MOBILE HARBOR
SUPPLEMENTAL INFORMATION

MAY 1983

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SUPPLEMENTAL INFORMATION

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INTRODUCTION

1. Purpose and Scope. The purpose of this document is to provide additional information that will aid in the Chief of Engineers and Assistant Secretary of Army, Civil Works, decision with respect to the plan recommended in the 1980 Survey Report on Mobile Harbor. The scope of this document is limited to updating the economic analysis of the Recommended Plan as contained in the 1980 Survey Report; determining the feasibility of phased implementation of separable project features; and evaluating a transshipment facility proposed by the Alabama State Docks (ASD). On the basis of economic studies conducted to date as a part of Continuation of Planning and Engineering (CP&E), this document incorporates the following:

a. Changes in the number of foreign flag registry dry bulk carriers in the world fleet.
b. Changes in vessel operating costs.
c. Updated historic data to reflect actual conditions as a basis for projections.
d. Revised Panama Canal use costs to accurately reflect current conditions.
e. Revised unit costs and updated the Federal interest rate to current levels.

2. Additional economic analysis using the updated information was conducted for separable project features namely:
a. Turning Basin opoosite McDuffie Island.
b. Anchorage Area opposite McDuffie Island.
c. Channel Widening in the upper Harbor.
d. Passing Lane in the vicinity of the junction of the Main Ship Channel and the Theodore Ship Channel.
e. A 57-foot channel across the Mobile Bay bar and a 55-foot access channel to the transshipment facility.
f. Remaining costs/remaining benefits to full channel deepening and widening.

3. Other data, such as dredging quantities and project costs, have been refined for implementation of separable project features plus the transshipment facility. These have been calculated using recent hydrographic surveys and updated cost estimates. Estimates of cost of the transshipment facility were furnished by the Alabama State Docks.

4. Format. This Supplemental Information document consists of a summary document and an information appendix. The summary document contains background information, results of the economic analysis, and findings. The Economic Appendix contains detailed information supporting the economic analysis of phased implementation of Mobile Harbor Deepening to include the transshipment facility and 55-foot access channel.

BACKGROUND

5. Mobile Harbor Survey Report - October 1980. The Survey Report on Mobile Harbor Deepening was completed in October 1980, approved by the Board of Engineers for Rivers and Harbors on 18 March 1981 and forwarded by the Chief of Engineers to the Assistant Secretary of Army (Civil Works) on 18 November 1981. Since FY 1982 the study has been in the CP&E stage which is scheduled for completion in FY 1986.

6. The Recommended Plan in the Survey Report would modify the existing project for Mobile Harbor, Alabama, to provide deep-draft navigation improvements. The plan provides for deepening and widening existing channels to accommodate ocean-going bulk cargo vessels requiring 55-foot channel access to transport coal and iron ore and for the disposal of all maintenance dredged material from the existing and proposed project in the Gulf of Mexico. Dredged material from the proposed new entrance channel to Mobile Bay and the lower bay ship channel would also be placed in the Gulf while new work dredged material from the upper bay would be placed in a 1,710-acre confined disposal area on the shallow bay bottom adjacent to the Brookley Industrial Complex. Measures to mitigate the loss of wetlands and bay bottom productivity are included as part of the recommended plan. The Recommended Plan is depicted on Plate 1.

7. The cost of these modifications is estimated to be $447,718,000 based on October 1982 price levels. On the basis of traditional cost sharing, the non-Federal portion of the cost is estimated to be $39,633,000. Annualized costs at 7 7/8% interest rate and a 50 year project life are estimated to be $45,832,000. Benefits accruing to navigation and land enhancement are estimated to be $59,792,000 annually. The benefit-cost ratio is 1.3 based on data contained in the 1980 Survey Report.

8. Implementation, as envisioned in the 1980 Survey Report, consists of multi-staged construction of several separable features of the Recommended Plan which are incrementally justified and not dependent upon model studies for adequate impact assessment. These features could be implemented in an accelerated manner without suboptimizing or binding future action

to the completion of the Recommended Plan. These features were identified and discussed in the 1980 Survey Report as follows:

"The Recommended Plan presents a comprehensive guide for development of Mobile Harbor over the next 15 years (1980-95 time frame). In order to maintain efficiency and safety, separable early implementation features that should be considered include channel widening in the upper bay, a turning basin and anchorage area at the head of the bay, a passing lane in the central area of the bay and several environmental mitigation features to improve water circulation in the bay."

9. Phased Implementation. Following the guidelines in the 1980 Survey Report and concurrence with the Board of Engineers for Rivers and Harbors Report and Chief of Engineers Report, the separable project features for Mobile Harbor were placed into two categories for analysis. The first category, referred to as Phase I, consists of project features which could be designed and constructed in an accelerated manner. They are:

a. Construct a 1,500 foot turning basin opposite McDuffie Island.

b. Construct a 4,000 foot long anchorage area on the east side of the existing channel.

c. Construct a passing lane near the Theodore Channel.

d. Construct a 1,710 acre diked disposal area.

e. Widen the upper 4.2 miles of the channel to 650 feet.

f. Construction of mitigation measures.

10. The Phase I items are common to and an integral part of the Recommended Plan. In addition to those items contained in the Phase I plan, the Recommended Plan consists of the following project features, referred to as Phase II:

a. Channel deepening and widening to 55 feet by 550 feet from the mouth of the bay northward for approximately 27.0 miles.

b. Deepening and widening the entrance channel over the Mobile Bay Bar.

c. Gulf disposal of dredged material.

d. Construction of mitigation measures.

The Recommended Plan would provide for disposal of about 141.2 million cubic yards of new work material as well as all future maintenance material for a 50-year economic life.

11. Continuation of Planning and Engineering (CP&E). The first funds for CP&E were allocated in FY 1982. Subsequently, the Mobile Harbor Deepening Project was designated a "Fast Track" project on 1 March 1982 by the Deputy Commander, South Atlantic Division in an effort to obtain an expedited construction start. A Plan of Work (POW) was developed in June 1982 which established a schedule and management system to efficiently execute CP&E activities. Consistent with the recommendation contained in the 1980 Survey Report, the report of the Board of Engineers for

Rivers and Harbors, and the Chief of Engineers Report, CP&E studies are addressing the separable project features as a first order of priority.

12. The Alabama State Docks (ASD) approached the Mobile District in the summer of 1982 to discuss "phased" development of Mobile Harbor which would provide 55-foot channel access as soon as possible. The ASD envisioned a transshipment facility adjacent to a 55-foot channel near the mouth of Mobile Bay and have expressed their desire to have the feasibility of such a facility included in the CP&E studies of Phase I project features. At the same time the ASD reaffirmed its support for the Recommended Plan as the preferred plan for ultimate harbor development.

13. Alabama State Docks Transshipment Facility. Since completing the Survey Report in 1980, several significant events have occurred. These have caused the local sponsor, the Alabama State Docks, to seek phased implementation of the plan recommended in the 1980 Survey Report. The events are:

a. The $150 million McDuffie Coal Handling Plant, became operational in 1975 and has enjoyed excellent success. The McDuffie Plant increases the Port of Mobile's capacity to ship coal to approximately 24 million tons annually.

b. Interest in and demand for coal moving through the Port of Mobile have accelerated.

c. Clients and shippers continually press the Port of Mobile to provide a 55-foot channel access for the larger, more efficient vessels as 55-foot draft vessels are presently calling at McDuffie Island and leaving light loaded.

d. The $50 million in revenues from the State of Alabama's lease of bay bottoms for oil exploration are earmarked by state law for use in harbor development such as the transshipment facility.

e. The State Docks feels it must develop port facilities for 55-foot channel access as soon as practicable to capitalize on its $200 million investment and remain as a competitive port.

f. ASD consulting engineers have given very positive indications of financial and operational feasibility of a proposed transshipment facility located near the mouth of Mobile Bay.

14. The primary purpose of the transshipment facility would be to top off vessels which were loaded at McDuffie Island. The facility envisioned is a platform structure, 96X1120-feet, with moveable transloader. The location of the transshipment facility, as presently envisioned, would be adjacent to the main ship channel, just inside Mobile Bay north of Fort Morgan. Plates 2 and 3 show the relative location of the transshipment facility and a conceptual plan of the facility, respectively.

15. In summary, the implementation studies for the Recommended Plan in the 1980 Survey Report were designed so that work could be accomplished in separable units. The transshipment facility is compatible with the operational effectiveness of the other Phase I project features. The Phase II features would essentially be unchanged and consist of channel deepening to 55-feet and widening to 550-feet for the entire length of the bay. Implementation of the channel widening and deepening would complete the modification of Mobile Harbor as recommended in the 1980 Survey Report.

UPDATED EVALUATION AND ANALYSIS

16. General. An economic analysis was undertaken to determine the benefits which would accrue to implementation of the Full Development Plan as contained in the 1980 Survey Report using an updated data base and the current Federal interest rate. Additionally, the Phase I features including the transshipment facility, were analyzed to determine their incremental feasibility and collective overall feasibility. Updated project first costs were used for the Recommended Plan as well as revised cost estimates for each feature of the Phase I plan. Finally a general analysis of remaining costs/remaining benefits was conducted to determine the economic effects on Phase II features. More detailed information on the economic analysis is contained in the Economic Appendix.

17. Recommended Plan Benefits. The benefits associated with Mobile Harbor Recommended Plan result from the use of larger, more efficient vessels; reduced transit time to the existing turning basin; reduced in-port berthing charges and delays; reduced tug assistance; and land enhancement. The total savings are estimated to be $75,618,000 on an average annual basis. There would also be 1,047 acres of developable land of the 1,710 acre total created by the filling of the Brookley Disposal area with new work material. The land enhancement benefit is estimated to be equivalent to the least-cost alternative for creating such land. This is estimated to total $44,305,000. Annualized at 7 7/8% for a 50-year project life, the land enhancement benefit would be $3,586,000. Total average annual benefits to the Recommended Plan are estimated to be $81,298,000.

18. Phase I Project Feature Benefits. An analysis of the Phase I items was conducted to determine incremental feasibility of each feature. The results of benefit evaluations are as follows:

a. Transshipment Facility. The benefits would be the transportation savings in more efficient utiliztion of the capacity of large vessels. The average annual benefits are estimated to be $44,269,000.

b. Turning Basin. The benefits measure savings in hourly vessel operating costs, reduced tug assistance, and port fees by using a turning basin opposite McDuffie Island rather then the existing turning basin further upstream. The benefits would be $389,000 on an average annual basis for those vessels calling at McDuffie Island and nearby Tennessee Coal and Iron docks.

c. Anchorage Area. The benefits are reduced layberth charges, reduced in-port moving fees, and reduced anchorage times and delays in the Gulf of Mexico. An anchorage area opposite McDuffie Island and south of the turning basin would produce an estimated $2,500 per vessel savings for those vessels calling at McDuffie Island, $2,300 per vessel savings for grain vessels; and $97,400 annual savings from reduced fog delays. The sum total of benefits to the anchorage area is estimated to be $561,000. annually.

d. Combined Turning Basin/Anchorage Area. With the implementation of these two features adjacent to each other, there is a significant increase in time savings and benefits. The average annual benefits expected to accrue from the combination turning basin/anchorage area is $2,094,000.

e. Upper Channel Widening. The 4.2 miles of channel widening, in the 1980 Survey Report was reduced to 2.25 miles based on conferences with the Port of Mobile's Harbormaster concerning operational efficiency in the vicinity of McDuffie Island. The benefit to channel widening in the upper 2.25 miles of ship channel are savings from maintaining speed and reduced tug assistance while passing a docked vessel at the McDuffie Island Coal Handling Plant since a reduced speed is presently required. Average annual savings, or benefits, from channel widening are expected to be $4,998,000.

f. Turning Basin, Anchorage area, and Channel Widening. The combined benefits to construction and operation of a turning basin, anchorage area, and channel widening near McDuffie Island are estimated to be $5,456,000 on an average annual basis.

g. Passing Lane. Benefits which would accrue to a 2 mile segment of channel widened from 400 to 550-feet would be reduced delays for inbound and outbound traffic. These benefits are not estimated in this analysis because of an apparent low incidence of congestion, lack of an appropriate simulation model to document the nature and extent of the congestion problem, and a priority need for the remaining Phase I items.

h. Land Enhancement (Phase I). There would be 120 acres of fast-land created by disposal of new work material from construction of a turning basin, anchorage area, and channel widening. Based on an average least cost value to create land of $42,500 per acre, total benefits would be $5,100,000 or $411,000 on an average annual basis.

19. Recommended Plan Costs. The Recommended Plan to provide a 55X550-foot channel the length of Mobile Bay and a 57X700-foot

channel across the Mobile Bay Bar involves the dredging of approximately 141 million cubic yards of new work material. The estimated first cost is $447,718,000. The Traditional Federal/non-Federal cost sharing is as follows:

Federal	$408,055,000
Non-Federal	$ 39,663,000
Cash	($ 21,600,000)
Other	($ 18,053,000)
Total	$447,718,000

20. Phase I Plan Costs. The cost to construct Phase I consists of dredging approximately 34.0 million cubic yards of new work material for a turning basin, anchorage area, and 2.25 miles of channel widening at the 40-foot depth; a 57X700 foot channel across the Mobile Bay bar; a transshipment facility; and a 55-foot access channel to the facility. The total cost of Phase I is estimated to be $201,491,700. Apportionment of the incremental costs in accordance with traditional cost-sharing would be as follows:

Federal	$119,018,500
Non-Federal	$ 82,473,200
Total	$201,491,700

21. Benefit-Cost Ratio. The benefit-cost ratio for the Recommended Plan and Phase I plan is as follows:

50-Year Project Life @ 7 7/8%

	Benefits 1/	Costs	BCR
Full Development Plan	$81,298,000	$45,832,000	1.8
Phase I Plan	$50,136,000	$22,111,000	2.3

1/ Includes land enhancement.

22. Remaining Benefits/Remaining Costs. Remaining benefits would be the additional transportation savings from the use of the 55-foot channel over the 27 mile channel and land enhancement benefits from the creation of an additional 922 acres of fast land at the Brookley disposal site. The remaining costs include those for portions of dredging for the transshipment facility, deepening and widening the existing 40X400-foot channel to 55X550-feet from the transshipment facility to one-mile below the Interstate 10 tunnels, annual maintenance dredging, and navigation aids. The remaining costs and remaining benefits are calculated as follows for a 50-year project life and 7 7/8% interest rate.

23. Total remaining average annual costs are estimated to be $32,983,000 and remaining benefits are estimated to be $35,635,000 for a RC/RB ratio of 1.1.

LOCAL COOPERATION AGREEMENT

24. Local Sponsor. The Alabama State Docks Department was authorized under Title 33 of the Alabama Code which provides that "There shall be a state agency known as the Alabama State Docks Department....to promote, supervise, control, manage, and direct the State Docks and all other state lands within its jurisdiction." Further, Title 33 provides, "The State of Alabama may engage in, through the agency of the Alabama State Docks Department provided and designated by law, works of internal improvement, and of promoting, developing, constructing, maintaining and operating all harbors, seaports or riverports within state jurisdiction, including the acquisition or construction, maintaining and operating at seaports and riverports of harbor watercraft and terminal railroads, as well as all other kinds of terminal facilities."

25. Requirements. The items of local cooperation remain unchanged from those contained in the 1980 Survey Report in that the local sponsor will be required to agree to the following under traditional cost-sharing arrangements:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction and maintenance of the project 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 initial and subsequent disposal of dredged material, and including necessary retaining dikes, wiers, bulkheads, and embankments therefor, or the costs of such retaining works;

b. Hold and save the United States free from damages due to the construction and maintenance of the project not including damages due to the fault or negligence of the United States or its contractors;

c. Accomplish without cost to the United States all alterations and relocations of building, transportation facilities, storm drains, utilities, and other structures and improvements necessary for project purposes.

d. Provide and maintain without cost to the United States vessel berthing areas and local access channels;

e. Prohibit erection of any structure within 100 feet of the project channel as authorized;

f. Provide a cash contribution based on the final first cost allocated to special local benefits deriving from land enhancement due to landfill; and

h. Fulfill the requirements of non-Federal cooperation as specified in the terms of conditions of the Uniform Relocation Assistance and Real Property Acquistion Policy Act of 1970 (PL 91-646) approved 2 January 1971.

26. Status of Local Assurances. By letter dated July 7, 1982 the Alabama State Docks Department reaffirmed its full support for the project and its intent to provide financial participation in its construction at levels consistent with the Administration's deep draft navigation policy proposals, subject to Congressional action, and the Department's ability to meet these financial obligations. The Alabama State Docks Department has indicated their awareness and understanding of the financial responsiblity required for undertaking phased development of a deep-draft navigation project.

FINDINGS

27. General. In summary, the studies contained herein have demonstrated a definite need for 55-foot channel access to the Port of Mobile. The capacity of the McDuffie Coal Handling Plant compares favorably with Corps projections of up to 19.7 million tons in the year 2000. Additionally, the early need for 55-foot channel access for the larger, more efficient vessels is necessary in order to capitalize on the $200 million investment of the Alabama State Docks in upgrading facilities and construction of the McDuffie Coal Handling Plant. Thus, the concept of a transshipment facility located in Lower Mobile Bay was suggested by the Alabama State Docks as a part of continuing harbor development which could be implemented in a relatively short period of time. The preferred ultimate long-term development plan, however, continues to be a 55-foot channel the length of Mobile Bay as recommended in the 1980 Survey Report.

30. In the Continuation of Planning and Engineering (CP&E), the Mobile Harbor deepening project was divided into phases the first of which included a turning basin, anchorage area, passing lanes, channel widening in the upper reaches at the 40-foot depth and environmental mitigation measures. Based on the Alabama State Docks request, the transshipment facility and a 57X700-foot channel across the Mobile Bay bar, and a 55-foot access channel were included in Phase I. The Phase I plan is a plan which can be implemented in a relatively short period of time and is economically feasible. The Phase I plan also has the support of the local sponsor since it would permit the shipment of coal in deeper draft vessels from the Port of Mobile approximately seven years sooner than under full channel deepening conditions.

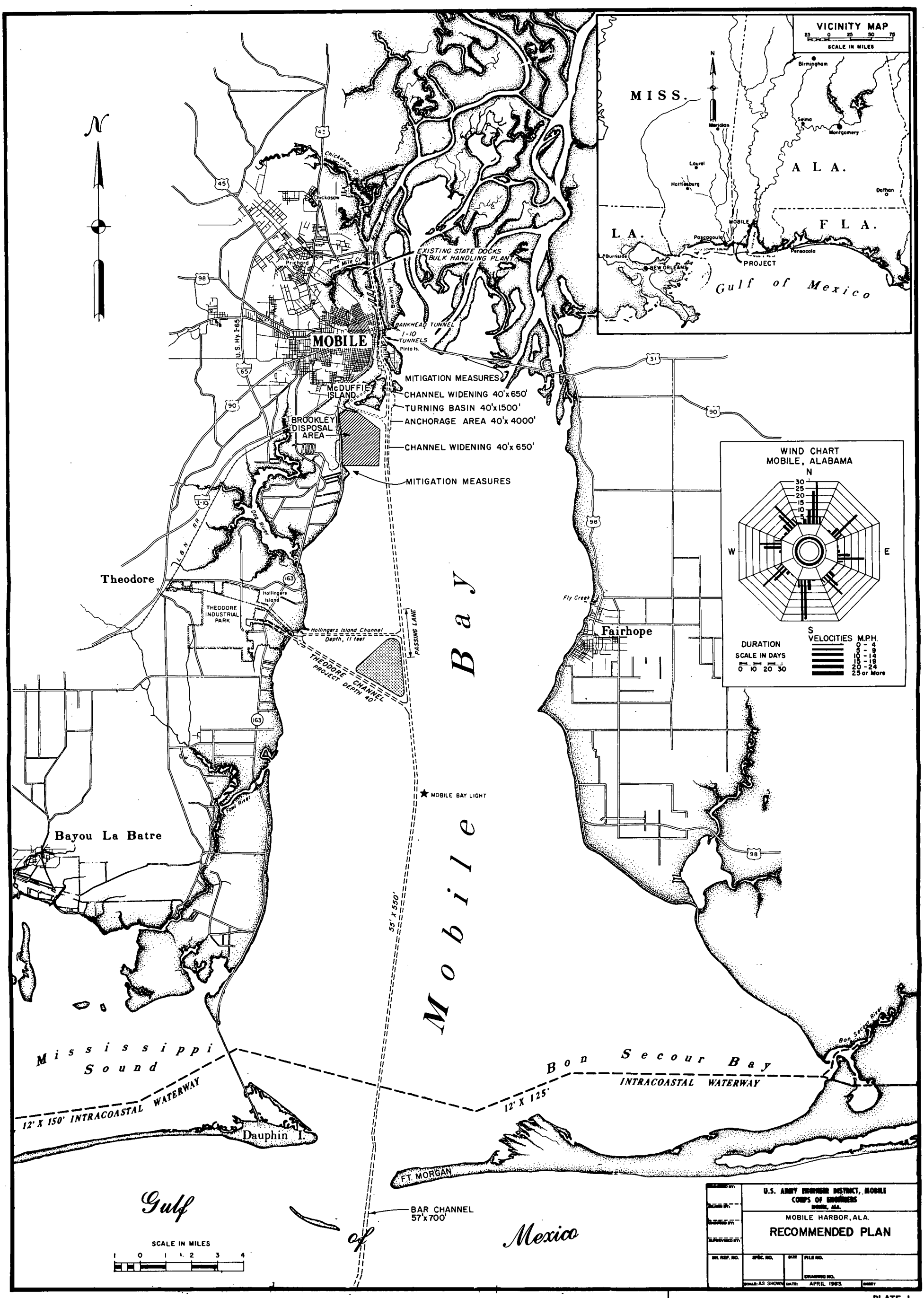

N
MOBILE
McDUFFIE ISLAND
BROOKLEY DISPOSAL AREA
EXISTING STATE DOCKS BULK HANDLING PLANT
BANKHEAD TUNNEL
I-10 TUNNELS
Pinto Is.
MITIGATION MEASURES
CHANNEL WIDENING 40'x650'
TURNING BASIN 40'x1500'
ANCHORAGE AREA 40'x 4000'
CHANNEL WIDENING 40'x 650'
MITIGATION MEASURES
Theodore
THEODORE INDUSTRIAL PARK
Hollingers Island
Hollingers Island Channel Depth, 11 feet
THEODORE CHANNEL PROJECT DEPTH 40'
PASSING LANE
MOBILE BAY LIGHT
55' X 550'
Fairhope
Fly Creek
Bayou La Batre
Mississippi Sound
12' X 150' INTRACOASTAL WATERWAY
Dauphin I.
Mobile Bay
Bon Secour Bay
12' X 125'
INTRACOASTAL WATERWAY
Bon Secour River
FT. MORGAN
BAR CHANNEL 57'x700'
Gulf of Mexico
SCALE IN MILES
VICINITY MAP
SCALE IN MILES
MISS.
ALA.
LA.
FLA.
Birmingham
Selma
Montgomery
Meridian
Laurel
Hattiesburg
Dothan
MOBILE
Pascagoula
Pensacola
Burnside
NEW ORLEANS
PROJECT
Gulf of Mexico
WIND CHART
MOBILE, ALABAMA
N
S
W
E
VELOCITIES M.P.H.
0 - 4
5 - 9
10 - 14
15 - 19
20 - 24
25 or More
DURATION
SCALE IN DAYS
0 10 20 30
U.S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
MOBILE HARBOR, ALA.
RECOMMENDED PLAN
APRIL 1983

PLATE I

MOBILE BAY

40 FT. x 400 FT. BAY CHANNEL
APPROXIMATELY 26 NAUTICAL MILES

TRANSSHIPMENT FACILITY

TURNING BASIN

DOCK

DAUPHIN ISLAND

FORT MORGAN

55 FT. x 700 FT. ENTRANCE CHANNEL
APPROXIMATELY 7.5 NAUTICAL MILES

N

NAUTICAL MILES

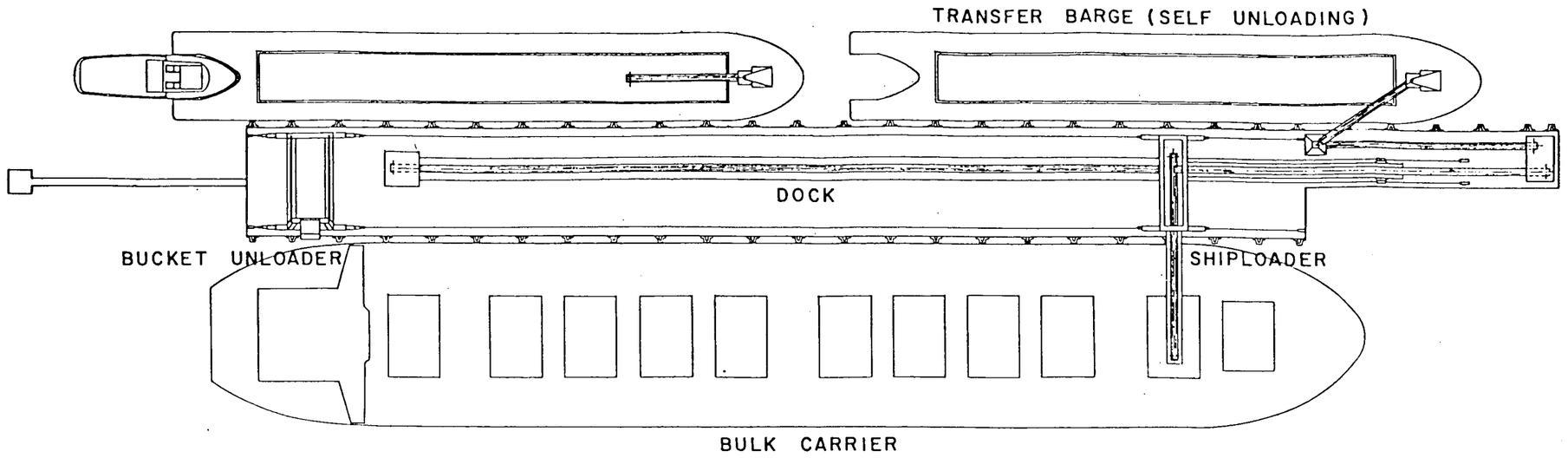
0 ½ 1 2

GULF OF MEXICO

US Army Corps of Engineers
Mobile District

LOCATION

LOWER BAY TRANSSHIPMENT FACILITY



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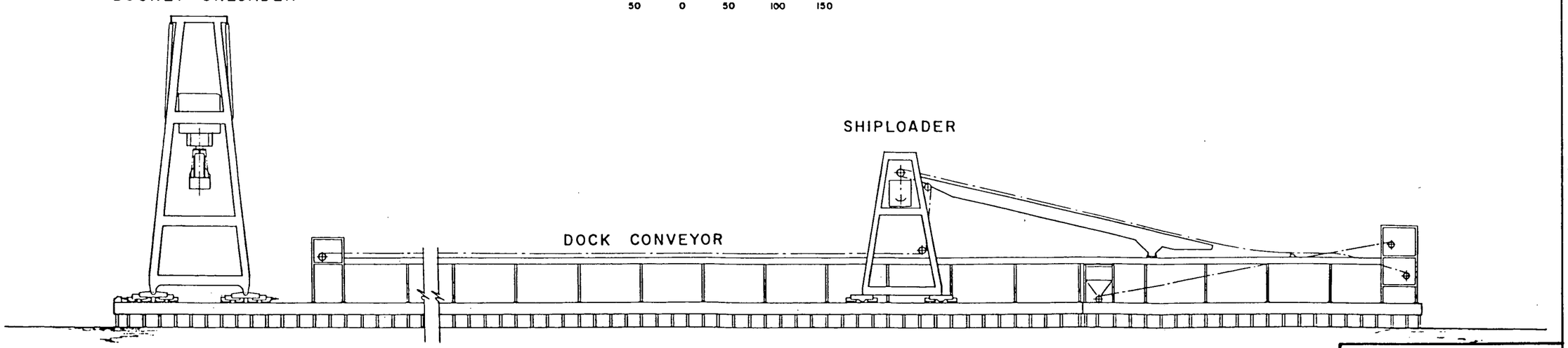
PLAN

SCALE IN FEET

50 0 50 100 150



ELEVATION

SCALE IN FEET

30 0 30 60 90

LOWER BAY TRANSSHIPMENT FACILITY

US Army Corps of Engineers
Mobile District

ECONOMIC APPENDIX
TO
MOBILE HARBOR
SUPPLEMENTAL INFORMATION

ECONOMIC APPENDIX

SUPPLEMENTAL INFORMATION DOCUMENT

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Section IV

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SECTION I

UPDATE OF MOBILE HARBOR SURVEY REPORT

The purpose of this section of the Appendix is to update the economics of the recommended plan in the Survey Report on Mobile Harbor, Alabama, dated October 1980. The economic analysis of the recommended plan is contained in Section F of Appendix 5 to the Survey Report. Most of the information contained in Section F is still applicable and extensive reference will be made to that information. Specific reference to F-Tables refer to tables in Section F of Appendix 5.

The basic changes made for this analysis are updates to Section F and include: (1) changes in the number of foreign flag registry dry bulk carriers in the world fleet, (2) changes in both the "at sea" and "in port" hourly operating costs of those vessels, (3) addition of historic data on export coal tonnages for the Port of Mobile from which the projections of future tonnage of export coal were made, (4) updated costs for the use of the Panama Canal, and (5) updated unit costs and the current Federal discount rate for implementing the recommended plan.

Table F-8 has been revised to show current payload carrying capability of each of the vessel classes in the foreign fleet of dry bulk carriers. The U.S. dry bulk carriers were eliminated from consideration since none of these vessels are currently engaged in the transport of the commodities which were accepted for benefit analysis. The number of vessels assigned to each size category of foreign flag dry bulk carriers were obtained from Lloyds Register of Shipping Statistical Tables, 1980 issue for existing vessels in the fleet and "The Bulletin" published by the American Bureau of Shipping, January 1980 issue for vessels under construction or on order. The

result of these changes had no effect on the percent of tonnage that would continue to move through the Panama Canal. Table 1 displays the above noted changes and revises Table F-8.

Base year tonnages shown on Table F-10 have been revised based on more current data obtained from "Waterborne Commerce of the United States - 1980" and export coal data in 1981 from the Alabama State Docks. The projection of the export coal tonnage in Section F considered what shippers expected to move to the various destinations in 1979 and 1981. The additional historic data for 1980 and 1981 showed greater export coal tonnage than was projected. The percentage share of each destination remained the same as in Section F. The annual growth rate of 1.2 percent used for projecting coal exports also remained unchanged. Table 2 displays the export coal tonnage that was used for benefit analysis and modifies Table F-10.

The tonnages of import iron ore and import coal remained unchanged from those shown in Section F. Table 3 summarizes the amount of base year tonnages of import and export commodities and updates Table F-13.

Table 4 is used in lieu of Tables F-24 through F-27. This table displays the tonnage of export coal to the four destinations over the life of the project. The tonnages destined for Japan includes that amount which is expected to continue moving through the Panama Canal.

Table 5 summarizes the volumes of iron ore and coal expected to move through the Port of Mobile over the project life. This table updates similar information shown on Table F-28.

Table 6 summarizes the volumes of iron ore and coal expected to move through the Port of Mobile during the project life. This commerce was used in the benefit analysis. Table F-29 is updated with information shown on this table.

TABLE 1

CARRYING CAPACITY OF DRY BULK CARRIERS IN THE WORLD FLEET

EXPECTED TO USE MOBILE HARBOR FOR MOVEMENTS OF IRON ORE AND COAL

(Foreign Flag Registry)

VESSEL SIZE (DWT)	AVERAGE DRAFT (Ft.)	NUMBER[1] OF VESSELS	PAYLOAD PER[2] VESSEL (Short Tons)	PAYLOAD CAPABILITY OF TOTAL VESSELS (Short Tons)	PERCENT OF TOTAL CAPABILITY
15,000	29	175	16,128	2,822,400	1.76
17,000	30	258	18,278	4,715,827	2.94
20,000	31	383	21,504	8,236,032	5.13
23,000	32	374	24,730	9,248,870	5.76
26,000	33	351	27,955	9,812,275	6.11
29,000	34	310	31,181	9,666,048	6.02
32,000	35	249	34,406	8,567,194	5.34
36,000	36	233	38,707	9,018,778	5.62
39,000	37	120	41,933	5,031,936	3.14
43,000	38	120	46,234	5,548,032	3.46
47,000	39	108	50,534	5,457,715	3.40
52,000	40	139	55,910	7,771,546[3]	4.84
56,000	41	106	60,211	6,382,387[3]	3.98
61,000	42	114	65,587	7,476,941	4.66
65,000	43	67	69,888	4,682,496	2.92
70,000	44	53	75,264	3,988,992	2.48
75,000	45	30	80,640	2,419,200	1.51
81,000	46	24	87,091	2,090,189	1.30
86,000	47	23	92,467	2,126,746	1.33
92,000	48	35	98,918	3,462,144	2.16
98,000	49	40	105,370	4,214,784	2.63
104,000	50	40	111,821	4,472,832	2.79
110,000	51	38	118,272	4,494,336	2.80
117,000	52	40	125,798	5,031,936	3.13
123,000	53	29	132,250	3,835,238	2.39
130,000	54	29	139,776	4,053,504	2.53
137,000	55	25	147,302	3,682,560	2.29
144,000	56	22	154,829	3,406,234	2.12
151,000	57	19	162,355	3,084,749	1.92
159,000	58	16	170,957	2,735,309	1.70
166,000	59	8	178,483	1,427,866	0.89
174,000	60	5	187,085	935,424	0.58
182,000	61	3	195,686	587,059	0.37
TOTAL		3,586		160,487,578	100.00

[1] Fifteen years old and under, plus those under construction or on order as of 1 January 1981.

[2] Developed by the equation: DWT x (.96 x 1.12).

[3] Total payload capability for vessels ranging from 15,000 through 56,000 dwt is 92.3 million tons or 57 percent of the world fleet payload capability.

TABLE 2

BASE-YEAR TONNAGES OF COAL EXPORTS EXTENDED TO 1986

FORMING A COMPOSITE BASE FOR PROJECTIONS

(Thousands of Short Tons)

YEAR	1975	1976	1978	1981	1986
Tons	2,367.0[1/]	2,865.0[1/]	2,799.0[1/2/]	8,259.0[1/3/]	15,580.8[4/]
TONNAGES ACCEPTED FOR BENEFIT ANALYSIS					
To Japan[5/]	686.0	809.0	817.0	2,383.5	4,496.6
To Italy	521.0	664.0	605.0	1,832.3	3,456.6
To England/Europe	174.0	221.0	202.0	610.6	1,151.8
To East Coast of South America	77.0	98.0	90.0	271.6	512.4
TOTAL	1,458.0	1,792.0	1,714.0	5,098.0	9,617.4

[1/] Exports obtained from port records.

[2/] Decrease in exports for 1978 is due to U.S. Coal Miner's strike in early 1978.

[3/] A coal miner's strike and a river lock closure limited 1981 tonnage to a ten month operation. The 1981 tonnage was normalized to a twelve month operation.

[4/] Substantial increases in 1986 brought about by opening of Tenn-Tom Waterway in that year. Total tonnage includes approximately 6.8 million tons that will be diverted because of lower transportation costs via Tenn-Tom Waterway. All other tonnages projected at 1.2 percent average annual growth rate from last historic year.

[5/] Tonnage reflects 43 percent of the total to Japan which is expected to move in large dry bulk carriers around the Cape of Good Hope. The remaining 57 percent will continue to move through the Panama Canal.

TABLE 3

SUMMARY OF 1986 TONNAGE USED FOR BENEFIT ANALYSIS

COMMODITY	ANNUAL VOLUME (Short Tons)
Iron Ore (Imports)	3,756,000
Coal (Imports)	896,000
Coal (Exports)	9,617,400
TOTAL	14,269,400

TABLE 4

PROJECTED TONNAGE OF EXPORT COAL

(Short Tons)

		COMPOSITE OF ANNUAL TONNAGE DESTINED TO:			
YEAR	RATIO TO 1986	JAPAN[1/]	ITALY	ENGLAND-EUROPE	EAST COAST SOUTH AMERICA
1986	1.000	10,457,200	3,456,600	1,151,800	512,400
1995[2/]	1.114	11,649,300	3,850,700	1,283,100	570,800
2000	1.182	12,360,400	4,085,700	1,361,400	605,700
2010	1.182	12,360,400	4,085,700	1,361,400	605,700
2020	1.182	12,360,40^	4,085,700	1,361,400	605,700
2030	1.182	12,360,400	4,085,700	1,361,400	605,700
2044	1.182	12,360,400	4,085,700	1,361,400	605,700

[1/] Unadjusted tonnage, which includes tonnage that will continue to move through the Panama Canal with project improvements at Mobile

[2/] First year of project life.

TABLE 5

SUMMARY OF PROSPECTIVE COMMERCE FOR SELECTED YEARS THROUGHOUT THE PROJECT LIFE (1995-2044)

(Thousands of Short Tons)

COMMODITY	1986	1995[1/]	2000	2010	2020	2030	2035	2044
Iron Ore	5,264.0	5,857.0	6,263.0	7,291.0	8,400.0	9,596.0	10,475.0	10,475.0
Coal (Import)	896.0	896.0	896.0	896.0	896.0	896.0	896.0	896.0
Coal (Export)	15,580.8	17,354.1	18,413.2	18,413.2	18,413.2	18,413.2	18,413.2	18,413.2
TOTAL	21,738.2	24,007.1	25,572.2	26,600.2	27,709.2	28,905.2	29,784.2	29,784.2

[1/] First year of project life.

TABLE 6

SUMMARY OF PROJECTED COMMERCE USED FOR BENEFIT ANALYSIS FOR SELECTED YEARS THROUGHOUT THE PROJECT LIFE (1995-2044)

(Thousands of Short Tons)

Commodity	1986	1995[1/]	2000	2010	2020	2030	2035	2044
Iron Ore	3,756.0	4,178.0	4,468.0	5,202.0	5,993.0	6,846.0	7,474.0	7,474.0
Coal (Import)	896.0	896.0	896.0	896.0	896.0	896.0	896.0	896.0
Coal (Export)	9,617.4	10,713.8	11,367.8	11,367.8	11,367.8	11,367.8	11,367.8	11,367.8
TOTAL	14,269.4	15,787.8	16,731.8	17,465.8	18,256.8	19,109.8	19,737.8	19,737.8

[1/] First year of project life.

Vessel operating costs have been revised to incorporate more current data on these values. As discussed in paragraph 148 of Section F, those costs reflected October 1978 price levels. The costs used in this updating procedure were furnished by OCE and were January 1981 price levels. By use of appropriate indexes, these costs were increased by a factor of 1.14 to reflect October 1982 price levels, (see Attachment 1, Benefit and Cost Update, to the Survey Report, Volume 1). Table 7 displays the updated at sea and in port vessel operating costs as well as other vessel characteristics which modified Table F-36.

The vessel operating costs and other appropriate vessel characteristics were used to compute a per-ton transportation cost of movements between the foreign ports and the Port of Mobile. The range of vessel sizes in each fleet which would use an existing 40-foot channel or the proposed 55-foot channel depth was considered in computing the per-ton cost. Table 8 displays the comparison of per-ton costs for movements of smaller vessels routed through the Panama Canal versus larger vessels routed around the Cape of Good Hope. The toll charges for using the Panama Canal are also considered in the per-ton costs. Table 8 updates Table F-40.

Table 9 summarizes the unit savings per-ton transportation costs for all of the commodities and origin-destinations that are expected to benefit from a 55-foot channel depth. Table 9 also updates data referring to a channel depth of 55 feet in Table F-41 through F-46 of Section F.

Table 10 displays the total annual savings and the average annual equivalent savings for import iron ore by port of origin. Transportation costs per ton and total saving were calculated by the same computer model. Table 10 udpates data relating to a depth of 55 feet as shown in Table F-48 and F-53. Table 11 shows similar information by port of origin or destination as shown in Table 10 except this information relates to import and export coal. Table 11 updates Tables F-49, F-50, and F-55.

Table 12 updates Table F-56 in part. It summarizes annual volumes of traffic and savings by commodity for the 55-foot channel alternative and gives the average annual equivalent savings.

TABLE 7

GENERAL CHARACTERISTICS AND HOURLY OPERATING COST DATA FOR OCEAN-GOING DRY BULK CARRIERS EXPECTED TO TRANSPORT IRON ORE AND COAL THROUGH MOBILE HARBOR FOR ALL DEPTHS CONSIDERED

(Foreign Flag)

VESSEL SIZE (d.w.t.) (Long Tons)	LENGTH[1/] (Ft.)	BREADTH[2/] (Ft.)	MAXIMUM REGISTERED DRAFT (Ft.)	IMMERSION FACTOR (Short Tons Per Ft.)	PAYLOAD CAPACITY[3/] (Short Tons)	AVERAGE SPEED (Knots)	PORT TIME (Hours)	HOURLY OPERATING COSTS 1982 PRICE LEVELS[4/] AT SEA	IN PORT
15,000	521	69	29	811	16,128	15	101	$ 911	$ 569
17,000	535	71	30	914	18,278	15	101	960	610
20,000	554	74	31	1,017	21,504	15	102	1,033	670
23,000	571	77	32	1,120	24,730	15	103	1,106	730
26,000	587	80	33	1,224	27,955	15	104	1,175	788
29,000	602	82	34	1,327	31,181	15	105	1,243	841
32,000	617	85	35	1,430	34,406	15	106	1,302	890
36,000	635	88	36	1,533	38,707	15	107	1,366	945
39,000	648	90	37	1,636	41,933	15	108	1,398	977
43,000	665	93	38	1,739	46,234	15	109	1,430	1,011
47,000	681	96	39	1,842	50,534	15	110	1,462	1,040
52,000	700	99	40	1,945	55,910	15	112	1,522	1,076
56,000	715	101	41	2,048	60,211	15	113	1,589	1,104
61,000	732	104	42	2,151	65,587	15	114	1,689	1,138
65,000	746	107	43	2,254	69,988	15	116	1,777	1,165
70,000	762	109	44	2,357	75,264	15	117	1,887	1,197
75,000	778	112	45	2,460	80,640	15	118	1,990	1,228
81,000	796	115	46	2,563	87,091	15	120	2,099	1,261
86,000	811	118	47	2,666	92,467	15	122	2,169	1,285
92,000	828	120	48	2,769	98,918	15	124	2,234	1,311
98,000	844	123	49	2,872	105,370	15	125	2,286	1,336
104,000	860	126	50	2,975	111,821	15	127	2,328	1,361
110,000	876	129	51	3,078	118,272	15	129	2,368	1,386
117,000	893	132	52	3,181	125,790	15	131	2,415	1,417
123,000	908	134	53	3,284	132,250	15	133	2,460	1,446
130,000	925	137	54	3,387	139,776	15	135	2,522	1,480
137,000	941	140	55	3,490	147,302	15	137	2,590	1,516
144,000	957	142	56	3,593	154,829	15	139	2,664	1,554
151,000	972	145	57	3,696	162,355	15	141	2,738	1,593
159,000	989	148	58	3,800	170,957	15	143	2,825	1,636
166,000	1,004	150	59	3,902	178,483	15	145	2,900	1,675
174,000	1,021	153	60	4,006	187,085	15	148	2,987	1,718
182,000	1,037	156	61	4,109	195,686	15	150	3,073	1,761

SOURCE: Data drawn from vessel operating statistics provided annually by OCE and from a statistical analysis on data extracted from The Dry Bulk Carrier Register - 1975, compiled and published by H. Clarkson and Company, Ltd., London, England.

[1/] Computed based on regression equation: LNG = 313.9 + 1.694 x (square root of d.w.t.). Formula = Yc = a + bx.

[2/] Computed based on regression equation: BRD = 33.43 + .287 x (square root of d.w.t.). Formula = Yc = a + bx.

[3/] Computed based on the following equation: d.w.t. (.96 x 1.12).

[4/] The 1 January 1981 prices, as authorized by OCE, updated to 1 October 1982.

TABLE 8

COMPARISON OF PER-TON TRANSPORTATION COSTS ON IRON ORE AND COAL ROUTED THROUGH THE PANAMA CANAL VERSUS COSTS FOR VESSELS ROUTED AROUND THE CAPE OF GOOD HOPE

ITEM	40-FT. CHANNEL VIA PANAMA CANAL[1] MILES[3]	COSTS[4]	55-FT. CHANNEL VIA CAPE OF GOOD HOPE[2] MILES[3]	COSTS
IRON ORE				
Australia to Mobile	17,934	$52.71	20,020	$31.21
Cost Differential		$21.50		
Difference in Miles - 2,086 nautical miles				
COAL				
Mobile to Japan	15,499	$44.88	25,926	$39.93
Cost Differential		4.95		
Difference in Miles - 10,427 nautical miles				

[1] Vessel fleet size 15--56,000 d.w.t. for iron ore and 20--56,000 for coal.

[2] Vessel fleet size 61--144,000 d.w.t. for both iron ore and coal.

[3] Adjusted to reflect a 60 percent utilization rate.

[4] Costs include Panama Canal toll charges.

TABLE 9

SUMMARY OF UNIT SAVINGS ON IMPORT AND EXPORT COMMODITIES[1/]

ITEM	40-FT. CHANNEL COST PER TON[2/]	55-FT. CHANNEL COST PER TON[3/]	SAVINGS PER TON
IMPORT IRON ORE			
Puerto Ordaz, Venezuela[4/]	$14.19	$12.46	$ 1.73
Port Cartier, Quebec, Canada[5/]	15.27	12.40	2.87
Tubarao, Brazil	28.00	22.70	5.30
Point Ubu, Brazil	23.81	19.31	4.50
Dampier, Australia[6/]	52.71	31.21	21.50
IMPORT COAL			
Richard's Bay, South Africa	$26.53	$21.43	$ 5.10
EXPORT COAL			
Japan[7/]	$44.88	$39.93	$ 4.95
Italy[8/]	26.88	21.96	4.92
England/Europe[9/]	22.79	18.41	4.38
East Coast South America[10/]	15.85	12.82	3.03

1/ Cost calculated by use of a computer model which considers a 60 percent vessel utilization rate and up to five feet light loading of the five largest vessel classes that can use a 40- or 55-foot channel depth.

2/ Cost include vessel sizes ranging from 15--56,000 d.w.t. for iron ore and 20--56,000 d.w.t. for coal.

3/ Cost include vessel sizes ranging from 15--144,000 d.w.t. for iron ore and 20--144,000 d.w.t. for coal.

4/ Cost for a 55-foot channel are restricted to vessel sizes ranging from 15--104,000 d.w.t. due to 45-foot channel depth available at Puerto Ordaz.

5/ Costs and savings are a weighted average of 54 percent of tonnage moved in vessels with a 60 percent utilization rate and 46 percent of tonnage moved in vessels with a 50 percent utilization rate.

6/ Cost per-ton for a 40-foot channel include the Panama Canal toll charges for vessels ranging in size from 15--56,000 d.w.t. Costs per-ton for a 55-foot channel are for vessels ranging in size from 61--144,000 d.w.t.

TABLE 9 (Cont'd)

SUMMARY OF UNIT SAVINGS ON IMPORT AND EXPORT COMMODITIES[1/]

[7/] The principal ports are: Tabuta, Tokyo, Ohita, Kimitsu, and Fukuyama. Costs per-ton for a 40-foot channel include the Panama Canal toll charges for vessels ranging in size from 20--56,000 d.w.t. Costs per-ton for a 55-foot channel are for vessels ranging in size from 61--144,000 d.w.t.

[8/] The principal ports are: Taranto, Genoa and Venice, Italy; and Iskenderun, Turkey. Tonnage to Alexandria, Egypt was eliminated from benefit analysis. Costs per-ton for a 55-foot channel were restricted to vessel sizes ranging from 20--137,000 d.w.t. due to depths at foreign ports.

[9/] The principal ports in this area are: Newport, England; Cardiff and Port Talbot, Wales; Glascow, Scotland; Antwerp, Belgium; Dunkerque, France; Goteborg, Sweden; and Kristiansand, Norway.

[10/] The principal ports in this area are: Vitoria and Rio de Janeiro, Brazil.

TABLE 10

-AVERAGE ANNUAL SAVINGS FROM IMPORT IRON ORE FOR 55-FOOT CHANNEL

	1986	1995	2000	2010	2020	2030	2035	2044	AAE[1] 1995-2044 7 7/8%
Puerto Ordaz, Venezuela									
Tons (Thousands)	2,594.0	2,887.1	3,086.8	3,592.6	4,140.0	4,728.8	5,162.0	5,162.0	
Unit Savings	$1.73	$1.73	$1.73	$1.73	$1.73	$1.73	$1.73	$1.73	
Total Savings (Thousands)	$4,479.8	$4,986.0	$5,330.9	$6,204.5	$7,149.7	$8,166.6	$8,914.7	$8,914.7	$5,948.8
Port Cartier, Canada									
Tons (Thousands)	368.8	410.5	438.9	510.8	588.7	672.4	734.0	734.0	
Unit Savings	$2.87	$2.87	$2.87	$2.87	$2.87	$2.87	$2.87	$2.87	
Total Savings (Thousands)	$1,059.2	$1,178.8	$1,260.4	$1,466.9	$1,690.5	$1,930.8	$2,107.8	$2,107.8	$1,406.5
Tubarao, Brazil									
Tons (Thousands)	336.9	375.0	400.9	466.6	537.7	614.2	670.4	670.4	
Unit Savings	$5.30	$5.30	$5.30	$5.30	$5.30	$5.30	$5.30	$5.30	
Total Savings (Thousands)	$1,784.6	$1,986.3	$2,123.7	$2,471.7	$2,848.2	$3,253.3	$3,551.3	$3,551.3	$2,369.8
Point Ubu, Brazil									
Tons (Thousands)	232.3	258.6	276.5	321.8	370.8	423.5	462.3	462.3	
Unit Savings	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50	$4.50	
Total Savings (Thousands)	$1,044.7	$1,162.8	$1,243.2	$1,446.9	$1,667.3	$1,904.5	$2,079.0	$2,079.0	$1,387.3
Dampier, Australia									
Tons (Thousands)	223.5	248.8	266.0	309.6	356.7	407.4	444.8	444.8	
Unit Savings	$21.50	$21.50	$21.50	$21.50	$21.50	$21.50	$21.50	$21.50	
Total Savings (Thousands)	$4,805.3	$5,348.3	$5,718.3	$6,655.4	$7,669.3	$8,760.1	$9,562.6	$9,562.6	$6,381.1
TOTAL TONS (Thousands)	3,755.5	4,180.0	4,469.1	5,201.4	5,993.9	6,846.3	7,473.5	7,473.5	
TOTAL SAVINGS (Thousands)	$13,173.6	$14,662.2	$15,676.5	$18,245.4	$21,025.0	$24,015.3	$26,215.4	$26,215.4	$17,493.5

[1] Average Annual Equivalent.

NOTE: Total savings may not equal product of tons and unit savings due to rounding.

TABLE 11

AVERAGE ANNUAL SAVINGS FROM IMPORT AND EXPORT COAL FOR 55-FOOT CHANNEL

	1986	1995	2000	2010	2020	2030	2035	2044	AAE[1/] 1995-2044 7 7/8%
IMPORT COAL									
Richard's Bay, South Africa									
Tons (Thousands)	896.0	896.0	896.0	896.0	896.0	896.0	896.0	896.0	
Unit Savings	$5.10	$5.10	$5.10	$5.10	$5.10	$5.10	$5.10	$5.10	
Total Savings (Thousands)	$4,564.9	$4,564.9	$4,564.9	$4,564.9	$4,564.9	$4,564.9	$4,564.9	$4,564.9	$4,564.9
EXPORT COAL									
Japan									
Tons (Thousands)	4,496.6	5,009.2	5,315.0	5,315.0	5,315.0	5,315.0	5,315.0	5,315.0	
Unit Savings	$4.95	$4.95	$4.95	$4.95	$4.95	$4.95	$4.95	$4.95	
Total Savings (Thousands)	$22,258.1	$24,780.7	$26,303.6	$26,303.6	$26,303.6	$26,303.6	$26,303.6	$26,303.6	$25,993.8
Italy									
Tons (Thousands)	3,456.6	3,850.7	4,085.7	4,085.7	4,085.7	4,085.	4,085.7	4,085.7	
Unit Savings	$4.92	$4.92	$4.92	$4.92	$4.92	$4.92	$4.92	$4.92	
Total Savings (Thousands)	$17,006.4	$18,933.8	$20,097.4	$20,097.4	$20,097.4	$20,097.4	$20,097.4	$20,097.4	$19,860.7
England/Europe									
Tons (Thousands)	1,151.8	1,283.1	1,361.4	1,361.4	1,361.4	1,361.4	1,361.4	1,361.4	
Unit Savings	$4.38	$4.38	$4.38	$4.38	$4.38	$4.38	$4.38	$4.38	
Total Savings (Thousands)	$5,044.8	$5,616.5	$5,961.7	$5,961.7	$5,961.7	$5,961.7	$5,961.7	$5,961.7	$5,891.5
East Coast South America									
Tons (Thousands)	512.4	570.8	605.7	605.7	605.7	605.7	605.7	605.7	
Unit Savings	$3.03	$3.03	$3.03	$3.03	$3.03	$3.03	$3.03	$3.03	
Total Savings (Thousands)	$1,552.7	$1,728.7	$1,834.9	$1,834.9	$1,834.9	$1,834.9	$1,834.9	$1,834.9	$1,813.3
TOTAL TONS (Thousands)	9,617.4	10,713.8	11,367.8	11,367.8	11,367.8	11,367.8	11,367.8	11,367.8	
TOTAL SAVINGS (Thousands)	$45,862.0	$51,059.7	$54,197.6	$54,197.6	$54,197.6	$54,197.6	$54,197.6	$54,197.6	$53,559.3

[1/] Average Annual Equivalent.

NOTE: Total savings may not equal product of tons and unit savings due to rounding.

TABLE 12

SUMMARY OF ANNUAL VOLUME OF TRAFFIC AND SAVINGS FOR A 55-FOOT CHANNEL

(October 1982 Prices - Short Tons)

	IRON ORE		IMPORT COAL		EXPORT COAL		TOTAL	
YEAR	TONS (1,000)	SAVINGS ($1,000)	TONS (1,000)	SAVINGS ($1,000)	TONS (1,000)	SAVINGS ($1,000)	TONS (1,000)	SAVINGS ($1,000)
1986	3,755.5	$13,173.6	896.0	$4,564.9	9,617.4	$45,862.0	13,743.9	$60,925.8
1995	4,180.0	14,662.2	896.0	4,564.9	10,713.8	51,059.7	15,789.8	70,286.8
2000	4,469.1	15,676.5	896.0	4,564.9	11,367.8	54,197.6	16,732.9	74,439.0
2010	5,201.4	18,245.4	896.0	4,564.9	11,367.8	54,197.6	17,465.2	77,007.9
2020	5,993.9	21,025.0	896.0	4,564.9	11,367.8	54,197.6	18,257.7	79,787.5
2030	6,846.3	24,015.3	896.0	4,564.9	11,367.8	54,197.6	19,110.1	82,777.8
2035	7,473.5	26,215.4	896.0	4,564.9	11,367.8	54,197.6	19,737.3	84,977.9
2044	7,473.5	26,215.4	896.0	4,564.9	11,367.8	54,197.6	19,737.3	84,977.9
AAE[1/]		$17,493.5		$4,564.9		$53,559.3		$75,617.7
							SAY	$75,618.0

[1/] Average Annual Equivalent 1995-2044 at 7 7/8%.

Land enhancement benefits, as described in paragraphs 183 and 184 of Section F, are still applicable. The benefits are calculated as the least costly method of providing the equivalent amounts of fill since that value is less than the current market value of comparable land. The least total first cost estimate of providing landfill was updated to $44,505,000 which yields an average annual equivalent benefit of $3,586,000. On a per acre basis, the least first costs are $42,500 and the average annual benefits are $3,425 for each of 1,047 acres of fast land. The current market value of usable industrial or commercial land was not updated since the least costly estimate of providing landfill is still less than the 1978 values shown in Section F, ($65,000 to $100,000 per acre).

The project cost data shown in Section F have been updated and the average annual costs of $45,832,000 are shown in the main body of this report. The recommended plan also included a turning basin and an anchorage area which could be constructed on an accelerate schedule. The benefits for those two items were not analyzed that time. Section II describes the benefit analyses of those items. A summary of all the average annual benefits and annual costs for the recommended plan are shown on Table 13.

TABLE 13

SUMMARY OF ECONOMIC ANALYSIS OF RECOMMENDED PLAN

(October 1982 Price Levels)

Average Annual Transportation Benefits	$75,618,000
Average Annual Turning Basin and Anchorage Area Benefits[1/]	2,094,000
Average Annual Land Enhancement Benefits	3,586,000
Total Average Annual Benefits	$81,298,000
Total Average Annual Costs	45,832,000
Net Average Annual Benefits	$35,467,000
Benefit to Cost Ratio	1.8

[1/] See Table 25.

SECTION II
PHASE I FEATURES

INTRODUCTION

This section is concerned with the economic analyses of those project features which can be designed and constructed in an accelerated manner. The Phase I items being considered to contribute to the efficiency of the harbor for vessels currently calling at the Port of Mobile are:

* Construction of a 57-foot channel for 7.4 miles across the Mobile Bay bar, a 55-foot channel for approximately one mile, 55-foot access to the north end of a transshipment facility, and a 40-foot access back to the main ship channel. The total amount of all the required dredging is 18,000,000 cubic yards.

* Construction of a 1,500 foot square turning basin to a 40 foot depth on the east side of the main ship channel, south of Little Sand Island, and opposite McDuffie Island. The width of the turning basin includes the width of the main ship channel.

* Construction of a 500 x 4,000 foot anchorage area to a 40 foot depth adjacent to the south end of the turning basin along the east side of the main ship channel not including channel width.

* Widening of the upper 4.2 miles or 3.65 nautical miles of main ship channel to 650 feet at a depth of 40 feet. The 4.2 mile length for widening was originally selected because of the possible affects on the control of vessel approaching upper Mobile Harbor at lower speeds requiring tug assistance. Preliminary indications from the Mobile Harbormaster indicate that a shorter segment of widening is adequate for vessels approaching the upper harbor. The dimensions of this feature have been altered based on vessel handling characteristics as determined by the Harbormaster. The southernmost two miles of channel widening were not considered in this analysis.

* Construction of a passing lane near the Theodore Channel. The dimensions of this feature would be 40' x 550' x 2 miles. The channel width of the selected plan is 550 feet.

* Construction of a 500 acre diked disposal area.

* Construction of mitigation measures.

Numerous interviews were conducted with persons familiar with the 1981 fleet calling at Mobile, the procedures and costs associated with servicing those vessels, and the problems those vessels encountered. With the exception of the transshipment facility, the analyses are based on the 1981 fleet. The fleet used in the analysis of the transshipment facility is the same as that used to update the Mobile Harbor Survey Report. Among the persons contacted were the Harbormaster, the Mobile Bar Pilots Association, Steamship agents, and terminal operators. The vessel fleet calling at Mobile in 1981 consisted of 62 container ships, 419 dry bulk carriers, 533 general cargo ships, and 86 tankers. Of the dry bulk carriers, 131 called at the McDuffie Coal Handling Plant, 41 called at Tennessee Coal and Iron (TCI), 86 called at the public grain elevator, 153 called at other Alabama State Docks' piers, 7 called for repairs, and 1 called at the petroleum piers. The major problems encountered by this fleet includes:

* Lack of sufficient channel depth to utilize the more efficient large vessels.

* The travel distance from the loading/unloading docks to the existing turning basin for the dry bulk ore and coal vessels.

* The Alabama State Docks requirement for coal and grain vessels to stop at a layberth for inspections and bunkering prior to proceeding to the loading docks.

* The proximity of the McDuffie Coal Handling Plant to the west side of the existing channel.

* The length of the main ship channel from the bar to McDuffie Island, the beam width of vessels calling at Mobile, and the 400-foot channel width combine to cause delays when traffic is reduced to one-way movements.

The benefits for each Phase I feature were analyzed separately. Combinations of the features were also analyzed since the benefits are not strictly additive. The transshipment facility, the turning basin, and the anchorage area were analyzed separately. Next, two combinations of the turning basin and anchorage area were analyzed. The upper channel widening was then analyzed separately and then added to the turning basin and anchorage area. Lastly, a passing lane near Theodore was analyzed.

TRANSSHIPMENT FACILITY

The transshipment facility will be situated adjacent to a 55-foot channel from the Gulf of Mexico approximately one mile north of the mouth of Mobile Bay. This facility will be completed in 1988, seven years prior to completion of the recommended 55-foot channel extending to the upper Mobile Harbor area. Equipment to transport coal from the McDuffie Coal Handling Plant to the transshipment facility will be required. The facility will be used to "top-off" export coal shipments until the recommended 55-foot channel to the upper harbor is completed.

The updated values for export coal tonnages, shown in Section I of this appendix, were used in the economic feasibility analysis of the transshipment facility. To allocate the amount of tonnage that would be loaded at the McDuffie Coal Handling Plant and at the transshipment facility it was assumed that vessels which range in size from 104,000 through 144,000 d.w.t. with drafts from 50 to 56 feet would be utilized. This range of vessels was used for allocation purposes only. As will be subsequently shown, the benefits for the transshipment facility are based on savings associated with vessels ranging from 61,000 through 144,000 d.w.t. with drafts from 42 to 56 feet.

The payload carrying capacity of each class of vessel size was adjusted to account for a 4-foot under keel safety clearance and light-load condition when departing the Port of Mobile. This is identical to the procedure used in the Survey Report. Each class of vessel would be loaded to 36-feet at McDuffie. The remaining draft would be loaded to 51-feet at the transshipment facility. An immersion factor, expressed in tons per foot, was used to determine the percent of total load that would be loaded at the transshipment facility.

The range of vessel sizes used to determine costs and savings per ton for these vessels are the same as those used to compute benefits for the recommended 55-foot channel. The savings per ton of export coal for each of the four destinations as shown in Section I would apply to that portion loaded at McDuffie. The savings per ton for that portion loaded

at the transshipment facility is reduced by a $1.50 per ton which includes a $0.75 charge for transporting coal from McDuffie to the transshipment facility and a $0.75 handling charge at the facility. The handling charge at McDuffie would be incurred regardless of the type of vessel being loaded; therefore, this charge was not considered in this analysis. Table 14 through 17 displays the tonnage loaded at McDuffie and the transshipment facility and the transportation savings involved in exporting the 1986 coal tonnage to each of the four destination areas.

A growth rate of 1.2 percent per year was used to project export coal from 1986 through 2000. The 2000 tonnage was held constant for the remainder of project life. This projection procedure is identical to that used in analyzing the 55-foot channel depth alternative in the original report and in Section I of this report. Table 18 displays the growth in tonnage and savings over the life of the project and the average annual equivalent benefits at 7 7/8% discount rate.

The Alabama State Docks (A.S.D.) employed Black and Veatch, Consulting Engineers of Kansas City, Missouri to determine the financial feasibility of developing a transshipment facility near the mouth of Mobile Bay. The Black and Veatch Report computed total operation and maintenance costs based on 12.5 million tons of coal being topped-off at the facility. A cost per ton for transportation can not de deduced from the Black and Veatch Report. It is assumed, however, that the total operation and maintenance cost may be overstated since this analysis is based upon approximately 4.3 million tons being topped-off at the transshipment facility.

The Black and Veatch report included both first costs and O&M costs for the transshipment facility, the transportation equipment, and dredging. The costs for the facility and the transportation equipment were used as shown in that report. First costs for dredging and O&M for dredging have been replaced with Corps estimates. This combination of costs has been used in determining average annual costs.

TABLE 14

SAVINGS TO TRANSSHIPMENT FACILITY FROM 1986 EXPORT COAL TO JAPAN

(October 1982 Prices)

CLASS (d.w.t.)	DRAFT (Ft.)	PAYLOAD PER CLASS (Tons)	PERCENT OF TOTAL PAYLOAD (%)	PAYLOAD PER VESSEL (Tons)	IMMERSION FACTOR PER VESSEL (Tons/Ft.)	ADJUSTED PAYLOAD PER VESSEL[1/] (Tons)	LIGHT LOAD AT McDUFFIE[2/] (Ft.)	PERCENT 1986 TONNAGE AT TRANSSHIPMENT[3/] (%)	1986 TONNAGE AT TRANSSHIPMENT[4/] (Tons)	SAVINGS PER TON AT TRANSSHIPMENT ($/Ton)	SAVINGS PER CLASS AT TRANSSHIPMENT ($1,000)
110,000	51	4,494,336	18.4	118,272	3,078	118,272	15	39.0	322,676	$3.45	$1,113.2
117,000	52	5,031,936	20.5	125,798	3,181	122,617	16	38.9	358,581	3.45	1,237.1
123,000	53	3,835,238	15.7	132,250	3,284	125,682	17	44.4	313,449	3.45	1,081.4
130,000	54	4,053,504	16.5	139,776	3,387	129,615	18	47.0	348,711	3.45	1,203.1
137,000	55	3,682,560	15.0	147,302	3,490	133,342	19	49.7	335,222	3.45	1,156.5
144,000	56	3,406,234	13.9	154,829	3,593	136,864	20	52.5	328,139	3.45	1,132.1
TOTAL		24,503,808	100.0						2,006,778	$3.45	$6,923.4

CLASS (d.w.t.)	PERCENT 1986 TONNAGE AT McDUFFIE (%)	1986 TONNAGE AT McDUFFIE (Tons)	SAVINGS PER TON AT McDUFFIE ($/Ton)[5/]	SAVINGS PER CLASS AT McDUFFIE ($1,000)	TOTAL TONNAGE PER CLASS (Tons)	TOTAL SAVINGS PER CLASS ($1,000)
110,000	61.0	504,698	$4.95	$ 2,498.3	827,374	$ 3,611.5
117,000	61.1	563,222	4.95	2,787.9	921,803	4,025.0
123,000	55.6	392,517	4.95	1,943.0	705,966	3,024.4
130,000	53.0	393,228	4.95	1,946.5	741,939	3,149.6
137,000	50.3	339,268	4.95	1,679.4	674,490	2,835.9
144,000	47.5	296,888	4.95	1,469.6	625,027	2,601.7
TOTAL		2,489,821	$4.95	$12,324.7	4,496,599	$19,248.1

NOTE: 1986 Tonnage accepted for benefit analysis is 4,496,600 tons.

1/ Adjusted Payload Per Vessel: The payload for each class of vessel is adjusted to reflect the load each would carry on a 55-foot channel with four feet under keel safety clearance. Example: 144,000 d.w.t. vessel with 56 foot draft is light loaded five feet, thus 154,829 - (5 x 3,593) = 136,864.

2/ Light Load at McDuffie: Each class of vessel is loaded to 36 feet at McDuffie. The light load is the difference between the draft and 36 feet.

3/ Percent 1986 Tonnage at Transshipment: The percent of total 1986 tonnage that is loaded on each class vessel at the transshipment facility is the product of the immersion factor and the light load at McDuffie divided by the adjusted payload. Example: 144,000 d.w.t. vessel (3,593 x 20) ÷ 136,864 = 52.5%.

4/ 1986 Tonnage at Transshipment: The amount of tonnage that is loaded on each class vessel at the transshipment facility is the product of the total 1986 tonnage, the percentage share for each class and the percent allocated to be loaded at the transshipment facility. Example: 144,000 d.w.t. vessel destined for Japan is 4,496,600 x .139 x .525 = 328,139.

5/ See Table 9 in Section I for Savings Per Ton.

TABLE 15

SAVINGS TO TRANSSHIPMENT FACILITY FROM 1986 EXPORT COAL TO ITALY

(October 1982 Prices)

CLASS (d.w.t.)	DRAFT (Ft.)	PAYLOAD PER CLASS (Tons)	PERCENT OF TOTAL PAYLOAD (%)	PAYLOAD PER VESSEL (Tons)	IMMERSION FACTOR PER VESSEL (Tons/Ft.)	ADJUSTED PAYLOAD PER VESSEL[1/] (Tons)	LIGHT LOAD AT McDUFFIE[2/] (Ft.)	PERCENT 1986 TONNAGE AT TRANSSHIPMENT[3/] (%)	1986 TONNAGE AT TRANSSHIPMENT[4/] (Tons)	SAVINGS PER TON AT TRANSSHIPMENT ($/Ton)	SAVINGS PER CLASS AT TRANSSHIPMENT ($1,000)
104,000	50	4,472,832	17.5	111,821	2,975	111,821	14	37.2	225,025	$3.42	$ 769.6
110,000	51	4,494,336	17.6	118,272	3,078	115,194	15	40.1	243,953	3.42	834.3
117,000	52	5,031,936	19.7	125,798	3,181	119,436	16	42.6	290,085	3.42	992.1
123,000	53	3,835,238	15.0	132,250	3,284	122,398	17	45.6	236,431	3.42	808.6
130,000	54	4,053,504	15.8	139,776	3,387	126,228	18	48.3	263,787	3.42	902.2
137,000	55	3,682,560	14.4	147,302	3,490	129,852	19	51.1	254,350	3.42	869.9
TOTAL		25,570,406	100.0						1,513,631	$3.42	$5,176.7

CLASS (d.w.t.)	PERCENT 1986 TONNAGE AT McDUFFIE (%)	1986 TONNAGE AT McDUFFIE (Tons)	SAVINGS PER TON AT McDUFFIE ($/Ton)[5/]	SAVINGS PER CLASS AT McDUFFIE ($1,000)	TOTAL TONNAGE PER CLASS (Tons)	TOTAL SAVINGS PER CLASS ($1,000)
104,000	62.8	379,880	$4.92	$1,869.0	604,905	$ 2,638.6
110,000	59.9	364,409	4.92	1,792.9	608,362	2,627.2
117,000	57.4	390,865	4.92	1,923.1	680,950	2,915.2
123,000	54.4	282,059	4.92	1,387.7	518,490	2,196.3
130,000	51.7	282,356	4.92	1,389.2	546,143	2,291.4
137,000	48.9	243,400	4.92	1,197.5	497,750	2,067.4
TOTAL		1,942,969	$4.92	$9,559.4	3,456,600	$14,736.1

NOTE: 1986 Tonnage accepted for benefit analysis is 3,456,600 tons. Size of vessels in fleet is restricted by available depth at foreign port. Footnotes one through five are same as Table 15 footnotes.

TABLE 16

SAVINGS TO TRANSSHIPMENT FACILITY FROM 1986 EXPORT COAL TO ENGLAND/EUROPE

(October 1982 Prices)

CLASS (d.w.t.)	DRAFT (Ft.)	PAYLOAD PER CLASS (Tons)	PERCENT OF TOTAL PAYLOAD (%)	PAYLOAD PER VESSEL (Tons)	IMMERSION FACTOR PER VESSEL (Tons/Ft.)	ADJUSTED PAYLOAD PER VESSEL[1/] (Tons)	LIGHT LOAD AT McDUFFIE[2/] (Ft.)	PERCENT 1986 TONNAGE AT TRANSSHIPMENT[3/] (%)	1986 TONNAGE AT TRANSSHIPMENT[4/] (Tons)	SAVINGS PER TON AT TRANSSHIPMENT ($/Ton)	SAVINGS PER CLASS AT TRANSSHIPMENT ($1,000)
110,000	51	4,494,336	18.4	118,272	3,078	118,272	15	39.0	82,653	$2.88	$ 238.0
117,000	52	5,031,936	20.5	125,798	3,181	122,617	16	38.9	91,850	2.88	264.5
123,000	53	3,835,238	15.7	132.250	3,284	125,682	17	44.4	80,290	2.88	231.2
130,000	54	4,053,504	16.5	139,776	3,387	129,615	18	47.0	89,322	2.88	257.2
137,000	55	3,682,560	15.0	147,302	3,490	133,342	19	49.7	85,867	2.88	247.3
144,000	56	3,405,324	13.9	154,829	3,593	136,864	20	52.5	84,053	2.88	242.1
TOTAL		24,503,808	100.0						514,035	$2.88	$1,480.3

CLASS (d.w.t.)	PERCENT 1986 TONNAGE AT McDUFFIE (%)	1986 TONNAGE AT McDUFFIE (Tons)	SAVINGS PER TON AT McDUFFIE ($/Ton)[5/]	SAVINGS PER CLASS AT McDUFFIE ($1,000)	TOTAL TONNAGE PER CLASS (Tons)	TOTAL SAVINGS PER CLASS ($1,000)
110,000	61.0	129,278	$4.38	$ 566.2	211,931	$ 804.2
117,000	61.1	144,269	4.38	631.9	236,119	896.4
123,000	55.6	100,543	4.38	440.4	180,833	671.6
130,000	53.0	100,725	4.38	441.2	190,047	698.4
137,000	50.3	86,903	4.38	380.6	172,770	627.9
144,000	47.5	76,048	4.38	333.1	160,101	575.2
TOTAL		637,766	$4.38	$2,793.4	1,151,801	$4,273.7

NOTE: 1986 Tonnage accepted for benefit analysis is 1,151,800 tons.

Footnotes one through five are same as Table 15 footnotes.

TABLE 17

SAVINGS TO TRANSSHIPMENT FACILITY FROM 1986 EXPORT COAL TO EAST COAST OF SOUTH AMERICA

(October 1982 Prices)

CLASS (d.w.t.)	DRAFT (Ft.)	PAYLOAD PER CLASS (Tons)	PERCENT OF TOTAL PAYLOAD (%)	PAYLOAD PER VESSEL (Tons)	IMMERSION FACTOR PER VESSEL (Tons/Ft.)	ADJUSTED PAYLOAD PER VESSEL[1/] (Tons)	LIGHT LOAD AT McDUFFIE[4/] (Ft.)	PERCENT 1986 TONNAGE AT TRANSSHIPMENT[3/] (%)	1986 TONNAGE AT TRANSSHIPMENT[4/] (Tons)	SAVINGS PER TON AT TRANSSHIPMENT ($/Ton)	SAVINGS PER CLASS AT TRANSSHIPMENT ($1,000)
110,000	51	4,494,336	18.4	118,272	3,078	118,272	15	39.0	36,770	$1.53	$ 56.3
117,000	52	5,031,936	20.5	125,798	3,181	122,617	16	38.9	40,861	1.53	62.5
123,000	53	3,835,238	15.7	132.250	3,284	125,682	17	44.4	35,718	1.53	54.6
130,000	54	4,053,504	16.5	139,776	3,387	129,615	18	47.0	39,737	1.53	60.8
137,000	55	3,682,560	15.0	147,302	3,490	133,342	19	49.7	38,199	1.53	58.4
144,000	56	3,406,234	13.9	154,829	3,593	136,864	20	52.5	37,392	1.53	57.2
TOTAL		24,503,808	100.0						228,677	$1.53	$349.8

CLASS (d.w.t.)	PERCENT 1986 TONNAGE AT McDUFFIE (%)	1986 TONNAGE AT McDUFFIE (Tons)	SAVINGS PER TON AT McDUFFIE ($/Ton)[5/]	SAVINGS PER CLASS AT McDUFFIE ($1,000)	TOTAL TONNAGE PER CLASS (Tons)	TOTAL SAVINGS PER CLASS ($1,000)
110,000	61.0	57,512	$3.03	$174.3	94,282	$ 230.6
117,000	61.1	64,181	3.03	194.5	105,042	257.0
123,000	55.6	44,728	3.03	135.5	80,446	190.1
130,000	53.0	44,809	3.03	135.8	84,546	196.6
137,000	50.3	38,661	3.03	117.1	76,860	175.5
144,000	47.5	33,831	3.03	102.5	71,223	159.7
TOTAL		283,722	$3.03	$859.7	512,399	$1,209.5

NOTE: 1986 Tonnage accepted for benefit analysis is 512,400 tons.

Footnotes one through five are same as Table 15 footnotes.

TABLE 18

ANNUAL VOLUMES OF METALLURGICAL COAL EXPORTS AND SAVINGS FROM USE OF A TRANSSHIPMENT FACILITY

(October 1982 Prices)

DESTINATION	1986	1988[1/]	1995	2000-2037	AAE 1988-2037 @ 7 7/8%
JAPAN					
Tonnage (000)	4,496.6	4,604.5	5,009.2	5,315.0	
Total Savings ($1,000)	$19,248.1	$19,712.0	$21,428.9	$22,747.4	$21,589.7
ITALY					
Tonnage (000)	3,456.6	3,539.6	3,850.7	4,085.7	
Total Savings ($1,000)	$14,736.1	$15,091.2	$16,405.7	$17,415.1	$16,528.8
ENGLAND/EUROPE					
Tonnage (000)	1,151.8	1,179.4	1,283.1	1,361.4	
Total Savings ($1,000)	$ 4,273.7	$ 4,376.7	$ 4,757.9	$ 5,050.7	$ 4,793.6
EAST COAST OF S. AMERICA					
Tonnage (000)	512.4	524.7	570.8	605.7	
Total Savings ($1,000)	$ 1,209.5	$ 1,238.6	$ 1,346.5	$ 1,429.4	$ 1,356.6
GRAND TOTAL					
Tonnage (000)	9,617.4	9,848.2	10,713.8	11,367.8	
Total Savings ($1,000)	$39,467.4	$40,418.5	$43,939.0	$46,642.6	$44,268.7
				SAY	$44,269.0

[1/] First year of project life.

Table 19 displays the $170,294,000 itemized first cost estimate for the transshipment facility and bar channel. Table 20 displays the $44,269,000 average annual equivalent benefits, the $19,206,000 average annual cost, net benefits of $25,063,000, and the 2.3 benefit to cost ratio.

Additionally, the transshipment facility was analyzed using a seven year project life from 1988 to 1995. The average annual equivalent benefits were reduced to $43,939,000 and the average annual costs were increased to $38,054,000. Under this condition the benefit to cost ratio would be 1.1.

There are several other categories that could be considered in the benefit analysis of the transshipment facility. Imports of both iron ore and steam coal and export grain could be handled at the facility. It would be possible to "top-off" dry bulk carriers from other Gulf ports. According to the latest information available, the Alabama State Docks is considering these possibilities in their operation of the facilities. This information was not available when the benefit analysis was made.

TABLE 19

ESTIMATED FIRST COST OF 55-FOOT BAR CHANNEL AND TRANSSHIPMENT FACILITY

(October 1982 Prices)

ITEM		TOTAL COST
Dredging:		
Bar Channel - 17,100,000 cu. yd. @ $3,734/cu. yd.		$ 63,855,000
Berthing Area - 200,000 cu. yd. @ $2.455/cu. yd.		491,000
Access Channels - 4,800,000 cu. yd. @ $3.734/cu. yd.		17,923,000
	SUB-TOTAL	$ 82,269,000
Contingencies @ 20% of $82,269,000		$ 16,454,000
Engineering and Design @ 3% of $98,723,000		2,962,000
Supervision and Administration @ 3% of $101,685,000		3,051,000
	SUB-TOTAL	$ 22,467,000
Transshipment Facility Cost[1/]		$ 21,900,000
Equipment Cost[1/]		$ 31,000,000
Interest During Construction 7 7/8%, 2 yrs.		$ 12,658,000
	TOTAL INVESTMENT	$170,294,000

[1/] From Black and Veatch, values include contingencies, engineering and design, and supervision and administration.

TABLE 20

AVERAGE ANNUAL BENEFITS AND COSTS OF 55-FOOT BAR CHANNEL AND TRANSSHIPMENT FACILITY

(October 1982 Prices)

Total Investment	$170,294,000
Interest and Amortization 7 7/8%, 50 yrs.	.08057
Average Annual Charge	$ 13,721,000
Operation and Maintenance	
Dredging - Bar Channel	$ 1,685,000
- Facility[1/]	400,000
Facility and Equipment[1/]	3,400,000
Annual O&M Costs	$ 5,485,000
TOTAL ESTIMATED ANNUAL COST	$ 19,206,000
AVERAGE ANNUAL EQUIVALENT BENEFITS	$ 44,269,000
NET BENEFITS	$ 25,063,000
BENEFIT TO COST RATIO	2.3

[1/] From Black and Veatch Report.

TURNING BASIN ONLY

The benefits for provision of a turning basin opposite McDuffie Island would accrue to some of the colliers calling at McDuffie and some of the ore and coal vessels calling at the Tennessee Coal and Iron Comapny (TCI) Bulk Marine Terminal. The benefits are measured by savings of hourly vessel operating costs, hours of tug service saved, and associated fees for pilots. The average size collier calling at McDuffie is 60,000 d.w.t. with an hourly "at sea" operating cost of $1,685 per hour. The average size of vessels calling at TCI is 76,700 d.w.t. with an hourly at sea operating cost of $2,022.

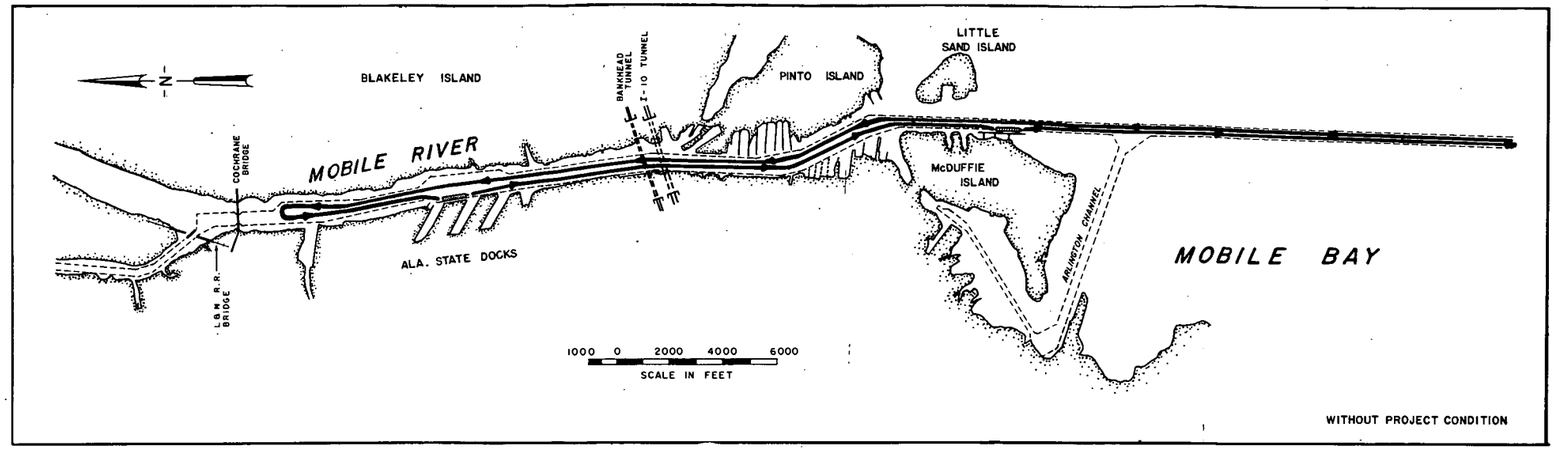
With the exception of the small colliers, it takes three tugs to dock and two tugs to undock the McDuffie or TCI vessels. Approximately 53 percent of all movements are subject to overtime rates. These rates are in effect for movements on week days which begin prior to 6 a.m. or end after 6 p.m., and on movements on weekends or holidays. The hourly cost of tug services, including overtime rates, is $700.

Under existing conditions, the harbormaster requires that vessels calling at McDuffie accomplish bunkering at a layberth within 24 hours of moving to the McDuffie Coal Handling Plant. The only available space to accomplish this task is generally at a river-end pier. The procedure is: (1) bring a collier into the harbor to the present 1,000-foot turning basin at Cochran Bridge; (2) turn; (3) dock headed down channel at a river-end pier; (4) bunker and complete the hull inspection; and (5) move to the McDuffie Terminal. A schematic diagram tracing the movement of McDuffie colliers under "without" and "with" the proposed turning basin opposite McDuffie Island is displayed on Figure 1. Approximately ten percent of the colliers loaded at McDuffie, however, are bunkered prior to arrival. In those instances, the hull inspection is performed at McDuffie. A turning basin opposite McDuffie would eliminate the need for these vessels to travel to Cochran Bridge, turn, and return to the McDuffie Coal Handling Plant. The savings are computed as reduced time in terms of vessel operating cost plus reduced tug service time.

CORPS OF ENGINEERS | 4 | 3 | 2 | 1 | U. S. ARMY

REVISIONS

STA.	ZONE	DESCRIPTION	DATE	APPROVED	



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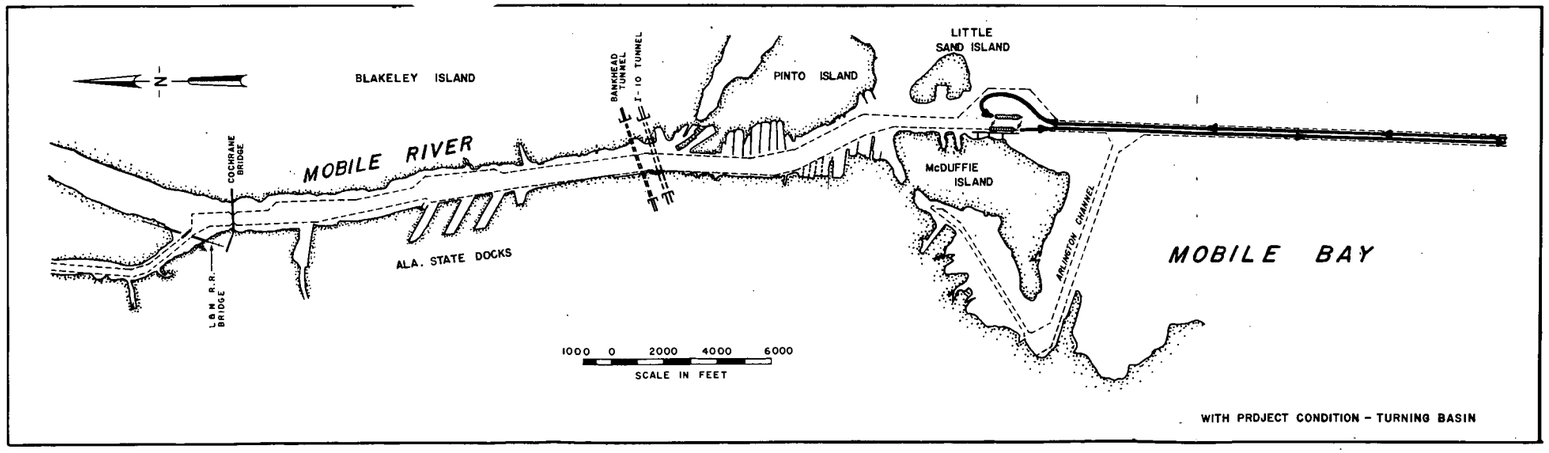


WITH PROJECT CONDITION - TURNING BASIN

U. S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
MOBILE, ALA.

MOBILE HARBOR, ALABAMA
MOVEMENT PATTERN
McDUFFIE

SH. REF. NO.	SPEC. NO.	SIZE	FILE NO.
			DRAWING NO.
	SCALE: AS SHOWN	DATE: MAY 1983	SHEET 1 OF 4

5 | 4 | 3 | 2 | 1 FIGURE 1

E D C B A

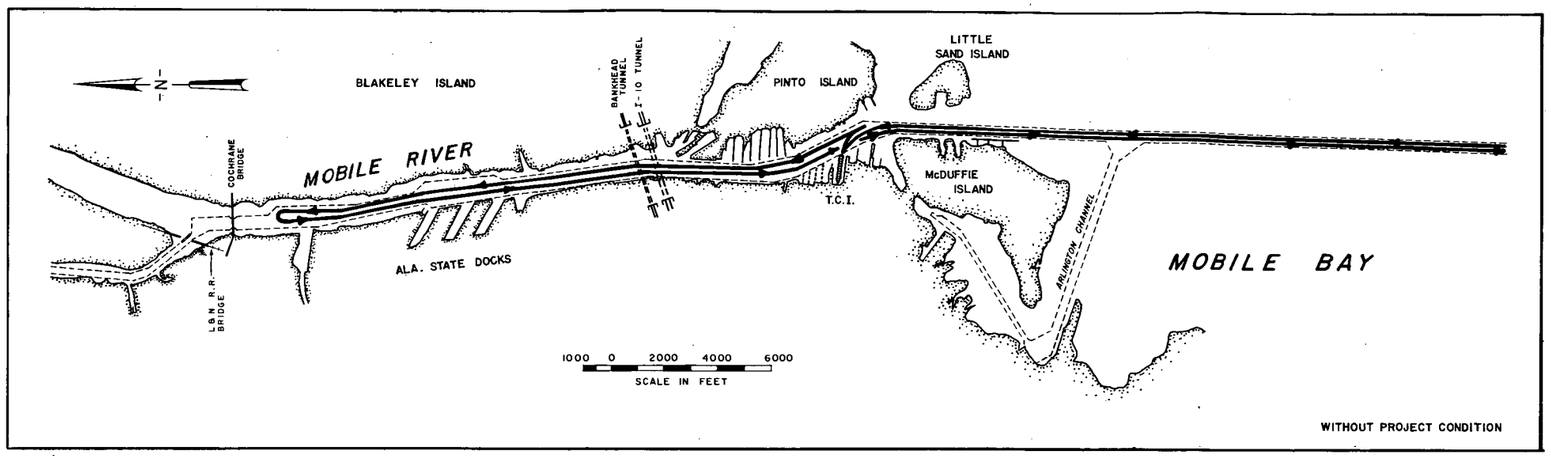
The time involved in moving a vessel from the vicinity of McDuffie Island to the turning basin at Cochran Bridge, turning the vessel and returning to McDuffie Coal Handling Plant is 2.5 hours. These transit times involved the use of three tugs. This is one-hour transit time each way and 30 minutes turning time. The time required to turn a vessel at a turning basin opposite McDuffie Island is estimated to be 15 minutes. The difference in turning time is due to the river current effects on the vessel at the Cochran Bridge which would be absent in a turning basin at the river's mouth. The total time saved for the vessel and each of two tugs would be two hours and 15 minutes. In addition, one less tug would be required to turn opposite McDuffie Island as compared to turning at Cochran Bridge. Docking and undocking times are equal in either case and are thus not considered.

For 1981, the 131 vessels that called at McDuffie were normalized to 157 vessels. A miner's strike and a river lock closure for maintenance resulted in curtailed operations to approximately ten months.

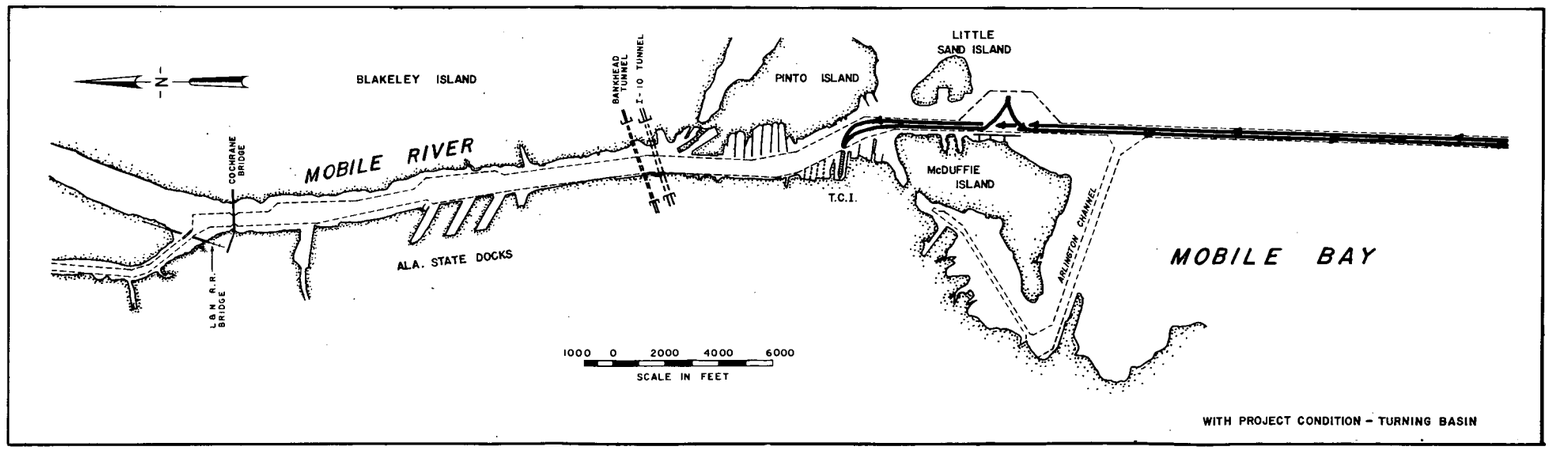
Some of the coal and ore vessels that call at TCI would also benefit from a turning basin. Under existing conditions, bunkering for these vessels is performed at the TCI docks. In addition, TCI has a turning dolphin adjacent to the channel and all vessels less than 740 feet in length can turn there. Of the 41 vessels that called at TCI in 1981, 31 had a length greater than 740 feet. The procedure used in loading or unloading these vessels is to move directly to TCI and to dock headed up. The vessels are then backed stern first out of the slips and either turned on the dolphin or proceed to the turning basin at Cochran Bridge and turned. With a turning basin opposite McDuffie Island, the 31 TCI vessels could be backed to or from that location. This procedure would take approximately 20 minutes to accomplish. Figure 2 is a schematic drawing tracing the movement of the TCI vessels "without" and "with" the proposed turning basin.

The time involved in taking a vessel from TCI to the turning basin at Cochran Bridge, turning, and returning is the same as the McDuffie

REVISIONS				
SYM.	ZONE	DESCRIPTION	DATE	APPROVED



WITHOUT PROJECT CONDITION



WITH PROJECT CONDITION - TURNING BASIN

U. S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
MOBILE, ALA.

MOBILE HARBOR, ALABAMA
MOVEMENT PATTERN
T.C.I.

SH. REF. NO.	SPEC. NO.	SIZE	FILE NO.
			DRAWING NO.
	SCALE: AS SHOWN	DATE: MAY 1983	SHEET 2 OF 4

FIGURE 2

coal vessels, 2.5 hours. The 15 minutes savings in turning time is also the same. The total time savings, however, for the TCI vessels is less since 20 minutes are required to back to or from a turning basin opposite McDuffie Island. The total hours saved by TCI vessels would be one hour and 55 minutes. This savings is also associated with three tugs for each vessel movement. There would not be any savings in the number of tugs required for the TCI vessels, however, because of the degree of control required to move the larger vessels from the dock to a turning basin opposite McDuffie Island.

In addition to the normal pilots fee, there is a charge of $150 for any vessel in the lower harbor which must proceed to Cochran Bridge to turn in order to proceed to sea. This situation applies to the TCI vessels since the lower harbor is defined as that portion of the harbor south of the Interstate 10 tunnels. The McDuffie vessels are turned at Cochran Bridge prior to loading and are, thus, ready to proceed to sea when they depart. Table 21 summarizes the $389,000 benefits for the McDuffie and TCI vessels from a turning basin opposite McDuffie Island.

ANCHORAGE AREA ONLY

The benefits for providing an anchorage area opposite McDuffie Island would accrue to the colliers calling at the McDuffie Island Coal Handling Plant and to grain carriers calling at the grain elevators. The benefits are measured in layberth charges saved, the savings in costs incurred from shifting from one layberth to another and vessel operating costs saved by fog bound conditions which prohibit movement on the main ship channel to or from the Gulf of Mexico.

Layberth charges are assessed on a daily basis based on gross registered tons (GRT). The fee is $0.05/ton for each of the first two days and $.04/ton each for the third and fourth days. As previously stated, under existing conditions 90% of the vessels going to the McDuffie Coal Handling Plant or 141 vessels must go to a layberth for one day to bunker and have the hulls inspected. The average size of

TABLE 21

BENEFITS FOR TURNING BASIN

McDuffie Coal Vessels:	
157 vessels x 10% = 16 x 2.25 hrs. x $1,685/hr.	= $ 60,700
32 tugs x 2.25 hrs. x $700/hr.	= 50,400
16 tugs x 2.5 hrs. x $700/hr.	= 28,000
SUB-TOTAL	$139,100
TCI Ore and Coal Vessels (740+ feet long):	
31 vessels x 1.9167 hrs. x $2,022/hr.	= $120,000
93 tugs x 1.9167 hrs. x $700/hr.	= 124,800
31 turning fees @ $150	= 4,700
SUB-TOTAL	$249,500
TOTAL ANNUAL SAVINGS	$388,600
SAY	$389,000

these colliers is 60,000 d.w.t. with an average gross registered tons of 34,200. With an anchorage area opposite McDuffie Island, these vessels could bunker and have their hulls inspected at the anchorage rather than at a layberth. Savings in layberth charges for these vessels would be $241,100 (141 vessels x 34,200 g.r.t. x $.05/g.r.t.).

There were 86 vessels that called at the grain elevators in 1981. Of these vessels, 64 or 75% of them passed the various required inspections during the first day at layberth. The remaining 22 vessels passed inspection during the second day. On the average, the grain vessels had to wait an additional two days at layberth before proceeding to the grain elevator. The average size of the grain vessels was 32,000 d.w.t. with an average gross registered tons of 17,940. With an anchorage opposite McDuffie Island, these vessels could bunker, undergo

hull inspections, and await an available berth at the grain elevator. Savings in layberth charges for these vessels would be $231,100, computed as follows:

86 vessels x 75% x 17,940 g.r.t. x $.14/g.r.t. (layberth charges for 3 days)	= $163,300
86 vessels x 25% x 17,940 g.r.t. x $.18/g.r.t. (layberth charges for 4 days)	= 67,800
TOTAL	$231,100

Laybérths are assigned on an as available basis. A vessel at layberth must move if the dock is needed by another vessel to load or dishcarge cargo. Shifting from one layberth to another involves tug service time and longshoremen fees. In 1981, 12 coal vessels destined for McDuffie Coal Handling Plant and 5 grain carriers were required to shift from one layberth to another. Shifting required two tugs for one hour, on the average, a longshoremen's fee of $430, a pilot's fee of $100, and one hour vessel operating cost "at sea" less one hour vessel operating cost "in port". Table 22 shows the cost per vessel for shifting coal and grain vessels between layberths. Use of an anchorage area would eliminate the need for shifting between layberths at a savings of $41,100 (12 vessels x $2,478 + 5 vessels x $2,282).

TABLE 22

COST OF SHIFTING BETWEEN LAYBERTHS

(Per Vessel)

McDuffie Coal Vessels:		
2 tugs x 1 hr. x $700/hr.		= $1,400
Pilot fee		100
Longshoremen fee		430
1 hr. at sea cost less 1 hr. in port cost $1,685 - $1,137		548
	TOTAL	$2,478
State Docks Grain Elevator:		
2 tugs x 1 hr. x $700/hr.		= $1,400
Pilot fee		100
Longshoremen fee		430
1 hr. at sea cost less 1 hr. in port cost $1,261 - $909		352
	TOTAL	$2,282

Inspection of the daily visibility records for 1981 taken at the Dauphin Island Sea Laboratory indicate that there were approximately 20 days when the visibility in the Gulf of Mexico near the mouth of Mobile Bay was one mile or less for a period of at least five hours. The readings were taken at 0800 and 1300 hours. The records also indicate there were five days when visibility was restricted for more than five hours and vessel movement in or out of Mobile Harbor was restricted. Fog bound conditions do occur in the upper harbor, but they rarely restrict vessel movements within the upper harbor for more than a few hours, and were not included in this analysis. Fog bound conditions are defined as visibility less than one mile.

An anchorage area opposite McDuffie Island would benefit vessels at anchor in the Gulf of Mexico waiting for a berth in that they could

come in upon arrival and accomplish bunkering and hull inspection prior to loading. The inbound vessels would save the 8 to 12 hours it takes to weigh anchor and transit the channel. Departing vessels that are ready to sail could be shifted to the anchorage and their place taken by an inbound vessel. The inbound vessels would thus save an additional 8 to 12 hours by not having to wait to go to the loading dock. These savings apply only to the 284 vessels calling at McDuffie, TCI, and the grain elevator. The weighted average hourly operating cost for all sizes and types of these vessels is $1,075 "in port" and $1,579 "at sea". Table 23 shows the savings to the inbound vessels from an anchorage area and the costs of shifting departing vessels to the anchorage.

TABLE 23

SAVINGS FOR FOG BOUND DELAYS

Savings for Inbound Vessels	
Number of fog bound days	5
Vessels affected per day	2
Average cost per delay (10 hrs. x $1,075/hr.)	$ 10,750
Cost for 10 Delays	$107,500
Less Cost to Shift Departing Vessels to Anchorage	
Number of affected vessels	5
2 tugs x 30 min. each x $700/hr.	$ 700
Pilot fees per vessel	100
Longshoremen fees per vessel	430
30 min. at sea cost ($1,579 x .5)	790
Cost for Shifting 5 Vessels	$ 10,100
Savings for Fog Bound Delays	$ 97,400

There are other categories of benefits for an anchorage area, such as safety, which are not readily quantifiable. Emergencies such as fire or bomb threats could be dealt with in a more efficient manner at an inner harbor anchorage rather than in the Gulf. The possibility of a petroleum spill is always present when a vessel is taking on fuel. Cleanup of such a spill would be easier at an anchorage area as opposed to a dock. On occasion, minor topside repairs are necessary which could be made at anchorage thereby avoiding layberth charges. Convenience of crew changes would be another benefit. It is common for foreign flag vessels, approximately 87% of the current fleet, to change crew members while in port. There is difficulty and additional expense in changing crew members by vessels at anchor in the Gulf while waiting for a layberth. Illness or other medical emergencies could be dealt with more rapidly from an inner harbor anchorage area as opposed to the Gulf anchorage.

There are, however, additional costs associated with using an anchorage area rather than a layberth, primarily launch service. Launch service is estimated to be $150 for a round trip (r.t.). The coal vessels would require one round trip and the grain vessels would require two round trips. Bunkering is currently accomplished by barge. Some additional expense for bunkering may be incurred for the greater distance to the anchorage area.

With a second loading dock at McDuffie, operational in the spring of 1983, some bunkering could possibly be done at that site prior to loading, thereby not realizing all of the benefits associated with layberths. With the transshipment facility, however, one berth would be used to light load large vessels and the other berth would be used to load barges and Panamax equivalent size vessels. Because the second dock would be fully utilized, layberths for bunkering and inspections would then be required for all vessels. The average annual benefits of $561,300 which would accrue to an anchorage area are summarized in Table 24.

TABLE 24

BENEFITS FOR INNER HARBOR ANCHORAGE AREA

Savings in Layberth Charges:		
McDuffie Coal Vessel		
157 vessels x 90% = 141 x 34,200 GRT x $0.05		= $241,100
State Docks Grain Vessels		
86 vessels x 75% = 65 x 17,940 GRT x $0.14 (3 days)		= $163,300
86 vesseks x 25% = 21 x 17,940 GRT x $0.18 (4 days)		= 67,800
Savings in Layberth Shifts:		
McDuffie Coal Vessels		
12 vessels x $2,478		= $ 29,700
State Docks Grain Elevator		
5 vessels x $2,282		11,400
Savings for Fog Bound Delays		97,400
	SUB-TOTAL	$610,700
Less Additional Expenses for Launch Service		
157 vessels x 1 r.t. @ $150/r.t.		$ 23,600
86 vessels x 2 r.t. @ $150/r.t.		25,800
		$ 49,400
	TOTAL	$561,300

COMBINED TURNING BASIN AND ANCHORAGE AREA

The benefits associated with construction of both the turning basin and the anchorage area are considerably higher than the sum of the two features. With a combined anchorage and turning basin, all of the McDuffie colliers could be bunkered and/or have their hulls inspected at the anchorage and be turned at the turning basin. Thus, with these two features working in unison all of the McDuffie colliers avoid turning at the existing turning basin at Cochran Bridge. Figure 3 is a schematic drawing tracing the movements of the McDuffie colliers "without" and "with" a combined turning basin and anchorage area. The time saved by these vessels as shown in Table 21 is 2.25 hours. There is a slight reduction, however, in the time saved by these colliers since the travel time from the anchorage to the turning basin of 10 minutes must be subtracted. The benefits to the TCI vessels from a turning basin and all benefits from the anchorage area are not affected by the combination. Table 25 shows the $2,094,000 benefits to a combined turning basin and anchorage area.

TABLE 25

BENEFITS FOR A COMBINED TURNING BASIN AND ANCHORAGE AREA

Turning Basin:		
McDuffie Coal Vessels		
157 vessels x 2.083 hrs. x $1,685/hr.		= $ 551,000
314 tugs x 2.083 hrs. x $700/hr.		= 457,800
157 tugs x 2.500 hrs. x $700/hr.		= 274,800
	SUB-TOTAL	$1,283,600
TCI Ore/Coal Vessels[1/]		= $ 249,500
	SUB-TOTAL	$1,533,100
Anchorage Area[2/]		= $ 561,300
	TOTAL	$2,094,400
	SAY	$2,094,000

[1/] See Table 21 on page 32.

[2/] See Table 24 on page 37.

CORPS OF ENGINEERS | 4 | 3 | 2 | 1 | U. S. ARMY

REVISIONS				
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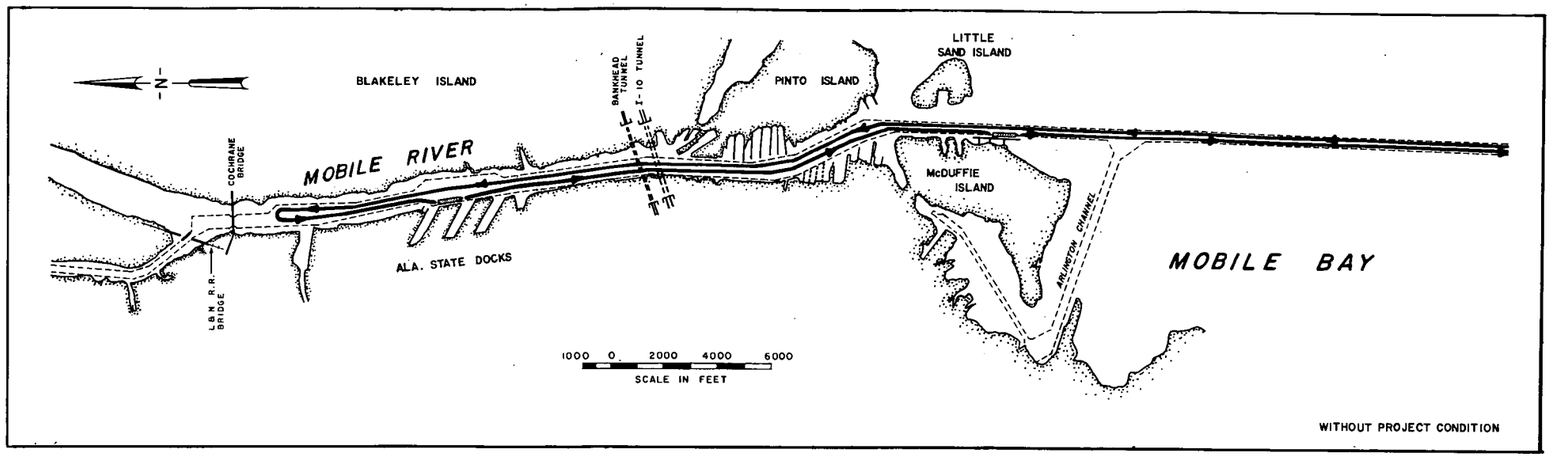

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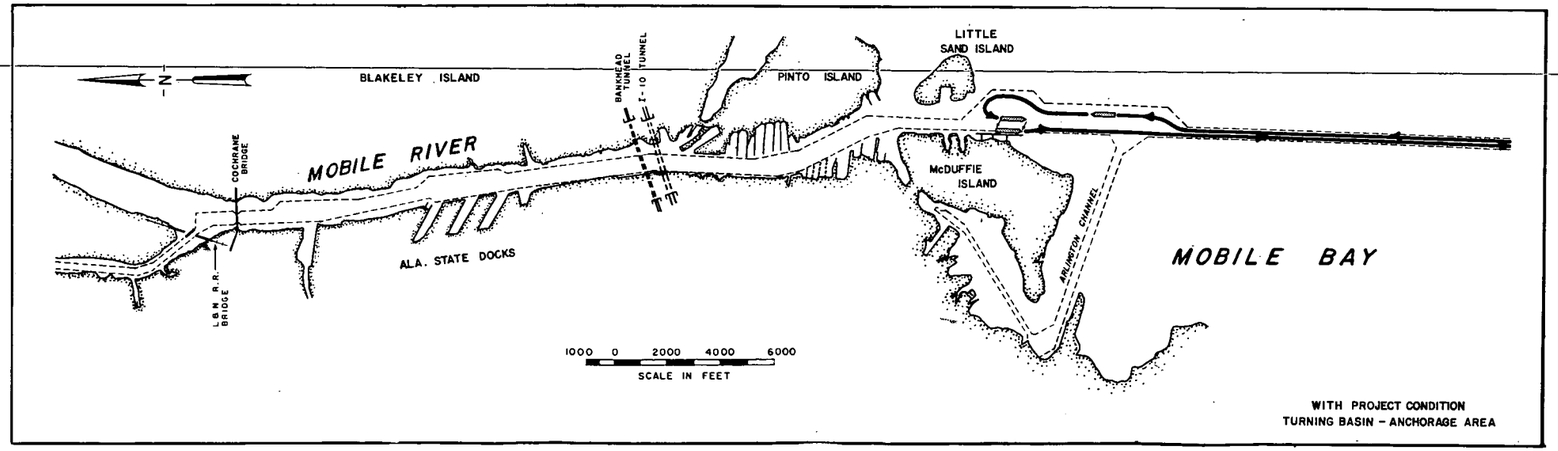

WITH PROJECT CONDITION
TURNING BASIN - ANCHORAGE AREA

U. S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
MOBILE, ALA.

MOBILE HARBOR, ALABAMA
MOVEMENT PATTERN
McDUFFIE

SH. REF. NO.	SPEC. NO.	SIZE	FILE NO.
			DRAWING NO.
SCALE: AS SHOWN	DATE: MAY 1983		SHEET 3 OF 4

5 | 4 | 3 | 2 | 1 | FIGURE 3

E D C B A

ALTERNATIVE CONFIGURATION FOR A COMBINED TURNING BASIN AND ANCHORAGE AREA

Conversations with the harbormaster and Bar Pilots Association revealed that a different configuration of a combined turning basin and anchorage area may be more desirable from an operational standpoint. That configuration was an area 1,500 feet by 5,500 feet which would allow turning while fast by the bow of the vessel. This turning manuever would allow greater tug control than free turning. The benefits for this configuration are approximately the same as the other except for the time saved by the McDuffie colliers. These vessels would not have to travel from an anchorage area to a turning basin, but some would have a slightly greater travel time after turning to McDuffie Coal Handling Plant. Since the precise location in this configuration that would be occupied by these colliers is not known, a travel time of five minutes from the midpoint of this configuration to the terminal was selected. The total time saved is thus two hours and 10 minutes. Table 26 shows the $2,135,000 benefits for this combination.

Since incremental benefits of $41,000 would be realized and since this configuration would require approximately 2,000,000 cubic yards of additional dredging at $2.45 per cubic yard, this configuration received no further consideration because of its lack of incremental feasibility.

TABLE 26

BENEFITS FOR A 1,500 x 5,500 FOOT COMBINED TURNING BASIN AND ANCHORAGE AREA

Turning Time Saved:		
McDuffie Coal Vessels		
157 vessels x 2.167 hrs. x $1,685/hr.		= $ 573,300
314 tugs x 2.167 hrs. x $700/hr.		= 476,300
157 tugs x 2.500 hrs. x $700/hr.		= 274,800
	SUB-TOTAL	$1,324,400
TCI Ore/Coal Vessels[1/]		$ 249,500
	SUB-TOTAL	$1,573,900
Anchorage Area[2/]		$ 561,400
	TOTAL	$2,135,300
	SAY	$2,135,000

Incremental Benefits to Alternative Combined Turning and Anchorage Basin:

$$\$2,135,000 - 2,094,000^{3/} = \$41,000$$

[1/] See Table 21 on page 32.

[2/] See Table 24 on page 37.

[3/] See Table 25 on page 38.

UPPER CHANNEL WIDENING ONLY

The Harbormaster's office has issued guidance concerning the safe operation of vessels which transits the harbor. This guidance includes a no wake speed limit while passing a collier docked at McDuffie Island. A no wake speed averages 3.0 knots for a loaded vessel and 4.0 knots for a vessel with ballast only for an average inbound and outbound speed of 3.5 knots. The speed limit with no collier docked at McDuffie is 6.0 knots. Widening the upper 2.25 nautical miles of the upper channel from 400 to 650 feet would permit faster vessel speeds when passing a collier docked at McDuffie Island. There is a collier docked at McDuffie virtually every day, thus the entire fleet calling at the Port of Mobile is affected by the no wake speed limit. The total time saved by the vessels is approximately 0.5 hour, (2.25 nautical miles ÷ 3.5 knots x 2 less 2.25 nautical miles ÷ 6 knots x 2 = 0.536 hrs., say 0.5 hr.).

A no wake speed for most of the fleet means partial loss of steerage. Therefore, reducing to a no wake speed means a vessel must use tug service in this reach of the channel. A wider channel in the vicinity of McDuffie Island which would permit faster vessel speeds would also eliminate the need for tug service.

Tug service time is computed from the time the tug leaves its dock until it returns to its dock. For the benefit calculations, it was assumed that the tugs could travel at six knots without a vessel and 3.5 knots with a vessel. The total tug time saved per round trip would be 2.0 hours, (2.25 nautical miles ÷ 6 knots x 2 plus 2.25 nautical miles ÷ 3.5 knots x 2 = 2.036, say 2 hrs.).

The Mobile Bar Pilots Association provided data on the number of tugs they would use to sail and to dock the various size and type vessels, a total of 2,937 tugs. Normalizing the number of McDuffie colliers adds another 130 tugs for a total of 3,067 tugs. A number of the smaller general cargo vessels could maintain navigation control at a no wake speed and were not considered in the benefit calculation.

Table 27 shows the $4,997,700 benefits for widening the upper 2.25 nautical miles of channel.

TABLE 27

BENEFITS FOR WIDENING UPPER 2.25 NAUTICAL MILES OF CHANNEL ONLY

Savings in vessel operating cost	
959 vessels x 0.5 hrs. x $1,468/hr.	= $ 703,900
Savings in tug service	
3,067 tugs x 2 hrs. x $700/hr.	= 4,293,800
TOTAL SAVINGS	$4,997,700

COMBINED TURNING BASIN, ANCHORAGE AREA, AND UPPER CHANNEL WIDENING

The major problem in passing McDuffie while a collier is docked is the hydraulic affect on both vessels in a narrow channel. During conversations with the Harbormaster's office and the Bar Pilots Association it was determined that the widening associated with construction of both the turning basin and the anchorage area was sufficient without additional widening for that part of the upper 2.25 nautical miles or 13,700 feet of channel. Construction of these two features in combination with additional widening on the upper end of the two features will provide safe vessel operation in this area of the channel. This procedure will accomplish the same results as would a full widening of the 2.25 nautical miles of channel without either the turning or anchorage basin.

The McDuffie Coal Handling Plant is located 150 feet from the ship channel. Provision of the turning basin and anchorage area along with the wider channel on the upper end of these two project features would provide adequate area at sufficient depth to dissipate the volumes of

water moved by large vessels in motion. The vessels could safely pass through the anchorage area and turning basin. The wider channel on the upper end of these two features is necessary to prevent maneuvering problems for vessels moving to and from the ship channel. This is because the northern side of the turning basin would be almost directly opposite the northern end of the second loading dock at McDuffie. Figure 4 is a schematic drawing of the bottom dimensions of the combined turning basin, anchorage area, and upper channel widening.

The benefits of channel widening in combination with the turning basin and anchorage area are not equal to the sum of the benefits for each of the project features. There are two reasons for this. First, the combined turning basin and anchorage area provide a portion of the benefits for channel widening. The portion of those benefits which should be assigned to the combined turning basin and anchorage area is based on the ratio of the length of the combined turning basin and anchorage area to the length of all three features. The second reason is that the vessels used in the determination of benefits for widening the channel in combination with the turning basin and anchorage area should be reduced by the number of vessels which would use the anchorage area, i.e., the McDuffie colliers and the grain carriers, and by the number of tugs associated with those vessels. Instead of moving through this reach of channel underway, these vessels would utilize the anchorage area for bunkering and hull inspections prior to going to the docks to load and would need the use of tugs to get underway. There are 243 McDuffie colliers and grain carriers and 1,036 tugs associated with moving these vessels. A weighted average operating cost for the remaining portion of the affected fleet was recomputed to be $1,446 when these dry bulk carriers were excluded. Table 28 shows the benefits for widening the channel which are to be apportioned between the combined turning basin and anchorage area, and the upper channel widening.

CORPS OF ENGINEERS | 4 | 3 | 2 | 1 | U. S. ARMY

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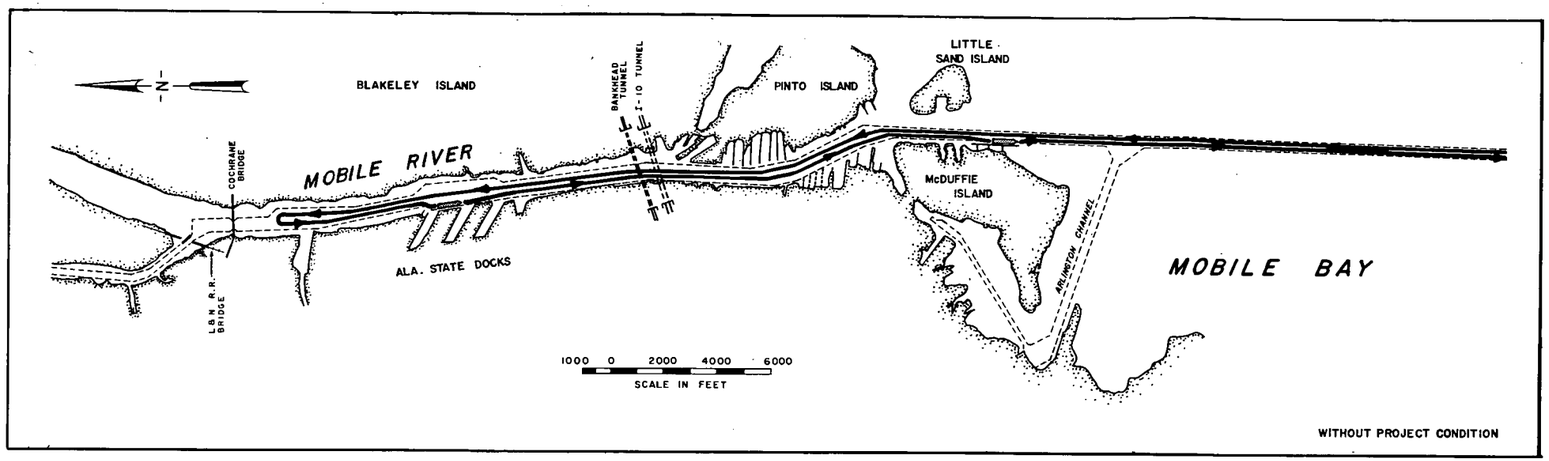

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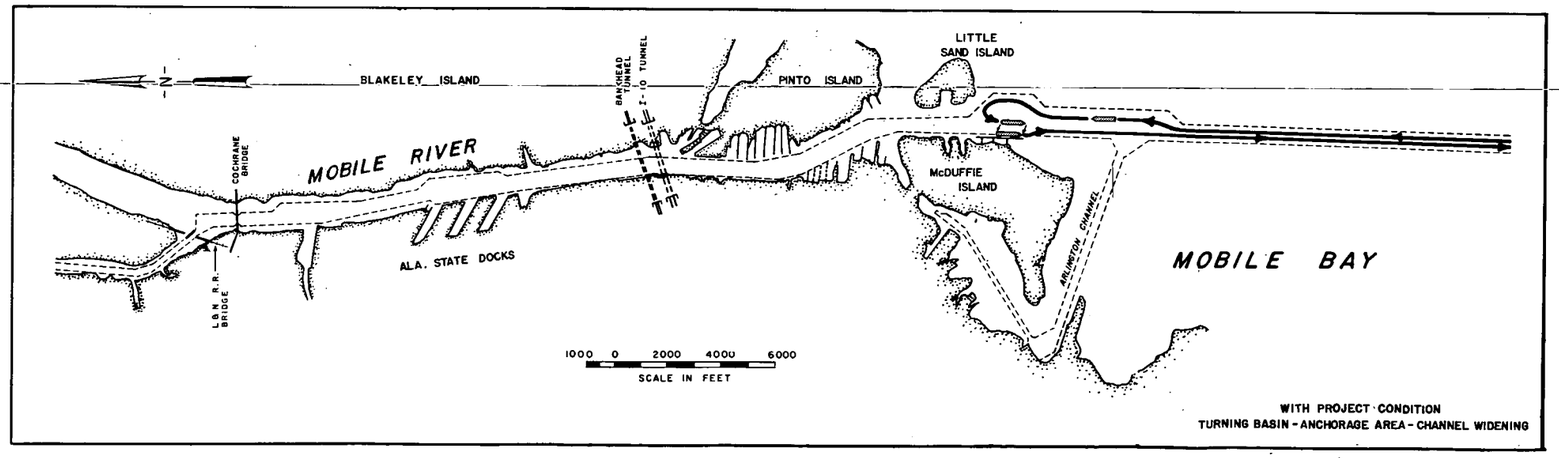

WITH PROJECT CONDITION
TURNING BASIN - ANCHORAGE AREA - CHANNEL WIDENING

U. S. ARMY ENGINEER DISTRICT, MOBILE
CORPS OF ENGINEERS
MOBILE, ALA.

MOBILE HARBOR, ALABAMA

MOVEMENT PATTERN
McDUFFIE

SH. REF. NO.	SPEC. NO.	SIZE	FILE NO.
			DRAWING NO.
	SCALE, AS SHOWN	DATE: MAY 1983	SHEET 4 OF 4

FIGURE 4

5 | 4 | 3 | 2 | 1

E D C B A

TABLE 28

BENEFITS FOR WIDENING THE CHANNEL SUBJECT TO APPORTIONMENT

Savings in vessel operating cost	
959 - 243 vessels x 0.5 hr. x $1,446	= $ 517,700
Savings in tug service	
3,067 - 1,036 tugs x 2 hrs. x $700/hr.	= $2,843,400
TOTAL	$3,361,100

Total widening for the 2.25 nautical miles of channel would involve widening a channel length of approximately 13,700 feet. The upper 3,000 feet of this 2.25 nautical miles, however, has an existing width of at least 650 feet. The length of the combined turning basin and anchorage area including the transition zones to and from the channel and between the turning basin and anchorage area is approximately 7,450 feet. The benefits for channel widening which are apportioned to the combined turning basin and anchorage area are thus the ratio of 7,450 feet to 10,700 or 70 percent. The remaining benefits are apportioned to widening the portion of the channel north of the turning basin. Table 29 shows the total benefits for combining the turning basin, anchorage area, and channel widening.

TABLE 29

BENEFITS TO TURNING BASIN, ANCHORAGE AREA, AND CHANNEL WIDENING

Turning Basin and Anchorage Area		
Amount from Table 25		$2,094,400
Portion of Channel Widening (70% of $3,361,100)		2,352,800
	SUB-TOTAL	$4,447,200
Channel Widening		
(30% x $3,361,100)		$1,008,300
	TOTAL	$5,455,500
	SAY	$5,456,000

PASSING LANE

Provision of a passing lane in the vicinity of the junction of the main ship channel and the Theodore ship channel would relieve the delays caused by controlled traffic conditions. The Formulation of Plans, Section D of the Survey Report contains the design criteria for channel widths. That evaluation selected a 550-foot bottom width in the main bay channel for a 55-foot deep channel. Such a channel width would permit safe one-way passage for the largest vessel and safe two-way traffic for the majority of the remaining vessels likely to call at the Port of Mobile.

Currently, controlled traffic conditions exist when a vessel with a beam width of 115 feet or greater transits the channel. Arrival and/or departure times are adjusted so that inbound vessels arrive as departing vessels clear the sea buoy at the channel entrance or departing vessels get under way after the inbound vessel has passed its location. There are no records that show the actual delays caused by these adjustments to arrival or departure times.

A simulation model to measure the delays associated with channel congestion is under development. The operation of the port is too complex to calculate benefits for the passing lane based on averages and simplifying assumptions. Therefore, the benefits for a passing lane will be computed when the simulation model is operating and available for use.

LAND ENHANCEMENT

For the Phase I items, it is proposed that 13,776,000 cubic yards of the new work material dredged from the upper bay turning basin, anchorage area, and channel widening be deposited in an area adjacent to Brookley. Of the 500 acre diked disposal area, it is estimated that 120 acres of usable commercial or industrial land and 380 acres of disposal area would be created. The least costly method of providing the same improvements are calculated as the benefit attributable to this fast land. As stated earlier, the first costs are $42,500 per acre. The average annual equivalent benefits for this area are $3,425 per acre for a total of $411,000 at 7 7/8 percent discount rate.

A comparison of the benefits to costs for the transshipment facility is shown on Table 20. The annual costs associated with the remaining Phase I features are shown in the main body of this report. A comparison of the average annual benefits to costs for the remaining Phase I features is shown on Table 30.

TABLE 30

SUMMARY OF ECONOMIC ANALYSIS OF REMAINING PHASE I FEATURES

(October 1982 Prices)

	AVERAGE ANNUAL BENEFITS	AVERAGE ANNUAL COSTS	BCR
Turning Basin and Anchorage Area	$4,447,200	$1,912,300	2.3
Channel Widening	1,008,300	993,600	1.02
Land Enhancement	411,000	Included Above	N/A
TOTAL	$5,866,500	$2,905,900	2.0
Passing Lane	N/C	$ N/C	N/A

N/C - Not computed.

N/A - Not appropriate.

SECTION III
REMAINING BENEFITS AND REMAINING COSTS

INTRODUCTION

Economic studies being conducted as part of Continuing Planning and Engineering (CP&E) have developed information concerning export steam coal which has recently begun to move through the Port of Mobile. With the completion of the second phase of development of the McDuffie Island Coal Handling Plant, space to store steam coal became available. The economic evaluation of export steam coal is not complete at this time; however, it has been included in this section of the Appendix, with simplifying assumptions as subsequently explained, to provide an indication of the impact on benefits remaining for deepening the entire length of the main ship channel to 55-feet. To place the recommended plan and the transshipment facility on a comparable basis, export steam coal was added to the analysis of both.

EXPORT STEAM COAL - RECOMMENDED PLAN

Numerous studies have been made recently which project the amounts of U.S. export of both metallurgical and steam coal. The amounts of export coal used for the recommended plan is almost entirely metallurgical coal. Table 31 displays the various forecasts of U.S. export coal. An average of U.S. export of steam coal was computed from those forecasts.

It was assumed that the 6.39 percent of all U.S. export coal shipped from the Port of Mobile in 1980 would continue into the future. The Port of Mobile's share of export steam coal was taken from the average of U.S. export steam coal and is shown on Table 32.

It was further assumed that each of the four destinations for export metallurgical coal would share the export steam coal in the same proportions

TABLE 31

U.S. COAL EXPORTS: COMPARISON OF EIA PROJECTIONS WITH OTHER PROJECTIONS, 1985-2000

(Million Short Tons per Year)

PROJECTION YEAR	EIA ARC 81 (Nov 81)	EIA ARC 80 (Jan 80)	ICF[a] (Nov 81)	DOE NEPP (Jul 81)	DRI (1981)	EXXON (Jan 81)	ICE[b] (Jan 81)	NCA Mid (Jan 81)	TEXACO (1981)	WOCOL B (1980)	AVG[1/] ALL STEAM
1985 Forecasts											
Metallurgical Coal	57	60	59	65	67	NA	NA	53	NA	51	
Steam Coal.	51*	25*	50*	45*	47*	NA	28*	52*	NA	35*	41.6
Total	108	85	109	110	114	95	NA	105	92	86	
1990 Forecasts											
Metallurgical Coal	62	70	64	70	72	NA	NA	59	NA	62	
Steam Coal.	80*	38*	88*	75*	72*	NA	64*	83*	NA	69*	71.6
Total	142	108	152	145	144	99	NA	142	126	131	
1995 Forecasts											
Metallurgical Coal	67	85	65	NA	77	NA	NA	NA	NA	NA	
Steam Coal.	104*	58*	129*	NA	87*	NA	NA	NA	NA	NA	94.5
Total	171	143	194	NA	164	123	NA	NA	151	NA	
2000 Forecasts											
Metallurgical Coal	72	NA	NA	70	83	NA	NA	NA	NA	72	
Steam Coal.	152*	NA	NA	180*	130*	NA	197*	NA	NA	151*	162.0
Total	224	NA	NA	250*	213	147	NA	NA	NA	223	

[a]Excludes exports to Eastern Europe.

[b]Steam coal projections for selected Western European and Far East Asian countries only.

NA = Not available.

Abbreviations: ARC = Annual Report to Congress

ICF = ICF Incorporated, Potential Role of Appalachian Producers in the Steam Coal Export Market, prepared for the Appalachian Regional Commission (Washington, D.C.: November 1981), p. 11.

DOE, NEPP = Department of Energy, National Energy Policy Plan

DRI = Data Resources, Inc.

ICE = Interagency Coal Export Task Force

NCA = National Coal Association

WOCOL = Report of the World Coal Study

1/ This column has been added to the original information.

*Denotes the values used to compute the averages.

SOURCE: U.S. Coal Exports: Projections and Documentation, Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels, U.S. Department of Energy, (DOE/EIA - 0317), March 1982, p. 26.

as those shown for export metallurgical coal on Table 11, page 13. Unit savings were also taken from Table 11. Table 33 shows the computation of average annual equivalent benefits for export steam coal for the 55-foot channel.

TABLE 32

PROJECTED ANNUAL TONNAGE OF EXPORT STEAM COAL

(October 1982 Prices)

YEAR	TONNAGE U.S. (Millions)	TONNAGE MOBILE (Millions)
1985	41.6	2.658
1990	71.1	4.543
1995	94.5	6.039
2000-2044	162.0	10.352

TABLE 33

AVERAGE ANNUAL BENEFITS FOR EXPORT STEAM COAL - RECOMMENDED PLAN

(October 1982 Prices)

DESTINATION	SAVINGS PER TON	PERCENT ALLOCATION	1995 TONNAGE (1,000)	1995 SAVINGS ($1,000)	2000-2044 TONNAGE (1,000)	2000-2044 SAVINGS ($1,000)
Japan	$4.95	46.8	2,826.3	$13,990.2	4,844.7	$23,981.3
Italy	4.92	35.9	2,168.0	10,666.7	3,716.4	18,284.7
England/Europe	4.38	12.0	724.7	3,174.2	1,242.2	5,440.8
East Coast South America	3.03	5.3	320.0	969.6	548.7	1,662.6
TOTAL		100	6,039.0	$28,800.7	10,352.0	$49,369.4
AAE @ 7 7/8% 1995-2044						$45,185.4
					SAY	$45,185.0

EXPORT STEAM COAL - TRANSSHIPMENT FACILITY

Table 34 displays the average annual equivalent benefits from export steam coal to the transshipment facility. The percent of coal loaded at McDuffie and distribution between the four destinations is based on the data shown on Tables 14 through 17.

REMAINING BENEFITS AND COSTS

The total average annual equivalent benefits for the recommended plan and the transshipment facility are shown on Table 35. The first year of project life for the transshipment facility was changed from 1988 to 1995 to make the average annual equivalent benefit values comparable to those for the recommeded plan. The result of changing the first year of project life for the transshipment facility is to increase benefits for export metallurgical coal from $44,269,000 to $46,093,000 and to increase benefits for export steam coal from $30,562,000 to $38,888,000.

The average annual cost for the recommended plan are for all items at a 55-foot depth. Based on preliminary analysis and conversations with the Mobile Harbormaster, the benefits to a turning basin and anchorage area at a 40-foot depth would not differ significantly from the benefits at a 55-foot depth since the benefits for these features accrue, primarily, to empty inbound vessels. The average annual cost for the recommended plan are, thus reduced by the amount associated with dredging the turning basin and anchorage area from 40 to 55 feet.

The average annual cost for the transshipment facility are net of the costs for the facility, transportation equipment, and associated operation and maintenance. As such, they represent only the average annual costs of dredging and maintaining a deeper channel over the bar. The ratio of remaining benefits to remaining costs is 1.1. Table 35 displays the remaining benefits and costs analysis.

TABLE 34

AVERAGE ANNUAL BENEFITS FROM EXPORT STEAM COAL FOR TRANSSHIPMENT FACILITY

(October 1982 Prices)

DESTINATION	% LOADED AT McDUFFIE	% LOADED AT TRANS-SHIPMENT	SAVINGS PER TON AT McDUFFIE ($/Ton)	SAVINGS PER TON AT TRANSSHIPMENT ($/Ton)	1988 TONNAGE (1,000 Tons)	1988 SAVINGS ($1,000)	1990 TONNAGE (1,000 Tons)	1990 SAVINGS ($1,000)
Japan	55.4	44.6	$4.95	$3.45	1,715.0	$ 7,341.9	2,126.1	$ 9,101.8
Italy	56.2	43.8	4.92	3.42	1,315.6	5,608.4	1,630.9	6,952.5
England/Europe	55.4	44.6	4.38	2.88	439.8	1,632.1	545.2	2,023.2
East Coast of South America	55.4	44.6	3.03	1.53	194.3	458.7	240.8	568.5
					3,664.7	$15,041.1	4,543.0	$18,646.0

	1995 TONNAGE (1,000 Tons)	1995 SAVINGS ($1,000)	2000-2044 TONNAGE (1,000 Tons)	2000-2044 SAVINGS ($1,000)		AAE 7 7/8% 1988-2037 1/	AAE 7 7/8% 1995-2044
Japan	2,826.3	$12,099.4	4,844.7	$20,740.2		$14,918.3	$18,982.5
Italy	2,168.0	9,242.4	3,716.4	15,843.0		11,395.8	14,500.3
England/Europe	724.7	2,689.4	1,242.2	4,609.8		3,315.9	4,219.2
East Coast of South America	320.0	755.5	548.7	1,295.5		931.8	1,185.7
TOTAL	6,039.0	$24,786.5	10,352.0	$42,488.5		$30,561.8	$38,887.7
					SAY	$30,562.0	$38,888.0

1/ Average annual equivalent. First year of project life, 1988, is based on interpolation of values between 1985 and 1990, considering a growth rate of 11.3% per year.

TABLE 35

REMAINING BENEFITS AND REMAINING COSTS

(October 1982 Prices)

	AVERAGE ANNUAL BENEFITS	AVERAGE ANNUAL COSTS	BENEFIT TO COST RATIO
Recommended Plan			
Channel Deepening and Widening			
Import Iron Ore (Table 12)	$ 17,494,000	$ N/A	N/A
Import Steam Coal (Table 12)	4,565,000	N/A	N/A
Export Metallurgical Coal (Table 12)	53,559,000	N/A	N/A
Export Steam Coal (Table 34)	45,185,000	N/A	N/A
SUB-TOTAL	$120,803,000	$45,832,000 [1]	2.6
Turning Basin and Anchorage Area (Table 25)	$ 2,094,000	($ 1,360,000 [2]	N/A
Land Enhancement	3,586,000	Included Above	N/A
TOTAL	$126,483,000	$44,472,000	2.8
Phase I Features			
Transshipment Facility			
Export Metallurgical Coal [3]	$ 46,093,000	$ N/A	N/A
Export Steam Coal [3]	38,888,000	N/A	N/A
SUB-TOTAL	$ 84,981,000	$ 8,583,300 [4]	N/A
Turning Basin and Anchorage Area (Table 30)	$ 4,447,400	$ 1,912,300	2.3
Upper Channel Widening (Table 30)	1,008,300	993,600	1.02
Land Enhancement (Table 30)	411,000	Included Above	N/A
TOTAL	$ 90,847,700	$11,489,200	7.9
REMAINING BENEFITS AND COSTS	$ 35,635,300	$32,982,600	1.1

[1] Average annual costs include dredging Turning Basin and Anchorage Area to 55 feet.

[2] Average annual costs are to dredge Turning Basin and Anchorage Area from 40 to 55 feet.

[3] Changing the first year of project life for the transshipment facility increases the average annual benefits from $44,269,000 to $46,093,000, and from $30,562,000 to $38,888,000.

[4] Average annual costs include only the costs of dredging and maintaining a deeper channel across the bar and the main ship channel.

SENSITIVITY ANALYSIS

The economic evaluation of information concerning export steam coal indicates that the four destinations for export metallurgical coal would not share export steam coal in the same proportions. As shown in Section I of this Appendix, the proportion of metallurgical coal allocated to the four destinations is as follows: 47 percent to Japan, 36 percent to Italy, 12 percent to England/Europe, and 5 percent to the East Coast of South America. The preliminary analysis of export steam coal indicates that the allocation of total tonnage would be: 4 percent to Japan, 51 percent to Italy, and 45 percent to England/Europe. Weighted average savings per ton of $4.77 and $4.68 were computed for the two sets of total tonnage allocations. It is thus believed that the benefits shown for export steam coal are reasonable and that the relative magnitude of those benefits will not change significantly based on changes in the relative amounts of total tonnage allocated to each destination.

In addition, a second category of benefits could be computed. The construction schedule for the recommended plan envisions deepening the entire length of the channel in three successive 5-foot increments. Thus, transportation savings would begin to accrue to those intermediate depths during construction. The artificial alteration of the first year of project life for the transshipment facility from 1988 to 1995 to make these features comparable, however, complicates the analysis of remaining benefits if benefits during construction are included. For this reason, an analysis of benefits during construction was not undertaken at this time.

SECTION IV
SUMMARY OF ECONOMIC ANALYSES

INTRODUCTION

The purpose of this appendix to the Supplemental Information Document on the Mobile Harbor Survey Report is to provide the economic analyses of the recommended plan and those project features which can be developed in an accelerated manner. Those Phase I features consist of a transshipment facility, a turning basin, an anchorage area, widening of the upper channel, and a mid-bay passing lane. An analysis of export steam coal based on recently developed information was made to provide an indication of impacts on remaining benefits when this commodity is included in the analyses of the recommended plan and the transshipment facility. Finally, an analysis of remaining benefits and costs was made.

The analysis of the recommended 55-foot channel plan consisted of updating export metallurgical coal tonnages, updating transportation costs and savings, and updating the discount rate. The transshipment facility would provide earlier access to deep water for export coal movements. The same information developed in updating the recommended plan was used in the economic analysis of the transshipment facility. The analysis of the remaining Phase I features which would enhance the efficient operation of port facilities was based on the vessel characteristics of the fleet which called at Mobile in 1981. No projection of future vessel characteristics was made for the analysis. The analysis of export steam coal was based on information extracted from an Energy Information Administration, U.S. Department of Energy document regarding U.S. export of steam coal through the year 2000. The Port of Mobile's historic share of U.S. coal export was assumed to remain unchanged.

UPDATE MOBILE HARBOR SURVEY REPORT

The Mobile Harbor Survey Report was updated to reflect current conditions. The major changes included updating export coal projections by inclusion of additional historic data. The cost of transportation per ton, and hence, the savings per ton for all commodities were updated from October 1978 values to October 1982 values. In addition, the procedures to account for the toll charges for using the Panama Canal were modified and updated to October 1982 prices. The discount rate of 6 7/8 percent was updated to 7 7/8 percent.

The result of these changes increased the average annual benefits from $33,130,000 to $79,204,000. Benefits for a turning basin and anchorage area were discussed in the Survey Report but were not analyzed. The inclusion of benefits for the turning basin and anchorage area increases the total benefits to $81,298,000. The export coal used in the Survey Report was almost totally metallurgical. Export metallurgical coal accounted for $53,559,000 of the updated total benefits. There was not enough supporting information during the time of the Survey Report to allow the inclusion of export steam coal in the benefits determination.

TRANSSHIPMENT FACILITY

The construction of a transshipment facility to handle export coal would provide earlier access to deep water at the Port of Mobile by the larger more efficient colliers that are currently in use. About 30 percent of the total export metallurgical coal that is projected to be shipped from Mobile would utilize a transshipment facility. The transportation costs per ton would be higher than for the recommended plan by an amount to transport and load coal at the facility. The average annual benefits from export metallurgical coal for a transshipment facility are estimated to be $44,269,000. The average annual costs are estimated to be $19,205,000. Assuming a 50 year project life and the current Federal discount rate of 7 7/8 percent, the benefit to cost ratio would be 2.3.

The transshipment facility was also analyzed assuming a seven year project life and a discount rate of 7 7/8 percent. The transshipment facility is scheduled to be completed in 1988 and the recommended plan is scheduled to be completed in 1995. Using this assumption, the average annual benefits for export metallurgical coal were estimated to be $43,939,000 and the average annual costs were estimated to be $38,054,000. The benefit to cost ratio would be 1.1.

TURNING BASIN, ANCHORAGE AREA, AND UPPER CHANNEL WIDENING

These Phase I features were included in the Recommended Plan set forth in the Survey Report, but were not analyzed at that time. Based on preliminary analysis and conversations with the Mobile Harbormaster, the benefits to a turning basin and anchorage area at a 40-foot depth would not differ significantly from the benefits at a 55-foot depth. The benefits for these features accrue, primarily to empty inbound vessels.

While each of these Phase I features were analyzed as separate entities, it was discovered that the most efficient project was a combination of all three features acting in unison. This project would provide for the more efficient operation of the harbor facilities, primarily for the coal and grain movements. The project would reduce the travel distance and associated tug service for colliers to the existing turning basin. It would allow inbound coal and grain vessels to bunker and accomplish inspections at anchorage as opposed to performing these tasks at a layberth. In addition, the problems associated with a narrow channel while a vessel was docked at McDuffie which cause vessel speed reductions and tug assistance would be eliminated. The average annual benefits for these features were based on the fleet that called at Mobile in 1981. No projection of future fleets were included. These items were analyzed at the existing project depth of 40 feet. The average annual benefits including land enhancement were estimated to be $5,867,000 and the average annual costs were estimated to be $2,906,000. The benefit to cost ratio would be 2.0.

PASSING LANE

A passing lane in the vicinity of the junction of the Main Ship Channel and the Theodore Ship Channel is still under consideration for early construction. A passing lane would relieve channel congestion due to increased traffic and the increased size of vessels. A simulation model under development is needed, however, to compute the benefits attributable to this feature. The benefits will be computed as soon as the simulation model is completely operational.

SUMMARY OF ECONOMIC ANALYSES

A summary of the economic analyses is provided in Table 36. The total benefits for the recommended plan includes benefits for land enhancement which are based on 1,047 acres of usable industrial and commercial land. The total benefits for the Phase I features includes land enhancement benefits for 120 acres of usable land.

REMAINING BENEFITS AND COSTS

An analysis of remaining benefits and remaining costs was also performed. To accomplish this task, an analysis of benefits from export steam coal was made. The results of this analysis were added to the analyses of the recommended plan and the transshipment facility.

Numerous studies have been recently completed which project U.S. export of steam coal. These studies and the Port of Mobile's historic share of U.S. export coal were used to project the amount of export steam coal that was used in the benefit analysis. In the absence of more definitive information, it was assumed that the distribution of export steam coal would be the same as the distribution of export metallurgical coal. Under that assumption, the average annual benefits from export steam coal are estimated to be $45,185,000 for the recommended plan and $30,562,000 for the transshipment facility.

Preliminary analysis of available data suggests that a different distribution of export steam coal would be warranted. Changing the

TABLE 36

SUMMARY OF ECONOMIC ANALYSES

(October 1982 Prices)

RECOMMENDED	ANNUAL BENEFITS	ANNUAL COSTS	NET BENEFITS	BENEFIT COST RATIO
55-foot Channel[1/]	$75,618,000	$45,832,000	$29,786,000	1.7
Turning Basin and Anchorage Area[2/]	2,094,000	Included Above	2,094,000	N/A
Land Enhancement[3/]	3,586,000	Included Above	3,586,000	N/A
TOTAL	$81,298,000	$45,832,000	$35,466,000	1.8
PHASE I FEATURES				
Transshipment Facility[4/]	$44,269,000	$19,205,000	$25,064,000	2.3
Turning Basin, Anchorage Area, and Upper Channel Widening[2/]	5,456,000	2,906,000	2,550,000	1.9
Passing Lane	N/C	N/C	N/A	N/A
Land Enhancement[5/]	411,000	Included Above	411,000	N/A
TOTAL	$50,136,000	$22,111,000	$28,025,000	2.3

[1/] Fifty year project life, 1995 first year of project life, 7 7/8% discount rate.

[2/] Based on 1981 fleet, no projection of number or size of future vessels.

[3/] Based on 1,047 acres of useable industrial and commercial land.

[4/] Fifty year project life, 1988 first year of project life, 7 7/8% discount rate.

[5/] Based on 120 acres of useable industrial and commercial land.

distribution of the total tonnage, however, results in less than a 5 percent change in benefits because savings per ton to Japan do not differ significantly from the savings per ton to northern or southern European destinations.

The addition of export steam coal increased the average annual benefits for the recommended plan from $81,298,000 to $126,483,000. The average annual benefits for the transshipment facility increased from $44,269,000 to $74,831,000 with the inclusion of export steam coal.

Average annual costs for the recommended plan were reduced by the amount to dredge the turning basin and anchorage area from 40 to 55 feet, $1,360,000, since the benefits would not differ significantly at either depth. The average annual cost for the recommended plan are, thus, $44,472,000.

The first year of project life for the transshipment facility was changed from 1988 to 1995 in order to make the average annual equivalent benefits comparable to those for the recommended plan. The result of this change increased the average annual equivalent benefits for the transshipment facility from $74,831,000 to $84,981,000.

Average annual costs for the transshipment facility of $8,583,300 reflect only the cost to dredge and maintain a deeper channel across the bar and the Main Ship Channel. Inclusion of the benefits and costs associated with the other Phase I features results in total benefits of $90,847,700 and total costs of $11,489,200. The remaining benefits and costs are $35,635,300 and $32,982,800, respectively. The ratio of remaining benefits to remaining costs would be 1.1.