluate subsurface conditions and assess their impact on the considered alternatives. Subsurface explorations were available from past studies performed by the Buffalo District. In addition, information was also obtained from public and private offices with interests at scattered sites, mostly bridges, in the study area. The analysis indicated that, for the Lakefront Harbor modification plan warranting further, detailed study, the soil materials generally consist of silts and clays underlain by a glacial till which is at a depth below proposed dredging limits. A sediment analysis was also conducted to estimate the increase in maintenance dredging associated with various deepening alternatives. In addition, a preliminary materials survey was conducted to determine the availability of various stone materials. It was found that there are several sources of armor stone, underlayer stone, and bedding stone within a 100-mile radius of the project site. Additional details on this study are provided in Appendix A, "Geotechnical."

(2) Fishing Demand Analysis - Various current and projected economic variables such as income level, household size, leisure time and population were assembled and analyzed to forecast existing and future demand for fishing activity days in the Cleveland Harbor area. This demand forecast was

then used to size various components (such as needed parking space, restroom facilities, etc.) of the breakwater fishing plans under consideration during Stage 2 planning. A monetary value for each activity day was also developed. This information was then used to estimate benefits that would result from providing fishermen access to the west breakwater. The results of the fishing demand analysis are presented in Appendix B, "Economic Evaluation."

(3) Traffic Flow Computer Model - A traffic flow computer model was developed by personnel of North Central Division in the spring of 1981. The purpose of this computer model was to simulate traffic flow on the Cuyahoga River for the four main commodities shipped at Cleveland Harbor - iron ore, limestone, sand and gravel, and salt. Included in the computer model were delay times associated with various restricted portions of the navigation channel. By having the computer model assume that these restricted portions of the navigation channel were modified to permit unhindered navigation, the annual savings in vessels transit times could be calculated. These projected time savings were then multiplied by the hourly operating cost of the vessels in order to estimate annual benefits that would accrue if these restricted portions of the navigation channel were modified. Additional details on this traffic flow computer model are provided in Appendix B, "Economic Evaluation."

(4) Fleet and Tonnage Forecast - Commodity movements of iron ore, limestone, sand and gravel, and salt at Cleveland Harbor for the 10-year period 1969 to 1978 were analyzed in order to establish a historical volume of cargo shipped at Cleveland Harbor. This historical cargo movement was then multiplied by projected growth rates for these commodities in order to estimate future commodity movements at Cleveland Harbor to the year 2040. In addition, the historical fleet composition in use at Cleveland Harbor for the 3-year period 1978 to 1980 was also analyzed. Future fleet compositions for various alternatives (including No-Action) were then developed to the year 2040 by changing this historical fleet composition based on such factors as the average age of the present fleet, the trends for new vessel construction on the Great Lakes, and future vessel replacement plans of various shipping companies that call at Cleveland Harbor. These tonnage and fleet forecasts were then used to estimate navigation benefits that would accrue if Cleveland Harbor was modified. The results of these forecasts are presented in Appendix B, "Economic Evaluation."

(5) Wave Refraction Analysis - A wave refraction analysis, which defined the shoreward propagation of the design deep-water waves at Cleveland Harbor, was conducted by personnel of the Corps Waterways Experiment Station. This information was required in order to design breakwaters for various alternatives investigated and to define the deep-water wave at the boundary of the hydraulic model. The results of this refraction analysis are presented in Appendix C, "Coastal Engineering Design" and in the Cleveland Harbor hydraulic model study report scheduled for public release in the fall of 1982.

(6) Hydraulic Model Study - As previously discussed, during supplemental studies conducted by the Buffalo District subsequent to completion of the 1972-1976 Feasibility Study, local shipping interests stated that physical

modeling of any proposed modifications to the west (main) entrance for 1,000-foot vessel operation would be required. The purposes of this physical modeling would be to determine optimum design for proposed modifications to the west (main) entrance for 1,000-foot vessel operation and to determine resultant wave heights in the Lakefront Harbor as a result of these modifications. Accordingly, the District contracted with the Corps Waterways Experiment Station for the construction of a 1:100 scale hydraulic model of the west (main) entrance to Cleveland Harbor and subsequent model testing. The physical limits of the model and the model layout are shown on Figure 2. Figure 3 is an overhead photograph of the model.

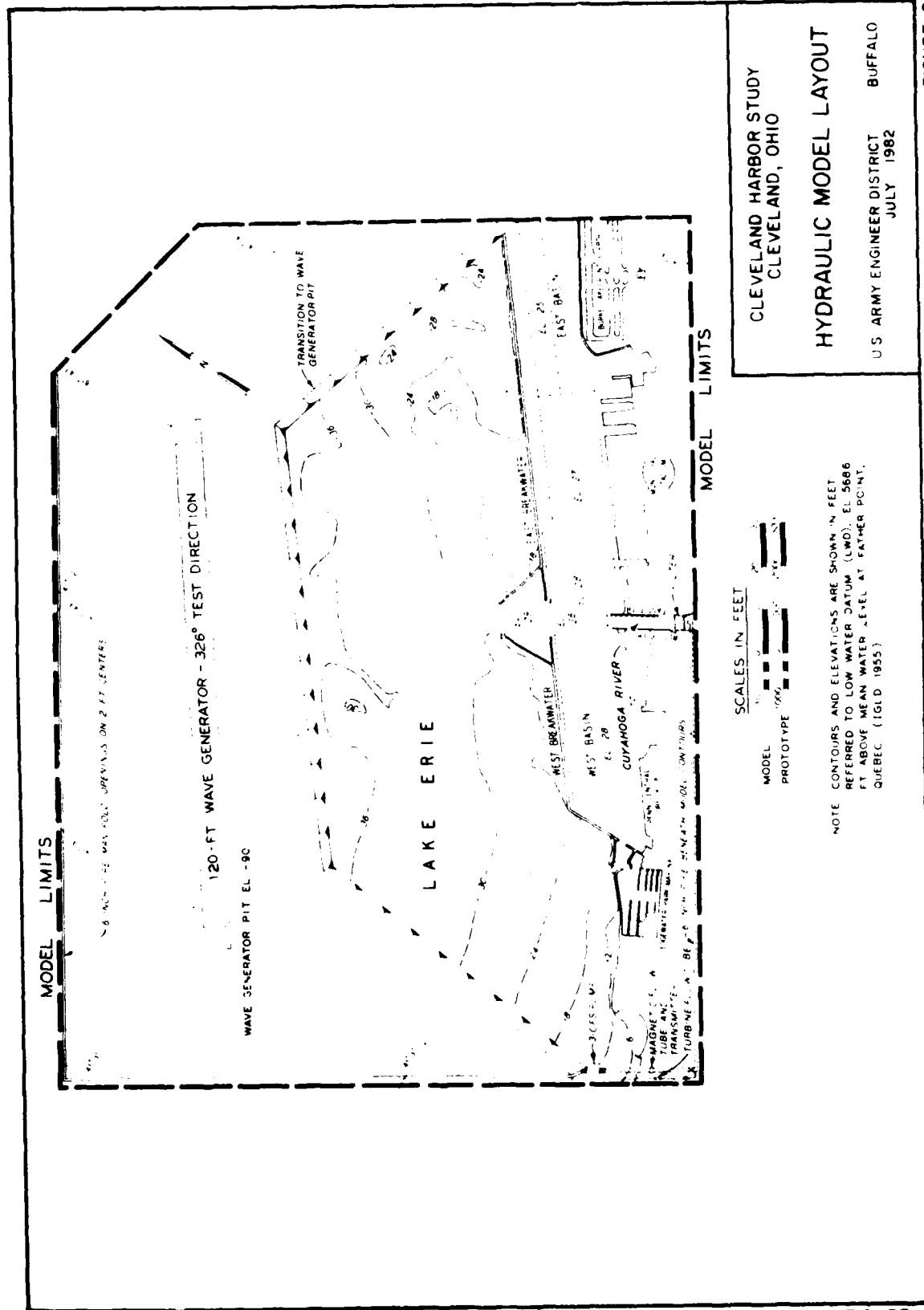
Model construction was completed in January 1979 and model testing was conducted from February 1979 to February 1981. Included in these model tests were ship navigation tests using a remote controlled scale model of a 1,000-foot vessel operated by experienced masters of 1,000-foot vessels. A photograph of this scale model ship is provided in Figure 4. The purpose of these ship navigation tests was to ensure that proposed modifications to the west (main) entrance would provide for safe and efficient operation of 1,000-foot vessels. In addition, during some of the ship navigation tests, an erratic wind field was simulated to qualitatively assess the effects winds would have on 1,000-foot vessel operation while entering and leaving a modified west (main) entrance.

Results of the model tests and ship navigation tests will be discussed in subsequent sections of the Main Report. Additional details on these tests are also provided in Appendix C, "Coastal Engineering Design" and in the Cleveland Harbor hydraulic model study report scheduled for public release in the fall of 1982.

(7) Literature Search - The U. S. Fish and Wildlife Service, under an Interagency Support Agreement with the District, conducted a literature search of available data on fish and wildlife resources in the study area. The information obtained from this literature search was then used to assess the impacts of alternative plans on the existing environment at Cleveland Harbor. Results of this literature search are provided as Exhibit H-1 in Appendix H, "Reports of Others."

(8) Review of U. S. Coast Guard Accident Reports - As will be discussed in Section II of the Main Report, "Problem Identification," shipping interests identified seven locations on the Cuyahoga River where undue vessel delays are encountered due to physical restrictions in the navigation channel. However, these shipping interests did not indicate whether or not any vessel accidents had occurred at these seven locations. Accordingly, District personnel reviewed the accident reports for Cleveland Harbor compiled by the U. S. Coast Guard-9th Coast Guard District for the 10-year period 1972 to 1981. This information was then used to estimate general navigation benefits that would accrue from reduced vessel accidents if these physical channel restrictions were eliminated.

(9) Analysis of Channel Depth Requirements - As will be discussed in Section II of the Main Report, "Problem Identification," navigation channels at Cleveland Harbor do not provide adequate channel depths for most bulk



CLEVELAND HARBOR STUDY
CLEVELAND, OHIO

HYDRAULIC MODEL LAYOUT

U.S. ARMY ENGINEER DISTRICT
BUFFALO
JULY 1982

FIGURE 2

FIGURE 2



FIGURE 3 - OVERHEAD PHOTOGRAPH OF HYDRAULIC MODEL

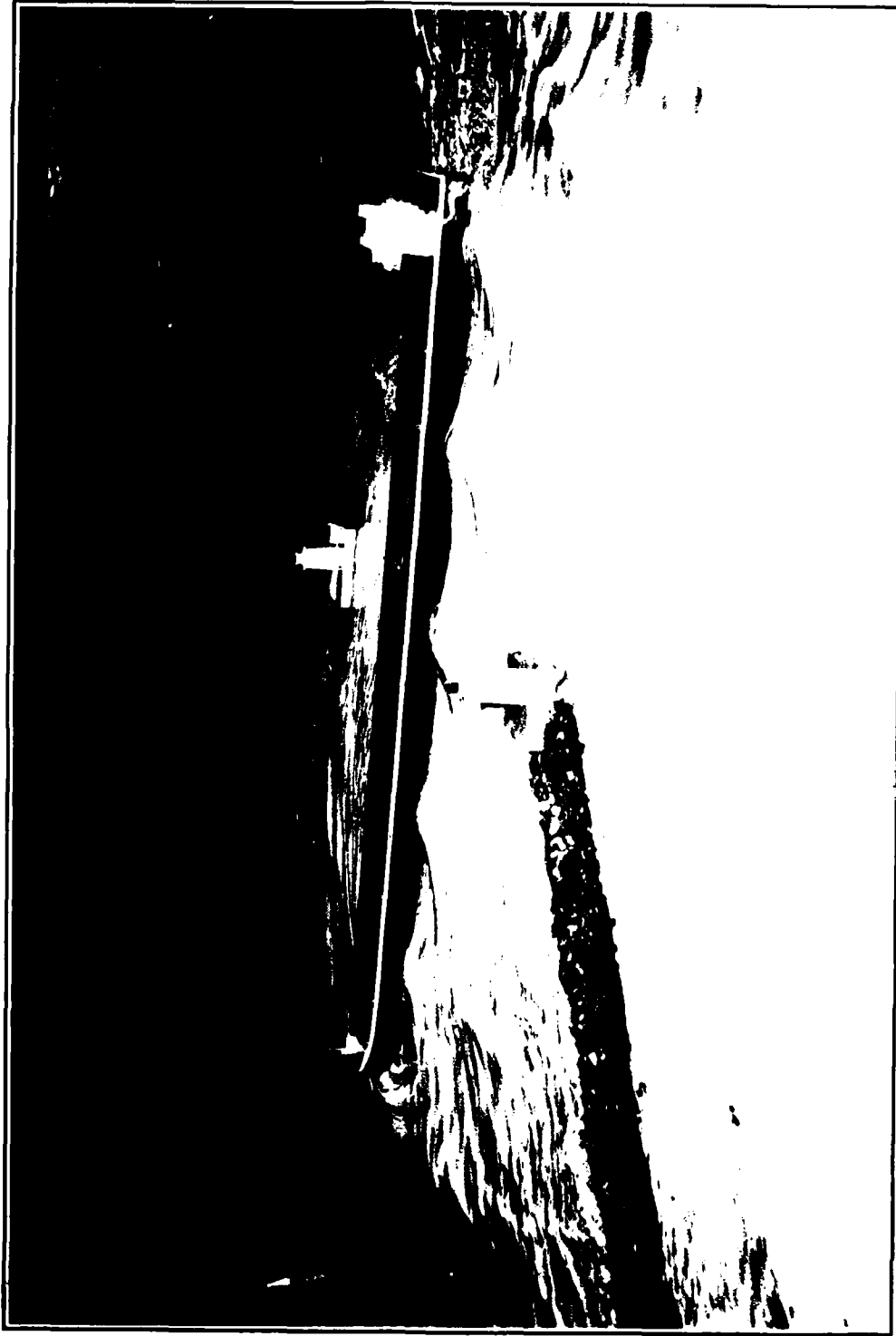


FIGURE 4 - SCALE MODEL 1000-FOOT VESSEL

cargo vessels. Thus, these vessels are forced to navigate light-loaded (i.e., at less than the maximum system's draft of 25.5 feet at LWD), resulting in increased transportation costs.

As part of this Phase I study, an analysis of channel depth requirements for bulk cargo vessels was undertaken by Buffalo District personnel. Five factors were evaluated: static draft; squat; roll; pitch; and underkeel clearance. The resulting required channel depths were then incorporated into several harbor modification plans which involved channel deepening. Results of this analysis are discussed in Section II of the Main Report and in Appendix C, "Coastal Engineering Design."

(10) Review of Department of The Army Permits - As will be discussed in Section II of the Main Report, "Problem Identification," shipping interests indicated a need to study the feasibility of deepening the navigation channels at Cleveland Harbor. This proposed deepening would make the depth of the navigation channels compatible with the maximum Great Lakes System's Draft of 25.5 feet.

As part of the study of deepening the navigation channels, the effects this deepening would have on the stability of the existing bulkheads was analyzed (i. e. whether deepening the navigation channels would cause failure of the existing bulkheads). Basic data on the construction of the existing bulkheads was obtained from Department of the Army Permits for these bulkheads, when available. (Note: Permit information was available for about 40 percent of the existing bulkheads on the Cuyahoga River and for about 25 percent of the existing bulkheads on the Old River. The stability analysis was therefore conducted on the bulkheads for which permit information was available and based on the indicated percentages, the results were expanded to cover the remaining bulkheads for which permit information was not available). When the analysis indicated that deepening would cause failure of the existing bulkheads, replacement of these bulkheads was included as a plan component of the alternative and its cost was included in the cost estimate of the alternative. Additional details on this analysis are provided in Appendix D, "Design."

5. STUDY PARTICIPANTS AND COORDINATION

a. Public Involvement.

The completed Plan of Study for this Phase I study was distributed to the political leaders in the area and to various local, State and Federal agencies for their review and comment. Loan copies of the POS were also supplied to local libraries for review by the general public and various civic groups. In addition, until the supply was exhausted, personal copies of the report were made available to study participants free of charge.

Following approval of this Stage 2 report, a public meeting will be held in Cleveland, OH. The purposes of this meeting will be to present the results of the Stage 2 investigation and to solicit public comment. All comments made at this meeting will be given equal consideration and those that warrant further study will be investigated during Stage 3 planning.

b. Pre-Phase I GDM Coordination.

Prior to initiation of this Phase I study, the Buffalo District met with local interests, including the Cleveland Port Authority, the Lake Carriers Association, various shipping companies, Consolidated Rail Corporation (Conrail), various dock operators, the U. S. Coast Guard and technical advisors (University of Michigan and the Corps Coastal Engineering Research Center and Waterways Experiment Station), on 19 and 20 July 1977. The purposes of these workshops meetings were to discuss and define criteria for the design of harbor entrance improvement plans for 1,000-foot vessel operation, to establish a range of harbor entrance alternatives which should be investigated during the Phase I study and to discuss physical modeling of the proposed harbor modifications. Local interests expressed a preference for an east entrance-west exit concept for operation of 1,000-foot vessels in the Lakefront Harbor similar to the plan developed during 1972-1976 Feasibility Study with emphasis on early construction of the east entrance component of the project plan. This position was consistent with Congressional attempts at that time to authorize the east entrance component of the project plan for construction. Early construction of the east entrance component would have accommodated Republic Steel's proposed plan to construct a new iron ore transshipment facility in the Lakefront Harbor which would accommodate receipt of iron ore in 1,000-foot vessels. (Note: As previously discussed, this proposed transshipment facility was subsequently constructed at Lorain Harbor, OH). In addition, it was decided to eliminate the proposed breakwater extension at the east end of the east breakwater from the project plan since shipping companies stated that, although it would be nice to have, it was not absolutely necessary for safe and efficient operation of 1,000-foot vessels. Minutes of these two workshop meetings are provided in the Classification Report and Plan of Study for Cleveland Harbor, OH, February 1979 (revised October 1979).

c. Coordination during Preparation of the Plan of Study.

During preparation of the Plan of Study for this Phase I study several meetings were held with local interests to obtain their views on how the study should be conducted and the alternatives that should be investigated. Minutes of these workshop meetings are included in the Plan of Study. A summary of the results of these workshop meetings follows.

The initial workshop meeting was held on 12 January 1979, with the Lake Carriers Association, various shipping companies, Conrail, the Greater Cleveland Growth Association and the Cleveland Port Authority. At this meeting, participants stated that there was now no need for early construction of the east entrance component of the project plan due to construction of Republic Steel's new iron ore transshipment facility in Lorain Harbor instead of at Cleveland Harbor. The participants also stated their preference for a total study of all alternatives in order to develop the best long range plan. However, there was a difference of opinion on which entrance (i.e. west (main) or east entrance) should be developed for 1,000-foot vessel operation, if only one entrance could be economically justified.

The second workshop meeting was also held on 12 January 1979, with officials of the city of Cleveland. At this meeting, city officials stated that the city had no official Lakefront development plan. However, expansion of Burke Lakefront Airport was under consideration. This proposed expansion would include construction of new land fill areas in the Lakefront Harbor immediately east and north of the existing airport and the city would be interested in using any dredged material from the harbor modification plan for this land-fill area. They also stated their support for expansion and upgrading of Conrail's existing iron ore transshipment facility adjacent to the west basin of the Lakefront Harbor. (Note: Conrail presently owns and operates an iron ore transshipment facility adjacent to the west basin of the Lakefront Harbor (see Plate 1 in Appendix J). Iron ore is received at this dock in bulk cargo vessels and is transferred to railroad cars for delivery to inland steel mills located in southern Ohio, West Virginia, and Pennsylvania. During the 1972-1976 Feasibility Study, it was assumed that this transshipment facility would be upgraded and expanded since the existing facility is in a state of disrepair and could not economically handle the forecasted increase in iron ore tonnage that would be required by the steel mills presently served by this facility. The assumed expansion/upgrading of this facility was in addition to the assumption that the three local steel mills would construct an additional transshipment facility, as previously discussed, in the Lakefront Harbor for receipt of iron ore destined for upriver steel mills in Cleveland. Thus, it was assumed during the Feasibility Study that there would be two iron ore transshipment facilities in the Lakefront Harbor).

A third workshop meeting was held on 25 January 1979, with the Cleveland Port Authority. At this meeting the Cleveland Port Authority stated that they continued to support the development of a new iron ore transshipment facility at their Dock 20-24 area and were coordinating with prospective users. They also stated their preference for an east entrance plan in-lieu-of modifying the west (main) entrance for 1,000-foot vessel operation and restated their previous commitment to act as the project's local sponsor.

The fourth workshop meeting was held on 1 February 1979 with Conrail. At this meeting Conrail stated that they were very interested in upgrading/expanding their existing iron ore transshipment facility in the Lakefront Harbor and were in the process of hiring a consultant to conduct a feasibility study. In addition, Conrail stated that their iron ore dock on the Old River (Erie Ore Dock) was permanently closed down. Further, Conrail stated that railroad companies have previously studied the economic feasibility of unit train movements of iron ore directly from the Mesabi iron ore range to consuming steel mills but they have concluded that it was not economically competitive with water movement.

The final workshop meeting conducted during preparation of the Plan of Study was on 28 March 1979 with State and local agencies, the U. S. Coast Guard and industry representatives. At this meeting, study participants expressed their support for an east entrance plan for 1,000-foot vessel operation. The Ohio Department of Natural Resources also stated that, although their Lakefront recreational plan proposes an island development in the east basin which could conflict with an east entrance modification plan for commercial

navigation, they expect to modify the plan in the near future to eliminate this potential conflict.

d. Coordination With Harbor Users.

During the course of this Stage 2 study, several workshop meetings were held with industry representatives. The first workshop meeting was held on 14 March 1979 with experienced vessel masters of 1,000-foot vessels representing various shipping companies using Cleveland Harbor. At this meeting, vessel masters expressed their unanimous preference for an east entrance plan for 1,000-foot vessel operation with minor changes to the west entrance to facilitate vessel egress. The vessel masters also agreed that the proposed breakwater extension at the east end of the east breakwater in the project plan recommended in the 1976 Feasibility Report was not required. In addition, the vessel masters discussed various operating characteristics of 1,000-foot vessels and proposed tentative channel dimensions for the east entrance plan. Summary minutes of this workshop meeting are provided as Exhibit G-1 in Appendix G, "Public Involvement."

A second workshop meeting was held with vessel masters on 8 April 1981. At this meeting vessel masters developed several preliminary concepts to modify the west (main) entrance for 1,000-foot vessel operation during storm conditions. These preliminary concepts were then tested in the hydraulic model at WES to ensure that the design criteria, also established by the vessel masters at this workshop meeting, were met. The vessel masters also defined "fair-weather" and "all-weather" weather conditions for 1,000-foot vessel operation, established channel depth requirements for 1,000-foot vessels during both fair and stormy weather conditions and reviewed the "all-weather" east entrance plan and a "fair-weather" west entrance plan which were developed by the Buffalo District. The vessel masters again expressed their preference for the proposed east entrance plan. Minutes of this workshop meeting are provided as Exhibit G-2 in Appendix G.

A third workshop meeting was held with vessel masters on 29 and 30 October 1981 at the Corps Waterways Experiment Station. At this workshop meeting vessel masters conducted ship navigation tests on the "all-weather" west entrance plan developed at the 8 April 1981 workshop meeting, modified by WES personnel in order to meet design criteria also established at this workshop meeting. As a result of these ship navigation tests, an additional "all-weather" west entrance plan was formulated and model tested to eliminate the problem the vessel masters had with the previous plan when entering the harbor when winds were from the north-northeast. Summary minutes of this workshop meeting are provided as Exhibit G-3 in Appendix G.

A fourth workshop meeting was held on 16 February 1982 with Ontario Stone Corporation, the new owner of the former Erie Ore Dock on the Old River. At this workshop meeting Ontario Stone indicated their short range plans for operation of their new dock. They also indicated that they were in the preliminary stages of discussions with a company interested in exporting approximately 2,000,000 tons of coal per year from their new dock. However, since they were still in preliminary discussions, no firm commitment for this activity could be made at that time. In addition, Ontario Stone indicated

that if authorized but uncompleted improvements on the Old River were implemented, they would transfer stone receipts (approximately 1,000,000 tons per year) from their Cuyahoga River dock that they presently use to their new Old River dock in order to take advantage of the potential transportation savings that these improvements would permit. Summary minutes of this workshop meeting are provided as Exhibit G-4 in Appendix G.

The final Stage 2 workshop meeting was held on 4 May 1982. In attendance were representatives of the Lake Carriers Association, various shipping companies, various dock owners, the Chessie System, the U. S. Coast Guard, the U. S. Fish and Wildlife Service, the city of Cleveland, the Cleveland Port Authority, and the Ohio Department of Natural Resources. At this meeting, the Buffalo District presented the results of the Stage 2 planning effort for commercial navigation and solicited comments from meeting participants. In addition, a consensus of opinions was reached on which commercial navigation alternatives to carry forward into Stage 3 planning and which alternatives to eliminate from further consideration. Summary minutes of this workshop meeting are provided as Exhibit G-5 in Appendix G.

In addition to the workshop meetings held with harbor users as previously discussed, two sets of questionnaires were also sent to harbor users to obtain their input in formulating alternative plans and to ensure that navigation benefits that would accrue due to the alternative plans were accurately estimated. The first questionnaire was sent to shipping companies who regularly use Cleveland Harbor. The questionnaire requested their response to questions dealing with: (1) modifications to the harbor entrance and Lakefront Harbor for safe and efficient operation of 1,000-foot vessels; (2) modifications to the Cuyahoga and Old River navigation channels in order to reduce vessel delay; (3) deepening of the Cuyahoga River navigation channel; and (4) authorized but uncompleted improvements on the Old River. Results of this questionnaire are discussed in Section II of the Main Report, "Problem Identification."

The second questionnaire was sent to dock operators at Cleveland Harbor and requested that they confirm records of historical commodity movements at their docks for the 10-year period 1969 to 1978. They were also requested to project future anticipated commodity movements at their docks. This information was then used in developing historical and future commodity movements at Cleveland Harbor, as discussed in subsequent sections of the Main Report.

e. Coordination With the Cleveland-Cuyahoga County Port Authority.

The local sponsor for the navigation project is the Cleveland Port Authority. As such, the Cleveland Port Authority attended and participated in the pre-Phase I coordination meetings, a majority of the workshop meetings held during preparation of the Plan of Study and the 8 April 1981, the 29 and 30 October 1981 and the 4 May 1982 workshop meetings previously discussed. They also met with the Buffalo District on 26 February 1980. At this meeting, the Cleveland Port Authority again expressed their support for an east entrance plan for 1,000-foot vessel operation. They also indicated that they would attempt to develop a unified position from the

harbor users as to which entrance to modify for 1,000-foot vessel operation. However, as will be discussed in Section II of the Main Report, "Problem Identification," they were unsuccessful in this attempt. Summary minutes of this workshop meeting are provided as Exhibit G-6 in Appendix G.

In addition to the coordination required for this Phase I study, the Buffalo District also provided input into the Cleveland Port Authority's harbor development study conducted in 1981 by the engineering firm of Tippetts-Abbott-McCarthy-Stratton. This harbor development plan will be discussed in greater detail in Section III of the Main Report, "Formulation of Preliminary Alternative Plans."

f. Coordination With the City of Cleveland.

In addition to participating in the 12 January 1979 workshop meeting conducted during preparation of the Plan of Study, officials of the city of Cleveland attended and participated in the 14 March 1979, 8 April 1981 and the 4 May 1982 workshop meetings. At these workshop meetings, city officials discussed their proposed plans to expand Burke Lakefront Airport and stated their interest in using dredged material from any proposed improvement plan to construct additional land fill areas required by this proposed expansion. Additional coordination with the city of Cleveland on this aspect will be conducted during Stage 3 planning, if improvement plans involving significant amounts of dredged material are carried forward into Stage 3.

g. Coordination With the U. S. Coast Guard.

In addition to attending and participating in the 19 and 20 July 1977, the 28 March 1979 and the 4 May 1982 workshop meetings, the U. S. Coast Guard, 9th Coast Guard District, met with the Buffalo District on 16 September 1981. At this workshop meeting, the Coast Guard defined the aids to navigation that would be required for various Lakefront Harbor modification plans under consideration and estimated their initial construction costs and additional annual maintenance costs. The Coast Guard also provided the same information for an additional Lakefront Harbor modification plan developed subsequent to the 16 September 1981 workshop meeting via telephone conversation on 23 December 1981. Summary minutes of the 16 September 1981 workshop meeting are provided as Exhibit G-7 in Appendix G.

h. Coordination With the Ohio Department of Natural Resources.

As previously discussed, the local sponsor for the proposed recreational fishing project is the Ohio Department of Natural Resources (ODNR). As such, ODNR attended the 15 March 1982 workshop meeting on recreational fishing. At this meeting, it was decided to develop two recreational fishing plans to provide fishermen access to the west breakwater. These two plans would differ from each other depending on the type of improvements made at Edgewater Marina, the small-boat marina immediately west of Cleveland Harbor (see Plate 1 in Appendix J). The first plan assumes the existing entrance to Edgewater Marina is completely blocked off with a new breakwater and that a new entrance would be provided into the west basin of the Cleveland

Lakefront Harbor. Small boats would use this new entrance to enter the west basin and would then continue into Edgewater Marina through the existing gap in the west breakwater. The second recreational fishing plan that was developed assumes that the existing entrance to Edgewater Marina is only slightly modified to reduce wave energy entering the marina and continues to serve as the main entrance to Edgewater Marina. However, selection of the plan to recommend for construction, if economically justified, must await the results of the Section 107 Study for Edgewater Marina. This study, initiated in April 1982, will determine the feasibility of modifying Edgewater Marina and the extent of these modifications. Summary minutes of the 15 March 1982 workshop meeting are provided as Exhibit G-8 in Appendix G.

Personnel of ODNR also attended the 28 March 1979 and the 4 May 1982 workshop meetings. At these meetings ODNR assessed the impact of various commercial navigation alternative plans on their proposed Cleveland Lakefront State Park master plan. This master plan will be discussed in Section III of the Main Report.

1. Coordination With the U. S. Fish and Wildlife Service.

The U. S. Fish and Wildlife Service, Columbus Field Office, provided the Buffalo District with a "Planning Aid Letter" and an Intermediate Report during Stage 2 planning (Exhibits H-1 and H-2 in Appendix H, respectively). In their "Planning Aid Letter," the Fish and Wildlife Service documented the results of their literature search conducted to summarize existing data on the fish and wildlife resources in the study area. In their Intermediate Report (Exhibit H-2), the Fish and Wildlife Service expressed their support for carrying forward various alternative plans into Stage 3 planning and discussed the need to investigate measures to mitigate for adverse environmental impacts of the alternatives.

The Fish and Wildlife Service also attended and participated in the 15 March 1982 and 4 May 1982 workshop meetings. At the 15 March 1982 workshop meeting they assisted in formulating recreational fishing plans and reviewed the need for developing additional fish habitat areas on the lakeward side of the breakwaters at Cleveland Harbor. At the 4 May 1982 workshop meeting, they assisted in the selection of the commercial navigation alternatives to be carried forward into Stage 3 planning. Minutes of these two workshop meetings are provided as Exhibits G-8 and G-5 in Appendix G, respectively.

j. Cultural Resources Coordination.

By letter dated 13 October 1981 to the Western Reserve Historical Society, the Buffalo District requested information on the eligibility of the lighthouse at the lakeward end of the west arrowhead breakwater at Cleveland Harbor for nomination to the National Register of Historic Places. Mr. Eric Johannesen, Preservation Officer, replied by letter dated 15 October 1981 (Exhibit F-5a in Appendix F) that the lighthouse was included in a thematic resource nomination to the National Register submitted in August 1980. However, he did not know if the lighthouse was subsequently listed.

By letter dated 25 February 1982, the Buffalo District also requested information on the impacts of alternatives developed during Stage 2 planning on cultural resources in the study area. This letter was sent to the National Park Service and the Ohio Historic Preservation Office. By letter dated 2 March 1982 (Exhibit F-5b in Appendix F), the National Park Service replied that with the exception of the lighthouse on the west arrowhead breakwater, they were not aware of any significant cultural resources that would be affected by the alternatives. The Ohio Historic Preservation Office replied by letter dated 17 March 1982 (Exhibit F-5c) that the lighthouse on the west arrowhead breakwater should be considered eligible for the National Register of Historic Places and that a Preliminary Case Report would have to be prepared if a plan that affected this lighthouse was recommended for construction. They also listed properties eligible for or presently on the National Register that may be affected by various Cuyahoga and Old River navigation alternatives under consideration.

k. Model Study Coordination.

As previously discussed, a hydraulic model study of the west (main) entrance to Cleveland Harbor was conducted by the Corps Waterways Experiment Station. The purposes of this model study were to determine optimum designs for proposed modifications to the west (main) entrance for 1,000-foot vessel operation and to determine resultant wave heights in the Lakefront Harbor as a result of these modifications. Approval to conduct this hydraulic model study was provided by the Office of the Chief of Engineers by letter dated 24 January 1978.

Throughout the course of the model study, study participants have been kept informed on the results of the model tests through verbal conversations, site visits to WES and discussions and movies presented at the 8 April 1981 and 4 May 1982 workshop meetings. Study participants will also be provided with either a copy of the model study report, currently scheduled for public release in the fall of 1982, or the location of the libraries where the report will be available for public review.

6. THE REPORT

The overall organization of this report consists of a Main Report, a series of Technical Appendices (Appendices A through E), a Pertinent Correspondence Appendix (Appendix F), a Public Involvement Appendix (Appendix G), Reports of Others Appendix (Appendix H), a Study Management Appendix (Appendix I), and a Plate Appendix (Appendix J). The Main Report is written to give both the general and technical reader a clear understanding of the study, the study results and the key decisions and conclusions. The Technical Appendices provide additional detailed information on the design, costs and benefits of the alternatives studied. The Pertinent Correspondence Appendix includes copies of pertinent correspondence with organizations and individuals, significant in the development of this Stage 2 study. The Public Involvement Appendix includes minutes of the workshop meetings conducted during the course of this study. Reports of Others (Appendix H) includes the U. S. Fish and Wildlife Service's "Planning Aid Letter" and Intermediate Report. The Study Management Appendix contains a revised "Study Flow Network," which outlines

the future major study activities for this Phase I study; and an updated "Proposed Schedule of Major Activities," which outlines the future major activities prior to construction of a project at Cleveland Harbor. The Plate Appendix includes all the plates developed for the Main Report for easy reference.

7. PRIOR STUDIES AND REPORTS

a. Cleveland Harbor Area.

Many studies of the water resources problems and needs in the Cleveland Harbor area have been made by the Corps of Engineers. The following is a summary of the various reports pertinent to this Cleveland Harbor Phase I study:

(1) Beginning in 1914, there have been 15 Corps of Engineers reports that address improvements to and modification of the Cleveland Harbor commercial navigation project. A summary of these reports, including the 1976 Feasibility Report, is provided in Table 1.

(2) In response to U.S. House of Representative's Committee resolutions of 28 December 1946 and 9 June 1960, the Buffalo District prepared a report entitled Review of Reports for Flood Control and Allied Purposes, Cuyahoga River, OH (1 September 1969) recommending:

(a) Improvements for flood control and streambank erosion in the 9-mile reach of the Cuyahoga River between the Harvard-Dension Bridge (approximate river mile 7) and the mouth of Tinkers Creek (approximate river mile 16).

(b) Construction of a sediment settling basin in the vicinity of river mile 8.0 (approximately 2 miles upstream from the head of commercial navigation) in the interest of commercial navigation, pollution abatement, and Lake Erie restoration.

The report was returned to the Buffalo District in June 1970 as the necessary local assurances were not furnished to cover the cost sharing requirements for a cash contribution in return for windfall benefits. For this reason, and because subsequent legislation for the Cuyahoga River Restoration Study under Section 108 of the 1970 River and Harbor Act provided for expanded study scope, no further action was taken on the 1969 Review of Reports.

(3) Section 108 of the River and Harbor Act of 1970 authorized the Chief of Engineers to study and undertake measures in the interest of water quality, environmental quality, recreation, fish and wildlife and flood control for the Cuyahoga River Basin, Ohio. To date, three Interim Reports have been completed under the resulting Cuyahoga River Restoration Study. The First Interim Report (September 1971) presented the scope of the longer-term Framework Plan plus an Early-Action Program for the Cuyahoga River Restoration Study. The Framework Plan presented a description of the basin's

Table 1 - Prior Corps of Engineers Report for Cleveland Harbor

Year of Report	Work Considered	Congressional Document	Recommendation	Action by Congress (1)
1914	Elimination of bends in Cuyahoga River	H. Doc. 707,63d Cong., 2d sess.	Partly Unfavorable (2)	8 Aug 1917 River and Harbor Act
1932	Dredging in outer harbor to 25 feet, constructing spur breakwater, removing part of old breakwater, abandoning 932 ft. thereof, and eliminating from project 298 ft. of the shoreward extension of west pier.	H. Doc. 477 72nd Cong., 2d sess.	Favorable	30 Aug 1935 River and Harbor Act
1935	Emergency dredging in Cuyahoga and Old Rivers for one year only.	Rivers & Harbors Committee Doc. 39 74th Cong., 1st sess.	Favorable	30 Aug 1935 River and Harbor Act
1936	Maintenance and improvement of Cuyahoga and Old Rivers to a depth of 21 ft., and 18 ft. turning basin and bank cuts 1-9.	Rivers & Harbors Committee Doc. 84 74th Cong., 1st sess.	Favorable	26 Aug 1937 River and Harbor Act
1939	Turning basin and channel extension to Harvard-Dension Viaduct.	H. Doc. 232, 76th Cong., 1st sess.	Partly Favorable (3)	2 Mar 1945 River and Harbor Act
1942	1,300-foot channel extension.	H. Doc. 95, 79th Cong., 1st sess.	Favorable	2 Mar 1945 River and Harbor Act
1942	Flood control.	Preliminary examination.	Unfavorable	20 Apr 1943 (4)
1946	Elimination of turning basin, deepening from 21 ft. to 23 ft. in Cuyahoga and Old Rivers, Federal participation in reconstruction of 7 railroad bridges and bank cut 10.	H. Doc. 629, 79th Cong., 2d sess.	Favorable	24 Jul 1946 River and Harbor Act
1957	Deepening east basin of outer harbor to a depth of 25 ft., reconstruction of 2 railroad bridges and 1 highway bridge, bank cuts 11-15 and elimination of pier reconstruction for one railroad bridge.	H. Doc. 107, 85th Cong., 1st sess.	Favorable	3 Jul 1958 River and Harbor Act

(1) Act authorizing recommended improvement.

(2) Recommended Federal dredging, not exceeding \$400,000 in any official plan adopted by the city.

(3) Unfavorable to channel extension.

(4) Date of submission to Congress.

Table 1 - Prior Corps of Engineers Report for Cleveland Harbor (Cont'd)

Year of Report	Work Considered	Congressional Document	Recommendation	Action by Congress (1)
1958	Deepening lake approach entrance channel, to 29 feet, west basin and west end of east basin to 28 feet, lower Cuyahoga River to junction with Old River and Old River to upstream limit of 23-foot project to 27 feet.	H. Doc. 152, 86th Cong., 1st sess.	Favorable	14 Jul 1960 Rivers and Harbor Act
1961	Deepening an area extended easterly about 3,800 feet from the existing 28-foot project area and southerly from the existing maintenance limit on the north to a limit 75 feet north of the harbor line on the south, 27 feet deep easterly of a line 800 feet east of the west end of the east breakwater and 28 feet deep westerly of that line. Dredging a dock approach channel to the Nicholson Cleveland Terminal Company pier, 25 feet deep, from the 25-foot depth contour to a limit 75 feet north of the pierhead line, 400 feet ft. wide at the shore ward end and flared toward the lake.	H. Doc. 527, 87th Cong., 2d sess.	Favorable	23 Oct 1962 Rivers and Harbor Act
1966	Deepening Old River to 27 feet, from the present upstream limit of authorized deepening to 27 feet to the head of navigation thereon.	Not Applicable	Favorable	(5)
1976	Deepening and widening east entrance to 32 feet, deepening east basin channel to 28 feet, removing portion of spur breakwaters at west (main) entrance and improvements for recreational fishing.	H. Doc. 24, 96th Cong., 1st Sess.	Favorable	1976 Water Resources Development Act (6)
1977	Removal of Jefferson Avenue Bridge abutments.	Not Applicable	Unfavorable	(5)

(5) Authority: Section 107 of the 1960 River and Harbor Act.

(6) Authorized Phase I GDM.

In Addition to the above, the River and Harbor Act of 13 June 1902 states:
 "The Secretary of War may, in his discretion, dredge to a depth of twenty-five feet (23 feet referred to low-water datum) in any portion of said (Cleveland) Harbor."

resource problems and needs and possible alternative means of dealing with these problems and needs. Sources of pollution and other degradable conditions were sought out and identified. Current pollution abatement programs were inventoried to determine their effects on pollution. The Early-Action Program consisted of four action programs that were considered compatible with the overall framework plan and which could be constructed or accomplished without additional study. Big Creek, an Early-Action flood control project, is in the final plans and specification stage.

The Second Interim Report (March 1976) identified the significant flooding problems within the Cuyahoga River Basin and developed corrective plans for these problems. In the report, it was concluded that flood control correction plans could not be economically justified (excluding the Big Creek improvements). Further, it was recommended that, in general, the affected communities implement flood plain management programs to prevent increased flood damages.

The Third Interim Report (November 1979, revised April 1981) investigated the erosion and sedimentation problems in the Cuyahoga River Basin. In this report it was concluded that streambank erosion was a minor contributor (approximately 5 percent) to the Cuyahoga River sediment load and that streambank erosion control plans were not economically feasible. Further, it was also concluded that upland (sheet and rill) erosion contributes significantly to the Cuyahoga River sediment load (approximately 50 percent) and recommended that local interests implement land management programs to control this erosion.

(4) In August 1973, the Buffalo District completed the Wastewater Management Study for Cleveland-Akron Metropolitan and Three Rivers Watershed Area which evaluated alternative plans for water quality improvement in the Cuyahoga, Chargin and Rocky River watersheds and receiving Lake Erie by treatment of municipal and industrial waste-waters and urban storm runoff. The findings of this study, which identified four alternative land and water-oriented methods for wastewater treatment, along with the findings of similar studies conducted by the Corps of Engineers in five other areas, were submitted to both houses of Congress by the Secretary of the Army (SOA) by letter dated 28 April 1978. No recommendation for program implementation was provided by the SOA.

(5) In December 1981, the Buffalo District completed a reconnaissance (Stage 1) level letter report which recommended that a Detailed Project Report (DPR) be prepared under authority of Section 107 of the 1970 River and Harbor Act for Edgewater Marina. The purposes of this study are to determine the economic and environmental feasibility of modifying Edgewater Marina for wave reduction in the existing small-boat docking area and for expansion of this small-boat docking area. Approval to prepare a DPR was subsequently provided by the Division Engineer, North Central Division by letter dated 23 March 1982. Funds to initiate the study were provided in May 1982.

(NOTE: As previously discussed, selection of a recreational fishing plan to recommend for construction, if economically justified, is dependent upon the results of this study which will determine, among other things, the extent of

modifications required at the marina entrance to reduce wave energy entering the marina. Since it is not known at this time when the DPR will be completed, two eventualities will be considered in this Phase I study: (1) that the DPR is not completed prior to completion of this Phase I study and thus the extent of modifications to the marina entrance are not known; and (2) the DPR is completed and the final modification plan has been selected. In the first instance, two plans will be recommended for construction, if economically justified. One plan will assume that the existing entrance to Edgewater Marina is completely closed and a new entrance is provided into the west basin of Cleveland Harbor. Small boats would then enter the west basin through this new entrance and continue into Edgewater Marina through the existing gap in the west breakwater. The second recreational fishing plan will assume that the existing entrance to Edgewater Marina is only slightly modified and continues to serve as the main entrance to the marina. Actual construction of either of the recommended recreational fishing plans would await completion of the DPR. The second eventuality assumes that the results of the DPR are known prior to completion of this Phase I study. In that case, only one plan would be recommended for construction, if economically justified. Construction of this plan would be concurrent with other recommended modifications to Cleveland Harbor in the interest of commercial navigation, if adequate construction funding is provided.)

(6) In partial response to Section 6 of Public Law 79-14, approved 2 March 1945, the Buffalo District initiated the Lake Erie Coast-Cleveland Interim Feasibility Study in 1979. The purposes of this study are to define the recreational small-boat needs in the Cleveland Harbor area and to determine if plans to meet these needs are economically and environmentally justified. Stage 1 planning for this Interim was started in 1979 and concentrated on two areas for future modifications and/or expansion: (1) the existing East 55th Street Marina in the east basin of Cleveland Harbor (see Plate 1 in Appendix J); and (2) at the upstream end of the Old River. However, planning is currently suspended, pending receipt of additional funding to complete the Interim Study.

(7) By letter dated 9 April 1975, the Mayor of the village of Bratenahl, located immediately east of Cleveland Harbor, stated that lakefront properties in the village were experiencing considerable beach starvation and shoreline erosion. The Mayor also expressed his concern that the Cleveland Harbor breakwaters were a significant contributing factor to this degrading condition. Accordingly, the Buffalo District initiated a Section 111 Study in Fiscal Year 1982 for the Bratenahl area with completion of the study currently scheduled for late 1984. The purposes of this study are to determine the effects of the harbor structures on shoreline erosion and to determine if mitigation of such damages attributable to the harbor structures is warranted.

b. Other Corps of Engineers Studies.

Other ongoing studies by the Corps of Engineers are pertinent to and may have an influence on future considerations at Cleveland Harbor. A summary of these various studies follows:

(1) The Navigation Season Extension Study - The purpose of this study, completed in December 1979, was to determine the economic feasibility of extending the navigation season for all the Great Lakes and the St. Lawrence Seaway. Navigation on the GL/SLS presently occurs from about the first week in April to mid-to-late December. A limited 8-1/2 to 9-month season results in diseconomies to commerce and industry which resort to stockpiling of raw materials or to more costly alternate transportation routes to sustain year round operations. In his letter of 3 March 1982 transmitting the final study report to the Secretary of the Army, the Chief of Engineers recommended a navigation season extension to 10-3/4 months on the upper lakes and 10 months on Lake Ontario and the St. Lawrence River.

For this Cleveland Harbor Phase I study, an 8-1/2 to 9-month navigation season has been assumed for Stage 2. A sensitivity analysis on this assumption will be conducted in Stage 3, if warranted.

(2) The Great Lakes Connecting Channels and Harbors Study - This current feasibility study covers the upper Great Lakes Navigation System (Lakes Superior, Michigan, Huron, Erie and their connecting channels). The purpose of this study is to determine the feasibility of modifications to the existing commercial navigation system, including the need to increase the system's draft (presently at 25.5 feet) and /or size of vessel using the system (presently limited to a vessel no larger than 1,000 X 105 feet). The study will also determine the feasibility of enlarging and/or augmenting the locks at Sault Ste. Marie. The study is presently scheduled for completion concurrent with the Cleveland Harbor study.

For Stage 2 of the Cleveland Harbor study, it has been assumed that the present navigation system will not change and that the locks at Sault Ste. Marie will not constrain commodity growth at Cleveland Harbor. These assumptions will be reviewed during Stage 3 and, if warranted, appropriate adjustments and/or sensitivity analyses will be made.

(3) St. Lawrence Seaway Additional Locks Study - The purpose of this current feasibility study is to determine the adequacy of the existing locks and channels in the U. S. section of the Seaway with respect to present and future commercial navigation needs, and the advisability of their rehabilitation, enlargement, or augmentation. The study is scheduled to be completed concurrent with the Cleveland Harbor study.

Again, for Stage 2 of the Cleveland Harbor study, it has been assumed that the present Seaway System will not change and that its' capacity will not constrain commodity movements at Cleveland Harbor. These assumptions will be reviewed during Stage 3 and, if warranted, adjustments and/or sensitivity analyses will be made.

(4) The Maximum Ship Size Study - This study was completed in 1977 by North Central Division, Corps of Engineers, to screen future vessel sizes and improvement alternatives for use in the Great Lakes Connecting Channels and Harbors and the St. Lawrence Seaway Additional Locks studies. One conclusion reached in this study was that the maximum economically sized bulk cargo vessel that would use the Great Lakes Navigation System would be 1,200 feet

long by 130 feet wide. However, this study was subsequently revised and updated in 1981 to reflect current industry views that the maximum sized vessel that would use the Great Lakes Navigation System would be 1,100 feet long by 105 feet wide.

During Stage 2 of the Cleveland Harbor study, no plans were formulated to accommodate this maximum sized vessel since no shipping company indicated any long range plans to construct such a vessel. However, the adaptability of plans developed for 1,000-foot vessel operation to accommodate 1,100-foot vessel operation was assessed and analyzed. The results of this assessment were then used, along with other criteria, in selecting plans to carry forward into Stage 3 planning (Development of Detailed Plans).

(5) National Waterways Study - This study examined the capabilities of the Nation's existing waterway system and the additional waterway improvements necessary to effectively serve present and future transportation requirements of the Nation. The study was conducted by the Institute for Water Resources, Corps of Engineers and was completed in August 1981. As discussed in the next section of the Main Report, "Problem Identification," growth rates developed in this study for iron ore and limestone were used, in conjunction with other information, to estimate future movement of these commodities at Cleveland Harbor.

(6) Great Lakes/St. Lawrence Seaway Regional Transportation Study - This study was conducted by Booz-Allen and Hamilton, Inc. during 1981 to investigate the feasibility of future modifications to the Great Lakes - St. Lawrence Seaway Navigation System. Individual study components included tonnage forecasts, fleet forecasts and freight rate studies. In addition, the costs of alternative lock sizes were also compared with estimates of future navigation benefits. Preliminary conclusions reached during this study were further refined by Detroit and Buffalo Districts.

Tonnage and fleet forecasts developed for this study were used, in conjunction with other information, to develop forecasts of future commodity movements at Cleveland Harbor and the future fleet that would carry these commodities.

(7) Section 108d of Public Law 92-500 directed the Corps of Engineers to develop a program for the "restoration and environmental repair" of Lake Erie. The resulting Lake Erie Wastewater Management Study (LEWWM) by the Buffalo District has identified nutrient enrichment - particularly phosphorus in all of its forms - as the primary cause of heavy eutrophication in the western basin of Lake Erie and marginal eutrophication in the central and eastern basins. The study has determined that 44 percent of the phosphorus loading to Lake Erie is from nonpoint or diffuse sources such as that attached to sediment. The study will continue through 1982, and the "Final Study Report" will use results of pilot management programs on selected Lake Erie tributary watersheds to recommend specific implementation programs for these and unmonitored watersheds in the Lake Erie Basin.

SECTION II

PROBLEM IDENTIFICATION

The purpose of this section is to inform the reader of this report of the water and related resource problems and needs in the study area and for which this study seeks a solution. The section presents information on the existing physical and human environment and the commercial navigation facilities in the study area; discusses the need to modify the existing commercial navigation features of Cleveland Harbor and other water-related resource problems for which this study seeks a solution; reviews the planning constraints under which this study was conducted; discusses the specific planning objectives of the study; and reviews the conditions that would exist if no Federal action was taken.

8. EXISTING CONDITIONS

The purpose of this subsection is to present the environmental setting without the project to permit impact assessment of the various alternatives. The information presented will provide a data base for impact assessment and evaluation purposes.

a. Physical Environment.

(1) Location. The city of Cleveland, OH, is located on the south shore of Lake Erie about 176 miles southwest of Buffalo, NY, and 96 miles east of Toledo, OH. Cleveland Harbor consists of a breakwater protected Lakefront Harbor in Lake Erie and improved navigation channels on the Cuyahoga River and Old River. The limits of the existing Federal navigation project are shown on Plates 1 and 2 in Appendix J.

(2) Physiography - Topography. The Ohio shoreline of Lake Erie lies within the Central Lowland Physiographic Province (Fenneman, 1938). East of Cleveland, this province is typically a 5 to 10-mile wide strip of relatively flat land bordering the lake. The natural land surface often rises abruptly, forming bluffs 20 to 40 feet high at or near the Lake Erie shoreline. West of Cleveland, the province continues to follow the Lake Erie shore, but broadens to include approximately the western half of Ohio. On the south, the province is bordered by the Appalachian Plateaus Province. Terrain in the Cleveland area is relatively flat, sloping toward Lake Erie with elevations ranging from about 580 feet at the lake to about 1,000 feet, 10 to 15 miles inland. Most of the city is located on plateaus about 80 to 100 feet higher than the lakefront and is divided from the lakefront by steep bluffs.

(3) The Cuyahoga River. The Cuyahoga River rises about 10 miles northeast of Burton in Geauga County, OH, and flows in a generally "U" shaped curve through northeastern Ohio, emptying into Cleveland Harbor and ultimately Lake Erie at Cleveland, OH. The river is approximately 100 miles long and, with its tributaries, drains an area of 810 square miles. The river varies in width from 20 to 85 feet and in depth from a few inches to 4 or 5 feet, except in Cleveland where the river channel has been widened and deepened to the project depths shown on Plates 1 and 2.

(4) Climate. The Cuyahoga County region is dominated by a continental climate which is moderated by Lake Erie. The area experiences an average growing season of 195 days which is greater than that observed at most other locations in the U.S. at the same latitude.

The mean annual temperature at Cleveland based on a 40-year record (1941-1980) is 49.8°F (U.S. Department of Commerce, 1980). The mean annual snowfall of 52.0 inches comprises about 15 percent of the average annual precipitation of 34.22 inches. Precipitation is normally well distributed throughout the year.

Winds in the Cleveland area are most commonly from the south and average about 11 miles per hour. A wind diagram for the Cleveland Coast Guard Station on the Cleveland Lakefront is presented on Figure 5.

(5) Geology. In northern Ohio, a thick sequence of sedimentary, Paleozoic strata is extensively mantled by Pleistocene glaciolacustrine and glacial till deposits. The Paleozoic strata are underlain primarily by Precambrian gneiss and granites. Outcrops of Precambrian rocks are absent in Ohio (U.S. Army Engineer District, Buffalo, 1978; Ohio Geological Survey, 1920; and Stour, et al., 1943).

Natural, unconsolidated surface deposits in the Cleveland area are derived from material associated with Pleistocene glaciation, fossil beaches and ridges formed during the development of Lake Erie, and the weathering of exposed bedrock. The glacial drift material is extremely variable in character, consisting of dense, impermeable till in some areas and open, permeable sand and gravel in others.

The unconsolidated surface deposits are underlain by members of the Ohio Shale Formation of Devonian age along a 5 to 7 mile wide belt that parallels the south shore of Lake Erie. Total thickness of this formation is as great as 500 to 600 feet in some areas. South of the Ohio Shale Formation belt, surface deposits are underlain by younger Mississippian and Pennsylvanian shales, sandstones, and limestones. These materials are eroded and transported to the Cleveland Harbor area by way of the Cuyahoga River (U. S. Army Engineer District, Buffalo, 1978; Ohio Geological Survey, 1920; and Stour, et al. 1943).

(6) Soils. Shorelines of Cleveland Harbor and the lower Cuyahoga River consist primarily of Urban land which is characterized by nearly level and gently sloping areas that are predominantly covered by concrete, asphalt, buildings, and other impervious surfaces (Musgrave and Holloran, 1980). Fill along the harbor shore consists primarily of material dredged from Lake Erie and the Cuyahoga River while some areas along the river contain waste from the local steel industry.

In addition to Urban land, the Urban land-Mahoning soil association, the Allis-Urban land association, the Oshtemo-Urban land - Chili association, and the Urban land - Elnora - Jintown association exist in close proximity to the lower Cuyahoga River and Cleveland Harbor. A general soils map for Cuyahoga

County is shown on Figure 6. No prime or unique farmlands border the Federal project site.

(7) Littoral Transport. The predominant Lake Erie longshore current in the Cleveland area is from west to east. Longshore movement of littoral material is impeded by the lakeward extremities of the harbor breakwaters which extend past the 30-foot depth contour. Coastal structures west of Cleveland Harbor at Edgewater Park have also trapped a considerable amount of sand which is unavailable for beach building to the east.

(8) Water Levels and Fluctuations. All depths mentioned, unless otherwise stated, are referred to International Great Lakes - 1955 (IGLD-1955) low water datum for Lake Erie, which is 568.6 feet above mean water level at Father Point, Quebec. Water levels in Cleveland Harbor and the lower portion of the Cuyahoga River are influenced by water level fluctuations in Lake Erie. Long-term Lake Erie levels are dependent on precipitation, evaporation, and runoff, with the highest levels generally occurring in summer and the lowest in winter. Temporary changes in the level of Lake Erie are caused by the action of wind which may push water towards either end of the lake. Amplitudes greater than 13 feet have been recorded simultaneously between opposite ends of the lake. Water levels generally do not fluctuate greatly with the wind near the center of the lake, although wave activity during storms is often violent, creating hazardous boating conditions and accelerating shore erosion.

(9) Water Quality. The Lake Erie Nearshore Study of the area between Ashtabula, OH, and Vermilion, OH, (Richards, 1981) concluded that concentrations of most water quality parameters investigated were highest at river mouths. Water quality problem areas included the Black River, Rocky River, Chagrin River, Grand River, Ashtabula River, and Cleveland Harbor including the Cuyahoga River. For the Cleveland Harbor - Cuyahoga River area, the study detected violations of Ohio EPA water quality standards and/or International Joint Commission objectives for conductivity, dissolved oxygen, ammonia, manganese, iron, cyanide, phenols, lead, zinc, cadmium, and nickel.

Richards (1981) determined that seasonal patterns in runoff and biological activity produced significant water quality changes in the nearshore zone. At most nearshore sampling stations, stratification of chemical parameters in the water column did not occur, although stratified conditions did occur intermittently at the outermost stations. Concentrations of most parameters investigated were higher and more variable in the nearshore zone than in the open lake.

Garlauskas (1974) identified zones of water quality in the Cleveland lake shore area as shown on Figure 7. In general, water quality deteriorates from west to east along the Cleveland shoreline and improves with distance from shore. Local areas of water quality degradation occur near the mouth of the Cuyahoga River, near the westerly and easterly wastewater treatment plants, and along the lake side of the east breakwater opposite Burke Lakefront Airport where dredged material was deposited in past years. Concentration ranges of water quality parameters recorded in Cleveland Harbor in 1967 are presented on Table 2.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OHIO DIVISION OF LANDS AND SOILS
OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
GENERAL SOIL MAP
CUYAHOGA COUNTY, OHIO



SOIL LEGEND

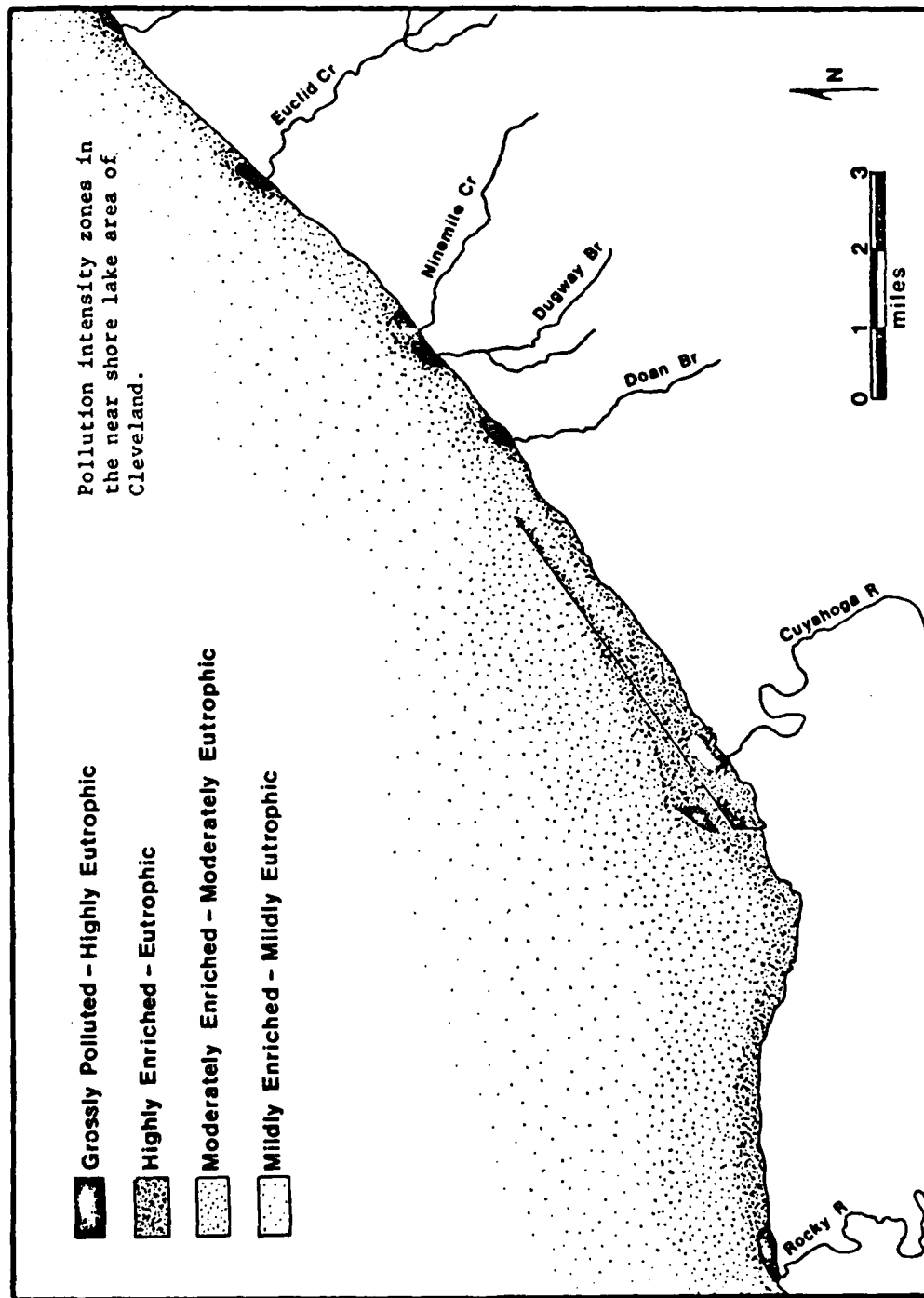
- DEEP SOILS ON UPLANDS AND THE HIGHER PARTS OF LAKE PLAINS**
- 1 Urban and Mahoning association. Urban and Mahoning soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 2 Mahoning-Elyria association. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 3 Mahoning-Elyria association. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
- MODERATELY DEEP SOILS ON UPLANDS AND LAKE PLAINS**
- 4 Urban and Mahoning association. Urban and Mahoning soils are moderately deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 5 Mahoning-Elyria association. These soils are moderately deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 6 Mahoning-Elyria association. These soils are moderately deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
- DEEP SOILS ON BEACH RIDGES, OUTWASH TERRACES, AND LAKE PLAINS**
- 7 Urban and Mahoning association. Urban and Mahoning soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 8 Mahoning-Elyria association. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 9 Mahoning-Elyria association. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
- DEEP SOILS ON 1000' PLAINS AND ON STEEP TERRACES**
- 10 Urban and Mahoning association. Urban and Mahoning soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
 - 11 Mahoning-Elyria association. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.
- URBAN LAND**
- Urban land. These soils are deep, well drained, and have a high water table. They are found in the higher parts of the lake plains.

Compiled 1960



Figure 6

Source: Musgrave and Holloran, 1980



Source: Garlauskas, 1974

Figure 7

Maximum and minimum values for water quality parameters recorded by the Ohio Environmental Protection Agency for 1978-1980 at the Lower Harvard Avenue and the West 3rd Street Bridges are shown on Table 3. In general, the waters of the lower Cuyahoga River are grossly polluted and have high temperatures, low concentrations of dissolved oxygen, intermittent toxicity, and excessive amounts of solids, ammonia, BOD, COD, oil, fecal coliform bacteria, zinc, iron, lead, cyanide, phenols, floating debris, odor, and turbidity.

Table 2 - Concentration Ranges of Water Constituents
Cleveland Outer Harbor, 1967

Constituent	:	Range
Total P mg/l	:	0.08 - 0.55
Soluble P mg/l	:	0.03 - 0.16
Organic N mg/l	:	0.22 - 1.93
Ammonia N mg/l	:	0.36 - 2.42
Nitrate N mg/l	:	0.43 - 1.50
Chloride mg/l	:	32 - 90
Phenol ug/l	:	1 - 86
Total Solids mg/l	:	219 - 585
Dissolved Solids mg/l	:	173 - 428
Conductivity umhos/cm	:	260 - 620
Coliforms/100ml	:	1,400 - 58,000

Source: Hartley, 1968

Table 3 - Cuyahoga River Water Quality 1978-1980

Parameter	Maximum and Minimum Concentrations				
	At Lower Harvard Avenue :		At West 3rd Street		
	:(Based on 21 Collections :		:(Based on 7 Collections		
	: 18 Oct 78 - 18 Sep 80) :		28 Aug 78 - 18 Sep 80)		
	Maximum	Minimum	Maximum	Minimum	
Water Temperature °C	25.0	1.0	30.0	7.5	
pH Field S.U.	8.0	6.6	7.7	6.7	
DO mg/l	12.2	4.0	6.5	0.2	
Conductivity - Field					
Micromhos	1472	350	1224	650	
Suspended Solids mg/l	562	<10	18	10	
Dissolved Solids mg/l	764	330	593	506	
TKN mg/l	6.69	1.13	7.55	3.31	
Ammonia N mg/l	4.24	0.66	6.77	2.26	
Nitrite N mg/l	0.9	<0.01	0.89	<0.02	
Nitrate N mg/l	2.45	0.53	2.42	1.20	
Total Phosphorus mg/l	1.00	0.18	0.69	0.15	
Soluble Phosphorus					
mg/l	0.26	0.10	-	-	
BOD, 5 Day mg/l	10	5.8	-	-	
COD mg/l	94.4	10	28	8	
TOC mg/l	22	7.1	-	-	
Chloride mg/l	213	25	128	124	
Fluoride mg/l	0.94	0.30	1.8	1.62	
MBAS mg/l	0.28	0.09	0.25	0.25	
Fecal Coliform 100 ml	41000	6000	15000	3900	
Fecal Strep 100 ml	27000	200	2500	100	
Phenols ug/l	50	5	21	7	

Table 3 - Cuyahoga River Water Quality 1978-1980 (Cont'd)

Parameter	Maximum and Minimum Concentrations			
	At Lower Harvard Avenue :		At West 3rd Street	
	:(Based on 21 Collections :		:(Based on 7 Collections	
	: 18 Oct 78 - 18 Sep 80) :		28 Aug 78 - 18 Sep 80)	
	Maximum	Minimum	Maximum	Minimum
Hardness Total	:	:	:	:
Ca CO ₃ mg/l	269	167	356	225
Copper Total	:	:	:	:
ug/l	60	<30	<30	<30
Zinc Total ug/l	600	40	100	60
Arsenic Total ug/l	<10	<10	<10	<10
Cadmium Total ug/l	15	<5	<10	<5
Chromium Total ug/l	60	<30	<30	<30
Iron Total ug/l	25,000	910	1330	290
Lead ug/l	130	8	56	6
Manganese ug/l	510	130	310	250
Mercury Total ug/l	<0.5	<0.5	<0.5	<0.5
Nickel Total ug/l	100	<100	100	<100
Oil-Grease mg/l	1340	1340	<5.0	<5.0
Cyanide mg/l	0.15	<.01	0.14	0.04
PCB ug/l	<0.5	<0.5	-	-

NOTE: Not all water quality parameters listed were analyzed for each water sample taken.

SOURCE: Ohio Environmental Protection Agency, 1981.

Steel companies along the lower Cuyahoga River collectively recycle about 400 million gallons of water per day (mgd), primarily for contact cooling. This use represents about 73 percent of the average river flow of 550 mgd. Water quality in the lower Cuyahoga River and Cleveland Harbor is further depressed during periods of low river flow (Garlauskas, 1974).

The U.S. Environmental Protection Agency has determined that during summer low flow conditions, at least the lower 1 mile of the Cuyahoga River acts as an estuary. On occasion, lake water invades the river, creating a mixing zone in the lower mile of the Cuyahoga River.

Normally, a mixing zone exists where the Cuyahoga River enters the harbor and Lake Erie. Currents moving from west to east within the breakwater protected harbor tend to deflect the plume of the Cuyahoga River to the east. Havens and Emerson Ltd. (1968) reported that under typical conditions, about 80 percent of the water from the Cuyahoga River flowed easterly through the harbor, while about 20 percent exited through the existing harbor entrance channel.

(10) Sediments. Sediments enter Cleveland Harbor and the lower Cuyahoga River through surface runoff, shore and bank erosion, and the discharge of industrial and domestic waste. Dissolved materials from industrial and upland agricultural activities also enter the water and become attached to the sediments. Sediments carried downstream by the Cuyahoga River are deposited in the Federal navigation channel, where widening and deepening have created low current velocities.

Sediments reaching Cleveland Harbor and the lower Cuyahoga River consist primarily of medium to fine grained materials and contain high concentrations of iron, nitrogen, phosphates, oil, grease, and other pollutants. High pollution levels depress aquatic populations and inhibit natural oxidation processes in the river sediments, although a somewhat lesser effect is observed in the Outer Harbor area.

Region 5 of the U.S. Environmental Protection Agency (USEPA) conducted sediment sampling in Cleveland Harbor and the lower Cuyahoga River in 1977. Based on the 1977 sediment test results, the USEPA classified the sediments within the entire Cuyahoga River section of the Cleveland Federal navigation project as heavily polluted. Harbor surface sediments within the breakwaters were also classified as heavily polluted (see Plate 4 in Appendix J). Sediment core samples were taken at 4 of the 1977 harbor sampling locations. The core sample taken at the east end of the existing Federal project and the core sample taken directly southeast of the west arrowhead breakwater were heavily polluted for the entire lengths of the cores.

The USEPA classified the sediments outside the breakwaters in the lake approach channel as unpolluted, while sediments outside the east entrance light were considered as borderline unpolluted/moderately polluted. Comparison of the 1977 test results with previous data collected in 1972 indicated that an improvement in sediment quality had occurred for some parameters tested.

(11) Air Quality. The Ohio Environmental Protection Agency (OEPA) considers air pollutants to be those substances which are added to the ambient (outside) air in quantities sufficient to cause harmful effects on humans (OEPA, 1979). Six substances are presently known which have harmful effects at concentrations above the National Ambient Air Quality Standards. These six substances are referred to as Criteria Pollutants (substances for which air quality standards have been adopted by the U.S. Environmental Protection Agency) and include total suspended particulates (TSP), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), photochemical oxidants (ozone), and lead.

Although a seventh class of substances known as non-methane hydrocarbons (NMHC) is not harmful in itself, guidelines have been established in an attempt to control their role in the formation of dangerous photochemical oxidants such as ozone (OEPA, 1979). Table 4 shows the air quality standards in effect during 1979 for the seven pollutants listed above.

The Cleveland Air Quality Control Region consists of Lorain, Cuyahoga, Lake, Geauga, Portage, Summit, Medina, and Stark Counties, OH. Table 5 summarizes the number of days in which air quality standards were exceeded in 1979 for the various air quality control regions in Ohio.

Although violations of short term air quality standards did occur in Ohio, no air pollution alerts needed to be called in 1979.

b. Biological Environment.

(1) Upland Vegetation - Only a very limited quantity of upland vegetation currently exists along the Cuyahoga River and the Lakefront Harbor areas. Some trees, vines, and shrubs occur along the west side of Irishtown Bend between bridges 5 and 8 on the lower Cuyahoga River. The eastern end of Whiskey Island and the filled diked disposal areas are partially vegetated with grasses, shrubs, and small trees.

(2) Mammals, Reptiles, and Amphibians - Recent surveys of mammals, reptiles, and amphibians in the Cleveland Harbor area are lacking. Loss of upland habitat due to urbanization has probably eliminated most mammals from the Cleveland Harbor area. Populations of reptiles and amphibians are believed to be limited due to habitat modification and degraded water quality.

(3) Birds - A total of about 260 species of birds have been reported in the Cleveland area. The harbor is situated on the edges of both the Atlantic and Mississippi flyways. Waterfowl migrate through the Cleveland area on both north-south and east-west routes between breeding and wintering grounds.

Birds which are especially common in the harbor area include Bonaparte's gull (Larus philadelphia), the ring billed gull (L. delawarensis), and the herring gull (L. argentatus). These gulls rest on harbor structures and feed in the surrounding waters. Other common bird species include the horned

Table 4 - Federal and State Ambient Air Quality Standards

Pollutant	Duration	Restoration	Ohio EPA Standards		US EPA Standards	
			Primary	Secondary	Primary	Secondary
Suspended Particulates	Annual geometric mean	Not to be exceeded	75 ug/m ³		75 ug/m ³	60 ug/m ³ *
Suspended Particulates	24-hour concentration	Not to be exceeded more than once per year	260 ug/m ³	150 ug/m ³	260 ug/m ³	150 ug/m ³
Sulfur Dioxide	Annual arithmetic mean	Not to be exceeded	80 ug/m ³ (0.03 ppm)		80 ug/m ³ (0.03 ppm)	
Sulfur Dioxide	24-hour arithmetic mean concentration	Not to be exceeded more than once per year	365 ug/m ³ (0.14 ppm)		365 ug/m ³ (0.14 ppm)	
Sulfur Dioxide	3-hour arithmetic mean concentration	Not to be exceeded more than once per year		1300 ug/m ³ (0.5 ppm)		1300 ug/m ³ (0.5 ppm)
Carbon Monoxide	1-hour arithmetic mean concentration	Not to be exceeded more than once per year	10 mg/m ³ (9.0 ppm)		10 mg/m ³ (9.0 ppm)	
Carbon Monoxide	1-hour arithmetic mean concentration	Not to be exceeded more than once per year	40 mg/m ³ (35.0 ppm)		40 mg/m ³ (35.0 ppm)	
Ozone	1-hour arithmetic mean concentration	Not to be exceeded more than one day per year	240 ug/m ³ (0.12 ppm)		235 ug/m ³ (0.12 ppm)	
Non-Methane Hydrocarbons	3-hour arithmetic mean concentration	Not to be exceeded between 8 a.m. and 9 a.m.	160 ug/m ³ (0.24 ppm)		160 ug/m ³ (0.24 ppm)	
Nitrogen Dioxide	Annual arithmetic mean	Not to be exceeded	100 ug/m ³ (0.05 ppm)		100 ug/m ³ (0.05 ppm)	
Lead	3-month arithmetic mean concentration	Not to be exceeded			1.5 ug/m ³	

NOTES: a. Primary standards established for the protection of public health.
b. Secondary Standards are established for the protection of public welfare.
c. Values in parentheses are equivalent values in parts per million by volume.
d. *Air Quality Guidelines

SOURCE: Ohio Environmental Protection Agency, 1979

Table 5 - Number of Days in Which Air Quality Standards Were Exceeded

	TSP		SO ₂		NO ₂		CO		OZONE
	24-Hour	3-Hour	24-Hour		Annual		8-Hour	1-Hour	1 Hour
Air Quality	Obs. >260	Avg. >1300	Avg. >365		>100		Avg. 10.	Avg. >40	Avg. >235
Control Region	ug/m ³	ug/m ³	ug/m ³		ug/m ³		mg/m ³	mg/m ³	ug/m ³
Number 079	7	0	0		*0		0	0	16
Cincinnati									
Number 103	9	0	0		0		-	-	-
Portsmouth									
Number 124	0	0	0		0		0	0	7
Toledo									
Number 173	0	0	0		0		0	0	13
Dayton									
Number 174	25	1	3		0		10	0	19
Cleveland									
Number 175	6	0	0		0		-	-	-
Mansfield									
Number 176	0	0	0		0		13	1	0
Columbus									
Number 177	2	0	0		0		-	-	1
N.W. Ohio									
Number 178	6	0	0		0		4	0	28
Youngstown									
Number 179	0	0	1		0		-	-	-
Marietta									
Number 180	46	-	-		0		-	-	-
Sandusky									
Number 181	20	0	2		0		8	0	4
Steubenville									
Number 182	0	0	0		0		-	-	10
Chillicothe									
Number 183	3	0	0		0		-	-	-
Zanesville									

*No short term standard is in effect for NO₂.

SOURCE: Ohio Environmental Protection Agency, 1979.

grebe (Podiceps auritis), common loon (Gavia immer), great blue heron (Ardea herodias), mallard (Anas platyrhynchos), black duck (Anas rubripes), canvas-back (Aythya valisineria), goldeneye (Bucephala clangula), bufflehead (Bucephala albeola), oldsquaw (Clangula hyemalis), and common merganser (Mergus merganser). When ice is on the lake, waterfowl are often attracted to the open water areas associated with power plant effluents in Cleveland Harbor.

(4) Fish - Fish populations in the Cleveland area have suffered greatly due to degradation of aquatic habitat. The fish fauna of the lower 7 miles of the Cuyahoga River generally consists of relatively few individuals and species, although fish routinely enter the river from the Lakefront Harbor (White et al., 1975). The relative abundance of species collected by White, et al. (1975) in Cleveland Harbor and adjacent marinas during 1971-1974 is presented on Table 6. The most abundant species in the harbor are common emerald shiner, eastern gizzard shad, and yellow perch. The yellow perch is the species making the most important contribution to the commercial and sport fisheries harvest. Both coho and chinook salmon occur in the harbor and are stocked in the Chagrin River, which empties into Lake Erie about 15 miles east of Cleveland Harbor (White et al., 1975).

White et al. (1975) described the area of Cleveland Harbor and adjacent marinas as one of the fish nursery zones in the Cleveland area. Species collected as fry or young-of-the-year in Cleveland Harbor are identified on Table 7. Most of the harbor nursery areas are dominated by a few abundant species.

The lower 5 miles of the Cuyahoga River were reported to support young-of-the-year populations of goldfish, emerald shiner, and green sunfish (White et al., 1975). cursory examinations indicate that goldfish may deposit eggs on the undersides of boats and on harbor pilings.

A list of species spawning in Cleveland Harbor would probably be similar to Table 7 (White et al., 1975). Goldfish, pumpkinseed sunfish, largemouth bass, and yellow perch were observed spawning within Cleveland Harbor during the period 1972-74 (White et al., 1975). The actual success of spawning in Cleveland Harbor has not been documented, but is probably limited due to relatively poor water quality.

(5) Benthos and Plankton - Table 8 presents a list of benthic macroinvertebrates collected in the Lake Erie nearshore zone near Cleveland. Pliodzikas (1979) found that the majority of these organisms consisted of aquatic oligochaetes. Fisheries investigations performed for the U.S. Army Corps of Engineers (1978) indicate that abundant populations of relatively mobile benthic macroinvertebrates such as crayfish, amphipods, and isopods may be found on the harbor breakwalls, where abundant growths of the algae Cladophora sp. occur.

Significant increases in phytoplankton populations occur during the spring and fall in Cleveland Harbor. Although the dominant species are diatoms such as Asterionella spp., Melosira spp., and Fragiluria spp., the green and blue-green algae also contribute to phytoplankton blooms (Hartley and Van Vooren, 1977; U.S. Army Corps of Engineers, 1978).

Table 6 - Relative Abundance of Fishes Collected in Cleveland Harbor and Adjacent Marinas during 1971-1974

Species	: Number Collected	: Percent of Total
Longnose Gar	: 1	: 0.01
Alewife	: 92	: 0.85
Eastern Gizzard Shad	: 2525	: 23.43
Chinook Salmon	: 9	: 0.08
Coho Salmon	: 42	: 0.39
Rainbow Trout	: 2	: 0.02
Rainbow Smelt	: 323	: 3.00
Northern Pike	: 15	: 0.14
Carp	: 64	: 0.59
Goldfish	: 97	: 0.90
Golden Shiner	: 393	: 3.65
Longnose Dace	: 1	: 0.01
Creek Chub	: 1	: 0.01
Western Blacknose Dace	: 1	: 0.01
Common Emerald Shiner	: 4092	: 37.97
Striped Shiner	: 1	: 0.01
Spottail Shiner	: 903	: 8.38
Spotfin Shiner	: 6	: 0.06
Northeastern Sand Shiner	: 33	: 0.31
Northern Mimic Shiner	: 6	: 0.06
Northern Fathead Minnow	: 1	: 0.01
Bluntnose Minnow	: 74	: 0.69

Table 6 - Relative Abundance of Fishes Collected in Cleveland Harbor and Adjacent Marinas during 1971-1974 (Cont'd)

Species	Number Collected	Percent of Total
Stoneroller Minnow	2	0.02
Eastern Quillback	1	0.01
Black Redhorse	1	0.01
Golden Redhorse	2	0.02
Northern Shorthead Redhorse	1	0.01
Common White Sucker	89	0.83
Channel Catfish	2	0.02
Brown Bullhead	23	0.21
Black Bullhead	14	0.13
Stonecat Madtom	13	0.12
Trout-perch	153	1.42
Brook Silverside	3	0.03
White Bass	223	2.07
White Crappie	80	0.74
Black Crappie	11	0.10
Northern Rock Bass	5	0.05
Northern Largemouth Black Bass	3	0.03
Warmouth Sunfish	1	0.01
Green Sunfish	3	0.03
Bluegill Sunfish	4	0.04
Pumpkinseed Sunfish	34	0.32
Yellow Walleye	2	0.02
Yellow Perch	1254	11.64
Northern Logperch Darter	1	0.01
Freshwater Drum (Sheepshead)	170	1.58
TOTALS		
47 Species	10,777	100.05

SOURCE: White, et al., 1975

Table 7 - Fish Species Collected as Fry or Young-of-the-Year in
Cleveland Harbor, 1972-74

Species	:	Relative Abundance
Alewife	:	Abundant
Eastern Gizzard Shad	:	Abundant
Rainbow Smelt	:	Abundant
Eastern Quillback	:	Rare
Common White Sucker	:	Uncommon
Carp	:	Common
Goldfish	:	Common
Golden Shiner	:	Abundant
Longnose Dace	:	Rare
Common Emerald Shiner	:	Abundant
Spottail Shiner	:	Uncommon
Fathead Minnow	:	Rare
Bluntnose Minnow	:	Common
Trout-Perch	:	Rare
Brook Silverside	:	Rare
White Bass	:	Uncommon
Rockbass	:	Uncommon
Largemouth Blackbass	:	Rare
Green Sunfish	:	Uncommon
Bluegill Sunfish	:	Common
Pumpkinseed Sunfish	:	Abundant
Yellow Perch	:	Common
Northern Logperch Darter	:	Rare
White Crappie	:	Uncommon

SOURCE: White, et al., 1975

Table 8 - Benthic Macroinvertebrate Taxa Reported in the Lake Erie
Nearshore Zone in the Vicinity of Cleveland, OH

Phylum Coelenterata	:	Class Hydrozoa
	:	<u>Hydra</u> sp.
	:	
Phylum Aschelminthes	:	Class Nematoda
	:	<u>Alaimus</u> sp.
	:	<u>Dorylaimus</u> sp.
	:	<u>Mesodorylaimus</u> sp.
	:	
Phylum Annelida	:	Class Polychaeta
	:	<u>Manayunkia speciosa</u>
	:	
	:	Class Oligochaeta
	:	<u>Aulodrilus piqueti</u>
	:	<u>A. pluriseta</u>
	:	<u>Branchiura sowerbyi</u>
	:	<u>Ilyodrilus templetoni</u>
	:	<u>L'anodrilus angustipenis</u>
	:	<u>L. cervis</u>
	:	<u>L. clasperedeianus</u>
	:	<u>L. hoffmeisteri</u>
	:	<u>L. profundicola</u>
	:	<u>L. udekemianus</u>
	:	<u>Pelosclex ferox</u>
	:	<u>P. mulisetosus</u>
	:	<u>Potamothrrix moldaviensis</u>
	:	<u>P. vej dovskyi</u>
	:	<u>Tubifex tubifex</u>
	:	<u>Dero digitata</u>
	:	<u>Nais communis</u>
	:	<u>N. pseudobtusa</u>
	:	<u>N. variabilis</u>
	:	<u>Ophidonais serpentina</u>
	:	<u>Stylria fossularis</u>
	:	
	:	Class Hirudinea
	:	<u>Illinobdella</u> sp.
	:	<u>Helobdella stagnalis</u>
	:	
Phylum Mollusca	:	Pelecypoda
	:	<u>Pisidium</u> sp.
	:	<u>P. casertanum</u>
	:	<u>P. henslowanum</u>
	:	<u>P. lilljeborgi</u>
	:	<u>Sphaerium</u> sp.

Table 8 - Benthic Macroinvertebrate Taxa Reported in the Lake Erie
Nearshore Zone in the Vicinity of Cleveland, OH (Cont'd)

	:	
	:	Class Gastropoda
	:	<u>Amnicola</u> sp.
	:	<u>Physa</u> sp.
	:	<u>Valvata sincera</u>
	:	
Phylum Arthropoda	:	Class Crustacea
	:	<u>Lirceus</u> sp.
	:	<u>Cypricercus</u> sp.
	:	<u>Asellus intermedius</u>
	:	<u>Gammarus fasciatus</u>
	:	<u>Ponotoporeia affinis</u>
	:	
	:	Class Insecta
	:	Order Diptera
	:	<u>Chironomus</u> sp.
	:	<u>C. plumosus</u>
	:	<u>C. riparius</u>
	:	<u>Tanytarsini</u> (Tribe)
	:	<u>Procladius</u> sp.
	:	<u>P. adumbratus</u>
	:	<u>P. attenuatus</u>
	:	<u>P. euliciformes</u>
	:	<u>P. riparius</u>
	:	

SOURCE: Rolan, 1973
Nacht, 1977

From Pliodzinkas 1979

The most abundant zooplankton in Cleveland Harbor include Rhizopoda, Rotifera, Cladocera, and Copepoda. Populations of zooplankton generally appear to peak in the fall.

(6) Threatened and Endangered Species - Section 7 of the Endangered Species Act of 1973, as amended, requires Federal agencies to coordinate with the U.S. Fish and Wildlife Service regarding any threatened or endangered species, either listed or proposed to be listed, which may be present in the concerned area. Chapter 119 of the Ohio Revised Code gives protection to species designated as endangered by the state of Ohio.

In June 1981 the U.S. Fish and Wildlife Service provided the Buffalo District with the following list of species which may be present in the project area:

<u>Common Name</u>	<u>Scientific Name</u>	<u>Federal Classification</u>	<u>Habitat</u>
Indiana bat	<u>Myotis sodalis</u>	Endangered	Caves and Riparian
Peregrine Falcon	<u>Falco perigrinus</u>	Endangered	Migratory
Kirtland's Warbler	<u>Dendroica Kirtlandii</u>	Endangered	Migratory
Bald Eagle	<u>Haliaeetus leucocephalus</u>	Endangered	Breeds in Lucas, Ottawa, Sandusky, and Erie Counties, OH,
Blue Pike	<u>Stizostedion vitreum glaucum</u>	Endangered	Lake Erie

No species listed as threatened or endangered by either the Federal Government or the State of Ohio are known to inhabit the project area. The eutrophic nature of Cleveland Harbor and the lower Cuyahoga River effectively eliminates any inhabitation of endangered fish species in the project area. Although endangered fish species may occasionally pass through the harbor area, it is unlikely that any such occurrence is anything but of an infrequent and transitory nature. Individuals of the listed endangered bird species may infrequently pass through or near Cleveland, especially during migrations. However, it is highly unlikely that nesting of these species occurs in Cleveland due to the highly industrialized nature of the city and harbor area.

c. Human Environment

(1) Land and Water Use. Most of the land adjacent to the Cleveland Harbor Federal project has been developed for industrial and commercial use. Almost the entire lengths of the Cuyahoga and Old River navigation channels are lined with industrial plants, warehouses, commercial offices, and dock and terminal storage facilities. The locations of major industrial and commercial tracts adjacent to the Federal project are shown on Plates 1 and 2.

Major storage areas for general cargo are located along the east basin and the west bank of the Cuyahoga River just upstream of the Old River mouth.

Dry bulk storage areas are located along the west basin, along the middle section of the Old River, and along the middle and upper sections of the Cuyahoga. Liquid bulk storage tanks are also situated along the middle section of the Cuyahoga.

Lands used for transportation purposes include the Burke Lakefront Airport along the east basin and numerous railroad trunk lines that cross the industrialized sections along the Cuyahoga and Old Rivers. Several small-boat marinas are located along the Lakefront Harbor and one is located along the Old River. Open space areas adjacent to the project channels include the eastern part of Whiskey Island, the Corps diked disposal facilities along the east basin, and some vacant lots along the river shoreline. Public lands include the Coast Guard and Corps docks west of the airport and the Federal piers and breakwaters in the Lakefront Harbor. The Cleveland central business district is located immediately east of the industrial area along the east bank of the Cuyahoga. Land west of the Cuyahoga is predominantly occupied by a mixture of residential, light industrial, warehousing, and commercial structures and facilities (Doxiadis Associates International, 1971).

Water from the Cuyahoga and Old Rivers is used primarily for commercial and industrial purposes. Water use in the Lakefront Harbor is somewhat more diversified and includes recreational, commercial, public utility, and government activities. The adjacent open lake area is used primarily for recreation, commercial navigation, public water supplies, and limited commercial fishing operations.

(2) Bridges, Pipelines, and Utility Crossings. Table 9 lists the bridges spanning the Cuyahoga and Old Rivers within the existing Federal project limits. Submerged pipelines, submerged cables, tunnels, and aerial cables crossing the Cuyahoga and Old Rivers are listed on Table 10. Submerged cables to the east and west breakwaters, three water supply intake tunnels, and one sewer outfall pipeline exist in the general Lakefront Harbor area.

(3) Population and Housing. The city of Cleveland is the largest city in Ohio, with a population of 573,822 (U.S. Department of Commerce, 1981, a). Cuyahoga County is the largest county in Ohio, with about 38 percent of its population residing in the city of Cleveland. The four-county Cleveland Standard Metropolitan Statistical Area (SMSA) was inhabited by 1,938,876 persons in 1978 and was at that time the 17th most populated metropolitan area in the United States (U.S. Department of Commerce, 1981 b). During the period between 1970 and 1980, the city of Cleveland experienced a 23.6 percent decrease in population, while the county experienced a somewhat lesser reduction in population of 12.9 percent. By the year 2030, the population of the Cleveland SMSA is expected to reach 2,265,333 (U.S. Department of Commerce, 1981, b) and the population of the city of Cleveland is expected to reach 634,848 (U.S. Department of Commerce, 1981, c).

The racial composition of Cleveland's 1980 population was 307,264 whites, 251,347 blacks, 1,094 American Indians, Eskimos, or Aleuts, 3,384 Asians or Pacific Islanders, and 10,733 individuals having other racial backgrounds

Table 9 - Bridges Spanning the Cuyahoga River and the Old River

Miles Above: West Pier- head Light	Location and Name	Type	Center-Draw Openings-Clear Width Normal to Channel (Feet)	Minimum Clear Height Above LWD		Purpose for Which Used
				Open (feet)	Closed (feet)	
	<u>Cuyahoga River</u>					
0.76	Consolidated Rail Corp- poration	Vertical Lift	250	98.6 (1)	8.6	Railroad
1.01	Main Avenue Viaduct	Fixed (2)	218	-	97.7 (3)	Highway
1.28	Baltimore & Ohio Railroad	Bascul (4)	229	-	8.7	Railroad
1.39	Center Street	Swing	113	-	17.7	Highway
1.42	Detroit-Superior Viaduct	Fixed (2)	113	-	98.0	Highway
1.89	Union Terminal Viaduct	Fixed (2)	200	-	98.2	Railway
1.93	Columbus Road	Vertical Lift	220	98.4 (1)	17.6	Highway
2.24	Consolidated Rail Cor- poration (British Street)	Vertical Lift	200	97.7 (1)	8.4	Railroad
2.42	Consolidated Rail Cor- poration (Carter Road)	Vertical Lift	200	98.8 (1)	23.5	Railroad
2.43	Carter Road	Vertical Lift	201	97.3 (1)	22.6	Highway
2.80	Eagle Avenue	Vertical Lift	187	97.5 (1)	15.6	Highway
3.14	Lorain-Carnegie Viaduct	Fixed (2)	178	-	96.4	Highway
3.19	Consolidated Rail Cor- poration (Lorain- Carnegie)	Bascul (4)	134	-	20.8	Railroad
3.34	Norfolk & Western Railway	Vertical Lift	200	97.7 (1)	64.2	Railroad
3.42	Inner Belt Freeway	Fixed (2)	230	-	97.0 (5)	Highway
3.69	West 3rd Street	Vertical Lift	200	97.3 (1)	10.5	Highway
4.33	Consolidated Rail Cor- poration (Erie Lackawanna)	Bascul (4)	117	-	29.3	Railroad
4.51	Jefferson Avenue	-	100	-	-	Super- Structure Removed
4.71	Newburgh & South Shore Railway	Bascul (4)	110	-	11.1	Railroad
4.75	Baltimore & Ohio Railroad	Bascul (4)	110	-	10.3	Railroad
5.35	Republic Steel Cor- poration	Fixed	210	-	99.0	Conveyor and Pipe- line Bridge
5.42	River Terminal Railroad	Bascul (4)	129	-	15.5	Railroad
5.43	Clark Avenue Viaduct	Fixed (2)	184	-	98.4	Highway (6)
5.47	Norfolk & Western Railway	Vertical Lift	200	97.7 (1)	28.9	Railroad
	<u>Old River</u>					
1.75	Baltimore & Ohio Railroad	Bascul (4)	170	-	6.9	Railroad
1.89	Willow Avenue	Vertical Lift	150	98.0 (1)	12.6	Highway

(1) Raised position.

(2) High level.

(3) Min. clear height in center 165 feet

(4) Single leaf.

(5) Minimum clear height in center 199 feet.

(6) Bridge closed to vehicular traffic - to be replaced.

SOURCE: U.S. Army Corps of Engineers, 1978 and U.S. Army Corps of Engineers, 1981.

Table 10 - Submerged Pipelines, Submerged Cables, Tunnels and Aerial Cables Crossing the Cuyahoga and Old Rivers within the Existing Federal Project Limits

Miles Above: West : Pierhead : Light :	Description of Crossing	:Depth Below LWD :or Minimum Clear :Height Above LWD :(feet)
:	<u>Cuyahoga River</u>	:
0.98	:City of Cleveland water main in tunnel.	: 60.4 below
1.14	:City of Cleveland water main in tunnel	: 57.0 below
1.16	:Cleveland Electric Illuminating Company; 12 :submerged cables (out of service)	: 34.5 below
1.20	:City of Cleveland water main in tunnel	: 56.7 below
2.80	:Cleveland Electric Illuminating Company; 6 :cables	: 34.0 below
3.09	:City of Cleveland water main tunnel (out of :service)	: 56.4 below
3.33	:Western Union Telephone; 4-4-inch pipes	: 27.7 below
3.70	:City of Cleveland Branch cable (out of service)	: 31.7 below
3.71	:Aerial power cable	: 124.0 above
4.32	:Mobil Oil Company; 2-6 inch pipes	: 32.0 below
4.49	:City of Cleveland; 3 Branch cables :(out of service)	: 30.7 below
4.50	:City of Cleveland Branch cable (out of service)	: 31.7 below
4.52	:City of Cleveland Branch cable	: 30.0 below
4.65	:Standard Oil Company; 3-6 inch pipes	: 32.0 below
4.73	:Aerial cable	: 118.0 above
4.76	:Aerial cable	: 118.0 above
4.77	:Baltimore & Ohio Railroad; 2 cables	: 30.0 below
5.34	:Aerial electrical cable	: 122.0 above
5.40	:Republic Steel Corporation service tunnel	: 45.0 below

Table 10 - Submerged Pipelines, Submerged Cables, Tunnels and Aerial Cables Crossing the Cuyahoga and Old Rivers within the Existing Federal Project Limits (Cont'd)

Miles Above:		Depth Below LWD
West :		or Minimum Clear
Pierhead :		Height Above LWD
Head Light :	Description of Crossing	(feet)
5.43 :	:City of Cleveland water main in tunnel	: 41.2 below
5.48 :	:Standard Oil Company; 5 pipes	: 32.0 below
5.49 :	:Aerial cable	: unknown
5.78 :	:Sun Oil Company pipe	: 32.0 below
:	<u>Old River</u>	:
1.00 :	:City of Cleveland Branch cable (out of service)	: 29.7 below
1.04 :	:City of Cleveland Branch cable (out of service)	: 31.7 below

SOURCE: U.S. Army Corps of Engineers, 1980 and U.S. Department of Commerce, 1981c.

(U.S. Department of Commerce, 1981, a). The percentage of nonwhites in Cleveland (46.4 percent) was nearly twice the percentage for the county (24.6 percent).

In 1980, the number of housing units in the city of Cleveland totaled 239,557, which constituted a 9.3 percent decrease from the 1970 total of 264,090 units. For Cuyahoga County, the number of housing units increased by 3.3 percent during this time period. Housing in the county consisted of 577,483 units in 1970 and 596,559 units in 1980 (U.S. Department of Commerce, 1981, a).

(4) Business and Industry. The Cleveland SMSA is one of the major manufacturing centers in the nation, accounting for 1.35 percent of total United States manufacturing employment in 1977 (U.S. Department of Commerce, 1980, a) although it had only 1 percent of total U.S. employment. Manufacturing accounts for 28 percent of the Cleveland SMSA's total employment (U.S. Department of Commerce, 1981, b). The fabricated metal products, machinery, primary metal, and transportation equipment industries are the dominant sectors, generating 54 percent of the total manufacturing jobs in the four-county region (U.S. Department of Commerce, 1980, a). Service industries follow a close second, accounting for 20 percent of the SMSA's total employment, followed by retail trade industries at 16 percent (U.S. Department of Commerce, 1981, b).

The city of Cleveland had .42 percent of total U.S. manufacturing employment in 1977 (U.S. Department of Commerce, 1980, a), although it had only .24 percent of total U.S. employment (U.S. Department of Commerce, 1981, b). The city contained 47 percent of the SMSA's manufacturing establishments and 46 percent of the SMSA's manufacturing employment (U.S. Department of Commerce, 1980, a). However, this predominance is being eroded as economic opportunities follow the residential movement to the suburbs (U.S. Army Corps of Engineers, 1976). Manufacturing accounts for 34 percent of the city of Cleveland's total employment (U.S. Department of Commerce, 1981, c). The primary metal, fabricated metal, and machinery industries are the dominant sectors generating 47 percent of the total manufacturing jobs in the city (U.S. Department of Commerce, 1980, a). Service industries generated 16 percent of total employment followed by retail trade industries at 15 percent and government at 13 percent (U.S. Department of Commerce, 1981, c).

One of the important aspects of business and industry in the Cleveland area is the harbor facility. "It is generally accepted that the port affects 100,000 local jobs in some way" as well as being a major international port on the Great Lakes (Port of Cleveland, 1980). Ocean going vessels from over 50 overseas countries and 120 world ports deliver and receive goods at the Port of Cleveland. Nearby interstate highways and rail lines connect the port to important retail and industrial markets in America. The port is the largest on Lake Erie and the fifth largest U.S. port on the Great Lakes. Cleveland's commercial water traffic generates more than \$3 billion per year in wages and salaries, corporate revenues, and local purchases dependent upon waterborne commerce (The Port of Cleveland, 1981).

(5) Employment and Income. Table 11 summarizes historical and projected employment by industry in the Cleveland SMSA. In 1978, the two largest

Table 11 - Historical and Projected Employment by Industry in the Cleveland SMSA

	Historical		No-Change-In-Share		Low-Change-In-Share		Moderate-Change-In-Share			
	1969	1978	1985	1990	2000	2030	1985	1990	2000	2030
Total Employment	965,421	988,733	1,105,946	1,153,295	1,191,621	1,206,607	1,075,447	1,112,477	1,142,395	1,154,249
Agricultural Production	5,533	7,168	6,739	6,534	6,345	5,664	7,343	7,291	7,208	6,472
Nonfarm	959,888	981,565	1,099,207	1,146,761	1,185,276	1,200,943	1,068,103	1,105,187	1,135,188	1,147,778
Private	843,413	851,760	962,143	1,007,492	1,045,328	1,063,748	932,033	967,265	996,846	1,012,244
Agricultural ser- vices, forestry, fisheries, and other										
Mining	2,027	3,436	3,799	3,987	4,042	3,968	4,167	4,476	4,616	4,556
Construction	1,751	1,601	2,254	2,414	2,387	2,276	1,858	1,883	1,785	1,678
Manufacturing	48,488	41,521	47,333	48,798	50,128	50,753	44,673	45,302	45,958	46,338
Non-durable Goods	319,923	279,800	299,956	305,251	304,531	293,845	291,212	293,809	291,193	280,362
Durable Goods	81,269	73,210	77,406	78,513	78,585	75,961	75,223	75,665	75,254	72,588
Transportation and Public Utilities	56,115	49,324	53,385	55,270	57,270	58,177	50,386	51,314	52,514	53,127
Wholesale Trade	59,576	66,324	74,884	77,580	79,640	80,007	71,407	72,954	74,095	74,174
Retail Trade	143,014	157,444	179,978	189,583	196,573	197,421	175,704	183,827	189,629	190,124
Finance, Insurance, and Real Estate	44,533	49,616	60,897	65,261	69,954	75,299	58,418	61,871	65,733	70,548
Services	167,966	202,694	239,658	259,350	280,801	302,001	234,227	251,831	271,324	291,337
Government	116,475	129,825	137,064	139,269	139,948	137,195	136,051	137,921	138,341	135,534
Federal Civilian	21,410	19,701	19,805	19,648	19,265	19,575	20,101	20,019	19,686	18,999
Federal Military	10,362	7,346	7,318	7,318	7,318	7,318	7,318	7,318	7,318	7,318
State and Local	84,703	102,778	109,941	112,303	113,365	111,302	108,632	110,584	111,338	109,217

general categories of employers were the manufacturing industries, which employed 28.3 percent of the total work force and the service industries, which employed 20.5 percent of the labor force (U.S. Department of Commerce, 1981, b). Major employers within the manufacturing sector are the nonelectrical machinery industries, the fabricated metal products industries and the primary metal industries (U.S. Army Corps of Engineers, 1978).

In 1978, the per capita personal income of the Cleveland SMSA was \$6,140, or about 117 percent of both the national average of \$5,227 (U.S. Department of Commerce, 1981, b) and the State average of \$5,238 (U.S. Department of Commerce, 1981, d). In 1970, only 6.9 percent of all families residing in the SMSA were below the poverty level compared to a national average of 10.7 percent and a State average of 6.9 percent. (U.S. Army Corps of Engineers, 1976). Per capita income for the city of Cleveland in 1978 was \$4,830 or about 92 percent of both the national average (U.S. Department of Commerce, 1981, c) and the State average (U.S. Department of Commerce, 1980, d).

(6) Transportation. Cleveland is served by two major east-west interstate highways, I-90 and I-80. Access to the south is provided by I-71 and I-77 together with US-21 and US-42. Several State routes also provide interconnecting links for highway freight service in the region. The Cleveland area is served by approximately 105 motor freight carriers.

The Baltimore and Ohio Railroad, the Norfolk and Western Railway, and Conrail are the three major trunk line railroads that serve the Cleveland area. The Newburgh and South Shore Railroad, the Cuyahoga Valley Railway, and the River Terminal Railway operate switching lines.

The primary air transportation terminals at Cleveland are the Cleveland-Hopkins International Airport and the Burke Lakefront Airport. The Burke Lakefront Airport is used primarily for short, regional flights, while the larger Cleveland-Hopkins terminal is used by the major airlines for long-distance air travel.

The existing commercial harbor at Cleveland consists of a breakwater protected Lakefront Harbor on Lake Erie and navigation channels on the Cuyahoga and Old Rivers. The Lakefront Harbor consists of about 1,300 acres, protected by a breakwater over 30,000 feet long. The channel in the Cuyahoga River is 5.8 miles long and the Old River channel is about one mile long. The commercial harbor is shown on Plates 1 and 2 in Appendix J.

(7) Municipal Services. All of the various utility agencies and companies that serve the city of Cleveland have facilities in or provide service to the harbor area. The Cleveland Water Authority has public water supply intakes in Lake Erie to the east and west of the harbor. According to the Ohio Department of Natural Resources, the Cleveland public water intake system is divided into east and west subsystems by the Cuyahoga River. The area east of the river is served by the Nottingham and Baldwin Filtration Plants. The area west of the river is served by the Division and Crown Filtration Plants (Ohio Department of Natural Resources, 1972).

Three sewage treatment plants serve the harbor area. The Westerly Wastewater Treatment Plant is located near the western extremity of the harbor at the terminus of the Old River. This plant, the oldest of the three facilities, has a capacity of 30-31 mgd and provides only primary treatment. It is presently being rebuilt and upgraded, and discharges into Lake Erie. The Southerly Wastewater Treatment Plant is located along the Cuyahoga River about 6.5 miles upstream from Lake Erie. It provides both primary and secondary treatment, has a capacity of 100 mgd and discharges into the Cuyahoga River. The Easterly Wastewater Treatment Plant is located 8 miles northeast of the mouth of the Cuyahoga River. It has the present capability of providing primary and secondary treatment for about 125 mgd of sewage, and discharges into Lake Erie (Northeast Regional Sewer District, 1982).

Natural gas is provided to the project area by the East Ohio Gas Company. The Ohio Bell Telephone Company provides telephone services. Electrical services for the area are provided by the Cleveland Electric Illuminating Company (U.S. Army Corps of Engineers, 1978).

(8) Recreational Resources. Recreational boating is the most visible form of recreation in the Cleveland Harbor area. Marinas and yacht clubs are located along the east basin shoreline, immediately west of the west breakwater, and at the upper end of the Old River. Although some recreational boating takes place within the harbor navigation channels, these areas serve primarily as travel routes to areas outside the harbor. Harbor cruises are available to the general public on the tour ship Goodtime II.

Water skiing occurs in the Outer Harbor. Many anglers fish in the Outer Harbor around piers, breakwaters, and other structures, although access to these areas is presently limited. Swimming is generally limited to areas outside Cleveland Harbor. The closest public swimming facility is at Edgewater Park, located about 0.3 mile west of the base of the west breakwater. Numerous other beaches are located along Lake Erie in Cuyahoga County, although most are privately owned and opened only to members of lakeshore property associations.

Court games, field games, and picnicking are available at several municipal parks and playgrounds and private beach clubs in the Cleveland lakeshore area. The Cleveland Metroparks System, comprising more than 1,800 acres of park land, contains eleven metroparks which surround the general Cleveland area. The system contains interpretive centers, hiking trails, bridle paths, bicycle trails, swimming and fishing areas, picnic areas, shelter houses, play fields, and golf courses. Cleveland Municipal Stadium, home of the Cleveland Indians baseball team and the Cleveland Browns football team, is located near the east basin shoreline within 1 mile of the river mouth.

(9) Cultural Resources. More than 40 properties in the city of Cleveland are listed on the National Register of Historic Places. Many of the city's National Register sites are located in or immediately east of the central business district. Recent coordination with the Ohio State Historic Preservation Officer (SHPO) (see Exhibit F5c in Appendix F) indicates that the National Register or eligible properties along the Cuyahoga River include the Center Street Swing Bridge (Bridge No. 4 - see Plate 2), the Old Superior

Avenue Viaduct (Detroit-Superior High Level Bridge - Bridge No. 5), the Columbus Road Vertical Lift Bridge (Bridge No. 7), the Union Terminal Groups (Union Terminal High Level Railroad Bridge - Bridge No. 6), and the Lorain-Carnegie Bridge (Bridge No. 10). The Ohio SHPO also stated that the Cleveland West Pierhead Light should be considered eligible for inclusion in the National Register of Historic Places. The Cleveland West Pierhead Light and a small metal beacon on the east arrowhead breakwater mark the main entrance to Cleveland Harbor. Erected in 1909-1910, the West Pierhead Lighthouse and its foundation occupy approximately .25-acre. The lighthouse played an important role in the development of Cleveland Harbor.

A cultural resources survey of the Cleveland Harbor project area was performed in April 1976 and was included in the Final Environmental Impact Statement prepared in 1978 in conjunction with the Cleveland Harbor Feasibility Study of 1972-1976.

d. Navigation Facilities.

(1) The Great Lakes - St. Lawrence Navigation System - The Great Lakes and interconnecting channels, the St. Lawrence River, and the Gulf of the St. Lawrence provide a 2,400-mile commercial waterway from the Atlantic Ocean to the westerly end of Lake Superior. The geographic extent of the system and a schematic profile through the system are shown on Figure 8.

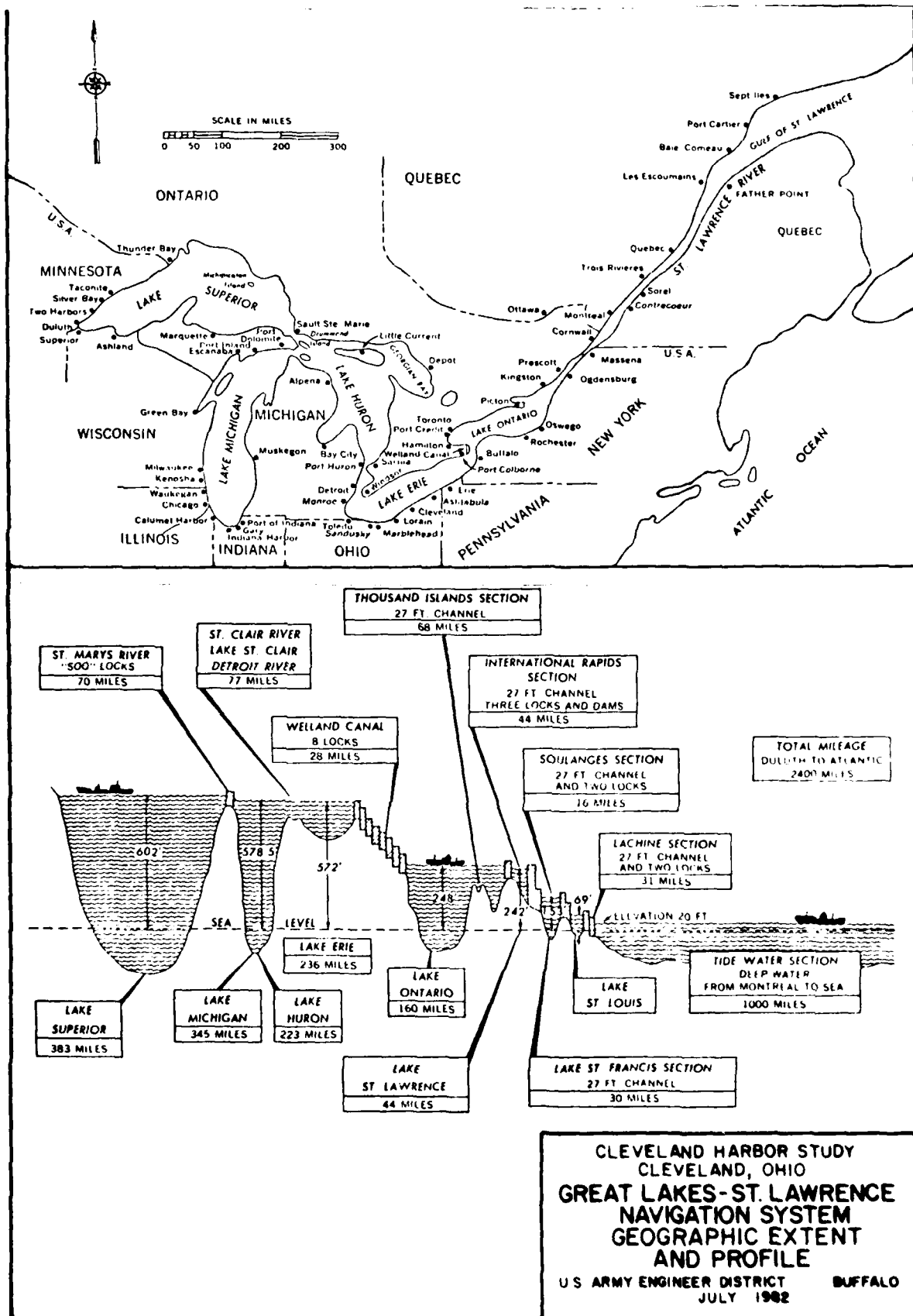
The section of the system between Cleveland Harbor and the Upper Great Lakes (Superior, Huron, and Michigan) is designed for a vessel up to 1,000 feet in length, with a beam of 105 feet and a draft of 25.5 feet at low water datum. The limiting features in this section of the system are the locks in the St. Marys Falls Canal, which connect Lake Superior with Lake Huron.

The section of the system between Cleveland Harbor and the Atlantic Ocean is designed for a vessel up to 730 feet in length, with a beam of 75 feet and a draft of 25.5 feet at low water datum. The limiting features of this section of the system are the locks in the Welland Canal and the St. Lawrence Seaway.

(2) Vessel Traffic - In the past 300 years, vessel traffic on the Great Lakes has evolved from canoes to 1,000-foot bulk cargo carriers.

The first sailing vessels were introduced about 1680; the first steamer about 1820. The first bulk carrier (211 feet long) was built about 1890. Subsequent bulk carriers increased in size to about 500 feet in 1900, 600 feet in 1906, 639 feet in 1941, 678 feet in 1949, 730 feet in 1956, and finally to 856 feet and to 1,000 feet in 1972. The 1,000-foot vessel put into service in 1972 doubled the record tonnage carried by any vessel built prior to that time.

The present (1981) Great Lakes vessel fleet consists of about 349 vessels, 155 Canadian and 194 United States. About 73 percent of the fleet are bulk carriers, which account for about 92 percent of the total cargo carrying capacity of the fleet. Characteristics of the combined United States and Canadian Great Lakes fleet are shown in Table 12.



The fleet is arbitrarily divided into 10 classes according to vessel length. The United States bulk carriers are predominantly Class V (600-649 feet) through Class VII (700-730 feet) vessels; the Canadian bulk carriers are predominantly Class VII (700-730 feet) vessels. Many of the larger bulk carriers cannot operate in Cleveland Harbor due to the configuration and depths of the Lakefront Harbor entrance and the river channels. The balance of the Great Lakes fleet (tankers) are Class I (400 feet) through Class IV (550-599 feet) vessels. The physical dimensions of Cleveland Harbor do not restrict the operation of these size vessels.

The trend in new Great Lakes vessel construction for the last 10 years (1972-1981) is to build larger capacity vessels, especially Class X vessels (1,000 feet in length), the maximum size vessel that can transit the Upper Lakes. Of the 27 new vessels built during this period for the Great Lakes fleet, 13 vessels, or 48 percent, were Class X vessels. It is expected that this trend will continue for the foreseeable future.

Ocean vessels up to 683 feet in length trade in the Great Lakes. The size of ocean vessels, which have deeper drafts than lake vessels, is limited by the depths through the St. Lawrence Seaway and the Welland Canal. Ocean vessels deliver general cargo to facilities located along the Lakefront Harbor at Cleveland.

(3) The Present Harbor - Presently, Cleveland Harbor is used by commercial and recreational vessels. The commercial vessels trade primarily in bulk iron ore and ore concentrates, stone products, and salt. Iron ore and ore concentrates are delivered to rail transshipment facilities adjacent to the west basin and to steel plants on the Cuyahoga River. Stone products are delivered to docks on the two river channels. Salt is shipped from the Old River. General cargo movement, which is minor in terms of total harbor tonnage (about 3 to 4 percent), is concentrated in the Lakefront Harbor immediately east of the river entrance. Recreational boating activities are developed in the easterly one-third of the Lakefront Harbor, immediately west of the west breakwater, and at the upstream end of Old River.

The harbor consists of a breakwater-protected Lakefront Harbor in Lake Erie and improved navigation channels on the Cuyahoga River and Old River. The harbor is Federally improved and is shown on Plates 1 and 2 in Appendix J. The Lakefront Harbor encompasses an area of about 1,300 acres and extends for a distance of about 30,000 feet parallel to shore. There are two harbor entrances. The west (main) entrance channel is located opposite the mouth of the Cuyahoga River. The secondary entrance is located at the end of the east breakwater. Small boats can also enter the Lakefront Harbor through a narrow opening in the west breakwater near the shore.

The east breakwater consists principally of dumped core stone that is covered with large, individually placed armor stone. The west breakwater is a stone-filled timber crib structure with a concrete cap. Most sections of the west breakwater are protected by a stone slope on the lakeward side.

Water depth through the main arrowhead entrance is 29 feet below low water datum. Depths are 28 feet in the west basin and in part of the east basin.

Table 12 - Characteristics of the Great Lakes Fleet, 1981

	Class I	Class II	Class III	Class IV	Class V	Class VI	Class VII	Class VIII	Class IX	Class X	TOTAL
Length Range (Feet)	400	400 - 499	500 - 549	550 - 599	600 - 649	650 - 699	700 - 739	731 - 739	850 - 849	950 - 1099	-
Representative Carrying Capacity (Short Tons)	10,136	10,136	13,160	15,792	22,568	25,984	30,072	35,840	49,840	66,080	-
Total Vessels	93	32	2	16	87	24	68	13	1	13	349
Percent of Total Fleet	26.6	9.2	-6	4.6	24.9	6.9	19.5	3.7	.3	3.7	100
US Fleet	63	10	2	7	65	12	10	11	1	13	194
Percent of Total Fleet	18.1	2.9	-6	2.0	18.6	3.4	2.9	3.2	.3	3.7	55.6
Canadian Fleet	30	22	0	9	22	12	58	2	0	0	155
Percent of Total Fleet	8.6	6.3	0	2.6	6.3	3.4	16.6	.6	0	0	44.4
Bulk Freighters (BF)	21	5	1	6	63	10	44	8	0	0	158
Percent of Total Fleet	6.0	1.4	-3	1.7	18.1	2.9	12.6	2.3	0	0	45.3
U S Bulk	8	4	1	2	45	2	7	6	0	0	75
Percent of Total Fleet	2.3	1.1	-3	.6	12.9	.6	2.0	1.7	0	0	21.5
Canadian Bulk	13	1	0	4	18	8	37	2	0	0	83
Canadian Tankers	15	20	0	2	0	0	0	0	0	0	37
Percent of Total Fleet	4.3	5.7	0	.6	0	0	0	0	0	0	10.6
Total Ship Capacity U.S. (Short Tons)	190,457	1,020,790	27,272	93,290	1,176,829	312,032	316,568	365,120	49,840	1,014,440	3,648,638
CAN.	151,502	229,686	0	122,261	439,628	258,396	1,886,326	63,112	0	0	3,150,911
Bulk Freightier Cap.	86,386	63,445	14,784	77,784	1,138,721	203,292	1,342,062	253,512	0	0	3,159,986
Percent of Total Cap.	1.3	.6	.2	1.1	16.7	3.0	19.7	3.7	0	0	46.5
US BF Capacity (Short Tons)	6,922	34,093	14,784	24,360	798,605	43,232	193,816	190,400	0	0	1,306,212
CAN BF Capacity (Short Tons)	79,464	9,352	0	53,424	340,116	160,060	1,148,246	63,112	0	0	1,853,774
Self - Unloader Cap. (Short Tons)	10,382	12,376	12,488	110,930	477,736	367,136	860,832	174,720	49,840	1,014,440	3,090,880
Percent of Total Cap.	.2	.2	.2	1.6	7.0	5.4	12.7	2.6	.7	14.9	45.5
US Self - Unloader Cap. (Short Tons)	6,507	0	12,488	68,930	378,224	268,800	122,752	174,720	49,840	1,014,440	2,096,701
CAN Self - Unloader Cap. (Short Tons)	3,875	12,376	0	42,000	99,512	98,336	738,080	0	0	0	994,179
Average Year U S Bulk	1953	1945	1921	1916	1938	1954	1957	1957	1972	1978	-
Canadian	1959	1968	-	1934	1949	1953	1965	1964	-	-	-

The remaining portion of the east basin, opposite the general cargo docks, is 27 feet deep. The channel through the east basin to the east entrance is 25 feet deep.

The entrance to the Cuyahoga River navigation channel is bounded by parallel, stone-filled timber crib piers with concrete superstructures located 325 feet apart. The navigation channel on the Cuyahoga River extends about 5.8 miles upstream from the lakeward end of the piers. The Old River navigation channel is about 1 mile long. The authorized depth of the Cuyahoga River navigation channel is 27 feet from the lakeward end of the piers to a point upstream of Old River. The balance of the Cuyahoga River navigation channel has an authorized depth of 23 feet. The Old River navigation channel has an authorized depth of 27 feet, but has been deepened and maintained to only about 23 feet.

Authorized Federal navigation improvements to the Lakefront Harbor are completed. Uncompleted portions of authorized Federal improvements to the Cuyahoga and Old River navigation channels are described in the following paragraphs and appear on Plates 1 and 2.

(a) Uncompleted Improvements to the Cuyahoga River Navigation Channel - Uncompleted work on the Cuyahoga River includes the replacement of Conrail Bridge No. 14 and related river bank Cut No. 11 and an unnumbered cut to include widening the channel to within 10 feet of the bank to the east in the vicinity of Bridge No. 14, authorized by the 1958 River and Harbor (R&H) Act; the remaining portion of bank Cut No. 4 adjacent to a mill owned by Cereal Food Processors, Inc., originally authorized by the 1937 R&H Act and reauthorized by the 1946 R&H Act; and deepening to 27 feet, the reach of the Cuyahoga River between Conrail Bridge No. 1 and the junction of Old River, authorized by the 1960 R&H Act.

The plans and specifications for the bridge replacement have been completed. Construction has been delayed indefinitely pending resolution of related real estate problems. Cut No. 11 and the unnumbered cut to the east are scheduled to follow the completion of the bridge replacement. The remaining portion of Cut No. 4 has been classified inactive and has not been completed because of problems related to real estate acquisition required for the bank cut. The deepening in the lower reach of the Cuyahoga River upstream of the Conrail Bridge is scheduled to be accomplished in conjunction with authorized channel deepening in the Old River.

(b) Uncompleted Improvements to the Old River Navigation Channel - Uncompleted work on the Old River includes the replacement of the Baltimore and Ohio Railway Bridge No. 23 at the mouth of Old River and bank Cuts Nos. 12 through 15, authorized by the 1958 R&H Act and deepening of the channel to 27 feet from the mouth of the Old River to the upstream limit of navigation in the vicinity of the westerly end of the Forest City Publishing Company dock, authorized by the 1960 R&H Act and extended by authority of Section 107 of the 1960 R&H Act.

The plans and specifications for the bridge replacement have been completed. However, an alternative plan is being investigated which would provide a new

rail connection between the Baltimore and Ohio and the Conrail trackage east of the river. This plan would eliminate the railway bridge crossing at the mouth of the Old River. Progress on this alternative plan requires a new agreement between the Corps of Engineers and the Baltimore and Ohio Railroad for design and construction of the alternative improvement. The design and construction of the bank cuts and channel deepening would follow the removal of the present bridge.

(4) Harbor Maintenance Operations - The Corps of Engineers is responsible for repairing the breakwaters and piers, and for dredging the river channels and Lakefront Harbor to authorized depths.

Corps of Engineers derrick boats are currently used to maintain the breakwaters. Repairs to the east breakwater, virtually a continuous process, include rearrangement of the existing armor stone and the addition of new armor or core stone where required. Recently, the easternmost 4,400 feet of the east breakwater were rehabilitated with concrete dolos at a cost of about \$9 million. Repairs to the west breakwater have been temporarily suspended. The practice of repouring the concrete cap has proven to be impractical because of the difficulty encountered in securing the concrete forms from the continual wave action of the lake. Several alternative methods of repair are under consideration. A recent inspection of the west breakwater disclosed that where the stone slope on the lakeside is built up above the lake level, the breakwater has remained in good condition. Future repairs will be focused on rebuilding the lakeside slope and repairing the concrete cap.

Dredging operations in Cleveland Harbor have historically been divided into contract dredging on the Cuyahoga and Old Rivers and the Government's hopper dredging in the Lakefront Harbor. The Cuyahoga River is normally dredged twice annually; once in the fall and once in the spring. The fall dredging provides a settling basin at the upstream limit of the navigation channel for the material brought downstream during the winter and early spring. Without this dredging, sediments transported by the spring runoff could significantly shoal the channel and restrict commercial shipping until the spring dredging was completed.

The Lakefront Harbor and the Cuyahoga River navigation channel are generally dredged to the authorized project depths. The Old River navigation channel is not maintained to the authorized depth of 27 feet because the prerequisite removal of the Baltimore and Ohio Railway Bridge at the mouth of the Old River, bank cuts, and channel deepening have not been completed. In general, the upper 1,000 feet of the Old River channel is maintained to 21 feet and the balance of the channel to 23 feet.

During the period of 1970-1974, virtually all of the dredged material was placed in two diked disposal areas constructed in the late 1960's as part of a pilot study of dredging and water quality problems in the Great Lakes. From 1972 to fall of 1974, harbor dredging was reduced to selective dredging in the Cuyahoga River because of the lack of adequate storage volume in the diked disposal areas. As a result of the reduced dredging, the Cuyahoga River channel was maintained at less than 23 feet.

The pilot dredging and water quality study of the late 1960's led to enactment of legislation in 1970 (Public Law 91-611) which authorized the construction of spoil disposal facilities of sufficient capacity for a period not to exceed 10 years. A new dike disposal area (Site 12) was constructed next to the earlier pilot dikes and was operational in the fall of 1974. This new dike disposal area, which has a capacity for about 3-1/2 years of dredging, was the first stage of the 10-year dike disposal program. A second dike area (Dike 14), opposite Gordon Park to contain the remaining 6-1/2 years of dredging, was constructed in 1980.

It is estimated that over the 7-year period (fall 1974 to spring 1981) an average of about 650,000 cubic yards of sediments were removed each year to maintain the navigation channels and Lakefront Harbor at authorized depths. This average annual amount consisted of about 550,000 cubic yards from river channels and 100,000 cubic yards from the Lakefront Harbor. In addition, private interests dredged about 50,000 cubic yards of sediment annually along private docks.

A review of historical flooding along the Cuyahoga River navigation channel and preliminary hydraulics investigations were conducted as a part of the 1972 - 1976 Feasibility Study. These studies indicated that if the channel is maintained to the authorized depth, the 50-year and 100-year floods, and the estimated flood of record which occurred in 1913 would be retained within the limits of the navigation channel and would not overtop the bulkheads along the river banks. The hydraulic investigation also examined the potential for flooding that might result if dredging of the navigation channel was discontinued and the river sediments accumulated in the channel. Assuming that sediments would fill the navigation channel until the channel bottom attained the slope similar to the channel bottom upstream of the project, the sediments would reduce the depth of the channel at the river mouth from 27 feet to about 8 feet. This assumption is supported by field measurements taken in 1827 which indicated that at that time, the depth at the river mouth was about 7 or 8 feet. The results of the preliminary hydraulics investigation indicated that if dredging were discontinued and the river channel allowed to silt in, the 50-year and 100-year flood flows, and the 1913 flood would overtop the bulkheads. The extent of potential flood damage was not estimated.

(5) Cargo Movement: Great Lakes; Cleveland Harbor - Great Lakes commodity movement in 1978 totaled about 221,000,000 net tons. Of this total, 19,700,000 net tons, or 9 percent, were shipped to or from Cleveland Harbor, ranking Cleveland as the fifth largest harbor on the Great Lakes in terms of commodity movements. Great Lakes marine tonnages in 1978 (221,000,000 net tons) were only about 11 percent of the total United States commerce of about 2,000,000,000 tons, with Cleveland accounting for about 1 percent of the national total. However, 78 percent of the total United States iron ore tonnage of 120,000,000 net tons, was routed through the Great Lakes, with about 12 percent of the United States total iron ore shipments entering Cleveland Harbor.

Cleveland is an important but specialized harbor. Of the 19,700,000 net tons of cargo shipped in 1978 (see Table 13), 18,200,000 tons, or 92 percent, consisted of iron ore, limestone, sand and gravel, and salt. Iron ore, the largest commodity shipped in 1978 at 13,800,000 net tons, or 70 percent of the total, is either consumed locally at the local steel mills or transshipped to inland steel mills in southern Ohio, West Virginia, and Pennsylvania. Limestone, with 2,700,000 net tons received in 1978, or 13-1/2 percent of the total, and sand and gravel, with 1,200,000 net tons received in 1978 or 6.2 percent of the total, are both consumed locally. Salt, the fourth significant commodity at Cleveland Harbor and the major commodity exported, accounted for about 3 percent of the total commodity movement at Cleveland Harbor in 1978. In addition, salt constituted the major commodity shipped on the Old River segment of the harbor.

Projected future tonnages for these four commodities at Cleveland Harbor are presented in Table 14. These projections were developed by the Buffalo District in early 1981 by estimating 1980 tonnages based on the historical movement of these commodities in the 10-year period 1969 to 1978, modified to reflect the expected decline in shipment of these commodities as a result of the general economic conditions prevailing at that time. These estimated 1980 tonnages were then projected to the year 2040, based on commodity growth rates developed in the National Waterways Study for these commodities, modified to reflect information received from dock operators at Cleveland on the anticipated long-term commodity movements at their docks and the capacity of industrial plants at Cleveland consuming these commodities. Additional details on this process are presented in Appendix B, "Economic Evaluation."

As indicated in Table 14, tonnages for these four commodities are expected to grow from an estimated 1980 total of 15,800,000 net tons to 27,000,000 net tons in 2040, or an overall increase of 71 percent. Iron ore will experience the largest increase, growing from 11,900,000 net tons to 21,600,000 net tons, or an overall increase of 82 percent. Movement of sand and gravel is expected to remain constant at 1,300,000 net tons throughout the evaluation period.

(6) Docks and Terminal Facilities - There are 65 wharves and docks within the Federal project limits at Cleveland Harbor; 14 are located in the Lakefront Harbor, 40 are situated adjacent to the Cuyahoga River, and 11 are located adjacent to the Old River. Table 15 summarizes these commercial dock facilities. In addition, locations of these docks are shown on Plates 1 and 2 in Appendix J. As previously stated, the principal commodities shipped in terms of annual tonnage are iron ore, limestone, sand and gravel, and salt.

9. PROBLEMS, NEEDS, AND OPPORTUNITIES

a. Commercial Navigation Needs.

The fundamental commercial navigation need at Cleveland Harbor is to move bulk cargo more efficiently and economically through the harbor. There are also hazards to navigation which must be investigated.

Table 13 - Selected Commodity Movements at Cleveland Harbor, OH
(1,000's of Tons)

Year	Iron Ore		Limestone		Sand and Gravel		Salt		Selected Commodities:	
	Tonnage	Percent	Tonnage	Percent	Tonnage	Percent	Tonnage	Percent	Subtotal	Harbor Total
	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)	:(Total)
1969	17,593	71.4	2,565	10.4	1,944	7.9	539	2.2	22,641	91.9
1970	16,649	72.8	2,454	10.7	1,524	6.7	515	2.3	21,142	92.5
1971	14,694	71.5	2,091	10.2	1,431	7.0	440	2.1	18,656	90.8
1972	17,450	73.1	2,477	10.4	1,378	5.8	792	3.3	22,097	92.6
1973	18,080	72.8	2,826	11.4	1,615	6.5	435	1.8	22,956	92.5
1974	15,635	71.3	2,590	11.8	1,404	6.4	882	4.0	20,511	93.5
1975	13,263	73.1	1,906	10.5	966	5.3	916	5.0	17,051	94.0
1976	13,396	73.7	1,935	10.7	823	4.5	740	4.1	16,894	93.0
1977	10,526	65.4	2,280	14.2	922	5.7	595	3.7	14,323	88.9
1978	13,770	70.0	2,653	13.5	1,225	6.2	506	2.6	18,154	92.3
10 Year:										
Average:	15,106	71.7	2,378	11.3	1,323	6.3	636	3.0	19,443	92.3

SOURCE: Waterborne Commerce Statistics, Part 3, Great Lakes, Corps of Engineers.

Table 14 - Projected Commodity Tonnages - Cleveland Harbor
(Tonnages are in Millions of Short Tons)

		Project Year								
		1	5	10	20	30	40	50		
Commodity	1980	1990	1995	2000	2010	2020	2030	2040	Annual Growth Rate	
									(percent)	
Iron Ore	11.9	13.2	14.1	15.3	17.2	18.9	20.5	21.6	1.0	
Limestone	2.0	2.3	2.4	2.5	2.7	2.8	3.0	3.1	0.7	
Sand and Gravel	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.0	
Salt	0.6	0.8	1.0	1.0	1.0	1.0	1.0	1.0	0.9	
Total	15.8	17.6	18.8	20.1	22.2	24.0	25.8	27.0		

Forecasts of future increases in bulk cargo tonnage further compound the problem. During the 10-year period, 1969 to 1978, an average of about 19.4 million net tons of the four principal bulk commodities (iron ore, limestone, sand and gravel, and salt) were shipped at Cleveland Harbor. Collectively, it is projected that this tonnage will grow to 27 million tons in the year 2040. If the harbor is modified to permit more efficient and economical delivery of these large forecasted tonnages, the transportation savings could be in the order of several millions of dollars annually.

The more specific commercial navigation problems related to the Lakefront Harbor, the Cuyahoga River navigation channel, and the Old River navigation channel are discussed below.

(1) Lakefront Harbor - There are two main commercial navigation problems in the Lakefront Harbor: (a) the absence of safe entrance conditions for 1,000-foot vessel operation; and (b) inadequate channel depth. These two problems will be discussed separately.

The present west (main) entrance to the Lakefront Harbor was originally designed for safe and efficient operation of a vessel measuring 730 feet in length and 75 feet in beam (Class VII vessel), the largest vessel in use on the Great Lakes at that time. However, as previously discussed, of the 27 new vessels built during that last 10 years (1972-1981), 13 (or 48 percent) were Class X vessels (1,000 feet long by 105 feet in beam). The reason for this shift to larger vessels is the tremendous transportation savings that can be realized by the larger vessel. For example, assuming a full 275-day navigation season and loading to the maximum Great Lakes System Draft of 25.5 feet, the estimated transportation costs for a Class VII vessel transporting a ton of iron ore from Duluth-Superior to Cleveland Harbor is about \$7.00. Similarly, the transportation cost for a Class X vessel transporting the same ton of iron ore, is about \$5.00. Thus, there is a potential savings of up to \$2.00 for every ton of iron ore shipped to the Lakefront Harbor, if Class X vessels were used exclusively. However, since the west (main) entrance to Cleveland Harbor was not designed to accommodate Class X vessels, the harbor entrance dimensions restrict delivery of iron ore to the less efficient and more costly Class VII vessels.

There are three concerns at the west (main) entrance that hinder 1,000-foot vessel operation: inadequate stopping distance; physical obstacles; and inadequate channel width. According to experienced vessel masters at the 8 April 1981 workshop meeting (see Exhibit G-2), the required stopping distance for 1,000-foot vessels entering the harbor during adverse weather conditions, after the vessel is completely into the protected entrance channel, but prior to making the turn into either the east or west basin, is 1,800 to 2,000 feet. This stopping distance assumes that the vessel is traveling at 6 miles per hour (mph), the speed that is required to offset the effects of crosscurrents at the lakeward end of the arrowhead breakwaters and the effects of winds and waves that are present during adverse weather. Since the total length of the entrance channel at the west (main) entrance is only about 1,000 feet, it does not provide an adequate stopping distance for Class X vessels.

Table 15 - Commercial Dock Data - Cleveland Harbor

Dock Owner	Dock Operator	Principal Dock Use	Dock-Side Equipment	Dock Name
		Lakefront Harbor (1)		
Nicholson Cleveland Terminal Co.	do	Vessel mooring.	Two 10-ton cranes, six forklift trucks, one 4-ton freight elevator.	Nicholson Cleveland Terminal Co. Dock
U. S. Government	U. S. Coast Guard	Vessel mooring.	None.	Cleveland Harbor Station Dock
U. S. Government	COE	Vessel mooring.	None.	COE Dock
City of Cleveland	do	Not used.	None.	E. 9th Street Pier
City of Cleveland	Goodtime Transit, Inc.	Vessel mooring.	None.	City Pier
City of Cleveland	Cleveland Port Authority and Cleveland Stevedoring Co.	Receipt of general cargo.	Seven cranes, 42 forklift trucks, two front-end loaders	Berth 32E
City of Cleveland	Cleveland Port Authority and Cleveland Stevedoring Co.	Receipt of general cargo.	See Berth 32E.	Berths 28, 30, and 32N
City of Cleveland	Cleveland Port Authority and Cleveland Stevedoring Co.	Receipt of general cargo.	See Berth 32E plus one stiff-leg crane.	Berth 28W
City of Cleveland	Cleveland Port Authority and Cleveland Stevedoring Co.	Receipt of general cargo.	See Berth 32E.	Pier No. 26
City of Cleveland	Cleveland Port Authority and Cleveland Stevedoring Co.	Receipt of general cargo.	See Berth 32E.	Pier No. 24
Cleveland Port Authority	Lake Erie Asphalt Products, Inc.	Receipt of iron ore.	One front-end loader, portable conveyors.	Dock No. 20
City of Cleveland	do	Launch mooring.	None.	West Basin Docks
Conrail	Great Lakes Dredge and Dock Co.	Vessel mooring.	None.	Whiskey Island Yard Dock
Conrail	Ohio and Western Pennsylvania Dock Co.	Receipt of iron ore.	Four hulettas, two front-end loaders.	Ore Dock No. 11

Table 15 - Commercial Dock Data - Cleveland Harbor (Cont'd)

Dock Owner	Dock Operator	Principal Dock Use	Dock-Side Equipment	Dock Name
Cuyahoga River - Right Bank (2)				
Joseph Waters	Alpha Concrete Corp.	Receipt of stone.	One front-end loader.	Alpha Concrete Corp. Wharf
Cuyahoga County	Not operated.	Not used.	None.	Harbormaster Dock
Ryan Realty and J&R Properties	Beacon-Hausher Marine Co.	Handling of marine supplies.	None.	Beacon-Hausher Marine Co. Wharf
Lois Samsel	Samsel Rope and Marine Supply Co.	Vessel mooring.	None.	Samsel Rope and Marine Supply Co. Dock No. 2
Great Lakes Towing Co.	do	Tug mooring.	None.	Great Lakes Towing Co. Wharf
Samsel Realty Co.	Samsel Rope and Marine Supply Co.	Receipt of marine supplies, vessel mooring.	One crane, two fork-lift trucks.	Samsel Rope and Marine Supply Co., Dock No. 1
Cereal Food Processors, Inc.	do	Receipt of wheat.	Ship unloading building.	Cereal Food Processors Dock
Cuyahoga Lime Co.	do	Receipt of limestone.	One bulldozer, one front-end loader.	Cuyahoga Lime Co. Dock
Medusa Cement Co.	do	Receipt of cement.	Dockside conveyor.	Medusa Cement Co., Cleveland Dock
City of Cleveland	Not operated.	Not used.	None.	Columbus Road Dock
B&O Railroad Co.	Various operators.	Vessel mooring and repairs.	None.	B&O Collision Bend Mooring Dock
Mid-Continent Coal and Coke Co. and City of Cleveland	Mid-Continent Coal and Coke Co.	Export of coke breeze.	One loading tower.	Mid-Continent Coal and Coke Co. Dock
Ford Motor Co.	do	Receipt of limestone and iron ore.	One front-end loader.	Ford Motor Co. Dock
The Cleveland Builders Supply Co.	do	Receipt of sand and limestone.	Three front-end loaders.	Cleveland Builders Supply Co., Dock No. 2
United Garage and Service Corp.	Ontario Stone Corp.	Receipt of limestone.	Four front-end loaders.	Ontario Stone Corp., Dock No. 2
U. S. Steel Corp.	Not operated.	Not used.	None.	U. S. Steel Corp. Furnace Stone and Pig Iron Dock

Table 15 - Commercial Dock Data - Cleveland Harbor (Cont'd)

Dock Owner	Dock Operator	Principal Deck Use	Dock-Side Equipment	Dock Name
<u>Cuyahoga River - Right Bank (Cont'd) (2)</u>				
U. S. Steel Corp.	Not operated.	Not used.	Two hulettas.	U. S. Steel Corp., Central Furnace Ore Wharf
Reiss Oil Terminal Corp.	do	Loading and unloading of petroleum products.	None.	Marine Fueling Wharf
E. I. DuPont de Nemours & Co., Inc.	Not operated.	Not used.	None.	DuPont Acid Plant Sulphur Dock
Republic Steel Corp.	do	Receipt of limestone.	None.	Republic Steel Corp., Lower Dock
Republic Steel Corp.	do	Receipt of fuel oil.	None.	Republic Steel Corp., Fuel Oil Dock
Republic Steel Corp.	do	Receipt of iron ore.	Two traveling bridge cranes, one bulldozer, five front-end loaders.	Republic Steel Corp., Upper Dock
J & L Steel Corp.	do	Receipt of iron ore, limestone, and fuel oil.	Two traveling bridge cranes, two scrapers, two front-end loaders.	J & L Steel Corp., Cleveland Works Wharf
<u>Cuyahoga River - Left Bank (2)</u>				
Republic Steel Corp.	do	Receipt of iron ore and limestone.	Two traveling bridge cranes.	Republic Steel Corp., West Side Dock
C-I-L Chemicals, Inc.	do	Receipt of sulfuric acid.	None.	C-I-L Chemicals Wharf
Koppers Co., Inc.	do	Receipt of asphalt.	One hand-operated hoist.	E. Koppers Co. Wharf
Cleveland Builders Supply Co.	do	Receipt of sand and stone.	One front-end loader.	Cleveland Builders Supply Co. Dock
Gulf Oil Refining and Marketing Co.	do	Fueling harbor bunkering vessels.	None.	Gulf Oil Corp., Cleveland Terminal Wharf
Mobil Oil Corp.	Clifton Concrete and Supply Co.	Receipt of sand and stone.	One front end loader.	Clifton Concrete and Supply Co. Wharf
Texaco, Inc.	Not operated.	Not used.	Two hand-operated derricks.	Texaco Wharf

Table 15 - Commercial Dock Data - Cleveland Harbor (Cont'd)

Dock Owner	Dock Operator	Principal Dock Use	Dock-Side Equipment	Dock Name
<u>Cuyahoga River - Left Bank (Cont'd) (2)</u>				
Shell Oil Co.	do	Deployment of oil spill recovery boat.	One derrick.	Shell Oil Co. Wharf
Cleveland Builders Supply Co.	do	Receipt of sand.	See Cleveland Builders Supply Co., Dock No. 2.	Cleveland Builders Supply Co., "F" Mill Dock
Cleveland Builders Supply Co.	do	Receipt of miscellaneous bulk materials and fuel oil.	See Cleveland Builders Supply Co., Dock No. 2.	Cleveland Builders Supply Co., Dock No. 4
Bradford-Carter Estate	Eagle-Scranton Corp.	Vessel mooring.	None.	Eagle-Scranton Corp. Mooring Dock
City of Cleveland	City of Cleveland	Fireboat mooring.	None.	Eagle Ave. Fireboat Wharf
Scranton-Averell, Inc.	G&W Industries, Inc.	Vessel mooring.	Four cranes.	G&W Industries Wharf
Alpert Bros. Leasing Co., Inc.	G&W Industries, Inc.	Vessel mooring.	None.	Alpert Bros. Leasing Co., Upper Dock
Alpert Bros. Leasing Co., Inc.	Alpha Precast Corp.	Receipt of sand and stone, shipment of dollose.	One hoist, one front end-loader, two forklift trucks.	Alpert Bros. Leasing Co., Lower Dock
B&O Railroad Co.	G&W Industries, Inc.	Vessel mooring.	None.	Sycamore St. Dock
B&O Railroad Co.	Not operated.	Not used.	None.	B&O Railroad Co., Main St. Warehouse Wharf
<u>Old River - Right Bank (2)</u>				
U. S. Steel Corp.	Various operators.	Receipt of limestone, vessel mooring.	None.	U. S. Steel Corp., Sycamore St. Wharf
National Gypsum Co.	do	Receipt of bulk cement.	None.	Huron Cement, Cleveland Terminal Wharf
Ontario Stone Corp.	do	Receipt of coal and steel scrap.	Three hulets.	Erie-Lackawanna Ore Dock
Forest City Publishing Co.	Great Lakes Towing Co.	Vessel mooring.	Two cranes.	Great Lakes Towing Co., Shipyard Wharf

Table 1f - Commercial Dock Data - Cleveland Harbor (Cont'd)

Dock Owner	Dock Operator	Principal Dock Use	Dock-Side Equipment	Dock Name
		Old River - Right Bank (Cont'd) (2)		
Forest City Publishing Co.	G&W Industries, Inc.	Vessel mooring.	None.	Forest City Publishing Co. Wharf
		Old River - Left Bank (2)		
Dunbar and Sullivan Dredging Co.	do	Vessel mooring.	Eight cranes.	Dunbar and Sullivan Dredging Co. Slip
International Salt Co.	do	Shipment of salt.	One loading tower.	International Salt Co., Cleveland Mine Wharf
Ashland Petroleum Co.	do	Receipt and shipment of petroleum products.	One hand-operated crane.	Ashland Petroleum Co. Wharf
Sand Products Corp.	Brian D. Stickney, Contractor	Receipt of sand.	One front-end loader.	Sand Products Corp., Dock No. 1
Ontario Stone Corp.	do	Receipt of limestone, manganese ore, and iron ore.	Three front-end loaders.	Ontario Stone Corp., Dock No. 3
Ontario Stone Corp.	do	Receipt of limestone.	See Ontario Stone Corp., Dock No. 3.	Ontario Stone Corp., Dock No. 1

SOURCE: The Port of Cleveland, Ohio - Port Series No. 43, Revised 1981

(1) See Plate 1 for location of docks.

(2) See Plate 2 for location of docks.

The inadequacy of the stopping distance at the west (main) entrance is not restricted to Class X vessels. Several times in the recent past, Class V and Class VII vessels have entered the harbor at speeds of 6 to 7 mph and have had to drop their stern anchors and throw their engines into full reverse in order to stop before striking the piers flanking the Cuyahoga River. Entering the harbor at a reduced speed would not be practical during adverse weather conditions because a speed of 6 to 7 mph is required to maintain adequate vessel control. Also, deepening of the east entrance to its present authorized depth of 25 feet below LWD was originally authorized in order to allow Class V vessels the use of the east entrance during adverse weather conditions in lieu of the west (main) entrance which was considered inadequate as an entrance during storm conditions. However, the depth of the east entrance became inadequate when the allowable draft of the Great Lakes Navigation System was increased to 25.5 feet. This is also the reason why the existing east entrance cannot be used in its present condition by Class X vessels which presently load to the maximum system's draft of 25.5 feet.

Vessel masters at the 8 April 1981 workshop meeting also indicated that the many obstacles in the vicinity of the west (main) entrance also pose problems for 1,000-foot vessel operations. These obstacles include the lighthouses on the ends of the east and west arrowhead breakwaters, the east and west spur breakwaters, and the piers flanking the Cuyahoga River. The vessel masters stated that they lose sight of an object when it is closer than 300 to 400 feet away, and are forced to rely on instruments and/or lookouts stationed at the bow of the vessel. This problem is intensified at Cleveland Harbor due to the strong crosscurrents present at the west (main) entrance. Thus, the many obstacles that are present at the west (main) entrance increase the risk of a vessel accident.

Numerous accidents have occurred in the vicinity of the west (main) entrance in the past. The last reported accident occurred in 1979 and involved a bulk cargo vessel which struck the base of the lighthouse on the end of the east arrowhead breakwater due to a sudden wind squall. The accident caused about \$250,000 in damages to the lighthouse and about \$65,000 in damages to the vessel.

Local interests have also stated that the existing width of the entrance channel between the ends of the east and west spur breakwaters (750 feet) is inadequate for 1,000-foot vessels turning into either the east or west basin, even during relatively calm weather conditions. Vessel navigation tests conducted at WES with a scale model of a 1,000-foot vessel confirmed this local position. It was the opinion of the vessel master conducting the ship navigation tests, and subsequent opinions of other masters who ran ship navigation tests at later dates, that even under ideal weather conditions, there was no margin for error when a vessel entered the harbor and turned into either the east or west basin with the present channel width. Since minor mishaps can be expected at almost any time (i.e., sudden burst of wind, ruptured fuel line to the engines, momentary distraction of the vessel master, etc.), there was a consensus that the existing west (main) entrance was not a safe entrance for 1,000-foot vessels even under ideal weather conditions. Local shipping interests also concurred with this position.

The second commercial navigation problem in the Lakefront Harbor is inadequate channel depth at both the west (main) entrance and the east entrance for Class V through Class X vessels. Because of this inadequate channel depth, these vessels must enter Cleveland Harbor light-loaded (i.e., at less than the maximum system's draft of 25.5 feet at LWD).

The required entrance channel depths for Class V through Class X vessels, loaded to the maximum system's draft of 25.5 feet, were developed using the following criteria (also see Appendix C, "Coastal Engineering Design"):

Vessel Static Draft (The overall depth of water as measured from the waterline to the bottom of the vessel's keel while the vessel is at rest. The maximum static draft for the Great Lakes Navigation System is 25.5 feet at LWD.)

Squat (lowering of the water surface around a moving vessel which produces a relative change in the ship's position with respect to the bottom).

Roll (rotation of a vessel around a longitudinal axis, induced primarily by wave action and greatest when the hull is parallel to the wave crests).

Pitch (rotation of a vessel about its transverse axis induced by wave action, and greatest when the hull is normal to the wave crests).

Bottom Clearance (distance between the keel of a vessel and the channel bottom. As per Draft EM 1110-2-XXX, this distance is assumed to be 2 feet).

The required entrance channel depths for Class V, Class VII, and Class X vessels, at both the west (main) entrance and east entrance, are summarized in Table 16. Values for entrance speed and degree of roll were provided by vessel masters at the 8 April 1981 workshop meeting. As indicated, required entrance channel depths are about 32-feet below LWD for both the west (main) entrance and east entrance for Class V through Class X vessels. Since the authorized entrance channel depth at the west (main) entrance is 29 feet below LWD and the authorized depth at the east entrance is 25 feet below LWD, Class V through Class X vessels must enter the Lakefront Harbor light-loaded relative to LWD. This light loading results in additional transportation costs.

During coordination of the Plan of Study, local interests also stated that in addition to modifying the Lakefront Harbor for safe and efficient operation of 1,000-foot vessels, there was also a need to provide a harbor-of-refuge for these vessels at some port on the south shore of Lake Erie. However, at the 29 and 30 October 1981 workshop meeting (Exhibit G-3), vessel masters stated that there was no need to provide a harbor-of-refuge since vessels could lay-off Pelee Island at the western end of Lake Erie or the north shore of Lake Erie during storms. They would then proceed into the harbor when the weather moderated. Therefore, no further consideration was given to this aspect during this Phase I study.

Table 16 - Required Entrance Channel Depths (1)

	East Entrance (feet)	West (Main) Entrance (feet)
<u>Class V Vessel</u>		
Static Draft	25.5	25.5
Squat (at 6 MPH)	0.3	0.4
Roll (6 degrees)	3.6	3.6
Pitch	0	0
Bottom Clearance	2.0	2.0
Required Entrance Channel Depth Below LWD	31.4 say 32	31.5 say 32
<u>Class VII Vessel</u>		
Static Draft	25.5	25.5
Squat (at 6 MPH)	0.3	0.4
Roll (6 degrees)	3.9	3.9
Pitch	0	0
Bottom Clearance	2.0	2.0
Required Entrance Channel Depth Below LWD	31.7 say 32	31.8 say 32 (2)
<u>Class X Vessel</u>		
Static Draft	25.5	25.5
Squat (at 6 MPH)	0.3	0.5
Roll (4 degrees)	3.7	3.7
Pitch	0	0
Bottom Clearance	2.0	2.0
Required Entrance Channel Depth Below LWD	31.5 say 32	31.7 say 32 (3)

- (1) Does not include value for pitch since roll value is greater.
- (2) The required entrance channel depth for Class VI and Class VIII vessels is similar to that required for Class VII vessels.
- (3) As previously stated, Class X vessels cannot enter the Lakefront Harbor through the west (main) entrance due to inadequate entrance conditions. However, if the west (main) entrance was modified, additional channel depths would also be required.

(2) Cuyahoga River Navigation Channel - There are three main commercial navigation concerns in the Cuyahoga River navigation channel: whether or not authorized, but uncompleted, improvements are still economically justified; inadequate channel depth; and physical restrictions of the navigation channel which cause undue vessel delay. These three problems will be discussed separately.

As previously discussed, there are two authorized improvement projects on the Cuyahoga River that have not been completed (see Plate 2): (a) the remaining portion of bank Cut No. 4; and (b) the replacement of Conrail Bridge No. 14 and related bank Cut No. 11, and widening of the navigation channel to within 10 feet of the east bank in the vicinity of Bridge No. 14. The remaining portion of bank Cut No. 4 has been classified as inactive because local interests have not found it possible to budget for funds in the amount that would be required for acquisition of the required upland property under present conditions. Replacement of Bridge No. 14 and related channel widening has been deferred pending resolution of a real estate problem related to the proposed bridge realignment.

Subsequent to authorization of these two improvement plans, a reduction in traffic flow on the Cuyahoga River has occurred. This reduced traffic flow is a result of, among other things, the closing of the U. S. Steel mill, which previously received iron ore and limestone by bulk cargo vessels and the shift of iron ore receipts destined for Republic Steel Corporation's inland steel mills from their Cuyahoga river docks to their new iron ore transshipment facility in Lorain. Thus, there is a question as to whether or not these authorized improvements are still economically justified considering current reduced traffic conditions.

In addition to reduced traffic flow, the requirement to replace the ship unloading building for the Cereal Food Processors, Inc., facility adjacent to bank Cut No. 4 (see Figure 9) may also impact on whether or not this authorized project can be completed. In 1976, the Buffalo District investigated the possibility of deauthorizing the remaining portion of bank Cut No. 4 because it did not appear that local interests would be able to provide the \$5 million needed to relocate the buildings at the project site. Subsequently, Cereal Foods Processors, Inc., indicated that they planned on removing, but not replacing, these buildings (including the ship unloading building) and that the \$5 million expenditure by the local sponsor was, thus, no longer required. Therefore, the authorized improvement project was not deauthorized at that time. However, by letter dated 11 February 1982 (Exhibit F-6 in Appendix F), Cereal Food Processors, Inc., indicated that they have changed their position in regards to removing the ship unloading building. Therefore, if the remaining portion of bank Cut No. 4 is completed, the ship unloading building will have to be replaced and its cost paid for by local interests, further impacting on the feasibility of completing this authorized project.

In addition to reduced traffic flow, the requirement to replace Conrail Bridge No. 14 may favorably impact on the feasibility of completing the authorized improvements at this location. By letter dated 22 October 1981

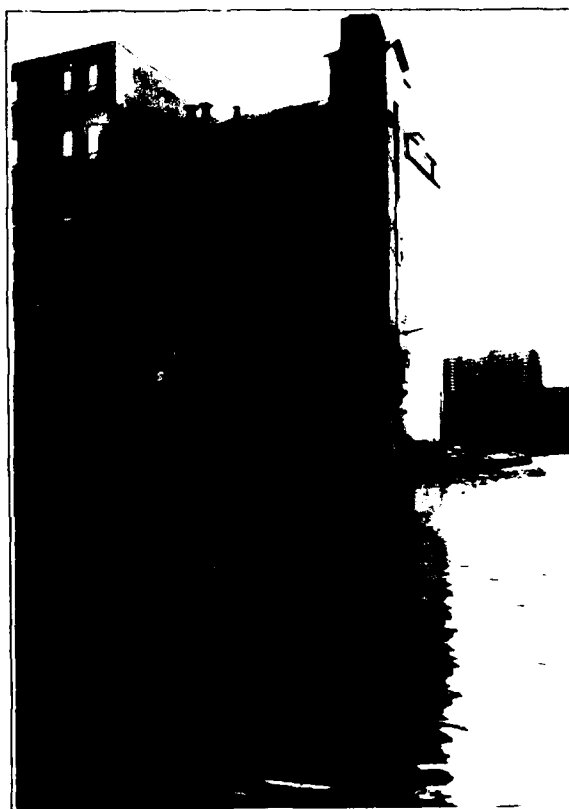


Figure 9 - Cereal Food Processors, Inc. Facility Adjacent to the Cuyahoga River. The ship unloading building is the 6-story addition to the extreme right (COE - 9/81).

(Exhibit F-7), Conrail stated that they plan on abandoning the rail line serviced by Bridge No. 14 and, thus, there would be no need to replace this bridge if the remaining authorized improvements in this area were completed (i.e., bank Cut No. 11 and widening of the navigation channel to within 10 feet of the east bank). It is assumed that when the rail line is abandoned, Conrail will remove the abandoned bridge and its center pier foundation. Thus, the cost of the authorized improvements at this location will decrease; however, it is not known if the decrease in project cost will be sufficient to overcome the decrease in benefits resulting from reduced traffic flow on the Cuyahoga River.

Based on the foregoing discussion, it is deemed appropriate to reevaluate the economic feasibility of the two authorized, but uncompleted, improvement projects on the Cuyahoga River as part of this Phase I study.

The second commercial navigation problem in the Cuyahoga River navigation channel is inadequate channel depth. Presently, Class V vessels, the largest vessels that can navigate the Cuyahoga River, are forced to either unload a portion of their cargo in the Lakefront Harbor with delivery of this cargo to upriver industries by truck before proceeding upriver or must enter Cleveland Harbor light-loaded initially. This results in additional transportation costs. For example, the estimated transportation cost for a 630-foot vessel transporting a ton of iron ore from Duluth-Superior to Cleveland Harbor, assuming a 275-day navigation season, and loaded commensurate with the present authorized channel depth of 23 feet below LWD (i.e., loaded to 21-foot static draft), is approximately \$10.00. Similarly, the transportation cost for the same vessel transporting the same ton of iron ore, but loaded to the maximum Great Lakes System draft of 25.5 feet, is only \$8.00. Thus, there is a potential savings of \$2.00 for every ton of iron ore shipped on the Cuyahoga River, if the navigation channel was deepened to allow loading to 25.5 feet. Coordination with local shipping companies indicated that, if the navigation channel was deepened, they would take advantage of this potential savings. In addition, because more vessel trips are required to carry the same amount of tonnage than would be required if the channel was deepened, interference between vessels is more pronounced. Thus, additional delays are incurred by vessels transiting the river at several congested areas of the navigation channel, resulting in additional transportation costs.

The required channel depth for Class V vessels loaded to 25.5 feet was developed using the same criteria previously discussed for required entrance channel depths in the Lakefront Harbor and the results are shown in Table 17. As indicated, a channel depth of 28 feet below LWD would be required for a Class V vessel to navigate the Cuyahoga River navigation channel loaded to the maximum Great Lakes System's draft of 25.5 feet.

The third main commercial navigation problem in the Cuyahoga River is physical restrictions of the navigation channel (congested areas) which cause undue vessel delays. As shown on Plate 2, the Cuyahoga River navigation channel is a winding, narrow channel with numerous bridge crossings and sharp bends which impede vessel movement. In response to a questionnaire developed

Table 17 - Required Cuyahoga River Navigation Channel Depth

<u>Class V Vessel</u>	:	
	:	
Static Draft	:	25.5 feet
	:	
Squat (at 2 MPH)	:	0.7 feet
	:	
Roll and Pitch (1)	:	0
	:	
Bottom Clearance	:	<u>2.0</u> feet
	:	
Required Channel Depth	:	
Below LWD	:	28.2 feet
	:	
	:	say 28 feet
	:	

(1) Roll and pitch and heave are induced by wave action. Since vessels traveling in the Cuyahoga River navigation channel will not encounter wave action, the value for these parameters is zero.

by the Buffalo District, shipping companies indicated that there were seven locations where vessel delays were more pronounced than at other locations, and that significant savings in vessel transit time would accrue if these restrictions were eliminated. These seven locations are as follows:

(a) Site No. 1 - Conrail Vertical Lift Bridge No. 1 at the mouth of the Cuyahoga River - Shipping companies reported that all size vessels transiting the Cuyahoga River are often forced to wait for this bridge to open before proceeding. This imposes, on average, an additional 30 minutes in transit time for each trip upriver or downriver.

(b) Site No. 2 - Navigation channel in the vicinity of Cut No. 4 (approximate river mile 1.0) - Because of the narrow channel width in this area (approximately 100 feet), Class V vessels (with an average beam of 68 feet) are required to reduce their speed and proceed very cautiously in order to avoid striking the adjacent banks. This causes, on average, an additional 20 minutes in transit time for each trip upriver or downriver. In addition, shipping companies stated that they experience an additional delay whenever a vessel is unloading at the Cereal Food Processors, Inc., dock. Before proceeding, they must wait for the docked vessel to move upriver, causing an additional delay of about 90 minutes. (NOTE: This 90-minute delay includes a 30-minute delay to the transiting vessel while waiting for the docked vessel to move upriver and a 60-minute delay incurred by the docked vessel while moving upriver, allowing the transiting vessel to pass, and moving back to the dock to finish unloading.)

(c) Site No. 3 - Bend in the vicinity of the Union Terminal Railroad Bridge and the Columbus Road Bridge (approximate river mile 1.5) - Because of the narrow channel width in this bend (in some places the width of the channel narrows to about 190 feet), Class V vessels are forced to reduce their speed and proceed very cautiously in order to avoid striking the banks and bridge piers. This causes, on average, an additional 10 minutes in vessel transit time for each trip upriver or downriver. In addition, shipping companies stated that the bend was too narrow for two-way traffic. Thus, if two vessels approach the bend at the same time, one vessel must pull over and wait, causing an additional 90-minute delay.

(d) Site No. 4 - Bend in the vicinity of the Norfolk and Western Railroad Bridge and Inner Belt Freeway Bridge (approximate river mile 3.0) - Because of the narrow channel width in this bend (in some places the width of the channel is only about 200 feet), Class V vessels are forced to reduce their speed and proceed very cautiously in order to avoid striking the banks and bridge piers. This causes, on average, an additional 10 minutes in vessel transit time for each trip. In addition, shipping companies stated that the bend was too narrow for two-way traffic. Thus, if two vessels approach the bend at the same time, one vessel must pull over and wait, causing an additional 90-minute delay.

(e) Site No. 5 - Bend in the channel at river mile 3.6 - As at other locations, Class V vessels are forced to reduce their speed and proceed very cautiously through this bend in order to avoid striking the banks (in some places the channel narrows to about 160 feet). This causes, on average, an

additional delay of 10 minutes in vessel transit time each way. In addition, as with the other bends, this bend is too narrow for two-way traffic, causing an additional 90-minute delay when two vessels approach the bend simultaneously.

(f) Site No. 6 - Conrail Bridge No. 14 (approximate river mile 4.0) - As shown in Figure 10, the east rest pier support for this bascule bridge is located near the center of the Cuyahoga River which reduces the navigable width of the channel to about 115 feet. Because of the narrow channel width, Class V vessels are forced to reduce their speed and proceed cautiously in order to avoid striking the bridge pier. This causes, on average, an additional 15 minutes in transit time, each way.

(g) Site No. 7 - Jefferson Avenue Bridge abutments (approximate river mile 4.3) - In 1961, the city of Cleveland removed the former Jefferson Avenue Bridge that spanned the Cuyahoga River. However, the bridge abutments, which jut out into the channel, were left in place and these abutments reduce the navigable width of the channel to about 130 feet (see Figure 11). Because of the narrow channel width, Class V vessels are forced to reduce their speed and proceed cautiously. This produces, on average, an additional 10-minute delay in vessel transit time.

Although the shipping companies also expressed concern about potential accidents at these seven congestion sites, no shipping company indicated whether or not vessel accidents had occurred previously. Accordingly, District personnel reviewed the accident reports for Cleveland Harbor compiled by the U. S. Coast Guard, 9th Coast Guard District, for the 10-year period, 1972 to 1981. The results of this review are presented in Table 18. As indicated, Sites 3, 4, and 7 have had accidents in the past involving considerable damage. Conversely, no accidents have been reported for Sites 5 and 6.

(3) Old River Navigation Channel - As previously discussed, there is presently an authorized, but uncompleted, project for improvement of the Old River navigation channel. Components of this authorized improvement project include: replacement of the B&O Railroad Bridge No. 23; bank Cuts Nos. 12-15; and deepening of the navigation channel to 27-feet below LWD. Implementation of this improvement plan would permit a Class VII vessel (730-foot vessel) to navigate the channel loaded to the maximum Great Lakes System's draft of 25.5 feet. (NOTE: The present dimensions of the Old River navigation channel limit the maximum size vessel to about 649 feet in length. Also, because the channel is maintained at a depth of only 23 feet below LWD, these vessels must travel light-loaded). However, preconstruction planning for this authorized improvement has been suspended since 1971.

Subsequent to authorization of this Old River improvement plan, several docks were closed which may affect the continued economic feasibility of the authorized plan. These closed docks are the old Erie Ore Dock (see Exhibit F-8); and the dock serving the Forest City Publishing Complex (see Exhibit F-9). Since navigation benefits accruing from waterborne commerce crossing these docks were used, in part, to economically justify the authorized project, the continued economic feasibility of the plan is in question. It is, therefore, deemed appropriate to reevaluate the economic feasibility of this authorized project in view of current conditions as part of this Phase I study.

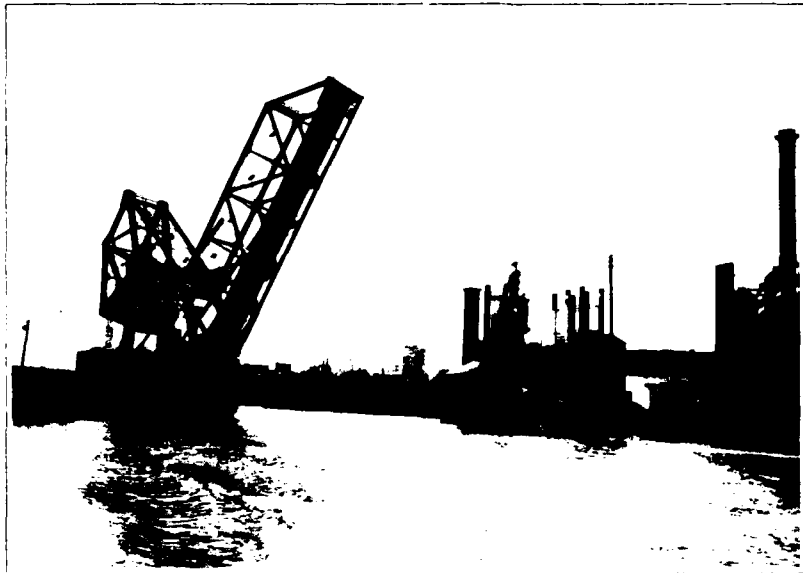


Figure 10 - Conrail Bridge No. 14 (COE - 9/81).



Figure 11 - Jefferson Ave. Bridge Abutments (COE - 9/81).

AD-A127 215

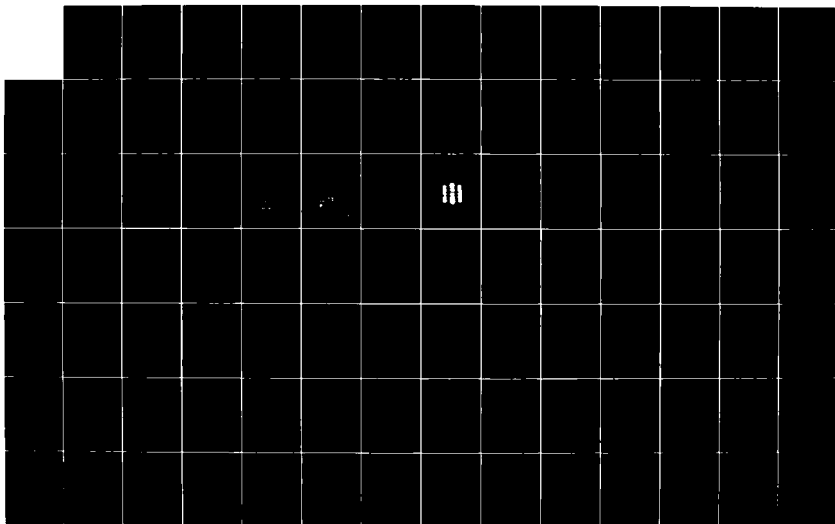
STAGE 2 REPORT FOR REFORMULATION PHASE I GENERAL DESIGN
MEMORANDUM CLEVELAND (U) CORPS OF ENGINEERS BUFFALO NY
BUFFALO DISTRICT F J HENRY ET AL. FEB 83

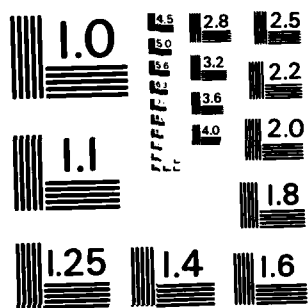
213

UNCLASSIFIED

F/G 13/10

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

Table 18 - Reported Accidents at Congestion Points on the
Cuyahoga River Navigation Channel (1972-1981) (1)

Congestion Point	Description of Accident (Date of Accident)	Amount of Damage
		\$
Site No. 1	Small-boat hit bridge (8/79).	5,000
Site No. 2	Class V vessel hit east bank of river.	No Damage
Site No. 3	Class V vessel collided with scow (6/79).	40,000
Site No. 3	Class V vessel hit Columbus Road Bridge (12/77).	6,000
Site No. 3	Class V vessel hit vessel moored at dock (12/77).	6,000
Site No. 3	Class V vessel hit dock.	Minor Damage
Site No. 4	Bridge tender closed N&WRR Bridge on Class V vessel (11/79).	20,000
Site No. 4	Class V vessel hit both banks of river (12/76).	22,000
Site No. 4	Class V vessel hit N&WRR Bridge (9/72).	4,000
Site No. 5	No reported accidents.	
Site No. 6	No reported accidents.	
Site No. 7	Class V vessel hit bridge abutments (5/78).	20,000
Site No. 7	Class V vessel hit bridge abutments (7/72).	39,000

(1) SOURCE: U. S. Coast Guard accident reports, 1972 through 1981.

b. Recreational Fishing Needs.

During the later stages of the 1972-1976 Cleveland Harbor Feasibility Study, the Ohio Department of Natural Resources (ODNR) and the U. S. Fish and Wildlife Service (USFWS) indicated that there presently was a need to provide additional recreational breakwater fishing facilities at Cleveland Harbor. The USFWS reiterated the need for these facilities in their 24 June 1981 "Planning Aid Letter," (Exhibit H-1); and ODNR reiterated the need for these facilities during verbal conversations with District personnel during this Phase I study.

Accordingly, as part of this Phase I study, District personnel conducted a recreational fishing demand analysis to establish the need for additional recreational fishing facilities in the Cleveland Harbor area. This demand forecast was developed using the demand projections for recreational fishing developed by the State of Ohio in their "Outdoor Recreation Plan 1975-1980," modified to reflect more recent population projections provided by the Ohio Department of Economic Development. These modified demand projections were then extrapolated to the year 2040 in 10-year intervals. Additional details on this procedure are provided in Appendix B, "Economic Evaluation."

The results of this demand analysis indicated that for the four-county planning region of Cuyahoga, Geauga, Lake, and Lorain Counties, the demand for fishing activity occasions throughout the total evaluation period would not exceed the region's existing supply. However, on a county-by-county basis, Cuyahoga County had a total demand that exceeded the county's existing supply. Therefore, a portion of the Cuyahoga County residents would have to travel to neighboring counties to satisfy their recreational fishing needs.

As with other urban areas in the country, there is a certain percentage of households in the Cleveland area with incomes below the poverty level (7.6 percent). These households, due to their low income, have limited access to private transportation and rely heavily on nearby recreational facilities or facilities near public transportation routes. Assuming that excess fishing occasions demanded by low income families is equal to the percentage of households that have incomes below the poverty level, low income families alone would demand about 122,000 yearly fishing activity occasions in 1990 that Cuyahoga County cannot supply. However, because of their private transportation restrictions, they may not be able to travel to other nearby counties to satisfy their recreational fishing needs. Thus, there is a need to provide additional recreational fishing facilities near public transportation routes in the Cleveland area. Since Cleveland Harbor is readily accessible from public transportation, provision of additional recreational fishing facilities from the west breakwater at Cleveland Harbor would be a major step in meeting this presently unfulfilled demand.

c. Recreational Small-Boat Needs.

Currently there are four active small-boat harbors or marinas located at Cleveland Harbor. These are the Edgewater and East 55th Street Marinas, administered by the Ohio Department of Natural Resources, and marinas

operated by the Lakeside Yacht Club and the Forest City Yacht Club. However, the existing facilities for recreational boating at these marinas are filled to capacity, with long waiting lists for permanent dock space.

Unfulfilled demand for small-boat berths in Cuyahoga County was estimated at about 2,000 berths in 1990 in a report entitled Development of Recreational Small-Boat Harbors on the Coast of Lake Erie in the Vicinity of Cleveland, OH, - Stage 1 Reconnaissance Report (September 1979), prepared by Betz-Converse-Murdock, Inc., for the Buffalo District. Thus, there is a significant demand for additional small-boat facilities in the Cleveland Harbor area. However, because the Buffalo District presently has the authority to study the potential for Federally constructed small-boat harbors under the Lake Erie Coast Study authorization and the Edgewater Marina Section 107 Study, no further consideration was given to such developments in this Phase I study.

d. Other Recreational Needs.

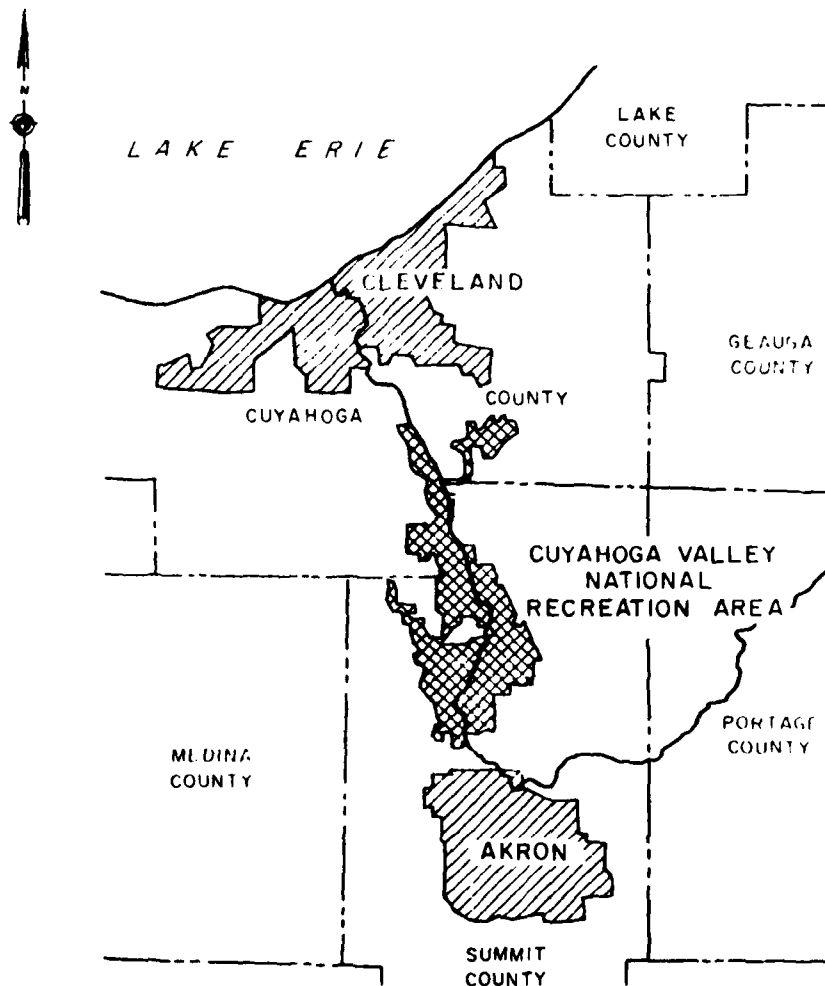
As with other large urban areas, residents of the city of Cleveland need additional facilities to meet their recreational needs. Additional facilities that are required include water-related facilities for boating and fishing, as previously discussed, and for swimming and nonwater-dependent facilities for activities such as hiking, biking, picnicking, and passive and active enjoyment of the natural environment.

Two public agencies have taken the lead in providing for these unmet recreational needs. One agency, the Ohio Department of Natural Resources, has developed plans for the Cleveland Lakefront State Park. Located along the shoreline of Lake Erie and encompassing Cleveland Harbor, the park will provide both water and nonwater related recreational facilities and will be developed over the next several decades. A master development plan for the park is provided as Plate 5 in Appendix J.

The second agency providing additional recreational facilities is the National Park Service under their management of the Cuyahoga Valley National Recreation Area (CVNRA). Authorized by Congress in 1974 (PL 93-555), the CVNRA will preserve for public use and enjoyment some 29,000 acres of rural valley landscape between Cleveland and Akron (see Figure 12). Emphasis in developing the recreation area will be to provide both passive and active enjoyment of the natural environment in a manner which will preserve its scenic, natural, and historic setting for future generations.

In addition to the Ohio Department of Natural Resources and the National Park Service, the city of Cleveland, Cuyahoga County, and the State of Ohio - Cleveland Metropolitan Parks Department maintain an extensive network of parks and recreational facilities for the general public.

In conclusion, although there is a need for additional recreational facilities in the Cleveland area, local agencies have taken the lead in meeting both the immediate and long-term needs of the area. Therefore, no further consideration was given to providing additional recreation facilities (with the exception of additional recreational breakwater fishing facilities) during this Phase I study.



SOURCE:
 "CUYAHOGA VALLEY 1975" - PAGE 8

CLEVELAND HARBOR STUDY
 CLEVELAND, OHIO
**CUYAHOGA VALLEY
 NATIONAL RECREATION AREA
 LOCATION MAP**
 U.S. ARMY ENGINEER DISTRICT JULY 1982 BUFFALO

e. Water Quality.

As previously discussed, the waters of the lower Cuyahoga River are grossly polluted and have high temperatures; low concentrations of dissolved oxygen; intermittent toxicity; and excessive solids, ammonia, BOD, COD, oil, fecal coliform bacteria, zinc, iron, lead, cyanide, phenols, floating debris, odor, and turbidity. Local interests have repeatedly stated the need to improve the water quality of the river.

The Northeast Ohio Areawide Coordinating Agency is currently involved in a Section 208 Study (PL 92-500) in the Cuyahoga River Watershed. The goal of this study is to identify development and management water quality programs that would control point and nonpoint sources of pollution, thereby reestablishing and maintaining the highest practical water quality in the Cuyahoga River. In addition, the Environmental Protection Agency has established discharge limitations for most pollutants with a view towards improving water quality. Thus, to avoid duplication of effort, no further consideration was given to improving water quality in the Cuyahoga River during this Phase I study.

f. Erosion and Sedimentation.

Erosion of the river channel and land surfaces feeds large quantities of sediments to the Cuyahoga River where it impairs water quality, aggravates flooding problems, depresses oxygen levels and alters aquatic life. When the river transports this sediment to the relatively quiet waters of the navigation channel at Cleveland, it is deposited and forms shoals. These shoals must then be removed by maintenance dredging, costing in excess of \$4,000,000 annually.

Due to the seriousness of the problem in the Cuyahoga River Watershed, the Buffalo District completed the Cuyahoga River, Ohio Restoration Study - Third Interim Preliminary Feasibility Report on Erosion and Sedimentation. In this report, it was concluded that streambank erosion was a minor contributor (approximately 5 percent) to the Cuyahoga River sediment load and that streambank erosion control plans were not economically justified. Further, it was concluded that upland (sheet and rill) erosion contributes significantly to the Cuyahoga River sediment load (approximately 50 percent) and recommended that local interests implement land management programs to control this erosion. Thus, since the basin's erosion and sedimentation problems were recently studied under the Cuyahoga River Restoration Study, no further consideration was given to erosion and sedimentation problems during this Phase I study.

g. Shoreline Erosion.

By letter dated 9 April 1975, the Mayor of the Village of Bratenahl, located immediately east of Cleveland Harbor, stated that lakefront properties in the village were experiencing considerable beach starvation and shoreline erosion. The Mayor also expressed his concern that the Cleveland Harbor breakwaters were a significant contributing factor to this degrading

condition. Accordingly, as previously discussed, the Buffalo District initiated a Section 111 Study in Fiscal Year 1982 for the Bratenahl area with completion of the study currently scheduled for late 1984. The purposes of this study are to determine the effects of the harbor structures on shoreline erosion and if mitigation of such damages attributable to the harbor structures is warranted. Thus, to avoid duplication of effort, no further consideration was given to this aspect under this Phase I study.

h. Artificial Fishery Habitat Development.

In their 24 June 1981 "Planning Aid Letter," (Exhibit H-1), the USFWS suggested that development of artificial spawning substrate (placement of tires, gravel, drain tiles, rock, rubble, etc.) for selected fish species be investigated as a potential mitigation measure for project-related negative environmental impacts. However, based on subsequent discussions between District and USFWS personnel, it was concluded that development of such artificial spawning areas would also enhance the natural environment and promote the propagation of desirable fish species. In addition, because of the degraded condition of the environment in the harbor area, any such improvement to the environment was urgently needed. Thus, not only was development of fishery habitat areas considered as a mitigation measure for possible negative fishery impacts of several alternatives, it was also considered as a desirable and needed objective of this Phase I study.

10. PLANNING CONSTRAINTS

During this Stage 2 study, several planning constraints were identified which impacted on the formulation of alternative plans developed to satisfy the water-related needs of the study area. These planning constraints included: (1) wave activity in the Lakefront Harbor; (2) development of an iron ore transshipment facility capable of accommodating 1,000-foot vessels in the Lakefront Harbor; and (3) the differing opinions of local interests on which entrance (i.e., west (main) or east entrance) to modify for safe and efficient operation of 1,000-foot vessels. These three planning constraints are reviewed below.

a. Wave Activity in the Lakefront Harbor.

Throughout the course of the 1972-1976 Feasibility Study and during this Phase I study, the Cleveland Port Authority, the local sponsor for the navigation project, stated that they would oppose any proposed modification plan to the west (main) entrance which would increase wave activity in the Lakefront Harbor opposite their general cargo docks. The Hanna Mining Company, which operates the existing Conrail iron ore transshipment facility adjacent to the west basin in the Lakefront Harbor, also stated their opposition to any plan that increased wave activity in the west basin. Both interests stated that existing wave activity in the Lakefront Harbor during storm conditions was barely tolerable. Any increase in wave activity would significantly hinder their operations, including forcing them to close down their docks during certain periods of time and increasing the costs of maintaining their facilities due to increased damages. In turn, this would produce a corresponding increase in their operating costs which would have to be

passed on to the consumer. In addition, local shipping companies stated that any increase in wave activity in the Lakefront Harbor would also significantly affect vessel safety, since vessels operating in the Lakefront Harbor are proceeding at a slow rate of speed. This slow speed is not sufficient to offset the effects of increased wave activity acting on the vessel and may result in additional vessel accidents involving considerable damages to harbor structures and the vessels themselves.

During the course of this Phase I study, every effort was made to prevent an increase in wave activity in the Lakefront Harbor as a result of proposed modifications to the west (main) entrance. In this respect, the hydraulic model study at WES was extensively used. Existing wave activity in the Lakefront Harbor was initially established for a wide spectrum of wave heights and directions. This base condition was then compared to the wave heights that would be present as a result of proposed modifications to the west (main) entrance. When wave heights exceeded existing conditions, modifications to the improvement plan under consideration were made to reduce the resulting wave heights back down to existing conditions, and these mitigative measures were then considered an integral part of the proposed improvement plan.

(NOTE: Although existing wave activity in the Lakefront Harbor is high, it presently does not significantly hinder dock or vessel operations. Thus, little or no benefit would be gained by modifying the existing harbor structures to reduce wave activity in the Lakefront Harbor below present conditions and plans to accomplish this aspect were not investigated for this Phase I study. However, as discussed above, any proposed modification plan to the west (main) entrance must include measures to insure that an increase in wave activity does not result from such modification. Local interests are in agreement with this approach.)

b. Development of an Iron Ore Transshipment Facility.

The economic feasibility of plans to modify the Lakefront Harbor for safe and efficient operation of 1,000-foot bulk cargo vessels is dependent upon the development of an iron ore transshipment facility in the Lakefront Harbor capable of accommodating such vessels. The Selected Plan recommended in the 1976 Feasibility Report was economically justified under the assumption that two such facilities would be constructed: (1) a local transshipment facility which would receive iron ore in 1,000-foot vessels and transship the iron ore to the three local steel mills adjacent to the Cuyahoga River via a conveyor system or by barges; and (2) upgrading of the existing Conrail iron ore transshipment facility adjacent to the west basin of the Lakefront Harbor which transships iron ore from bulk cargo vessels to inland steel mills in southern Ohio, West Virginia, and Pennsylvania via its rail line. However, as previously discussed, local interests are no longer interested in constructing a local transshipment facility to service the local steel mills. In addition, Conrail has not committed itself to modernizing and enlarging its existing transshipment facility. Thus, local development plans for an iron ore transshipment facility in the Lakefront Harbor, capable of accommodating 1,000-foot vessels, are uncertain at the present time.

During the course of this Phase I study, it has been assumed that an iron ore transshipment facility, capable of accommodating 1,000-foot vessels, will be constructed in the Lakefront Harbor. Factors supporting this assumption include the following:

(1) Even though Conrail has made no commitment as to whether or not they will modernize and expand their existing iron ore transshipment facility, they have expended considerable funds in conducting engineering and economic feasibility studies on this aspect. They have also been an active supporter of modifying Cleveland Harbor for 1,000-foot vessel operation, and have provided extensive input to both the 1972-1976 Feasibility Study and this Phase I study. Although this in itself is not a commitment, it indicates Conrail's serious interest in modernizing and upgrading their existing iron ore transshipment facility.

(2) In late 1980, the Cleveland Port Authority authorized and funded the Cleveland Harbor Development Study conducted by the engineering firm of Tippetts-Abbott-McCarthy-Stratton. The purpose of this study was to obtain an orderly plan to guide the development of the Port of Cleveland through the end of the century and beyond. The resulting recommended development plan will be discussed in Section III of the Main Report, "Formulation of Preliminary Alternative Plans." However, one recommendation of the study was that the Cleveland Port Authority purchase the existing Conrail iron ore transshipment facility, modernize it, and lease it back to Conrail to operate. This recommendation was made based upon estimated net revenues of about \$78,000,000 (present worth in 1981 dollars using a 10 percent interest rate and 20-year economic life) and an estimated investment cost of about \$21,000,000, exclusive of property acquisition costs. Thus, upgrading of the existing Conrail facility appears to be economically justified.

(3) Other local entities have expressed interest in constructing an iron ore transshipment facility in the Lakefront Harbor. For example, Lake Erie Asphalt Products, Inc., has applied for a Department of the Army Permit for filling operations and new bulkheading in the vicinity of Dock 20, at the mouth of the Cuyahoga River in conjunction with their proposed new iron ore transshipment facility. However, construction of this facility is on "hold," awaiting, among other things, adoption of a final master development plan by the Port of Cleveland.

Based on the foregoing discussion, it is the District's position that there is sufficient justification to support the assumption that an iron ore transshipment facility, capable of accommodating 1,000-foot vessels, will be constructed in the Lakefront Harbor. However, to fully insure that benefits credited to any recommended Lakefront Harbor modification plan are, in fact, realized, the District proposes to make any such recommendation with the stipulation that no construction be started until written assurances are provided by local interests that an iron ore transshipment facility, capable of accommodating 1,000-foot vessels, will be constructed in the Lakefront Harbor.

c. Differing Opinions on Which Entrance to Modify for 1,000-Foot Vessel Operation.

Although local shipping interests are unanimous in their support of modification of the Lakefront Harbor for safe and efficient operation of 1,000-foot vessels, they are divided as to which entrance (i.e., west (main) entrance or east entrance) should be developed as an "all-weather" entrance. Support for modifying the west (main) entrance is primarily due to the reduction of shipper's transit time from the upper Great Lakes to the Lakefront Harbor by about 1 to 2 hours. Support for modifying the east entrance is due primarily to safety considerations in that vessels could enter the east entrance during storm conditions under full power and still have sufficient maneuvering room to reduce their speed. Modifying the east entrance would also decrease the possibility of vessels striking physical obstacles, which would not be the case if the west (main) entrance were modified.

During the course of this Phase I study, both the Buffalo District and the Cleveland Port Authority were unsuccessful in their early attempts to develop a unified local position on which entrance to modify. Accordingly, modification plans were formulated at both the west (main) entrance and the east entrance for 1,000-foot vessel operation. Selection of the final recommended plan, however, if economically and environmentally justified, will be based primarily upon the plan that provides the greatest average annual net benefits (difference between a plan's average annual benefits and average annual costs).

11. NATIONAL OBJECTIVES

Current Federal policy, as developed by the President's Water Resources Council, requires that the alternative water and related resource plans be formulated in accordance with the national objectives of National Economic Development (NED) and Environmental Quality (EQ). Therefore, in accordance with the guidance established in Engineering Regulation 1105-2-30, "General Planning Principles," dated 5 February 1982, this study was consistent with the planning requirements of the Water Resources Council "Principles and Standards" (P&S) and related policies. In accomplishing the study, equal consideration was given to the P&S objectives of NED and EQ described below:

National Economic Development (NED) - National Economic Development is achieved by increasing the value of the nation's output of goods and services and improving economic efficiency.

Environmental Quality (EQ) - Environmental Quality is achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

12. SPECIFIC PLANNING OBJECTIVES

Specific planning objectives are the national, State, and local water and related land resources management needs (opportunities and problems) specific to a study area that can be addressed to enhance National Economic

Development and Environmental Quality. Based on a review of the directives established by the authorizing legislation for the Cleveland Harbor Phase I study, previous reports for the area, statements by individuals in the private sector, input from officials at many levels of Government and an analysis of the problems and needs of the study area, as discussed previously, the specific planning objectives for the Cleveland Harbor study that have been identified are as follows:

a. Promote the economical movement of bulk cargo through Cleveland Harbor by modifying the Lakefront Harbor for safe and efficient operation of the new generation of bulk cargo vessels (such as Class X vessels) loaded to the maximum Great Lakes System's draft of 25.5 feet.

b. Promote the economical movement of bulk cargo at Cleveland Harbor by modifying the Cuyahoga River navigation channel at historically congested areas where undue vessel delays occur.

c. Promote the economical movement of bulk cargo at Cleveland Harbor by modifying the Cuyahoga River navigation channel such that the navigation channel is compatible with the maximum Great Lakes System's draft of 25.5 feet.

d. Determine if previously authorized but uncompleted improvements to the Cuyahoga River and Old River navigation channels are still justified in light of current conditions.

e. Promote the region's ability to meet its unfulfilled needs for additional recreational fishing facilities.

f. Enhance desirable fish habitat in the study area.

g. Ensure that proposed harbor modification plans do not increase shoreline erosion.

h. Ensure that proposed harbor modification plans do not further degrade water quality.

i. Ensure that proposed harbor modification plans are compatible with future contemplated recreational facilities.

j. Ensure that proposed harbor modification plans do not cause an increase in wave activity in the Lakefront Harbor.

k. Ensure that proposed harbor modification plans do not further aggravate the already serious erosion and sedimentation problem in the Cuyahoga River Basin.

13. CONDITIONS IF NO FEDERAL ACTION TAKEN (WITHOUT PROJECT CONDITIONS)

In any formulation, there is always the basic question . . . "Is there a justified need for change?" Therefore, the conditions that would exist if no

Federal action were taken was investigated for this Phase I study. Besides answering the basic question, these conditions will also provide a common basis for comparing alternative plans of improvement as discussed in Section IV of the Main Report.

As a result of no-action, there would be no modifications to the Federally improved harbor at Cleveland, OH. Therefore, bulk cargo movement at Cleveland Harbor would be restricted to smaller and less efficient bulk cargo vessels. In addition, because of inadequate channel depth, these vessels would be forced to navigate at less than the Great Lakes System's draft of 25.5 feet. Bulk cargo vessels would also continue to experience undue vessel delays at historically congested areas. The potential for vessel accidents would also remain high.

As a result of no Federal action, there would be no opportunity to enhance recreational fishing opportunities in the Cleveland Harbor area and the unfulfilled demand for such facilities would remain unmet. This would have a particularly severe impact on the local residents who have incomes below the poverty level since these residents do not have the means to travel outside the area to fulfill their recreational fishing needs. No action would also preclude the potential for enhancement of the natural environment since artificial fish habitat areas would not be constructed.

If no Federal action were taken, there would be no need for the monetary investment that would be required to modify Cleveland Harbor. However, since it is expected that at least several of the proposed modification plans would result in benefits greater than their costs, this potential return on investment would be foregone. No Federal action would also result in no disturbance of the existing environment. Thus, the existing water quality, shoreline erosion, and erosion and sedimentation problems of the area would not be further aggravated. In addition, wave activity in the Lakefront Harbor would not increase. The possibility of conflict with proposed local recreational plans would also be avoided.

SECTION III

FORMULATION OF PRELIMINARY ALTERNATIVE PLANS

This section of the Stage 2 report provides: a brief review of the alternatives investigated during the 1972-1976 Feasibility Study; subsequent events that necessitated reformulation of the authorized plan of improvement; the formulation methodology used in this Stage 2 evaluation; and a discussion of the development of preliminary alternative plans.

14. PLAN FORMULATION RATIONALE

a. Commercial Navigation Alternatives Considered in the 1972-1976 Feasibility Study.

During the 1972-1976 Feasibility Study, as reported in the Cleveland Harbor, Ohio Feasibility Report For Harbor Modification, (June 1976), a total of 64 alternatives for addressing the commercial navigation needs at Cleveland Harbor were investigated. Although a discussion on each alternative is not provided in this Stage 2 report, a review of the major concepts/alternatives considered for the economical movement of bulk cargo at Cleveland Harbor are discussed below.

(1) Commercial Navigation Alternatives Initially Eliminated - During the early stages of the Feasibility Study, several alternatives were eliminated from further consideration because of economic and/or technical reasons. These alternatives involved plans for delivery of bulk cargo to Cleveland Harbor other than by bulk cargo vessels and were as follows:

(a) Barging from Originating Harbor - The first of the alternatives considered interlake movement of bulk cargo with a barging system typically used on rivers. Direct barging of bulk materials could be accomplished with minor change to the present harbor. Such an operation would, in effect, be similar to direct vessel delivery by bulk carriers with a transfer of materials to barges for local distribution. Numerous questions regarding costs of modifying "source" harbor facilities and the efficiency and safety of barges on the open lakes were also considered in discontinuing evaluation of this alternative in its entirety. An alternative which included bulk cargo delivery to the Lakefront Harbor and barge transshipment up the Cuyahoga River was given further consideration.

(b) LASH Delivery From Originating Harbors - The second alternative was a "Lighter-aboard-ship" or LASH System for direct waterborne movement. The Seabee system is similar. These shipping methods utilize vessels constructed to carry lighters or barges within their hulls which are hoisted aboard the "mother ship" by a large gantry crane or an elevator mounted on the vessel. This shipping concept is being employed now in the foreign trade field primarily from ports on the Gulf Coast with vessels over 890 feet long and capable of carrying about 30,000 net tons of cargo. Applicability of such a

shipping vehicle and system to the bulk cargo trade on the Great Lakes involves technical problems relating to the relatively high unit weights of iron ore and stone cargo. The configuration of these vessels would also have to conform to the locks and navigation channels in the Great Lakes. The application of the LASH system at Cleveland Harbor would be limited to moving cargo bound for upriver locations. The modifications to the harbor required for accommodating LASH were similar to those required for a barge transshipment alternative which was given further consideration.

(c) Railroad Car Ferry Delivery From Shipping Harbor - A third possible alternative considered but dismissed was to ship bulk cargo on vessels capable of carrying railroad cars directly from the source harbors to Cleveland. Such a system would require an inordinate number of railroad cars with the consequent deadweight. Further, the inter-lake movement of such a system could be hazardous during storm conditions. Major terminal changes to handle the railroad cars would also be required at the numerous origins and destinations.

(d) Rail From Source - The fourth alternative was all-rail movement of iron ore from Lake Superior to Cleveland. The published rate for all-rail movement from the Mesabi Range to Cleveland was about \$15.70 a net ton in August 1975 compared to a \$5.60 rate for an equivalent movement by vessel. No unit train rates were available. Such a rate would undoubtedly be lower than the \$15.70 per ton rate, but would require installation of extensive unloading facilities at the local steel plants in Cleveland to efficiently unload and release unit trains. The lower unit train rates are made possible by efficient loading and unloading, as the line haul time would normally be about the same as for conventional rail service. Because of the significantly higher cost for direct rail movement when compared to movement by bulk cargo vessels, this alternative was eliminated from further consideration.

(e) Tractor-Trailer Delivery From Source - A fifth alternative analyzed cursorily but eliminated was direct tractor-trailer delivery of iron ore from source to consuming plant. The analysis indicated that based on a 50-ton bottom dump trailer, a 900-mile one way haul distance and 24 hour one way haul time, over 1,000 trucks would be required to move the forecasted 1980 consumption by Cleveland plants. The required number of trucks would nearly double by the year 2030. Over 500 truck deliveries per day would be required in 1980; increasing to more than 1,000 deliveries per day by 2030.

Preliminary calculations indicated a \$14.00 cost/ton (August 1975 price levels) for trucking ore exclusive of overhead and profit of the tractor-trailer operation, and loading and unloading costs. This alternative mode of iron ore delivery is unlikely because of the number of trucks involved, the impacts of high traffic volumes, upgrading, and maintenance along the haul route and increased fuel consumption. Further, the preliminary cost calculations indicated that the costs would be significantly greater than by bulk cargo vessels.

(f) Rail Transship From Another Lake Erie Port - Two alternatives for transshipping iron ore from other Lake Erie ports were considered and then eliminated. One included vessel delivery of iron ore to another Lake Erie

port and then transshipment to Cleveland by rail. The ports of Toledo, Huron, Lorain, Ashtabula and Conneaut all have docks engaged in transshipping iron ore to inland plants and could have handled iron ore destined for Cleveland. All of these harbors had depths commensurate with the Great Lakes Connecting Channels and the St. Lawrence Seaway and rail connections to Cleveland; Ashtabula probably having the best connections for large volume movements.

While this alternative would be economically viable, there would be an overland rail charge and extra handling costs in addition to the vessel delivery cost which is common to all Lake Erie ports. A \$3.00 rail rate (August 1975 price levels) was an estimated average rate based on comparable hauls. In addition, the Cleveland plants were not equipped to receive large tonnages by rail, thereby requiring substantial investments in new facilities to modify the existing rail system.

Because of the additional rail haul and handling charges and the investments necessary to receive and handle large tonnage, it appeared that transshipment of significant tonnages through other ports would probably not develop and thus, this alternative was eliminated from further consideration.

(g) Tractor-Trailer Transshipment from Another Lake Erie Port - This is a variation of the previous alternative using tractor-trailers in-lieu-of rail delivery from other Lake Erie harbors. A cursory analysis was made of equipment requirements and costs. Based on a 50-ton bottom-dump trailer and assuming a 3-hour round trip haul time, about 70 tractor-trailers units would be required in 1980. The number of units would nearly double by the year 2030. Over 500 deliveries per day would be required to move the forecasted ore tonnage in 1980. Daily deliveries would increase to over 1,000 by 2030. Preliminary calculations indicated a cost of about \$1.00 per ton (August 1975 price levels) to haul by tractor-trailer, exclusive of overhead and profit of the haul operator and loading and unloading costs. Undesirable aspects of this alternative included inherent traffic congestion, and required upgrading and increased maintenance of haul routes. Further, the added cost of transshipment would in effect offset the lake leg savings that could be made possible by delivering iron ore to a remote harbor in vessels more efficient and economical than those which could navigate the Cuyahoga River navigation channel. As a result, this alternative was eliminated from further consideration.

(h) Tractor-Trailer Transshipment from Cleveland Lakefront - This alternative was not studied because of the anticipated traffic congestion and haul route up-grading and maintenance. However, barge, rail and conveyor transshipment were analyzed to determine if lakefront transshipment, in general, would be more economical than direct delivery in larger more efficient vessels which would require improvements in the Cuyahoga River navigation channel.

Other alternatives such as airplane, pipeline (slurry-type delivery), or aerial gondolas were preliminarily discounted as being unsuitable, impractical, or too expensive for bulk deliveries. Therefore, the first conclusion reached during the 1972-1976 Feasibility Study was that the most economical means for delivery of bulk cargo to Cleveland Harbor was by bulk cargo vessels. This conclusion remains relevant today, for the same reasons.

(2) Commercial Navigation Alternatives Developed in Detail - Four main structural commercial navigation alternatives, in addition to the base case (no-action) alternative, were developed for delivery of bulk cargo to Cleveland Harbor by bulk cargo vessels. These alternatives were: (1) direct delivery in 1,000-foot vessels to the Lakefront Harbor, modify Cuyahoga River for direct delivery to upriver docks by 680-foot vessels; (2) direct delivery in 1,000-foot vessels to the Lakefront Harbor, modify Cuyahoga River for direct delivery to upriver docks by a hypothetical 800-foot by 105-foot vessel; (3) direct delivery in 1,000-foot vessels to both the Lakefront Harbor and to docks along the Cuyahoga River; and (4) direct delivery in 1,000-foot vessels to the Lakefront Harbor and transshipment by either barge, rail or conveyor to upriver docks.

A common feature of all four structural plans included modifying the Lakefront Harbor to accommodate 1,000-foot vessels. Although four options were originally proposed by local shipping interests to accomplish this purpose, further discussion indicated that only two options should be developed in detail. These options were:

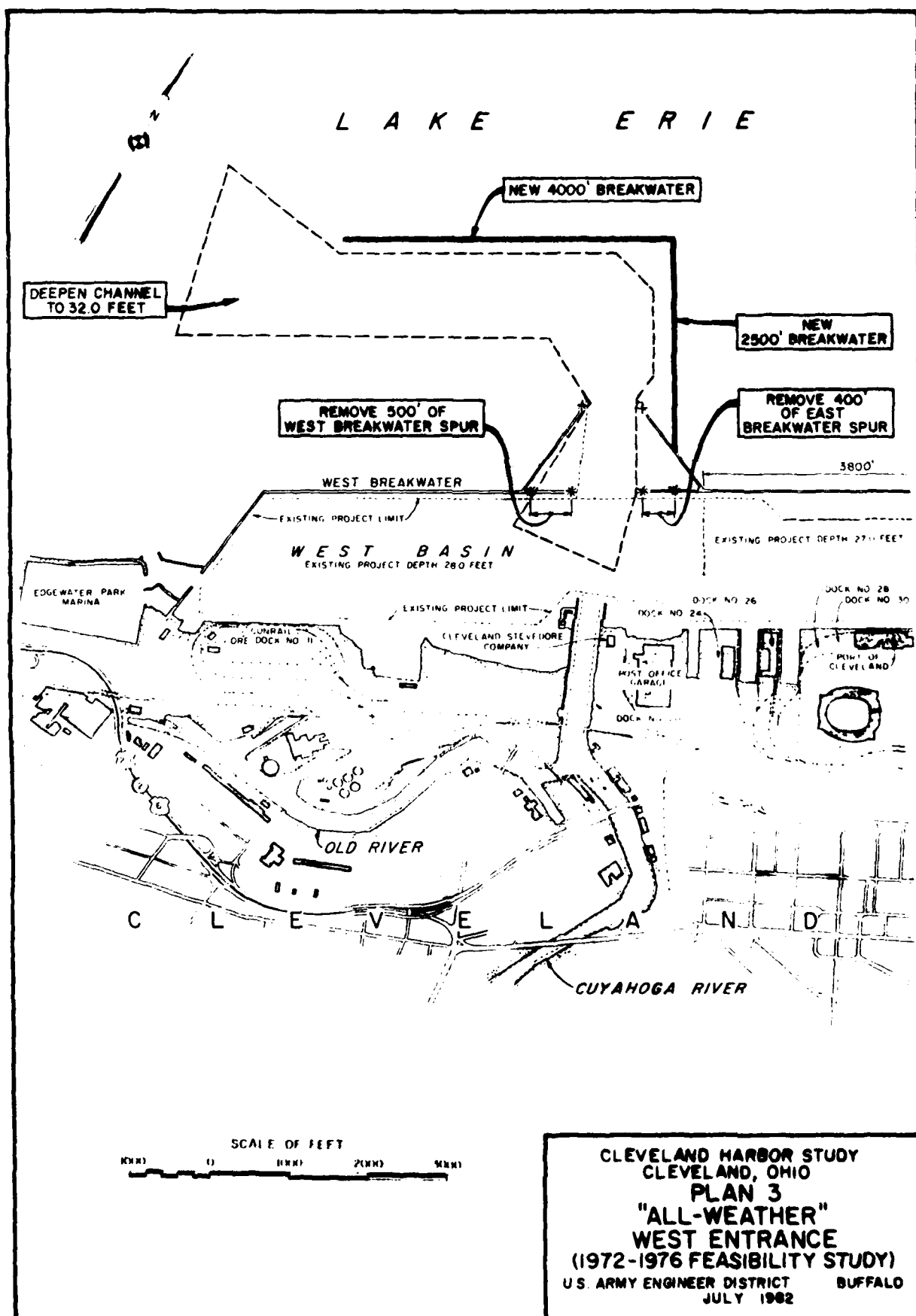
(a) Plan 1 - Plan 1 was similar to the plan authorized by the 1976 WRDA (see Plate 3 in Appendix J) and included providing a "fair-weather" west (main) entrance and an "all-weather" east entrance for safe and efficient operation of 1,000-foot vessels. The estimated cost of this plan, on mid-1975 price levels, was \$16.4 million.

(b) Plan 3 - The second plan developed in detail was Plan 3, an "all-weather" west (main) entrance plan for 1,000-foot vessel operation. Included in this plan (see Figure 13) was an "L"-shaped breakwater protected entrance channel deepened to 32 feet and partial removal of the east and west spur breakwaters. The cost of this plan, on mid-1975 price levels, was \$41.7 million.

Because Plan 3 offered no significant advantages for commercial navigation over Plan 1 and was considerably more expensive to implement than Plan 1, Plan 3 was eliminated from further consideration and Plan 1 was selected as the preferred entrance alternative for 1,000-foot vessel operation.

Another common feature of all four structural plans was upgrading of the Conrail iron ore transshipment facility located adjacent to the west basin of the Lakefront Harbor. The cost of this upgrading was estimated at \$21.4 million. However, because it was assumed that this upgrading would be required to handle the future iron ore receipts destined for inland steel mills in southern Ohio, West Virginia, and Pennsylvania, whether or not an improvement plan was implemented, its cost was not included in the economic evaluation of the four main structural alternatives under consideration.

The first of the four main structural alternatives under consideration, the 680-foot vessel option, included: (1) common modifications to the Lakefront Harbor for operation of 1,000-foot vessels which would deliver iron ore to the upgraded hinterland iron ore transshipment facility; and (2) modifications to five bridges spanning the Cuyahoga River and several bank cuts in order to permit a vessel measuring 680 feet in length and 78 feet in width



and loaded to a 21-foot static draft to navigate the Cuyahoga River navigation channel. The cost of this alternative, on mid-1975 price levels, was \$87.0 million.

The second plan, the 800-foot vessel option, included modifying the alignment of the Cuyahoga River and deepening the channel to 27 feet in order to accommodate a hypothetical 800-foot by 105-foot vessel loaded to the maximum system's draft of 25.5 feet. Also included in this scheme were 11 bridge modifications and various bank cuts. The cost of this alternative, including common modifications to the Lakefront Harbor for operation of 1,000-foot vessels, was \$258.1 million on mid-1975 price levels.

The third plan, the 1,000-foot vessel option, was formulated to provide direct 1,000-foot vessel delivery of bulk materials to the three steel mills located near the head of the navigation channel. Included in this plan were modifications to 14 bridges and extensive bank cuts. This option also involved considerable disruption to existing riverfront facilities. The estimated cost of this plan, including Lakefront modifications, was \$374.7 million.

The fourth plan studied was a transshipment alternative with either a barge option or a conveyor option for delivery of iron ore consumed by the three upriver steel mills. In addition to modifying the Lakefront Harbor for 1,000-foot vessel operation and upgrading of the existing hinterland iron ore transshipment facility, this plan included a second iron ore transshipment facility to handle iron ore destined for upriver steel plants. It was assumed that this facility would be located in the west basin and adjacent to the upgraded hinterland transshipment facility. The proposed facility consisted of a new receiving dock, capable of accommodating a 1,000-foot vessel, iron ore storage areas and either a barge loadout facility or a transfer station to a conveyor system. The cost of this plan with the barge option was \$47.9 million and with the conveyor option was \$116.1 million. (NOTE: Because of the high cost of upgrading existing local railroad trackage and existing receiving plants at the three local steel mills and the extra rail haul charge, a rail transshipment option for the fourth plan was eliminated from further consideration early in the detailed study phase).

The cost and benefits for the four main structural commercial navigation alternatives are summarized in Table 19. As indicated, all four alternatives had benefit/cost ratios greater than 1 and positive average annual net benefits. However, in terms of both B/C ratios and average annual net benefits, the fourth alternative plan, with either the conveyor option or the barge option, was obviously the most economically efficient plan. In addition, the fourth plan avoided the disruption to existing riverfront development along the Cuyahoga River that would be required for the first three plans. The fourth plan, with either the barge option or the conveyor option, was, therefore, identified as the selected plan of improvement.

Based on review of the selected plan by the U. S. Fish and Wildlife Service and the U. S. Environmental Protection Agency, the selected plan was subsequently modified to include provision for dike disposal of dredged bottom material from proposed Lakefront channel improvements that was suspected of being unsuitable for open-lake disposal. This additional item increased the previous cost estimate for the fourth plan by about \$6.9 million.

Table 19 - Summary of Costs and Benefits, Four Main Commercial
Navigation Improvement Alternatives (1972-1976
Feasibility Study)

Alternative	First Cost (1)		Annual (2)		Average	
	Fed.	Non-	Costs	Benefits	Annual Net:Benefit	Benefits : Cost
	Total :(\$1,000,000):		:(\$1,000,000):		:(\$1,000,000):Ratio	
1. 1,000-foot Lakefront, 680-foot Cuyahoga	61.6	25.4	87.0	5.6	11.6	6.0
2. 1,000-foot Lakefront, 800-foot Cuyahoga	182.6	75.5	258.1	16.7	20.4	3.7
3. 1,000-foot Lakefront, 1,000-foot Cuyahoga	249.9	124.8	314.7	24.2	32.2	8.0
4a. 1,000-foot Lakefront, Conveyor Upriver	16.4	99.7	116.1	7.5	27.8	20.3
4b. 1,000-foot Lakefront, Barge Upriver	16.4	31.5	47.9	3.1	20.4	17.3

(1) Mid - 1975 price levels.

(2) Based on mid - 1975 price levels, 50-year economic life and 6-1/8 percent interest rate.

b. Need for Reformulation of Alternatives (Reformulation Phase I General Design Memorandum).

The need for reformulating the authorized plan is discussed in detail in Section I of the Main Report. In summary, additional studies conducted by the Buffalo District, subsequent to completion of the 1972-1976 Feasibility Study, indicated that: (1) proposed modifications to the east entrance, as an added increment to the basic plan of improving the west (main) entrance, could be economically justified, depending on the choice of wind speed criteria limiting the use of the proposed west (main) entrance; (2) if modifications to only one entrance were economically justified, local interests were in disagreement on which entrance should be modified; and (3) regardless of which entrance was modified, proposed modification plans to both the west (main) and east entrances were not totally satisfactory and may not provide the degree of storm protection originally anticipated. In addition, local interests are no longer interested in constructing a Lakefront transshipment facility for delivery of iron ore to the local steel mills. These aspects led to the conclusion that reformulation of the authorized plan was required. Also, during coordination of the Plan of Study and subsequent correspondence, local interests expressed the need for additional modifications to the general navigation project. These additional modifications included: (1) deepening the Cuyahoga River navigation channel; (2) modifying the Cuyahoga River navigation channel at various locations where undue vessel delays occur; and (3) completing authorized but uncompleted improvements on the Cuyahoga River and Old River. Thus, the original study scope was expanded to include formulation, assessment and evaluation of these additional proposed modification plans. Approval to conduct a Reformulation Phase I General Design Memorandum study was provided by the Division Engineer, North Central Division, in November, 1979.

c. Stage 2 Reformulation.

The objective of this Stage 2 investigation is to identify the best general plan(s) for satisfying the commercial navigation and recreational fishing needs at Cleveland Harbor based on physical constraints, the desires and preferences of local interests and being consistent with sound engineering, economic, and environmental principles. In this process, an iterative procedure that provided for increased levels of refinement in design and critique and evaluation by the principal study participants (i. e. - Corps of Engineers; Ohio Department of Natural Resources; U. S. Fish and Wildlife Service; Cleveland Port Authority; and harbor users) was used to narrow the range of alternatives to carry forward. The procedure also allows for review and comments by the general public at informal meetings, workshops and public meetings.

Investigation of other water resources problems and needs, such as other types of recreation, water quality, wave activity in the Lakefront Harbor, shoreline erosion and/or erosion and sedimentation was limited to a level of refinement necessary to adequately assess potential impacts on each by proposed modification plans.

15. GENERAL FORMULATION AND EVALUATION CRITERIA

Federal policy on multiojective planning, derived from both legislative and executive authorities, establishes and defines the national objectives for water resource planning, specifies the range of impacts that must be assessed and sets forth the conditions and criteria which must be applied when evaluating plans. Plans must be formulated to meet the needs of the area with due regard to benefits and costs, both tangible and intangible and effects on the ecology and social well-being of the community.

The formulation of a plan, including the screening of alternatives, must of necessity be within the context of an appropriate framework and set of criteria. The planning framework is established in the Water Resource Council's "Principles and Standards for Planning Water and related Land Resources," which requires the systematic preparation and evaluation of alternative solutions to problems, under the objectives of National Economic Development (NED) and Environmental Quality (EQ). The process also requires that the impacts of a proposed action be measured and the results displayed or accounted for in terms of contributions to four accounts: NED, EQ, Regional Economic Development (RED) and Other Social Effects (OSE). The formulation process must be conducted without bias as to structural and nonstructural measures.

Within the structure of the overall planning framework other more specific criteria relative to general policies, technical engineering, economic principles, social and environmental values and local conditions must be established. These criteria, noted as "Technical," "Economic," and "Socio-economic and Environmental" are listed as follows:

a. Technical Criteria.

(1) Design wave and lake level for design of breakwater crest elevations should be based on the commercial navigation season which is assumed to extend from April to December on Lake Erie.

(2) A coincident 200-year design frequency, using the 20-year recurrence significant deep water wave height in combination with the 10-year lake level, should be used for stability design of breakwater structures.

(3) Overtopping of protective works for the design condition would be permitted to the extent that the residual interior wave shall be limited to a height consistent with safe and efficient operation of the commercial navigation facility. Residual interior wave heights will be established by the hydraulic model study at WES.

(4) Plans for modifying the west (main) entrance shall be formulated such that wave activity in the Lakefront Harbor does not increase, as verified by the hydraulic model study at WES.

(5) Navigability of proposed modification plans will be based on a qualitative assessment, using the scale model of a 1,000-foot vessel.

(6) Breakwaters will be designed to prevent increased starvation to downdrift areas.

(7) Channel width design will be based on criteria established in Draft EM 1110-2-XXXX.

(8) Channel depth design will be based on the best available technical information, input from experienced vessel masters, a static draft of 25.5 feet, and low water conditions which are exceeded 95 percent of the time (i.e.; LWD - 568.6).

(9) Stability of existing bulkheads after channel deepening will be based on analysis of data obtained from available Department of the Army Permits which cover a percentage of all bulkheads. Based on the results of this stability analysis, the results will be expanded to cover the remaining bulkheads for which permit information is not available.

(10) Design of new bulkheads will be based on criteria established in Draft EM 1110-2-2906, dated 16 November 1970.

b. Economic Criteria.

(1) Tangible benefits should exceed project economic costs.

(2) Each separable unit of improvement or purpose should provide benefits at least equal to its cost unless justifiable on a non-economic basis.

(3) Each plan, as ultimately formulated, should provide the maximum net benefits possible within the formulation framework.

(4) The costs for alternative plans of development should be based on preliminary layouts, estimates of quantities and June 1982 unit prices.

(5) The benefits and costs should be in comparable economic terms to the fullest extent possible.

(6) A 50-year economic life and 7-5/8 percent interest rate are used for the economic evaluation.

(7) The project evaluation period is a 50-year interval beyond the estimated implementation date of 1990.

(8) The base case for comparison of alternative plans is the "do-nothing" (no-action) plan.

(9) A 275-day navigation season will be assumed for Stage 2. A sensitivity analysis on this assumption will be conducted in Stage 3, if warranted.

(10) For Stage 2, assume that the present Great Lakes Navigation System will not be substantially altered and that the locks at Sault Ste. Marie will not constrain commodity growth at Cleveland Harbor. A sensitivity analysis on this assumption will be conducted in Stage 3, if warranted.

(11) Assume that 1,000-foot vessels are not present in the "base" fleet. (NOTE: During the past few years, several 1,000-foot vessels have entered Cleveland Harbor during calm weather conditions and unloaded their cargo at Conrail's existing iron ore transshipment facility adjacent to the west basin of the Lakefront Harbor. However, as previously discussed, local interests are of the opinion that the existing harbor entrances are not suitable for safe and efficient operation of 1,000-foot vessels, even under ideal weather conditions. Ship navigation tests using the scale model of a 1,000-foot vessel subsequently confirmed this position. Therefore, since the present dimensions of the harbor entrances are not suitable for safe and efficient operation of 1,000-foot vessels, 1,000-foot vessels were not included in the "base" fleet. To check this study assumption and its effect on project feasibility, a sensitivity analysis was conducted which included 1,000-foot vessels in the base fleet, although at a level of use less than that which would be present if the harbor entrances were modified for 1,000-foot vessel operation (i.e.; post-project conditions). Results of this sensitivity analysis are presented in Appendix B, "Economic Evaluation").

(12) Assume that an iron ore transshipment facility, capable of accommodating 1,000-foot vessels, will be constructed in the Lakefront Harbor irrespective of whether or not harbor modifications are made. On this basis, the cost of the transshipment facility is not chargeable to the cost of the harbor project.

(13) For Stage 2, assume maximum vessel operating draft is based on low water conditions (i.e., LWD). (NOTE: Actual water levels in Lake Erie frequently exceed LWD and shippers take advantage of this extra depth of water to load their vessels deeper. Traditionally, this extra depth of water has not been taken into account in analyzing the economic feasibility of Corps of Engineers navigation projects. However, to check the effect of this study assumption on project feasibility, an alternate economic analysis, using long-term average lake levels in-lieu-of LWD, will be conducted in Stage 3.)

(14) For Stage 2, assume shippers load their vessels based on safe operating drafts (i.e., 22.5 feet relative to LWD for existing conditions). (NOTE: Safe operating drafts, as discussed in Section II of the Main Report, were developed based on the design storm condition and, as such, an appropriate allowance for vessel motion as a result of wave and/or wind action was included in the analysis. Since the design storm condition occurs infrequently, shippers normally load their vessels deeper than the safe operating draft with the expectation that conditions will be calm when they attempt to enter Cleveland Harbor. In the event that conditions are not calm, they are forced to lay-off in Lake Erie and wait for the weather to moderate before attempting a harbor entry. Traditionally, this practice has not been taken into account in analyzing the economic feasibility of the Corps of Engineers navigation projects. However, to check the effect of this study assumption on project feasibility, an alternate economic analysis, which assumes a fully loaded "base" fleet (i.e., a "base" (existing) fleet loaded to 25.5 feet relative to LWD), will be conducted in Stage 3).

c. Socio-economic and Environmental Criteria.

The criteria for socio-economic and environmental considerations in water resource planning are prescribed by the National Environmental Policy Act of 1969 (PL 91-190) and Section 122 of the River and Harbor Act of 1970, (PL 91-611). These criteria prescribe that all significant adverse and beneficial economic, social and environmental effects of planned developments be considered and evaluated during plan formulation.

d. Design and Other Considerations.

(1) Design weather conditions - Two weather conditions were considered in formulation of harbor modification plans for 1,000-foot vessel operation in the Lakefront Harbor: "all-weather" conditions; and "fair-weather" conditions. "All-weather" conditions are defined as the worst weather conditions for which vessel masters would enter the Lakefront Harbor, proceed to the dock, and initiate the unloading cycle. This condition was further defined as a maximum 8-foot wave and 30-knot wind from the west through northeast at the 8 April 1981 vessel masters workshop meeting. Vessel masters also defined "fair-weather" conditions as a maximum 4-foot wave and 20-knot wind from the west through northeast.

(2) Disposal of Dredged Material - It has been assumed that all dredged material is polluted and will be placed in the existing Dike Site 14. This assumption will be verified in the summer of 1982, when a sediment sampling

program will be conducted in conjunction with the annual maintenance dredging activities at Cleveland Harbor. (NOTE: As previously discussed, Dike Sites 12 and 14 were authorized to provide containment for 10 years of maintenance dredging. Sizing of these diked disposal areas to meet this authorized life expectancy was based on an anticipated average yearly dredging volume of 975,000 cubic yards. However, over the seven year period, fall 1974 to spring 1981, an average of only about 650,000 cubic yards of dredging was required to maintain the navigation channels at authorized depths. In addition, private interests dredged about 50,000 cubic yards of sediment annually along private docks. Since this reduced dredging volume is expected to continue for the foreseeable future, Dike Sites 12 and 14 will have excess capacity over the 10 years authorized life of approximately $2\frac{3}{4}$ million cubic yards $([975,000 \text{ cy/yr} - (650,000 \text{ cy/yr} + 50,000 \text{ cy/yr})] \times 10 \text{ yrs})$ and this excess capacity will be used to contain dredged material resulting from proposed harbor modification plans. This course of action is consistent with recent attempts by Congressional interests to authorize construction of the east entrance component of the authorized plan, with dredged material being placed in Dike Site 14.)

(3) Mitigation - There is insufficient environmental data at this time to determine the need for mitigation or the type of mitigation that might be required. Therefore, plans and associated costs for mitigation, with the exception of development of fish habitat areas utilizing stone rubble from the breakwater removal component of several plans, are not included in the estimates for this Stage 2 report. Mitigation will be evaluated in Stage 3, as appropriate.

(4) 1,100-foot Vessel Operation - As previously discussed, the Maximum Ship Size Study, conducted by North Central Division, determined that, among other things, the largest economically sized bulk cargo vessel that would use the Great Lakes Navigation System would be 1,100 feet long by 105 feet wide. However, since no shipping company indicated any long range plans to construct a vessel larger than 1,000 feet long, plans were not formulated during this Phase 1 study to accommodate a 1,100-foot long vessel. The ability of 1,000-foot vessel plans to accommodate a 1,100-foot vessel was, however, used as an evaluation criteria in the plan selection process.

(5) Cost Sharing - Traditional cost allocation between Federal and non-Federal interests for commercial navigation and recreational fishing projects is established by existing law. However, the President recently submitted proposed legislation to provide for full recovery of certain operation and maintenance costs for deep draft ports and their connecting channels on or after 1 October 1982 and for full recovery of construction costs for deep draft ports and their connecting channels which receive initial construction funding on or after 1 October 1981. Therefore, Federal and non-Federal costs for commercial navigation modification plans are presented for both traditional and proposed cost allocation methods. (NOTE: Federal and non-Federal costs for authorized but uncompleted improvements on the Cuyahoga River and Old River navigation channels, which received initial construction funding prior to 1 October 1981, are presented under traditional cost allocation only). Federal and non-Federal costs for recreational

fishing plans are based on traditional cost allocation, only. Traditional and proposed cost allocation methods are as follows:

(a) Traditional Cost Allocation - Federal costs in commercial navigation projects under traditional cost allocation methods include 100 percent of the design, construction and operation and maintenance costs of breakwaters, navigation channels and aids to navigation. Federal responsibilities also include cost sharing on the design and construction of bridge alterations when required for navigation improvements under the provisions of Section 6 of Public Law 647, 79th Congress, as amended. Non-Federal responsibilities for commercial navigation projects include 100 percent of the costs for lands, easements, and rights-of-way; building demolition and replacement; removal, replacement and/or relocation of railroad track and utilities; and required bank stabilization and bulkhead construction. Non-Federal interests are also responsible for deepening berthing areas and slips adjacent to general navigation channels and for the design and construction of all docks and related upland facilities. Federal responsibilities for recreational fishing plans include 50 percent of the design and construction costs of these facilities. Non-Federal responsibilities include providing lands, easements, and rights-of-way, and 50 percent of the design and construction costs of these facilities. Non-Federal interests are also responsible for operating and maintaining these facilities.

(b) Proposed Cost Allocation - Non-Federal interests are responsible for 100 percent of the design, construction and operation and maintenance costs of commercial navigation projects for which initial construction funding is received on or after 1 October 1981.

16. DEVELOPMENT OF ALTERNATIVE PLANS (POSSIBLE SOLUTIONS)

a. Development of Preliminary Plans.

Within the prescribed planning framework and established criteria, possible solutions were identified and will be evaluated in a three stage iterative process to address the needs of the study area and the overall planning objectives. Each stage includes the four functional planning tasks of problem identification, formulation of alternatives, impact assessment and evaluation. Each stage contains essentially the same sequence of tasks but emphasis shifted as the process proceeded.

This document reports the results of the Stage 2 evaluation. The level of study performed is consistent with the Stage 2 objective of evaluating a broad range of possible solutions and identifying the best general plan (or plans) for satisfying the commercial navigation and recreational fishing needs at Cleveland Harbor. (NOTE: The results of the Stage 1 evaluation, which concentrated on problem identification, were reported in the Classification Report and Plan of Study for Cleveland Harbor, OH, February 1979 (revised October 1979).)

The primary water resources needs for which a solution is sought under this authority are to move bulk cargo more efficiently and economically through Cleveland Harbor and to provide for unfulfilled recreational fishing needs in

the Cleveland Harbor area. As possible solutions to addressing these needs, twenty preliminary structural alternatives and one preliminary non-structural alternative were identified during the initial phase of this Stage 2 investigation in addition to the "no-action" option. These preliminary alternatives are as follows:

Lakefront Harbor Modification Plans

<u>Alternative Plan Number</u>	<u>Options</u>	<u>Plans</u>
1		"All-Weather" East Entrance
2		"Fair-Weather" West Entrance
3	A	"All-Weather" West Entrance (Modified "L" - Shaped Breakwater)
	B	"All-Weather" West Entrance (1,000-foot Parallel Breakwater Extensions)
	C	"All-Weather" West Entrance (Detached East Arrowhead Extension)
	D	"All-Weather" West Entrance ("L"- Shaped Breakwater)
4		Combined "All-Weather" East Entrance and "Fair-Weather" West Entrance
9		Tug Assistance

Old River Modification Plans

5	A	Authorized Old River Improvements (Replace Bridge No. 23)
	B	Authorized Old River Improvements (Interchange System)

Cuyahoga River Modification Plans

6	A	Deepen Cuyahoga River to 25.5 Feet
	B	Deepen Cuyahoga River to 28 Feet
7	A	Reduce River Congestion (Site 1)
	B	Reduce River Congestion (Site 2)
	C	Reduce River Congestion (Site 3)
	D	Reduce River Congestion (Site 4)
	E	Reduce River Congestion (Site 5)
	F	Reduce River Congestion (Site 6)
	G	Reduce River Congestion (Site 7)

Recreational Fishing Plans

8	A	Recreational Breakwater Fishing (Edgewater Marina Breakwater)
	B	Recreational Breakwater Fishing (West Breakwater)

No-Action

10		"No-Action" Plan
----	--	------------------

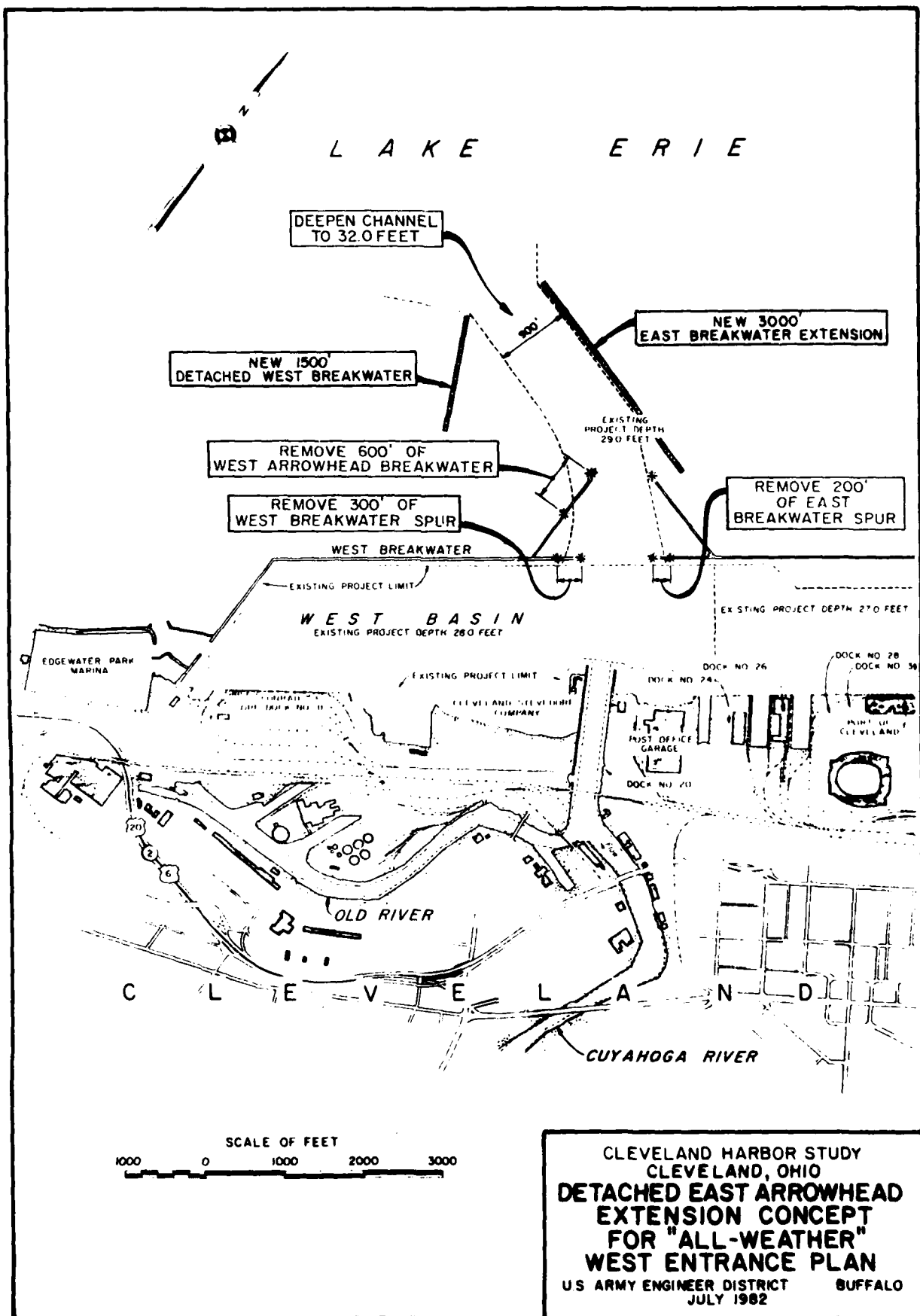
b. Initial Iteration of Alternatives.

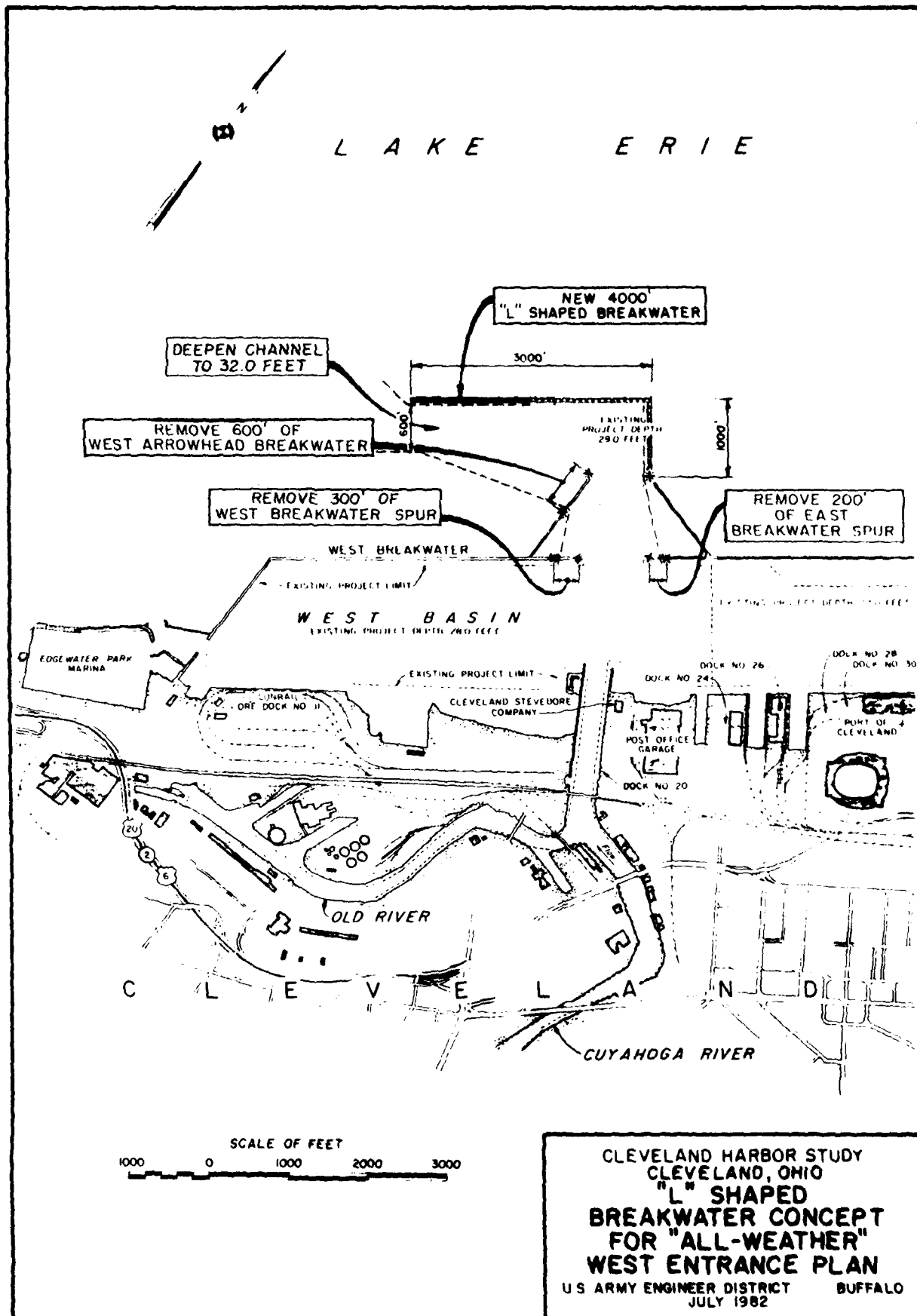
Initial evaluation and assessment of the 21 preliminary alternatives, in terms of their contributions to the planning objectives and accounts, indicated that four plans should be eliminated from further consideration. These plans were: Plan No. 3C, 3D, 9 and 7A. The reasons for their elimination are discussed below. Initial evaluation and assessment also indicated that the remaining 17 preliminary structural alternatives and the "No-Action" option warranted further consideration. These alternatives are discussed in Section IV of the Main Report "Assessment and Evaluation of Preliminary Plans."

Alternative Plans No. 3C, 3D, 9, and 7A were eliminated from further consideration for the following reasons. Alternative Plan No. 3C (see Figure 14) was originally suggested by vessel masters at the 8 April 1981 workshop meeting as the preferred concept for development of an "all-weather" west entrance plan for safe and efficient operation of 1,000-foot vessels. However, model study tests at WES indicated that this plan could not meet the wave height criteria which were also established by the vessel masters for a plan to be acceptable (i.e., wave heights in the Lakefront Harbor increased over existing conditions and wave heights exceeded 3 feet for an 8-foot incident wave at the existing arrowhead entrance - for additional details see Appendix C, "Coastal Engineering Design"). Therefore, since this plan did not meet wave height criteria, it was eliminated from further consideration.

Alternative Plan 3D (see Figure 15) was also suggested by vessel masters at the 8 April 1981 workshop meeting as an alternative concept for development of an "all-weather" west entrance plan for safe and efficient operation of 1,000-foot vessels. Model tests at WES for this plan indicated that wave height criteria, also established by the vessel masters for a plan to be acceptable, were met. However, model testing of a modified version of this concept (Plan 3A), which involved rotating the north leg of the new "L"-shaped breakwater lakeward, indicated that this modified plan, while meeting the wave height criteria, also improved navigability due to the reduced turning angles. Therefore, the modified version was carried forward and Plan 3D was eliminated from further consideration.

Plan 9 (Tug Assistance) was originally developed as a means of providing for safe and efficient operation of 1,000-foot vessels without the required harbor modifications (i.e., Plan 9 was developed as a nonstructural solution). However, this plan would require that Class V and larger vessels continue to enter Cleveland Harbor light-loaded relative to LWD since harbor entrance channels would not be deepened to adequate depths. In addition, there would be a high potential for serious accidents at the west (main) entrance due to the difficulty tugs would have in controlling the movements of 1,000-foot vessel during rough weather. This problem is further compounded by the narrow opening of the arrowhead breakwaters at the west (main) entrance (i.e.; 600-foot opening).





Increasing the width of the opening at the west (main) entrance would not be practical since wave activity in the Lakefront Harbor would increase significantly. Also, no tugs of sufficient size to control the movements of a 1,000-foot vessel (2,000-3,000 horse power) are available on the Great Lakes. For these reasons, Plan 9 was eliminated from further consideration.

Plan 7A, which would eliminate undue vessel delays at Conrail Bridge No. 1 on the Cuyahoga River, was also suggested by shipping interests. The delay at Bridge No. 1 is caused by vessels waiting for the existing vertical lift bridge to open. To eliminate the vessel delays at this site, the existing vertical lift bridge would have to be replaced with a fixed high level bridge providing about 98 feet of vertical clearance. In addition, extensive modifications to the approach tracks on either side of the bridge, including placing about 2 miles of track on trestles, would be required. Since benefits that would accrue from eliminating vessel delays at this site (approximately \$675,000 per year which could support a project of about \$9,000,000 in construction costs) would not be sufficient to economically justify a project of this scope, Plan 7A was eliminated from further consideration.

17. PLANS OF OTHERS

In order for the Corps of Engineers to effectively develop plans for any water resources project, it is necessary to coordinate these plans with the plans being developed by other public and private organizations. Within Cleveland Harbor, local interests who have developed plans for the area include the Cleveland Port Authority, Conrail, Lake Erie Asphalt Products (LEAP), Ontario Stone Corporation, Ashland Oil Company, city of Cleveland and the Ohio Department of Natural Resources (ODNR).

In late 1980 the Cleveland Port Authority authorized and funded the Cleveland Harbor Development study conducted by the engineering firm of Tippetts - Abbott - McCarthy - Straton. The purpose of this study was to obtain an orderly plan to guide development of the Port of Cleveland through the end of the century and beyond. The resulting recommended development plan, shown on Figures 16 and 17, included: (1) purchasing and upgrading Conrail's existing iron ore transshipment facility adjacent to the west basin (Figure 16); (2) continuation of the existing iron ore lightening operation at Dock 20 (Figure 17); (3) expansion of facilities in the vicinity of Docks 24 to 26 for "other" dry bulk cargos such as potash, fluoraspar, bauxite, ferro-manganese, pig iron and limestone which are projected to grow from 200,000 tons in 1981 to about 1 million tons in 2005; and (4) continued development of the old Post Office building adjacent to Dock 20 as a Foreign Trade Zone. The Cleveland Port Authority is presently reviewing the recommended plan and a decision on whether to adopt all or part of the plan is expected in the near future.

As previously discussed, Conrail is also studying the feasibility of upgrading and expanding their iron ore transshipment facility adjacent to the west basin. However, they have not publicly released the results of their studies nor have they publicly stated their ultimate development plans.

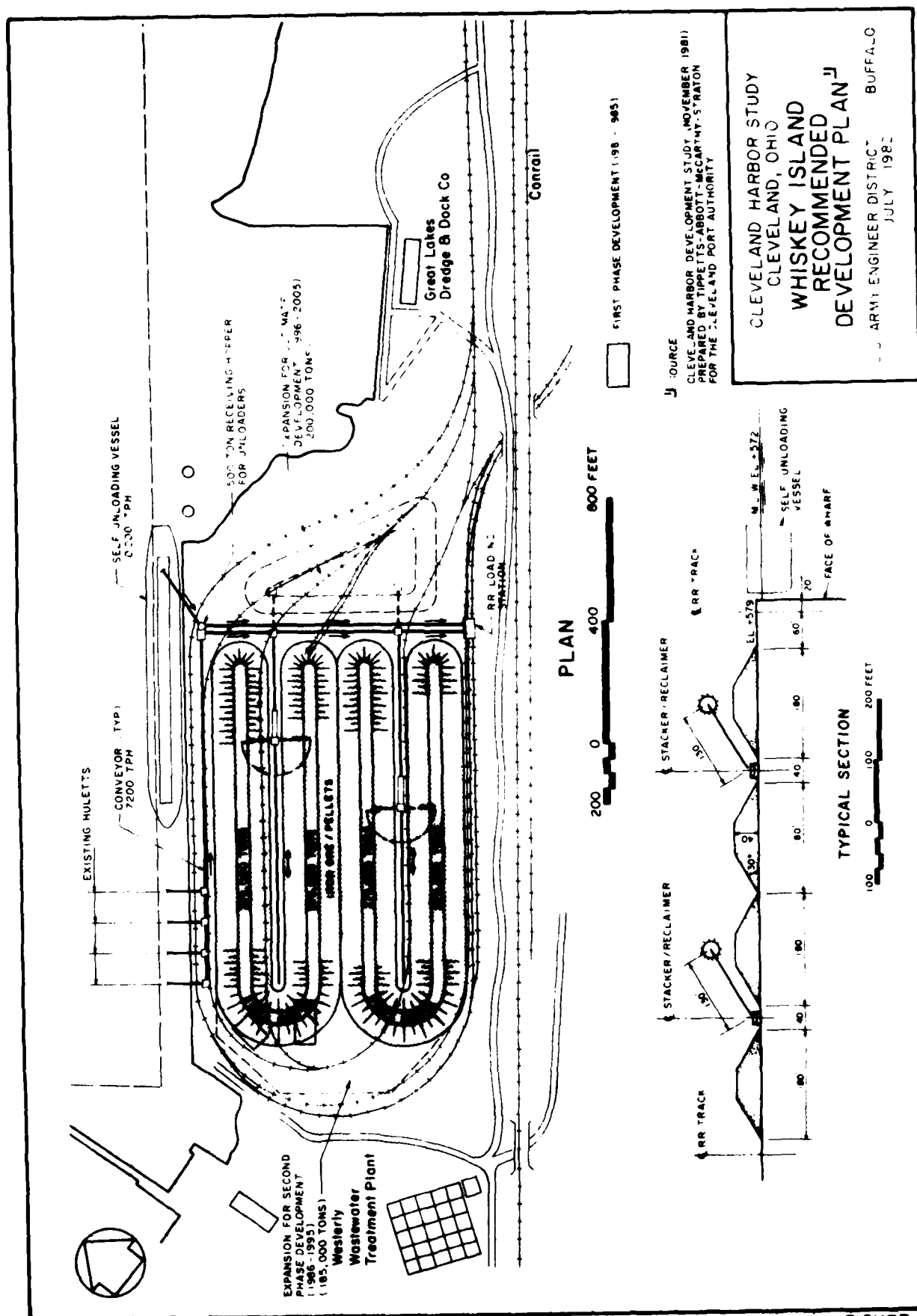
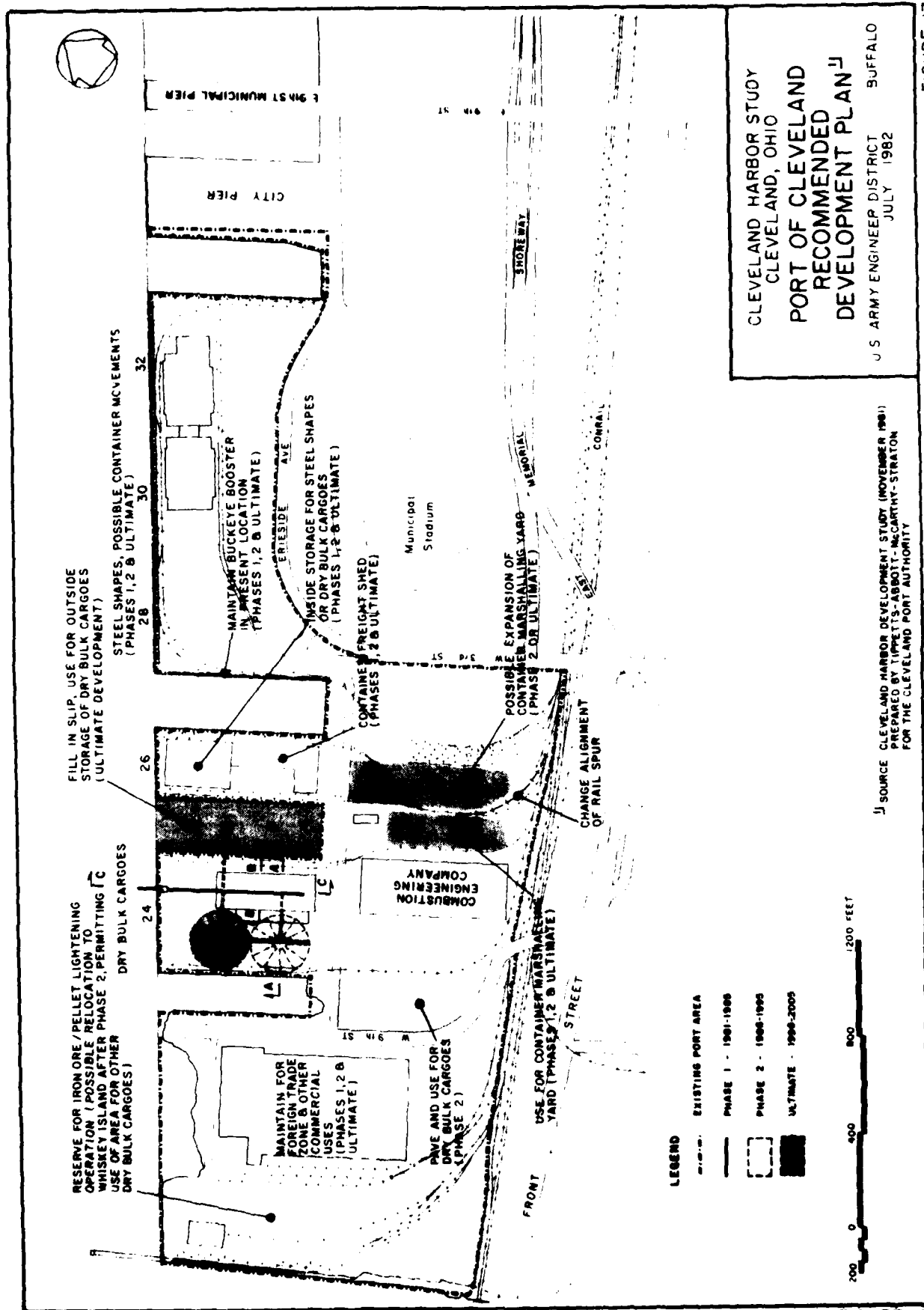


FIGURE 16



CLEVELAND HARBOR STUDY
CLEVELAND, OHIO
PORT OF CLEVELAND
RECOMMENDED
DEVELOPMENT PLAN¹¹
U.S. ARMY ENGINEER DISTRICT BUFFALO
JULY 1982

¹¹ SOURCE CLEVELAND HARBOR DEVELOPMENT STUDY (NOVEMBER 1981)
PREPARED BY TIPPETTS-ABBOTT-McCARTHY-STRATON
FOR THE CLEVELAND PORT AUTHORITY

FIGURE 17

FIGURE 17

Thus, their future plans remain uncertain. In addition, Conrail has not publicly commented on the Cleveland Port Authority's recommended development plan which includes purchasing their existing facility.

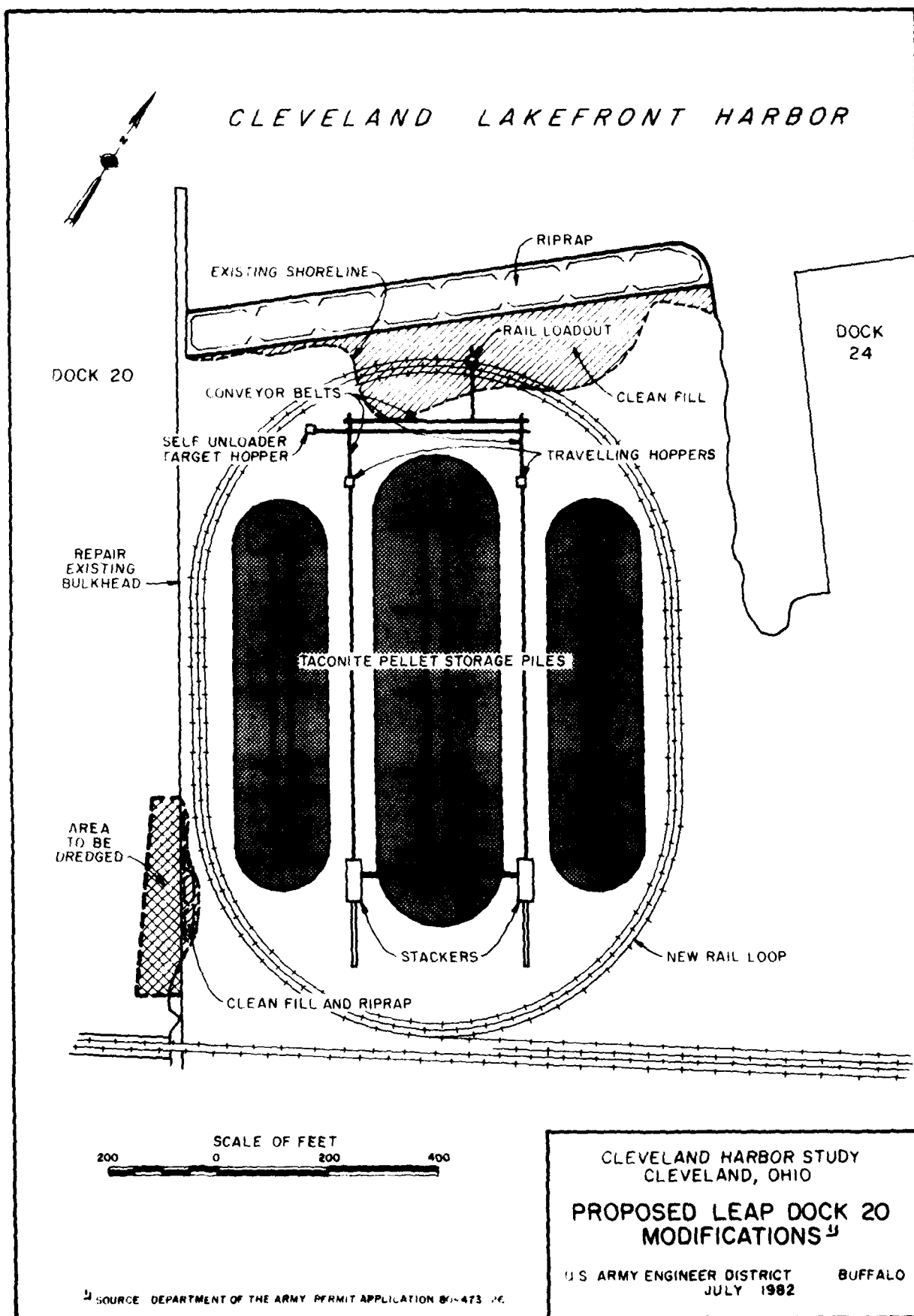
Lake Erie Asphalt Products, Inc. (LEAP) is also studying the feasibility of constructing an iron ore transshipment facility in the vicinity of Dock 20 (see Figure 18). However, their plans are currently on hold, pending, among other things, the final decision of the Cleveland Port Authority on the ultimate use of the old Post Office building which would have to be removed if LEAP proceeds with their development plans.

The Ontario Stone Corporation recently purchased the former Erie Ore Dock on the Old River. During discussions with Buffalo District personnel on 16 February 1982 (see Exhibit G-4 in Appendix G), they indicated that they were conducting preliminary discussions with a company interested in exporting approximately 2 million tons of coal per year from their new dock. If this new business materializes, it would significantly increase the tonnage on the Old River navigation channel and may have a significant impact on the economic feasibility of completing authorized but uncompleted improvements on the Old River. However, since Ontario Stone Corporation is still in the preliminary discussion stage, no firm commitment for this activity can be made at this time.

Ashland Petroleum Company presently operates an oil refinery facility on Whiskey Island, adjacent to the Old River. During discussions with District personnel on 11 February 1982, (see Exhibit F-10 in Appendix F), they indicated that they were studying the feasibility of constructing a coal/oil mixing facility on their property. Coal would arrive at this facility by train and oil would be shipped in 450-foot vessels. The coal and oil would then be blended to produce boiler fuel for a local steel mill and would be shipped to this mill by barge. They also indicated that the present navigation channels on the Cuyahoga River and Old River would be sufficient for their needs and that they would not change their operations (i.e., use a larger vessel and/or use a vessel that could load to a deeper draft) if the navigation channels were modified.

The city of Cleveland is presently studying the feasibility of expanding Burke Lakefront Airport in the east basin of the Lakefront Harbor (see Plate 1). The plan currently under consideration requires a landfill area adjacent to the harbor side of the present airport. This new landfill area would extend westerly from the east end of the Corps filled disposal areas to the west end of the present airport and lakeward to within 100 feet of the present east basin channel. As previously discussed, city officials are interested in using dredged material from any proposed improvement plan for construction of this proposed landfill area. Further coordination with the city of Cleveland on this aspect will be conducted in Stage 3 planning, if improvement plans involving significant amounts of dredged material are carried forward into Stage 3.

As previously discussed, the Ohio Department of Natural Resources has developed plans for the Cleveland Lakefront State Park. Located along the



shoreline of Lake Erie and encompassing Cleveland Harbor, the park will provide for both water and non-water related recreational facilities and will be developed over the next several decades. A master development plan for the park is provided as Plate 5 in Appendix J.

As indicated in the development plan, ODNR proposes to develop Whiskey Island as a recreation area. However, Whiskey Island also appears to be the preferred location of local interests for a new iron ore transshipment facility capable of accommodating 1,000-foot vessels. It is also a prerequisite that such a facility be constructed before plans to modify the Lakefront Harbor for 1,000-foot vessel operation be implemented. Therefore, ODNR and local interests will have to decide whether to develop Whiskey Island as a recreational area or as an iron ore transshipment facility. If the decision is for recreational development, an alternative sites for an iron ore transshipment facility will have to be selected before a plan to modify the Lakefront Harbor for 1,000-foot vessel operation can be implemented.

SECTION IV

ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS

This section provides a summary of the engineering design, economic evaluation and environmental assessment of the 17 structural plans that an initial screening of a wide range of possible solutions indicated had the greatest potential for meeting the planning objectives of promoting the economical movement of bulk cargo through Cleveland Harbor and providing additional recreational fishing facilities in the Cleveland Harbor area. These 17 alternatives are:

Lakefront Harbor Modification Plans

Alternative Plan No. 1 - "All-Weather" East Entrance.

Alternative Plan No. 2 - "Fair-Weather" West Entrance.

Alternative Plan No. 3 (Option A) - "All-Weather" West Entrance (Modified "L"-Shaped Breakwater).

Alternative Plan No. 3 (Option B) - "All-Weather" West Entrance (1,000-Foot Parallel Breakwater Extensions).

Alternative Plan No. 4 - Combined "All-Weather" East Entrance and "Fair-Weather" West Entrance.

Old River Modification Plans

Alternative Plan No. 5 (Option A) - Authorized Old River Improvements (Replace Bridge No. 23).

Alternative Plan No. 5 (Option B) - Authorized Old River Improvements (Interchange System).

Cuyahoga River Modification Plans

Alternative Plan No. 6 (Option A) - Deepen Cuyahoga River to 25.5 Feet.

Alternative Plan No. 6 (Option B) - Deepen Cuyahoga River to 28 Feet.

Alternative Plan No. 7 (Option B) - Reduce River Congestion (Site 2).

Alternative Plan No. 7 (Option C) - Reduce River Congestion (Site 3).

Alternative Plan No. 7 (Option D) - Reduce River Congestion (Site 4).

Alternative Plan No. 7 (Option E) - Reduce River Congestion (Site 5).

Alternative Plan No. 7 (Option F) - Reduce River Congestion (Site 6).

Alternative Plan No. 7 (Option G) - Reduce River Congestion (Site 7).

Recreational Fishing Plans

Alternative Plan No. 8 (Option A) - Recreational Breakwater Fishing (Edgewater Marina Breakwater).

Alternative Plan No. 8 (Option B) - Recreational Breakwater Fishing (West Breakwater).

In addition, the basis of comparison for the above structural plans is:

Alternative Plan No. 10 - "No-Action."

Appendices A through E to this report provide details of the engineering and economic analyses associated with the 17 structural alternatives for which preliminary designs were prepared. These appendices are:

Appendix A - Geotechnical

Appendix B - Economic Evaluation

Appendix C - Coastal Engineering Design

Appendix D - Design

Appendix E - Cost Estimates

18. LAKEFRONT HARBOR MODIFICATION PLANS (PLANS 1-4)

The primary objective of the Lakefront Harbor modification plans developed during Stage 2 planning was to provide for safe and efficient operation of vessels up to 1,000 feet long by 105 feet wide in the Lakefront Harbor. Several of the plans would also provide deeper entrance channel depths which are required in order for Class V to Class X vessels to enter the Cleveland Lakefront Harbor loaded to the maximum Great Lakes System's draft of 25.5 feet.

In developing plans to provide for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor, two different weather conditions were considered: (1) "fair-weather" conditions; and (2) "all-weather" conditions. "Fair-weather" conditions were defined by vessel masters at the 8 April 1981 workshop meeting as a maximum 4-foot wave and 20-knot wind from the west through northeast. "All-weather" conditions, also established by the vessel masters, were defined as a maximum 8-foot wave and 30-knot wind from the west through northeast.

As previously discussed, all Lakefront Harbor modification plans were developed under the following main assumptions: (1) that an iron ore transshipment facility, capable of accommodating 1,000-foot vessels, would be constructed in the Lakefront Harbor; and (2) that all dredged material is polluted and would be placed in Dike Site 14 which has excess capacity over and above its authorized 10-year life. In addition, due to lack of sufficient environmental data, mitigation plans to compensate for unavoidable

negative environmental impacts of the alternatives were not formulated in Stage 2, with the exception of developing fish habitat areas utilizing stone rubble from the breakwater removal component of several plans. Mitigation will be evaluated in Stage 3, as appropriate.

Pertinent engineering, economic, environmental and related data for Plans 1 through 4 follow.

a. Alternative Plan No. 1 - "All-Weather" East Entrance.

(1) Description of Plan 1 - Plan 1 would provide an "all-weather" entrance into the Lakefront Harbor for 1,000-foot vessels at the existing east entrance. The plan would also provide deeper channel depths which would allow Class V through Class X vessels to enter Cleveland Harbor loaded to the maximum Great Lakes System's draft of 25.5 feet. The layout and project features for Plan 1 are shown on Plate 6 in Appendix J.

Components of Plan 1 include a fan-shaped entrance channel at the existing east entrance and an interior channel through the east basin to the west basin. The fan-shaped entrance channel, dimensioned by vessel masters during the 1972-1976 Feasibility Study and reaffirmed at the 14 March 1979 and 8 April 1981 workshop meetings, was sized to allow 1,000-foot vessels, entering Cleveland Harbor from the west, sufficient maneuvering room to turn into the east entrance. After making the turn, the width of the entrance channel narrows to 900 feet. The 900-foot width is required since vessels would still be under the influence of wave action during the design "all-weather" conditions, especially when the waves were from the north through northeast directions. Once the vessels are completely into the protected harbor and are no longer subject to wave attack, the width of the channel narrows to 500 feet, sufficient for two-way traffic through the remainder of the east basin.

As shown in Table 16 of Section II, depths of the entrance channel and interior channel would be 32 feet and 28 feet below LWD, respectively. The 32-foot depth of the entrance channel is required in order to provide sufficient depth of water for vessels experiencing roll under the design "all-weather" conditions (i.e., 4° roll for a Class X vessel and 6° roll for Class V - Class VII vessels for an 8-foot wave). Once the vessels are completely into the protected harbor and are no longer under wave attack (and thus do not experience any roll), the depth of the channel decreases to 28 feet, except in the vicinity of the west (main) entrance where the depth again increases to 30 feet. This extra depth is required since vessels would again be under wave attack from waves entering the harbor through the existing arrowhead breakwaters for the design "all-weather" conditions. Once the vessels are into the protected west basin, the existing 28-foot depth is sufficient for vessel operations. The principal construction item for Plan 1 would be approximately 1.3 million cubic yards of assumed polluted dredged material.

The main navigational advantage of Plan 1 is that the 4-mile long channel through the east basin provides unlimited stopping distance for vessels entering Cleveland Harbor under storm conditions. Thus, vessels entering the

harbor can enter at whatever speed is required to maintain vessel control and still have sufficient room to slow down before approaching their destination dock. For this reason, Plan 1 is also considered adequate for operation of 1,100-foot vessels, if such vessels enter the Great Lakes fleet. The second main advantage of Plan 1 is the low potential for vessel accidents due to the absence of the many obstacles that are present at the west (main) entrance. The disadvantage of Plan 1 is the 1 to 2 hours of extra transit time that would be required to travel through the east basin versus entering through the west (main) entrance.

(2) Cost Estimate for Plan 1 - The detailed cost estimate for Plan 1 is presented in Table E1 of Appendix E. Tables 20 and 21, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 1 is \$5,060,000 on June 1982 price levels (Table 20) and the total investment cost, including interest during construction, is also \$5,060,000 (Table 21). The total annual charges, including additional annual maintenance costs over and above existing annual maintenance costs for Cleveland Harbor, are \$395,900.

(3) Economic Evaluation of Plan 1 - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 1 is presented in Appendix B, "Economic Evaluation." In summary, commercial navigation benefits that would be realized include: (1) benefits that would accrue from the use of 1,000-foot vessels to carry iron ore to transshipment facilities in the Lakefront Harbor in-lieu-of the less efficient and more costly Class V to Class VII vessels presently in use; and (2) benefits that would accrue by providing deeper channel depths that would enable Class V through Class X vessels to enter the Lakefront Harbor loaded to the maximum Great Lakes System's draft of 25.5 feet. In addition, benefits would also be realized for reduced vessel delay costs on the Cuyahoga River due to the Lakefront Harbor deepening. As previously discussed, several Class V vessels which deliver iron ore to docks on the Cuyahoga River now enter the Lakefront Harbor loaded to a static draft of 22.5 feet relative to LWD, unload a portion of their cargo at a Lakefront dock and proceed up river at a 21-foot static draft. If the Lakefront Harbor entrance channel was deepened to 32 feet, these vessels would be able to enter the Lakefront Harbor loaded to a static draft of 25.5 feet relative to LWD, 3 feet deeper than present conditions permit. Since these vessels would be carrying more cargo per trip, the total number of trips required to ship the same annual tonnage would be reduced. A reduction in the total number of annual vessel trips would, in turn, reduce interference between vessels on the Cuyahoga River resulting in reduced vessel delay costs. The accrued benefit for reduced vessel delay costs has been credited to Plan 1. It should be noted, however, that the extra tonnage carried by these vessels would have to be unloaded in the Lakefront Harbor and trucked to the upriver receiving dock. From Table B49, in Appendix B, the annual commercial navigation benefits for Plan 1 total \$17,605,000.

Table 20 - Estimate of Total Project Cost for Alternative Plan No. 1 (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	3,290,000		3,290,000	-	-	3,290,000
2. Mobilization and Demobilization	8,000		8,000	-	-	8,000
Subtotal	3,298,000		3,298,000	-	-	3,298,000
3. Contingencies (25%+)	832,000		832,000	-	-	832,000
Subtotal	4,130,000		4,130,000	-	-	4,130,000
4. Engineering and Design	410,000		410,000	-	-	410,000
5. Supervision and Administration	520,000		520,000	-	-	520,000
Total Project Cost	5,060,000 (1)		5,060,000 (1)	0	0	5,060,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 1. Mitigation will be evaluated in Stage 3, as appropriate.

Table 21 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 1 (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	5,060,000		5,060,000	-	-	5,060,000
Interest During Construction (2)			0	-	-	0
Lands and Damages	0		0	-	-	0
Total Investment, Including Lands	5,060,000		5,060,000	0	0	5,060,000
<u>Annual Charges for the Project</u>						
Interest	385,800		385,800	-	-	385,800
Amortization	10,100		10,100	-	-	10,100
Additional Maintenance	0 (3)		0	-	-	0
Total Annual Charges	395,900		395,900	0	0	395,900

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 1-year construction period.

(3) Since the volume of annual maintenance dredging for Plan 1 is not expected to increase over existing conditions, the additional maintenance cost for this plan is zero.

(NOTE: Due to physical restrictions of some Class V vessels which does not permit vessel loading to a 25.5-foot static draft and/or because not all source harbors have channel depths commensurate with vessels loading to a 25.5-foot static draft, all vessels would not be able to take full advantage of the deeper channel depths provided in Plan 1. This aspect has been factored into the benefits stated above for Plan 1 and for all other plans that involve channel deepening.)

Table 22, following, summarizes the annual benefits, annual charges, net benefits and benefit-to-cost ratio for Plan 1. Net commercial navigation benefits are \$17,209,100 annually and the B/C ratio is 44.5.

Table 22 - Summary of Benefits and Costs for Alternative Plan No. 1 (1)

	: Average	: Average	: Net Average	: Benefit/Cost
	: Annual Benefits:	: Annual Charges:	: Annual Benefits:	: Ratio
	: \$: \$: \$:
Total Project:	17,605,000	395,900	17,209,100	44.5

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assesment of Plan 1 - This plan would provide significant long-term benefits to regional development and would contribute to increased vessel safety and economic stability. Utilization of the harbor by larger vessels would significantly reduce the required number of vessel transits, thereby saving fuel and reducing transportation costs, vessel traffic, and the likelihood of accidents.

The new harbor entrance and deepened channel would require annual maintenance dredging although Plan 1 should produce only relatively minor net impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and annual maintenance dredging may cause temporary inconveniences to commercial navigation, would destroy benthic populations in the area dredged, and would disperse fish from the immediate work area. Repeated maintenance dredging would result in periodic disruption of the benthic community structure at the dredging sites. After each dredging operation, benthic recolonization and fish movement into the area should occur. However, since the volume of maintenance dredging for Plan 1 is not expected to increase over existing practices, the net impacts of Plan 1 would be relatively minor. Studies to date have identified no threatened or endangered species that would be affected by the project.

Dredging would result in temporary increases in water turbidity and suspended solids. Temporary releases of pollutants and/or nutrients associated with the harbor sediments would also be expected. Temporary adverse impacts to water drawn through nearby water supply intakes might also occur. Turbidity caused by dredging would decrease light penetration, causing short-term reductions in phytoplankton productivity. Elevated levels of suspended solids and pollutants may cause temporary adverse fishery impacts. Temporary changes in water color, turbidity, and odor may cause minor aesthetic impacts

during dredging. The extent of water quality effects would be determined by the current, waves, wind action, and background water quality conditions that exist during the actual dredging period.

The location for disposal of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Sediment testing will be performed to determine the pollutional classification of the harbor sediments. If the material is suitable for open lake disposal, it would be placed in a selected site in Lake Erie. If the material is not suitable for placement in the open lake it would be placed in an appropriate confined disposal site (Dike Site 14). Since past sediment testing results indicate that most of the dredged material is polluted, the Buffalo District is presently assuming that most or all of the material would be placed in Diked Disposal Facility Site No. 14, which has sufficient capacity to handle the additional material dredged.

In general, confined dredged material disposal in Site No. 14 would hasten the conversion of aquatic habitat to terrestrial habitat. The impacts associated with construction and operation of Diked Disposal Facility Site No. 14 are discussed in the Final Environmental Impact Statement for that project (U.S. Army Corps of Engineers, 1975).

Dredging activities would have temporary impacts on some recreational activities in the project area. Recreational boating, water skiing, and sport fishing in the Lakefront Harbor may be temporarily disrupted due to the operation of dredging equipment. Temporary water quality impacts may also affect sport fishing and swimming at nearby sites outside the Lakefront Harbor. The operation of dredging equipment would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site.

Changes in the travel routes of commercial vessels in Cleveland Harbor would be associated with this plan (i.e., greater use of the east basin by commercial vessels). However, although commercial vessels would occasionally inconvenience recreational boaters in the east basin, the overall impact should be minor due to the reduced number of commercial vessels that would enter Cleveland Harbor. Also, since the Lakefront Harbor is heavily commercialized, no significant adverse aesthetic impacts would be expected. The general appearance of structures in the Lakefront Harbor would also be unaltered.

No impacts on cultural resources in the Cleveland Harbor area would be expected to result due to implementation of this plan.

(5) Conclusions - Plan 1, exclusively a simple dredging project, offers an economical and environmentally acceptable solution to providing for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor. The plan would also allow Class V to Class X vessels to enter the Lakefront Harbor loaded to the maximum system's draft of 25.5 feet. In addition, the potential for vessel accidents would be reduced due to the absence of the many obstacles that are present at the west (main) entrance. Plan 1 would also accommodate 1,100-foot vessels, if such vessels enter the Great Lakes

fleet. For these reasons, it is concluded that Plan 1 should be carried forward into Stage 3 planning.

b. Alternative Plan No. 2 - "Fair-Weather" West Entrance.

(1) Description of Plan 2 - Plan 2 would provide a "fair-weather" entrance into the Lakefront Harbor for 1,000-foot vessels at the existing west (main) entrance. However, the plan does not include a provision to deepen the existing harbor entrance channels and, therefore, Class V to Class X vessels would continue to enter the Lakefront Harbor light-loaded relative to LWD (i.e., at less than the maximum system's draft of 25.5 feet). The layout and project features for Plan 2 are shown on Plate 7 in Appendix J.

Components of Plan 2 include removing sections of the spur breakwaters at the west (main) entrance to promote 1,000-foot vessel operation during "fair-weather" conditions and breakwater modifications to prevent increased wave activity in the Lakefront Harbor as a result of the spur breakwater removal. Ship navigation tests at WES conducted by experienced vessel masters indicated that, as a minimum, 500 feet of spur breakwaters should be removed to promote safe operation of 1,000-foot vessels during the design, "fair-weather" conditions. Accordingly, 300 feet of the west spur breakwater and 200 feet of the east spur breakwater would be removed. The stone rubble from these breakwater removals would be used to create a fishery habitat development area immediately lakeward of the west breakwater. The existing entrance channel would also be widened in the vicinity of the spur breakwater removals, with the dredged material being placed in Dike Site 14.

Model tests at WES also indicated that, with the spur breakwaters removed, a significant increase in wave activity in the Lakefront Harbor would occur, especially opposite the Cleveland Port Authority's docks east of the Cuyahoga River and at Conrail's iron ore transshipment facility adjacent to the west basin. Therefore, additional breakwater modifications were added to Plan 2 to reduce this increased wave activity back down to existing conditions. These additional breakwater modifications included raising the west arrowhead breakwater from +8 to +14 LWD and adding 300-foot breakwater extensions at the ends of the east and west arrowhead breakwaters. New aids to navigation would be placed on the lakeward ends of these new breakwater extensions. In addition, new 20-foot standard pole lights would also be placed on the ends of the shortened spur breakwaters.

The main advantage of this plan is the savings in vessel transit time of about 1 to 2 hours as compared to the transit time required for an east entrance plan. However, since Plan 2 was formulated as a "fair-weather" plan only, there would be a diseconomy associated with this plan, as 1,000-foot vessels would not be able to enter Cleveland Harbor during stormy weather. Also, because the entrance channels would not be deepened, Class V through Class X vessels would have to enter the harbor light-loaded relative to LWD. In addition, due to the many obstacles present at the west (main) entrance, the potential for vessel accidents would remain high.

(2) Cost Estimate for Plan 2 - The detailed cost estimate for Plan 2 is presented in Table E2 of Appendix E. Tables 23 and 24, following, summarize

the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under the traditional cost allocation method and under the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 2 is \$15,100,000 (Table 23) and the total investment cost, including interest during construction, is \$16,251,400 (Table 24). The total annual charges are \$1,304,000.

(3) Conclusions - Plan 2 was originally formulated in order to develop a low cost means of providing for 1,000-foot vessel operation in the Lakefront Harbor. However, model study tests indicated that by removing the spur breakwaters, a significant increase in wave activity in the Lakefront Harbor would occur. Since local interests, including the local sponsor, would oppose any plan that resulted in increased wave activity in the Lakefront Harbor, additional breakwater modifications were added to Plan 2 to reduce the resultant wave action back down to existing conditions. These breakwater modifications increased the cost of Plan 2 significantly, such that the cost of this plan would be about three times the cost of Plan 1 (\$5,060,000). In addition, since Plan 2 would not provide deeper channel depths and 1,000-foot vessels could only enter Cleveland Harbor under "fair-weather" conditions, the benefits that would be realized from implementation of Plan 2 would be significantly less than those for Plan 1. Thus, it was obvious that Plan 2 would be significantly less economically efficient than Plan 1. For this reason, it was concluded that Plan 2 should be eliminated from further consideration. In addition, since it was obvious that Plan 2 was significantly less economically efficient than Plan 1 and in order to save study funds, a formal economic evaluation and an environmental assessment were not completed for this plan.

c. Alternative Plan 3A - "All-Weather" West Entrance (Modified "L"-Shaped Breakwater).

(1) Description of Plan 3A - Plan 3A would provide an "all-weather" entrance into the Lakefront Harbor for 1,000-foot vessels at the existing west (main) entrance. The plan would also provide deeper channel depths which would allow Class V through Class X vessels to enter Cleveland Harbor loaded to the maximum system's draft of 25.5 feet. The layout and project features for Plan 3A are shown on Plate 8 in Appendix J.

Components of Plan 3A include a new modified "L"-shaped breakwater protected entrance channel and removal of portions of the existing west arrowhead and east and west spur breakwaters. The initial 3,000-foot length of the new entrance channel would provide sufficient distance for a 1,000-foot vessel, entering the harbor at 6 mph (the speed required to maintain adequate vessel control under the design "all-weather" conditions), to slow down to 2 to 3 mph prior to making the turn into the existing arrowhead entrance. To facilitate this turn, 600 feet of the west arrowhead breakwater would be removed. In addition, to facilitate turning into the Lakefront Harbor 300 feet of the west spur breakwater and 200 feet of the east spur breakwater would also be removed. The stone rubble from these breakwater removals would be used to create a fishery habitat development area immediately lakeward of the west breakwater. The width of the new entrance channel would gradually increase

Table 23 - Estimate of Total Project Cost for Alternative Plan No. 2 (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	1,254,000		1,254,000	-	-	1,254,000
2. Spur Breakwater Removal	735,950		735,950	-	-	735,950
3. New Cellular Pierheads (East and West Spur Breakwater)	1,538,180		1,538,180	-	-	1,538,180
4. Raise West Arrowhead Breakwater	2,864,800		2,864,800	-	-	2,864,800
5. Breakwater Extensions	3,606,480		3,606,480	-	-	3,606,480
6. Aids to Navigation	146,000		146,000	-	-	146,000
7. Mobilization and Demobilization	370,000		370,000	-	-	370,000
Subtotal	10,515,410		10,515,410	-	-	10,515,410
8. Contingencies (20%)	2,065,590		2,065,590	-	-	2,065,590
Subtotal	12,581,000		12,581,000	-	-	12,581,000
9. Engineering and Design	1,161,000		1,161,000	-	-	1,161,000
10. Supervision and Administration	1,358,000		1,358,000	-	-	1,358,000
Total Project Cost	15,100,000 (1)		15,100,000 (1)	0	0	15,100,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 2. Mitigation would have been evaluated in Stage 3, if this plan would have been carried forward.

Table 24 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 2 (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	15,100,000		15,100,000	-	-	15,100,000
Interest During Construction (2)	1,151,400		1,151,400	-	-	1,151,400
Lands and Damages	0		0	-	-	0
Total Investment, Including Lands	16,251,400		16,251,400	0	0	16,251,400
<u>Annual Charges for the Project</u>						
Interest	1,239,200		1,239,200	-	-	1,239,200
Amortization	32,300		32,300	-	-	32,300
Additional Maintenance	32,500		32,500	-	-	32,500
Total Annual Charges	1,304,000		1,304,000	0	0	1,304,000

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 2-year construction period.

from 600 feet at the lakeward end of the channel to 1,250 feet at the entrance into the Lakefront Harbor. The entrance channel would also be deepened to 32 feet below LWD. Further, a portion of the east basin would be deepened to 28 feet. This extra depth would allow a 1,000-foot vessel to enter the east basin and back into the west basin, negating the need to turn the vessel prior to departure.

The new entrance channel would be protected by two new breakwater extensions; a 4,000-foot extension on the north and a 1,000-foot extension on the south. The 4,000-foot breakwater extension would limit wave heights in the entrance channel to about 2 to 3 feet for the design condition (i.e., 8-foot incident wave) and would help prevent an increase in wave activity in the Lakefront Harbor for waves from the northwest through northeast. The 1,000-foot breakwater extension to the south would define the new channel limits and would prevent an increase in wave activity in the Lakefront Harbor for waves from the west through northwest. Both breakwater extensions and the new ends of the spur breakwaters would be adequately provided with new aids to navigation.

The main advantage of Plan 3A is the savings in vessel transit time of about 1 to 2 hours as compared to the transit time required for an east entrance plan. However, the potential for vessel accidents would remain high due to the many obstacles that would be present at the west (main) entrance. In addition, the stopping distance provided with this plan, although adequate, does not have the margin of safety inherent with the east entrance plan. Navigation tests at WES also indicated that this entrance may not be totally satisfactory when winds are from a northerly direction. In this instance, the extra force that the wind exerts on the vessel's stern cabin tended to turn the vessel in a counterclockwise direction, which was opposite to the turn they were trying to make. In several test runs, this caused the vessel to strike the north breakwater extension. For this reason, the vessel masters requested that a second "all-weather" west entrance plan be developed. Also, for this reason, it is considered that, although an 1,100-foot vessel could probably use this entrance, it would involve a higher degree of risk than for Plan 1.

(2) Cost Estimate for Plan 3A - The detailed cost estimate for Plan 3A is presented in Table E3 of Appendix E. Tables 25 and 26, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 3A is \$33,200,000 (Table 25) and the total investment cost, including interest during construction, is \$36,997,300 (Table 26). The total annual charges are \$3,160,200.

(3) Economic Evaluation of Plan 3A - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 3A is presented in Appendix B, "Economic Evaluation." In summary, benefits that would accrue from implementation of Plan 3A would be the same as for Plan 1. That is, these benefits include benefits that would

Table 25 - Estimate of Total Project Cost for Alternative Plan No. 3A (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
	\$		\$		\$	
1. Dredging	840,000		840,000	-	-	840,000
2. Spur Breakwater Removal	735,950		735,950	-	-	735,950
3. New Cellular Pierheads (East and West Spur Breakwater)	1,538,180		1,538,180	-	-	1,538,180
4. West Arrowhead Breakwater Removal (1)	1,169,650		1,169,650	-	-	1,169,650
5. Breakwater Extensions	18,775,820		18,775,820	-	-	18,775,820
6. Aids to Navigation	444,000		444,000	-	-	444,000
7. Mobilization and Demobilization	8,000		8,000	-	-	8,000
Subtotal	23,511,600		23,511,600	-	-	23,511,600
8. Contingencies (20%+)	4,688,400		4,688,400	-	-	4,688,400
Subtotal	28,200,000		28,200,000	-	-	28,200,000
9. Engineering and Design	2,300,000		2,300,000	-	-	2,300,000
10. Supervision and Administration	2,700,000		2,700,000	-	-	2,700,000
Total Project Cost	33,200,000 (2)		33,200,000 (2)	0	0	33,200,000 (2)

(1) Includes removal of lighthouse at end of west arrowhead breakwater.

(2) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 3A. Mitigation will be evaluated in Stage 3, as appropriate.

Table 26 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 3A (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	33,200,000		33,200,000	-	-	33,200,000
Interest During Construction (2)	3,797,300		3,797,300	-	-	3,797,300
Lands and Damages	0		0	-	-	0
Total Investment, Including Lands	36,997,300		36,997,300	0	0	36,997,300
<u>Annual Charges for the Project</u>						
Interest	2,821,100		2,821,100	-	-	2,821,100
Amortization	73,600		73,600	-	-	73,600
Additional Maintenance	265,500		265,500	-	-	265,500
Total Annual Charges	3,160,200		3,160,200	0	0	3,160,200

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 3-year construction period.

accrue from operation of 1,000-foot vessels in the Lakefront Harbor and benefits that would be realized by providing adequate entrance channel depths for Class V to Class X vessels, including benefits for reducing vessel delay costs on the Cuyahoga River due to the Lakefront Harbor deepening. As previously stated, these benefits total \$17,605,000 annually. (NOTE: Although Plan 3A would save 1 to 2 hours in vessel transit time when compared to Plan 1, this savings is such a small percentage of the total 5 to 6-day round trip that it did not affect the estimated benefits for Plan 3A.)

Table 27, following, summarizes the annual benefits, annual charges, net benefits and B/C ratio for Plan 3A. Net commercial navigation benefits are \$14,448,800 annually and the B/C ratio is 5.6.

Table 27 - Summary of Benefits and Costs for Alternative Plan No. 3A (1)

	: Average	: Average	: Net Average	: Benefit/Cost
	: Annual Benefits:	: Annual Charges:	: Annual Benefits:	: Ratio
	: \$: \$: \$:
Total Project:	17,605,000	3,160,200	14,448,800	5.6

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 3A - This plan would provide significant long-term benefits to regional development and would contribute to increased vessel safety and economic stability. Use of the harbor by larger vessels would significantly reduce the required number of vessel transits, thereby saving fuel and reducing transportation costs, vessel traffic, and the likelihood of accidents.

The modified harbor entrance and deepened portion of the east basin would continue to require annual maintenance dredging, although the plan should produce relatively minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring in the general vicinity of the harbor entrance. Water quality impacts would also occur although at a somewhat lesser degree, in Cleveland Harbor east of the dredging area.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that at least a portion of the material is polluted and would be placed in Diked Disposal Facility Site No 14, which has sufficient capacity to handle the additional material dredged.

The breakwater removal operations associated with this plan would result in the loss of relatively good quality benthic and fishery habitat along the

sides of about 1,100 feet of presently existing breakwaters. However, placement of the rubble in the fishery habitat development area would greatly enhance the value of benthic and fishery habitat in an 11.5 acre area. The stone rubble would encourage the growth of attached algae, increase the diversity and abundance of benthic macroinvertebrates, and provide valuable cover, spawning sites, and feeding areas for fish populations in the Cleveland Harbor area. The fishery habitat development area associated with this plan would also provide fishery benefits in an area where the existing habitat has been seriously degraded due to commercial and industrial development.

Placement of the breakwater extensions associated with this plan would result in the covering of about 17.8 acres of benthic habitat. The sides of the breakwaters would provide relatively good quality benthic and fishery habitat which would be similar to that currently found along the existing breakwaters at Cleveland Harbor. The operation of machinery for the breakwater removals, construction of the new breakwaters, and construction of the fishery habitat development area would result in short-term increases in water turbidity and would temporarily disperse fish from the work area.

Water quality impacts associated with the operation of construction and dredging equipment may temporarily affect sport fishing and swimming at nearby sites outside the Lakefront Harbor. Recreational boating, water skiing, sport fishing, and commercial navigation may be temporarily disrupted due to the operation of heavy equipment in the Lakefront Harbor. The operation of machinery would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site.

The permanent changes in harbor configuration and vessel traffic associated with this plan are expected to produce only minor visual aesthetic impacts.

Implementation of this plan would require removal of the Cleveland West Pierhead Lighthouse, resulting in the loss of associated cultural resources. The Ohio SHPO has advised the Buffalo District that if the light is involved and adversely affected, it would be necessary to prepare a Preliminary Case Report and request the comments of the Advisory Council on Historic Preservation.

(5) Conclusions - Plan 3A offers an economical and environmentally acceptable solution to providing for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor. The plan would also allow Class V to Class X vessels to enter Cleveland Harbor loaded to the maximum system's draft of 25.5 feet relative to LWD. However, when compared to Plan 1, Plan 3A would not offer the degree of safety that Plan 1 would provide. Also, the average annual net benefits for Plan 3A are significantly less than for Plan 1 (\$14,448,800 for Plan 3A versus \$17,209,100 for Plan 1), indicating that Plan 1 is more economically efficient than Plan 3A. The initial construction cost for Plan 3A (\$33,200,000) is also significantly higher than for Plan 1 (\$5,060,000). Further, Plan 3A may not be totally adequate as an entrance for 1,000-foot vessels when the winds are from a northerly direction. For these reasons, it is concluded that Plan 3A should be eliminated from further consideration.

d. Alternative Plan No. 3B - "All-Weather" West Entrance (1,000-Foot Parallel Breakwater Extensions).

(1) Description of Plan 3B - Plan 3B would provide an "all-weather" entrance into the Lakefront Harbor for 1,000-foot vessels at the existing west (main) entrance and was originally formulated as an alternative west entrance plan when ship navigation tests indicated that Plan 3A may not be totally satisfactory as an "all-weather" entrance. The plan would also provide deeper channel depths which would allow Class V through Class X vessels to enter Cleveland Harbor loaded to the maximum system's draft of 25.5 feet. The layout and project features for Plan 3B are shown on Plate 9 in Appendix J.

Components of Plan 3B include an extended breakwater protected entrance channel and removal of portions of the existing east and west spur breakwaters. The existing west entrance channel would be extended lakeward about 1,000 feet in order to provide adequate stopping distance for 1,000-foot vessels entering the harbor at 6 mph. In addition, to facilitate turning into either the east or west basin, the channel would be widened as it enters the Lakefront Harbor by removing 300 feet of the west spur breakwater and 200 feet of the east spur breakwater. Stone rubble from these breakwater removals would be used to create a fishery habitat development area immediately lakeward of the west breakwater.

The new entrance channel would be deepened to 32 feet below LWD, sufficient to accommodate vessel roll under the design "all-weather" conditions. In addition, since wave action would still enter the Lakefront Harbor, the area of the Lakefront Harbor in the vicinity of the entrance channel would also be deepened to 30 feet. As with Plan 3A, a portion of the east basin would be deepened to 28 feet to accommodate vessels entering the east basin and then backing into the west basin.

The extended entrance channel would be protected by a pair of 1,000-foot long breakwater extensions. These breakwaters would provide protection from wave action as 1,000-foot vessels enter the harbor and slow down prior to turning into either the east or west basin and would prevent an increase in wave action in the Lakefront Harbor as a result of the spur breakwater removals. Both the new breakwater extensions and the new ends of the spur breakwaters would be suitably provided with new aids to navigation.

Ship navigation tests conducted by vessel masters indicated that the navigability of this plan was superior to that of Plan 3A, especially when winds were from a northerly direction. In addition, a 1 to 2 hour savings in vessel transit time would be realized as compared to Plan 1. However, the potential for vessel accidents would remain high due to the many obstacles that are present in the vicinity of the entrance. In addition, the stopping distance provided with this plan, although adequate, does not have the margin of safety inherent with the east entrance plan. For these reasons, it is also considered that, although a 1,100-foot vessel could probably use this entrance, it would involve a higher degree of risk than for Plan 1.

(2) Cost Estimate for Plan 3A - The detailed cost estimate for Plan 3B is presented in Table E4 of Appendix E. Tables 28 and 29, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 3B is \$18,900,000 (Table 28) and the total investment cost, including interest during construction, is \$20,341,100 (Table 29). The total annual charges are \$1,645,200.

(3) Economic Evaluation of Plan 3B. The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 3B is presented in Appendix B, "Economic Evaluation." In summary, benefits for Plan 3B are the same as for Plan 3A, or \$17,605,000 annually.

Table 30, following, summarizes the annual benefits, annual charges, net benefits and B/C ratio for Plan 3B. Net commercial navigation benefits are \$15,959,800 annually and the B/C ratio is 10.7.

Table 30 - Summary of Benefits and Costs for Alternative Plan No. 3B (1)

	: Average	: Average	: Net Average	: Benefit/Cost
	: Annual Benefits:	: Annual Charges:	: Annual Benefits:	: Ratio
	: \$: \$: \$:
Total Project:	17,605,000	1,645,200	15,959,800	10.7

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 3B - This plan would provide significant long-term benefits to regional development and would contribute to increased vessel safety and economic stability. Use of the harbor by larger vessels would significantly reduce the required number of vessel transits, thereby saving fuel and reducing transportation costs, vessel traffic, and the likelihood of accidents.

The modified harbor entrance and deepened portion of the Lakefront Harbor would continue to require annual maintenance dredging, although the plan should produce relatively minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring in the general area between the harbor entrance and the mouth of the Cuyahoga River. Water quality impacts would also occur to a somewhat lesser degree in Cleveland Harbor east of the dredging area.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on

Table 28 - Estimate of Total Project Cost for Alternative Plan No. 3B (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
1. Dredging	2,287,500	2,287,500	-	-	-	2,287,500
2. Spur Breakwater Removal	735,950	735,950	-	-	-	735,950
3. New Cellular Pierheads (East and West Spur Breakwater)	1,538,180	1,538,180	-	-	-	1,538,180
4. Breakwater Extensions	8,433,120	8,433,120	-	-	-	8,433,120
5. Aids to Navigation	188,000	188,000	-	-	-	188,000
6. Mobilization and Demobilization	8,000	8,000	-	-	-	8,000
Subtotal	13,190,750	13,190,750	-	-	-	13,190,750
7. Contingencies (20%+)	2,630,250	2,630,250	-	-	-	2,630,250
Subtotal	15,821,000	15,821,000	-	-	-	15,821,000
8. Engineering and Design	1,425,000	1,425,000	-	-	-	1,425,000
9. Supervision and Administration	1,654,000	1,654,000	-	-	-	1,654,000
Total Project Cost	18,900,000 (1)	18,900,000 (1)	0	0	0	18,900,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 3B. Mitigation will be evaluated in Stage 3, as appropriate.

Table 29 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 3B (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$			\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	18,900,000		18,900,000	-	-	18,900,000
Interest During Construction (2)	1,441,100		1,441,100	-	-	1,441,100
Lands and Damages	0		0	-	-	0
Total Investment, Including Lands	20,341,100		20,341,100	0	0	20,341,100
<u>Annual Charges for the Project</u>						
Interest	1,551,000		1,551,000	-	-	1,551,000
Amortization	40,500		40,500	-	-	40,500
Additional Maintenance	53,700		53,700	-	-	53,700
Total Annual Charges	1,645,200		1,645,200	0	0	1,645,200

(1) 7-5/8 percent interest rate, 50-year life (1 = .07625, amort. = .00199). Does not include costs for mitigation of adverse environmental impacts.

(2) 2-year construction period.

past sediment testing results, the Buffalo District is presently assuming that most of the material is polluted and would be placed in Diked Disposal Facility Site No. 14, which has sufficient capacity to handle the additional dredged material.

The breakwater removal operations associated with this plan would result in the loss of relatively good quality benthic and fishery habitat along the sides of about 500 feet of presently existing breakwaters. However, placement of the stone rubble in the fishery habitat development area would greatly enhance the value of benthic and fishery habitat in a 5.7 acre area. The stone rubble would encourage the growth of attached algae, increase the diversity and abundance of benthic macroinvertebrates, and provide valuable cover, spawning sites, and feeding areas for fish populations in the Cleveland Harbor area. The fishery habitat development area associated with this plan would provide fishery benefits in an area where the existing habitat has been seriously degraded due to commercial and industrial development.

Placement of the breakwater extensions associated with this plan would result in the covering of about 7.1 acres of benthic habitat. The sides of the breakwaters would provide relatively good quality benthic and fishery habitat which would be similar to that currently found along the existing breakwaters at Cleveland Harbor. The operation of machinery for the breakwater removals, construction of the new breakwaters, and construction of the fishery habitat development area would result in short-term increases in water turbidity and would temporarily disperse fish from the work area.

Water quality impacts associated with the operation of construction and dredging equipment may temporarily affect sport fishing and swimming at nearby sites outside the Lakefront Harbor. Recreational boating, water skiing, sport fishing, and commercial navigation may be temporarily disrupted due to the operation of heavy equipment in the Lakefront Harbor. The operation of machinery would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site.

The permanent changes in harbor configuration and vessel traffic associated with this plan are expected to produce only minor visual aesthetic impacts.

Although implementation of this plan would require breakwater construction adjacent to the Cleveland West Pierhead Lighthouse, removal of this lighthouse would not be required. No significant losses of cultural resources are expected to result.

(5) Conclusions - Plan 3B offers an economical and environmentally acceptable solution to providing for safe and efficient operation of 1,000-foot vessels in the Lakefront Harbor. The plan would also allow Class V through Class X vessels to enter Cleveland Harbor loaded to the maximum system's draft of 25.5 feet relative to LWD. However, in terms of vessel safety, Plan 3B is inferior to Plan 1. Also, net average annual benefits for Plan 3B (\$15,959,800) are significantly less than for Plan 1 (\$17,209,100) indicating that Plan 1 is more economically efficient than Plan 3B. Further, the initial construction cost for Plan 3B is over three times the cost for

Plan 1 (\$18,900,000 versus \$5,060,000). For these reasons, it is concluded that plan 3B should be eliminated from further consideration.

e. Alternative Plan No. 4 - Combined "All-Weather" East Entrance and "Fair-Weather" West Entrance.

(1) Description of Plan 4 - Plan 4 combines the features of Plan 1 and Plan 2. That is, Plan 4 includes an "all-weather" entrance at the existing east entrance and a deepened channel through the east basin to the west basin and a "fair-weather" entrance at the existing west (main) entrance. Components of Plan 4 are the same as for Plans 1 and 2, previously discussed. The layout and project features for Plan 4 are shown on Plate 10 in Appendix J.

In developing Plan 4, the objective was to combine the positive features of Plans 1 and 2 into one overall plan of improvement. The "all-weather" east entrance would be used by 1,000-foot vessels during stormy conditions. As previously discussed, the "all-weather" east entrance plan provides the cheapest and safest way to provide for 1,000-foot vessel operation in the Lakefront Harbor. In addition, the deepened channels would allow Class V to Class X vessels to enter Cleveland Harbor loaded to the maximum system's draft of 25.5 feet. The "fair-weather" entrance would be used by 1,000-foot vessels during relatively calm conditions, resulting in a savings of about 1 to 2 hours in vessel transit time, each time the modified west (main) entrance was used. This plan is also considered adequate for 1,100-foot vessel operation.

(2) Cost Estimate for Plan 4 - The detailed cost estimate for Plan 4 is presented in Table E5 of Appendix E. Tables 31 and 32, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 4 is \$19,800,000 (Table 31) and the total investment cost, including interest during construction, is \$21,309,800 (Table 32). The total annual charges are \$1,699,800.

(3) Conclusions - Following completion of the cost estimate for Plan 4, it was obvious that there were not sufficient incremental benefits to incrementally justify adding a "fair-weather" west (main) entrance plan to the basic plan of providing an "all-weather" entrance at the existing east entrance (i.e., the savings in vessel transit time of 1 to 2 hours during calm weather conditions would not result in sufficient added benefits to justify an additional expenditure of about \$15 million). Therefore, since Plan 4 did not have incremental justification, it was considered that this plan should be eliminated from further consideration. In addition, to save study funds, a detailed economic evaluation and environmental assessment were not completed for this plan.

Table 31 - Estimate of Total Project Cost for Alternative Plan No. 4 (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	4,518,000	:	4,518,000	:	-	4,518,000
2. Spur Breakwater Removal	735,950	:	735,950	:	-	735,950
3. New Cellular Pierheads (East and West Spur Breakwater)	1,538,180	:	1,538,180	:	-	1,538,180
4. Raise West Arrowhead Breakwater	2,864,800	:	2,864,800	:	-	2,864,800
5. Breakwater Extensions	3,606,480	:	3,606,480	:	-	3,606,480
6. Aids to Navigation	146,000	:	146,000	:	-	146,000
7. Mobilization and Demobilization	378,000	:	378,000	:	-	378,000
Subtotal	13,787,410	:	13,787,410	:	-	13,787,410
8. Contingencies (20%+)	2,795,590	:	2,795,590	:	-	2,795,590
Subtotal	16,583,000	:	16,583,000	:	-	16,583,000
9. Engineering and Design	1,489,000	:	1,489,000	:	-	1,489,000
10. Supervision and Administration	1,728,000	:	1,728,000	:	-	1,728,000
Total Project Cost	19,800,000 (1)	:	19,800,000 (1)	:	0	19,800,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 4. Mitigation would have been evaluated in Stage 3 if this plan would have been carried forward.

Table 32 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 4 (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	19,800,000		19,800,000	-	-	19,800,000
Interest During Construction (2)	1,509,800		1,509,800	-	-	1,509,800
Lands and Damages	0		0	-	-	0
Total Investment, Including Lands	21,309,800		21,309,800	0	0	21,309,800
<u>Annual Charges for the Project</u>						
Interest	1,624,900		1,624,900	-	-	1,624,900
Amortization	42,400		42,400	-	-	42,400
Additional Maintenance	32,500		32,500	-	-	32,500
Total Annual Charges	1,699,800		1,699,800	0	0	1,699,800

(1) 7-5/8 percent interest rate, 50-year life (1 = .07625, amort. = .00199). Does not include costs for mitigation of adverse environmental impacts.

(2) 2-year construction period.

19. OLD RIVER MODIFICATION PLANS (PLANS 5A AND 5B)

As previously discussed, there is presently an authorized but uncompleted project for improvement of the Old River navigation channel. If implemented, this improvement plan would permit a Class VII vessel (730-foot vessel) to navigate the Old River navigation channel loaded to the maximum system's draft of 25.5 feet. (NOTE: The present dimensions of the Old River navigation channel limit the maximum size vessel to about 649 feet in length. Also, because the channel is maintained at a depth of only 23 feet below LWD, these vessels must travel light-loaded.)

Subsequent to authorization of this Old River improvement plan, several docks were closed which may affect the continued economic feasibility of the authorized plan. These closed docks are the old Erie Ore Dock and the dock serving the Forest City Publishing Complex. Since navigation benefits accruing from waterborne commerce crossing these docks were used, in part, to economically justify the authorized project, the continued economic feasibility of the plan is in question. It was, therefore, deemed appropriate to reevaluate the economic feasibility of this authorized project in-light-of current conditions as part of this Phase I study. The results of this reevaluation follow.

a. Alternative Plan No. 5A - Authorized Old River Improvements (Replace Bridge No. 2).

(1) Description of Plan 5A - Plan 5A would modify the Old River navigation channel for use by vessels up to 730 feet in length (Class VII vessel). The plan would also provide deeper channel depths which would allow Class V to Class VII vessels to load to the maximum system's draft of 25.5 feet. The layout and project features for Plan 5A are shown on Plates 11 and 12 in Appendix J.

Components of Plan 5A include four bank cuts (Cuts No. 12-15), replacing the existing B&O Railroad bridge (Bridge No. 23) and deepening the navigation channel to 28 feet below LWD. Bank Cuts No. 12-15 are required in order to provide adequate channel widths for vessels up to 730 feet long and 75 feet wide. (NOTE: The present channel width limits the maximum size vessel to about 649 feet in length and 68 feet in width.) However, the new channel width would only provide for one-way traffic. Thus, if two vessels approach each other from opposite directions, one vessel would be forced to pull over and wait. Further widening of the channel to permit two-way traffic would not be practical, due to the high added cost of such a plan and the infrequent number of times vessels would approach each other from opposite directions (i.e., the added benefits for two-way traffic would be insufficient to justify the added cost to the project). The new channel banks adjacent to Bank Cuts No. 12-15 would be bulkheaded, as per the previous request of local interest who desire to save as much upland area as possible.

The existing B&O Railroad bridge at the mouth of the Old River (Bridge No. 23) would also be replaced with a new vertical lift bridge spanning the new channel width. Following construction of this new vertical lift bridge and the corresponding approach track modifications, the existing bridge superstructure and west pier foundation would be removed.

The depth of the Old River navigation channel to just upstream of the International Salt Company property and the downstream reach of the Cuyahoga River from its mouth to just upstream of its junction with the Old River would be deepened to 28 feet below LWD. This deepening is required to permit Class V and Class VII vessels to navigate the channel loaded to the maximum system's draft of 25.5 feet. In addition, two private slips (one serving the International Salt Company Dock and one serving the former Erie Ore Dock) would also be deepened by local interests to 28 feet, commensurate with the new depth of the Federal channel. However, due to the channel deepening, several existing bulkheads lining the navigation channel would become unstable and these bulkhead would have to be replaced prior to the proposed channel deepening. (NOTE: The authorized improvement plan includes deepening the Old River navigation channel to 27 feet below LWD. However, recent experience has indicated that the 1-foot allowance for underkeel clearance previously used is not adequate and that a 2-foot allowance for underkeel clearance should be used. This extra allowance for underkeel clearance increased the required depth from 27 feet below LWD to 28 feet.)

During its review of Plan 5A, Ontario Stone Corporation expressed concern that the existing 98 feet of vertical clearance provided by Conrail Bridge No. 1 at the mouth of the Cuyahoga River and the existing Willow Avenue Bridge No. 24 on the Old River may not provide adequate vertical clearance for Class VII vessels. Accordingly, District personnel contacted the Lake Carriers Association to ascertain the required vertical clearance for Class VII vessels. In their response (see Exhibit F-11 in Appendix F), LCA indicated that the existing 98 feet of vertical clearance was sufficient for American-owned Class VII vessels and most Canadian-owned Class VII vessels. Thus, no further consideration was given to this aspect.

(2) Cost Estimate for Plan 5A - The detailed cost estimate for Plan 5A is presented in Table E6 of Appendix E. Tables 33 and 34, following, summarize the estimated project costs and annual charges and provide a breakdown of Federal and non-Federal share of these costs. Cost allocation is presented on traditional cost allocation methods only, since this project received initial construction funding prior to 1 October 1981. From these tabulations, it is seen that the total project cost for Plan 5A is \$66,687,000 (Table 33) and the total investment cost, including interest during construction, is \$76,795,300 (Table 34). The total annual charges are \$6,008,500.

(3) Economic Evaluation for Plan 5A - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 5A is presented in Appendix B "Economic Evaluation." In summary, commercial navigation benefits that would be realized include: (1) benefits that would accrue due to the use of Class VII vessels to export salt from the docks on the Old River in-lieu-of the less efficient and more costly 649-foot vessels presently in use; (2) benefits that would accrue due to the use of Class V vessels, loaded to a static draft of 24 feet as dictated by the source harbor, to carry limestone to the former Erie Ore Dock in-lieu-of the less efficient and more costly 630-foot vessels loaded to a 21-foot static draft presently in use on the Cuyahoga River; and, (3) benefits that would accrue by providing deeper channel depths that would enable Class V to

Table 33 - Estimate of Total Project Cost for Alternative Plan No. 5A (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (1)	
	Project Cost	Federal Share	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
	\$	\$	\$	\$	\$	\$
1. Dredging	3,145,600	3,145,600	-	N/A	-	N/A
2. Clearing and Grubbing	34,000	-	34,000	-	-	-
3. Existing Bulkhead Removal	363,050	363,050	-	-	-	-
4. New Bulkheads/Bulkhead Replacement	28,554,300	-	28,554,300	-	-	-
5. Bridge Demolition and Replacement	14,172,125	(2):13,463,519 (3)	708,606 (3)	-	-	-
6. Mobilization and Demobilization	370,000	135,000	235,000	-	-	-
7. Lands and Damages	403,000	-	403,000	-	-	-
Subtotal	47,042,075	17,107,169	29,934,906	-	-	-
8. Contingencies (20%+)	9,457,925	3,439,831	6,018,094	-	-	-
Subtotal	56,500,000	20,547,000	35,953,000	-	-	-
9. Engineering and Design	4,500,000	1,636,000	2,864,000	-	-	-
10. Supervision and Administration	5,000,000	1,818,000	3,182,000	-	-	-
Subtotal	66,000,000	24,001,000	41,999,000	-	-	-
11. Private Construction Features (4)	687,000	-	687,000	-	-	-
Total Project Cost	66,687,000 (5)	24,001,000 (5)	42,686,000 (5)	-	-	-

(1) Authorized but uncompleted improvements on the Old River were initially funded for construction prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocation.

(2) Includes \$2,125 for clearing and grubbing.

(3) Federal/non-Federal cost allocation is assumed to be 95 percent/5 percent, respectively, for Stage 2 studies. Application of cost-sharing allocation under the provisions of Section 6 of Public Law 647, 79th Congress, as amended, will be applied during Stage 3, as appropriate.

(4) Modifications to private docks required to take full advantage of deeper allowable draft in the Old River navigation channel. Includes contingencies, engineering and design and supervision and administration.

(5) Does not include cost for mitigation of adverse environmental impacts that may be required for Plan 5A. Mitigation will be evaluated in Stage 3, as appropriate.

Table 34 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 5A (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (2)	
	Project Cost	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share	
	\$	\$	\$	\$	\$	
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	66,284,000	24,001,000	42,283,000	N/A	N/A	
Interest During Construction (3)	10,108,300	3,660,100	6,448,200			
Lands and Damages	<u>403,000</u>	<u>0</u>	<u>403,000</u>			
Total Investment, Including Lands	76,795,300	27,661,100	49,134,200			
<u>Annual Charges for the Project</u>						
Interest	5,855,700	2,109,200	3,746,500			
Amortization	152,800	55,000	97,800			
Additional Maintenance	<u>0</u>	<u>0</u>	<u>0</u>			
Total Annual Charges	6,008,500	2,164,200	3,844,300			

- (1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.
- (2) Authorized but uncompleted improvements on the Old River were initially funded for construction prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocation.
- (3) 4-year construction period.

Class VII vessels to load to the maximum system's draft of 25.5 feet relative to LWD. (NOTE: Benefits for Plan 5A have been calculated under the assumption that the channels in the Lakefront Harbor would be deepened to depths commensurate with vessels loading to a 25.5-foot static draft. This assumption appears reasonable, due to the high B/C ratio for Plan 1 (i.e., 44.5).) In addition, Plan 5A would also accrue an advanced replacement benefit for early replacement of the existing bulkheads and Bridge No. 23 which, in effect, extends the useful life of these structures. From Table B49 in Appendix B, these benefits total \$2,405,400, annually.

Table 35, following, summarizes the annual benefits, annual charges, net benefits and benefit/cost ratio for Plan 5A. Net commercial navigation benefits are -\$3,603,100 annually and the B/C ratio is 0.4.

Table 35 - Summary of Benefits and Costs for Alternative Plan No. 5A (1)

	: Average	: Average	: Net Average	: Benefit/Cost
	: Annual Benefits:	: Annual Charges:	: Annual Benefits:	: Ratio
	: \$: \$: \$:
Total Project:	2,405,400	6,008,500	-3,603,100	0.4

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 5A - The increase in vessel size and tonnage per vessel permitted by this plan would reduce the required number of vessel transits, the likelihood of vessel accidents, and the quantity of fuel consumed. The increase in shipping efficiency would also reduce the shipping time and the cost of transportation per unit of cargo shipped on the Old River.

The deepened navigation channel would continue to require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring in the Old and lower Cuyahoga Rivers. Water quality impacts would also occur to a somewhat lesser degree in areas of Cleveland Harbor adjacent to the Cuyahoga River mouth.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Facility Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The disposal of upland material excavated from bank Cuts No. 12, 13, 14, and 15 would also be more extensively evaluated during Stage 3 planning, as

appropriate. Although the use of the excavated material for productive purposes (i.e. road construction, building sites) would be desirable, the removal methods currently under consideration would cause the material to become waterlogged and unfit for use as stable fill. If the material is determined to be unpolluted, it could potentially be deposited at an established open-lake disposal site offshore from Cleveland Harbor. If the material is polluted, it could be placed in Diked Disposal Site No. 14, which has the capacity to handle this additional material.

The operation of heavy machinery for the bank cuts, the bulkhead work, and construction of a new vertical lift bridge with fendering would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Temporary disturbances to benthic communities would also occur. A limited quantity of relatively low value benthic habitat would be permanently destroyed due to placement of one of the bridge piers, supports for the bridge fenders, and portions of the steel sheet pile bulkheads. However, approximately 2.8 acres of similar aquatic habitat would be created from industrial waterfront property due to the bank cuts associated with this plan.

The operation of construction machinery and dredging equipment may cause temporary inconveniences to commercial vessels and small boats passing through the work area. The operation of machinery would also create minor visual impacts and would result in minor increases in noise and exhaust emissions at the work site. Since the area bordering the Old and lower Cuyahoga Rivers is heavily industrialized, the aesthetic impacts associated with this plan would be minor.

No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Based on a reevaluation of the authorized but uncompleted improvements on the Old River navigation channel, it appears that these improvements are no longer economically justified. Factors that contributed to this change include reduced benefits due to the closing of several docks on the Old River and an increase in construction costs due to an increase in the total length of bulkheads that would have to be replaced. (NOTE: During previous studies, it was estimated that about 5,085 linear feet of bulkheads would have to be replaced due to the four bank cuts and the channel deepening. However, based on the reanalysis conducted for this Phase I study, it now appears that about 8,730 linear feet of bulkheads would have to be replaced.) However, as previously discussed, recent discussions with local interests have indicated that Ontario Stone Corporation is in the preliminary discussion stage with a company interested in exporting approximately 2 million tons of coal annually from their dock on the Old River. If this new business materializes, Plan 5A would accrue an additional benefit which preliminary calculations indicate may approach \$2.00 per ton, or \$4 million annually. These additional benefits would be sufficient to increase the B/C ratio for Plan 5A to about 1.1. It is therefore concluded that, although current traffic volume on the Old River is insufficient to economically justify construction of Plan 5A, potential additional traffic may be sufficient to increase the B/C ratio to above 1.0 and thus these authorized

improvements should continue to be kept in the inactive category until such time as a final determination has been made on this new business. If this new business materializes, construction of these improvements would then be pursued under their existing construction authorization. However, if this new business does not materialize, these improvements would then become a candidate for deauthorization. In any event, no further consideration will be given to Plan 5A during the remainder of this Phase I study.

b. Alternative Plan No. 5B - Authorized Old River Improvements (Interchange System).

(1) Description of Plan 5B - Plan 5B is similar to Plan 5A except that in lieu of replacing the existing B&O Railroad bridge, the bridge would be removed and a new connection and interchange system to Conrail trackage would be provided on the east side of the Cuyahoga River. This alternate connection was originally proposed by the B&O Railroad in 1968 as a means of reducing the cost of the authorized Old River improvements. The railroad reiterated their continued interest in this approach by letter dated 24 November 1981 (Exhibit F-12 in Appendix F). The layout and project features for Plan 5B are shown on Plates 11 and 12 in Appendix J.

Components of Plan 5B which were previously discussed for Plan 5A, include bank Cuts No. 12 through 15, removing the existing B&O Railroad Bridge No. 23 and deepening the Cuyahoga River navigation channel from its mouth to just upstream of the Old River and the Old River navigation channel from its mouth to just upstream of the International Salt Company property to 28 feet below LWD. In addition, a new connection with Conrail trackage on the east side of the Cuyahoga River would be provided. This new connection would start at the existing B&O freight office at approximate river mile 2.1 and would proceed in a northerly direction for about 1,200 feet before connecting into Conrail's existing "Big-4 wye." B&O traffic would then reach Whiskey Island via this new connection and Conrail Bridge No. 1. In addition, to maintain the interchange capability between Conrail and the B&O Railroad, a new 5,500-foot long interchange track would be provided on existing Conrail property to the east of the Cuyahoga River since the existing interchange system on Whiskey Island would no longer be operational with the proposed new connection. As with Plan 5A, implementation of Plan 5B would permit vessels up to 730 feet in length to navigate the Old River navigation channel loaded to the maximum system's draft of 25.5 feet.

(2) Cost Estimate for Plan 5B - The detailed cost estimate for Plan 5B is presented in Table E7 of Appendix E. Included in this estimate is the estimated cost of the new connection and interchange system with Conrail provided by the B&O Railroad (see Exhibit F-13 in Appendix F). Tables 36 and 37, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs. Cost allocation is presented on traditional cost allocation methods only, since this project received initial construction funding prior to 1 October 1981. From these tabulations, it is seen that the total project cost for Plan 5B is \$54,087,000 (Table 36) and the total investment cost, including interest during construction, is \$60,167,400 (Table 37). The total annual charges are \$4,707,500.

Table 36 - Estimate of Total Project Cost for Alternative Plan No. 5B (June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (1)	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
1. Dredging	3,145,600		3,145,600	-	N/A	N/A
2. Clearing and Grubbing	34,000		-	34,000		
3. Existing Bulkhead Removal	363,050		363,050	-		
4. New Bulkheads/Bulkhead Replacement	28,554,300		-	28,554,300		
5. Bridge Demolition	870,000		870,000 (2)	(2)		
6. Railroad Interchange System	3,510,000		3,510,000 (2)	(2)		
7. Mobilization and Demobilization	370,000		78,000	292,000		
8. Lands and Damages	925,000		-	925,000		
Subtotal	37,771,950		7,966,650	29,805,300		
9. Contingencies (20%+)	7,528,050		1,587,350	5,940,700		
Subtotal	45,300,000		9,554,000	35,746,000		
10. Engineering and Design	3,900,000		823,000	3,077,000		
11. Supervision and Administration	4,200,000		886,000	3,314,000		
Subtotal	53,400,000		11,263,000	42,137,000		
11. Private Construction Features	687,000 (3)		-	687,000 (3)		
Total Project Cost	54,087,000 (4)		11,263,000 (4)	42,824,000 (4)		

(1) Authorized but uncompleted improvements on the Old River were initially funded for construction prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocation.

(2) Bridge demolition and railroad interchange system are in-lieu-of replacing the B&O Railroad Bridge No. 23 and results in significant savings to the Government. Therefore, the full construction cost of these items are to be borne by the Federal Government. Approval of this course of action was provided by the Office of the Chief of Engineers by letter dated 27 August 1968.

(3) Modifications to private dock slips required to take full advantage of deeper allowable drafts in the Old River navigation channel. Includes contingencies, engineering and design and supervision and administration.

(4) Does not include cost for mitigation of adverse environmental impacts that may be required for Plan 5B. Mitigation will be evaluated in Stage 3, as appropriate.

Table 37 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 5B (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (2)	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	53,162,000		11,263,000	41,899,000	N/A	N/A
Interest During Construction (3)	6,080,400		1,288,200	4,792,200		
Lands and Damages	925,000		0	925,000		
Total Investment, Including Lands	60,167,400		12,551,200	47,616,200		
<u>Annual Charges for the Project</u>						
Interest	4,587,800		957,000	3,630,800		
Amortization	119,700		25,000	94,700		
Additional Maintenance	0		0	0		
Total Annual Charges	4,707,500		982,000	3,725,500		

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) Authorized but uncompleted improvements to the Old River were initially funded prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocation.

(3) 3-year construction period.

(3) Economic Evaluation of Plan 5B - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 5B is presented in Appendix B, "Economic Evaluation." In summary, benefits that would accrue from implementation of Plan 5B would be similar to those for Plan 5A. That is, benefits that would accrue from operation of 730-foot vessels in the Old River, benefits that would be realized by providing adequate channel depths for Class V through Class VII vessels, benefits that would accrue due to limestone receipts being shifted from the Cuyahoga River dock presently in use to the former Erie Ore Dock on the Old River, and advanced replacement benefits for existing bulkheads that would be replaced. However, since Bridge No. 23 would not be replaced under Plan 5B, advanced replacement benefits for this aspect have not been included. From Table B49 in Appendix B, these benefits total \$2,098,500, annually.

Table 38, following, summarizes the annual benefits, annual charges, net benefits and benefit/cost ratio for Plan 5B. Net commercial navigation benefits are -\$2,609,000 annually and the B/C ratio is 0.5.

Table 38 - Summary of Benefits and Costs for Alternative Plan No. 5B (1)

	: Average : Annual Benefits:	: Average : Annual Charges:	: Net Average : Annual Benefits:	: Benefit/Cost : Ratio
	: \$: \$: \$:
Total Project:	2,098,500	4,707,500	-2,609,000	0.5

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 5B - This plan would provide the same impacts that were discussed previously in the environmental assessment for Plan 5A, except that the impacts associated with construction of a new railroad bridge on the Old River would be eliminated. In addition, the Baltimore and Ohio-Conrail connection located north of the Baltimore and Ohio Railroad freight office would be constructed on land now occupied by city streets and perhaps one or more commercial buildings and parking lots. Building and parking lot relocations may be required, necessitating the commitment of an additional upland area and relocation of the business enterprises. The affected city streets would be either blocked off or provisions would be made for railroad crossings. Depending on the option chosen, temporary and/or permanent alterations in local traffic flow at the site could result.

The interchange trackage running approximately parallel to the Lake Erie shoreline would be located in an area which is already occupied by railroad tracks. No significant impacts to area businesses, street traffic and upland habitat are expected. Both the Baltimore and Ohio-Conrail connection and the interchange trackage would produce minor alterations in railroad traffic flow in the project area.

Plan 5B would eliminate any vessel delays caused by operation of a moveable railroad bridge on the Old River. However, increased use of the Conrail Bridge associated with the plan could create a slight increase in vessel delays on the Cuyahoga River. No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Even with the significant cost savings of about \$12.6 million that would be realized by providing a new connection and interchange system between the B&O Railroad and Conrail on the east side of the Cuyahoga River in-lieu-of replacing Bridge No. 23, existing traffic on the Old River is not sufficient to economically justify Plan 5B. However, as with Plan 5A, potential additional coal traffic may materialize which preliminary calculations indicate may provide a potential additional \$4 million annual benefit, increasing the B/C ratio for Plan 5B to about 1.3. It is therefore concluded that these authorized improvements should be kept in the inactive category until such time as a final determination has been made on this new business. If this new business materializes, construction of these improvements would then be pursued under their existing construction authorization. However, if this new business does not materialize, these improvements would then become a candidate for deauthorization. It should also be noted that, due to its lower construction cost, Plan 5B would provide greater average annual net benefits than Plan 5A and would thus be more economically efficient. As with Plan 5A, no further consideration will be given to Plan 5B during the remainder of this Phase I study.

20. CUYAHOGA RIVER MODIFICATION PLANS (PLANS 6 AND 7)

The primary purpose of the Cuyahoga River modification plans developed during Stage 2 planning was to increase the efficiency, and thus decrease the transportation cost, of the Class V vessels (up to 630 feet in length) currently using the navigation channel. In this regard, plans were developed to deepen the navigation channel to partially or totally eliminate the need to traverse the channel light-loaded and to eliminate undue vessel delay at several locations. In addition, several sites identified as delay points were also authorized but uncompleted improvements to the Cuyahoga River navigation channel (the remaining portion of bank Cut No. 4 and replacement of Conrail Bridge No. 14 and related channel widening). Thus, in analyzing whether or not plans to reduce vessel delays at these points would be economically justified, a reevaluation of these authorized improvements in-light-of current conditions was also completed.

Pertinent engineering, economic, environmental and related data for Plans 6 (Deepen Cuyahoga River) and 7 (Reduce River Congestion) follow.

Plan 6 - Deepen Cuyahoga River

a. Alternative Plan No. 6A - Deepen Cuyahoga River to 25.5 Feet.

(1) Description of Plan 6A - Plan 6A would deepen the existing Cuyahoga River navigation channel by 2.5 feet. However, although Class V vessels up to 630 feet in length would be able to load 2.5 feet deeper than present conditions permit, they would still have to transit the river loaded to less

than the maximum system's draft of 25.5 feet. The layout and project features for Plan 6A are shown on Plate 13 in Appendix J.

Components of Plan 6A include deepening the navigation channel to 25.5 feet below LWD and replacing existing bulkheads and bridge fendering systems that would become unstable due to the channel deepening. The dredged material from this proposed deepening would be placed in Dike Site 14, which has sufficient excess capacity over and above its authorized 10-year life.

A depth of 25.5 feet was selected for analysis because it was half-way between the existing 23-foot project depth and the 28-foot depth required for a vessel to transit the river loaded to the maximum system's draft of 25.5 feet. By drawing a curve depicting construction cost versus anticipated benefits for the three different project depths (i.e., 23 feet, 25.5 feet and 28 feet), the optimum plan for river deepening could be identified.

Due to the river deepening, however, a majority of the bulkheads lining the navigation channel would become unstable (approximately 42,400 linear feet). These bulkheads would thus have to be replaced prior to deepening the channel. The cost of these bulkhead replacements, even under traditional cost allocation methods, would be paid for entirely by local interests. In addition, several existing bridge fenders would also become unstable and these bridge fenders would also have to be replaced prior to the channel deepening. Further, the existing Western Union Telephone underground pipes which cross the Cuyahoga River at about river mile 2.8 would have to be lowered because they would be uncovered by the proposed deepening.

(2) Cost Estimate for Plan 6A - The detailed cost estimate for Plan 6A is presented in Table E8 of Appendix E. Tables 39 and 40, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 6A is \$213,000,000 (Table 39) and the total investment cost, including interest during construction, is \$253,435,600 (Table 40). The total annual charges are \$20,165,400.

(3) Economic Evaluation of Plan 6A - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 6A is presented in Appendix B, "Economic Evaluation." In summary, commercial navigation benefits that would be realized include: (1) benefits that would accrue by providing a deeper navigation channel that would allow Class V vessels up to 630 feet in length to load about 2.5 feet deeper than present conditions permit, including benefits that would be realized for reducing vessel delay costs on the Cuyahoga River since the channel deepening would reduce the total number of trips required to carry the same annual tonnage; and (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads. From Table B49 in Appendix B, these benefits total \$8,915,600 annually. (NOTE: Benefits for Plan 6A have been calculated under the assumption that the channels in the Lakefront Harbor would be deepened to depths commensurate with vessels loading to a 25.5-foot static draft. This assumption appears reasonable, due to the high B/C ratio for Plan 1 (i.e., 44.5).)

Table 39 - Estimate of Total Project Cost for Alternative Plan No. 6A (June 1982 Price Levels)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
1. Dredging	6,553,800	6,553,800	-	-	6,553,800
2. Replace Existing Bulkheads	144,604,700	-	144,604,700	-	144,604,700
3. Bridge Fender Replacement	3,271,065	3,271,065	-	-	3,271,065
4. Utility Relocations	18,480	-	18,480	-	18,480
5. Mobilization and Demobilization	370,000	23,135	346,865	-	370,000
6. Lands and Damages	879,000	-	879,000	-	879,000
Subtotal	155,697,045	9,848,000	145,849,045	-	155,697,045
7. Contingencies (20%)	30,802,955	1,970,000	28,832,955	-	30,802,955
Subtotal	186,500,000	11,818,000	174,682,000	-	186,500,000
8. Engineering and Design	13,000,000	827,000	12,173,000	-	13,000,000
9. Supervision and Administration	13,500,000	851,000	12,649,000	-	13,500,000
Total Project Cost	213,000,000 (1)	13,496,000 (1)	199,504,000 (1)	0	213,000,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 6A. Mitigation will be evaluated in Stage 3, as appropriate.

Table 40 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 6A (June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	212,121,000		13,496,000	198,625,000	-	212,121,000
Interest During Construction (2)	40,435,600		2,572,700	37,862,900	-	40,435,600
Lands and Damages	879,000		0	879,000	-	879,000
Total Investment, Including Lands	253,435,600		16,068,700	237,366,900	0	253,435,600
<u>Annual Charges for the Project</u>						
Interest	19,324,400		1,225,200	18,099,200	-	19,324,400
Amortization	504,400		32,000	472,400	-	504,400
Additional Maintenance	336,600		336,600	0	-	336,600
Total Annual Charges	20,165,400		1,593,800	18,571,600	0	20,165,400

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 5-year construction period.

Table 41, following, summarizes the annual benefits, annual charges, net benefits and benefit/cost ratio for Plan 6A. Net commercial navigation benefits are -\$11,249,800 annually, and the B/C ratio is 0.4.

Table 41 - Summary of Benefits and Costs for Alternative Plan No. 6A (1)

	: Average	: Average	: Net Average	: Benefit/Cost
	: Annual Benefits:	: Annual Charges:	: Annual Benefits:	: Ratio
	: \$: \$: \$:
Total Project:	8,915,600	20,165,400	-11,249,800	0.4

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 6A - Although this plan would not allow an increase in vessel size, the increase in tonnage per vessel trip permitted by the plan would reduce the required number of vessel transits, the likelihood of vessel accidents, and the quantity of fuel consumed. The increase in shipping efficiency would reduce both the shipping time and cost of transportation per unit of cargo shipped on the Cuyahoga River.

The deepened Cuyahoga River channel would continue to require annual maintenance dredging, although the plan should not produce major impacts on the long-term annual maintenance costs, the duration of dredging, or the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts in the Cuyahoga River dredging area as were previously described in the environmental assessment for Plan 1, with the greatest impacts occurring in the Cuyahoga River. Water quality impacts would also occur to a somewhat lesser degree in areas of Cleveland Harbor adjacent to the river mouth.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Facility Site No. 14, which has sufficient capacity to accommodate the additional dredged material.

The operation of heavy machinery for bulkhead replacements, bridge fender replacements, and the utility relocation identified on Plate 13 would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Temporary disturbances to benthic communities would also occur. A limited quantity of relatively low value benthic habitat would be permanently destroyed due to the placement of supports for the new bridge fenders and placement of the new steel sheet pile bulkheads and any required backfill.

The operation of construction machinery and dredging equipment may cause temporary inconveniences to commercial vessels and small boats passing through

the work area. The operation of machinery would also create minor visual impacts and would result in minor increases in noise and exhaust emissions at the work site. Since the area bordering the Cuyahoga River is heavily industrialized, the aesthetic impacts associated with the plan would be very minor.

Although work would be performed in the vicinity of the Center Street Bridge, the Detroit-Superior High Level Bridge, the Union Terminal High Level Railroad Bridge, the Columbus Road Bridge, and the Lorain-Carnegie Bridge, these structures would not be modified under this plan. Therefore, no presently known cultural resources would be adversely affected due to plan implementation.

(5) Conclusions - Plan 6A is not economically justified, with a B/C ratio of 0.4 and net average annual commercial navigation benefits of -\$11,249,800. It is therefore concluded that Plan 6A should be eliminated from further consideration.

b. Alternative Plan No. 6B - Deepen Cuyahoga River to 28 Feet.

(1) Description of Plan 6B - Plan 6B is similar to Plan 6A except that the navigation channel would be deepened to 28 feet instead of 25.5 feet. The 28-foot depth is sufficient to allow Class V vessels up to 630 feet in length to load to the maximum system's draft of 25.5 feet. The layout and project features for Plan 6B are shown on Plate 14 in Appendix J.

Components of Plan 6B include deepening the navigation channel to 28 feet below LWD and replacing about 42,400 linear feet of bulkheads and several bridge fendering systems that would become unstable due to the channel deepening. The dredged material from this proposed channel deepening would be placed in Dike Site 14 which has sufficient excess capacity over and above its authorized project life. In addition, five underground utilities which cross the Cuyahoga River would also be relocated (lowered).

(2) Cost Estimate for Plan 6B - The detailed cost estimate for Plan 6B is presented in Table E9 of Appendix E. Tables 42 and 43, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 6B is \$220,000,000 (Table 42) and the total investment cost, including interest during construction, is \$261,770,000 (Table 43). The total annual charges are \$21,154,100.

(3) Economic Evaluation of Plan 6B - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 6B is presented in Appendix B, "Economic Evaluation." In summary, commercial navigation benefits that would be realized include: (1) benefits that would accrue by providing a deeper navigation channel that would allow Class V vessels up to 630 feet in length to load to the maximum system's draft of 25.5 feet; and (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads. From Table B49 in

Table 42 - Estimate of Total Project Cost for Alternative Plan No. 6B
(June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	11,233,200		11,233,200	-	-	11,233,200
2. Replace Existing Bulkheads	144,604,700		-	144,604,700	-	144,604,700
3. Bridge Fender Replacement	3,271,065		3,271,065	-	-	3,271,065
4. Utility Relocations	86,000		-	86,000	-	86,000
5. Mobilization and Demobilization	370,000		33,235	336,765	-	370,000
6. Lands and Damages	879,000		-	879,000	-	879,000
Subtotal	160,443,965		14,537,500	145,906,465	-	160,443,965
7. Contingencies (20 percent +)	32,056,035		2,907,500	29,148,535	-	32,056,035
Subtotal	192,500,000		17,445,000	175,055,000	-	192,500,000
8. Engineering and Design	13,500,000		1,221,000	12,279,000	-	13,500,000
9. Supervision and Administration	14,000,000		1,273,000	12,727,000	-	14,000,000
Total Project Cost	220,000,000 (1)		19,939,000 (1)	200,061,000 (1)	0	220,000,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 3B. Mitigation will be evaluated in Stage 3, as appropriate.

Table 43 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 6B
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
Total Investment for the Project					
Total Project Cost, Excluding Lands	219,121,000	19,939,000	199,182,000	-	219,121,000
Interest During Construction (2)	41,770,000	3,800,900	37,969,100	-	41,770,000
Lands and Damages	879,000	0	879,000	-	879,000
Total Investment, Including Lands	261,770,000	23,739,900	238,030,100	0	261,770,000
Annual Charges for the Project					
Interest	19,960,000	1,810,200	18,149,800	-	19,960,000
Amortization	520,900	47,200	473,700	-	520,900
Additional Maintenance	673,200	673,200	0	-	673,200
Total Annual Charges	21,154,100	2,530,600	18,623,500	0	21,154,100

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 5-Year construction period.

Appendix B, these benefits total \$9,745,100 annually. (NOTE: Benefits for Plan 6B have been calculated under the assumption that the channels in the Lakefront Harbor would be deepened to depths commensurate with vessels loading to a 25.5-foot static draft. This assumption appears reasonable, due to the high B/C ratio for Plan 1 (i.e., 44.5).)

Table 44, following, summarizes the annual benefits, annual charges, net benefits, and benefit/cost ratio for Plan 6B. Net commercial navigation benefits are -\$11,409,000 annually and the B/C ratio is 0.5.

Table 44 - Summary of Benefits and Costs for Alternative Plan No. 6B (1)

	: Average	: Average	: Net Average	:
	: Annual	: Annual	: Annual	: Benefit/Cost
	: Benefits	: Charges	: Benefits	: Ratio
	: \$: \$: \$:
Total Project	: 9,745,100	: 21,154,100	: -11,409,000	: 0.5
	:	:	:	:

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 6B - Although this plan would not allow an increase in vessel size, the increase in tonnage per vessel trip permitted by the plan would reduce the number of required vessel transits, the likelihood of vessel accidents, and the quantity of fuel consumed. The increase in shipping efficiency would reduce both the shipping time and cost of transportation per unit of cargo shipped on the Cuyahoga River.

The deepened Cuyahoga River channel would continue to require annual maintenance dredging, although the plan should not produce major impacts on the long-term annual maintenance costs, the duration of dredging, or the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts in the Cuyahoga River dredging area as were previously described in the environmental assessment for Plan 1, with the greatest impacts occurring in the Cuyahoga River. Water quality impacts would also occur to a somewhat lesser degree in areas of Cleveland Harbor adjacent to the river mouth.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Facility Site No. 14, which has sufficient capacity to accommodate the additional dredged material.

The operation of heavy machinery for bulkhead replacements, bridge fender replacements and the five (5) utility relocations identified on Plate 14 would produce short-term increases in water turbidity and would temporarily

disperse fish from the work area. Temporary disturbances to benthic communities would also occur. A limited quantity of relatively low value benthic habitat would be permanently destroyed due to the placement of supports for the new bridge fenders and placement of the new steel sheet pile bulkheads and any required backfill.

The operation of construction machinery and dredging equipment may cause temporary inconveniences to commercial vessels and small boats passing through the work area. The operation of machinery would also create minor visual impacts and would result in minor increases in noise and exhaust emissions at the work site. Since the area bordering the lower Cuyahoga River is heavily industrialized, the aesthetic impacts associated with the plan would be very minor.

Although work would be performed in the vicinity of the Center Street Bridge, the Detroit-Superior High Level Bridge, the Union Terminal High Level Railroad Bridge, the Columbus Road Bridge, and the Lorain-Carnegie Bridge, these structures would not be modified under this plan. Therefore, no presently known cultural resources would be adversely affected due to plan implementation.

(5) Conclusions - Plan 6B is not economically justified, with a B/C ratio of 0.5 and net average annual commercial navigation benefits of -\$11,409,000. It is, therefore, concluded that Plan 6B should be eliminated from further consideration.

Plan 7 - Reduce River Congestion (1)

c. Alternative Plan 7B - Reduce River Congestion (Site 2).

(1) Description of Plan 7B - Plan 7B, an authorized but uncompleted project on the Cuyahoga River navigation channel, would eliminate undue vessel delay at Site 2 (river mile 1.0), identified by shipping interests as causing, on average, an additional 20 minutes in transit time for each trip upriver or downriver. The plan would not, however, eliminate the 90-minute delay vessels experience when ships are unloading at the Cereal Food Processors, Inc., dock since elimination of this delay would require relocation of the adjacent mill or relocation of their unloading dock, both of which the mill owner opposes. The layout and project features for Plan 7B are shown on Plates 15 and 16 in Appendix J.

Components of Plan 7B include relocating the Cereal Food mill's ship unloading building, completing the remaining portion of bank Cut No. 4, and bulkheading the new bank cut. Completion of bank Cut No. 4 would increase the width of the navigation channel opposite Cereal Food's mill from the present 100-foot width to about 150 feet. This 150-foot width is considered adequate to eliminate the vessel delay at this site when vessels are not

(1) As previously discussed in Section III, Plan 7A, formulated to reduce vessel delays at Conrail Bridge No. 1, was eliminated from further consideration during the initial iteration due to its lack of economic feasibility.

docked at the mill. It would not, however, provide an adequate channel width to facilitate vessel passage when a ship is docked.

New bulkheading is required opposite the mill to save as much upland area as possible, especially since cutting the bank back on a stable slope would require relocation of a significant portion of the mill. The existing bulkheads adjacent to Booth Fisheries would also have to be replaced, since these bulkheads would become unstable once the navigation channel was moved closer to them.

(NOTE: Bank Cut No. 4, as originally authorized, includes increasing the width of the navigation channel opposite Cereal Food's mill to about 200 feet. However, this would require the relocation of a significant portion of the mill. Since a 150-foot channel width, which would not require the relocation of the mill, is considered adequate for one-way traffic, the original authorized width of 200 feet was reduced to 150 feet during this Stage 2 study.)

(2) Cost Estimate for Plan 7B - The detailed cost estimate for Plan 7B is presented in Table E10 of Appendix E. Tables 45 and 46, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs. Cost allocation is presented on traditional cost allocation methods only, since this project received initial construction funding prior to 1 October 1981. From these tabulations, it is seen that the total project cost for Plan 7B is \$3,670,000 (Table 45) and the total investment cost, including interest during construction, is also \$3,670,00 (Table 46). The total annual charges are \$287,100.

(3) Economic Evaluation of Plan 7B - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 7B is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include: (1) benefits that would accrue due to the elimination of the 20-minute delay at this site; and (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads. From Table B49 in Appendix B, these benefits total \$501,200 annually.

Table 47, following, summarizes the annual benefits, annual charges, net benefits and benefit/cost ratio for Plan 7B. Net commercial navigation benefits are \$214,000 annually and the B/C ratio is 1.8.

Table 45 - Estimate of Total Project Cost for Alternative Plan No. 7B
(June 1982 Price Levels)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation (1)	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
1. Dredging	79,200	79,200		N/A	N/A
2. Demolition of Structures	30,000	-	30,000		
3. Clearing and Grubbing	1,594	-	1,594		
4. Existing Bulkhead Removal	72,000	72,000			
5. New Bulkheads/Bulkhead Replacement	1,995,675	-	1,995,675		
6. Mobilization and Demobilization	130,000	8,800	121,200		
7. Lands and Damages	70,000	-	70,000		
Subtotal	2,378,469	160,000	2,218,469		
8. Contingencies (25 percent +)	596,531	40,000	556,531		
Subtotal	2,975,000	200,000	2,775,000		
9. Engineering and Design	312,000	21,000	291,000		
10. Supervision and Administration	383,000	26,000	357,000		
Total Project Cost	3,670,000 (2)	247,000 (2)	3,423,000 (2)		

(1) Cut No. 4 was initially funded for construction prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocations.

(2) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7B. Mitigation will be evaluated in Stage 3, as appropriate.

Table 46 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7B
(June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (2)	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
			\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	3,600,000		247,000	3,353,000	N/A	N/A
Interest During Construction (3)	0		0	0		
Lands and Damages	70,000		0	70,000		
Total Investment, Including Lands	3,670,000		247,000	3,423,000		
<u>Annual Charges for the Project</u>						
Interest	279,800		18,800	261,000		
Amortization	7,300		500	6,800		
Additional Maintenance	0		0	0		
Total Annual Charges	287,100		19,300	267,800		

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) Cut No. 4 was initially funded for construction prior to 1 October 1981 and, as such, cost sharing is based on traditional cost allocation.

(3) 1-year construction period.

Table 47 - Summary of Benefits and Costs for
Alternative Plan No. 7B (1)

	Average	Average	Net Average	
	Annual	Annual	Annual	Benefit/Cost
	Benefits	Charges	Benefits	Ratio
	\$	\$	\$	
Total Project	501,200	287,100	214,100	1.8

(1) Based on June 1982 price levels, 7-5/8 percent interest rate, and 50-year economic life.

(4) Environmental Features/Assessment of Plan 7B - The decrease in delay time under this plan would reduce the quantity of fuel consumed, the shipping time, and the cost of transportation per unit of cargo shipped through the site. The increase in channel width would also contribute to vessel safety on the Cuyahoga River.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River. Although maintenance dredging would cause periodic disruptions to the benthic community structure, an additional 0.2-acre of aquatic habitat would be created due to the bank cut associated with this plan. Bulkhead work adjacent to the existing bulkhead would result in the permanent loss of a limited quantity of relatively low value benthic habitat.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The disposal of upland material from bank Cut No. 4 would also be more extensively evaluated during Stage 3 planning, as appropriate. The removal methods currently under consideration would cause the excavated material to become waterlogged and unsuitable for use as stable fill. Depending on the pollutional classification of the material, it could either be deposited at an established open lake disposal site or placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material.

The operation of heavy machinery for the bank cut and bulkhead work would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The operation of machinery may cause temporary

inconveniences to commercial vessels and small boats passing through the work area.

Upland excavation for bank Cut No. 4 would result in the loss of a total of 0.2-acre of upland property bordering the Cuyahoga River. Relocation of the existing ship unloading building would require the permanent commitment of an additional unknown quantity of waterfront property to insure the continued operation of the existing facility owned by Cereal Food Processors, Inc. Impacts associated with construction of the new building are unknown since a new location has not been designated.

The operation of machinery for the building demolition, dredging, bank cut, and bulkhead work would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impact associated with this plan would be minor.

Although work would be performed in the vicinity of the Center Street Bridge and the Detroit-Superior High Level Bridge, these structures would not be modified under this plan. Therefore, no presently known cultural resources would be adversely affected due to plan implementation.

(5) Conclusions - Plan 7B, an authorized but uncompleted project on the Cuyahoga River navigation channel, is economically justified with a B/C ratio of 1.8 and net average annual benefits of \$214,100. However, local interests, who are responsible for a significant portion of the cost of this plan, have stated that they wish to keep this project in its present inactive status until final Federal legislation is passed on new cost-sharing methods for commercial navigation projects (see Exhibit G-5 in Appendix G). Local interests have also stated that the Cereal Food mill is presently in a state of disrepair and may be closed down in the future. If this mill was closed, it would significantly lower the non-Federal cost of this project since the ship unloading building would not have to be relocated and there would be no need to bulkhead the portion of bank Cut No. 4 opposite their property. It is, therefore, concluded that this authorized but uncompleted project should remain in its present inactive status until final Federal legislation is passed on cost-sharing for commercial navigation projects and the ultimate disposition of the Cereal Food's mill is known. (NOTE: Cereal Food Processors, Inc. disputes the position that their mill is in a state of disrepair, with the exception of their ship unloading building. They have also stated that they have no plans to close their milling facility. However, this has not changed the position of local interests to keep this authorized project in the inactive category for the present time.)

d. Alternative Plan 7C - Reduce River Congestion (Site 3).

(1) Description of Plan 7C - Plan 7C would eliminate undue vessel delay at Site 3 (river mile 1.5) identified by shipping interests as causing, on average, an additional 10 minutes in transit time for each trip upriver or downriver. The plan would also eliminate the potential for vessel accidents at this site due to the increase in channel width. (NOTE: As shown on Table 18, over the 10-year period 1972-1981, four vessel accidents have occurred at

this site with damages totalling about \$52,000.) The layout and project features for Plan 7C are shown on Plates 15 and 16 in Appendix J.

Components of Plan 7C include relocating an existing trailer and storage bin, new bank Cut No. 16 and replacing the Cleveland Union Terminal Bridge and Columbus Road Bridge with new bridges spanning the widened channel. Bank Cut No. 16 would increase the width of the navigation channel at this site from its present 190-foot width to about 310 feet. This 310-foot width is considered adequate to eliminate the 10-minute vessel delay at this site. It would not, however, eliminate the 90-minute delay that occurs when two vessels approach this site from opposite directions. As discussed in the economic evaluation section for Plan 7C, eliminating this 90-minute delay would not be economically feasible. In addition, to save as much upland area as possible and to avoid additional building relocations, the landward side of bank Cut No. 16 would be bulkheaded.

(2) Cost Estimate for Plan 7C - The detailed cost estimate for Plan 7C is presented in Table E11 of Appendix E. Tables 48 and 49, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 7C is \$42,500,000 (Table 48) and the total investment cost, including interest during construction, is \$47,338,200 (Table 49). The total annual charges are \$3,703,700.

(3) Economic Evaluation of Plan 7C - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 7C is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include: (1) benefits that would accrue due to the elimination of the 10-minute delay at this site; (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads, the Cleveland Union Terminal Bridge, and the Columbus Road Bridge; and (3) vessel accidents avoided. From Table B49 in Appendix B, these benefits total \$1,251,700 annually.

Table 50, following, summarizes the annual benefits, annual charges, net benefits and benefit/cost ratio for Plan 7C. Net commercial navigation benefits are -\$2,452,000 annually and the B/C ratio is 0.3.

As previously stated, in addition to the 10-minute delay encountered when vessels transit this site, an additional delay of 90 minutes is incurred when two vessels approach the site from opposite directions. However, eliminating this additional 90-minute delay would only provide an additional \$94,000 in average annual benefits. This additional benefit is not sufficient to economically justify Plan 7C as currently formulated (B/C ratio of 0.4) without considering the extra cost that would be incurred to provide a channel width sufficient for two-way traffic. Therefore, no further consideration was given to eliminating this additional 90-minute delay.

Table 48 - Estimate of Total Project Cost for Alternative Plan No. 7C
(June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	908,160		908,160	-	-	908,160
2. Clearing and Grubbing	10,625		-	10,625	-	10,625
3. Existing Bulkhead Removal	439,450		439,450	-	-	439,450
4. Bridge Demolition and Replacement	22,400,000		21,280,000 (2)	1,120,000 (2)	-	22,400,000
5. New Bulkheads	6,117,310		-	6,117,310	-	6,117,310
6. Mobilization and Demobilization	130,000		98,000	32,000	-	130,000
7. Lands and Damages	199,000		-	199,000	-	199,000
Subtotal	30,204,545		22,725,610	7,478,935	-	30,204,545
8. Contingencies (20 percent +)	6,095,455		4,545,390	1,550,065	-	6,095,455
Subtotal	36,300,000		27,271,000	9,029,000	-	36,300,000
9. Engineering and Design	2,900,000		2,182,000	718,000	-	2,900,000
10. Supervision and Administration	3,300,000		2,482,000	818,000	-	3,300,000
Total Project Cost	42,500,000 (1)		31,935,000 (1)	10,565,000 (1)	0	42,500,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7C. Mitigation will be evaluated in Stage 3, as appropriate.

(2) Federal/non-Federal cost allocation is assumed to be 95 percent/5 percent, respectively, for Stage 2 studies. Application of cost-sharing allocation under the provisions of Section 6 of Public Law 647, 79th Congress, as amended, will be applied during Stage 3, as appropriate.

Table 49 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7C
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
<u>Total Investment for the Project</u>					
Total Project Cost, Excluding Lands	42,301,000	31,935,000	10,366,000	-	42,301,000
Interest During Construction (2)	4,838,200	3,652,600	1,185,600	-	4,838,200
Lands and Damages	199,000	0	199,000	-	199,000
Total Investment, Including Lands	47,338,200	35,587,600	11,750,600	0	47,338,200
<u>Annual Charges for the Project</u>					
Interest	3,609,500	2,713,500	896,000	-	3,609,500
Amortization	94,200	70,800	23,400	-	94,200
Additional Maintenance	0	0	0	-	0
Total Annual Charges	3,703,700	2,784,300	919,400	0	3,703,700

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 3-Year construction period.

Table 50 - Summary of Benefits and Costs for Alternative Plan No. 7C (1)

	: Average	:	Average	:	Net Average	:	
	: Annual	:	Annual	:	Annual	:	Benefit/Cost
	: Benefits	:	Charges	:	Benefits	:	Ratio
	: \$:	\$:	\$:	\$
	:	:	:	:	:	:	:
Total Project	: 1,251,700	:	3,703,700	:	- 2,452,000	:	0.3
	:	:	:	:	:	:	:

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 7 C - The decrease in delay time under this plan would reduce the quantity of fuel consumed, the shipping time, and the cost of transportation per unit of cargo shipped through the site. The increase in channel width would also contribute to vessel safety on the Cuyahoga River.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River. Although maintenance dredging would cause periodic disruptions to the benthic community structure, an additional 2.7 acres of aquatic habitat would be created due to the bank cut associated with this plan.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The disposal of upland material from bank Cut No. 16 would also be more extensively evaluated during Stage 3 planning, as appropriate. The removal methods currently under consideration would cause the excavated material to become waterlogged and unsuitable for use as stable fill. Depending on the pollutional classification of the material, it could either be deposited at an established open-lake disposal site or placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material.

The operation of heavy machinery for the bank cut and the installation of new bulkheads would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The operation of machinery may cause temporary inconveniences to commercial vessels and small boats passing through the work area.

Upland excavation for bank Cut No. 16 would result in the loss of 2.7 acres of waterfront property consisting primarily of private roadways, parking space, and vacant land containing some scattered patches of upland grasses and shrubs. Relocation of the trailer and storage bin would require the commitment of an additional minor amount of upland property.

The operation of machinery for the bridge replacements, bank cut, dredging, and bulkhead work would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impacts associated with this plan would be minor.

Both the Cleveland Union Terminal High Level Railroad Bridge and the Columbus Road Bridge, which are considered important cultural resources, would be replaced under this plan. If this plan were to be considered further for implementation, additional cultural resources coordination would be conducted with the Ohio SHPO, the National Park Service, and the Advisory Council on Historic Preservation.

(5) Conclusions - Plan 7C is not economically justified, with a B/C ratio of 0.3 and net average annual commercial navigation benefits of -\$2,452,000. It is, therefore, concluded that Plan 7C should be eliminated from further consideration.

e. Alternative Plan 7D - Reduce River Congestion (Site 4).

(1) Description of Plan 7D - Plan 7D would eliminate undue vessel delay at Site 4 (river mile 3.0) identified by shipping interests as causing, on average, an additional 10 minutes in transit time for each trip upriver or downriver. The plan would also eliminate the potential for vessel accidents at this site due to the increase in channel width. (NOTE: As shown on Table 18, over the 10-year period 1972-1981, three vessel accidents have occurred at this site with damages totalling about \$46,000. However, the proposed plan would not eliminate the possibility of the bridge closing on a vessel and benefits for eliminating this type of accident have not been credited to the project.) The layout and project features for Plan 7D are shown on Plates 15 and 17 in Appendix J.

Components of Plan 7D include relocating an existing rail line and utility, new bank Cuts No. 17 and 18, and replacing the Norfolk and Western Railroad Bridge with a new bridge spanning the widened channel. Bank Cuts No. 17 and 18 would increase the width of the navigation channel at this site from its present 200-foot width to about 350 feet. This 350-foot width is considered adequate to eliminate the 10-minute vessel delay at this site. It would not, however, eliminate the 90-minute delay that occurs when two vessels approach this site from opposite directions. As discussed in the economic evaluation section for Plan 7D, eliminating this 90-minute delay would not be economically feasible. In addition, to save as much upland area as possible and to prevent undermining the pier supports for the Inner Belt Freeway Bridge, the landward side of bank Cuts No. 17 and 18 would be bulkheaded.

Table 51 - Estimate of Total Project Cost for Alternative Plan No. 7D
(June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
1. Dredging	996,600		996,600	-	-	996,600
2. Clearing and Grubbing	17,000		-	17,000	-	17,000
3. Existing Bulkhead Removal	864,000		864,000	-	-	864,000
4. Bridge Demolition and Replacement	16,600,000		15,770,000 (2)	830,000 (2)	-	16,600,000
5. New Bulkheads	9,118,970		-	9,118,970	-	9,118,970
6. Utility and Railroad Relocations	46,480		-	46,480	-	46,480
7. Mobilization and Demobilization	130,000		82,400	47,600	-	130,000
8. Lands and Damages	298,000		-	298,000	-	298,000
Subtotal	28,071,050		17,713,000	10,358,050	-	28,071,050
9. Contingencies (20 percent +)	5,628,950		3,543,000	2,085,950	-	5,628,950
Subtotal	33,700,000		21,256,000	12,444,000	-	33,700,000
10. Engineering and Design	2,700,000		1,700,000	1,000,000	-	2,700,000
11. Supervision and Administration	3,100,000		1,956,000	1,144,000	-	3,100,000
Total Project Cost	39,500,000 (1)		24,912,000 (1)	14,588,000 (1)	0	39,500,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7D. Mitigation will be evaluated in Stage 3, as appropriate.

(2) Federal/non-Federal cost allocation is assumed to be 95 percent/5 percent, respectively, for Stage 2 studies. Application of cost-sharing allocation under the provisions of Section 6 of Public Law 647, 79th Congress, as amended, will be applied during Stage 3, as appropriate.

Table 52 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7D
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
<u>Total Investment for the Project</u>					
Total Project Cost, Excluding Lands	39,202,000	24,912,000	14,290,000	-	39,202,000
Interest During Construction (2)	4,483,700	2,849,300	1,634,400	-	4,483,700
Lands and Damages	298,000	0	298,000	-	298,000
Total Investment, Including Lands	43,983,700	27,761,300	16,222,400	0	43,983,700
<u>Annual Charges for the Project</u>					
Interest	3,353,800	2,116,800	1,237,000	-	3,353,800
Amortization	87,500	55,200	32,300	-	87,500
Additional Maintenance	0	0	0	-	0
Total Annual Charges	3,441,300	2,172,000	1,269,300	0	3,441,300

(1) 7-5/8 percent interest rate, 50-year life (1 = .07625, amort. = .00199). Does not include costs for mitigation of adverse environmental impacts.

(2) 3-Year construction period.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River. Although maintenance dredging would cause periodic disruptions to the benthic community structure, an additional 4.3 acres of aquatic habitat would be created due to the two bank cuts associated with this plan.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The disposal of upland material from bank Cuts No. 17 and 18 would also be more extensively evaluated during Stage 3 planning, as appropriate. The removal methods currently under consideration would cause the excavated material to become waterlogged and unsuitable for use as stable fill. Depending on the pollutional classification of the material, it could either be deposited at an established open lake disposal site or placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material.

The operation of heavy machinery for the utility relocation, bank cuts, and installation of new bulkheads would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The operation of machinery may cause temporary inconveniences to commercial vessels and small boats passing through the work area.

Upland excavation for bank Cut No. 17 would result in the loss of 3.7 acres of waterfront property consisting primarily of bulk storage area with a single set of railroad tracks and scattered patches of upland grasses along the river bank. Relocation of the approximately 850 feet of railroad tracks would require the permanent commitment of an additional quantity of upland property.

Upland excavation for bank Cut No. 18 would result in the loss of 0.6-acre of property containing some large trees, shrubs, and nonwoody vegetation. Due to the highly commercialized nature of the area and the limited quantity of low value habitat to be affected, negligible impacts to wildlife are expected.

The operation of machinery for the bank excavations, bridge replacement, railroad track relocation, utility relocation, bulkhead work, and dredging would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impacts associated with this plan would be minor.

No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Plan 7D is not economically justified, with a B/C ratio of 0.2 and net average annual commercial navigation benefits of -\$2,732,400. It is, therefore, concluded that Plan 7D should be eliminated from further consideration.

f. Alternative Plan 7E - Reduce River Congestion (Site 5).

(1) Description of Plan 7E - Plan 7E would eliminate undue vessel delay at Site No. 5 (river mile 3.6) identified by shipping interests as causing, on average, an additional 10 minutes in transit time for each trip upriver or downriver. The layout and project features for Plan 7E are shown on Plates 15 and 17 in Appendix J.

Components of Plan 7E include relocating an existing building, and new bank Cut No. 19. Bank Cut No. 19 would increase the width of the navigation channel at this site from its present 160-foot width to about 300 feet. This 300-foot width is considered adequate to eliminate the 10-minute vessel delay at this site. It would not, however, eliminate the 90-minute delay that occurs when two vessels approach this site from opposite directions. As discussed in the economic evaluation section for Plan 7E, eliminating this 90-minute delay would not be economically feasible. In addition, to save as much upland area as possible and to avoid additional relocations, the landward side of bank Cut No. 19 would be bulkheaded.

(2) Cost Estimate for Plan 7E - The detailed cost estimate for Plan 7E is presented in Table E13 of Appendix E. Tables 54 and 55, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 7E is \$8,860,000 (Table 54) and the total investment cost, including interest during construction, is \$9,490,700 (Table 55). The total annual charges are \$742,600.

(3) Economic Evaluation of Plan 7E - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 7E is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include: (1) benefits that would accrue due to the elimination of the 10-minute delay at this site; and (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads. From Table B49 in Appendix B, these benefits total \$436,800 annually.

Table 56, following, summarizes the annual benefits, annual charges, net benefits, and B/C ratio for Plan 7E. Net commercial navigation benefits are -\$305,800 annually and the B/C ratio is 0.6.

As previously stated, in addition to the 10-minute delay encountered when vessels transit this site, an additional delay of 90 minutes is incurred when

Table 54 - Estimate of Total Project Cost for Alternative Plan No. 7E
(June 1982 Price Levels)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
1. Dredging	702,900	702,900	-	-	702,900
2. Clearing and Grubbing	9,350	-	9,350	-	9,350
3. Demolition of Structures	65,000	-	65,000	-	65,000
4. Existing Bulkhead Removal	448,200	448,200	-	-	448,200
5. New Bulkheads	3,939,990	-	3,939,990	-	3,939,990
6. Mobilization and Demobilization	130,000	26,000	104,000	-	130,000
7. Lands and Damages	588,000	-	588,000	-	588,000
Subtotal	5,883,440	1,177,100	4,706,340	-	5,883,440
8. Contingencies (25 percent \pm)	1,471,560	294,900	1,176,660	-	1,471,560
Subtotal	7,355,000	1,472,000	5,883,000	-	7,355,000
9. Engineering and Design	684,000	137,000	547,000	-	684,000
10. Supervision and Administration	821,000	165,000	656,000	-	821,000
Total Project Cost	8,860,000 (1)	1,774,000 (1)	7,086,000 (1)	0	8,860,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7E. Mitigation will be evaluated in Stage 3, as appropriate.

AD-A127 215 STAGE 2 REPORT FOR REFORMULATION PHASE I GENERAL DESIGN
MEMORANDUM CLEVEL. (U) CORPS OF ENGINEERS BUFFALO NY
BUFFALO DISTRICT F J HENRY ET AL. FEB 83

STAGE 2 REPORT FOR REFORMULATION PHASE I GENERAL DESIGN
MEMORANDUM CLEVEL. (U) CORPS OF ENGINEERS BUFFALO NY
BUFFALO DISTRICT F J HENRY ET AL. FEB 83

313

UNCLASSIFIED

F/G 13/10

NL

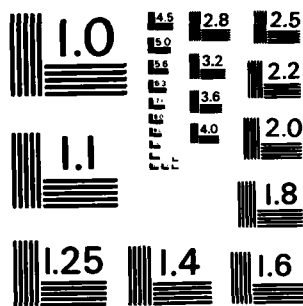
END

DATE _____

FILMEC

58

DTM



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 55 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7E
(June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	8,272,000		1,774,000	6,498,000	-	8,272,000
Interest During Construction (2)	630,700		135,200	495,500	-	630,700
Lands and Damages	588,000		0	588,000	-	588,000
Total Investment, Including Lands	9,490,700		1,909,200	7,581,500	0	9,490,700
<u>Annual Charges for the Project</u>						
Interest	723,700		145,600	578,100	-	723,700
Amortization	18,900		3,800	15,100	-	18,900
Additional Maintenance	0		0	0	-	0
Total Annual Charges	742,600		149,400	593,200	0	742,600

(1) 7-5/8 percent interest rate, 50-year life (i = .07625, amort. = .00199). Does not include costs for mitigation of adverse environmental impacts.

(2) 2-Year construction period.

two vessels approach the site from opposite directions. However, eliminating this additional 90-minute delay would only provide an additional \$7,000 in average annual benefits. This additional benefit is not sufficient to economically justify Plan 7E as currently formulated (B/C ratio of 0.6) without considering the extra cost that would be incurred to provide a channel width sufficient for two-way traffic. Therefore, no further consideration was given to eliminating this additional 90-minute delay.

Table 56 - Summary of Benefits and Costs for Alternative Plan No. 7E (1)

	: Average	: Average	: Net Average	:
	: Annual	: Annual	: Annual	: Benefit/Cost
	: Benefits	: Charges	: Benefits	: Ratio
	: \$: \$: \$:
Total Project	: 436,800	: 742,600	: -305,800	: 0.6

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 7E - The decrease in delay time under this plan would reduce the quantity of fuel consumed, the shipping time, and the cost of transportation per unit of cargo shipped through the site. The increase in channel width would also contribute to vessel safety on the Cuyahoga River.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River. Although maintenance dredging would cause periodic disruptions to the benthic community structure, an additional 2.6 acres of aquatic habitat would be created due to the bank cut associated with this plan.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The disposal of upland material from bank Cut No. 19 would also be more extensively evaluated during Stage 3 planning, as appropriate. The removal methods currently under consideration would cause the excavated material to become waterlogged and unsuitable for use as stable fill. Depending on the pollutional classification of the material, it could either be deposited at an established open lake disposal site or placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material.

The operation of heavy machinery for the bank cut and installation of new bulkheads would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The operation of machinery may cause temporary inconveniences to commercial vessels and small boats passing through the work area.

Upland excavation for bank Cut No. 19 would result in the loss of 2.6 acres of commercial, waterfront property containing part of the Feldman Mechanical Contractors Building. Relocation of the building would require the permanent commitment of an additional unknown quantity of upland property. Impacts associated with construction of the new building are unknown since a new location has not been designated.

The operation of machinery for the building demolition, bank cut, dredging, and bulkhead work would create minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impacts associated with this plan would be minor.

No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Plan 7E is not economically justified, with a B/C ratio of 0.6 and net average annual commercial navigation benefits of -\$305,800. It is, therefore, concluded that Plan 7E should be eliminated from further consideration.

g. Alternative Plan 7F - Reduce River Congestion (Site 6).

(1) Description of Plan 7F - Plan 7F, an authorized but uncompleted project on the Cuyahoga River navigation channel, would eliminate undue vessel delay at Site 6 (river mile 4.0) identified by shipping interests as causing, on average, an additional 15 minutes in transit time for each trip upriver or downriver. The layout and project features for Plan 7F are shown on Plates 15 and 18 in Appendix J.

Components of Plan 7F include relocating an existing utility and bank Cut No. 20 (formerly unnumbered when this improvement plan was originally authorized for construction). Bank Cut No. 20 would increase the width of the navigation channel at this site from its present 115-foot width to about 190 feet. This 190-foot width is considered adequate to eliminate the 15-minute vessel delay at this site. In addition, to save as much upland area as possible, and because the existing bulkheads would become unstable due to bank Cut No. 20, the landward side of bank Cut No. 20 would be bulkheaded. However, during review of this plan at the 4 May 1982 workshop meeting, local interest requested that during detailed study, the possibility of cutting back the bank on a stable slope be investigated. If feasible, this would significantly reduce the cost of this plan.

It should be noted that in formulating Plan 7F, it has been assumed that Conrail would remove Bridge No. 14 and its center pier when they abandon the bridge. This assumption is consistent with the U. S. Coast Guard and Corps

of Engineers regulations concerning obstructions to navigation in navigable waters of the United States.

(NOTE: The authorized improvement project at this site also includes bank Cut No. 11, opposite bank Cut No. 20, which would further increase the channel width by about 45 feet. However, since the 190-foot wide channel provided by bank Cut No. 20 is considered adequate to eliminate the 15-minute delay at this site, bank Cut No. 11 was eliminated from further consideration.)

(2) Cost Estimate for Plan 7F - The detailed cost estimate for Plan 7F is presented in Table E14 of Appendix E. Tables 57 and 58, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs. Cost allocation is presented on traditional cost allocation methods only, since this project received initial construction funding prior to 1 October 1981. From these tabulations, it is seen that the total project cost for Plan 7F is \$2,930,000 (Table 57) and the total investment cost, including interest during construction, is also \$2,930,000 (Table 58). The total annual charges are \$229,200.

(3) Economic Evaluation of Plan 7F - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 7F is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include: (1) benefits that would accrue due to the elimination of the 15-minute delay at this site; and (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads. From Table B49 in Appendix B, these benefits total \$369,100 annually.

Table 59, following, summarizes the annual benefits, annual charges, net benefits, and B/C ratio for Plan 7F. Net commercial navigation benefits are \$139,900 annually and the B/C ratio is 1.6.

Table 59 - Summary of Benefits and Costs for Alternative Plan No. 7F (1)

	Average	Average	Net Average	
	Annual	Annual	Annual	Benefit/Cost
	Benefits	Charges	Benefits	Ratio
	\$	\$	\$	
Total Project	369,100	229,200	139,900	1.6

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 7F - The decrease in delay time under this plan would reduce the quantity of fuel consumed, the shipping time, and the cost of transportation per unit of cargo shipped through the site. The increase in channel width would also contribute to vessel safety on the Cuyahoga River.

Table 57 - Estimate of Total Project Cost for Alternative Plan No. 7P
(June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (2)	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	105,600		105,600	-	N/A	N/A
2. Clearing and Grubbing	1,063		-	1,063		
3. Bulkhead Replacement	1,633,695		-	1,633,695		
4. Utility Relocations	25,000		-	25,000		
5. Mobilization and Demobilization	130,000		8,000	122,000		
6. Lands and Damages	3,000		-	3,000		
Subtotal	1,898,358		113,600	1,784,758		
7. Contingencies (25 percent +)	476,642		28,400	448,242		
Subtotal	2,375,000		142,000	2,233,000		
8. Engineering and Design	249,000		15,000	234,000		
9. Supervision and Administration	306,000		18,000	288,000		
Total Project Cost	2,930,000 (1)		175,000 (1)	2,755,000 (1)		

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7P. Mitigation will be evaluated in Stage 3, as appropriate.

(2) Cut No. 20 was included in the authorized but uncompleted improvements at this site and was initially funded for construction prior to 1 October 1981. As such, cost allocation is based on traditional cost allocation.

Table 58 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7P
(June 1982 Price Levels) (1)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation (2)	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
			\$	\$	\$	\$
<u>Total Investment for the Project</u>						
Total Project Cost, Excluding Lands	2,927,000		175,000	2,752,000	N/A	N/A
Interest During Construction (3)	0		0	0		
Lands and Damages	3,000		0	3,000		
Total Investment, Including Lands	2,930,000		175,000	2,755,000		
<u>Annual Charges for the Project</u>						
Interest	223,400		13,300	210,100		
Amortization	5,800		400	5,400		
Additional Maintenance	0		0	0		
Total Annual Charges	229,200		13,700	215,500		

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) Cut No. 20 was included in the authorized but uncompleted improvements at this site and was initially funded for construction prior to 1 October 1981. As such, cost allocation is based on traditional cost allocation.

(3) 1-Year construction period.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance costs, the duration of dredging, and the volumes of material dredged. Both the initial and maintenance dredging should result in the same general types of water quality, benthic, and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material dredged.

The operation of heavy machinery for bulkhead replacement, dredging, and pipeline relocation would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The bulkhead work would result in the permanent loss of a limited quantity of benthic habitat, although a limited quantity of new habitat would be created by the bridge pier removal.

Work activities may cause temporary inconveniences to commercial vessels and small boats passing through the work area. The operation of machinery would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impacts associated with this plan would be minor.

No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Plan 7F, an authorized but uncompleted project on the Cuyahoga River navigation channel, is economically justified with a B/C ratio of 1.6 and net average annual benefits of \$139,900. In addition, because Conrail Bridge No. 14 would not be replaced, related real estate problems associated with the bridge replacement would no longer be a factor. It is, therefore, concluded that this project should be reclassified to the active category and be constructed under its original authorization. The project's perspective local sponsor, the Cleveland Port Authority, is currently preparing a letter requesting that this proposed action be undertaken.

h. Alternative Plan 7G - Reduce River Congestion (Site 7).

(1) Description of Plan 7G - Plan 7G would eliminate undue vessel delay at Site 7 (river mile 4.3) identified by shipping interests as causing, on average, an additional 10 minutes in transit time for each trip upriver or downriver. The plan would also eliminate the potential for vessel accidents at this site due to the increase in channel width. (NOTE: As shown on Table 18, over the 10-year period 1972-1981, two vessel accidents have occurred at this site with damages totalling about \$59,000.) The layout and project features for Plan 7G are shown on Plates 15 and 18 in Appendix J.

Components of Plan 7G include relocating an existing utility, removing the portion of the former Jefferson Avenue Bridge abutments which protrude into the navigation channel and new bank Cuts No. 21 and 22. Removing a portion of the bridge abutments and bank Cuts No. 21 and 22 would increase the width of the navigation channel at this site from its present 130-foot width to about 190 feet. This 190-foot width is considered adequate to eliminate the 10-minute vessel delay at this site. In addition, to save as much upland area as possible and to avoid removing the entire bridge abutments, the landward side of bank Cuts No. 21 and 22 would be bulkheaded.

(2) Cost Estimate for Plan 7G - The detailed cost estimate for Plan 7G is presented in Table E15 of Appendix E. Tables 60 and 61, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under both the traditional cost allocation method and the President's new proposed cost allocation method. From these tabulations, it is seen that the total project cost for Plan 7G is \$4,000,000 (Table 60) and the total investment cost, including interest during construction, is also \$4,000,000 (Table 61). The total annual charges are \$313,000.

(3) Economic Evaluation of Plan 7G - The detailed discussion of the projected commercial navigation benefits that would be realized from implementation of Plan 7G is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include: (1) benefits that would accrue due to the elimination of the 10-minute delay at this site; (2) advanced replacement benefits that would accrue for early replacement of the existing bulkheads; and (3) vessel damages avoided. From Table B49 in Appendix B, these benefits total \$225,800 annually.

Table 62, following, summarizes the annual benefits, annual charges, net benefits, and B/C ratio for Plan 7G. Net commercial navigation benefits are -\$87,200 annually and the B/C ratio is 0.7.

Table 62 - Summary of Benefits and Costs for Alternative Plan 7G (1)

	: Average	:	Average	:	Net Average	:
	: Annual	:	: Annual	:	: Annual	: Benefit/Cost
	: Benefits	:	: Charges	:	: Benefits	: Ratio
	: \$:	: \$:	: \$:
Total Project	: 225,800	:	: 313,000	:	: -87,200	: 0.7
	:	:	:	:	:	:

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

(4) Environmental Features/Assessment of Plan 7G - The decrease in delay time under this plan would reduce the quantity of fuel consumed, the shipping time, and the cost of transportation per unit of cargo shipped through the site. The increase in channel width would also contribute to vessel safety on the Cuyahoga River.

Table 60 - Estimate of Total Project Cost for Alternative Plan No. 7G
(June 1982 Price Levels)

Item	Total		Traditional Cost Allocation		Proposed Cost Allocation	
	Project Cost	\$	Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$	\$
1. Dredging	28,380		28,380	-	-	28,380
2. Clearing and Grubbing	2,338		-	2,338	-	2,338
3. Removal of Bridge Abutments	546,000		-	546,000	-	546,000
4. Bulkhead Replacement	1,881,695		-	1,881,695	-	1,881,695
5. Utility Relocations	11,220		-	11,220	-	11,220
6. Mobilization and Demobilization	130,000		1,620	128,380	-	130,000
7. Lands and Damages	13,000		-	13,000	-	13,000
Subtotal	2,612,633		30,000	2,582,633	-	2,612,633
8. Contingencies (25 percent +)	657,367		7,000	650,367	-	657,367
Subtotal	3,270,000		37,000	3,233,000	-	3,270,000
9. Engineering and Design	327,000		4,000	323,000	-	327,000
10. Supervision and Administration	403,000		5,000	398,000	-	403,000
Total Project Cost	4,000,000 (1)		46,000 (1)	3,954,000 (1)	0	4,000,000 (1)

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 7G. Mitigation will be evaluated in Stage 3, as appropriate.

Table 61 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 7G
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Traditional Cost Allocation		Proposed Cost Allocation	
		Federal Share	Non-Federal Share	Federal Share	Non-Federal Share
		\$	\$	\$	\$
<u>Total Investment for the Project</u>					
Total Project Cost, Excluding Lands	3,987,000	46,000	3,941,000	-	3,987,000
Interest During Construction (2)	0	0	0	-	0
Lands and Damages	13,000	0	13,000	-	13,000
Total Investment, Including Lands	4,000,000	46,000	3,954,000	0	4,000,000
<u>Annual Charges for the Project</u>					
Interest	305,000	3,500	301,500	-	305,000
Amortization	8,000	100	7,900	-	8,000
Additional Maintenance	0	0	0	-	0
Total Annual Charges	313,000	3,600	309,400	0	313,000

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 1-Year construction period.

The widened channel would require annual maintenance dredging, although the plan should produce only minor impacts on the long-term annual maintenance cost, the duration of dredging and the volumes of material dredged. Both the initial and maintenance dredging would result in the same general types of water quality, benthic and fishery impacts described previously in the environmental assessment for Plan 1, with the greatest impacts occurring at the dredging site and in adjacent areas of the Cuyahoga River. Although maintenance dredging would cause periodic disruptions to the benthic community structure, an additional 0.1 acre of aquatic habitat would be created due to the two bank cuts associated with this plan. Replacement of the existing bulkheads may result in the permanent loss of a limited quantity of relatively low value benthic habitat.

The location for placement of the dredged material under this plan would be more thoroughly evaluated during Stage 3 planning, as appropriate. Based on past sediment testing results, the Buffalo District is presently assuming that the material is polluted and would be placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional dredged material.

The disposal of upland material from bank Cuts No. 21 and 22 would also be more extensively evaluated during Stage 3 planning, as appropriate. The removal methods currently under consideration would cause the excavated material to become waterlogged and unsuitable for use as stable fill. Depending on the pollutional classification of the material, it could either be deposited at an established open lake disposal site or placed in Diked Disposal Site No. 14, which has sufficient capacity to accommodate the additional material.

The operation of heavy machinery for the bank cuts, bulkhead work, utility relocation and removal of the bridge abutments would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. Additional short-term benthic disturbances would also occur. The operation of machinery may cause temporary inconveniences to commercial vessels and small boats passing through the work area.

Upland excavation for bank Cuts No. 21 and 22 would result in the loss of 0.1 acre of waterfront property which is occupied by portions of Jefferson Avenue, bulk storage facilities, and small patches of upland vegetation. The operation of machinery for the bank cuts, utility relocation, dredging, bulkhead work and removal of the bridge abutments would create minor visual impacts and would cause minor increases in noise and exhaust emissions at the work site. Since the area is already heavily commercialized, the total permanent aesthetic impacts associated with this plan would be minor.

No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Based on the economic evaluation conducted for this Stage 2 study, Plan 7G is not economically justified with a B/C ratio of 0.7 and net average annual benefits of -\$87,200. However, shipping interests at the 4 May 1982 workshop meeting indicated that numerous minor accidents

occur at this site, but are not of sufficient magnitude to be reported to the Coast Guard. Even though each accident involves only minor damage, in total, they represent a significant amount of damage which may be sufficient to increase the B/C ratio for Plan 7G above 1.0. It is, therefore, concluded that Plan 7G should be carried forward into Stage 3 planning in order to evaluate these potential additional benefits. If these additional benefits are sufficient to economically justify Plan 7G, additional detailed study on this plan would be conducted. However, if these additional benefits are not sufficient to justify Plan 7G, this plan would then be eliminated from further consideration.

21. RECREATIONAL FISHING PLANS (Plans 8A and 8B)

The primary purpose of the recreational fishing plans developed during Stage 2 planning was to provide fishermen access to the Cleveland Harbor west breakwater. If implemented, such a plan would be a major step in providing recreational fishing opportunities for residents of the Cleveland Harbor area who, due to their low incomes, cannot travel to neighboring counties to satisfy their recreational fishing needs.

In developing plans to provide for fishermen access to the west breakwater, two scenarios were considered. The first scenario (Plan 8A) assumed that the existing entrance to Edgewater Marina would be completely blocked off with a new breakwater and that a new entrance would be provided into the west basin of the Cleveland Lakefront Harbor. Small boats would use this new entrance to enter the west basin and would then enter Edgewater Marina through the existing gap in the west breakwater. The second scenario (Plan 8B) assumes that the existing entrance to Edgewater Marina is only slightly modified to reduce wave energy entering the marina and continues to serve as the main entrance to Edgewater Marina. However, selection of the plan to recommend for construction, if economically justified, must await the results of the Section 107 study for Edgewater Marina which will determine the feasibility of modifying Edgewater Marina and the extent of these modifications.

Pertinent engineering, economic, environmental, and related data for Plans 8A and 8B follow.

a. Alternative Plan 8A - Recreational Breakwater Fishing (Edgewater Marina Breakwater).

(1) Description of Plan 8A - Plan 8A would provide additional recreational fishing facilities on 850 feet of new north breakwater in the existing entrance to Edgewater Marina and on about 750 feet of the west breakwater of Cleveland Harbor. Total additional fisherman access provided by this plan would be approximately 1,600 linear feet, sufficient for about 160 fishermen at any one time. The layout and project features for Plan 8A are shown on Plate 19 in Appendix J.

Components of Plan 8A include a concrete walkway and chain railing on the assumed new north breakwater of Edgewater Marina, new chain railings on the lakeward and harbor sides of the west breakwater of Cleveland Harbor, a new parking area, and expanded restroom facilities. The concrete walkway on the

assumed new north breakwater would be 5 feet wide and would connect into the existing concrete walkway on the existing north breakwater of Edgewater Marina to the west and into the existing west breakwater of Cleveland Harbor to the east. Once on the west breakwater, access between the two levels would be provided by two new stairways. The new fishing access facilities are considered adequate for use by handicapped persons.

Fishermen parking would be provided to the west of Edgewater Marina, immediately adjacent to existing parking. The new parking area would accommodate 40 cars. In addition, additional restroom facilities would be provided by expanding the new restroom facilities currently being provided by ODNR as part of their Cleveland Lakefront State Park improvement plan. (NOTE: The new parking area would be located in an area presently being used for a baseball diamond. However, ODNR plans on relocating the baseball diamond and constructing new parking facilities in conjunction with their proposed park improvement plan.)

(2) Cost Estimate for Plan 8A - The detailed cost estimate for Plan 8A is presented in Table E16 of Appendix E. Tables 63 and 64, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under the traditional cost allocation method. From these tabulations, it is seen that the total project cost for Plan 8A is \$586,000 (Table 63) and the total investment cost, including interest during construction, is also \$586,000 (Table 64). The total annual charges are \$57,900.

(3) Economic Evaluation of Plan 8A - The detailed discussion of the projected recreational fishing benefits that would be realized from implementation of Plan 8A is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include benefits for providing access for up to 160 fishermen with an average value of \$3.95 per fishing experience. From Table B59 in Appendix B, these benefits total \$124,800 annually.

Table 65, following, summarizes the annual benefits, annual charges, net benefits, and B/C ratio for Plan 8A. Net recreational fishing benefits are \$66,900 annually and the B/C ratio is 2.2.

Table 65 - Summary of Benefits and Costs for Alternative Plan No. 8A (1)

	: Average	:	Average	:	Net Average	:
	: Annual	:	: Annual	:	: Annual	: Benefit/Cost
	: Benefits	:	: Charges	:	: Benefits	: Ratio
	: \$:	: \$:	: \$:
Total Project	: 124,800	:	: 57,900	:	: 66,900	: 2.2
	:	:	:	:	:	:

(1) Based on June 1982 price levels, 7-5/8 percent interest rate and 50-year economic life.

Table 63 - Estimate of Total Project Cost for Alternative Plan No. 8A
(June 1982 Price Levels)

Item	Total Project Cost \$	Traditional Cost Allocation	
		Federal Share : \$	Non-Federal Share \$
1. Walkway and Railings	261,000	130,500	130,500
2. Comfort Station Expansion	65,000	32,500	32,500
3. Parking Area	16,900	8,450	8,450
4. Lands and Damages	22,000	-	22,000
Subtotal	364,900	171,450	193,450
5. Contingencies (25 percent +)	91,100	42,550	48,550
Subtotal	456,000	214,000	242,000
6. Engineering and Design	59,000	28,000	31,000
7. Supervision and Administration	71,000	33,000	38,000
Total Project Cost (1)	586,000	275,000	311,000

(1) Does not include costs for mitigation of adverse environmental impacts that may be required for Plan 8A. Mitigation will be evaluated in Stage 3, as appropriate.

Table 64 - Estimated Investment Cost and Annual Charges for Alternative Plan No. 8A
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Federal Share : Non-Federal Share \$	Traditional Cost Allocation \$
<u>Total Investment for the Project</u>			
Total Project Cost, Excluding Lands	564,000	275,000	289,000
Interest During Construction (2)	0	0	0
Lands and Damages	<u>22,000</u>	<u>0</u>	<u>22,000</u>
Total Investment, Including Lands	586,000	275,000	311,000
<u>Annual Charges for the Project</u>			
Interest	44,700	21,000	23,700
Amortization	1,200	600	600
Additional Maintenance	<u>12,000</u>	<u>0</u>	<u>12,000</u>
Total Annual Charges	57,900	21,600	36,300

(1) 7-5/8 percent interest rate, 50-year life ($i = .07625$, $\text{amort.} = .00199$). Does not include costs for mitigation of adverse environmental impacts.

(2) 1-Year construction period.

(4) Environmental Features/Assessment of Plan 8A - This plan would enhance recreational fishing opportunities in the Cleveland Harbor area by providing fishing access along 850 feet of the assumed new north breakwater of Edgewater Marina and along 750 feet of the Cleveland Harbor west breakwater. Assuming a 10-foot space standard per angler and a turnover rate of 2, the plan would provide fishing access for a maximum of 320 fishermen per day. The expanded comfort station and new parking area would provide additional restroom and parking facilities for area fishermen. The parking area would provide space for 40 cars, although the fishing access area would be readily available to lower income families dependent on public transportation facilities.

Construction of the new parking area and expansion of the comfort station would modify a total upland area of about 12,000 square feet, which is currently used for recreational purposes (baseball diamonds). No aquatic habitat would be permanently affected by this plan, although minor disturbances could occur due to the operation of water-based machinery during construction. The construction machinery would create minor increases in noise and exhaust emissions at the work site. The permanent visual aesthetic impacts associated with this plan would be minor. No presently known cultural resources would be adversely affected due to implementation of this plan.

(5) Conclusions - Plan 8A is economically justified with net average annual benefits of \$66,900 and a B/C ratio of 2.2. It is, therefore, concluded that Plan 8A should be carried forward into Stage 3 planning.

b. Alternative Plan 8B - Recreational Breakwater Fishing (West Breakwater).

(1) Description of Plan 8B - Plan 8B would provide recreational fishing facilities on the existing west breakwater of Cleveland Harbor. Total fisherman access provided by this plan would be approximately 5,725 linear feet, sufficient for about 572 fishermen at any one time. The layout and project features for Plan 8B are shown on Plate 20 in Appendix J.

Components of Plan 8B include chain railings on the Cleveland west breakwater and west arrowhead breakwater, a pedestrian bridge, two safety platforms, a new parking area and expanded restroom facilities. The chain railing would start at the landward end of the west breakwater and would continue to the lighthouse on the lakeward end of the west arrowhead breakwater. As in Plan 8A, access between the two levels of the west breakwater would be provided by stairways, located every 500 feet. A pedestrian bridge would also be provided to span the gap in the west breakwater. This pedestrian bridge would be at the same elevation as the crest of the west breakwater (i.e., 12 feet above LWD). The new fishing access facilities are considered adequate for use by handicapped persons.

Due to the suddenness with which storms are generated on Lake Erie and the long length of the access facilities on the breakwaters, two safety platforms would also be provided on the west breakwater. These safety platforms would

provide a sheltered area for fishermen who become stranded on the west breakwater during storm conditions when waves overtop the breakwater. The safety platforms were sized to accommodate a total of about 290 fishermen, approximately half the maximum number of fishermen that would use the facilities at any one time. It should be noted, however, that these safety platforms would not be accessible to some handicapped persons because of the stairways. Therefore, fishing access for these handicapped people would be limited to the first 1,000 feet or so of the west breakwater.

Fishermen parking, sized to accommodate 145 cars, would be provided to the west of Edgewater Marina. Fishermen would use this area on weekends and other peak days and would be driven to the west breakwater by a shuttle bus service. On nonpeak days, fishermen would be able to park in the boat launch parking area, immediately south of the west breakwater. In addition, additional restroom facilities would be provided by expanding the new restroom facilities currently being provided by ODNR in conjunction with their public launch ramps.

(2) Cost Estimate for Plan 8B - The detailed cost estimate for Plan 8B is presented in Table E17 of Appendix E. Tables 66 and 67, following, summarize the estimated project costs and annual charges and provide a breakdown of the Federal and non-Federal share of these costs under the traditional cost allocation method. From these tabulations, it is seen that the total project cost for Plan 8B is \$1,700,000 (Table 66) and the total investment cost, including interest during construction, is also \$1,700,000 (Table 67). The total annual charges are \$196,000.

(3) Economic Evaluation of Plan 8B - The detailed discussion of the projected recreational fishing benefits that would be realized from implementation of Plan 8B is presented in Appendix B, "Economic Evaluation." In summary, benefits that would be realized include benefits for providing access for up to 572 fishermen with an average value of \$3.95 per fishing experience. From Table B59 in Appendix B, these benefits total \$446,400 annually.

Table 68, following, summarizes the annual benefits, annual charges, net benefits, and B/C ratio for Plan 8B. Net recreational fishing benefits are \$250,400 annually and the B/C ratio is 2.3.

Table 68 - Summary of Benefits and Costs for Alternative Plan No. 8B (1)

	: Average	:	Average	:	Net Average	:
	: Annual	:	: Annual	:	: Annual	: Benefit/Cost
	: Benefits	:	: Charges	:	: Benefits	: Ratio
	: \$:	: \$:	: \$:
Total Project	: 446,400	:	: 196,000	:	: 250,400	: 2.3
	:	:	:	:	:	:

(1) Based on June 1982 price levels, 7-5/8 percent interest rate, and 50-year economic life.

Table 66 - Estimate of Total Project Cost for Alternative Plan No. 8B
(June 1982 Price Levels)

Item	Total Project Cost \$	Traditional Cost Allocation	
		Federal Share : \$	Non-Federal Share \$
1. Railings	349,725	174,862	174,863
2. Safety Platforms	300,000	150,000	150,000
3. Comfort Station Expansion	65,000	32,500	32,500
4. Pedestrian Bridge	235,000	117,500	117,500
5. Parking Area	61,100	30,550	30,550
6. Lands and Damages	72,000	0	72,000
Subtotal	1,082,825	505,412	577,413
7. Contingencies (25 percent +)	267,175	124,588	142,587
Subtotal	1,350,000	630,000	720,000
8. Engineering and Design	162,000	76,000	86,000
9. Supervision and Administration	188,000	88,000	100,000
Total Project Cost (1)	1,700,000	794,000	906,000

(1) Does not include cost for mitigation of adverse environmental impacts that may be required for Plan 8B. Mitigation will be evaluated in Stage 3, as appropriate.

Table 67 -- Estimated Investment Cost and Annual Charges for Alternative Plan No. 8B
(June 1982 Price Levels) (1)

Item	Total Project Cost \$	Traditional Cost Allocation	
		Federal Share : \$	Non-Federal Share : \$
<u>Total Investment for the Project</u>			
Total Project Cost, Excluding Lands	1,628,000	794,000	834,000
Interest During Construction (2)	0	0	0
Lands and Damages	72,000	0	72,000
Total Investment, Including Lands	1,700,000	794,000	906,000
<u>Annual Charges for the Project</u>			
Interest	129,600	60,500	69,100
Amortization	3,400	1,600	1,800
Additional Maintenance	63,000	0	63,000
Total Annual Charges	196,000	62,100	133,900

(1) 7-5/8 percent interest rate, 50-year life (1 = .07625, amort. = .00199). Does not include costs for mitigation of adverse environmental impacts.

(2) 1-Year construction period.

(4) Environmental Features/Assessment of Plan 8B - This plan would enhance recreational fishing opportunities in the Cleveland Harbor area by providing fishing access along 5,725 feet of the Cleveland Harbor west breakwater. Assuming a 10-foot space standard per angler and a turnover rate of 2, the plan would provide fishing access for a maximum of 1,145 fishermen per day. The two safety platforms associated with the plan would provide safe refuge during storm conditions for a total of about 290 anglers. The expanded comfort station and new parking area would provide additional restroom and parking facilities for area fishermen. The new parking area would provide space for 145 cars, and would probably be used most heavily during weekends, when a shuttle bus service would run between the parking area and the shoreward end of the west breakwater. The fishing access area would be serviced by city bus lines and would be readily available to lower income families dependent on public transportation facilities.

Construction of the new parking area would modify an upland area of about 1 acre, which is currently used for recreational purposes (baseball diamonds). However, these baseball diamonds are presently designated to be relocated as part of ODNR's Cleveland Lakefront State Park plan. The comfort station expansion would require the commitment of about 384 square feet of upland area presently used as a parking lot.

Supports for the new pedestrian bridge would be expected to permanently destroy a very limited quantity of aquatic and benthic habitat. The operation of heavy equipment in Cleveland Harbor would produce short-term increases in water turbidity and would temporarily disperse fish from the work area. The operation of heavy machinery may cause temporary inconveniences to boat launching activities at ODNR's launch facility near the shoreward end of the west breakwater. Construction machinery may also create temporary disturbances to small-boat navigation in the project area. Only small motor boats and sailboats with collapsible masts would be able to pass beneath the new pedestrian bridge. Large sailboats would be unable to navigate between Edgewater Marina and the breakwater protected portion of Cleveland Harbor without passing outside Cleveland Harbor.

Construction machinery would create minor increases in noise and exhaust emissions at the work site. The permanent visual impacts associated with this plan would be minor. This plan would facilitate public access to the West Pierhead Lighthouse. Because a greater number of people would be permitted to visit this structure, the potential for vandalism may be increased.

(5) Conclusions - Plan 8B is economically justified with net average annual benefits of \$250,400 and a B/C ratio of 2.3. It is, therefore, concluded that Plan 8B should be carried forward into Stage 3 planning.

As stated earlier, the decision on implementing either Plan 8A or 8B is contingent upon the plan of improvement selected for Edgewater Marina.

22. ALTERNATIVE PLAN 10 - "NO-ACTION" PLAN

The "No-Action" or do-nothing plan represents the base condition for evaluation of the 17 structural plans previously described. This option,

although not favored by the local sponsors and local interests (i.e., shipping companies, area fishermen, dock operators, etc.), avoids both the monetary investments and potential adverse impacts associated with the structural improvements. However, bulk cargo movement at Cleveland Harbor would be restricted to smaller and less efficient bulk cargo vessels. Also, because of inadequate channel depth, these vessels would be forced to navigate at less than the maximum Great Lakes System's draft of 25.5 feet. Bulk cargo vessels would also continue to experience undue vessel delays at historically congested areas. The potential for vessel accidents would also remain high. In addition, the "no-action" plan would not meet any of the needs of recreational fishermen in the Cleveland Harbor area. Further, the opportunity to construct artificial fish habitat areas would be foregone. Problems stated earlier in the report would remain unchanged. The "No-Action" plan would also not meet the planning objectives to provide for economical movement of bulk cargo through Cleveland Harbor and to provide additional recreational fishing facilities.

23. SUMMARY EVALUATION OF IMPACTS DURING CONSTRUCTION - PLANS 1, 3, 5-8, AND 10

a. Social Impacts.

(1) Noise - Under all plans except the "No-Action" Plan, construction noises would occur which could be disturbing to persons near the work area. Relatively continuous motor noise would be expected when water and/or land based equipment would demolish structures, excavate land, perform dredging, repair existing structures, and perform new construction. Activities in the Lakefront Harbor would probably produce the least noise impacts since relatively few persons would be near the work sites. Construction noises would be most noticeable near work sites on land and along the shores of the Cuyahoga and Old Rivers. The noise effect for all plans is expected to be relatively minor since any work would be performed in areas which are currently used by heavy industrial, commercial, and/or transportation equipment.

(2) Aesthetics - Construction activities would present an obstruction to the view of the individual work sites. However, since work sites for all of the plans are located in areas which are used by heavy industrial, commercial and/or transportation equipment, the aesthetic impacts associated with the various alternatives would be minor.

(3) Displacement of People, Businesses, and Farms - None of the alternatives would affect area residences, although the relocation of buildings associated with Plans 5B and 7E could result in the movement of the affected business enterprises to other sites in the Cleveland Metropolitan area. No farms would be affected by any of the plans.

(4) Community Cohesion, Community Growth, and Regional Growth -The short-term construction impacts associated with all of the various plans except the "No-Action" Plan would have no significant impacts on community cohesion, community growth, or regional growth.

b. Economic Impacts.

(1) Business and Industrial Activity - Implementation of any of the construction plans would constitute a business activity of an industrial nature. Each of the plans should produce a positive effect which would be directly proportional to the project cost.

(2) Tax Revenues and Property Values - Implementation of any of the plans except the "No-Action" Plan should result in a minor and temporary increase in income tax revenues due to the increase in employment associated with the work. Sales taxes would also be received for materials purchased for the work. The purchase of private land by the local sponsor for bank cuts on the Cuyahoga and Old Rivers would remove a relatively small amount of land from the local tax base. Some minor decrease in adjacent property values may also be associated with the purchase of land for upland construction activities.

(3) Public Facilities and Services - Local business establishments such as restaurants, service and repair shops, motels, and retail stores may derive benefits from the presence of construction workers involved in carrying out all plans except the "No-Action" Plan. This effect is expected to be slight due to the limited size of the work crews for each plan. Similarly, the demand for public services in the form of police, rescue, and medical services would not rise appreciably due to the presence of the workers.

(4) Employment/Labor Force - The input of capital for all of the construction plans would result in a temporary increase in employment and the labor force during construction. These impacts would be relatively minor and of short duration since no construction alternative would employ more than 25-30 construction workers or require a time span exceeding 5 years.

c. Environmental Impacts.

(1) Air Quality - Air quality in the project area would be temporarily affected by dust, noise, odors, and vehicle emissions from the operation of construction equipment under all plans except the "No-Action" Plan. The construction Contractor would be required to control such emissions and effects where practical.

(2) Water Quality - Some short-term reversible impacts on water quality would occur during implementation of any of the construction plans associated with the project. The operation of construction and dredging equipment would cause considerable elevations in levels of suspended solids and turbidity, as well as the release of pollutants and/or nutrients associated with the bottom sediments. These impacts would be of relatively high magnitude and short duration, disappearing soon after the construction and/or dredging was completed. Some accidental spillage of fuels, oil, and grease could occur due to the operation of both land-based and marine construction equipment.

(3) Natural Resources - Certain aspects of all the implementable plans, except the "No-Action" Plan, would require the commitment of natural resources in the form of construction materials and energy expended during the construction process. These include:

- (a) breakwater stone taken from a stone quarry;
- (b) steel, which would be required for steel sheet piling, bridges, railroad rails, chain railing, and various other structural features associated with the project;
- (c) wood, which would be associated with bridge fenders and railroad trackage;
- (d) lime, aggregate, and other materials used in making concrete; and
- (e) petroleum products, which would be used in all phases of construction by vehicles and machinery.

(4) Ecosystems - Some destructive impacts to aquatic populations would occur due to dredging and the placement of structures in Cleveland Harbor and the Cuyahoga and Old Rivers. Although some impacts would be temporary, the aquatic areas occupied by the placement of structures would in many cases lead to the permanent destruction of aquatic habitat. Although the placement of breakwaters and fish habitat development areas associated with Plans 3A and 3B would result in the covering of existing benthic habitat, the new benthic substrate associated with these structures would be rapidly colonized with benthic macroinvertebrates. The fish habitat development areas and some of the underwater portions of the breakwaters would encourage the growth of attached algae, increase the diversity and abundance of benthic macroinvertebrates, and provide valuable cover, spawning sites, and feeding areas for fish populations in the Cleveland Harbor area. The use of Diked Disposal Facility Site No. 14 for the confinement of dredged material and/or upland material from bank cuts on the Cuyahoga and Old Rivers would hasten the conversion of aquatic habitat to terrestrial habitat. The bank cuts associated with Plans 5A, 5B, 7B, 7C, 7D, 7E, and 7G would result in the permanent destruction of a limited quantity of relative low value terrestrial habitat and in the creation of an equal quantity of aquatic habitat.

(5) Man-Made Resources - Construction activities under all plans except the "No-Action" Plan and Plans 8A and 8B would result in the renovation and/or improvement of commercial navigation facilities in the Cleveland Harbor area. Plans 8A and 8B would enhance the recreational resources of the area by providing fishermen access to the Cleveland Harbor west breakwater. Buildings, bridges, and/or other upland structures would be relocated, constructed, or demolished under Plans 5A, 5B, 7B, 7C, 7D, 7E, 7G, 8A and 8B. Underwater utility relocations would be required under Plans 6A, 6B, 7D, 7F, and 7G.

(6) Cultural Resources - Of the various Lakefront Harbor plans presently under consideration, only Plan 3A would result in removal of the Cleveland West Pierhead Lighthouse. No presently known cultural resources would be

adversely affected due to implementation of Plans 1, 3B, 5A, 5B, 6A, 6B, 7B, 7D, 7E, 7F, 7G, 8A, 8B, or 10, although Plan 8B would facilitate public access to the West Pierhead Lighthouse. Implementation of Plan 7C would require replacement of both the Union Terminal High Level Railroad Bridge and the Columbus Road Bridge as stated in the individual environmental assessment for that plan.

24. SUMMARY EVALUATION OF IMPACTS FOR FUTURE CONDITIONS - PLANS 1, 3, 5-8, AND 10

This section of the environmental assessment will attempt to identify impacts that would occur to the Cleveland area after plan implementation. The output of Plans 1, 3, and 5-7 would be to provide long-term benefits to the area economy, vessel safety, and shipping efficiency. The output of Plans 8A and 8B would be to provide long-term recreational benefits in the form of fishermen access to the harbor breakwaters. Plan 10 would allow continuation of the base case and would not provide the project benefits associated with the various construction plans.

a. Social Impacts: Noise; Aesthetics; Displacement of People, Businesses, and Farms; Community and Regional Growth; and Community Cohesion.

Noise levels at each construction site would return to normal levels after the construction phase is complete. Minor noise increases and visual impacts would occur during periodic maintenance dredging activities. The permanent visual changes associated with Plans 1, 3, and 5-8 would be expected to provide only minor aesthetic impacts. Although no residences or farms would be affected under any of the plans, the relocation of buildings under Plans 5B and 7E could result in the permanent relocation of businesses to other sites in the Cleveland Metropolitan Area. Any permanent changes in the realignment of railroad tracks and city streets associated with Plan 5B should create only minor impacts to traffic flow in the work area. No long-term impacts to community cohesion would be associated with any of the project plans. Plans 1, 3, and 5-7 may encourage regional growth by providing long-term economic benefits associated with permanent increases in shipping efficiency.

b. Economic Impacts: Business and Industrial Activity; Tax Revenues and Property Values; and Employment/Labor Force.

The increase in shipping efficiency and the economic benefits associated with Plans 1, 3 and 5-7 may encourage the growth and/or efficiency of business and industrial activity in the Cleveland area. The potential benefits to business and industry may in turn stimulate employment opportunities, although a decrease in transportation - related employment may occur due to the increase in shipping efficiency. Any benefits to business, industrial activity, and employment may increase tax revenues, although the purchase of private land by the local sponsor would permanently remove a relatively small amount of land from the local tax base. Only relatively minor impacts to local property values would be expected to result due to implementation of any of the plan alternatives.

c. Environmental Impacts: Air Quality; Water Quality; Natural Resources; Ecosystems; Man-made Resources; and Cultural Resources.

Aquatic and terrestrial habitat would be permanently modified and/or destroyed as discussed in the environmental assessments for each of the individual project plans, except the "No-Action" Plan. All modifications to man-made resources associated with Plans 1, 3, and 5-8 should be permanent, lasting the entire life of the project. Maintenance activities would cause periodic air quality, water quality, aquatic organism, and disposal impacts which would be similar to those occurring during the construction phase. Project maintenance would require the use of additional petroleum products and any additional natural resources such as stone or wood which may be required for the repair of project structures. All cultural resources impacts discussed previously in the Summary Evaluation of Impacts During Construction would be permanent, lasting the duration of the project.

25. COMPLIANCE WITH ENVIRONMENTAL PROTECTION STATUTES

The following paragraphs will present a brief description of the Buffalo District's proposed methods for compliance with all applicable environmental statutes for all structural recommendations which may result from this study.

a. National Environmental Policy Act.

A Final Environmental Impact Statement (EIS) for the Cleveland Harbor Navigation Project was filed with the U.S. Environmental Protection Agency on 26 October 1978. However, project reformulation has resulted in new project alternatives which are significantly different from those discussed in the Final EIS. The Buffalo District has determined that there are significant impacts resulting from changes in the project which would significantly affect the quality of the human environment. Therefore, the Buffalo District proposes to prepare Draft and Final EIS supplements which will be included within the Draft and Final Reformulation Phase I GDM's respectively. This action will assure compliance with NEPA.

b. Various Acts, Executive Orders, etc., Concerning the Preservation of Cultural Resources.

Appropriate cultural resources studies and consultations will be accomplished as necessary to assure compliance with all cultural resource statutes.

c. Clean Air Act, as Amended.

Copies of the Draft and Final EIS supplements will be sent to the appropriate Regional Administrator of the U.S. Environmental Protection Agency requesting agency comments in compliance with the Clean Air Act.

d. Clean Water Act.

This act requires the evaluation of the effects of the placement of dredged and/or fill materials into waters of the United States. As

appropriate, a Section 404 (b)(1) evaluation will be performed and State Section 401 water quality certification will be requested during Stage 3 planning.

e. Coastal Zone Management Act.

The State of Ohio does not have an approved Coastal Zone Plan and the Ohio Department of Natural Resources is no longer participating in the Coastal Zone Management Program. There are, therefore, no consistency requirements to be met with respect to the Coastal Zone Management Act for the Cleveland Harbor study.

f. Endangered Species Act.

Coordination with the U.S. Fish and Wildlife Service indicates that except for occasional transient species, no Federally listed or proposed threatened or endangered species are known to exist in the project area.

g. Federal Water Project Recreation Act and Land and Water Conservation Fund Act.

During project planning, full consideration has been given to opportunities afforded for outdoor recreation and fish and wildlife enhancement. Appropriate coordination will be accomplished as necessary to insure compliance with this act.

h. Fish and Wildlife Coordination Act.

This act requires early and continual coordination of project planning with the U.S. Fish and Wildlife Service to assure equal consideration of fish and wildlife values and resources in the development of alternatives. This coordination was initiated early in the Cleveland Harbor study and will be continuous through further project planning.

i. River and Harbor Act of 1970.

The requirements of this act have been fulfilled by Corps planning actions. All 17 points identified in Section 122 of this act (PL 91-611) have been addressed in this report for Plans 1, 3, 5-8, and 10.

j. Wild and Scenic Rivers Act.

The Cuyahoga and Old Rivers are not considered either wild or scenic in the vicinity of the existing Federal project.

k. Executive Order 11988, Flood Plain Management, 24 May 1977.

The existing Federal navigation project at Cleveland Harbor is partially located in the base flood plain of the Cuyahoga and Old Rivers. If structural improvements to these portions of the existing project were required, there would be no practicable alternative to performing work in the base

flood plain of the Cuyahoga and Old Rivers. The work would, therefore, be in compliance with Executive Order 11988, Flood Plain Management.

1. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Since no wetlands would be affected by any of the project alternatives, they would be in compliance with Executive Order 11990, Protection of Wetlands.

m. Analysis of Impacts on Prime and Unique Farmlands, CEQ Memorandum, 30 August 1976.

Since none of the project alternatives would affect prime or unique farmlands in any manner, they would be in compliance with this memorandum.

SECTION V

COMPARISON OF PRELIMINARY PLANS

This section compares the impacts of the 17 preliminary structural plans that an initial screening of alternatives indicated had the greatest potential for meeting the commercial navigation and recreational fishing needs at Cleveland Harbor. The basis of comparison for these 17 preliminary plans is the "no-action" (do-nothing) plan. The section also discusses: the rationale for eliminating preliminary plans from further consideration; the rationale for selecting preliminary plans for further, detailed study; the future course of action on the authorized but uncompleted projects on the Cuyahoga and Old River navigation channels; and the rationale for selection of candidate NED and EQ plans. The section then concludes with a discussion of local views on the future course of this Phase I study.

26. COMPARISON OF PRELIMINARY PLANS

Tables 69 and 70, following, compare the impacts of the 17 preliminary structural plans (Plans 1-8) and the "no-action" (do-nothing) plan (Plan 10). Impacts are measured and the results displayed or accounted for in terms of contributions to four accounts: National Economic Development (NED); Environmental Quality (EQ); Regional Economic Development (RED); and Other Social Effects (OSE). Table 71 summarizes the B/C ratios for the 17 preliminary structural plans.

27. TRADE-OFF ANALYSIS

a. Trade-Off Analysis of Structural vs. Nonstructural Alternatives.

With the exception of the "no-action" plan, the initial screening of alternatives indicated that the greatest potential for meeting the primary planning objectives of promoting the economical movement of bulk cargo at Cleveland Harbor and providing additional recreational fishing facilities in the Cleveland Harbor area, involved structural modifications to existing harbor facilities (i.e., structural plans). One primarily non-structural plan (Plan 9 - Tug Assistance) was formulated during the initial phase of this Stage 2 investigation. However, initial evaluation and assessment of this plan indicated that it should be eliminated from further consideration due to operational difficulties associated with the plan and because the plan would not provide adequate channel depths which would allow Class V through Class X vessels to enter Cleveland Harbor loaded to the maximum systems draft of 25.5 feet. Thus, with the exception of the "no-action" plan, no non-structural plan was carried forward beyond the initial iteration. (NOTE: As previously discussed, an array of non-structural plans (such as rail delivery of iron ore from its source or another Lake Erie port and truck delivery of iron ore from its source or another Lake Erie port) were formulated to promote the economical movement of bulk cargo at Cleveland Harbor during the 1972-1976 Feasibility Study. However, because of economic and/or technical reasons, these non-structural plans were eliminated from further consideration during

Table 69 - Summary of Effects for Alternative Plans Nos. 1 through 68

PLAN DESCRIPTION	Plan 1	Plan 2	Plan 3A	Plan 3B	Plan 4	Plan 5A	Plan 5B	Plan 6A	Plan 6B
	This plan consists of dredging a fan-shaped entrance channel at the existing east entrance and dredging a 300-foot wide channel through the east basin to the west basin. Plan is suitable for vessel operation in "all-weather" conditions.	This plan consists of removing sections of the spur breakwater at the west (main) entrance to promote vessel operation during "fair-weather" conditions. Also included are breakwater modifications to prevent increased wave activity in the Lakefront Harbor as a result of the spur breakwater removal.	This plan consists of providing a new modified "L"-shaped breakwater protected entrance channel at the existing west (main) entrance to the spur breakwaters: removing portions of the spur breakwaters: operation. Extended entrance channel would be protected by two new 1,000-foot long parallel breakwaters. Plan is suitable for vessel operation during "all-weather" conditions.	This plan consists of extending and deepening the existing west (main) entrance channel and removing portions of the spur breakwaters: weather, while the bridge at the mouth of the Old River (Bridge No. 23) with a new connection and interchange system with the Coorrell Bridge spanning the new channel width and deepening the side of the Cuyahoga River would be provided. MTO traffic at a reduced level from present practice. In addition, island via this new connection and interchange system and Correll Bridge would be replaced, deepening would be replaced. Implications of this plan would allow a vessel up to 730 feet in length to navigate the Old River navigation channel loaded to the system's draft of 25.5 feet.	This plan combines the features of Plans 1 and 2. The "all-weather" east entrance would be used during rough weather, while the "fair-weather" west entrance would be used during calm conditions. Use of the "fair-weather" west entrance in-lieu of the "all-weather" east entrance would save 1 to 2 hours in vessel transit time; be bulkheaded and entered or left the harbor.	This plan consists of four bank cuts (Cuts Nos. 12-15), replacing the existing MTO Railroad Bridge, the bridge would be removed and a new connection and interchange system with the Coorrell Bridge spanning the new channel width and deepening the side of the Cuyahoga River would be provided. MTO traffic at a reduced level from present practice. In addition, island via this new connection and interchange system and Correll Bridge would be replaced, deepening would be replaced. Implications of this plan would allow a vessel up to 730 feet in length to navigate the Old River navigation channel loaded to the system's draft of 25.5 feet.	This plan is similar to Plan 5A, except that in-lieu of replacing the existing MTO Railroad Bridge, the bridge would be removed and a new connection and interchange system with the Coorrell Bridge spanning the new channel width and deepening the side of the Cuyahoga River would be provided. MTO traffic at a reduced level from present practice. In addition, island via this new connection and interchange system and Correll Bridge would be replaced, deepening would be replaced. Also, one utility would be relocated (lowered).	This plan consists of deepening the Cuyahoga River navigation channel from the existing depth of 23 feet to 25.5 feet below LMD. Even four utilities would be relocated. The deepened channel would allow vessels to load to the Great Lakes System draft of 25.5 feet.	This alternative is similar to Plan 6A, except that the channel would be deepened to 28 feet instead of 25.5 feet, and four utilities would be relocated. The deepened channel would allow vessels to load to the Great Lakes System draft of 25.5 feet.
1. National Economic Development									
2. Beneficial Impacts:									
(1) Total Annual Benefit	\$17,605,000	Not evaluated.	\$17,605,000	\$17,605,000	Not evaluated.	\$ 2,405,400	\$2,098,500	\$8,915,600	\$9,745,100
3. Adverse Impacts									
(1) Total Investment Cost - Traditional Cost Allocation 1/									
(a) Federal	\$5,000,000	\$16,251,400	\$20,341,100	\$20,341,100	\$21,309,800	\$27,661,100	\$12,551,200	\$ 16,068,700	\$ 23,739,900
(b) Non-Federal	\$5,000,000	\$16,251,400	\$20,341,100	\$20,341,100	\$21,309,800	\$76,795,300	\$60,167,400	\$233,435,600	\$261,770,000
Total	\$10,000,000	\$32,502,800	\$40,682,200	\$40,682,200	\$42,619,600	\$104,456,400	\$72,718,600	\$246,501,200	\$295,509,900
(2) Annual Charges - Traditional Cost Allocation 2/									
(a) Federal	\$395,900	\$1,304,000	\$1,645,200	\$1,645,200	\$1,699,800	\$2,164,200	\$ 982,000	\$ 1,593,800	\$ 2,530,600
(b) Non-Federal	\$395,000	\$1,304,000	\$1,645,200	\$1,645,200	\$1,699,800	\$3,844,300	\$3,225,500	\$18,271,600	\$18,623,500
Total	\$790,900	\$2,608,000	\$3,290,400	\$3,290,400	\$3,399,600	\$6,008,500	\$4,207,500	\$20,865,400	\$21,154,100
(3) Total Investment Cost - Proposed 1/									
(a) Federal	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	2/	\$ 0	\$ 0
(b) Non-Federal	\$5,000,000	\$16,251,400	\$20,341,100	\$20,341,100	\$21,309,800	\$27,661,100	\$12,551,200	\$33,435,400	\$61,770,000
Total	\$5,000,000	\$16,251,400	\$20,341,100	\$20,341,100	\$21,309,800	\$27,661,100	\$12,551,200	\$33,435,400	\$61,770,000
(4) Annual Charges - Proposed Cost Allocation 2/									
(a) Federal	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	2/	\$ 0	\$ 0
(b) Non-Federal	\$195,900	\$1,104,000	\$1,445,200	\$1,445,200	\$1,499,800	\$1,889,100	\$1,699,800	\$20,165,400	\$21,154,100
Total	\$195,900	\$1,104,000	\$1,445,200	\$1,445,200	\$1,499,800	\$1,889,100	\$1,699,800	\$20,165,400	\$21,154,100

SILVERCUMT IMPACTS

Table 68 - Summary of Effects for Alternative Plans Nos. 1 through 68 (Cont'd)

	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7
5. Economic Efficiency:							
(1) Net Annual Benefits	\$17,209,100 44.5	Plan 2 was eliminated from further consideration following completion of the cost estimate for this plan. This plan was not incrementally economically efficient than Plan 1. Thus, no further evaluation was conducted for this plan.	\$15,959,800 5.6	Plan 4 was eliminated from further consideration following completion of the cost estimate for this plan. This plan was not incrementally economically justified. Thus, no further evaluation was conducted for this plan.	\$-2,679,000 0.5	\$-11,249,800 0.4	\$-11,409,000 0.5
2. Environmental Quality							
a. Beneficial Impacts							
(1) Biological Impacts	None	None	None	2.8 acres created from bank cut loss. 12-11.	None	None	None
(a) Aquatic Habitat	None	None	None	None	None	None	None
(b) Benthic and Fishery Habitat	None	None	None	None	None	None	None
(2) Air Quality	Slight increase due to four vessels.	None	None	None	None	None	None
(3) Water Quality	None	None	None	None	None	None	None
(4) Port Savings	None	None	None	None	None	None	None
b. Adverse Impacts							
(1) Biological Impacts	Degradation during construction and maintenance dredging. Losses over version of 68 acres of aquatic habitat to terrestrial habitat (Otha 14).	None	None	None	None	None	None
(a) Aquatic Habitat	Degradation during construction and maintenance dredging. Losses over version of 68 acres of aquatic habitat to terrestrial habitat (Otha 14).	None	None	None	None	None	None
(b) Benthic and Fishery Habitat	Degradation during construction and maintenance dredging. Losses over version of 68 acres of aquatic habitat to terrestrial habitat (Otha 14).	None	None	None	None	None	None
(c) Terrestrial Area	Degradation during construction and maintenance dredging. Losses over version of 68 acres of aquatic habitat to terrestrial habitat (Otha 14).	None	None	None	None	None	None
(2) Air Quality	Slight decrease during construction and maintenance operations.	None	None	None	None	None	None
(3) Water Quality	Decrease during construction and maintenance operations.	None	None	None	None	None	None
3. Regional Economic Development							
a. Beneficial Impacts							
(1) Tax Revenue	Slight increase during construction.	None	None	None	None	None	None
(2) Employment/Labor Force	Slight increase during construction.	None	None	None	None	None	None
(3) Property Value and Tax Base	None	None	None	None	None	None	None
(4) Public Facilities and Services	None	None	None	None	None	None	None
(5) Industries and Commerce	Slight increase during construction.	None	None	None	None	None	None
(6) Employment of Farm Labor	None	None	None	None	None	None	None
(7) Resources	None	None	None	None	None	None	None
(8) Regional Growth	Amenable to desired regional growth.	None	None	None	None	None	None

Table 69 - Summary of Effects for Alternative Plans Nos. 1 through 68 (Cont'd)

	Plan 1	Plan 2	Plan 3A	Plan 3B	Plan 4	Plan 5A	Plan 5B	Plan 5C	Plan 68
2. Adverse Impacts									
(1) The Burgeoning	None		None	None		None	None	None	None
(2) Employment/Labor Force	Slight decrease due to fewer vessels.		Same as Plan 1.	Same as Plan 1.		Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(3) Property Values and Tax Base	None		None	None		Removal of minor amount of land from tax base.	Same as Plan 5A.	None	None
(4) Public Facilities and Services	Slight increase during construction.		Same as Plan 1.	Same as Plan 1.		Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(5) Business and Industrial Activity	None		None	None		Decrease in economic receipts on Cuyahoga River.	Same as Plan 5A.	None	None
(6) Displacement of Farms	None		None	None		None	None	None	None
(7) Harbored Resources	None		1,100 feet of breakwater removed.	5,000 feet of breakwater removed.		Removal of M&O Railroad Bridge No. 23 removed.	Removal of M&O Railroad Bridge No. 23 removed.	None	None
(8) Regional Growth	None		None	None		Alteration of city streets, buildings, and parking lots for interchange system.	None	None	None
4. Other Social Effects									
2. Beneficial Impacts:									
(1) Noise	Slight decrease due to fewer vessels.		Same as Plan 1.	Same as Plan 1.		Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(2) Aesthetic Values	None		None	None		None	None	None	None
(3) Community Cohesion	None		None	None		None	None	None	None
(4) Cultural Resources	None		None	None		None	None	None	None
(5) Vessel Safety	Significant increase.		Negative increase.	Same as Plan 3A.		None	None	None	None
(6) Recreational Opportunities	Reduced interference to small boats due to fewer vessels.		Same as Plan 1.	Same as Plan 1.		Slight increase due to fewer vessels.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.
3. Adverse Impacts									
(1) Noise	Slight increase during construction and maintenance activities.		Same as Plan 1.	Same as Plan 1.		Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(2) Aesthetic Values	Minor impact during construction.		Same as Plan 1.	Same as Plan 1.		Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(3) Community Cohesion	None		None	None		None	None	None	None
(4) Cultural Resources	None		West Pierhead Light house removed.	None		None	None	None	None
(5) Vessel Safety	None		None	None		None	None	None	None
(6) Recreational Opportunities	Increased interference with small boats in east basin.		None	None		Increased interference due to increased tonnage on Old River.	Same as Plan 5A.	None	None

1/ Based on June 1982 price levels. Includes lands and damages and interest during construction.

2/ Based on June 1982 price levels, 7-5/8 percent interest rate, and 30-year economic life.

3/ This alternative was funded for construction prior to October 1981 and, as such, cost-sharing is based on traditional cost allocation.

Table 70 - Summary of Effects for Alternative Plans Nos. 7a through 8b and Plan 10

PLAN DESCRIPTION	Plan 7a	Plan 7c	Plan 7d	Plan 7e	Plan 7f	Plan 7g	Plan 8a	Plan 8b	Plan 10
PLAN DESCRIPTION	This plan consists of completing the remaining portion of Cut No. 4. In addition, the new bank cut would be bulkheaded and the existing bulkheads immediately downstream of Cut No. 4 would be replaced. A savings in vessel transit time of 20 minutes would result.	This plan consists of new bank Cut No. 16 and replacing the existing Cleveland Union Terminal Bridge and Columbus Road Bridge with new bridges spanning the widened channel. In addition, the new bank cut would be bulkheaded. A savings in vessel transit time of 10 minutes would result.	This plan consists of new bank Cut No. 17 and 18 and bulkheading the existing M&N Railroad Bridge with a new transit time of 10 minutes would result.	This plan consists of new bank Cut No. 19 and bulkheading the existing new bank cut. A savings in vessel transit time of 15 minutes would result.	This plan consists of removing the Jefferson Avenue Bridge abutments, new bank Cuts Nos. 21 and 22, and bulkheading the new bank; and on a portion of west abutment, the vessel transit time; west breakwater, and expanded parking and restroom facilities. Total fisherman access provided is 1,600 linear feet.	This plan consists of providing fisherman access facilities on the titles on the assumed Cleveland Harbor west breakwater, the new north breakwater of Edgewater Marina; west breakwater, and expanded parking and restroom facilities. Total fisherman access provided is 5,725 linear feet.	This plan consists of providing fisherman access facilities on the titles on the assumed Cleveland Harbor west breakwater, the new north breakwater of Edgewater Marina; west breakwater, and expanded parking and restroom facilities. Total fisherman access provided is 5,725 linear feet.	This plan consists of providing fisherman access facilities on the titles on the assumed Cleveland Harbor west breakwater, the new north breakwater of Edgewater Marina; west breakwater, and expanded parking and restroom facilities. Total fisherman access provided is 5,725 linear feet.	This plan consists of providing fisherman access facilities on the titles on the assumed Cleveland Harbor west breakwater, the new north breakwater of Edgewater Marina; west breakwater, and expanded parking and restroom facilities. Total fisherman access provided is 5,725 linear feet.
SIGNIFICANT IMPACTS									
1. National Economic Development									
2. Beneficial Impacts:									
(1) Total Annual Benefits	\$501,200	\$1,251,700	\$706,900	\$436,800	\$369,100	\$225,800	\$124,800	\$446,400	None
3. Adverse Impacts:									
(1) Total Investment Cost - Traditional Cost Allocation $\frac{1}{2}$									
(a) Federal	\$ 247,000	\$35,587,600	\$27,751,300	\$1,909,200	\$ 175,000	\$ 44,000	\$225,000	\$ 794,000	None
(b) Non-Federal	\$423,000	\$1,750,600	\$1,225,300	\$1,581,500	\$ 215,000	\$3,856,000	\$311,000	\$606,000	None
Total	\$1,670,000	\$47,338,200	\$43,983,700	\$7,490,700	\$2,390,000	\$4,700,000	\$366,000	\$1,700,000	
(2) Annual Charges - Traditional Cost Allocation $\frac{1}{2}$									
(a) Federal	\$ 19,300	\$2,784,300	\$2,172,000	\$149,400	\$ 13,700	\$ 3,400	\$21,600	\$ 62,100	None
(b) Non-Federal	\$17,400	\$19,400	\$1,349,300	\$93,200	\$215,500	\$309,400	\$4,300	\$133,900	None
Total	\$36,700	\$3,703,700	\$3,441,300	\$742,600	\$239,200	\$313,000	\$25,900	\$196,000	
(3) Total Investment Cost - Proposed Cost Allocation $\frac{1}{2}$									
(a) Federal	\$ 0	\$ 0	\$ 0	\$ 0	3/	\$ 0	N/A	N/A	None
(b) Non-Federal	\$47,338,200	\$47,338,200	\$43,983,700	\$9,490,700		\$4,000,000			None
Total		\$47,338,200	\$43,983,700	\$9,490,700		\$4,000,000			
(4) Annual Charges - Proposed Cost Allocation $\frac{1}{2}$									
(a) Federal	\$ 0	\$ 0	\$ 0	\$ 0	3/	\$ 0	N/A	N/A	None
(b) Non-Federal	\$3,703,700	\$3,703,700	\$3,441,300	\$742,600		\$313,000			None
Total		\$3,703,700	\$3,441,300	\$742,600		\$313,000			
5. Economic Efficiency:									
(1) Net Annual Benefits	\$214,100	\$-2,452,000	\$-2,732,400	\$-305,800	\$139,900	\$-87,200	\$66,900	\$250,400	None
(2) B/C Ratio	1.8	0.3	0.2	0.6	1.6	0.7	2.2	2.3	None

Table 70 - Summary of Effects for Alternative Plans Nos. 75 through 88 and Plan 10 (Cont'd)

	Plan 76	Plan 77	Plan 78	Plan 79	Plan 80	Plan 81	Plan 82	Plan 83	Plan 84	Plan 85	Plan 86	Plan 87	Plan 88	Plan 89	Plan 90	
2. Environmental Quality																
g. Beneficial Impacts																
(1) Biological																
(a) Aquatic Habitat	0.2 acre created from bank cut No. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000	2.7 acres created from bank cut No. 16, 17 and 18.	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(b) Benthic and Fishery Habitat	Slight increase due to reduced transit.	Same as Plan 78.	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(2) Air Quality																
(a) Aquatic Habitat	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(b) Benthic and Fishery Habitat	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(c) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(d) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(e) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(f) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(g) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(h) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(i) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(j) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(k) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(l) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(m) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(n) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(o) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(p) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(q) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(r) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(s) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(t) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(u) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(v) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(w) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(x) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(y) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(z) Water Quality	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
3. Regional Economic Development																
g. Beneficial Impacts																
(1) Tax Revenues	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(2) Employment/Labor Force	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(3) Property Values and Tax Base	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(4) Public Facilities	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(5) Business and Industrial Activity	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(6) Replacement of Farm Land	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(7) Harbors and Resources	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(8) Regional Growth	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
g. Adverse Impacts																
(1) Tax Revenues	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(2) Employment/Labor Force	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(3) Property Values and Tax Base	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.	Same as Plan 5A.
(4) Public Facilities	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.
(5) Business and Industrial Activity	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(6) Replacement of Farm Land	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(7) Harbors and Resources	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(8) Regional Growth	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
g. Displacement Off																
(1) Tax Revenues	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(2) Employment/Labor Force	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(3) Property Values and Tax Base	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(4) Public Facilities	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(5) Business and Industrial Activity	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(6) Replacement of Farm Land	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(7) Harbors and Resources	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(8) Regional Growth	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
g. Relocation of																
(1) Tax Revenues	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(2) Employment/Labor Force	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(3) Property Values and Tax Base	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(4) Public Facilities	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None
(5) Business and Industrial Activity	None	None	None	None	None	None	None	None								

Table 7D - Summary of Effects for Alternative Plans Nos. 7B through 8B and Plan 10 (Cont'd)

	Plan 7B	Plan 7C	Plan 7D	Plan 7E	Plan 7F	Plan 7G	Plan 8A	Plan 8B	Plan 10
4. Other Social Effects									
5. Beneficial Impacts									
(1) Noise	None	None	None	None	None	None	None	None	None
(2) Aesthetic Values	None	None	None	None	None	None	None	None	None
(3) Community Cohesion	None	None	None	None	None	None	None	None	None
(4) Cultural Resources	None	None	None	None	None	None	None	None	None
(5) Vessel Safety	Slight increase.	Moderate increase.	Same as Plan 7C.	Slight increase.	Same as Plan 7E.	Same as Plan 7C.	Increased fishing opportunities.	Same as Plan 8A.	None
(6) Recreational Opportunities	None	None	None	None	None	None	None	None	None
6. Adverse Impacts									
(1) Noise	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	None
(2) Aesthetic Values	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.	None
(3) Community Cohesion	None	None	None	None	None	None	None	None	None
(4) Cultural Resources	None	Bridges Nos. 5 and 7 removed.	None	None	None	None	None	Facilitate public access to West Pier Head Lighthouse.	None
(5) Vessel Safety	None	None	None	None	None	None	None	None	Potential for accidents remains high.
(6) Recreational Opportunities	None	None	None	None	None	None	None	Internal channel between Edgewater Marina and Cleveland Harbor eliminated for all but smaller boats.	Fishing needs of area remain unmet.

1/ Based on June 1982 price levels. Includes lands and damages and interest during construction.

2/ Based on June 1982 price levels, 7-1/8 percent interest rate, and 5-year economic life.

3/ This alternative was funded for construction prior to 1 October 1981 and, as such, cost-sharing is based on traditional cost allocation.

Table 71 - Summary of Benefit-Cost Ratios for Alternative Plans Nos. 1 through 8B (1)

	Plan 1	Plan 2	Plan 3A	Plan 3B	Plan 4	Plan 5A	Plan 5B	Plan 6A	Plan 6B	Plan 7A	Plan 7B	Plan 7C	Plan 7D	Plan 7E	Plan 7F	Plan 7G	Plan 8A	Plan 8B
B/C Ratio	44.5	(2)	5.6	10.7	(3)	0.4	0.5	0.4	0.5	1.8	0.3	0.2	0.2	0.6	1.6	0.7	2.2	2.3

- (1) Based on June 1982 price levels, 7-5/8 percent interest rate, and 50-year economic life.
- (2) An economic evaluation was not conducted for Alternative Plan No. 2 because Alternative Plan No. 1 provided greater benefits (i.e., vessel operation during "all-weather" conditions versus vessel operation in "fair-weather" conditions only) for one-third the cost. Thus, Plan No. 1 was obviously more economically efficient than Alternative Plan No. 2.
- (3) An economic evaluation was not conducted for Alternative Plan No. 4 since incremental benefits to justify adding the "fair-weather" west entrance component to the "all-weather" east entrance component were obviously insufficient to economically justify the added increment (i.e., the savings in vessel transit time of 1 to 2 hours during calm weather conditions would not result in sufficient incremental benefits to justify an additional expenditure of approximately \$15 million).

the initial phase of that study. The initial phase of the Feasibility Study also determined that the most economical means for delivery of bulk cargo to Cleveland Harbor was by bulk cargo vessels. Since these conclusions remain relevant today, no further consideration was given to these non-structural plans during this Phase I Study).

In terms of trade-offs between the "no-action" and the 17 preliminary structural plans, the "no-action" plan would restrict delivery of bulk cargo at Cleveland Harbor to smaller and less efficient bulk cargo vessels. Further, because of inadequate channel depths, these vessels would be forced to navigate at less than the maximum system's draft of 25.5 feet. Bulk cargo vessels would also continue to experience delays at historically congested areas and would continue to be subjected to a high potential for vessel accidents. In addition, the "no-action" plan would not meet any of the needs of recreational fishermen in the Cleveland Harbor area. The "no-action" plan would, however, require no monetary investment and would preclude the potential for conflict with other proposed recreational uses of the harbor. The trade-offs for the 17 structural plans would be the converse of those for the "no-action" plan.

b. Trade-Off Analysis of Structural Plans.

Of the 17 preliminary structural plans, five plans (Plans 1, 2, 3A, 3B, and 4) involve modifications to the Lakefront Harbor for safe and efficient operation of 1,000-foot vessels. Plan 1 includes modifications to the east entrance only and Plans 2, 3A, and 3B include modifications to the west (main) entrance only. Plan 4 includes modifications to both entrances. Plans 1, 3A, and 3B provide an "all-weather" entrance (entrance suitable for 1,000-foot vessel operation with a maximum 30-knot wind and 8-foot wave from the west through northeast directions) while Plan 2 provides a "fair-weather" entrance only (entrance suitable for 1,000-foot vessel operation with a maximum 20-knot wind and 4-foot wave from the west through northeast directions). Plan 4 would provide both a "fair-weather" entrance at the existing west (main) entrance and an "all-weather" entrance at the existing east entrance. Plans 1, 3A, 3B, and 4 also provide adequate channel depths which would permit Class V to Class X vessels to enter the Lakefront Harbor loaded to the maximum system's draft of 25.5 feet.

Plans 5A and 5B, an authorized but uncompleted project, would modify the Old River navigation channel such that vessels up to 730 feet in length and 75 feet in beam could transit the navigation channel loaded to the maximum system's draft of 25.5 feet. The only difference between the two plans is that Plan 5A includes replacement of the B&O Railroad Bridge No. 23, whereas, Plan 5B includes provisions for a new connection and interchange system with Conrail trackage on the east side of the Cuyahoga River in-lieu-of the bridge replacement.

Plans 6A and 6B would deepen the Cuyahoga River navigation channel to 25.5 feet and 28 feet below LWD, respectively. By comparing the results of the economic evaluation for each plan with the existing 23-foot authorized depth, the optimum depth of the navigation channel can be determined.

Plans 7B through 7G, which include two authorized but incompletd projects, would modify the Cuyahoga River navigation channel at six historically restricted locations and would eliminate the delay encountered when vessels transit these areas. Only one plan was formulated to eliminate the delay at each site. Originally, additional plans were to be formulated at Sites 2 through 5 to eliminate the delay encountered when two vessels approach these areas from opposite directions. However, subsequent evaluation for Sites 3 through 5 indicated that there were not sufficient additional benefits to justify eliminating this additional delay. In addition, coordination with the mill owner adjacent to Site 2 indicated that they would oppose any plan to eliminate this additional delay since it would entail relocation of their mill or their unloading dock. Thus, only one plan was formulated at each site.

Plans 8A and 8B would provide additional recreational fishing facilities at Cleveland Harbor. Plan 8A was formulated under the assumption that the existing entrance to Edgewater Marina would be completely blocked off and that a new entrance would be provided into the west basin of Cleveland Harbor. Small-boats would use this new entrance to enter the west basin and would then enter Edgewater Marina through the existing gap in the west breakwater. Plan 8B assumed that the existing entrance to Edgewater Marina was only slightly modified to reduce wave energy entering the marina and continues to serve as the main entrance to Edgewater Marina. However, selection of the plan to recommend for construction, if economically justified, must await the results of the Section 107 Study for Edgewater Marina which will determine the feasibility of modifying Edgewater Marina and the extent of these modifications.

In devising the alternative plans, primary consideration was given to economic considerations, vessel safety considerations, potential adverse environmental impacts and the effects on wave activity in the Lakefront Harbor. From investigations performed as part of this Stage 2 study, there appears to be no serious adverse environmental impacts from any of the alternatives formulated. In addition, for the Lakefront Harbor modification plans, additional structural modifications were added to the plans, where necessary, to ensure that wave activity in the Lakefront Harbor did not increase above existing conditions. Therefore, the overriding considerations used to determine which alternatives would be carried forward into Stage 3 planning are economic efficiency and vessel safety.

28. RATIONALE FOR PLANS ELIMINATED FROM FURTHER STUDY (PLANS 2, 3A, 3B, 4, 6A, 6B, 7C, 7D, AND 7E).

As stated in the Trade-Off Analysis section above, the overriding considerations in choosing which alternatives warrant further study and which alternatives should be eliminated from further consideration are economic efficiency and vessel safety.

a. Lakefront Harbor Modification Plans (Plans 2, 3A, 3B, and 4).

Although Plans 3A and 3B have benefit/cost ratios above 1, and thus, exhibit economic feasibility, average annual net benefits for each plan are

significantly less than for Plan 1 (\$14,448,800 for Plan 3A and \$15,959,800 for Plan 3B vs. \$17,209,100 for Plan 1). In addition, because of the many obstacles in the vicinity of the west (main) entrance, the potential for vessel accidents is higher for Plans 3A and 3B than for Plan 1. Further, the stopping distance provided with these plans, although adequate, does not have the margin of safety inherent with the east entrance plan which includes a 4-mile long channel through the east basin. For these reasons, Plans 3A and 3B were eliminated from further consideration.

Plan 2 was eliminated from further consideration because its construction cost was about three times the cost of Plan 1 (\$15,100,000 vs. \$5,060,000). In addition, Plan 2 would provide significantly less net benefits than Plan 1 since Plan 2 was formulated as a "fair-weather" plan only and the plan would not provide deeper channel depths that would permit vessels to load to the maximum system's draft of 25.5 feet. Thus, Plan 2 is significantly less economically efficient than Plan 1 and was eliminated from further consideration.

Following the completion of the cost estimate for Plan 4, it was obvious that there were not sufficient incremental benefits available to incrementally justify adding a "fair-weather" west (main) entrance plan to the basic plan of providing an "all-weather" entrance at the existing east entrance (i.e., the savings in vessel transit time of 1 to 2 hours during calm weather conditions would not result in sufficient added benefits to justify an additional expenditure of about \$15 million). Therefore, since Plan 4 did not have incremental justification, it was eliminated from further consideration.

b. Cuyahoga River Modifications Plans (Plans 6A, 6B, 7C, 7D, and 7E).

Plans 6A, 6B, 7C, 7D, and 7E were eliminated from further consideration because they were not economically justified with B/C ratios of 0.4, 0.5, 0.3, 0.2, and 0.6 and average annual net benefits of -\$11,249,800, -\$11,409,000, -\$2,452,000, -\$2,732,400, and -\$305,800, respectively.

29. RATIONALE FOR PLANS WARRANTING FURTHER DETAILED STUDY (Plans 1, 7G, 8A, 8B, and 10)

a. Plan 1 - "All-Weather" East Entrance.

Plan 1 is economically justified with a B/C ratio of 44.5 and average annual net benefits of \$17,209,100. The plan would also provide safer entrance conditions for 1,000-foot vessels (and also for 1,100-foot vessels if such vessels enter the Great Lakes fleet) than any of the west (main) entrance plans. The reason for this is because the 4-mile long protected channel through the east basin would allow vessels to enter Cleveland Harbor at adequate entrance speeds to counteract the wind and wave forces acting on the vessel during storm conditions. Further, due to the absence at the east entrance of the many obstacles that are present at the west (main) entrance, the potential for vessel accidents would be less for Plan 1 than for any of the west (main) entrance plans. It should also be noted that the initial construction cost for Plan 1 (\$5,060,000) is significantly less than for any of the other Lakefront Harbor modifications plans considered. For these

reasons, it is concluded that Plan 1 warrants further, detailed study, and should be carried forward into Stage 3.

b. Plan 7G - Reduce River Congestion (Site 7).

Based on the economic evaluation conducted for this Stage 2 study, Plan 7G is not economically justified with a B/C ratio of 0.7 and average annual net benefits of -\$87,200. However, shipping interests at the 4 May 1982 workshop meeting indicated that numerous minor accidents occur at this site, but are not of sufficient magnitude to be reported to the Coast Guard. Even though each accident involves only minor damage, in total, they represent a significant amount of damage which may be sufficient to increase the B/C ratio above 1.0 for Plan 7G. It is, therefore, concluded that Plan 7G should be carried forward into Stage 3 planning in order to evaluate these potential additional benefits. If these additional benefits are sufficient to economically justify Plan 7G, additional detailed study on this plan will be conducted. However, if these additional benefits are not sufficient to justify Plan 7G, this plan would then be eliminated from further consideration.

c. Recreational Fishing Plans (Plans 8A and 8B).

Plans 8A and 8B are economically justified with B/C ratios of 2.2 and 2.3 and average annual net benefits of \$66,900 and \$250,400, respectively. In addition, both plans would contribute significantly to providing additional recreational fishing opportunities for residents of the Cleveland Harbor area who, due to their low incomes, cannot travel to neighboring counties to satisfy their recreational fishing needs. For these reasons, it is concluded that Plans 8A and 8B warrant further, detailed study. It should be noted, however, that selection of the plan to recommend for construction must await the results of the Section 107 Study for Edgewater Marina. This study was initiated in May, 1982 and is tentatively scheduled for completion in mid FY 85.

d. Plan 10 - "No Action".

As with any potential water resources project, the "no-action" or do-nothing plan is carried forward as an alternative course of action in the event that more detailed studies show structural and/or non-structural plans can not be implemented because of the absence of engineering, economic, environmental, financial, social, or political viability. Therefore, the "no-action" Plan 10 will be considered further, and will be used as the basis-of-comparison in evaluating the structural plans that warrant further, detailed study.

30. FUTURE ACTIONS ON AUTHORIZED BUT UNCOMPLETED PROJECTS AT CLEVELAND HARBOR (PLANS 5A, 5B, 7B, AND 7F)

a. Old River Modification Plans (Plans 5A and 5B).

Based on a reevaluation of the authorized but uncompleted improvements on the Old River navigation channel (Plans 5A and 5B), it appears that these improvements are no longer economically justified with B/C ratios of 0.4 and 0.5 and average annual net benefits of -\$3,603,100 and -\$2,609,000 for Plans 5A and 5B, respectively. Factors that contributed to this change

include reduced benefits due to the closing of several docks on the Old River and an increase in construction costs due to an increase in the total length of bulkheads that would have to be replaced for either plan. However, recent discussions with local interests have indicated that Ontario Stone Corporation is in the preliminary discussion stage with a company interested in exporting approximately 2 million tons of coal annually from their dock on the Old River. If this new business materializes, an additional benefit would accrue to the authorized project which preliminary calculations indicate may approach \$2.00 per ton, or \$4 million annually. These additional benefits would be sufficient to increase the B/C ratio for Plan 5A to about 1.1 and the B/C ratio for Plan 5B to about 1.3. It is, therefore, concluded that, although current traffic volume on the Old River is insufficient to economically justify construction of either Plan 5A or 5B, potential additional traffic may be sufficient to increase the B/C ratio to above 1.0 for these plans. Thus, these authorized improvements should continue to be kept in the inactive category until such time as a final determination has been made on this new business. If this new business materializes, construction of either plan would then be pursued under the existing construction authorization. However, if this new business does not materialize, these improvements would then become candidates for deauthorization. It is also concluded that no further consideration of either plan is warranted as part of this Phase I Study.

b. Plan 7B - Reduce River Congestion (Site 2).

Plan 7B, an authorized but uncompleted project on the Cuyahoga River navigation channel, continues to be economically justified with a B/C ratio of 1.8 and average annual net benefits of \$214,100. However, local interests, who are responsible for a significant portion of the cost of this plan, have stated that they wish to keep this project in its present inactive status until final Federal legislation is passed on new cost-sharing methods for commercial navigation projects (see Exhibit G-5 in Appendix G). Local interests have also stated that the Cereal Food mill is presently in a state of disrepair and may be closed down in the future, although the mill owner disputes this statement. If this mill is closed, it would significantly lower the non-Federal cost of this project since the ship unloading building would not have to be relocated and there would be no need to bulkhead the portion of bank Cut No. 4 opposite their property. It is, therefore, concluded that this authorized but uncompleted project should remain in its present inactive status until final Federal legislation is passed on cost-sharing for commercial navigation projects and the ultimate disposition of the Cereal Food's mill is known. It is also concluded that no further consideration of this plan is warranted as part of this Phase I Study.

c. Plan 7F - Reduce River Congestion (Site 6).

Plan 7F, an authorized but uncompleted project on the Cuyahoga River navigation channel, continues to be economically justified with a B/C ratio of 1.6 and average annual net benefits of \$139,900. In addition, because Conrail Bridge No. 14 would not be replaced, related real estate problems associated with the bridge replacement would no longer be a factor. It is, therefore, concluded that this project should be reclassified to the active

category and be constructed under its original authorization. The project's perspective local sponsor, the Cleveland Port Authority, is currently preparing a letter requesting that this proposed action be undertaken. It is further concluded that no further consideration of this plan is warranted as part of this Phase I Study.

31. RATIONALE FOR CANDIDATE NED PLAN(S) AND EQ PLAN(S)

In selecting the candidate National Economic Development (NED) Plan(s), candidate plans must not only satisfy the planning objectives and evaluation criteria, they must also maximize net benefits. The plan that best fulfills these criteria is Alternative Plan No. 1, the "all-weather" east entrance plan, with average annual net benefits of \$17,209,100. It should be noted, however, that based on the results of Stage 2 planning, the ultimate recommendation of this Phase I study would be to implement Plan 1 and either Plan 8A or 8B. In this case, the final NED plan would be the recommended plan since both Plan 8A and 8B are economically efficient with average annual net benefits of \$66,900 and \$250,400, respectively, which would be added to those for Plan 1 (i.e., the final recommended plan would have average annual net benefits of \$17,276,000 or \$17,459,500 depending upon whether Plan 8A or 8B was selected). Thus, although Plan 1 is currently designated the candidate NED Plan, this designation may change in Stage 3, if the final recommended plan includes Plan 1 and either Plan 8A or 8B since the recommended plan would have higher average annual net benefits than Plan 1.

Recognizing that environmental quality has both natural and human manifestations, the EQ Plan addresses the planning objectives in a way which emphasizes aesthetic, ecological, and cultural contributions. Beneficial EQ contributions are made by preserving, maintaining, restoring or enhancing the significant cultural and natural environmental attributes of the study area. Developing an EQ Plan involves combining study specific measures together which best address the EQ objectives. EQ plans should not have adverse impacts which override their positive preservation and enhancement features. This means that candidate EQ Plans must make net positive contributions to the components of the EQ account.

Based on the results of this Stage 2 investigation, the plans that best fulfill these criteria are Plans 2, 3A, 3B, and 4, primarily because they include a fishery habitat development area as a plan component. This habitat area would provide significant fishery benefits in an area where the existing habitat has been seriously degraded due to past commercial and industrial development. However, as previously discussed, these plans have been deleted from further consideration due to economic and/or vessel safety considerations. It is, therefore, proposed that the addition of a fishery habitat development area for Plans 8A and 8B be investigated in Stage 3, as a means of enhancing the potential for fishing opportunities opposite the new recreational fishing access areas.

32. LOCAL RESPONSE TO STAGE 2 EVALUATION OF ALTERNATIVES

On 4 May 1982, a commercial navigation workshop meeting was held with representatives of the Lake Carriers Association, various shipping companies,

various dock owners, the Chessie System, the U.S. Coast Guard, the U.S. Fish and Wildlife Service, the city of Cleveland, the Cleveland Port Authority, and the Ohio Department of Natural Resources. At this meeting, participants expressed support for continuation of the study into Stage 3 planning. They also expressed their support for carrying forward Plans 1, 7G and 10, eliminating Plans 2, 3A, 3B, 4, 6A, 6B, 7C, 7D, and 7E from further consideration, keeping authorized Plans 5A or 5B, and 7B in the inactive category and placing authorized Plan 7F in the active category, as previously discussed. Summary minutes of this meeting are provided as Exhibit G-5 in Appendix G.

In regards to the recreational fishing plans (Plans 8A and 8B), the U.S. Fish and Wildlife Service expressed their support for carrying these plans forward into Stage 3 planning in their letter of 3 June 1982 (Exhibit H-2 in Appendix H) and during verbal conversations with the District. The Ohio Department of Natural Resources also expressed their support for carrying forward Plans 8A and 8B into Stage 3 planning during a telephone conversation with District personnel on 17 June 1982. At that time, they also reiterated their intention to act as the recreational fishing project's local sponsor.

Subsequent to completion of Stage 2 plan formulation and evaluation studies, Republic Steel Corporation requested that the Corps investigate the feasibility of deepening the turning basin on the Cuyahoga River from its present 18-foot depth to 23 feet (see Exhibit F-14 in Appendix F). Presently, self-unloading vessels (which unload from the stern) destined for Republic's up-river iron ore dock approach the dock bow first and start to unload their cargo. However, because the upstream bridge (Bridge No. 21) prohibits the vessel from moving upstream such that the stern mounted unloading boom can reach the upstream limits of the iron ore storage pile, these vessels must partially unload their cargo, back down to the turning basin, turn around, and then proceed back to the dock stern first in order to discharge the remainder of their cargo. If the turning basin was deepened to 23-feet, this extra vessel movement would not be necessary since the vessel could turn around during its' upstream transit and approach the dock stern first initially, resulting in a savings of 1-2 hours in vessel unloading time. It is, therefore, proposed that an additional alternative to deepen the turning basin to 23-feet be formulated and evaluated during Stage 3 planning (designated Plan 11), in addition to Stage 3 studies on Plans 1, 7G, 8A, 8B, and 10.

SECTION VI

STUDY MANAGEMENT

The purposes of this section are to provide an outline of the principal activities needed to complete the Reformulation Phase I General Design Memorandum, the methodologies to be used, to describe the contemplated public involvement and coordination activities, and to provide information on the study schedule and estimated costs for the remainder of the Phase I study. The primary study goal in Stage 2 has been to evaluate a wide range of alternative plans that would satisfy the planning objectives with the purpose of reducing the number of alternatives for further consideration. The evaluation to this point in time indicates that there are four preliminary structural plans - Plans 1, 7G, 8A, and 8B, and the "No Action" plan (Plan 10), that warrant further, detailed study in Stage 3. In addition, local interests have requested that an additional plan to deepen the turning basin to 23 feet (Plan 11) be formulated and assessed in Stage 3. The management plan presented herein assumes that these five structural plans, or some variation thereof, and the "No-Action" plan warrant further consideration.

33. STAGE 3 METHODOLOGY

The emphasis in Stage 3 will be placed on: refining the designs, quantities and cost estimates for Plans 1, 7G, 8A, 8B, and 11; refining the benefit analysis and economic evaluation for these plans; updating the environmental assessment for these plans; and developing mitigation plans to mitigate for unavoidable adverse environmental impacts. In addition, a Preliminary and Final 404 (b) (1) Evaluation and Draft and Final Environmental Impact Statement supplements will also be prepared. The 404 (b) (1) Evaluation will assess the effects of the placement of dredged and/or fill material into waters of the United States. The EIS supplement will update the EIS prepared for the 1972-1976 Feasibility Study to reflect current plans under consideration.

Of particular importance during Stage 3 planning is refinement of the entrance and interior channel depth requirements for Plan 1, a determination of whether or not dredged material is suitable for open-lake disposal for Plans 1, 7G, and 11 and alternate economic analyses that will be conducted for Plan 1 to determine the effect of various study assumptions on project feasibility. As previously discussed, two variables (underkeel clearance and vessel roll) used in estimating required channel depths during Stage 2 were provided by experienced vessel masters based upon their subjective evaluation of these two factors. Since these factors are critical to the determination of required channel depths, it is proposed that a study be conducted during Stage 3 by a Naval Architect/Marine Engineer to further define these two variables. This information would then be used to refine the entrance and interior channel depth requirements for Plan 1.

As discussed in Section III of the Main Report, it has been assumed for Stage 2 studies that all dredged material is polluted and would be placed in Dike Site 14. A sediment sampling/testing program was originally scheduled in

Stage 3 to verify this assumption. However, as a part of the District's annual maintenance program at Cleveland Harbor, dredged sediments are analyzed once every five years to determine their pollutional characteristics. Since the last sediment testing program was in 1977, the next testing program is scheduled to be completed in the summer of 1982. Information from this testing program will be sufficient to determine whether or not dredged material from Plans 1, 7G, and 11 is suitable for open-lake disposal. Therefore, to avoid duplication of effort and unnecessary expense, a sediment/sampling program will not be conducted as part of this Phase I study.

As discussed in Section III of the Main Report, benefits credited to various alternative plans during Stage 2 were developed under the assumptions that: (1) vessel operating draft is based on low water conditions (i.e., LWD); and (2) shippers load their vessels based on safe operating drafts (i.e., 22.5 feet relative to LWD for Plan 1 for existing conditions) which includes an additional depth of water to accommodate design storm-induced vessel motion. Since low water conditions and the design storm occur infrequently, alternate economic analyses, which assume long-term average lake levels and/or calm weather conditions (which permit vessel loadings up to 25.5 feet relative to LWD), will be conducted in Stage 3. The purposes of these alternate economic analyses are to determine the effect of various study assumptions on project feasibility and to provide sufficient information in the Final Phase I GDM Report to satisfy independent reviewers as to the economic viability of possible project improvements under a wide range of reasonable assumed vessel operating conditions.

The Study Flow Network (CPM) showing the activities involved in the remainder of this Phase I study is presented on Exhibit I-1 of Appendix I. With reference to the CPM, the future involvement of the interdisciplinary team in the remaining Phase I effort is as follows:

a. Coastal.

Contract work consists of a contract with a Naval Architect/Marine Engineer to investigate required underkeel clearance for bulk cargo vessels and to define vessel roll as a function of wave action. This information will then be used to refine entrance and interior channel depth requirements for Plan 1. In-house effort involves about 3 man-months to monitor the contract, refine the channel depth requirements and prepare the Draft and Final Phase I reports.

b. Engineering Design.

Design work includes: refine the designs for the pedestrian bridge and safety platforms included in Plan 8B (2 man-months); refine the bulkhead designs for Plans 7G and 11 (1 man-month); and preparation of the Draft and Final Phase I reports (1-1/2 man-months) - totalling about 4-1/2 man-months of in-house effort.

c. Geotechnical.

About 4 man-months of in-house effort will be required to prepare a material survey (1/2 man-month); establish soil parameters to be used in the design of

new bulkheads for Plans 7G and 11 (1-1/2 man-months); and preparation of the Draft and Final Phase I reports (2 man-months).

d. General Engineering.

The work involved includes: preparation of the final cost estimates for Plans 1, 7G, 8A, 8B, and 11 (2 man-months); and 1-3/4 man-months to prepare the Draft and Final Phase I reports for a total of 3-3/4 man-months of in-house effort.

e. Environmental.

Contract work consists of a contract with the USF&WL Service to complete the F&WL Coordination Act activities and conduct limited fisheries baseline studies in the vicinity of Plans 7G and 11. The in-house effort involves about 2 man-months

to prepare the Draft 404 (b) (1) Evaluation and Draft EIS supplement; 1 man-month to prepare the Final 404 (b) (1) Evaluation and Final EIS supplement; and 3-1/2 man-months to monitor the Coordination Act work and provide input for the Draft and Final Phase I reports. Total environmental in-house effort is 6-1/2 man-months. (NOTE: Because plans warranting further, detailed study will not impact on culturally significant resources, no additional cultural resources studies will be conducted in Stage 3. In addition, no further environmental baseline studies are planned in Stage 3 for Plan 1, since Plan 1 would not have a significant adverse impact on the environment.)

f. Economics.

Economics work includes: refine recreational fishing demand analysis (1/2 man-month); refine benefit analysis (including fleet and tonnage forecast updates) and economic evaluation for Plans 1, 7G, 8A, 8B, and 11 (2 man-months); conduct sensitivity analyses for Plans 1, 8A and 8B (1 man-month); and preparation of the Draft and Final Phase I reports (2-1/2 man-months) - totalling 6 man-months of in-house effort.

g. Real Estate.

The real estate appraisal for Plans 7G, 8A, 8B, and 11 will be conducted over a 2-month period by North Central Division.

h. Drafting.

About 6 man-months of in-house effort will be required to prepare visual aids for the public meetings and workshops, and graphic displays for the Draft and Final Phase I reports.

i. Word Processing.

About 4 man-months of in-house effort will be required to type information packets for the public meetings and workshops and to type the Draft and Final Phase I reports.

j. Reproduction.

Reproduction services will be required to print the Preliminary 404 (b) (1) Evaluation and the Draft and Final Phase I reports.

k. Program Development.

About 2 man-months of in-house effort will be required to prepare budgetary and appropriate Intensive Management documents.

1. Project Management and Planning.

The study manager is expected to spend approximately 50 percent of his time on Stage 3 activities primarily in coordinating efforts of the interdisciplinary team, preparation of materials for public meetings and workshops, coordination with other agencies and local interests and report preparation. Including planning supervision, this in-house effort totals 19 man-months.

34. PUBLIC INVOLVEMENT AND COORDINATION FOR STAGE 3

A technical workshop meeting with recreational fishing interests (primarily USF&WL Service and ODNR) will be held in the 1st Quarter of FY 83 to review Plans 8A and 8B and to refine the formulation of these plans. A second technical workshop meeting with local interests is also scheduled for the 3rd Quarter of FY 83 to review the refined designs for these plans and for Plans 1, 7G, and 11. In addition, close coordination will be maintained with principal study interests (ODNR, USF&WL Service, Cleveland Port Authority, shipping companies, dock operators, U.S. Coast Guard, etc.) throughout Stage 3 to obtain their input as the study progresses. Further, two public meetings will be held with the general public to keep them informed on the study progress and to solicit public comment. The first meeting will be held in the 1st Quarter of FY 83 to review the results of Stage 2 planning. The final public meeting will be held in the 3rd Quarter of FY 84 to present the findings of the Phase I study.

35. REFORMULATION PHASE I GDM SCHEDULE

The milestone dates shown on the CPM are the same as the latest approved study schedule. From the CPM, the Draft Phase I, including Draft EIS supplement, is scheduled for submittal to North Central Division in November 1983 (MS-26) and the Final Phase I GDM, including Final EIS supplement, in July 1984 (MS-30).

36. SCHEDULE OF MAJOR ACTIVITIES THROUGH CONSTRUCTION

The schedule for the major activities, assuming the final recommendation of this Phase I study is to implement a harbor modification plan, is shown on Exhibit I-2 in Appendix I. As indicated, following completion of the Phase I GDM in FY 84, the report would be sent forward for Washington level review and Congressional authorization. The Phase II GDM (final design document) would then be initiated upon receipt of study funds and is currently scheduled for completion by the end of FY 88. Plans and Specifications would follow, with initiation of construction projected to start in FY 90.

SECTION VII

CONCLUSIONS

The primary purpose of this section is to provide a summary of the significant conclusions reached during Stage 2 of this Phase I study.

37. CONCLUSIONS

Cleveland Harbor, OH, is located on the south shore of Lake Erie, at the mouth of the Cuyahoga River, approximately 176 miles southwest of Buffalo, NY, and 96 miles east of Toledo, OH. The harbor includes a breakwater protected Lakefront Harbor and an Inner Harbor consisting of improved navigation channels on the Cuyahoga River and Old River. The harbor area is shown on Plates 1 and 2 in Appendix J, "Plates."

Cleveland Harbor accommodates the waterborne movement of bulk and general cargo to and from the city of Cleveland and inland portions of the State of Ohio, and adjacent States. During the 10-year period, 1969 to 1978, an average of about 20,400,000 net tons of cargo entered the harbor and about 600,000 net tons of cargo were shipped from the harbor, ranking it as one of the major harbors on the Great Lakes. Vessel movement of bulk iron ore, limestone, sand and gravel, and salt accounted for about 92 percent of the total cargo. The configuration of the breakwaters and navigation channels, however, limit the size and effective utilization of the vessels which can move these commodities. Significant transportation savings could be realized if the harbor were modified to permit the use of larger and/or more efficient use of existing sized vessels.

The primary water resources needs for which a solution is sought under the Cleveland Harbor study authority are to move bulk cargo more efficiently and economically through Cleveland Harbor and to provide for unfulfilled recreational fishing needs in the Cleveland Harbor area. As possible solutions to addressing these needs, 20 preliminary structural alternatives and one preliminary non-structural alternative were identified during the initial phase of the Stage 2 investigation in addition to the "No Action" plan. Of the 20 structural alternatives developed, four plans (Plans 5A, 5B, 7B, and 7F) were previously authorized but uncompleted projects on the Old and Cuyahoga River navigation channels.

Initial evaluation and assessment of the 21 preliminary alternatives, in terms of their contributions to the planning objectives and accounts, indicated that four plans (Plans 3C, 3D, 7A, and 9) should be eliminated from further evaluation due to technical and/or economic considerations.

Additional evaluation and assessment of the 17 remaining alternatives indicated that:

a. Alternative Plans 1 ("All-Weather" East Entrance), 7G (Reduce River Congestion - Site 7), 8A (Recreational Breakwater Fishing - Edgewater Marina Breakwater), and 8B (Recreational Breakwater Fishing - West Breakwater) in addition to the "No-Action" Plan 10 warranted further, detailed study in Stage 3.

b. Alternative Plans 2, 3A, 3B, 4, 6A, 6B, 7C, 7D, and 7E should be eliminated from further consideration due to vessel safety and/or economic considerations.


c. Alternative Plans 5A and 5B, previously authorized but uncompleted improvements on the Old River navigation channel, were not economically justified in light of present traffic volumes. However, additional benefits from potential new coal traffic may be sufficient to increase the B/C ratio for either plan to above 1.0. It was, therefore, concluded that these authorized improvements should be kept in the inactive category until a final determination has been made on this new business. It was also concluded that no further consideration of either plan was warranted as part of this Phase I Study.

d. Alternative Plans 7B and 7F, previously authorized but uncompleted improvements on the Cuyahoga River navigation channel, remain economically justified in light of present conditions and should be constructed under their present authorization. It was also concluded that no further consideration of these plans was warranted as part of this Phase I study.

Subsequent to completion of Stage 2 plan formulation and evaluation studies, local interests requested that an additional plan to deepen the existing turning basin on the Cuyahoga River to 25 feet (designated Plan 11) be formulated and evaluated in Stage 3. It was therefore concluded that an additional plan to deepen the turning basin to 23 feet should be formulated and assessed during Stage 3 planning, in addition to Stage 3 studies on Plans 1, 7G, 8A, 8B, and 10.

SECTION VIII RECOMMENDATIONS

I recommend that the District proceed with a Stage 3 level investigation and prepare a Final Reformulation Phase I General Design Memorandum for the Cleveland Harbor Study.


ROBERT R. HARDIMAN
Colonel, Corps of Engineers
District Engineer

REFERENCES

1. Doxiadis Associates International. 1971. The Northern Ohio Urban System Research Project, Existing Conditions in Downtown Cleveland, A First Report (Report No. 9).
2. Fenneman, N. M. 1938. Physiography of the Eastern United States. McGraw-Hill Book Company, Inc. 714 pp.
3. Garlauskas, A. B. 1974. Water Quality Baseline Assessment for Cleveland Area-Lake Erie: Volume 1; Synthesis, EPA 905/9-74-0005. Region 5, U. S. Environmental Protection Agency, Chicago, IL. 158 pp.
4. Hartley, R. P. 1968. Interim Summary of Cleveland Harbor Dredging Effect Investigation Cleveland Program Office. Federal Water Pollution Control Administration.
5. Hartley, S. M. and A. R. Van Vooren, 1977. The Fishing Potentials, Special Management Areas, and their Interactions with Dredge Spoil Sites in Lake Erie. Ohio Department of Natural Resources, Division of Wildlife Coastal Zone Management Program. 308 pp.
6. Havens and Emerson Company, Ltd. 1968. Cleveland, OH Master Plan for Pollution Abatement. Technical Report, Part 2.
7. Musgrave, D. K. and D. M. Holloran. 1980. Soil Survey of Cuyahoga County, OH. Department of Agriculture, Soil Conservation Service. 223 pp.
8. Northeast Ohio Regional Sewer District. 1982. (Personal Communication with Mr. Dale Patrick).
9. Ohio Department of Natural Resources. 1972. Northeast Ohio Water Plan, Main Report.
10. Ohio Environmental Protection Agency. 1979. Ohio Air Quality - 1979, 127 pp.
11. Ohio Environmental Protection Agency. 1981. (Personal Communication with Mr. Robert Wysenski).
12. Ohio Geological Survey, 1920. Geologic Map of Ohio, First Printing.
13. Port of Cleveland. 1980. Port of Cleveland, Cleveland, OH. 40 pp.
14. Port of Cleveland. 1981. The Port of Cleveland on the North Coast 1981-1982. Port of Cleveland, OH. 22 pp.
15. Pliodzinkas, A. J. 1979. A General Overview of Lake Erie's Nearshore Benthic Macroinvertebrate Fauna. Center for Lake Erie Area Research, Ohio State University, Columbus. Report 126. 83 pp.

16. Richards, R. P. 1981. Chemical Limnology in the Nearshore Zone of Lake Erie Between Vermilion, OH, and Ashtabula, OH, 1978-1979: Data Summary and Preliminary Interpretations. Final Report on the Lake Erie Nearshore Study. (Research Report supported by grants from the U. S. Environmental Protection Agency and the Center for Lake Erie Area Research at Ohio State University). 86 pp.
17. Stour, W., L. Ves Steeg, and C. F. Lamb. 1943. Geology of Water in Ohio. Ohio Geological Survey, Bulletin No. 44.
18. U. S. Army Corp of Engineers. 1975. Diked Disposal Facility Site No. 14 Lake Erie, Cleveland Harbor, Cleveland OH, Final Environmental Impact Statement. U. S. Army Engineer District, Buffalo, NY. 133 pp. plus Appendices.
19. U. S. Army Corps of Engineers. 1976. Cleveland Harbor, OH, Feasibility Report for Harbor Modifications. U. S. Army Engineer District, Buffalo, NY. 197 pp.
20. U. S. Army Corps of Engineers. 1978. Cleveland Harbor Navigation Project. Final Environmental Impact Statement. U. S. Army Engineer District, Buffalo, NY. 210 pp. plus Appendices.
21. U. S. Army Corps of Engineers. 1980. Cleveland Harbor, OH, Cuyahoga and Old Rivers Maintenance Dredging for FY 81 General Plan. U. S. Army District, Buffalo, NY.
22. U. S. Army Corps of Engineers. 1981. The Port of Cleveland, OH. Port Series No. 43 Revised 1981. U. S. Government Printing Office, Washington, DC. 58 pp. plus map.
23. U. S. Department of Commerce (National Oceanic and Atmospheric Administration, Environmental Data and Information Service, National Climatic Center). 1980. Local Climatological Data: Annual Summary with Comparative Data, Cleveland OH. 4 pp.
24. U. S. Department of Commerce (Bureau of the Census). 1980a. 1977 Census of Manufacturers Geographic Area Series - Ohio. U. S. Government Printing Office, Washington, DC. 76 pp. plus Appendices.
25. U. S. Department of Commerce, (National Oceanic and Atmospheric Administration, National Ocean Survey). 1981. United States Coast Pilot. Great Lakes: Lakes Ontario, Erie, Huron, Michigan, and Superior and St. Lawrence River. 547 pp.
26. U. S. Department of Commerce (Bureau of the Census). 1981a. Advance Reports: 1980 Census of Population and Housing. 44 pp.
27. U. S. Department of Commerce (Bureau of Economic Analysis). 1981b. 1980 OBERS BEA Regional Projections: Volume 3 Standard Metropolitan Statistical Areas. U. S. Government Printing Office, Washington, DC. 280 pp.

28. U. S. Department of Commerce (Bureau of Economic Analysis). 1981c.
1980 OBERS BEA Regional Projections: Volume 6, Region 3, Great Lakes.
U. S. Government Printing Office, Washington, DC. 142 pp.
29. U. S. Department of Commerce (Bureau of Economic Analysis). 1981d.
1980 OBERS BEA Regional Projections: Volume 1, Methodology, Concepts,
and State Data. U. S. Government Printing Office, Washington, DC. 166 pp.
30. White, A. B., M. B. Trautman, E. J. Foell, M. P. Kelty, and R. Gaby,
1975. Water Quality Baseline Assessment for Cleveland Area - Lake Erie.
Volume II - Fishes. EPA-905/9-75-001. USEPA, Chicago, IL. 181 pp.

END

DATE
FILMED

5-83

DTI