CESAM/PDFC-88/02

(2)

GULFPORT HARBOR, MISSISSIPPI

REEVALUATION REPORT

US Army Corps
of Engineers
Mobile District

FEBRUARY 1988

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: CESAM/PDFC-88/02	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Reevaluation Report Gulfport Harbor, Mississippi	5. TYPE OF REPORT & PERIOD COVERED: Final Reevaluation Report Feb 1988
6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s): Johnny L. Grandison	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: US Army Engineer District, Mobile Coastal Section, Planning Division (CESAM-PD-FC) P. O. Box 2288, Mobile, AL 36628-0001	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: CESAM-PD-FC P. O. Box 2288 Mobile, AL 36628-0001	12. REPORT DATE: Feb 1988
	13. NUMBER OF PAGES: 48
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Reevaluation Report
Feasibility Study
Thin-Layer Disposal

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report consists of an economic, engineering and environmental reanalysis of the proposed modifications to the Gulfport Harbor navigation project.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

EXECUTIVE SUMMARY

At a meeting in Jacksonville Beach, Florida on 10 February 1986, representatives from the Office of the Assistant Secretary of the Army for Civil Works (ASA/CW) and the Office of the Chief of Engineers (OCE) asked that a decision on the merits of project modification at Gulfport Harbor, Mississippi be reached. This report presents the findings of a reevaluation undertaken to determine if the considered navigation improvements at Gulfport Harbor should be included in construction budgeting and if studies necessary to prepare the GDM should be continued.

Gulfport Harbor is located in Harrison County, Mississippi on Mississippi Sound, about equidistant (80 miles) from New Orleans, Louisiana, and Mobile, Alabama. The existing Federal channel at Gulfport is 32 feet deep by 300 feet wide and about 8 miles long across Ship Island Bar, 30 feet deep by 220 feet wide and about 11 miles long through Mississippi Sound to an anchorage basin at Gulfport Harbor. The anchorage basin is 30 feet deep, 1,320 feet wide and 2,640 feet long. The Federal project also includes a 26 acre commercial small boat harbor with an entrance channel that branches from the main ship channel. The entrance channel is 4,300 feet long and provides a navigation depth of 8 feet and a width of 100 feet.

Deepening the existing Federal project at Gulfport Harbor was authorized by the Supplemental Appropriations Act of FY 1985 and modified by the Water Resources Development Act of 1986 (WRDA 1986), PL 99-662. The WRDA of 1986 states in part, "...except that, for reasons of environmental quality, dredged material from such project shall be disposed of in open water in the Gulf of Mexico in accordance with all provisions of Federal law. For the purpose of economic evaluation of this project the benefits from such open water disposal shall be deemed to be at least equal to the costs of such disposal."

For this report, five channel configurations with increased depths ranging from 2 to 6 feet were evaluated. Along with these channel alternatives, the five disposal options which were considered in the 1976 feasibility report were reconsidered: Open Water Disposal, Island Construction, Thin-Layer Deposition (presently referred to as Thin-Layer Disposal), and Specially Designed Equipment (now referred to as Gulf Disposal).

The considered plans contained the following:

a. Deepen the existing channel only.

b. Deepen and widen the existing alignment to 300 feet in the sound and 400 feet on the bar.

c. Deepen only the existing alignment and relocate Ship Island Pass Channel.

e. Reroute the lower portion of the channel, at the authorized dimensions, through "Camille Cut", in Ship Island.

Each of the plans listed above was evaluated at depths of 32, 34, and 36 feet. Although varying channel widths were evaluated in conjunction with each considered channel depth, the benefits for the increased width were not calculated at this stage in the study. Bend widening was clearly needed with the considered improvements, and therefore, it was included in all alternatives.

Only a marginal increase in tonnages and the corresponding benefits would be gained with the considered 32-foot project depth, while the mobilization and demobilization costs are relatively constant for all plans of improvement. As such, the considered plans evaluated at the 32-foot depth were not economically justified.

A number of the alternative plans evaluated at the 34 and 36-foot depth demonstrated economic feasibility. On the basis of these preliminary evaluations, the National Economic Development (NED) plan was found to be alternative "C". Alternative "C" provides for deepening the existing Federal project to a 36-foot depth and widening the problem bends. Costs associated with this plan were computed using thin-layer disposal of new work material, with maintenance material being disposed along the sides of the channel as is currently practiced. Evaluations of the considered project modifications using gulf disposal for both new work and maintenance results in an uneconomical project unless the provisions of the authorization which state that the benefits of gulf disposal would be equal to the costs, are applied. Plan "C" yields a net annual benefit of $1,047,000, and has a benefit/cost ratio of 1.43 to 1. Alternative "C" may not be the recommended plan in the GDM. The hydrodynamic studies, currently being conducted by the Coastal Engineering Research Center (CERC) and the Mobile District, to resolve the shoaling problems associated with the westward migration of Ship Island could result in the recommendation of a different NED plan.

Due to the wording of the authorization in WRDA 1986, plans not involving gulf disposal of dredged material were evaluated to indicate the level of trade-off from the NED disposal plan; and therefore, the incremental cost being offset by environmental benefits associated with gulf disposal.

Thin-layer disposal was evaluated because it is the likely option that would produce a plan with the greatest economic benefits in excess of costs (the NED plan). The environmental feasibility of this type of disposal, however, has been of special concern to environmental interests. To determine if there would be any significant short-term impacts from thin-layer disposal, the Mobile District initiated two thin-layer prototype tests prior to passage of the WRDA 86. The test conducted in Mobile Bay at Fowl River utilized maintenance material, and the test conducted at Gulfport Harbor used new work material. The current prognosis of these tests is that thin-layer disposal may not result in significant short-term adverse environmental impacts. Further analyses will extrapolate these test results and other existing

information to the case of long-term effects on a large disposal area and assess the impacts on aquatic resources of Mississippi Sound.

This Reevaluation Report has clearly determined that there is a viable plan for navigation improvements at Gulfport Harbor. Work is continuing on the study to complete the evaluation of thin-layer disposal, refine the economic analyses to consider channel alignment and width variations, and to coordinate with local, state, and national environmental interests. A draft EIS detailing the impacts of thin-layer disposal in Mississippi Sound and disposal in the Gulf of Mexico will be coordinated in September 1988.

REEVALUATION REPORT
FOR
GULFPORT HARBOR, MISSISSIPPI

Table of Contents

Table of Contents (Cont'd)

List of Tables

Tables of Contents (Cont'd)

List of Tables

List of Figures

REEVALUATION REPORT
FOR
GULFPORT HARBOR, MISSISSIPPI

INTRODUCTION

PURPOSE

On 10 February 1986, there was a meeting at Jacksonville Beach, Florida, to discuss new starts resulting from project authorizations contained in the 1985 Supplemental Appropriations Act. Representatives from the office of the Assistance Secretary of the Army for Civil Works [ASA(CW)] and the Office of the Chief of Engineers (OCE) asked that a "go/no-go" decision point on project construction be reached for Gulfport Harbor as soon as possible. It was further decided that a decision would be made prior to the FY 1989 budget hearings, and that a reevaluation document would be prepared to support the conclusion reached. This report was prepared to serve as that reevaluation document. It contains dredging costs estimates based on volume computations using recent surveys and benefit computations using current traffic information. The Reevaluation Report will demonstrate that there is a viable incremental project worthy of construction within the project dimensions recently authorized by the Water Resources Development Act of 1986 (WRDA 86).

When the recommended improvements to Gulfport Harbor were authorized the data in the feasibility study was at least 10 years old. While the improvements were before Congress, costs and benefits were updated using cost indices. These indexed costs and benefits indicated that, the project was approaching infeasibility. Also during this period there was a significant change in commodity mix, traffic movements, and oil prices, all which indicated some reformulation may be necessary. In addition, investigation of disposal options and the associated environmental and economic impacts had to be conducted. Originally, these studies were to be accomplished in a Phase I General Design Memorandum. Currently, however, the reformulation investigations are being conducted as part of the preparation of the General Design Memorandum.

EXISTING PROJECT

Gulfport Harbor is located in Harrison County, Mississippi on Mississippi Sound about equidistant (80 miles) from New Orleans, Louisiana, and Mobile, Alabama. The existing Federal channel at Gulfport is 32 feet deep by 300 feet wide and about 8 miles long across Ship Island Bar, 30 feet deep by 220 feet wide and about 11 miles long through Mississippi Sound to an anchorage basin at Gulfport that is 30 feet deep, 1,320 feet wide and 2,640 feet long. The project also includes a 26 acre commercial small boat harbor with an entrance channel 8 feet deep by 100 feet wide and 4,300 feet long (See Figure 1).

AUTHORITY

The present plan of improvement was authorized by the Supplemental Appropriations Act for Fiscal Year 1985 and modified by the WRDA 86.

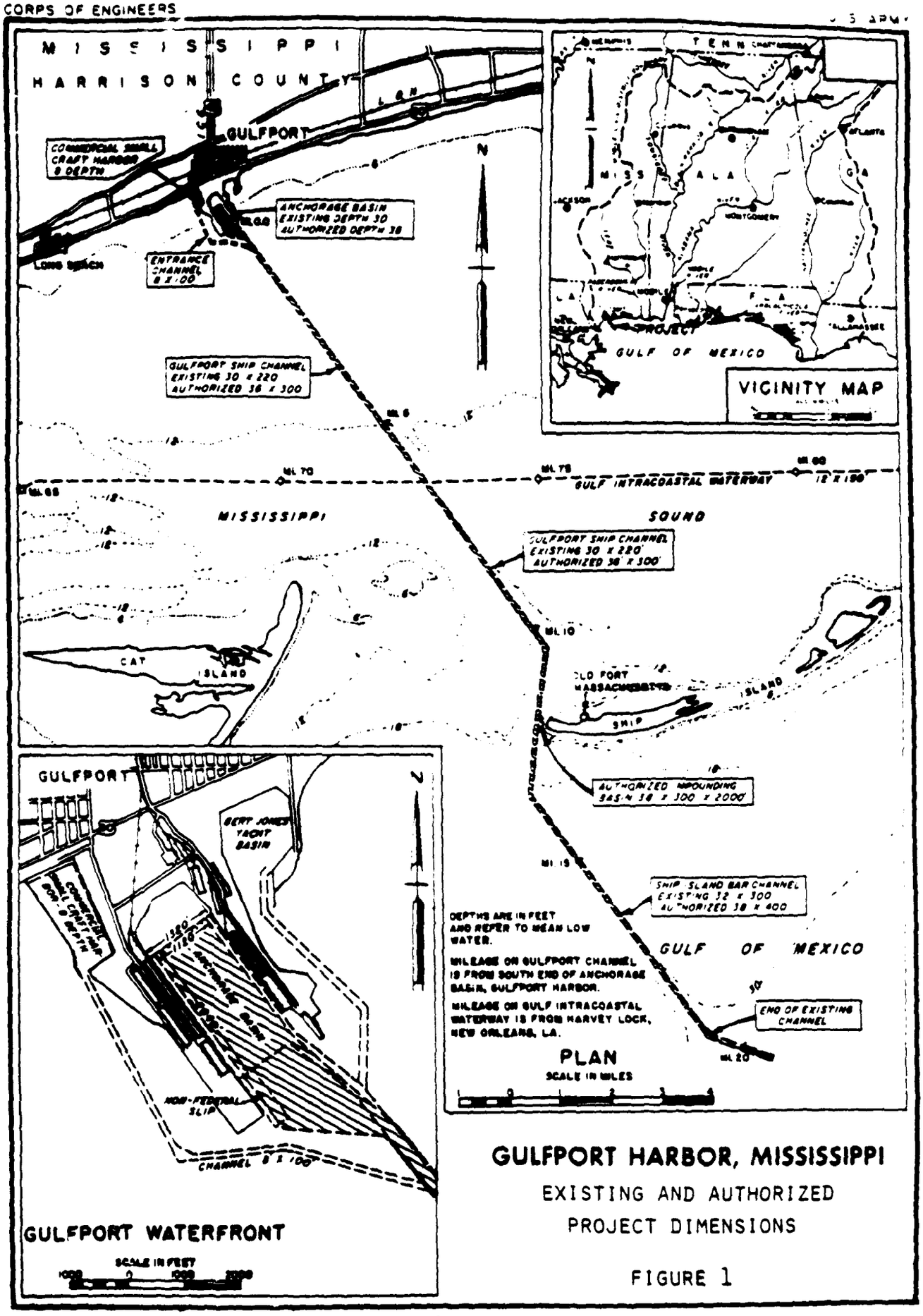
DESCRIPTION OF AUTHORIZED IMPROVEMENTS

Deepen and widen the existing ship channel from 30 feet by 220 feet to 36 feet by 300 feet in Mississippi Sound; and deepen and widen the bar channel from 32 feet by 300 feet to 38 feet by 400 feet, all along the present alignment. Relocate the Ship Island Pass channel segment, with dimensions of 38 by 400 feet, about 1000 feet to the west, with appropriate bend widening at each end, and add a littoral drift impoundment basin 38 feet deep by 300 feet wide by 2000 feet long opposite the western tip of Ship Island. Modify the anchorage basin from 30 feet deep by 1320 feet wide by 2640 feet long to 36 feet deep by 1120 feet wide by 2640 feet long and enlarge the entrance to the basin from a point 2300 feet south of the southeast corner and along an angle of about 45 degrees (See Figure 1). The material dredged from the project would be placed in approved deep-water areas in the Gulf of Mexico.

CONSIDERATION OF ALTERNATIVES

GENERAL

The wording in WRDA 86, authorizing the improvement of Gulfport Harbor channel, states in part, "... except that, for reasons of environmental quality, dredged material from such project shall be disposed of in open water in the Gulf of Mexico in accordance with all provisions of Federal law. For the purpose of economic evaluation of this project the benefits from such open water disposal shall be deemed to be at least equal to the costs of such disposal." As a means of determining the environmental benefits attributable to gulf disposal, we are conducting investigations are being conducted to



GULFPORT HARBOR, MISSISSIPPI

EXISTING AND AUTHORIZED PROJECT DIMENSIONS

FIGURE 1

identify the plan that maximizes net National Economic Development (NED) benefits. The difference in cost between the NED plan and the costs of gulf disposal will be taken as the environmental benefit for gulf disposal. Consequently, the economic feasibility of gulf disposal depends on the economic feasibility of the NED Plan. Recent reevaluations indicate that thin-layer disposal of dredged material on the Mississippi Sound bottom is the likely option that would produce a plan with the greatest NED benefits in excess of costs; therefore, it is necessary to evaluate the environmental impacts of this disposal option.

DISPOSAL OPTIONS

The 1976 feasibility report considered in detail 4 alternative disposal plans: Open Water Disposal, Island Construction, Thin Layer Deposition (presently referred to as Thin Layer Disposal), and Specially Designed Equipment (now referred to as Gulf Disposal). Each of these was reconsidered, some rather briefly, and each is discussed below, along with disposal practices currently utilized to maintain the existing Federal Project.

MAINTENANCE OF EXISTING FEDERAL PROJECT.

Maintenance of the existing project at Gulfport (30 foot x 220-foot) is accomplished by disposing in water areas along side the channel. This method of disposal is similar to that used for other deep-draft navigation projects in this area. The dredge discharge line is run about 2500 feet to the side of the channel and the dredged material pumped out to that point and discharged. The method has been popular because it is very simple and relatively inexpensive.

CONSTRUCTION AND MAINTENANCE OF AUTHORIZED PROJECT

a. Open Water Disposal. This option consists of continuing to dispose of maintenance material as now practiced for the existing Federal project. The new work material from the gulf to the west end of Ship Island would be placed in the Gulf of Mexico. The material from the anchorage basin to Ship Island would be deposited in open water areas adjacent to the channel.

b. Island Construction. In this alternative, new work dredged material from the anchorage basin and the Mississippi Sound channel reach would be used to create from 1 to 3 islands in the sound. Since this alternative was the second choice of many of the agencies reviewing the 1976 report, it was restudied for the present effort. While technically feasible, this is not a desirable alternative. The material to be dredged is very soft and could be expected to spread widely, leaving small islands which would actually be very flat mounds on the sound bottom. Preventing these islands from eroding would require extensive, and expensive, construction of riprap and planting

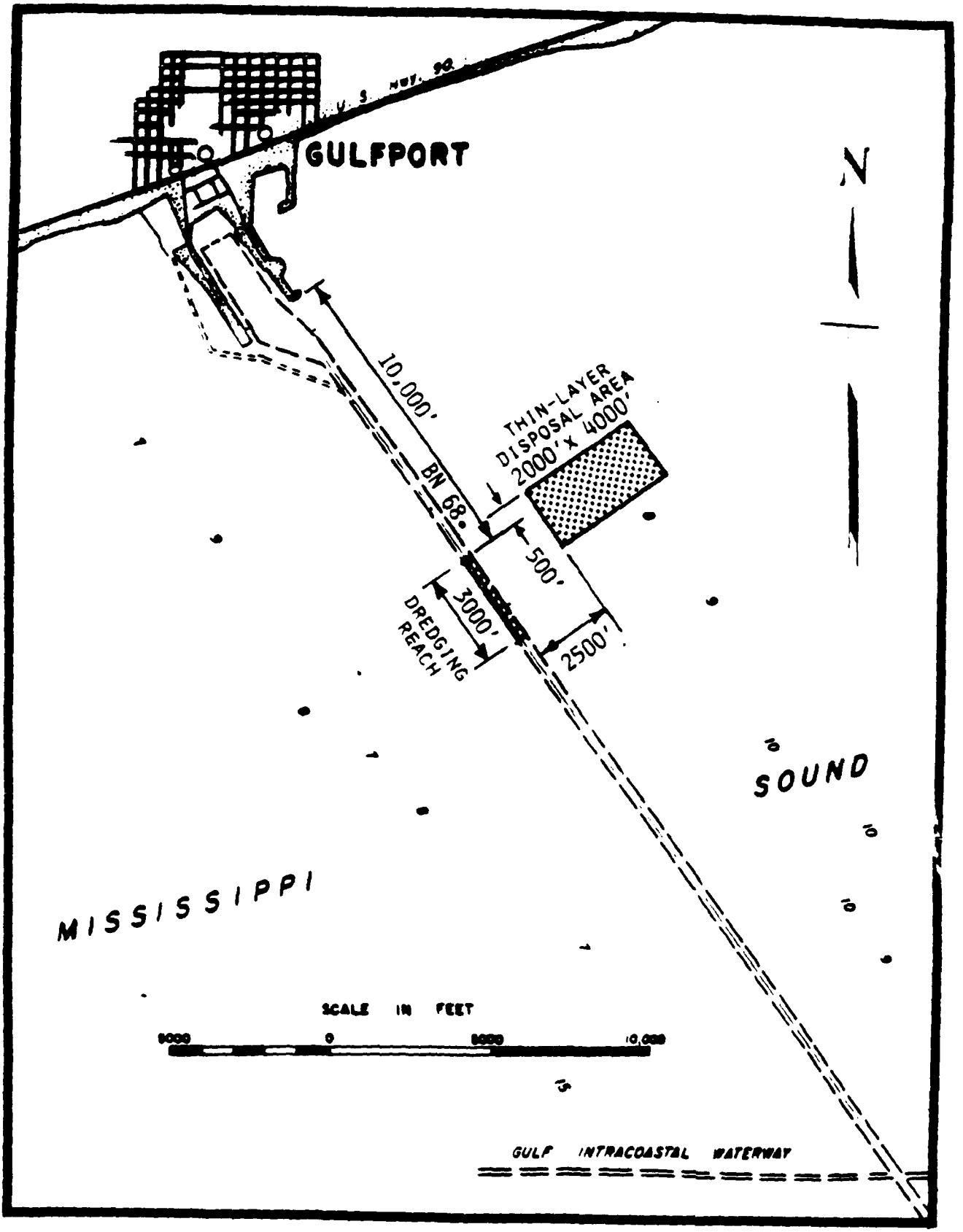
of vegetation. In preliminary analysis, this alternative generated costs that were only slightly less expensive than gulf disposal. Due to the difficulty and uncertainty associated with this alternative, more extensive investigations were not warranted.

c. Gulf Disposal (called" Specially Designed Equipment" in the 1976 report). This plan as developed for the 1976 report, would utilize special equipment (similar to contemporary bottom dump barge scows) to transport material removed by pipeline dredge from the sound channel to approved sites in the Gulf of Mexico. Constructing this equipment would have resulted in a large upfront investment. Since that time, the dredging industry has developed new plant, such as split hull bottom dump barge scows, which would eliminate the upfront investment and make this alternative more economical. This is still, however, the most expensive disposal alternative and preliminary evaluations show that this alternative would not be economically feasible based on traditional economic evaluation procedures. Gulf disposal for both new work and maintenance material is specified in the WRDA 86.

d. Thin Layer Deposition. This is a variation of open water disposal where the material dredged by pipeline dredge would be thinly spread (6-12 inch layer) over a wide area of the sound. This would avoid the possible mounding which could result from other forms of open water disposal and the loss of productive bottoms resulting from Island Construction. This disposal method for the Gulfport project is not acceptable to all environmental agencies and interests. The Mobile District is conducting two thin-layer tests to evaluate the practicality and feasibility of thin-layer disposal. One test is in Mobile Bay at Fowl River, which utilized maintenance material, and another is in Mississippi Sound at Gulfport Harbor, which used new work material (the test location is shown in Figure 2). The test at Gulfport was initiated as part of the current study effort and continued after passage of the WRDA 86. If the thin-layer disposal alternative is found to be the NED plan, it would then be the basis to determine economic feasibility of the gulf disposal option.

CHANNEL OPTIONS

Gulfport Harbor Ship Channel was constructed and maintained by local interests until the existing channel dimensions, authorized by the River and Harbor Act approved 30 June 1948, were constructed in 1950. During the early 1900's the bar channel segment of the project which extends for about 8 miles from the Gulf of Mexico through Ship Island Pass, was located several hundred yards west of Ship Island. By the 1950's, however, westward migration of the island produced significant shoaling and increased maintenance dredging requirements for the channel segment. Shoaling exceeded maintenance dredging, and resulted



GULFPORT HARBOR, MISSISSIPPI

DREDGING REACH AND DISPOSAL AREA FOR THIN-LAYER TEST

FIGURE 2

in a re-alignment of the channel westward around the advancing island tip.

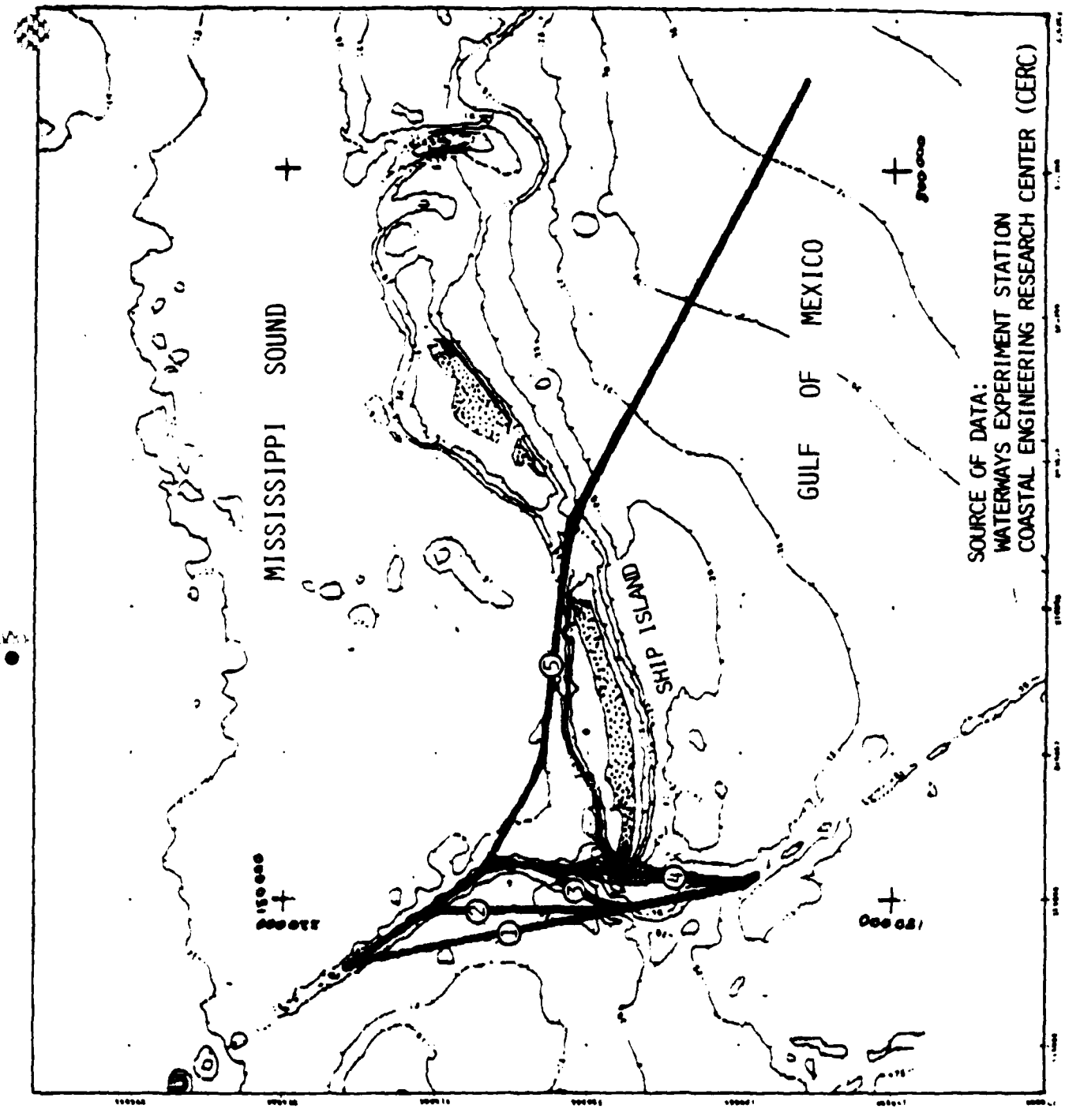
Representatives of the Gulfport Pilot's Association recommended several channel alignments which they believed would minimize the problem of extensive shoaling and ease navigation through the bends of the channel in the vicinity of Ship Island Pass. The Pilot Association's recommendations are considered in the alignments being evaluated for the Gulfport Harbor study.

To assist in defining the best channel alignment in the vicinity of Ship Island, the Waterways Experiment Station, Coastal Engineering Research Center (CERC) was requested to study and document the coastal processes associated with the island's migration through analysis of island morphologic change, bathymetric change, and wave refraction efforts. This information will be used to determine relationships between littoral transport and various navigation channel alignments and to select a channel alignment which eliminates or minimizes the impacts of island migration on the navigation channel for the economic life of the Gulfport Harbor project.

CERC was asked to investigate five general channel alignments with characteristics which address the problems associated with the westward migration of Ship Island (See Figure 3). Three of the alignments (1, 2, and 3) extend from the present bend in the entrance channel at the edge of Ship Island Pass outer bar to a point approximately 1900 feet west of the 30-foot contour adjacent to the island tip. The first of these three alignments, "1", continues the same bearing until it intersects with the original channel alignment further north. Alignment "2" follows the same path as "1" until it reaches a point west of Ship Island, where it changes bearing to due north until it intersects with the original channel alignment. Alignment "3" extends to a point 1900 feet west of Ship Island, but changes to a northeast bearing until it intersects with the original channel alignment. See Figure 3.

The original channel alignment at Gulfport Harbor will be examined also. This alignment, designated as alignment "4", would take advantage of the existing channel which is already dredged, but would involve extensive construction dredging adjacent to the west tip of Ship Island, as well as high annual maintenance dredging associated with the migration of Ship Island.

A fifth channel alignment (alignment "5") will be analyzed to determine the feasibility of relocating the ship channel across Mississippi Sound north of Ship Island, and out into the Gulf through Camille Cut. This alignment would require the most construction dredging, but could possibly be justified if long-term maintenance dredging associated with island migration could be avoided.



GULFPORT HARBOR, MISS.
CHANNEL ALIGNMENTS

FIGURE 3

The five channel considerations being studied by CERC are not considered engineering designs, as they are only approximate channel lay-outs for construction volumetric comparisons, and provide important hydrodynamic data. They do not include detailed navigability and environmental aspects, nor do they address the Corps design specifications.

The following channel alignments, which closely approximate those evaluated by CERC, were evaluated for this study.

a. Deepen the channel along the existing alignment, with no other improvements except for widening the problem bends. Since bend widening was a readily apparent and easily justified need, it was included in all alternatives. Considering each depth increment as a different alternative resulted in Alternatives A, for a 2-foot deepening, B for a 4-foot deepening, and C for a 6-foot deepening.

b. Deepen and widen to 300 feet in the sound and 400 feet on the bar along the existing alignment. This resulted in Alternatives D for 2 feet, E for 4 feet, and F for 6 feet. Alternative F is the Authorized Plan described in the WRDA 86.

c. Deepen only along the existing alignment, except relocate Ship Island Pass channel as authorized. This produced Alternatives G for 2 feet, H for 4 feet, and I for 6 feet.

d. Deepen and widen along the existing alignment, and relocate Ship Island Pass channel. Alternatives J for 2 feet, K for 4 feet, and L for 6 feet.

e. Reroute the lower portion of the channel, at the authorized width, through "Camille Cut" in Ship Island , with widening to 300 feet and deepening as required in the balance of the old channel. Alternatives M for 2 feet, N for 4 feet, and O for 6 feet.

BASIS OF ESTIMATED DREDGING COSTS

DISPOSAL PLANS

In the preparation of the cost estimates displayed in this document for each of the previously described channel alternatives, one disposal plan was considered. This plan includes the use of four different methods of dredged material disposal.

a. Thin layer disposal in Mississippi Sound. This method would route the discharge from a pipeline dredge through a spray head on a special barge which would be moored with anchored cables and moved constantly by winches attached to the cables. It is intended, by

using this method, to distribute the material as evenly as possible over 9,740-acres of Mississippi Sound bottoms and should result in a layer between 6 and 12 inches thick which would preclude the loss of nonmotile bottom lifeforms. Material dredged from the anchorage basin and the major portion of the channel segment from the basin to Ship Island Pass would be disposed of in this manner. The areas considered for disposal of new work material by this method are shown on Figure 4.

b. Feeder berm construction. Sandy material from Ship Island Pass and the nearshore portion of the Gulf Approach would be placed in water 14 to 18 feet deep near Cat Island so that the material would likely return to the littoral system. The channel segment from which new work material would be placed in the feeder berm is shown in Figure 5, along with the considered location of the berm.

c. Gulf disposal. Material farther out on the bar channel portion of the Gulf Approach contains increasing amounts of mud as distance from shore increases. This material becomes more unsuitable for berm construction as the mud content increases and also becomes more expensive to transport to a suitable berm site. This material, therefore, will be placed in the existing approved gulf disposal sites shown in Figure 6.

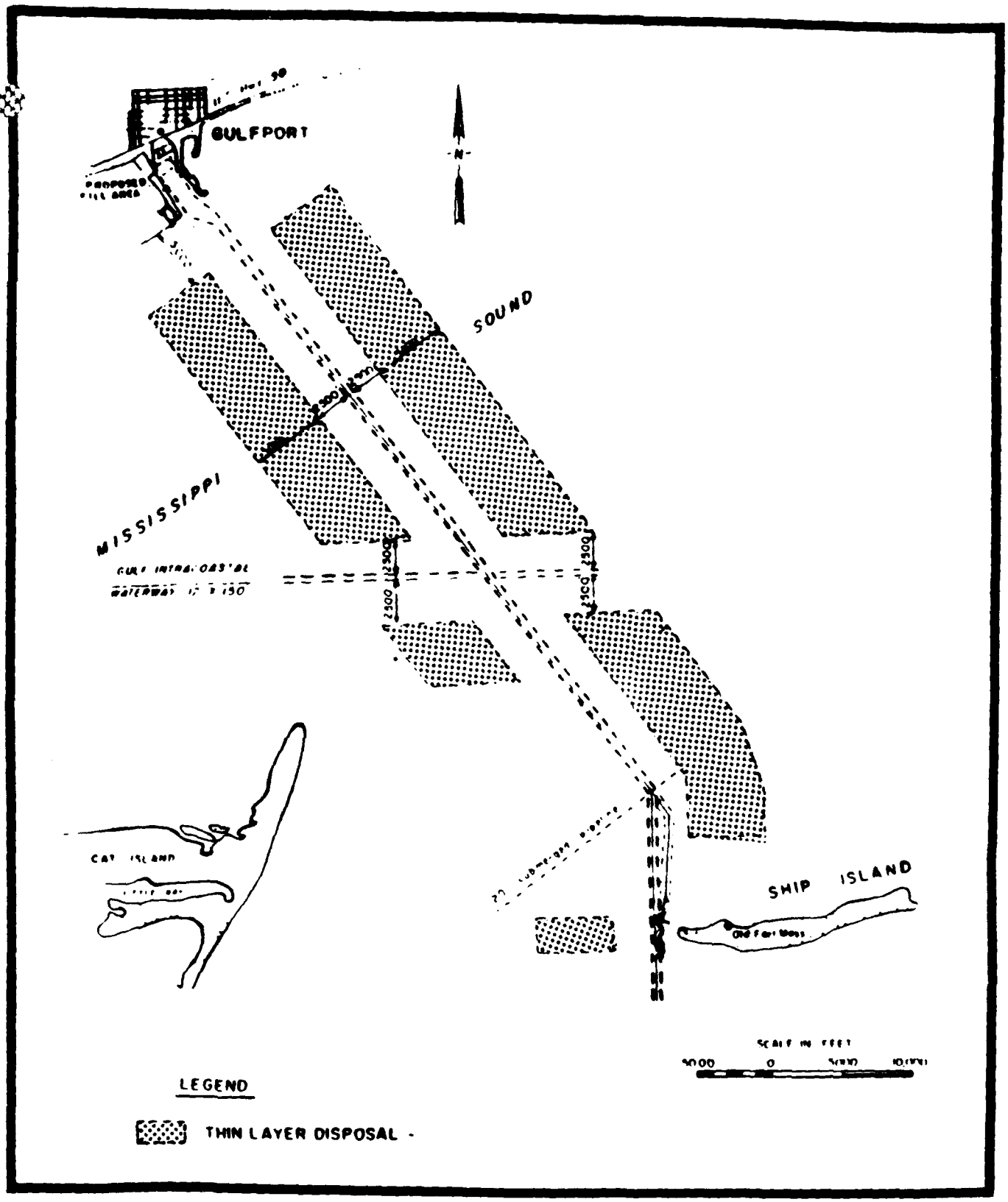
d. Open Water. Disposal of maintenance dredged material would be accomplished as currently practiced with material from the sound channel being placed along side the channel, material from Ship Island Pass placed to feed the littoral system, and the material from the bar crossing (Gulf approach) placed into the approved Gulf disposal site.

DREDGE PLANT

In the preparation of the cost estimate for this document, the use of two separate types of dredge plant was assumed. For thin layer deposition, estimates were prepared using data for a 24-inch pipeline dredge with all associated plant and a special discharge barge to accomplish the desired dispersion of dredged material. For the material in Ship Island Pass and the Gulf Approach reaches, it was assumed that a small hopper dredge of the Atchafalaya class would be used.

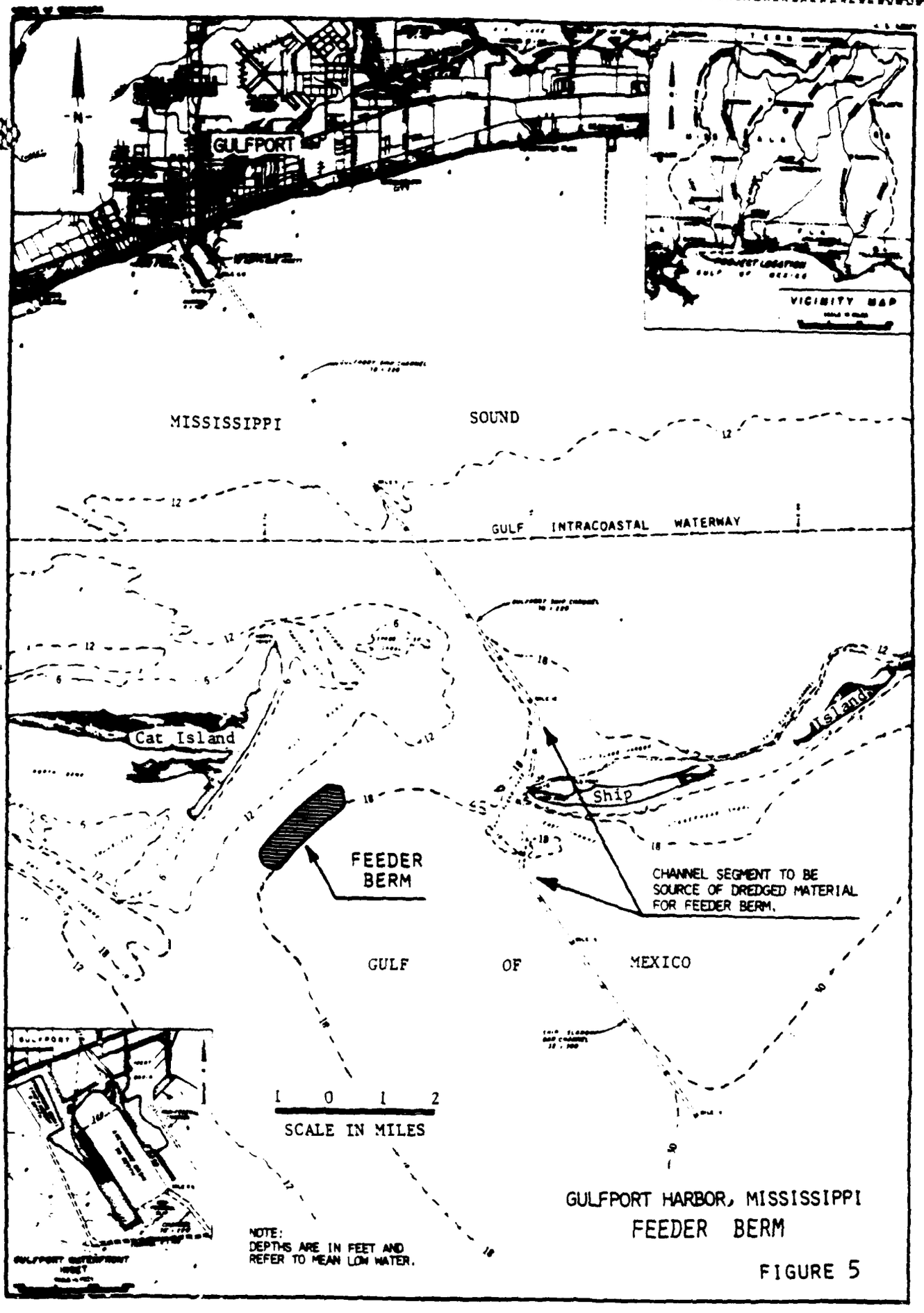
PLANT RATES

The plant rates used in the preparation of this estimate are well documented and in line with WRSC's estimates for this type of work. The rates are the most current and accurate available. The rate for the pipeline dredge was computed using the rates and methodology from EP 1110-1-8, dated June 1986. The basic monthly cost for a 24-inch pipeline dredge was estimated at $376,000. The rate for the hopper



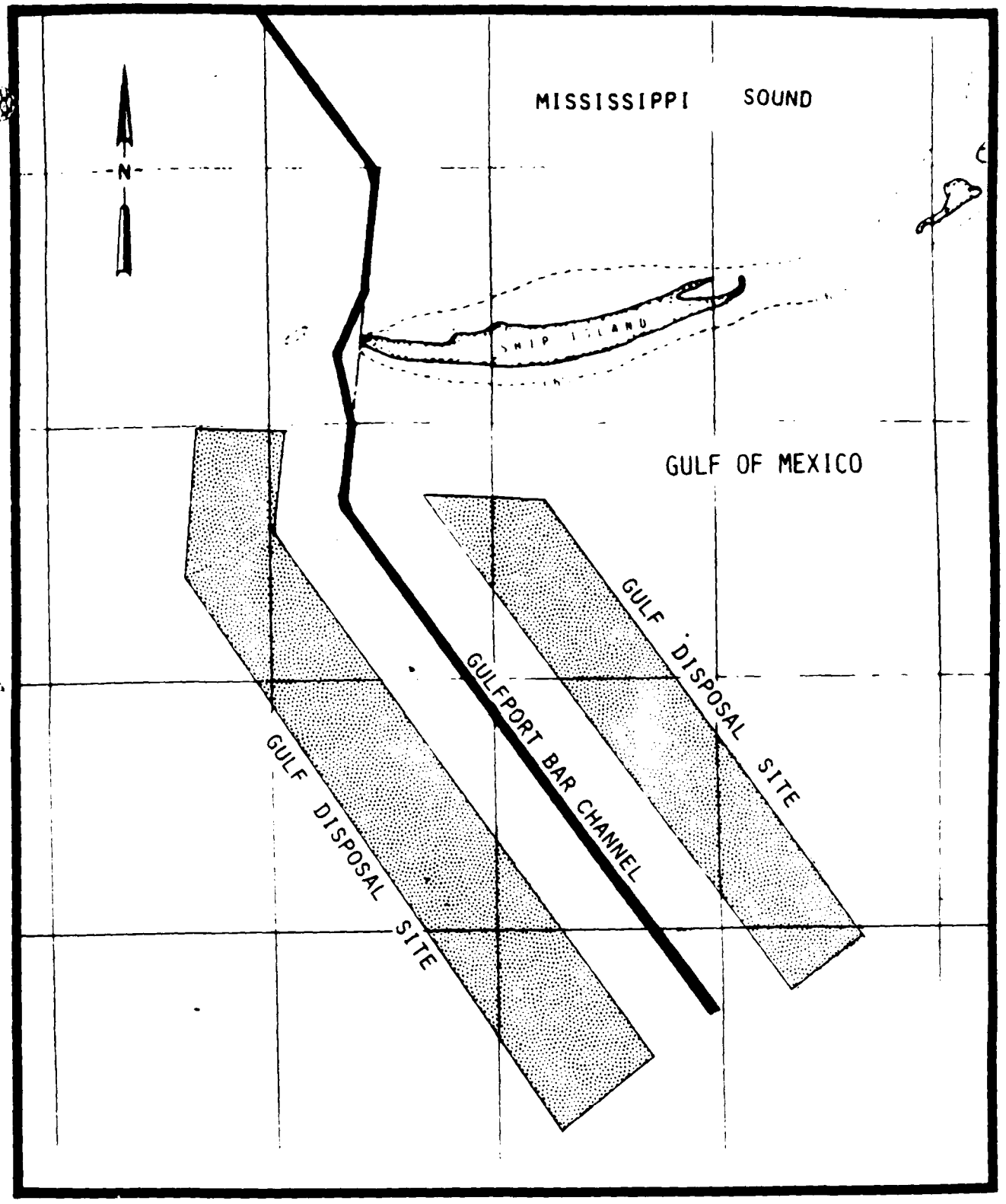
GULFPORT HARBOR, MISSISSIPPI
THIN LAYER DISPOSAL AREAS

FIGURE 4



GULFPORT HARBOR, MISSISSIPPI
FEEDER BERM

FIGURE 5



GULFPORT HARBOR, MISSISSIPPI

GULF DISPOSAL OPTION

FIGURE 6

dredge was based on actual audit information. The basic monthly cost for an Atchafalaya class hopper dredge was estimated to be $390,753.

MATERIAL TO BE DREDGED

Borings in selected locations have been taken to supplement information on file. Selected samples were forwarded to the Division Laboratory for analysis in August and a consolidated report will be completed by February 1988. Mississippi Sound in the vicinity of Gulfport Harbor typically has a layer of fine grained materials 4 to 12 feet thick which are soft to very soft in consistency. The soils in this layer, as classified by the Unified Soil Classification, are fat clay (CH), inorganic plastic silts (MH), and sandy lean clays (CL). Below this layer are firmer sandy soils consisting of clayey sands (SC), silty sands (SM) and poorly graded silty sands (SP-SM). In Ship Island Pass the material is poorly graded medium to fine sand with occasional lenses of silt and organic material. The offshore bar, with the Gulf Approach leg, is composed of fine sand with increasing amounts of other fine materials as distance offshore increases, grading into mud bottoms offshore in the gulf.

PRODUCTION RATES

In preparing the estimate, the production rates were based on actual historical maintenance data for the assumed plant types adjusted for the new work material discussed above.

DREDGING COSTS

GENERAL

Construction costs for the Gulfport Harbor channel improvement are predominantly dredging costs. Only two of the costs used in the present cost estimates are non-dredging, and those are relatively small. Those costs, for removing the old breakwater at the anchorage basin and additional navigation aids, were from the 1976 report estimates indexed to present cost levels.

DREDGING QUANTITIES

Total new work dredging volume for the authorized plan computed from recent hydrographic surveys has changed little from the total amount used in the 1976 feasibility study. The current estimate is 23,879,000 cubic yards (cy) compared to 23,791,000 cy in 1976. The pattern of the material to be removed, however, has changed somewhat. In 1976, it was estimated that 12,176,000 cy would have to be dredged

from the anchorage basin and Mississippi Sound channel. The present estimate is 11,205,000 cy. The difference was made up by an increase in the amount to be removed from Ship Island Pass and the Gulf Approach Channel. That amount is now estimated at 12,563,000 cy, but was 11,615,000 cy in the 1976 report. Dredging quantities for the various alternatives considered are listed in Table 1.

DREDGING COSTS

The presently estimated unit costs range from $0.49 to $0.57/cy for pipeline dredging and from $0.97 to $1.10/cy for conventional hopper dredging. Hopper dredging costs for deposition of Ship Island Pass material in a feeder berm in the vicinity of Cat Island were estimated at $1.06 to $1.86/cy because of the longer haul distance. Costs for the various alternatives are listed in Table 2. These costs were estimated without profit and, therefore, an additional 10% was added for estimated profit when the final estimates were prepared.

Table 1

Dredging Quantities for Formulated Alternatives
Quantities by Disposal Option and Dredged Reach
Cubic Yards

Alt No.	Thin Layer Miss. Sound	Feeder Berm Ship I. Pass	Gulf Disposal Gulf Approach	Total
A	4,111,000	2,070,000	1,617,000	7,798,000
B	6,048,000	2,549,000	2,683,000	11,280,000
C	7,951,000	3,072,000	3,907,000	14,930,000
D	7,055,000	2,577,000	2,453,000	12,085,000
E	9,322,000	3,207,000	3,818,000	16,347,000
F	11,680,000	3,884,000	5,363,000	20,927,000
G	3,992,000	5,811,000	2,453,000	12,256,000
H	5,714,000	6,411,000	3,818,000	15,943,000
I	7,656,000	7,311,000	5,363,000	20,330,000
J	6,831,000	5,811,000	2,453,000	15,095,000
K	8,977,000	6,411,000	3,818,000	19,206,000
L 1/	11,205,000	7,311,000	5,363,000	23,879,000
M	14,404,000	6,380,000	3,050,000	23,834,000
N	17,257,000	6,973,000	4,038,000	28,268,000
O	20,210,000	7,580,000	5,144,000	32,934,000

NOTE: For Alts M, N & O the west end of Ship Island used in lieu of the feeder berm for disposal of dredged material from the Ship Island Channel segment.

1/ Dimensions authorized in WRDA 86 (including the authorized 300' X 2000' deposition basin).

Table 2

Dredging Costs for Formulated Alternatives
Costs by Disposal Option and Dredged Reach
($1000)

Alt No.	Thin Layer Miss. Sound Unit Cost	Thin Layer Miss. Sound Total Cost	Feeder Berm Ship I. Pass Unit Cost	Feeder Berm Ship I. Pass Total Cost	Gulf Disposal Gulf Approach Unit Cost	Gulf Disposal Gulf Approach Total Cost	Mob & Demob Total Per Job	Total Dredg. Cost
A	0.54	2,220	1.69	3,499	0.98	1,585	170	7,474
B	0.45	2,722	1.69	4,308	0.98	2,630	170	9,830
C	0.52	4,135	1.69	5,192	0.98	3,830	170	13,327
D	0.52	3,669	1.54	3,969	0.88	2,159	170	9,967,
E	0.52	4,848	1.54	4,939	0.89	3,398	170	13,355
F	0.52	5,957	1.54	5,981	0.90	4,827	170	16,935
G	0.54	2,156	0.96	5,579	0.88	2,159	170	10,064
H	0.45	2,572	0.96	6,155	0.89	3,398	170	12,295
I	0.52	3,982	0.96	7,019	0.90	4,827	170	15,998
J	0.52	3,552	0.96	5,579	0.88	2,159	170	11,460
K	0.52	4,668	0.96	6,155	0.89	3,398	170	14,391
L 1/	0.52	5,827	0.96	7,019	0.90	4,827	170	17,843
M	0.52	7,490	1.24	7,912	1.00	3,050	250	18,702
N	0.52	8,974	1.24	8,647	1.00	4,038	250	21,909
O	0.52	10,510	1.24	9,400	1.00	4,144	250	25,304

NOTE: For Alt M, N, O the west end of Ship Island was used in lieu of the feeder berm for disposal of dredged material from the Ship Island Channel segment.

1/ Dimensions authorized in WRDA 86.

EXISTING COMMERCE

Table 3 displays the total tonnage at the Port of Gulfport for 1980-1986. Approximately 93 percent of the port's commerce is export or import trade and about 7 percent consists of coast-wide domestic shipments, with imports 53 percent greater than exports. A seven year average for commerce for the years 1980-1986 amounted to 1,239,015 tons. In the 1976 feasibility report, the 10-year average for 1965-1974 amounted to 850,080 tons. There was an almost continual increase in traffic at the port until 1986, which was a depressed year for shipping in the whole U.S.

The principal foreign products moving in deep draft vessels under the Without Project Condition include imported containerized fresh and canned fruits with a backhaul or paper and paperboard, dually imported ilmenite ore and containers with a backhaul of containers; and exported and imported miscellaneous products in containers. This port's first container operations started in 1973 with containerized fruit. By 1986, 50 percent of the port's tonnage was containerized. (The first 35-ton container crane was made operational in 1977 and the second, a 34-ton crane, was added in 1986 to substantially increase the port's operational capabilities.) Table 4 displays the major commodities and average tonnages which were imported or exported through the port during 1985 and 1986.

TABLE 3
Gulfport Harbor, MS Annual Commerce, 1980-1986
(Short tons)

	Total	Foreign		Domestic Receipts Shipments
		Imports	Exports	
1980	1,241,808	726,848	437,407	77,553
1981	1,120,102	729,390	311,806	78,906
1982	1,195,912	789,204	335,870	70,838
1983	1,147,970	726,910	312,330	108,730
1984	1,360,941	743,374	444,583	172,984
1985 a/	1,432,639	835,555	348,334	248,750
1986 b/	1,173,730	843,326	328,992	1,412
7-Year Average	1,239,015	770,658	359,903	108,453

a/ Preliminary data from the Offices of Waterborne Commerce Statistics Center, New Orleans, Louisiana.

b/ Preliminary data from Port Officials.

TABLE 4
Major Existing Foreign Commerce - Port of Gulfport
1985-1986 Average

Commodity	Average of 1985-1986 (Rounded) Imports (tons)	Exports (tons)	Total (tons)
Containers:			
Bananas	370,000		370,000
Canned Pineapple	50,000		50,000
General Cargo	60,000	80,000	140,000
Ilmenite Ore (bulk)	225,000		225,000
Bananas (break bulk)	180,000		180,000 a/
Paper/Paperboard (break bulk)		130,000	130,000
Animal Feeds (bulk)		50,000	50,000
Totals	885,000	260,000	1,145,000

a/ These were containerized in March, 1987.

COMPARISON OF 1975 TO 1987 CONDITIONS

Port Operations. Since 1975, port operations have changed from breakbulk to container and facilities have been modernized to accommodate containers. Only two (2) commodities remain at their 1975 base-year level—ilmenite ore and fresh fruit, but the fresh fruit is now containerized. Table 5 describes the major differences in commodities, vessel types, and operations, including a comparison of commodities and vessels which needed greater depths.

Vessel Operating Characteristics. As shown in Table 5, the kinds and sizes of vessels needing greater channel depths remain about the same. Ilmenite ore now moves in bulk carriers which have been modified to carry containers also. Fresh fruit was transported on general cargo vessels drawing approximately 24 feet in 1975. Now all fruit, fresh and canned, is transported in containers. In 1975 a vessel underkeel clearance of 4 feet was used. For 1987, underkeel clearances were based upon actual operations, which resulted in no underkeel clearance requirement for many of the vessels. However, container and Roll-on Roll-off (RoRo) vessels require either 1 or 2 feet underkeel clearance depending on the amount of freeboard on the vessel which is caused from repositioning of empty containers between ports. Specifically, the more freeboard, the more underkeel clearance required for maneuverability. These underkeel clearances were requested by company officials.

TABLE 5

Comparative Analysis of Commodities, Tonnages and Vessels Needing a Deeper Channel at Port of Gulfport (1976 and 1986)

	TONS					
	1976 REPORT			1987 REPORT		
	1975	WITH-PROJECT		1986	WITH-PROJECT	
COMMODITY	EXISTING CONDITION	1984 (YEAR 1)	2033 (YEAR 50)	EXISTING CONDITION	1991 (YEAR 1)	2041 (YEAR 50)
Iron and Steel Plates	44,000	180,000	759,000	0	0	0
Fertilizer & Fertilizer Materials	67,000	67,000	67,000	27,500	40,000	80,200
Ilmenite Ore	0	277,000	504,000	246,400	358,400	718,200
Iron & Steel Scrap	30,000	36,000	85,000	0 a/	336,000a/	673,300 a/
Fresh/Canned Fruit (containers)	0	0	0	369,700	369,700	1,109,100
General (containers)	0	0	0	150,000	171,900	344,500

	KIND, SIZE AND DRAFT VESSELS	
	1976 REPORT	1987 REPORT
Iron & Steel Plates	35,000 dwt DBC with 36 draft & 4' U/K clearance	N/A
Fertilizer & Fertilizer Materials	21,000 dwt GC with 36' draft & 4' U/K clearance	35,000 DBC ------ with 36' draft & "0" U/K clearance
Ilmenite Ore	35,000 dwt DBC with 36' draft & 4' U/K clearance	42,000 C/BC with 37' draft & "0" U/K clearance
Iron & Steel Scrap	25-35,000 dwt DBC with 36' draft & 4' U/K clearance	35,000 DBC with 36' draft & "0" U/K clearance
Fresh/Canned Fruit (containers)	N/A	13,320 dwt container ship with 30' draft & 2' U/K clearance
General (containers)	N/A	22,000 dwt RoRo's & container with 35'/33' drafts & 2'/1' U/K clearances, respectively

a/ This Gulfport company operated out of this channel in 1976, but is presently barging this scrap from Gulfport to New Orleans and shipping via 35,000 dwt dry bulk carriers because of lack of channel depth at Gulfport.

dwt = deadweight tonnage
DBC = dry bulk carrier
GC = general cargo
C/BC = Container/bulk carrier, or "conbulkers"
RoRo = Roll on/Roll off
U/K = underkeel
N/A = Not Applicable

BASE YEAR COMMERCE

General. "Base Year" is the first year a project is expected to be fully operational. The level of commerce (kind and tonnage) must be established for the base year of a proposed project, which is 1992 for Gulfport. (The level of commerce for the period 1992-2042 will be covered in the following section called "Without-Project Condition.") Operational characteristics of all existing and potential users of the port were ascertained from field survey by MDO personnel.

Traffic Surveys. During the course of this analysis, 60 firms and other interests were interviewed to determine existing and future commerce patterns and vessel needs at the Port of Gulfport. These are:

1. Gulfport Port Authority
2. Hapag - Lloyd Container Lines
3. Atlantic Container Lines
4. Columbus Lines
5. Lykes Lines
6. ACT/PACE Steamship Lines
7. Trans Freight Lines/NED-Lloyds a/
8. Standard Fruit & Steamship Company
9. Deppe Steamship Lines
10. TMT Shipping and Chartering
11. Newman Lumber Company a/
12. Baldwin Aircraft Company
13. Colonial Sugars-Borden, Inc. a/
14. F. J. Baker & Bros, Inc a/
15. Ryan Walsh Stevedoring Company, Inc. a/
16. Reynolds Metal Company
17. Legg Construction & Fabrication
18. Treated Wood Products, Inc.
19. Container General Corporation
20. Mandels, Inc.
21. Highside Chemicals, Inc.
22. Paceco, Inc.
23. Chemfax, Inc.
24. Reichhold Chemicals
25. Biloxi Pre-Stress Concrete
26. Lockheed Aircraft
27. Ce-Natco
28. Morton Thiokol, Inc.
29. Oceans International Corp. a/
30. Klumb Lumber Co.
31. Struthers Wells
32. ABC Containerlines, Inc. a/
33. United Brands Company a/
34. E.I. DuPont de Nemours & Co. a/
35. International Proteins Corporation a/
36. Goldin Industries, Inc. a/
37. U.S. Naval Oceanographic and Atmospheric Administration (NOAA) a/
38. U.S. Customs (Gulfport, Mobile and New Orleans)

39. Compass Marine and Towing Company
40. Parker Towing Company
41. Port Bienville, MS
42. Merchants River Transport (New Orleans)
43. Atlantic & Gulf Stevedores, Inc. a/
44. Ship Captain (Mr. Hubert Thomas), MV "Helen", ABC Containerlines, Inc.
45. Page & Jones, Inc.
46. Interoceans Steamship Agency
47. Mobile Ship Channelry
48. Gulfport Pilots Association a/
49. Waterman Isthmian Lines a/
50. Gulf Container Lines
51. U.S. Naval Construction Battalion (Gulfport), USN a/
52. Military Traffic Management Command, Eastern Area, US Army
53. Marine Corps Logistics Battalion, Albany, GA, USMC
54. Naval Facilities Engineering Command, Southern Division, USN
55. NASA Rocket Engine Test Site, Bay St. Louis
56. Mississippi Army Ammunition Plant, Bay St. Louis, US Army
57. Army Munitions & Chemical Command, US Army
58. Deputy Asst. Secretary of the Navy, Sealift & Maritime Affairs, USN
59. Harrison County Development Authority
60. Ter-Chemical, Inc. a/

a/ This firm or facility would benefit from a deeper channel.

Base Year Commerce, Tonnage, and Operations (1992). Deep-draft traffic currently engaged in foreign trade was analyzed to establish a base for the identification of movements which would be beneficially affected by the considered channel improvements at the Port of Gulfport. The conduct of these investigations and the rationale for accepting various commodities as base year commerce are explained in subsequent paragraphs.

a. Fresh and Canned Fruit (imports). United Brands Company presently imports 369,700 tons of fruit from Puerto Cortez, Honduras, annually. A committed container vessel (486'x84'x24') now arrives every 6 days. By 1992, three (3) new, committed container vessels (586'x110'x32', includes 2-foot underkeel clearance) will be carrying fruit into Gulfport every 6 days. The tonnage for Gulfport will remain the same at 370,000 tons. These vessel will have a 100 percent "backhaul" rate to the East Coast and then back to Honduras). This traffic would benefit from a deeper channel and was accepted as base year tonnage under without project conditions.

Standard Fruit and Steamship Company annually imports 180,000 tons of fresh and canned fruits from four (4) South and Central American ports. Their container vessel (409'x66'x25') arrives weekly. Previously, this traffic was break bulk on general cargo vessels, but

container operations started in March 1987. This company has two (2) new container vessels in service which draw 34 feet, but at present they do not call at Gulfport. According to company officials, this traffic will not change to Gulfport in the near future and, therefore, it was not included as base year tonnage.

b. Scrap Steel (export). Goldin Industries, Inc., a Gulfport firm located on the upper end of the Federal shallow draft channel for Biloxi Harbor, was moving scrap steel through this harbor in the 1976 report and subsequently changed to the Port of New Orleans. The company is presently barging 224,000 tons annually to Darrow, Louisiana (and railing another 112,000 tons annually to Darrow) for export through the Port of New Orleans to Japan and Europe in 35,000 dwt dry bulk carriers. With a deeper channel this entire operation (336,000 tons) would move to Gulfport by 1992 and was accepted, therefore, as base year tonnage under with project conditions.

c. Fishmeal (import). During 1986, International Proteins Corporation imported 27,500 tons of bulk fishmeal (a fertilizer or pet food raw material) into Gulfport from Chile. Traffic was in general cargo or small dry bulk carriers which were lightloaded to meet the 30' draft restrictions at Gulfport. Thus, 27,500 tons of fishmeal were accepted as base year tonnage under without project conditions.

d. Ilmenite Ore (import). E. I. DuPont de Nemours & Co. operates a titanium dioxide pigment plant at DeLisle, Mississippi, 15 miles northwest of Gulfport, which was described in the 1976 report. This plant presently imports 246,400 tons of ore annually from Australia on modified dry bulk carriers called "conbulkers," which carry 1100-1300 containers in addition to bulk commodities. (This trade term, "conbulker", or "conbulk vessel" will be used hereafter for these dry bulk carriers modified to carry containers.) ABC Containerlines of Belgium has a long-term charter to deliver this ore to Gulfport Harbor in six (6) committed 42,000 dwt conbulkers (3 draw 38 feet and 3 draw 36.5 feet). A 30-percent plant expansion is currently under construction, and will be completed by 1989 (an additional 112,000 short tons of ore will be needed for the expansion). In summary, 358,400 tons of ilmenite ore was accepted as base year tonnage under Without-Project Condition..

e. Containerized General Cargo (import/export). During 1985 and 1986, an average of 150,000 tons of containerized cargo was either imported or exported, mainly by Trans Freight Lines (TFL), a container line which operated a weekly service between Europe, the East Coast, and the Gulf Coast. Gulfport and Galveston, Texas, were the two Gulf ports in this feeder service. Originally a committed container fleet of six vessels (3 vessels drawing 33 feet and 3 vessels drawing 30 feet) was used in this feeder service and rarely were these vessels loaded to the existing channel depth. In September, 1986, a joint venture between TFL and Nedlloyd Lijnen Lines, a Rotterdam shipping line, changed the weekly service to a fleet of five (5) vessels—two (2) RoRo's drawing 35 feet each and three (3) container ships of which two (2) draw 30 feet and one (1) draws 33 feet). All five vessels lightloaded during 1986 and 1987 and will continue to lightload under

Without-Project Condition. Thus 150,000 short tons of general cargo in containers was accepted as base year tonnage under Without-Project Condition.

ABC Containerlines imports approximately 5,500 tons of containerized general cargo into Gulfport annually along with the bulk ilmenite ore from Australia. These same vessels imported 3000 containers annually into New Orleans during 1985 and 1986, or 60,000 tons annually. The major reason these vessels call at New Orleans is to offload enough to call at Gulfport. With a deeper channel this cargo would be shifted to Gulfport in order to avoid the long vessel transit times and greater port handling charges at New Orleans. This latter tonnage was not accepted as base year tonnage. Instead, the transfer of these containers was treated as "other benefits."

f. Military Cargoes and Ships. Numerous existing and potential military users were interviewed for possibly using the channel in larger or more fully loaded vessels. The US Naval Oceanographic Center located at Bay St. Louis, Mississippi, brings three (3) hydrographic sonar ships drawing 32.3 feet (including sonar equipment on the ship's bottoms) into New Orleans for resupply and crew liberty 1.5 times per vessel annually. These vessels would shift to Gulfport with the availability of a 34-foot channel for safety of the sonar equipment on bottom (silty bottom at Gulfport vs floating objects at New Orleans) and safety of its crew (Gulfport Harbor can be totally secured and their military pier at New Orleans cannot). Several of their smaller hydrographic vessels presently call at Gulfport (resupply and crew changes) on a regular basis.

The Naval Construction Battalion, located 1/4 mile from the port, annually trucks and rails approximately 25,000 tons of military equipment to Norfolk, New Orleans, or Jacksonville for aggregation into larger shiploads to foreign destinations. (During wartime this supply facility would be expected to ship over 200,000 tons annually to foreign destinations.) However, the Military Traffic Management Command (MTMC), which centralizes the routing of U.S. military cargoes, feels that the Port of Gulfport has no advantage over adjacent coastal ports (i.e., Mobile or New Orleans) for military shipments. Therefore, no export military cargoes could be claimed in this analysis.

Summary of Base Year Commerce and Tonnages. Table 6 displays the summary of types of commerce and tonnages which will be either imported or exported through the Port of Gulfport in deep-draft vessels under without project conditions and which would benefit from a channel depth greater than 30 feet.

TABLE 6
Summary of Without-Project Commerce and Tonnages at Gulfport in 1992 (Base Year)

Commodity	Tonnages
Fresh and Canned Fruits (Imports)	369,700
Scrap Metal (Export)	336,000
Fishmeal (Import)	27,500
Ilmenite Ore (Import)	358,400
Containerized General Cargo (Export/Import)	150,000
US Naval Oceanographic Vessels	a/
Total	1,241,600

a/ No "tonnage" is claimed.

WITHOUT-PROJECT CONDITION

General. The "Without-Project" condition is a projection of those conditions which seem most likely to occur at the study site, without the project being constructed, and for the same period being considered for that project (1992-2042). The purpose of this analysis is to explore possible changes in users' operational patterns from Existing Conditions (grow, stagnate or decline), and prepare an analysis for comparison with the "With-Project" Condition--a deeper channel. Any potential users of the channel must also be included in this analysis.

Changes in Vessel Operational Patterns. With the exception of the ilmenite ore, no major changes in vessel operating patterns are expected after the base year in vessel sizes or ports of origin or destination for port users. The mines in Australia will have reduced production of ilmenite by 1995, and, therefore, one-half the base year tonnage will be imported from country B which has a port depth of 36 feet (MDO will maintain confidentiality of DuPont's source for this ore) in chartered 23,000 dwt dry bulk carriers drawing 34 feet. The ore for the 30 percent plant expansion by 1992 will come from Country C, which has port depths greater than 36 feet, in chartered 35,000 dwt dry bulk carriers drawing 36 feet. In both these cases, vessels would be fully loaded with a deeper channel available at Gulfport.

Projected Increases in Traffic. Comparing the base year (1984) tonnage from the 1976 report to 1992 for this reanalysis, it was found that the total tonnage which would use a deeper channel increased 222 percent over the 10-year period between field surveys (1976 to 1986). Based upon import or export growth rates coupled with BEA earnings for

each commodity herein for this region, the following projections of base year tonnages over the 50 year project life for each commodity are as follows: fresh fruit, 300%; scrap metal, 284%; fishmeal, 200%; ilmenite ore, 200%; and containerized general cargo, 200%.

VESSEL TRAFFIC, CHARACTERISTICS AND COSTS

General. Based on the data in the 1976 Feasibility Report, the volume of vessel traffic (number of trips) decreased from the early 1970's; however, the percentage of vessels with drafts greater than 30 feet increased dramatically in this same period. As shown using 1985 data in Table 7, much larger vessels called at the port.

TABLE 7
Vessel Traffic at Gulfport by Draft
for the Years 1976 and 1985

	NO. VESSELS	
VESSEL DRAFTS (feet)	1976	1985
38	0	9
37	0	1
36	0	12
35	0	13
34	0	4
33	0	24
32	0	12
31	0	13
30	2	46
29	8	5
28	10	30
Less than 28	395	212
Total	415	381

Vessels with fully loaded drafts of 30 feet and greater were 35 percent of the total vessel trips in 1985 (as compared to less than one (1) percent in 1974). Almost 45 percent of the total vessel trips were in vessels with fully loaded drafts of 28 feet and greater, a 40 percent increase over the 1974 totals.

Vessel Characteristics. Pertinent data on the general characteristics of vessels expected to make up the fleet calling at the Port of Gulfport under the "Without-Project" condition are presented in Table 8. Ilmenite ore will continue to move in 42,000 dwt combulker ships from Australia. Based on data received from Dupont officials, part of the ore for their plant will also move from two other ports in 23,000 dwt and 35,000 dwt dry bulk carriers during the proposed project life. Fishmeal will move in 35,000 dwt dry bulk carriers also. Fruit will move in committed 13,320 dwt container vessels which are owned by United Brands Inc. General commodities will be exported or imported

in containers on two (2) committed Roll on/Roll off vessels and three (3) committed container vessels of the 21,200 and 19,000 dwt sizes, respectively, by Trans Freight Lines. All of these vessels will be foreign flag and all will be on a charter basis except for the vessels transporting fruit.

Vessel Operating Costs. Pertinent vessel operating costs based on 1987 price levels were obtained from the Office, Chief of Engineers (OCE). Operating costs are in terms of cost per hour for the operation of the vessels at sea and in port. That information is also shown in Table 8.

Hourly operating costs from Table 8 were applied to varying vessel operating procedures to determine net ton transportation costs. Consideration was given to such factors as distance of haul, speed of vessel, vessel size (dwt), amount of backhaul, and the allowable load of cargo under varying channel depths at Gulfport. Times in port were based upon port officials data or furnished by the Office of Chief of Engineers (OCE). Other costs developed for this study included consideration of accessory charges (port, vessel, and handling) at Gulfport and considered alternative ports. All costs were adjusted to reflect the cost per ton of cargo handled.

Unit transportation cost. Estimates of the operating costs per ton were computed for vessels fully loaded and light loaded using data from Table 8. The following computation illustrates the method used to determine ocean freight costs for the various movements considered. The unit costs were derived by dividing the total operating costs for a voyage for a particular vessel size by the volume of cargo that can be carried with increased channel depths.

SAMPLE COMPUTATION

Type Vessel = Dry Bulk Carrier
Deadweight tons = 35,000 tons
Time in Port (origin and destination)= 109 hours
Payload capacity = 35,280
Maximum draft = 36 feet
Cost per hour = $680 at sea; $426 in port
Immersion factor = 1,260 tons per foot of immersion
One-way distance = 11,000 nautical miles
Cost per one-way trip = ($680 x 773 hrs) + ($426 x 109 hrs) = $544,874
Time at sea = 11,000 nautical miles at 15 knots = 733 hours.
Cost per ton light loaded to 30 feet for a 30-foot channel:
$544,874 divided [35,280 - (1,260 x 6)] = $19.66
Cost per ton fully loaded to 36 feet for a 36-foot channel:
$544,874 divided by 35,280 = $15.44

ALTERNATIVE TRANSPORTION MODES AND COSTS

General. Various alternative modes of shipment were investigated to provide comparisons in evaluating transportation savings that would be realized from the proposed channel improvements at Gulfport.

TABLE 8
Characteristics and Hourly Operating Costs for Foreign Flag, Deep Draft Vessels
Transporting Commerce at Gulfport Harbor
Under Without-Project Condition

	VESSEL CHARACTERISTICS						OPERATING COSTS	
Commodity	Kind	Size (dwt)	Draft (feet)	Immersion Factor	Average Speed (Knots)	Payload Capacity	Time In Port (Hrs)	At Sea	In Port
Ilmenite Ore	Conbulker	42,000	37.4	1430	15	43,277	54	$ 740	$ 449
Ilmenite Ore	Bulk Carrier	23,000	33.3	974	15	23,184	36	619	397
Ilmenite Ore	Bulk Carrier	35,000	36	1260	15	35,280	54	680	426
Fishmeal	Bulk Carrier	35,000	36	1260	15	35,280	54	680	426
Fresh/canned Fruit	Container	13,320	30	696	19	14,319	24 b/	788	420
General (containers)	RoRo	22,500 a/	35 b/	1356	20	24,192	24 b/	881	574
General (containers)	Container	21,200	31	1068	20	21,370	24 b/	843	543
General (containers)	Container	19,000	33	974	20	19,152	24 b/	807	519

a/ *Used vessel costs* for a 24,000 dwt container vessel as a proxy for the RoRo based upon advice from company officials.
b/ "Operational draft" is 34 feet for these RoRo's; for all other container vessels, maximum draft is their "operational draft."

Consideration was given to alternative routings, different vessel sizes, allowable cargoes, and offloading cargo at alternative ports in determining savings. Subsequent paragraphs contain detailed descriptions of the alternative modes, cost, and unit savings for the various commodities identified as prospective commerce.

Ilmenite Ore (Import). Until 1995 DuPont has a long-term contract with ABC Containerlines of Belgium to deliver 246,400 tons of ore into Gulfport annually. There are six committed conbulkers in this fleet which average 42,000 dwt and draw 37.4 feet when fully loaded. These vessels load 18-24,000 tons of ore at Geraldton, Australia for a maximum draft of 29.5 feet and then top off with additional ore and/or 1100-1300 containers at other Australian and New Zealand ports to make the ocean trip fully loaded. Their first port of call is the New Orleans or Burnside Bulk Plants to offload ore and then to container terminals to offload containers for a total lightening of 11,200 tons to meet draft restrictions at Gulfport. The ore offloaded at New Orleans is bound for either DuPont's New Johnsonville, Tennessee or DeLisle (Gulfport) plants. (Based upon MDO field data obtained in 1986 for the Port Bienville feasibility study, 50,000 tons of ore is barged annually from either the New Orleans or Burnside Bulk Plants to Port Bienville destined for their Delisle plant. Delivery cost was $8.76 per ton including dual port handling charges and barge and truck costs to the DeLisle plant.) According to officials at ABC Containerlines, if a deeper channel were available all, ore for the Gulfport area and the 3,000 containers annually offloaded at New Orleans would be shifted to Gulfport to avoid the extra vessel and handling costs at New Orleans. (Ore destined for New Johnsonville would continue to be delivered to New Orleans or Burnside.) Alternative modes considered for this movement included: a) ocean transport to New Orleans and then move 246,400 tons by rail from the New Orleans/Burnside Bulk Plants to their DeLisle plant; b) same ocean leg and then move that 246,400 tons of ore by barge to Port Bienville and then by truck to their plant; c) ocean leg into New Orleans where 11,200 tons would be offloaded and 2500 tons of that same ore would be barged or trucked to their plant; move vessel to Gulfport and transport the remainder of the ore load (18,000 short tons) by rail to their plant; and d) ocean leg directly into Gulfport, lightloaded, and move by rail to plant.

These four alternative modes of transportation are compared in Table 9. Alternative C is their present mode of operation; and as can be seen, it is the cheapest alternative (alternative D is not reasonable since the vessel would travel 11,170 miles lightloaded by 7.4 feet). Other alternative ports such as Pascagoula or Mobile were excluded from this analysis since the DeLisle plant is only 99 miles from Burnside and a little less from the New Orleans bulk plants respectively.

Table 9
Alternative Transportation Modes for Ilmenite Ore for
Without-Project Condition

Alternative Mode a/	Per Ton Costs for a 30-foot Channel at Gulfport
A. Ocean to Burnside; b/	14.52
rail to Plant c/	9.40
	23.92
B. Ocean to Burnside; b/	14.52
barge to Port Bienville &	5.91
truck to Plant	2.85
	23.28
C. Ocean to Burnside; b/	14.52
offload 2,500 s/t & barged/trucked as in "B"; and remainder,	8.76
ocean to Gulfport;	15.67
rail to Plant	6.29
	22.12 d/
D. Ocean to Gulfport;	19.54
rail to Plant	6.29
	25.83

a/ A 42,000 dwt conbulker with 37.4-foot draft with no underkeel clearance was used, since these vessels are loading to 30' (and more) on the existing 30-foot channel at Gulfport.

b/ Channel depth at Burnside exceeds 36 feet, therefore the Burnside portion in alternatives C & D must be compared to a 40 foot channel at Burnside and a 30-foot channel at Gulfport.

c/ A truck rate of $12.20 per ton was not a viable alternative.

d/ The full ocean costs were proportioned by commodity (containers vs. ore) and distance for the average Gulfport ore which was offloaded at Burnside, so that double counting did not exist. The answer is weighted. This is the least cost alternative.

Fresh Fruit (Container Import). Since this is a completely containerized (and refrigerated) operation, no inland alternative to truck transportation was considered in this analysis. No other port is a viable alternative, since vessel charges at Gulfport are considerably less than Mobile and New Orleans. (See Table 10 for a sample cost comparison of an 18,500 dwt container vessel to the 19,000 dwt container vessel in Table 8.) It should be noted that the data in Table 10 does not include cargo handling charges or vessel delays at these ports since both are unpredictable. (Stevedoring charges are confidential and subject to change daily. Therefore they are not included in this analysis.)

Table 10
Comparison of Vessel Costs at
Gulfport, New Orleans and Mobile Harbor a/
(18,500 dwt container vessel, 632'x87'x27.5')

	Gulfport	New Orleans	Mobile
Pilots	$1,397	$ 2,461	$ 1,475
Tugs	1,000	2,100	1,102
Linesmen	200	250	200
Dockage (first 24 hours)	1,334	1,595	1,201
Harbor Fee	150	165	150
Vessel Operating Costs in Channel (entry + exit) ($996 per hour at sea) b/	3,75	13,884	7,131
Totals	$7,866	$20,455	$11,259

a/ Data furnished by the Port of Gulfport from a study conducted June, 1987, for a specific container line.

b/ Vessel speeds were obtained from Chief pilot at Gulfport, harbormaster at Mobile and the Corps of Engineers office at New Orleans. Vessel operating costs were obtained from EC 1105-2-167 dated 25 July 1986 (revised June 1987).

c/ This figure is based upon the vessel calling at the container terminals at the head of the Mississippi River Gulf Outlet. Had this vessel called at public terminals in the New Orleans harbor this figure would have been $18,426, or a total cost of $24,997.

Fishmeal (Import). Most of the fishmeal imported into Gulfport is used as chicken feed by poultry farmers in Southern Mississippi. A single truck load is the normal purchase by farmers; therefore, no other inland method of transportation was considered in this analysis. Nearby ports were not considered reasonable alternatives due to lesser vessel charges at Gulfport and the proximity of Gulfport Harbor to the final destinations of the fishmeal at southern Mississippi farms.

Containerized General Cargo (Export and Import). The same rationale as for fresh fruit above was used for these containerized cargoes for inland alternatives. Again, no alternative port was considered since the costs of utilizing the Port of Gulfport are less than the closest ports, Mobile and New Orleans (see Table 10).

Scrap Metal (Export). Iron and steel scrap (30,000 tons annually) was expected to be exported through Gulfport Harbor by Goldin Industries, Inc. in the 1976 Feasibility Report. Goldin Industries has grown since then and in 1986, 224,000 tons of scrap was trucked from all over the Southeastern United States and compacted at their Gulfport facility. It was then trucked to their facility at Biloxi Harbor, moved by barge to Darrow, Louisiana, and placed on 35,000 dwt dry bulk carriers destined for Japan (75%) and Europe (25%). Another 112,000 tons from all over the southeastern United States is moved by rail directly to Darrow for export on the same vessels.

Alternative transportation modes were considered for the existing 224,000 ton movement from Gulfport to Darrow. The 112,000 tons of precompacted scrap moved by rail to Darrow from the southeastern U.S. was not priced for an alternative mode since the price would not change. Specifically, the distances from origins to Darrow equal the distances from origins to Gulfport; and there would be no net difference. The rate for trucking the compacted scrap from Goldin Industries main yard to their barge site on the Harrison County Industrial Seaway was $1.00 per ton for the 224,000 tons of scrap metal; and the barge rate from Biloxi Harbor to Darrow was $3.25 per ton for a total cost of $4.25 per ton. The cost of the same movement by rail was in excess of $8.50 per ton; and by truck was even greater. Therefore, this movement is currently being transported to Darrow, Louisiana, by the cheapest alternative. Regarding alternative ports, New Orleans and Gulfport are the closest ports with storage facilities to stockpile the scrap metal dockside in the volumes necessary to fully load a 35,000 dwt dry bulk carrier. Fully loading a 35,000 dwt vessel to 36 feet at Darrow with a voyage to Kobe, Japan, produces costs of $14.18 per ton. Lightloading the same vessel to 30 feet at Gulfport for the same trip would cost $16.97 per ton, which validates the efficiency of the present mode(s) of transportation for this movement.

Summary of Alternative Modes. In all cases, present modes of transportation and choices of ports are the least cost alternatives for the users of the Port of Gulfport.

BASE YEAR AND WITHOUT-PROJECT CONDITION TRANSPORTATION MODES AND UNIT COST

Commodities and vessel patterns for 1992 and Without-Project Condition (1992-2042) were analyzed; and transportation costs were calculated on a unit basis for all commodities shown in Table 6.

Ilmenite Ore (Import). Unit costs were calculated for the Without-Project period (1992-2042) using the data for a 42,000 dwt conbulker shown in Table 5 on a run from Geraldton, Australia, into New Orleans for the offloading of 11,200 tons and then on into Gulfport where an average load of 18,000 tons of ore are offloaded at Gulfport (16,000 short tons of containers are still on the vessel upon leaving Gulfport). In 1995, one-half of this ore will come from Country B in 23,000 dwt dry bulk carriers drawing 34 feet. Without-Project Condition transportation costs were calculated for the total 246,400 tons of ore to move through New Orleans and then to Gulfport for the period 1992-1995. During the period 1996-2042, the transportation costs were split and computed for 123,200 tons to continue to move through New Orleans (and Gulfport) and the remainder to change origins (Country B) and move directly into Gulfport. Both movements were aggregated for the period 1996-2042, and this stream of transportation costs were discounted to present worth and amortized over 50 years at 8 5/8 percent interest rate for average annual equivalent transportation costs for the 246,400 tons of ore over the period 1992-2042. These discounted unit costs were $18.04.

Unit costs for ore coming from Country C for DuPont's plant expansion (112,000 tons) in 35,000 dwt bulk carriers (see Table 5) were compared to a 30 foot channel at Gulfport under Without-Project Condition (1992-2042), which were computed to be $9.60 per ton. In summary, unit costs for ore are as follows:

Table 11
Without-Project Unit Costs for Ore
Gulfport Harbor

	30'
246,400 Tons (Countries A & B)	18.04
112,000 Tons (Country C)	9.60 a/

a/ The alternative routing of this vessel is to fully load into Houston, Texas; offload enough ore to meet the 30' draft restriction at Gulfport; and return to Gulfport, which is equal in cost to lightloading directly into Gulfport. (Both were compared to a smaller vessel which would have to make more trips, which is more costly.)

Fresh Fruit (Import). Unit costs were calculated for the Without-Project Condition period for a 13,320 dwt container vessel drafting 28 feet (lightloaded 2 feet) from Puerto Cortez, Honduras to Gulfport. The unit costs were $9.36 under Without-Project Condition. (This vessel will be constructed and in operation by 1992.)

Fishmeal (Import). A unit cost per ton for a 35,000 dwt dry bulk carrier drafting 36 feet (the Company's future without-project vessel) lightloaded to 30 feet to/from Chile was calculated and the resulting costs per ton were $11.69 for a 30 foot channel.

Containerized General Cargo (Export and Import). Anticipated traffic under the Without-Project Condition (1992-2042) will be a feeder service from Port Everglades, Florida to Gulfport to Houston, Texas. A weighted cost per ton was calculated for 5 vessels (2 RoRo's and 3 container ships) fully loaded on the ocean leg which Gulfport will serve. The unit costs for 1992 conditions with a 30-foot channel at Gulfport were calculated at $4.13 per ton. Based on advice from company officials, the larger vessels (RoRo's) used in this analysis were limited to an "operational" draft of 34 feet.

Scrap Metal (Export). Under Without-Project Condition, this scrap metal will continue to be barged and railed to Darrow, Louisiana for export through the Port of New Orleans. Therefore, unit costs were developed for this movement through the Port of New Orleans which has a 40-foot channel. A weighted cost per ton (excluding port, handling, and vessel charges) was computed for this tonnage since 75 percent was destined to Japan, 12.5 percent to Spain, and 12.5 percent to Italy. Port depths are greater than 36 feet in Japan and 35 feet each at the ports in Spain and Italy. A 35,000 dwt dry bulk carrier drawing 36 feet was used for the route to Japan and a 30,000 dwt dry bulk carrier drawing 35 feet was used for the European routes. The actual ocean rate for New Orleans to Kobe, Japan, New Orleans to Barcalona, Spain and New Orleans to Genoa, Italy, voyages were $14.18, $9.75 and $10.24 per ton respectively. The weighted rate for the Without-Project routing through Darrow was $15.97 per ton which included $4.25 per ton for 224,000 tons to be trucked ($1.00) and barged ($3.25) to Darrow. The $15.97 figure was based upon total transportation costs over land and sea.

Summary of Unit Transportation Costs.

A summary of unit costs for Base Year and Without-Project Condition is presented in Table 12.

Table 12
Summary of Unit Transportation Costs
at Gulfport
(WITHOUT-PROJECT CONDITION)
($ PER SHORT TON)

COMMODITY	
Ilmenite Ore (import)	18.04
Ilmenite Ore (import)	9.60
Scrap Metal (export)	a/
Fishmeal (import)	11.69
Fresh Fruit (containers) (import)	9.36
General (containers) (import/export)	4.13

NOTE: All differences in port and handling charges are excluded in this table.

a/ This is a Gulfport firm which shipped this commodity through Gulfport Harbor until the late 1970's, but was forced to ship through the Port of New Orleans because of lack of channel depth at Gulfport. This traffic will return to Gulfport with a deeper channel. The unit rate for export through New Orleans is $15.97.

WITHOUT-PROJECT CONDITION PROJECTIONS OF COMMERCE

The projections in the 1976 Feasibility Report for ilmenite ore and scrap metal are still valid for the period 1992-2042 (200 and 284 percents, respectively). Imported fresh fruit (containers) was projected to increase 300% over the project life based upon a correlation of fresh fruit import trends and population increases in the Southeastern United States. Fishmeal and general cargo (in containers) were projected to increase 200 percent over the project life based upon MDO field data, which will be finalized in the GDM. Table 13 summarizes the projected tonnages for each commodity over this period.

Table 13
Without-Project Projected Tonnages by Decades (1992-2042)
Gulfport Harbor
(rounded)

	Tonnages					
	1992	2002	2012	2022	2032	2042
Ilmenite Ore	246,400	283,200	325,400	373,900	429,700	493,800
Ilmenite Ore	112,000	128,700	147,900	170,000	195,300	224,400
Scrap Metal	a/	a/	a/	a/	a/	a/
Fishmeal	27,500	31,600	36,300	41,700	48,000	55,100
Fresh Fruit (container)	369,700	460,500	573,500	714,400	889,800	1,109,100
General (container)	150,000	172,400	198,100	227,600	261,600	300,600
	905,600	1,076,400	1,281,200	1,527,600	1,824,400	2,183,300

a/ This is a Gulfport firm which shipped this commodity through Gulfport Harbor until the late 1970's, but was forced to ship through the Port of New Orleans because of lack of channel depth at Gulfport. This traffic will return to Gulfport with a deeper channel.

WITH-PROJECT TONNAGES, UNIT COSTS AND TRANSPORTATION BENEFITS

General. With a deeper channel at Gulfport Harbor, tonnages for some shippers may increase. Unit transportation costs will decrease since larger or more fully loaded vessels will be utilized. These changes from Without-Project Condition will be discussed below.

With-Project Tonnages. The tonnages for ilmenite ore and fresh fruit will remain as presented under Without-Project Condition. The tonnages for the other commodities will increase as follows:

Scrap Metal (Export). This commodity will change from New Orleans and will be moved through Gulfport in 1992 (base year); therefore, 336,000 short tons will move through Gulfport with a deeper channel based upon data from company officials.

Fishmeal (Import). Based upon data from company officials this commodity will increase to 40,000 short tons in 1992 with a deeper channel.

General (Containers) (Export/Import). Based upon data from Trans Freight Lines (TFL), this tonnage will increase to 171,900 short tons by 1992, the first year of a 50-year project.

In summary, With-Project tonnages are presented in Table 14. The increased tonnages for 1992 are shown along with the growth in tonnages over the project life.

With-Project Unit Costs. With a deeper channel, all commodities will move in larger and/or more fully loaded vessels. The process of computing the unit costs for each commodity is described below:

Ilmenite Ore (Import). Average annual transportation cost was computed for ore under the same process and in the same vessels as under Without-Project Condition for 32', 34' and 36' channels at Gulfport. These unit costs were $17.18, $14.27 and $13.63, respectively, for the ore coming from Australia and County B. (These vessels would still call at New Orleans with a 32-foot channel at Gulfport; however, New Orleans would be eliminated for 34 and 36-foot channels at Gulfport.)

Unit costs for ore coming from Country C were also calculated using the same vessels under Without-Project Condition. For a 32', 34' and 36' channel at Gulfport, these unit costs were $8.85, $8.22 and $7.67, respectively.

Table 14
With-Project Projected Tonnages by Decades (1992-2042)
Gulfport Harbor
(rounded)

	Tonnages					
	1992	2002	2012	2022	2032	2042
Ilmenite Ore	246,400	283,200	325,400	373,900	429,700	493,800
Ilmenite Ore	112,000	128,700	147,900	170,000	195,300	224,400
Scrap Metal	336,000	414,000	510,200	628,600	774,600	954,400
Fishmeal	40,000	46,000	52,800	60,700	69,800	80,200
Fresh Fruit (container)	369,700	460,500	573,500	714,400	889,800	1,109,100
General (container)	171,900	197,500	227,000	260,900	299,800	344,500
	1,276,000	1,529,900	1,836,800	2,208,500	2,659,000	3,206,400

Scrap Metal (Export). The overland modes of transportation and ports would change for this commodity with a deeper channel at Gulfport. Eliminating the barging to Darrow, Louisiana and substituting trucking the 224,000 tons to the Port of Gulfport at $2.25 per ton, and then routing the scrap in the same vessels to the same destinations with the same weighting process as presented under Without-Project Condition resulted in costs of $15.73, $14.64 and $13.77 for 32, 34, and 36 foot channels at Gulfport, respectively. (No underkeel clearance for vessel operation at Gulfport was used.) It should be noted that the costs per ton for scrap metal for the 32 and 34 foot channels at Gulfport will be further investigated in the GDM. The requirement to stockpile the scrap metal will require further investigations of port and handling charges in order to accurately compare the unit cost per ton at New Orleans and Gulfport. Specifically, this movement may only transfer to Gulfport with a 36-foot channel.

Fishmeal (Import). The Without-Project Condition vessel was more fully loaded with a 32', 34' and 36' channel at Gulfport. The resulting costs per ton were $10.79, $10.01 and $9.34, respectively, with the aforementioned channel depths.

Fresh Fruit (Import). The same Without-Condition vessel and trip was used to calculate unit costs for a 32', 34' and 36' channel at Gulfport. There unit costs were $8.45 for all three different channel depths, since the vessel would be fully loaded at 32 feet (30' loaded draft plus 2 feet underkeel clearance).

Containerized General Cargo (Export/Import). Using the same five (5) vessels in the feeder service which Gulfport will participate under Without-Project Condition, unit costs were $3.65, $3.38 and $3.29, respectively, for 32', 34' and 36' channels at Gulfport.

Summary. Table 15 displays the unit transportation costs for each commodity by channel depth.

TABLE 15
Summary of Unit Transportation Costs
for Various Considered Depths at Gulfport
(WITHOUT AND WITH-PROJECT CONDITIONS)

COMMODITY	COSTS PER TON ($) WITHOUT PROJECT	WITH PROJECT 32'	34'	36'
Ilmenite Ore (import)	18.04	17.18	14.27	13.63
Ilmenite Ore (import)	9.60	8.55	8.22	7.67
Scrap Metal (export)	15.97	15.73	14.64	13.77
Fishmeal (import)	11.69	10.79	10.01	9.34
Fresh Fruit (containers) (import)	9.36	8.45	8.45	8.45
General (containers) (import/export)	4.13	3.65	3.38	3.29

NOTE: All differences in port and handling charges are excluded in this table.

ECONOMIC BENEFITS

METHODOLOGY

The transportation benefits resulting from a deeper channel at Gulfport Harbor would be generated by more efficient utilization (greater loadings) of vessels presently calling at the port, the use of larger vessels, reduced vessel transit times and port times, and other benefit categories which include reduced port handling charges, reduced pilotage fees, etc. Benefits were computed as the difference in transportation costs between the Without-Project Condition and With-Project Condition. All future benefits were discounted to their present value and then amortized over the project life (1992-2042) at the FY 1988 interest rate of 8-5/8%. Transportation costs and/or data were based upon the latest Department of Army WRC guidelines dated February, 1987. For this analysis, all vessel capacities, commerce tonnages, etc. have been converted to short tons.

BENEFITS

With a deeper channel at Gulfport, transportation benefits accrue to shippers who will import and export commodities through the Port of Gulfport under the Without and With-Project Conditions. Base year traffic volumes and corresponding benefits that would be realized from considered improvements at Gulfport Harbor are presented in Table 16 and are shown here soley for the purpose of displaying a "no growth" scenario. Base Year volume is 1,276,000 tons; and annual savings for channel depths 32, 34 and 36 feet are $831,400,

$2,062,900 and $2,616,400, respectively. These benefits are generated by multiplying the 1992 tonnage by the differences in unit costs in Table 15.

Table 16
Base Year Tonnage and Benefits
Gulfport Harbor
(Rounded)

	1992 Tonnage (tons)	1992 Benefits 32'	34'	36'
Ilmenite Ore	246,400	$211,900	$928,900	$1,086,600
Ilmenite Ore	112,000	84,000	154,600	216,200
Scrap Metal	336,000	80,600	446,900	739,200
Fishmeal	40,000	36,000	67,200	93,600
Fresh Fruit (container)	369,700	336,400	336,400	336,400
General (container)	171,900	82,500	128,900	144,400
Totals	1,276,000	$831,400	$2,062,900	$2,616,400

Table 17 displays the transportation savings for the commodities and their tonnages which will move through Gulfport with alternative channel depth increases. These savings are generated by the differences in costs per ton in Table 15 for each successively deeper channel from the costs per ton for a 30-foot channel.

These benefits, by commodity and by channel depth, were converted to an average annual equivalent basis in Table 18 by discounting future benefits to present worth and then amortizing the benefits over the project life at 8-5/8 percent interest.

Table 17
Transportation Benefits For Alternative Channel Depths
Gulfport Harbor
($1,000)

	1992	2002	2012	2022	2032	2042
			32 Foot Channel			
Ilmenite Ore	$ 211.9	$ 243.6	$ 279.8	$ 321.6	$ 369.5	$ 425.7
Ilmenite Ore	84.0	96.5	110.9	127.5	146.5	168.3
Scrap Metal	80.6	92.7	106.5	122.4	140.6	161.6
Fishmeal	36.0	41.4	47.5	54.6	62.8	72.2
Fresh Fruit (containers)	336.4	386.6	444.3	510.5	586.7	674.2
General (containers)	82.5	94.8	109.0	125.2	143.9	165.4
Total	$ 831.4	$ 955.6	$1,098.0	$1,261.8	$1,450.0	$1,667.4
			34 Foot Channel			
Ilmenite Ore	$ 928.9	$1,067.7	$1,226.8	$1,409.6	$1,620.0	$1,861.6
Ilmenite Ore	154.6	177.6	204.1	234.6	269.5	309.7
Scrap Metal	446.9	513.5	590.1	678.2	779.2	895.5
Fishmeal	67.2	77.3	88.7	102.1	117.3	134.7
Fresh Fruit (containers)	336.4	386.6	444.3	510.5	586.7	674.2
General (containers)	128.9	148.1	170.2	195.7	224.8	258.4
Totals	$2,062.9	$2,370.8	$2,724.2	$3,130.7	$3,597.5	$4,134.1
			36 Foot Channel			
Ilmenite Ore	$1,086.6	$1,248.9	$1,435.0	$1,648.9	$1,895.0	$2,177.7
Ilmenite Ore	216.2	248.4	285.4	328.1	376.9	471.7
Scrap Metal	739.2	849.4	976.1	1,121.8	1,289.0	1,481.3
Fishmeal	93.6	107.6	123.6	142.0	163.3	187.7
Fresh Fruit (containers)	336.4	386.6	44.3	510.5	586.7	674.2
General (containers)	144.4	165.9	190.7	219.2	251.8	289.4
Totals	$2,616.4	$3,006.8	$3,455.1	$3,970.5	$4,562.7	$5,282.0

Table 18
Average Annual Equivalent Transportation Benefits
Gulfport Harbor
($1,000)

	32'	34'	36'
Ilmenite Ore	249.3	1,092.6	1,278.1
Ilmenite Ore	98.8	181.3	254.5
Scrap Metal	94.8	525.6	869.4
Fishmeal	42.3	79.1	110.1
Fresh Fruit (containers)	395.7	395.7	395.7
General (containers)	97.9	151.6	169.8
Totals	977.9	2,426.3	3,077.5

OTHER BENEFITS

The three (3) Navy oceanographic vessels mentioned above are 21,235 dwt research vessels with dimensions 535.7' x 76' x 29.8'. The hydrographic sonar array on each vessel bottom protrudes an additional 2.5 feet, and NOC requires another 2 feet of underkeel clearance for the safety of this $12.0 million piece equipment. These vessels presently come into New Orleans for resupply and crew liberty. Each trip requires one full day extra each way and 6 hours awaiting daylight to enter or exit the New Orleans channel because of floating objects in the Lower Mississippi River. Vessel operating costs were furnished by NOC. These vessels would be serviced at Gulfport with a 34 or 36 foot channel with a savings of $303,750 annually (1.5 trips annually x 2.25 days at New Orleans x $30,000/day x 3 vessels). This amount does not include a savings in the overland costs of crews and supply teams to resupply these vessels at Gulfport versus New Orleans.

The ABC Containerline vessels mentioned above, which transport the ilmenite ore for DuPont, also transport containers each trip. Annually, 3,000 containers are offloaded at New Orleans to lighten the vessel for entering Gulfport Harbor. These 3,000 containers would be transferred to the Port of Gulfport with a deeper channel. The savings shown here result from the difference in handling charges at the two ports and amount to $50 per container or $150,000 annually. This benefit would accrue to both a 34 and 36-foot channel.

During the winter months (1 November to 1 April) reduced depths caused by strong northerly winds result in vessel delays. Port officials report that at least five (5) of the larger vessels per month during this period are delayed one (1) hour each way awaiting high tide, which amounts to $18,750 annually (5 months x 5 vessels/mo x 1 hr x $750 average per hour).

Other transportation losses occur at three (3) bends in the entrance channel. The westward migration of Ship Island has forced a bend to the west near the midpoint of Ship Island Pass and, in turn, this realignment has progressively tightened the bend at the northern end of the pass. Based on data from port officials and harbor pilots, all vessels are delayed an average of 15 minutes each way because of these bends, which results in a loss of $118,500 annually (395 vessels x 30 minutes x $600 average hourly cost). In addition, 40 percent of the larger vessels (particularly RoRo's and container vessels with extensive freeboard) are delayed an extra 15 minutes each way during the winter months because high northerly winds complicate maneuvering in these bends, especially the northernmost. These additional delays result in losses of $22,000 annually (55 vessels x 30 min. x $800 average at sea hourly operating costs). Two (2) vessel groundings in the Spring of 1987 could have been avoided if these bends were eased. Additional widening for these bends would result in savings of $140,500 annually.

SUMMARY OF BENEFITS

Table 19 lists the transportation benefits and other benefits generated from reduced vessel transit times, reduced vessel delays (awaiting high tides), etc.

Table 19
Summary of Annual Benefits at Gulfport Harbor
($1,000)

	Channel Depths		
	32'	34'	36'
TRANSPORTATION BENEFITS			
Depth Related			
Better Vessel Utilization	977.9	2,426.3	3,077.5 a/
Other Benefits:			
(a) Reduction of Transit Times (Naval Hydrographic Sonar Vessels)	0	303.8	303.8
(b) Reduced Vessel Delays (Awaiting high tide)	0	18.8	18.8
(c) Reduced Port Handling Charges on 3,000 Containers	0	150.0	150.0
Bend related			
Reduced Vessel Transit Times Due to Widening Need at 3 Bends	118.5	140.5	140.5
TOTALS	1,096.4	3,039.4	3,690.6

a/ These benefits for a 38' channel are $3,184.8 for a total of $3,794.9.

CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

A summary of the estimated costs and benefits for each of the formulated plans is shown in Table 20. As that table clearly indicates, all of the 34-foot and 36-foot depth alternatives are economically feasible on the basis of the data developed to date. Absent further data, Alternative C, deepening to 36 feet on the existing channel alignment with widening of the problem bends, would be the plan recommended for construction. The present level of investigation, however, is not sufficient to determine if Alternative C is the NED plan. Further evaluation is needed on the benefits associated with channel bend widening. The submarine pipeline which crosses the existing Federal navigation project in Mississippi Sound will have to be investigated, and the extent of necessary relocation will have to be determined. Additionally, the Mississippi State Port Authority at Gulfport has current plans for port expansion. The effects of the port expansion will have to be evaluated and included in any recommended plan of improvement for the considered project.

Alternative "L", the plan authorized by the WRDA 1986, would deepen and widen the project along the existing alignment, and relocate Ship Island Pass Channel. The benefit-to-cost ratio for this alternative, using thin-layer disposal, is 1.16 to 1. The WRDA 1986, however, directs that all dredged material be taken to the Gulf of Mexico. Preliminary evaluations of this alternative using gulf disposal results in a benefit-to-cost ratio of 0.77 to 1. The project authorization in WRDA 1986, however, also states that the benefits for gulf dispsoal would be equal to the cost of such disposal. Accordingly, the benefit-to-cost ratio would be 1.11 to 1.

RECOMMENDATION

It is recommended that the current investigation be completed and the General Design Memorandum be prepared. A schedule of the plan of study is provided as Figure 7.

LARRY S. BONINE
Colonel, Corps of Engineers
District Engineer

TABLE 20

GULFPORT HARBOR, MISSISSIPPI
REEVALUATION REPORT
Thin Layer Alternatives
I = 8 5/8%

FIRST COST ITEMS ($1000)	ALTERNATIVES A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
GENERAL NAVIGATION FACILITIES															
Dredging															
Pipeline Dredging-TL Disposal	2442	2994	4548	4036	5333	6598	2372	2829	4380	3907	5135	6610	8239	9873	11561
Hopper Dredge-Feeder Berm Disposal	3849	4739	5711	4366	5433	6579	6137	6770	7721	6137	6770	7721	8703	9511	10340
Hoper Dredge-Gulf Disposal	1744	2893	4213	2375	3737	5310	2375	3738	5310	2375	3738	5310	3355	4442	5658
Mob & Demob Total	187	187	187	187	187	187	187	187	187	187	187	187	187	275	275
Dredging Subtotal	8222	10813	14659	10964	14690	18629	11071	13524	17598	12606	15830	19628	20484	24099	27834
Remove Existing Breakwater	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Subtotal	8283	10874	14720	11025	14751	18690	11132	13585	17659	12667	15891	19689	20545	24160	27895
Contingencies (15%)	1242	1631	2208	1654	2213	2804	1670	2038	2649	1900	2384	2953	3082	3624	4184
Subtotal	9525	12505	16928	12679	16964	21494	12802	15623	20308	14567	18275	22642	23627	27784	32079
Engineering and Design	667	875	1185	888	1187	1505	896	1094	1422	1020	1279	1585	1654	1945	2246
Supervision and Administration	286	375	508	380	509	645	384	469	609	437	548	679	709	834	962
Subtotal	10478	13756	18621	13947	18660	23643	14082	17185	22339	16024	20102	24903	25989	30562	35287
Navigation Aids (USCG)	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
TOTAL COST - GENERAL NAVIGATION	10520	13798	18663	13989	18702	23685	14124	17227	22381	16066	20144	24949	26031	30604	35329
TOTAL FEDERAL COST (.75GN)	7890	10348	13997	10491	14027	17764	10593	12920	16785	12049	15108	18711	19524	22953	26497
LERRD, ETC.															
Dredging Berthing Areas	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
LOCAL SHARE GN COST	2630	3449	4666	3497	4676	5921	3531	4307	5595	4016	5036	6237	6508	7651	8832
TOTAL NON-FEDERAL FIRST COST	2820	3639	4856	3687	4866	6111	3721	4497	5785	4206	5226	6427	6698	7841	9022
TOTAL PROJECT FIRST COST	10710	13988	18853	14179	18892	23875	14314	17417	22571	16256	20334	25139	26221	30794	35519

TABLE 20 (Cont'd)

GULFPORT HARBOR, MISSISSIPPI
REEVALUATION REPORT
Thin Layer Alternatives
I = 8 5/8%

ANNUAL COST ITEMS ($1000)	ALTERNATIVES A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
GENERAL NAVIGATION FACILITIES															
Total Federal First Cost	7890	10348	13997	10491	14027	17764	10593	12520	16785	12049	15108	18711	19524	22953	26497
Interest during Construction	143	226	620	346	621	922	509	671	1001	579	784	1116	1089	1567	2099
NET FEDERAL INVESTMENT	8033	10574	14617	10837	14648	18686	11102	13591	17786	12629	15892	19827	20612	24500	28596
FEDERAL															
Interest and Amortization	704	927	1281	950	1284	1638	973	1191	1559	1107	1393	1738	1807	2147	2506
Maintenance Dredging	828	828	828	828	828	828	828	828	828	828	828	828	828	828	828
Maintain Navigation Aids	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
TOTAL FEDERAL ANNUAL CHARGES	1540	1763	2117	1786	2120	2474	1809	2027	2395	1943	2229	2574	2643	2983	3342
Total Local First Cost	2820	3639	4856	3687	4866	6111	3721	4497	5785	4206	5226	6427	6698	7841	9022
Interest During Construction	51	79	215	122	215	317	179	233	345	202	271	117	373	528	715
NET LOCAL INVESTMENT	2871	3719	5071	3809	5081	6428	3900	4730	6130	4409	5497	6544	7071	8370	9737
NON-FEDERAL															
Interest and Amortization	252	326	444	334	445	563	342	415	537	386	482	574	620	734	853
Maintenance Dredging	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
TOTAL NON-FEDERAL CHARGES	273	347	465	355	466	584	363	436	558	407	503	595	641	755	874
TOTAL ANNUAL CHARGES	1813	2110	2583	2141	2586	3058	2172	2463	2953	2350	2732	3168	3283	3738	4217
BENEFITS															
Transportation Savings	1096	3039	3691	1096	3039	3691	1096	3039	3691	1096	3039	3691	1096	3039	3691
BENEFIT/COST RATIO	0.60	1.44	1.43	0.51	1.18	1.21	0.50	1.23	1.25	0.47	1.11	1.16	0.33	0.81	0.88
NET BENEFITS	-717	929	1108	-1045	453	633	-1076	576	738	-1254	307	523	-2187	-699	-526

NOTE: See page 9 for a description of the channel alternatives.

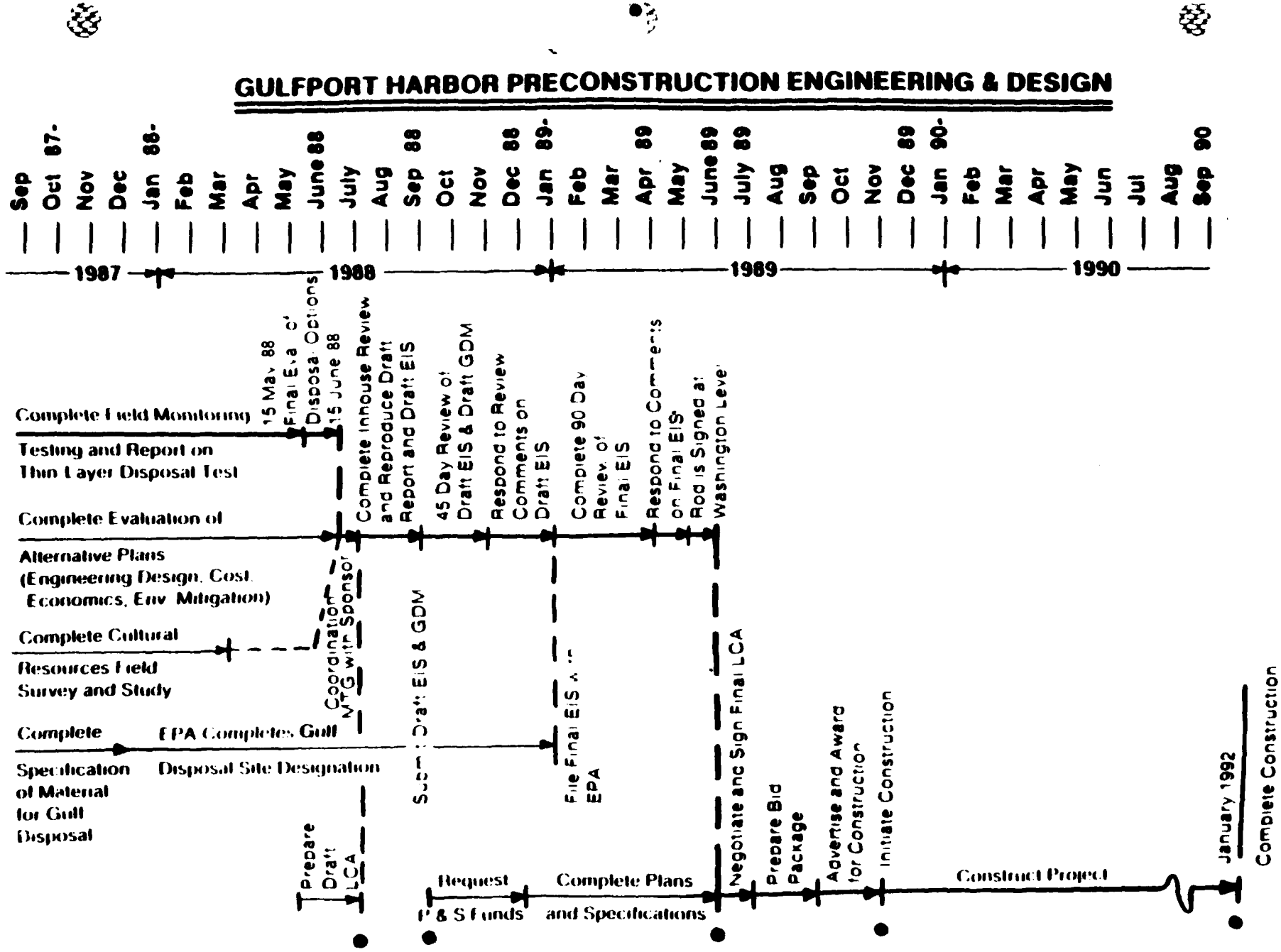


FIGURE 7. GULFPORT HARBOR PLAN OF STUDY SCHEDULE