U. S. ARMY, CORPS OF ENGINEERS

MISSISSIPPI RIVER-GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

GENERAL DESIGN

PREPARED IN THE OFFICE OF THE DISTRICT ENGINEER
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
NEW ORLEANS, LA.

JUNE 1959

LMVGU (NOD 30 Jun 59) 3d Ind
SUBJECT: Design Memorandum No. 2, General Design, Mississippi River-Gulf Outlet

U. S. Army Engr Div, Lower Mississippi Valley, Vicksburg, Miss. 21 Sep 1959

TO: District Engineer, U. S. Army Engr Dist, New Orleans

1. Referred to note approval of Route B and Design Memorandum No. 2 in accordance with LMVD comments except as noted in preceding indorsement.

2. Interested members of Congress; Director of Public Works, State of Louisiana; and the Governor of Mississippi were notified of the approval in second indorsement by letters dated 18 September 1959, copies of which were furnished you. Your office will notify the other local agencies involved in this matter.

3. You are directed to proceed with construction of the Outlet as approved. B/C ratios noted in paragraph 3 of the second indorsement will be used in discussions in response to queries from local interests, if required.

W. A. CARTER
Major General, USA
Division Engineer

ENGWR (30 Jun 59) 2nd Ind
SUBJECT: Design Memorandum No. 2, General Design, Mississippi River-Gulf Outlet

Office, Chief of Engineers, Washington 25, D. C., 16 September 1959

TO: Division Engineer, U. S. Army Engineer Division, Lower Mississippi Valley, VICKSBURG, MISSISSIPPI

1. Route B is approved as recommended.

2. Referring to paragraph 82 of DM 2, plans for construction and maintenance of the project should be based on utilizing equipment presently available to private industry and the Corps of Engineers. The utilization of a specialized type hopper dredge for maintenance would be subject to the availability of such equipment from private sources.

3. It is noted in Item 17 of the comments of the Division Engineer that the B/C ratios were developed by adding the increased ship operation costs to the Federal annual charges rather than adjusting the estimated annual benefits. The latter procedure is considered to be more appropriate. The benefit cost ratios as computed on this basis are: Route B, 1.82; Route D, 1.68; Route E6, 1.67; and Route E6 (Alt) 1.60.

FOR THE CHIEF OF ENGINEERS:

Incls w/d

WILLIAM F. CASSIDY
Brigadier General, USA
Assistant Chief of Engineers
for Civil Works

LMVGU (NOD 30 Jun 59) 1st Ind
SUBJECT: Design Memorandum No. 2, General Design, Mississippi River - Gulf Outlet

U. S. Army Engr Div, Lower Mississippi Valley, Vicksburg, Miss. 22 Jul 1959

TO: Chief of Engineers, DA, Washington, D. C.
ATTN: ENGMR and ENGWE

1. The District Engineer recommends approval of Route B on the basis that it is the least costly of the four routes considered.

2. Since the subject design memorandum did not include an analysis of the B/C ratios for the various routes, such an analysis has been included in the inclosed comments as item 17. Tables Nos. 2 and 3 were utilized in making the analysis. It will be noted that Route B gives the most favorable B/C ratio for the two conditions when the differential in annual ships' operation costs are added to the project annual costs. On the other hand, Route E-6 gives the most favorable B/C ratio for the remaining two conditions when the differential in annual ships' operation costs has been excluded and only the project annual costs have been considered. A discussion of these costs is given in item 22 of the inclosed comments.

3. In furtherance of the discussion of the differential in ships' operation costs, reference is made to New Orleans District letter dated 4 June 1959, subject: "Request for Permission to Prepare General Design Memorandum for Additional Lock on Mississippi River-Gulf Outlet" and to our 1st Indorsement thereon dated 30 June 1959. On page 7 of the traffic study inclosed with the above-referenced letter, a statement is made that about 30 percent of the vessels loading or unloading general cargo at New Orleans call at Gulf ports east of New Orleans. Because of the lack of information on the number of calls made by vessels at the Gulf ports east of New Orleans, it is not possible at this time to determine the differential in ships' operation costs for the four routes for the 30 percent of the vessels calling at the Gulf ports. This would reduce the advantage of Route B over Route E-6; however, there would still be an advantage.

4. In view of this analysis, and after weighing the advantages and disadvantages of the three principal routes as summarized in item 23 of the inclosed comments, I concur in the recommendation of the District Engineer.

5. Early decision in this matter is requested since the project schedule for construction will require the New Orleans District to proceed with plans and specifications for items of work beyond Bayou La Loutre at an early date.

2 Incl
1. 2 cys w/d
Added 1 Incl
2. LMVD comments (dup)

W. A. CARTER
Major General, USA
Division Engineer

15 July 1959

U.S. ARMY ENGINEER DIVISION, LOWER MISSISSIPPI VALLEY
CORPS OF ENGINEERS
Vicksburg, Mississippi

COMMENTS ON DESIGN MEMORANDUM INCLOSED WITH LETTER, LMNGY, U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, 30 JUNE 1959, SUBJECT, "DESIGN MEMORANDUM NO. 2, GENERAL DESIGN, MISSISSIPPI RIVER - GULF OUTLET"

1. Par. 4, page 3. Change 35 ft on line 6 to 30 ft.

2. Par. 17, page 9. a. The gradual increase of 100 ft in channel width and 2 ft in channel depth over a distance of 5 miles is impracticable. Therefore the second sentence should be revised to read as follows: "The sea bar or approach channel dimensions will be 38 feet deep and 600 feet wide."

b. The exact location of the turning basin has not been determined. Therefore the sentence beginning on line 10 should be modified to exclude a specific location. The recommended location will be included in the general design memorandum for the location of the navigation lock (see 1st Indorsement LMVGU 30 June 1959 on New Orleans District letter dated 4 June 1959, subject, "Request for Permission to Prepare General Design Memorandum for Additional Lock on Mississippi River - Gulf Outlet").

c. Add the following sentence to paragraph 17: "The dredge spoil will be used to confine the waters of the channel through Lake Athanasio and as practicable through the shallow waters of Breton Sound northward of Gardner Island."

3. Par. 18, page 9. This paragraph should point out that the location of the turning basin as mentioned in paragraph 17 and shown on plates 1 and 2 is a deviation from that shown in the project document (see comment 2b. above).

4. Par. 30, page 12. The proposed slopes (1 on 2) should be indicated. The memorandum should indicate whether slopes where land areas are submerged have been analyzed and whether the factors of safety obtained are comparable to those reported in Design Memoranda 1-A and 1-B.

5. Par. 32, page 13. At the end of the third sentence add "in Chandeleur Sound".

6. Par. 40, page 16. Add a subparagraph after paragraph 40 essentially as follows: "The exact location of the channel in the pass between Breton Island and Gosier Island and the alignment of the 38 ft by 600 ft sea bar channel will be made on the basis of a detailed hydrographic survey. The results of the survey will be given in Design Memorandum No. 1-C scheduled for 15 November 1959. The alignment of the sea bar channel will angle with the channel across Breton Sound to provide for the establishment of range lights for navigation and hopper dredge operations."

7. Par. 41, page 16. Revise to state that the sea bar channel will be 38 ft deep and 600 ft wide.

8. Par. 42, page 16. Insert the following after the first sentence: "Where the dredge spoil is adequate to confine the waters of the channel through the shallow open waters of Breton Sound retention dikes will be omitted until found necessary."

9. Pars. 42 and 43, page 21 and Plate 19. Although the allowance for subsidence of 25 percent of the height of dike may suffice, the value should be checked in detailed design based on available experience in the area and settlement analyses. The ability of the foundation to support dikes with 1 on 1.5 slopes also should be investigated in detailed design.

10. Table 1, page 17. The cost estimate should include the cost of aids to navigation (see paragraph 65, page 39 of House Document 245, 82d Congress, 1st Session).

11. Par. 44, page 21. On line four, place a period after the word "outlet" and delete "as shown on Plates 1 and 2".

12. Par. 46, page 22. Add a line, "Sea Bar Channel, 38 ft by 600 ft".

13. Par. 49, page 22. In third line, change "west" to "east".

14. Par. 50, page 22. In the first sentence change "Approved sources of sand and gravel" to "Sources of sand and grave previously approved for other CE projects".

15. Par. 51, page 22. Need for low-alkali cement with the aggregate cited in paragraph 50 should be considered.

16. Par. 82, page 35. This paragraph should be revised to explain why a pipeline dredge cannot be used in that portion of the channel where the depth of the sound exceeds 12 feet. Based on this criteria, it appears that approximately half of the Route B channel would require the use of a hopper dredge or an overboard-disposal type dredge.

17. Par. 86, page 36. Using annual benefits of $9,080,000 for all routes considered, B/C ratios are given for the four conditions below.

	ROUTE B	ROUTE D	ROUTE E-6	ROUTE E-6(Alt.)
I - WITHOUT DEFERRED DIKE CONSTRUCTION (Ships' operation costs included)				
Fed. An. Chg.	$4,674,700	$5,144,650	$5,567,410	$5,826,305
Non-Fed. An. Chg.	314,200	319,400	325,200	328,200
Total Annual Chg.	$4,988,900	$5,464,050	$5,892,610	$6,154,505
B/C Ratio	1.82	1.66	1.54	1.48
II - WITH DEFERRED DIKE CONSTRUCTION (Ships' operation costs included)				
Fed. An. Chg.	$5,418,200	$5,836,250	$6,409,910	$6,668,805
Non-Fed. An. Chg.	314,200	319,400	325,200	328,200
Total Annual Chg.	$5,732,400	$6,155,650	$6,735,110	$6,997,005
B/C Ratio	1.58	1.48	1.35	1.30
III - WITHOUT DEFERRED CONSTRUCTION (Ships' operation costs excluded)				
Fed. An. Chg.	$4,674,700	$4,981,900	$4,398,400	$4,513,300
Non-Fed. An. Chg.	314,200	319,400	325,200	328,200
Total Annual Chg.	$4,988,900	$5,301,300	$4,723,600	$4,841,500
B/C Ratio	1.82	1.71	1.92	1.88
IV - WITH DEFERRED CONSTRUCTION (Ships' operation costs excluded)				
Fed. An. Chg.	$5,418,200	$5,673,500	$5,240,900	$5,355,800
Non-Fed. An. Chg.	314,200	319,400	325,200	328,200
Total Annual Chg.	$5,732,400	$5,992,900	$5,566,100	$5,684,000
B/C Ratio	1.58	1.52	1.63	1.60

18. Table 6, page 37. Interest during construction includes the interest charges on $22,346,700 of work deferred until after 1967 (see paragraph 81, page 35). According to the schedule on page 34, the interim channel will be completed by December 1963 and benefits will begin to accrue. Therefore the interest during construction of $1,396,700 on the deferred work should be excluded thereby reducing the figure of $6,498,000 to $4,101,300 and the investment from $117,615,000 to $116,218,300. Likewise the annual charges would be reduced from $5,836,700 to $5,787,400.

19. Plate 1. Revise the note "Eased Entrance 36 ft x 500 ft to 38 ft x 600 ft" to read "Sea Bar Channel, 38 ft x 600 ft".

20. Plate 19. a. On the typical section, land cut, mile 63.15 to Chandeleur Sound, change the dimensions from the landside crown of the spoil dike to the borrow area from "not less than 85' " to "not less than 70'". This will facilitate obtaining dragline equipment capable of constructing the spoil dike.

b. Spoil should be placed in a position which will minimize the tendency for it to migrate back into the channel. This subject which is discussed in paragraphs 32d on page 14, 40 on page 16, 49 on page 22, and 65c on page 25 should be summarized in one paragraph clearly setting forth the proposed plan for spoil disposal.

21. Appendix I, Inclosure 9. In the third line of paragraph 12 change the rate from "cu. yds. per year per foot" to "cu. yds. per year per mile".

22. Appendix VI. a. It is noted that the operation costs as determined in this appendix were based on 1,550 calls by sea-going, general cargo vessels, the source of this figure being paragraph 19 of the Report of the Board of Engineers for Rivers and Harbors dated 20 April 1948 contained in the project document (HD 245/82/1).

b. The figure of 1,550 calls was determined by the Board as follows:

Annual volume of general cargo predicted in 10 years...	7,500,000 tons
General cargo in 1946.....	4,250,000 tons
Estimated general cargo to be handled in new terminals	3,250,000 tons
Average movement per call in 1946.....	2,065 tons

Number of calls of deep-draft vessels estimated for the new terminals located on the new Gulf Outlet Channel..... $3{,}250{,}000 \div 2{,}065 = 1{,}550$

c. The analysis in this appendix presupposes that all of the deep-draft vessels making the 1,550 calls at the Port of New Orleans will proceed from Dry Tortugas and Cape San Antonio direct to the port and return direct to either of these points without calling at any other port on the Gulf of Mexico en route. Obviously this assumption is questionable but a detailed traffic study would be required to ascertain the extent to which calls at other ports on the Gulf of Mexico would modify the estimates of ships' operation costs for the various routes.

23. Route analysis. The following is a brief summary of the advantages and disadvantages of each of the three principal routes.

a. ROUTE B

(1) Advantages:

(a) Most economical route when ships' operation costs are considered.

(b) Shortest sailing distance to the Port of New Orleans via Dry Tortugas and Cape San Antonio.

(2) Disadvantages:

(a) Requires a sea bar channel that passes through a wide shoal 12' to 15' deep of littoral origin. The sea leg of the channel will be difficult to maintain.

(b) Substantial increase in hopper dredge requirements when the 36-foot deep channel is subsequently increased to a depth of 40 feet.

(c) Second choice of the Beach Erosion Board.

(d) Fish and wildlife interests object to the route passing through important oyster-seed ground.

(e) Local interests, particularly the maritime interests, object to the route.

b. ROUTE D

(1) Advantages:

(a) Route preferred by local interests, particularly the maritime interests.

(b) Route preferred by the fish and wildlife agencies.

(2) Disadvantages:

(a) Longest channel.

(b) Most costly of the routes.

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Foot of Prytania Street
New Orleans 9, Louisiana

LMNGY

30 June 1959

SUBJECT: Design Memorandum No. 2, General Design, Mississippi River-Gulf Outlet

THRU: The Division Engineer
U. S. Army Engineer Division
Lower Mississippi Valley
Vicksburg, Mississippi

TO: The Chief of Engineers
Department of the Army
Washington 25, D. C.

1. In accordance with the provisions of EM 1110-2-1150, twelve copies of subject design memorandum are forwarded herewith for review and approval.

2. The channel alignment between the Inner Harbor Navigation Canal and Bayou La Loutre and the bridge crossing for Louisiana State Highway No. 47 have been previously approved.

3. Approval of subject Design Memorandum No. 2 is recommended.

1 Incl (12 cys)
Design Memorandum No. 2-
General Design, Miss. River-
Gulf Outlet

G. M. COOKSON
Colonel, CE
District Engineer

MISSISSIPPI RIVER-GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2
GENERAL DESIGN

STATUS OF DESIGN MEMORANDA

Design Memo Number	Title	Status
1-A	CHANNELS, Mile 63.77-Mile 68.85	Approved 11 September 1957
1-B	CHANNELS, Mile 39.01-Mile 63.77	Approved 27 Jan. 1959
1-C	CHANNELS, Gulf Entrance - Mile 39.01	*15 Nov. 1959
3	Retention Dikes	*31 July 1960

* Scheduled submission date

MISSISSIPPI RIVER-GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
GENERAL DESIGN

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PERTINENT DATA

LOCATION OF PROJECT

Southeast Louisiana

CHANNEL

Length	75.6 miles
Bottom width	500 feet
Depth	36 feet
Depth of advanced maintenance	2 feet
Allowable overdepth	2 feet
Side slopes	1 on 2
Degree of curvature	$1^{\circ}07'$ (maximum)
Tangent distance approaching a bridge	2,000 feet (minimum)
Channel excavation	288,474,000 cu. yds.

TURNING BASIN

Length	2,000 feet
Width	1,000 feet
Basin excavation	1,830,000 cu. yds.

RETENTION DIKES

Length (4.9 miles each side) total	9.8 miles
Crown elevation	5.0 m.l.g.
Height	5-11 feet
Stone	330,000 cu. yds.
Shell	348,000 cu. yds.

DEFERRED DIKE

Length	17.2 miles
Crown elevation	5.0 m.l.g.
Height	11-25 feet
Stone	758,000 cu. yds.
Shell	1,346,000 cu. yds.

LOUISIANA STATE HIGHWAY NO. 47 BRIDGE

Type: Semi-high level vertical lift bridge

Number of traffic lanes	4
Horizontal clearance	400 feet
Vertical clearance open position	156 ft. M.H.W.
Vertical clearance closed position	50 ft. M.H.W.
Length of lift span	480 feet
Length of structural approaches	2,017 feet
Length of bridge	2,497 feet

RIGHTS OF WAY

Channel - Width variable from 1,250 ft. to 1,500 ft.

Spoil disposal:

Permanent - Up to 2,000 ft. from channel right of way

Temporary - 2,000 ft. to 4,000 ft. from channel right of way

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

GENERAL DESIGN

PROJECT AUTHORIZATION

1. Authority. The Mississippi River-Gulf Outlet, La., a navigation improvement, was authorized by the River and Harbor Act approved 29 March 1956, Public Law 455, 84th Congress, 2d Session. The act reads as follows:

> "BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That the existing project for Mississippi River, Baton Rouge to the Gulf of Mexico, is hereby modified to provide for the Mississippi River-Gulf outlet to be prosecuted under the direction of the Secretary of the Army and supervision of the Chief of Engineers, substantially in accordance with the recommendations of the Chief of Engineers contained in House Document Numbered 245, Eighty-second Congress, at an estimated cost of $88,000,000: PROVIDED, That when economically justified by obsolescence of the existing industrial canal lock or by increased traffic, replacement of the existing lock or an additional lock with suitable connections is hereby approved to be constructed in the vicinity of Meraux, Louisiana, with type, dimensions, and cost estimates to be approved by the Chief of Engineers; PROVIDED FURTHER, That the condition of local cooperation specified in House Document Numbered 245, Eighty-second Congress, shall likewise apply to the construction of said lock and connection channels."

The report of the Chief of Engineers contained in House Document No. 245, 82d Congress, 1st Session, recommended modification of the existing project for Mississippi River, Baton Rouge to the Gulf of Mexico, to provide for construction of a seaway canal 36 feet deep and 500 feet wide extending 70 miles in length as a land and water cut on tangents and easy curves from a point south of the Intracoastal Waterway at Michoud southeasterly to and along the south shore of Lake Borgne and through the marshes to and across Chandeleur Sound to Chandeleur Island at or north of Errol Island, thence increasing gradually to a width of 600 ft., and depth of 38 ft. in the Gulf of Mexico, with protective jetties at the entrance, a permanent retention dike through Chandeleur Sound, and a wing dike along the islands as required; a turning basin at the landward end of the seaway canal, 36 feet deep, 1000 feet wide and 2000 feet long; and a connecting channel 36 feet deep and 500 feet wide extending westerly along the Gulf

Intracoastal Waterway from the turning basin to the Industrial Canal, including construction of a suitable highway bridge with approaches to carry Louisiana State Highway 47 (formerly 61) over the channel.

2. Local Cooperation. As set forth in the report of the Chief of Engineers, United States Army, appearing in House Document Numbered 245, 82d Congress, prosecution of work under the project is conditioned on the following provisions.....

> " * * * prior to initiation of construction, local interests furnish free of cost to the United States all lands, easements, rights-of-way, and spoil disposal areas for the initial construction, and when and as required for subsequent maintenance; furnish assurances satisfactory to the Secretary of the Army that they will accept ownership of the highway bridge and approaches upon completion of construction, together with maintenance, operation, and future replacement or alteration as may be required; will provide and maintain any other bridges required over the waterway, and accomplish all necessary utility or other highway relocations and alterations and maintenance thereof; will hold and save the United States free from all claims for damages due to construction, maintenance, and operation of the project; and will construct, maintain and operate terminal facilities commensurate with requirements of the expanded port."

3. Previous Projects. Previous projects for the different sections of the existing Mississippi River, Baton Rouge to the Gulf of Mexico project were adopted by the following River and Harbor Acts; July 4, 1836, March 3, 1837, August 30, 1852, July 8, 1856, and January 21, 1927. A historical summary on the South Pass and Southwest Pass projects appear in the 1915 Annual Report, page 1847 and further information on the Mississippi River, Baton Rouge to New Orleans, project appears in the 1937 Annual Report page 724.

4. Existing Project. The Mississippi River-Gulf Outlet is a modification of the existing project "Mississippi River Baton Rouge to the Gulf of Mexico, La." The existing project authorized by the River and Harbor Act of 2 March 1945 combines projects of the Mississippi River, Baton Rouge to New Orleans; Mississippi River, South Pass and Southwest Pass; adding thereto the project for Mississippi River from New Orleans to Head of Passes, to provide a single project "Mississippi River, Baton Rouge to the Gulf of Mexico," with channel dimensions as follows, depths being referred to mean low gulf. Baton Rouge to New Orleans 35 feet deep by 500 feet wide; port limits of New Orleans 35 feet deep by 1500 feet wide; New Orleans to Head of Passes, 40 feet deep by 1,000 feet wide; Southwest Pass, 40 feet deep by 800 feet wide; Southwest Pass Bar Channel, 40 feet deep by 600 feet wide; South Pass 30 feet deep by 450 feet wide; South Pass Bar Channel, 30 feet deep by 600 feet wide. The project as of June 1959 was 75% complete exclusive of the Mississippi River-Gulf Outlet. The reaches Baton Rouge to New

Orleans, New Orleans Harbor, and New Orleans to Head of Passes were completed in 1940 and maintenance dredging is required at river crossings above New Orleans and in the New Orleans Harbor. The deepening of the Southwest Pass and the bar channel from 35 feet to 40 feet m.l.g. together with construction of contraction works has not been initiated. The 35 ft. channel in South Pass is completed. No local cooperation is required by the existing project. The uncompleted features of the existing project do not affect the current plans for the Gulf Outlet since the Outlet is a complete and separate entity not dependent upon the existing project in any way.

5. Percent Completion. The Gulf Outlet Project, considered separately was 4.7% complete as of June 1959. The reach between the Inner Harbor Navigation Canal and Highway 47 (Paris Road) is 100% complete and the work is in progress on the reach between Highway 47 (Paris Road) and Bayou Dupre.

INVESTIGATIONS

6. Investigations Made in Connection with the Project Document. The project document (H.D. 245/82/1) reviewed reports on the Mississippi River-Gulf Outlet (H.D. 46/71/2) and previous reports; and reports on Intracoastal Waterway from Mobile to New Orleans (H.D. 96/79/1) and previous reports, to determine if any modification of the recommendations contained therein was advisable. In the first of the reports reviewed (H.D. 46/71/2) the Chief of Engineers had originally found no necessity for another deep-water outlet from the Mississippi River and no justification for the acquisition of the Inner Harbor Navigation Canal and lock at New Orleans. In the second report (H.D. 96/79/1) the Chief of Engineers recommended, among other items, a 12 ft. x 150 ft. channel in Mississippi Sound and Lake Borgne and from the mouth of the Rigolets to the Mississippi River at New Orleans, and for the acquisition of control of part of the Inner Harbor Navigation Canal and lock. These modifications were adopted by the Act approved 23 July 1942. A public hearing was held in New Orleans on 5 August 1943 in connection with preparation of referenced H. D. 245 to determine the character and extent of improvements desired by interested parties and the reasons therefor. Numerous routes and data supporting the routes were submitted by interested Civic Organizations and individuals. Studies were made of the waterway traffic using the Port of New Orleans facilities and the prospective traffic that would use the proposed outlet and the expanded Port Facilities. Various routes were investigated as to their suitability and cost including several routes on both the east and west banks of the Mississippi River. Data accumulated in previous surveys as well as wind, tide and current observations and soil borings in various locations were made and analyzed. The project report concluded that the proposed outlet on the east bank of the Mississippi was economically feasible.

7. Board of Engineers' Review. Interested parties were notified of the plan of improvement proposed and afforded an opportunity to

present additional information to the Board of Engineers for Rivers and Harbors. At the request of local interests the Board of Engineers held a public hearing in New Orleans on 5 and 6 March 1947 to further develop the views of the interested parties. In general the opinions expressed at the hearing were that an outlet was necessary for the expansion of port facilities and for relief of congestion at the public terminals and to provide for efficient and economical trans-shipment of the expanding commerce. They pointed out the obsolescence and difficulty of maintenance of some of the existing river terminals and the lack of suitable space on the river front for necessary expansion. They claimed that the development of new water-front areas was necessary to encourage industrial expansion at New Orleans. There were divergent views, however, as to whether the Outlet should be located on the east bank or west bank of the river. The Board of Commissioners of the Port of New Orleans reiterated its willingness and ability to provide the necessary local cooperation in the project as recommended by the Division Engineer. No definite offer of local cooperation on the west bank improvement was received. The Board recommended the adoption of the east bank route, with the following provision...."the exact location of the Outlet to the Gulf and the alignment of the seaway should be determined after more complete studies of sand movement, wave action, and local currents are made in cooperation with the Beach Erosion Board. Hence, if the improvement is authorized, ample provision should be made for modifications of the location and alignment of the canal should further studies show that a more suitable location is available."

8. Investigations Made Subsequent to Project Authorization. Engineering studies leading to the preparation of this design memorandum were begun with the initial allotment of planning funds for the project in Fiscal Year 1957. The investigations included:

a. Aerial and topographic surveys of the proposed channel alignment.

b. Soil borings along channel alignment and over a large reconnaissance area in Chandeleur Sound and Gulf.

c. Geological investigation of area.

d. Test pits for determination of shoaling rates in Chandeleur Sound and Gulf.

e. Current direction and velocity and tide studies in Chandeleur Sound and Gulf.

f. Visual observations of wave height and direction in Chandeleur Sound.

g. Salinity and suspended sediment sampling and testing.

h. Fish and Wildlife studies for documentation of existing conditions and mitigation of possible losses to resources.

i. Investigations and studies of similar channels in the area and in other districts.

j. Studies for bridge clearances.

k. Cost studies and economic studies.

Further details of these investigations and studies are given in other sections of this design memorandum and the appendices.

LOCAL COOPERATION

9. Local Cooperation Requirements. The items of local cooperation specified in the project document and listed in detail in paragraph 2 above include the furnishing of all lands and easements, constructing all relocations excepting the Highway 47 bridge, maintenance of the relocated facilities including the Highway 47 bridge to be built by the Government, and providing for expanded port facilities.

10. Designation of Local Interests. The Board of Commissioners of the Port of New Orleans was designated by the Governor of the State of Louisiana on 10 December 1956 as the State agency to furnish assurances of local cooperation on the project. The Governor, in his Act of Designation stated "by virtue of the authority vested in me by Section 81, Title 38, Louisiana Revised Statues of 1950, I do hereby designate the Board of Commissioners of the Port of New Orleans to the extent to which they are lawfully empowered to acquire and furnish to the United States of America as required such lands, servitudes and rights-of-way as are or may become necessary to the construction and maintenance of the Mississippi River-Gulf Outlet and to furnish to the United States the assurances of local participation required by said Public Law 455, 84th Congress." The responsible officials of the designated agency are as follows:

Board of Commissioners of the
Port of New Orleans
No. 2 Canal Street
P. O. Box 46
New Orleans 6, La.

President: Mr. Terrence J. Smith
Secretary: Mr. Robert E. Elliott
Executive Director: Dr. Robert W. French

11. Local Interests Coordination. Early in the initial planning stages the Board of Commissioners of the Port of New Orleans set up an engineering committee of all known interested parties to assist and aid in the planning and to make recommendation as to their particular needs. The committee was headed by Col. Marcel Garsaud, General Chairman and included representatives from the City of New Orleans - Department of Streets, Sewerage and Water Board, Planning Commission, Department of Health, the Public Belt Railroad, the following agencies of the State of Louisiana - Department of Health, Department of Highways,

Orleans Levee Board, and the Department of Public Works; the U. S. Army Engineer District, New Orleans and the New Orleans Public Service. To consider various items evolved by the construction of the project, the committee set up the following sub-committees: Location of levees; Vehicle Crossings of Channel; Relocation of Bayou Bienvenue; Power and Gas; Roads and Streets; Sewerage, water and drainage; Laying out of industrial sites; Filling of land; Laterals and turning basins; Railroad service; and Coordination with St. Bernard and Plaquemine Parishes.

The Board of Commissioners and its engineering committee were informed of various features of the project and were furnished survey, soil and other technical data, as the planning progressed. The Board at an early stage of the planning signified approval of the general plans for the project and furnished the necessary local support as required by the authorizing act. No public hearings were held subsequent to authorization.

12. Views of Local Interests. Since its inception, the Mississippi River-Gulf Outlet project has received the active support of the responsible citizens in the affected area. Local opinion has prevailed at all times that the project would prove of enormous benefit to the New Orleans area, to the Mississippi Valley, and to the nation as a whole. The wording of the project document, and preliminary cost studies referred to in paragraph 8-k and included in Appendix IV provided conclusive evidence that the route skirting the south shore of Lake Borgne to the vicinity of Bayou La Loutre crossing was most feasible and economical. However, some question as to the best possible route across Chandeleur Sound arose in post-authorization planning. Three routes, designated "B", "D" and "E-6" constituting minor departures from the document alignment seaward of Bayou La Loutre (see Plate 2 - Location Map), were developed and presented to the Board of Commissioners of the Port of New Orleans for comment. In a letter report dated 5 March 1959, the Board of Commissioners, acting as coordinating agency of the views of interested parties, reported as follows: ...."Various aspects of this problem have been considered, including those pertaining to acquisition of rights-of-way, navigation, steamship operations, fish and wildlife values, development of terminal facilities and industrial sites, as well as engineering features. A number of other planning groups and interests have been consulted including experienced pilots, steamship organizations, fish and wildlife interests, civic organizations, and other state agencies. The facts and opinions obtained from these sources unanimously and strongly favor the selection of Route "D"." The Board considers that Route "D" represents the least hazardous channel approach from the open sea, offers a reasonable sailing distance to the focal points of the major navigation routes, results in lowest real estate costs to local interests, and in the least damage to fish and wildlife values. The Board registers opposition to the selection of Routes "B" or "E-6" for the following reasons: Route "E-6" represents greater sailing distances than either of the other routes or the existing South Pass and Southwest Pass channels, with associated increased cost to navigation; Route "E-6" passes through a multiple ownership, partially developed

section that will cause real estate acquisition to be difficult and costly; Route "B", while somewhat shorter to major traffic lanes, is considered the most hazardous to navigation of the three proposed routes because of the sand bar formations in Breton Sound; the lights of the drilling rigs associated with the extensive oil and gas activity in Breton Sound along Route "B" alignment will prove confusing to pilots and introduce an additional navigational hazard; Route "B" will cause serious damage to seed oyster beds and will interfere with the oil and gas production in the Breton Sound area.

Accompanying the report of the Board of Commissioners of the Port of New Orleans were letters from other interested parties. In a letter dated 17 February 1959, from the Special Port Captains Committee of the New Orleans Steamship Association the following views were expressed....."In the unanimous opinion of this Committee, Route "D" is by far the most preferable of the three shown on the aforementioned map. Proposed Route "D", our Committee feels, has much safer approaches from sea than the other two. The anchorage areas at this Route are good beyond the ten fathom curve, thus providing vessels with more sea room. In connection with this Route it will be noted that shallow water lies close in to Curlew Island and it is, in addition, a more direct route to the Gulf than the other two routes. Moreover, our Committee believes that less fog should develop along Route "D" than would exist at the more southerly Route "B" due to the latter's closer proximity to the river passes and the cold water being discharged into the Gulf from the Mississippi River."

In a letter dated 20 February 1959, the American Merchant Marine Institute, Inc., New York, N.Y., stated...."As a result of consultation with our member companies which plan to operate ocean going vessels through the Mississippi River-Gulf Outlet Channel from New Orleans to the Gulf of Mexico when it is completed, the Institute strongly urges that Route "D" be recommended for selection by the District Engineer."

A letter dated 16 February 1959 from the New Orleans Tidewater Development Association reads in part ...."In our opinion, Route "B" should be discarded from further consideration. It is probably the most objectionable to Fish and Wild Life interests. Its distance through open water in the Sound is the greatest and its entrance to the Gulf of Mexico north of Breton Island makes it the least desirable. There is much to be said in favor of Route "E-6". That route entering the Gulf at deep water might obviate the necessity for jetties. In my opinion, the decision between Route "D" and Route "E-6" is one to be determined by engineering analyses, and also the consideration of Fish and Wild Life interests."

The St. Bernard Council, St. Bernard Parish, La., stated in a letter dated 19 February 1959...."Attached hereto is a copy of the third interim report of the Subcommittee of the Executive Committee of the St. Bernard Council, on the Mississippi River-Gulf Outlet."....."it would appear that Route "D" is to be preferred because the route crosses more continuous land area than the others, thereby affording

more land for possible industrial development. We are not equipped to review the desirability of this route from an engineering standpoint as to problems of construction and of maintenance, nor from the standpoint of its relationship to trade routes."

The complete text of the Board of Commissioners report, including exhibits, appears in Appendix II.

13. Status of Local Cooperation. Assurances of local cooperation dated 4 April 1957 furnished by the Board of Commissioners, Port of New Orleans, were approved by the Chief of Engineers on 29 August 1957. The assurances have been partially complied with. At this time rights of way have been furnished by the local agency from the Industrial Canal to Bayou Yscloskey. The Port Commission proposes to furnish rights of way between Bayou Yscloskey and Bayou La Loutre by 1 October 1959, and to Chandeleur Island by 1 January 1960. The Commission will begin furnishing title evidence and deeds conveying easements to the United States in Fiscal Year 1960.

14. Estimated Cost to Local Interests. The estimated cost to local interests based on current price levels is $7,150,000, of which approximately $2,800,000 is for rights-of-way and the remainder $4,350,000 represents costs for relocation of existing facilities. In addition, $62,000 annually will be required for operation and maintenance of the relocated facilities.

LOCATION OF PROJECT AND TRIBUTARY AREA

15. Location. The authorized project as described in paragraph 1 and shown on Plate 1 is located in the southeastern portion of the State of Louisiana, east of the Mississippi River and extends southeasterly from the City of New Orleans to the Gulf of Mexico, a distance of approximately 75.0 miles. The proposed ship channel commences at the Inner Harbor Navigation Canal in New Orleans, follows the Gulf Intracoastal Waterway for approximately 5 miles to a point 1/2 mile east of State Highway 47, thence via land and water cuts on long tangents and easy curves, it extends 70.0 miles in a southeasterly direction along the south shore of Lake Borgne and through the marshes to and across Chandeleur Sound in the vicinity of Breton Island to deep water (-38' contour) in the Gulf of Mexico.

16. Tributary Area. The immediate area traversed by the project is comprised of swampland, shallow lakes and bays, and Chandeleur Sound, extending from the suburbs of the City of New Orleans to the Gulf of Mexico. New Orleans, with a metropolitan population of 685,405 (1950 Census) because of its location near the mouth of the Mississippi River, is the natural gateway to the entire Mississippi Valley. The Port of New Orleans as well as the rapidly expanding developments along the Mississippi River between the Head of Passes and Baton Rouge serves as a transhipment terminal for shallow draft commerce utilizing the vast network of inland waterways formed by the river, its tributaries, and connecting streams including the Gulf Intracoastal Waterway. Inland water-

borne commerce may originate in or be destined for any of the States between the Appalachian and RockyMountains. Ocean commerce is carried by ships which call at all major United States and World ports.

The industries in the vicinity are closely allied with shipping and have been developed to utilize raw and semi-finished products attracted by the harbor and transportation facilities. It is an important petroleum center, being in the area of rapidly developing oil and gas activity. Numerous important oil refineries are expanding to meet increasing demands. Aluminum, synthetic rubber and chemical plants have shown similar growth patterns. Sulphur is producted in large quantities and several sugar refineries are located in the vicinity.

PROJECT PLAN

17. Project Works. The project, as shown on Plate 1, consists of a tidewater ship channel 36 feet deep and 500 feet wide extending from the City of New Orleans to the Gulf of Mexico, a total distance of about 75 miles. The outer five miles gradually increases in dimensions to 600 feet in width and 38 feet in depth. Retention dikes extending from the shoreline to the -6 ft. depth contour on both sides of the channel are included. A dike on the north side of the channel from the -6 ft. contour to the -20 ft. contour is included in the project, but its construction will be deferred until justified by actual channel maintenance experience. A turning basin 1000 ft. wide and 2000 ft. long is to be located in the vicinity of Bayou Dupre, about 7 miles from the Gulf Intracoastal Waterway. A semi-high level 4-lane highway bridge will be constructed to carry the vehicular traffic of Highway 47 (Paris Road) over the ship channel. The project authorization also includes an additional lock and connecting channel with the Mississippi River in the vicinity of Meraux, La., when justified by additional traffic or obsolence of the existing Inner Harbor Navigation Lock. This feature is not covered in this Design Memorandum.

DEPARTURES FROM PROJECT DOCUMENT PLAN

18. Changes in Alignment. The proposed channel alignment as shown on Plates 1 and 2 follows the project document alignment from its New Orleans terminus, to its junction with Bayou La Loutre. At this point the proposed channel alignment deviates slightly from the document alignment to the southwest so as to enter the Gulf of Mexico north of Breton Island and south of Grand Gosier Island. This minor deviation from the document alignment resulted from extensive studies that showed an economic advantage for this route over all others considered.

HYDROLOGY

19. General. The proposed improvement is a tidewater channel whose water surface elevation will vary with the tides and other variation of the Gulf of Mexico. The upper terminus of the channel is

at the Inner Harbor Navigation Canal, also a tidewater channel, which canal connects to the Gulf of Mexico through the existing Gulf Intracoastal Waterway and also via Lake Pontchartrain and Lake Borgne. The proposed channel traverses approximately 32.6 miles of open water in the Gulf of Mexico and Chandeleur Sound and 43 miles of marsh and swampland between Chandeleur Sound and the City of New Orleans. A relatively small area of land lying on the north side of the existing Gulf Intracoastal Waterway and within the limits of the City of New Orleans is leveed and drained. Disposal of initial dredge spoil is planned in general accordance with the desires of local interests and Fish and Wildlife agencies to preserve existing drainage patterns to the extent practicable.

20. Tides. Normal tides in the gulf range from 1 to 2 feet. Wind and storm tides reach levels of 6 to 8 feet above sea level, and infrequent hurricane surges produce heights of 12 feet or more along the coast line.

a. Inner Harbor Navigation Canal. Gage records are available on the Inner Harbor Navigation Canal since it was excavated in 1922. These records provide a good indication of the water elevations that may be expected in the proposed channel. Hydrographs showing the annual highwater and annual low water for the Inner Harbor Navigation Canal are shown on Plate 4. An all-time high of 7.2 ft. m.l.g. at this gage occurred during the passing of Hurricane "Flossy" in 1956. The low for the period of record was -0.7 ft. m.l.g. during 1939.

b. Vicinity Highway No. 47 (Paris Road). For the 10-year period, 1948 to 1958, tide gage records on the Gulf Intracoastal Waterway at a location in the vicinity of Highway 47 (Paris Road) are available and the annual high water and low water stages appear in the hydrograph shown on Plate 4. The highest stage, 8.35 m.l.g. was recorded in 1956 during the passing of Hurricane "Flossy" and the lowest stage, -0.5 m.l.g., was recorded in 1954.

c. Bayou Ysccloskey. From 1948 to 1958 records are also available from a gage located in Bayou Ysccloskey at Shell Beach, La. The annual high water and low water stages are presented in the hydrograph on Plate 4. The highest stage, 11.32 m.l.g., occurred in 1956 during the passing of Hurricane "Flossy" and low stage, -0.84 m.l.g., was also recorded in 1956.

d. North Pass and Breton Island. Also shown on Plate 4 is the tidal variation at North Pass from 1942 to 1953 and at Breton Island for 1956 and 1957. This hydrograph shows, in addition, the high and low stage recordings which occurred during the 1957-1958 period in the Breton Sound area.

The locations of the above gages are shown on Plate 1.

21. Currents. A network of hydrologic data collection stations was established in January 1957 and operated through December 1958

to supplement existing meager hydrological data. These are shown on Plate 5. Continuous recording meters were set at Towers A, B and C in Chandeleur Sound and weekly measurements were taken by boat at 7 stations in the Sound. Records from these observations show that currents are small (less than one half foot per second) most of the time and exceed this velocity only 10-15 percent of the time. Current directions range throughout 360 degrees, but are in a southerly direction about 60 percent of the time.

22. Water Sampling. Water sampling was initiated at some 30 odd stations in the Sound and scattered through the affected marsh area. These were analyzed for salt content, and after September 1957 five of the stations were also analyzed for silt content. The water samples were taken at mid-depth after it had been established by measurements that there was no pronounced change of salinity with depth. Salinity inside Chandeleur Sound varies from 10,000-15,000 p.p.m. of chlorine. There is a steep salinity gradient from the edge of the marsh to Yscloskey, the latter station being 30 to 50 percent of the former. Variations of salinity in the marsh are pronounced. Suspended sediment concentrations generally are between 50 and 150 p.p.m., occasionally being as much as 500 p.p.m. in the Sound due to storm disturbances. Beginning in May 1957 water temperature was taken in conjunction with the suspended sediment sampling. The indicated temperature range is 40 to 90 degrees F.

23. Waves. A wave gage is operated at Battledore Reef in Breton Sound. Maximum waves are normally 1 to 2 feet, infrequently 3 to 5 feet, and waves of greater height are estimated to occur under severe storm and hurricane conditions.

GEOLOGY

24. General Geology of the Area. The Mississippi River-Gulf Outlet traverses an area completely within a former deltaic complex of the Mississippi River abandoned an estimated 1,000 years ago. This deltaic complex consists of Recent marine deposits which were accumulated as sea level rose during the waning of the late Wisconsin Glacial Stage and since sea level reached its present stand. Distribution of surficial depositional types in the area are shown on Plate 6. The proposed project cuts through the lowlands between Lake Borgne and the natural levee ridge of the Mississippi River, extends across an ancient Mississippi River course, and its distributary courses, and continues through the bay bottom deposits of Chandeleur Sound. The top of the Pleistocene varies from about 60 feet below ground surface at the upper end of the project to about 200 feet below sea level at Chandeleur Islands. The Recent deposits in the lowlands are predominantly clay with a highly organic layer about 10 feet thick at the surface and silty and sandy soils at the base. Where minor distributaries of the ancient Mississippi River course are crossed, the Recent deposits are predominantly silty and sandy, but organic layers at the surface are also present. The deposits in Chandeleur Sound are predominantly fat clay (see Plate 7 for generalized geologic section).

A more detailed geology treatise on the area appears in Miscellaneous Paper No. 3-259, dated February 1958, "Geological Investigation of the Mississippi River-Gulf Outlet Channel," prepared by the U. S. Army Engineers Waterways Experiment Station.

SOILS

25. General. Design Memoranda 1-A approved 11 September 1957 and 1-B approved 27 January 1959 cover the detail soil report for the portion of the Mississippi River-Gulf Outlet Channel Project from the Inner Harbor Navigation Canal to Bayou La Loutre. The preliminary soil report for the extension of this project below Bayou La Loutre across Chandeleur Sound is presented in the following paragraphs.

26. Field Exploration. Exploratory general type soil borings extending to depths of 50 to 150 feet were made in Chandeleur Sound at locations shown on Plate 8 - "Reconnaissance Soil Borings in Chandeleur Sound - Location Map."

27. Laboratory Tests. Visual classification and water content determinations were made on all soil samples obtained from these general type borings. Logs of these borings are shown on Plates 9 through 13 - Logs of Borings.

28. Soil Conditions. The exploratory borings indicate that the subsurface seaward from Bayou La Loutre consist predominantly of very soft organic fat clay. From Bayou La Loutre to Chandeleur Sound, there is generally a surface layer of peat and matted vegetation about 10 feet thick overlying this fat clay. In areas where the Channel crosses ancient distributaries of the Mississippi River, there are old Channel fillings consisting of interspersed layers and lenses of silt, sand, and clay.

29. Selection of Route below Bayou La Loutre. Based on subsurface conditions, there is no appreciable difference in any possible route across Chandeleur Sound below Bayou La Loutre.

30. Stability Analysis. The stability analysis shown in Design Memoranda 1-A and 1-B, previously mentioned, is applicable where land and marsh areas are at or above water surface. In Chandeleur Sound and other areas where the marsh is not near or above the water surface, the spoil will be placed a minimum of 2,000 feet away from the channel to minimize the possibility of this spoil being washed back into the Channel.

OTHER PLANS INVESTIGATED

31. Alignment Deviations. Subsequent to project authorization four deviations from the alignment prescribed in House Document No. 245 were investigated in some detail. These alignments are identified as Routes B, D, E-6, and Alternate E-6 on Plate 2. All of the routes begin at a common point in the vicinity of Bayou La Loutre and

extend across Chandeleur Sound. Channel profiles from Bayou La Loutre to the -38 ft. contour for routes B, D and E-6 are shown on Plate 3. These investigations were conducted pursuant to the views expressed by the Board of Engineers for Rivers and Harbors in House Document No. 245...."that the exact location of the outlet to the Gulf and the alignment of the seaway should be determined after more complete studies of sand movement, wave action, and local currents are made in cooperation with the Beach Erosion Board..."

32. Beach Erosion Board Studies. At the inception of the design memorandum studies, the views of the Beach Erosion Board were requested pursuant to the provisions in House Document 245. The Board agreed to participate in the studies to determine the best route across Chandeleur Sound, to determine the design of dikes to protect the channel if required, and to determine the possible effects of hurricane wind waves propagated up the Channel toward New Orleans. The Board submitted on 11 March 1957 a letter report covering its preliminary analysis of available data on geomorphology, sedimentation, shore line and offshore depth changes, and waves. At this time the Board stated that characteristics of subsurface material throughout Chandeleur Sound were substantially the same, that changes in bottom hydrography and conditions throughout the Chandeleur Sound have been minor over the period of record, and that intensity of wave action is not significantly different in any part of Chandeleur Sound. The Board concluded that any alignment would be subject to about the same degree of prospective shoaling. The Board was also of the opinion that any route that cut across the Chandeleur Island chain would require jetties and recommended that routes north and south of the island chain be considered due to the expensive jetty cost in crossing the island chain. The Board further reported that hurricane waves developed in Chandeleur Sound could be transmitted up the channel to New Orleans, but that these waves would be reduced in transit by friction and refraction so as to be of minor significance at New Orleans.

Upon the recommendations of the Board, five test pits were excavated, 3 in Chandeleur Sound and 2 in the Gulf of Mexico, to determine shoaling rates and behavior of the spoil. The location and details of the pits are shown on Plate 14. Comparative cross sections of the pits taken over a period of approximately 1 year are shown on Plate 15. The character of the material and behavior of the spoil deposited from the excavation of the pits in Chandeleur Sound are shown on Plate 16.

The Board, upon conclusion of the test pit program, presented its findings in a report dated 29 April 1959, attached as Appendix 1, which recommended as follows:

a. Route E-6 is first and Route B is second in order of preference of the three routes considered.

b. Consideration should be given to minor realignment of Route E-6 to avoid open water areas.

c. Retention dikes should be initially provided landward of approximately 6 feet depth in Chandeleur Sound.

d. Dredge spoil should be deposited north of the channel in Chandeleur Sound at the maximum distance practicable without increase in cost by loss of dredge production (probably about 4,000 feet).

e. Consideration should be given to utilizing an "overboard disposal" dredge of the "Sealanes" type for channel maintenance in Chandeleur Sound.

33. Fish and Wildlife Studies and Recommendations. When planning on the project was initiated, representatives of the State and Federal Fish and Wildlife Agencies and other local groups expressed concern over the potential damage to fish and wildlife resources. Funds were made available from the project to U. S. Fish and Wildlife Service for initiation of a comprehensive study of the project and the surrounding areas. This study is under way but completion is not anticipated for several years. In the meanwhile the advice and assistance of the Service is utilized to the extent practicable in the development of detail plans, particularly with regard to disposal of spoil and marsh drainage, and in documenting existing ecological conditions. By teletype dated 5 June 1959 the U. S. Fish and Wildlife Service stated...."Studies to date indicate Route D would be significantly less detrimental to fish resources within marsh area than Routes B or E-6 provided....(1) spoil is placed on north side of alignment from Bayou La Loutre to Chandeleur Sound and (2) reasonable features to reduce silting effect and maintain present water circulation patterns are included in your contract specifications....". In November 1957 the Louisiana Wildlife and Fisheries Commission expressed a preference for Route D, which was reiterated by letter dated 2 March 1959.

The views of the Fish and Wildlife agencies as well as the report by Dr. Gordon Gunter, a consultant biologist engaged by this office to prepare a report on the possible biological effects of the various proposed routes, are presented in Appendix III, "Views of Fish and Wildlife Agencies."

34. Route Preference of Local Interests. Since local cooperation is required by the project, the Board of Commissioners of the Port of New Orleans, the assuring agency, was requested to determine a preference for one of the routes. The replies to the Board were unanimous in favor of Route "D". The views of local interests are reproduced in Appendix II.

35. Federal Project Cost Studies. In order to evaluate the merits of Routes B, D, E-6 and Alternate E-6, a detail cost estimate for each route was prepared. A summary of the Federal cost for the various routes are given in Table 1. The shoaling rates for maintenance purposes are shown, using both the Beach Erosion Board's estimated

rates and the rates considered by this District to be applicable, based upon experience in maintaining other projects in this District and information received from other Districts which have comparable channels along the Gulf of Mexico. This table indicates that the first cost of Route B is the least of the routes considered with Routes E-6, Alternate E-6 and D, following in order. The annual Federal cost of Route E-6 is the least with routes Alternate E-6, B and D, following in order. The table also indicates the cost of the various routes with a deferred retention dike (-6 ft. to -20 ft. contours in Chandeleur Sound) included as a project feature. Similar to the above, the cost of Route B is the least with Routes E-6, Alternate E-6 and D following in order. The deferred retention dike is included as an item in order that it may be constructed at a future date if, from actual maintenance experience, it is demonstrated that the channel cannot be maintained by dredging alone or that it is more economical to construct the dikes.

36. Non-Federal Project Cost Studies. A non-Federal cost comparison for the various routes is given in Table 2. This table reveals that there is no significant difference in the cost of the various routes; however, the cost of Route B is least and Routes D, E-6 and Alternate E-6 follow in order.

37. Navigation Cost Studies. As indicated on Plate 17, the distances to the two focal points of the foreign shipping lanes (Dry Tortugas and Cape San Antonio) differ with the various routes selected. This difference in distances results in different travel time between the focal points and the City of New Orleans. A comparison of the costs of ship operation over the various routes shows that Route B will effect an annual saving of $162,750 over Route D, $1,169,010 over Route E-6 and $1,313,005 over Alternate Route E-6. Details are given in Appendix VI.

38. Comparative Federal Costs. Table 3 shows the overall economic comparision of the various routes on an annual basis. Route B is indicated to be the lowest in total annual cost by more than $400,000 over the next lower alignment, Route D. The non-Federal charges shown in Table 2 make no significant change in the indicated differences in favor of Route B.

39. Project Route Selection. On the basis of these cost data Routes E-6 and Alternate E-6 may be discarded from further consideration. Route B is clearly indicated to be the most economical overall on the basis of tangible costs alone. Route B has the disadvantage however of being near Main Pass of the Mississippi River as shown on Plate 18. The shore line has built out to the east approximately 12.1 miles in the last 96 years. Encroachment of the Pass may become a factor adversely affecting the maintenance of the project toward the end of its 50 year economic life. This effect cannot be evaluated at this time. The unanimous preference for Route D of all of the local interests including the assuring agency and the Fish and Wildlife agencies, both Federal and State, constitutes a further serious disadvantage to Route B. On the other hand Route D which is favored

by all local interests is the more costly primarily as a result of the indicated requirement for jetties. There is a possibility, somewhat remote, that a channel through the Chandeleur chain if excavated sufficiently large initially and with placement of spoil therefrom in a manner to induce maximum tidal flow, that the channel could be maintained and in fact might enlarge, without jetties. In this connection it is proposed that the channel through the Island be excavated initially without the jetties and observed for a period of time in order to explore this possibility. The probability of success of this plan is such as to preclude elimination of the jetties from this Route. Route B is therefore selected for adoption.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

40. Channel. The detail location of the proposed channel is shown on Plate 2, and follows Route "B" below Bayou La Loutre. The proposed channel alignment follows the project document alignment utilizing the existing Intracoastal Waterway from the Inner Harbor Navigation Canal to a point approximately 1/2 mile east of Highway 47 (Paris Road) where it leaves the Intracoastal Waterway via a 1 degree curve and continues in a southeasterly direction skirting the southwestern shore of Lake Borgne to Bayou La Loutre, thence deviating slightly from the document location it continues in a southeasterly direction across the marshlands and bays to and across Chandeleur Sound to the -38 ft. contour in the Gulf of Mexico, crossing the Chandeleur Island chain to the north of Breton Island. The channel is 75.6 miles in length and as authorized will have a bottom width of 500 ft. at a depth of 36 ft. below mean low water. The excavation will initially be carried to 38 ft. below mean low water so as to provide a measure of advance maintenance. In addition, the Contractor will be allowed a maximum of 2 ft. overdepth in order to provide for the inaccuracies in dredging. Typical sections of the channel and spoil disposal are indicated on Plate 19. The channel as proposed will have gentle curves (1°7' max.) and long tangents as an aid to navigation. The tangents approaching a bridge will have a minimum distance of 2,000 feet. The spoil will be placed on the south and west sides with gaps left at all the important bayou and stream crossings so as to maintain existing small craft navigation and existing natural drainage to the maximum extent practicable.

41. Eased Entrance. At the Gulf, as shown on Plates 1 and 19, the channel will be enlarged to facilitate the entrance of ships. The channel width will be gradually increased over a five mile reach from 500 ft. to 600 ft. at the -38 ft. contour in the Gulf of Mexico. In this reach the depth of the channel will also be gradually increased from 36 ft. to 38 ft. at the entrance or the -38 ft. contour in the Gulf.

42. Retention Dikes. In order to protect the channel in the shallow open waters of Chandeleur Sound retention dikes will be constructed on both sides of the channel from the shoreline to the -6 ft. contour in Chandeleur Sound. The dikes will be constructed of a

TABLE 1

SUMMARY OF FEDERAL COST ESTIMATES
ROUTES B, D, E-6, & ALTERNATE E-6

Item	Route B Total Length 75.6 mi. Quantity	Route B Cost	Route D Total Length 77.0 mi. Quantity	Route D Cost	Route E-6 Total Length 74.2 mi. Quantity	Route E-6 Cost	Route E-6 (Alt.) Total Length 76.4 mi. Quantity	Route E-6 (Alt.) Cost
1. Channel Excavation (Complete)	19,819,000 cu. yd.	$3,541,600	19,819,000 cu. yd.	$3,541,600	19,819,000 cu. yd.	$3,541,600	19,819,000 cu. yd.	$3,541,600
2. Channel Excavation (land cut)	179,040,000 cu. yd.	39,054,200	215,830,000 cu. yd.	47,079,300	231,834,000 cu. yd.	50,570,200	242,632,000 cu. yd.	52,925,600
3. Channel Excavation (open water)	89,615,000 cu. yd.	21,719,800	81,980,000 cu. yd.	19,869,300	59,084,000 cu. yd.	14,320,100	59,084,000 cu. yd.	14,320,100
4. Turning Basin	1,830,000 cu. yd.	388,100	1,830,000 cu. yd.	388,100	1,830,000 cu. yd.	388,100	1,830,000 cu. yd.	388,100
5. Retention Dikes	4.9 mi. (ea. side)	9,241,500	2.79 mi. (ea. side)	5,549,000	4.17 mi. (ea. side)	8,070,900	4.17 mi. (ea. side)	8,070,900
6. Jetties	None	-	1.25 mi. (ea. side)	9,023,400	None	-	None	-
7. Bridge Hwy. No. 47 (Paris Road)	1	7,392,200	1	7,392,200	1	7,392,200	1	7,392,200
8. Sub-Total (First Cost)		81,337,400		92,842,900		84,283,100		86,638,500
9. Interest during const. (1/2 of 5 yrs @ 2-1/2%)		5,083,600		5,802,700		5,267,700		5,414,900
10. Investment		86,421,000		98,645,600		89,550,800		92,053,400
11. Int. on Inv. (2-1/2%)		2,160,500		2,466,100		2,238,800		2,301,300
12. Amort. (50 yrs. at 2-1/2%)		886,700		1,012,100		918,800		944,500
13. Channel Maint. (land cut or adj. to dike)	48 mi.	581,680	51.2 mi.	620,460	58.3 mi.	706,500	60.5 mi.	733,160
14. Channel Maint. (open water)	27.6 mi.	852,890 (927,060)*	25.8 mi.	950,470 (754,980)*	15.9 mi.	317,930 (433,230)*	15.9 mi.	317,930 (433,230)*
15. Retention Dike Maint.	9.8 mi.	118,760	5.58 mi.	67,620	8.34 mi.	101,070	8.34 mi..	101,070
16. Jetty Maintenance	None	-	2.5 mi.	60,590	None	-	None	-
17. Annual Costs		$4,600,500		$5,177,300		$4,283,100		$4,398,000
Annual Costs *		(4,674,700)*		(4,981,900)*		(4,398,400)*		(4,513,300)*

* Using NOD maintenance estimate for open water

TABLE (Cont'd)

Item	Route B Total Length 75.6 mi. Quantity	Route B Cost	Route D Total Length 77.0 mi. Quantity	Route D Cost	Route E-6 Total Length 74.2 mi. Quantity	Route E-6 Cost	Route E-6 (Alt.) Total Length 76.4 mi. Quantity	Route E-6 (Alt.) Cost
COST OF DEFERRED RETENTION DIKE								
18. Single Deferred Retention Dike	17.2 mi.	$22,629,600	18.0 mi.	$21,373,200	11.17 mi.	$23,764,200	11.17 mi.	$23,764,200
19. Int. during const. (1/2 of 5 yrs. at 2-1/2%)		1,414,400		1,335,800		1,485,300		1,485,300
20. Investment		24,044,000		22,709,000		25,249,500		25,249,500
21. Int. on Invest. (2-1/2%)		601,100		567,700		631,200		631,200
22. Amort. (50 yrs. at 2-1/2%)		246,700		233,000		259,100		259,100
23. Maintenance		208,400		218,100		135,400		135,400
24. Annual Costs		1,056,200		1,018,800		1,025,700		1,025,700
PROJECT COST INCLUDING DEFERRED RETENTION DIKE								
25. First Cost (Line 8 + 18)		103,967,000*		114,216,100*		108,047,300*		110,402,700*

CRITERIA FOR ESTIMATES

Construction	
Excavation, Land Cut	$ .18 per c.y.
Excavation, Open Water	.20 per c.y.
Excavation, Turning Basin	.175 per c.y.
Shell for dike	2.00 per c.y.
Stone for dikes (1.75 tons per c.y. at $12.00 per ton)	21.00 per c.y.
Stone for Jetties	25.00 per c.y.
Pole Mattress under Jetties	40.00 per square
Contingencies	12%
Engineering & Design	1.2%
Supervision & Administration	7%

Annual Maintenance	
Channel, land cut or adjacent to dike	$10,000 per mi.
Retention Dike	10,000 per mi.
Jetty	20,000 per mi.
Channel, open water:	
BEB Rates	
Route B	25,500 per mi.
Route D	30,400 per mi.
Route E-6	16,500 per mi.
Route E-6 Alt.	16,500 per mi.
NOD Rates	
Route B	
Mile 0 to 3; Mile 6 to 27.6	25,000 per mi.
Mile 3 to 6	50,000 per mi.
Route D	
Mile 0 to 5.2; Mile 7 to 25.8	25,000 per mi.
Mile 5.2 to 7	15,000 per mi.
Route E-6 and E-6 Alt.	
Mile 0 to 8	20,000 per mi.
Mile 8 to 15.9	25,000 per mi.

* Does not include $33,000 preauthorization studies

TABLE 2
SUMMARY OF NON-FEDERAL COSTS
ROUTES B, D, E-6 & ALTERNATE E-6

	Item	Route B	Route D	Route E-6	Route E-6 (Alt.)
		FIRST COST			
1.	Lands & Damages	$2,798,500	$3,011,500	$3,234,500	$3,320,500
2.	Relocations				
	a. Roads	112,000	112,000	112,000	112,000
	b. Utilities	3,882,800	3,826,800	3,770,800	3,770,800
3.	Engineering & Design	106,700	105,000	103,300	103,300
4.	Supervision & Administration	250,000	246,100	242,200	242,200
	Total First Cost	7,150,000	7,301,400	7,462,800	7,548,800
		ANNUAL CHARGES			
5.	Int. on invest. @ 2-1/2%. (No int. during const. ∴ invest.= first cost)	178,800	182,500	186,600	188,700
6.	Amortization (50 yrs. @ 2-1/2%)	73,400	74,900	76,600	77,500
7.	Maintenance	62,000	62,000	62,000	62,000
	Total Annual Charges	314,200	319,400	325,200	328,200
8.	Annual additional cost over Route B	-	5,200	11,000	14,000

TABLE 3
MISSISSIPPI RIVER-GULF OUTLET
COST COMPARISON *

Route	First Cost	Shoaling Maintenance Rates by	Annual Charges	Additional Annual Cost due to Longer Route (Over Rte. B)	Comparative Annual Charges	Annual Additional Cost Over Route B
B	$ 81,337,400	BEB	$ 4,600,500	$ -	$ 4,600,500	$ -
	81,337,400	NOD	4,674,700	-	4,674,700	-
D	92,842,900	BEB	5,177,300	162,750	5,340,050	739,550
	92,842,900	NOD	4,981,900	162,750	5,144,650	469,950
E-6	84,283,100	BEB	4,283,100	1,169,010	5,452,110	851,610
	84,283,100	NOD	4,398,400	1,169,010	5,567,410	892,710
Alt.E-6	86,638,500	BEB	4,398,000	1,313,005	5,711,005	1,110,505
	86,638,500	NOD	4,513,300	1,313,005	5,826,305	1,151,605
With Deferred Dike Construction (Includes maintenance on dike and channel maintenance within dike same as land cut)						
B	103,967,000	BEB	5,395,100	-	5,395,100	-
	103,967,000	NOD	5,418,200	-	5,418,200	-
D	114,216,100	BEB	5,862,200	162,750	6,024,950	629,850
	114,216,100	NOD	5,673,500	162,750	5,836,250	418,050
E-6	108,047,300	BEB	5,154,900	1,169,010	6,323,910	928,810
	108,047,300	NOD	5,240,900	1,169,010	6,409,910	991,710
Alt.E-6	110,402,700	BEB	5,269,800	1,313,005	6,582,805	1,187,705
	110,402,700	NOD	5,355,800	1,313,005	6,668,805	1,250,605

* Exclusive of Non-Federal Construction Costs (Lands and Relocations)

shell core capped with rock with a crown width of 5 ft. at elevation 5.0 ft. m.l.g. and 1 on 1.5 side slopes as indicated on Plate 19.

43. Deferred Dike. Also provided as a feature of the project, as authorized, is a dike across Chandeleur Sound, extending from the -6 ft. contour (end of retention dikes) to the -20 ft. contour as shown on Plates 1 & 19. Construction of this dike will be deferred until experience indicates that maintenance by dredging alone is more costly, impracticable or unduly obstructive to navigation. A typical section of the proposed deferred dike is shown on Plate 19.

44. Turning Basin. A turning basin 1,000 ft. wide and 2,000 ft. long will be constructed at the junction of the Gulf Outlet Channel with the channel connecting the authorized lock in the vicinity of Meraux to the Gulf Outlet as shown on Plates 1 and 2. Since the authorized lock will not be built until economically justified, the turning basin construction will be delayed until the location of the connecting channel becomes firm. The basin will be used as a turnaround for vessels using the new harbor facilities as well as an entrance to the new lock connection to be built at a future date.

45. Highway Bridge. A semi-high level, 4-lane highway bridge is proposed for the crossing of State Highway No. 47 (Paris Road) across the channel at Mile 63.56 as shown on Plate 20. The bridge will have a horizontal clearance of 400 ft. and a vertical clearance of 156 ft. in the open position and 50 ft. in the closed position above mean high water. The type of crossing has been approved by State of Louisiana, Department of Highways, the Bureau of Public Roads, U. S. Department of Commerce and the Chief of Engineers. Further details are given in the Section on "Relocations" and in Appendix V "Study of Navigation Clearances."

46. Design Criteria. In order properly to provide for navigational and other requirements, and for future maintenance, the following design criteria have been used in the preparation of this design memorandum.

Datum Plane	mean low gulf (mlg)
Channel width (authorized)	500 feet
Channel depth (authorized)	36 ft. (below mlg)
Required additional depth for advanced maintenance	2 feet
Allowable overdepth (inaccuracies in dredging)	2 feet
Channel side slopes	1 on 2
Berm width	90 feet (minimum)
Degree of curvature	1° (maximum)
Tangent distance approaching a bridge	2,000 ft. (minimum)
Spoil disposal distance - land cut	
Initial Channel Construction (variable distance)	2,000 to 4,000 ft. from channel r/w
Maintenance excavation	Up to 2,000 ft. from channel r/w

Spoil disposal distance in Chandeleur Sound-------2000 to 4000 ft. from channel
Spoil disposal in Gulf----------In deep water by hopper dredge
Bridge Design----------AASHO-1957
Live Loading----------H20-S16-44 Modified
Roadways----------2-28 ft. roadways
Design Speed----------50 MPH, 350' SSD
Clearances----------400 ft. horizontal
156 ft. vertical (open)
50 ft. vertical (closed)

47. Channel Protection. Stability analyses of general type and undisturbed borings showed that the toe of the spoil should be not closer than 420 feet from the channel centerline and that the channel slopes should be cut not steeper than 1 on 2. The channel will be excavated generally with a berm of approximately 630 ft., thus providing an adequate factor of safety for surface widening due to erosion. Bank protection works to prevent this anticipated erosion is not recommended as a project feature, nor included in the costs.

48. Channel Overdepth. It is proposed to excavate the channel 2 feet below the authorized project depth for advance maintenance. An allowance overdepth up to a maximum of 2 feet will also be permitted in order to care for inaccuracies in dredging operations and tidal fluctuations.

49. Spoil disposal. Excavated material will be deposited in leveed disposal areas south and west of the channel. Below Bayou La Loutre the spoil disposal areas may be shifted to north and west of the channel if warranted by Fish and Wildlife studies now under way.

SOURCES OF CONSTRUCTION MATERIALS

50. Concrete Aggregate and Stone. Approved sources of sand and gravel for concrete are located in Baton Rouge, Alexandria, Turkey Creek, and Minden, all in Louisiana and within economical shipping distance of the project. The nearest known supply of acceptable stone for riprap is in southwestern Arkansas, Alabama and Kentucky.

51. Cement. Portland cement, conforming to Federal Specifications SS-C-192b may be obtained from plants in New Orleans and Baton Rouge, La., and Birmingham, Ala.

52. Steel. Fabricated steel will be obtained from local jobbers or mills in Alabama and Texas. Reinforcing steel is available in large quantities from warehouses in New Orleans.

53. Piling. Timber piling, both untreated and creosoted is available in New Orleans and many surrounding communities.

54. Shell. Necessary shell will be dredged from shell reefs in the vicinity of the project by local supplier.

55. Other Materials. Other materials for construction including machinery, machine parts, electrical equipment, castings, lumber and other building materials, are available from commercial establishments and suppliers in New Orleans.

COORDINATION WITH OTHER AGENCIES

56. Board of Commissioners of the Port of New Orleans. This Board was designated as the State agency to provide the assurances and local cooperation by an Act of Designation of the Governor of the State of Louisiana dated 10 December 1956. A copy of the Act of Designation and the letter of acceptance by the Board dated 17 December 1956 are included in Appendix II.

57. St. Bernard Parish. Since most of the landlocked portion of the channel traverses the Parish of St. Bernard, the St. Bernard Parish Police Jury and the St. Bernard Parish Council of the Chamber of Commerce of the New Orleans Area have maintained an active interest in project planning. Liaison is being maintained with these groups as the planning progresses.

58. State of Louisiana, Department of Highways. The project provides for construction of a suitable bridge for the Highway 47 crossing of the waterway and requires that local interests accept, maintain and operate the structure. By letter dated 18 March 1957, the Director, Department of Highways has agreed to accept, maintain and operate the structure as required.

59. State of Louisiana, Department of Public Works. The Governor of the State of Louisiana designated the Board of Commissioners of the Port of New Orleans as State assuring agency, and requested that the Board of Commissioners of the Port of New Orleans in coordinating the project with the Corps of Engineers, cooperate with Director of the Department of Public Works and his staff to insure that all interests were being given due consideration. The Director is being kept informed as the studies and planning on the project progress.

60.1. Bureau of Public Roads. The Bureau of Public Roads, U. S. Department of Commerce has been informed and has participated in conferences regarding type of crossings for Highway No. 47 (Paris Road). The Bureau of Public Roads concurs in the construction of the 4-lane semi-high level bridge as proposed in this design memorandum.

60.2. U. S. Public Health Service. The Public Health Service by letter dated 14 May 1957 was informed of several projects, including the Mississippi River-Gulf Outlet in which they might participate or express their views. No reply to this communication has been received. No problems involving the Health Service have been identified to date.

61. Fish and Wildlife Agencies. When it became known that initial planning funds for the Gulf Outlet would be made available in Fiscal Year 1957, the Federal and State Fish and Wildlife agencies were promptly notified by letter. Intense public interest in the project followed initial press releases showing the proposed alignment, and many objections to the alignment were registered with the Fish and Wildlife agencies. In a conference in August 1957, the U. S. Fish and Wildlife Service and the Louisiana Wildlife and Fisheries Commission were fully appraised of the status of planning. An initial sum of $5,000 was allocated to the Service for Fiscal Year 1958 and in April 1958 a preliminary report was submitted by the U. S. Fish and Wildlife Service. The report made certain general recommendations for mitigation of losses to fish and wildlife values and proposed an extensive regional study to fully document existing values over a wide area of the Gulf of Mexico. As a result of a number of conferences the scope of the studies was curtailed to permit completion within a reasonable period that would permit utilization of the study data and recommendation in the detail project planning. On this basis the additional amount of $64,400 was made available to the U. S. Fish and Wildlife Service for Fiscal Year 1959. By letter dated 5 January 1959, the U. S. Fish and Wildlife Service furnished an interim report on the reach between Highway 47 (Paris Road) and Bayou Dupre. The recommendations are listed in Design Memorandum No. 1-B previously submitted and were essentially complied with in the plan for construction. Studies are continuing and it is anticipated that additional recommendations for mitigating losses, if any, will be incorporated in future project plans. Both the Federal and State agencies have advocated Route "D" as the preferable crossing of the marsh land and Chandeleur Sound. Details of their views are given in Appendix III, "Views of Fish and Wildlife Agencies."

62. City Planning Commission of New Orleans. The City Planning Commission of New Orleans submitted a report in September of 1958 concerning the proposed channel crossing at Highway 47 (Paris Road). The report contained detailed vehicular traffic predictions extending to the year 1995. This report indicated that the Planning Commission was strongly in favor of a channel crossing that would provide uninterrupted vehicular movement along Paris Road.

63. Mineral Board, State of Louisiana. The Mineral Board of the State of Louisiana was informed of the status of project planning in a letter dated 10 October 1957 and was asked to comment on the proposed routes. To date no reply to this letter has been received.

REAL ESTATE REQUIREMENTS

64. General. Under the provisions of the authorizing Act, local interests are responsible for providing all lands, easements, and rights of way necessary for the project. Local interests have furnished satisfactory assurances that they will provide the necessary rights of way and other items of local cooperation as required. To date, rights of way from the Inner Harbor Navigation Canal to Bayou

Yscloskey have been furnished. It is anticipated the balance will be made available as soon as the alignment below Bayou La Loutre is firmed and formal request is made for the rights of way. The estimated cost to local interests for the required easements for the recommended project route (Route B) rights of way is $2,798,500, including acquisition costs and contingencies. Also included in the total cost estimate are allowances for damages and resettlement.

65. Requirements. Rights of way requirements for the channel and spoil areas as indicated on Plate 19 are as follows:

a. Channel Right of Way. Between the Inner Harbor Navigation Canal and Paris Road (Mile 63.15), the harbor development reach, the right of way will be 1250 ft. wide, 750 ft. on the south side and 500 ft. on the north side of the channel centerline. The 500 ft. distance was determined by the existence of a protection levee on the north bank, a desire to use the available channel of the Gulf Intracoastal Waterway, and other previous commitments. Between Paris Road (Mile 63.15) and Chandeleur Sound, the channel rights of way will be 1500 ft. wide, with the channel centered in the 1500 ft. strip.

b. Permanent Spoil Area. A permanent spoil area 2000 ft. wide will be provided on the south side adjacent to the channel right of way line. This strip is intended for initial channel excavation disposal as well as future maintenance disposal.

c. Temporary Spoil Area. A temporary spoil area will be provided for disposal of material during initial construction. It will be generally 2000 feet wide and adjacent to the permanent area on the south side where practicable. The easement will expire upon completion of project construction.

66. Rights of Way Costs. Tabulated below are the costs to local interests associated with channel rights of way procurement.

Project Route (Route B)	Acres	Amount
Right of way	7,575	$ 1,368,000
Permanent spoil	10,262	536,460
Temporary spoil	9,563	215,885
Sub-total		2,120,345
Damages		226,400
Acquisition costs		451,755
Total lands and damages		$ 2,798,500

RELOCATIONS

67. General. Provision for a suitable bridge for the project crossing of Louisiana State Highway No. 47 (formerly No. 61, and locally referred to as Paris Road), is the only relocation that is a

Federal obligation. Local interests will be responsible for the relocation or readjustment of one highway, four power, one telephone, and six pipeline crossings. The location of these facilities are indicated on Plate 20, Relocations.

68. Louisiana State Highway No. 47 Crossing.

a. General. Louisiana State Highway No. 47 is presently a two-lane, black top highway in Orleans and St. Bernard Parishes that crosses the Gulf Intracoastal Waterway at approximately Mile 63.7 as shown on Plate 20, Relocations. A four-lane bascule bridge, with 160' horizontal clearance was previously authorized for the Highway No. 61 (now No. 47) crossing of the Gulf Intracoastal Waterway, by Public Law 675, 77th Congress, approved 23 July 1942. When the Gulf Intracoastal Waterway was excavated during World War II, construction of the bridge was deferred due to restrictions on the use of critical materials. As a temporary measure, the Government provided a pontoon bridge. After World War II was concluded, due to unavailability of funds, and also the possibility of authorization of the Mississippi River-Gulf Outlet, a bridge was not constructed, and the pontoon bridge remained in operation.

b. Design Memorandum Studies. In order to determine the type of bridge or other crossing (tunnel) that would best fulfill the needs of both navigation and vehicular traffic, an extensive study of types of bridges, clearances, and tunnels was undertaken. The State of Louisiana, Department of Highways and the U. S. Bureau of Public Roads cooperated in the study in furnishing vehicular traffic counts, cost estimates, and their views as to a satisfactory crossing. The results of the study indicated that a 4-lane, semi-high level bride with a horizontal clearance of 400 feet and vertical clearances of 156 feet in the open position and 50 feet in the closed position would fulfill the requirements of a suitable bridge with approaches as authorized. The details of this study are given in Appendix V, Study of Navigation Clearances.

c. Views of Local Interests. The Board of Commissioners of the Port of New Orleans has advocated a tunnel or a permanent fixed bridge with a vertical clearance of 175 feet. The City Planning Commission of New Orleans and other interested associations have advocated a tunnel and are seeking Federal legislation for a tunnel. Local interests were informed that the liability of the Government toward the cost of a tunnel would be limited to the cost of the suitable bridge as defined above. To date no responsible group is willing to pay the additional cost.

d. Recommended Crossing. The District Engineer has recommended and the Chief of Engineers has approved the construction of a 4-lane, semi-high level lift bridge for the State Highway crossing as detailed on Plate 21, Louisiana State Highway No. 47 (Paris Road) Bridge and Approaches. Contract negotiations are nearing completion and it is anticipated that a contract for the construction of the bridge on a reimbursable basis will be executed within a few weeks.

e. Ownership and Maintenance. The Department of Highways of the State of Louisiana will assume responsibility for the design and construction of this bridge and approaches on a cost reimbursable basis and has agreed to accept ownership and to maintain the bridge and approaches after construction has been completed.

69. New Orleans Public Service, Inc. Facilities.

a. 110 KV Aerial Power Line. A 2-circuit, 8 wire, 110,000 volt, 3 phase, electrical aerial transmission line, owned by the New Orleans Public Service, Inc., crosses the existing Gulf Intracoastal Waterway and the project channel near the Inner Harbor Navigation Canal at approximately Mile 68.5, as shown on Plate 20. The former span of 1,248 feet and minimum vertical clearance of 135 feet m.l.g. have been altered by the Owner to provide a span of 2,200 feet with vertical clearance of 170 feet m.l.g. across the newly excavated channel.

b. 115 KV Aerial Power Line. A single circuit, 3 wire, 115,000 volt, 3 phase electrical aerial transmission line, owned by the New Orleans Public Service, Inc., crosses the existing Gulf Intracoastal Waterway and the project channel at approximately mile 63.7 near State Highway No. 47 as shown on Plate 20. The present minimum horizontal clearance of 125 feet will be increased to 1,250 feet, and the present vertical clearance of 150 feet will be increased to 170 feet m.l.g. by Owner.

c. 13.2 KV Submarine Power Line. A single circuit, 3 wire, 13,200 volt, 3 phase electrical submarine power line, owned by the New Orleans Public Service, Inc., crosses the Gulf Intracoastal Waterway and the project channel at approximately mile 63.7 near State Highway No. 47 as shown on Plate 20. This line will be altered by Owner when required by channel construction to provide the necessary clearances.

d. 24-inch Gas Pipeline. A 24-inch gas pipeline crosses the existing Gulf Intracoastal Waterway and project channel 200 feet east of the centerline of Highway No. 47 at approximately Mile 63.6. This gas pipeline owned by the New Orleans Public Service, Inc., is shown on Plate 20. The pipeline will be altered to provide a bottom width of 600 feet at El. -50 m.l.g. by the Owner.

70. Southern Natural Gas Company Gas Pipelines. A 20-inch and a 24-inch gas pipeline owned by the Southern Natural Gas Company cross the proposed project channel at Mile 58.5 (vicinity Bayou Dupre), as shown on Plate 20. These gas pipelines will be altered to provide a bottom width of 750 feet at El. -50 m.l.g. A 6-inch pipeline owned by the Southern Natural Gas Company crosses the proposed project channel between Lake Athanasia and Chandeleur Sound as shown on Plate 20. This pipeline will be altered to provide a bottom width of 750 feet at El. -50 m.l.g.

71. Tennessee Gas Transmission Company 30-inch Gas Pipeline. A 30-inch gas pipeline owned by the Tennessee Gas Transmission Company crosses the proposed project channel at approximately Mile 51 in the vicinity of Shell Beach, as shown on Plate 20. This pipeline has been installed at El. -50 m.l.g. across a bottom width of 750 feet to clear the project channel.

72. Louisiana State Highway No. 46. State Highway No. 46 will be severed by the proposed channel as shown on Plate 20, at approximately Mile 44.5. Highway No. 46 is a 2-lane black top highway terminating at the nearby settlement of Shell Beach on Lake Borgne. No firm plans have been made at this date for any type of facility at this crossing. However, local interests are giving consideration to payment of severance damages to the landowners affected, or provision of a ferry at this crossing. The cost of providing a ferry is included as a part of local interest costs in this design memorandum.

73. Louisiana Power and Light Company 13.8 KV Aerial Power Line. A 4-wire, 3 phase, 13,800 volt electrical aerial power line, paralleling State Highway No. 46 near Shell Beach, owned by the Louisiana Power and Light Company crosses the proposed project channel as shown on Plate 20, at Mile 44.4. This line will be altered by Owner when required by channel construction to provide the necessary clearances.

74. Southern Bell Telephone and Telegraph Company Telephone Line. A 4-wire pole line paralleling Highway No. 46 near Shell Beach owned by the Southern Bell Telephone and Telegraph Company crosses the project channel as shown on Plate 20, at mile 44.4. This line will be altered by the Owner to provide the necessary clearances.

75. Kerr-McGee Oil Industries, Inc., 4-inch Pipelines. Two 4-inch pipelines owned by the Kerr-McGee Oil Industries, Inc., cross the proposed project channel near Breton Island in Chandeleur Sound as shown on Plate 20. These pipelines will be altered by the Owner to provide the necessary channel clearances.

76. Cost of Relocations. Relocations involved in the construction of the project are estimated to cost $11,743,700 of which $7,392,200 is Federal, and $4,351,500 is local. Costs of the various features are itemized as follows:

Feature	
Louisiana State Highway No. 47 bridge - Estimated Federal Cost	$6,100,000.00
Contingencies 12%	732,000.00
Subtotal	$6,832,000.00
Engineering & Design 1.2%	82,000.00
Supervision & Administration 7%	478,200.00
Total (Federal Cost)	$7,392,200.00

Feature	
New Orleans Public Service 110 KV Aerial Power Line	450,000.00 *
New Orleans Public Service, Inc., 115 KV Aerial Power Line	650,000.00
New Orleans Public Service, Inc., 13.2 KV Submarine Power Line	Included in above figure
New Orleans Public Service, Inc. 24-inch Gas Pipeline	500,000.00
Southern Natural Gas Company 20-inch and 24-inch Gas Pipelines	1,065,000.00
Tennessee Gas Transmission Company 30-inch Gas Pipeline	400,000.00
Louisiana State Highway No. 46 (Ferry) - estimated cost	100,000.00
Louisiana Power and Light Company 13.8 KV Power Line	250,000.00
Southern Bell Tel. & Tel. Company Telephone Line	100,000.00
Southern Natural Gas Company 6-inch Gas Pipeline	50,000.00
Kerr-McGee Oil Industries, Inc. 4-inch Pipeline	50,000.00
	$3,615,000.00
Contingencies 12%	379,800.00
Subtotal	3,994,800.00
Engineering & Design 3% +	106,700.00
Supervision & Administration 7% +	250,000.00
Total (Non-Federal Cost)	$4,351,500.00

* Actual cost of work completed, no contingency or E & D allowance

COST ESTIMATES

77. General. The total estimated Federal cost of the Mississippi River-Gulf Outlet project is $104,000,000 based on June 1959 price level. The cost to local interests for lands and relocations is $7,150,000. A summary of first costs is shown in Table 4. Details of the Federal Cost estimate are given in Table 5.

78. Comparison of Estimated Cost with Latest Approved Estimate. A comparison of the latest approved project cost of $106,000,000 (PB-3 approved 22 April 1959, effective 1 July 1959) with the estimated project cost of $104,000,000 contained in this report (June 1959 price level), shows a reduction of $2,000,000 in total project cost. It will be noted that the PB-3 estimate was based upon Route "D" whereas the design memorandum estimate is based on Route "B". The Route "D" estimate included jetties and a single dike across Chandeleur Sound whereas the Route "B" estimate includes double retention dikes to the -6 ft. contour and a single deferred retention dike to the -20 ft. contour, and jetties are not included. Also the contingency items were reduced from 15% on the PB-3 estimate to 12% in the Design Memorandum estimate.

TABLE 4

SUMMARY OF FIRST COSTS
(June 1959 Price Levels)

	Federal First Cost	Non-Federal First Cost	Total First Cost
I. Lands and Damages	-	$2,798,500	$2,798,500
II. Relocations			
A. Roads			
1. Bridge, St. Hwy. No. 47	6,832,000	-	6,832,000
2. Ferry, La. St. Hwy. No. 46	-	112,000	112,000
B. Utilities	-	3,882,800	3,882,800
III. Channels and Canals			
A. Channel Excavation	59,438,400	-	59,438,400
B. Turning Basin	358,700	-	358,700
IV. Breakwaters and Seawalls			
A. Retention Dikes	8,541,100	-	8,541,100
B. Deferred Retention Dike	20,914,700	-	20,914,700
V. Preauthorization Studies	33,000	-	33,000
VI. Engineering and Design	1,156,400	106,700	1,263,100
VII. Supervision and Administration	6,725,700	250,000	6,975,700
Totals	$ 104,000,000	$ 7,150,000	$111,150,000

TABLE 5
DETAILED ESTIMATE OF FEDERAL FIRST COST
(JUNE 1959 PRICE LEVEL)

ITEM	UNIT	QUANT.	UNIT COST	ITEM COST	TOTAL COST
I RELOCATIONS - ROADS					
Bridge, La. Hwy. No. 47	-	-	-	$6,100,000	
Contingencies (12%)				732,000	
TOTAL ITEM I				6,832,000	$6,832,000
II CHANNELS AND CANALS					
A. Channel, Sta. 0+00 to Sta. 268+00, 5.08 miles (complete)	C.Y.	19,819,000	$.165	3,270,100	
B. Channel, land cut, Sta. 268+00 to Sta. 301+00 = Sta. 0+00; Sta. 0+00 to Sta. 1971+40, 38.0 miles	C.Y.	179,040,000	.18	32,227,200	
C. Channel, water cut, Sta. 1971+40 to Sta. 3687+40, 32.5 miles	C.Y.	89,615,000	.20	17,923,000	
D. Turning Basin	C.Y.	1,830,000	.175	320,300	
SUB-TOTAL				53,740,600	
Contingencies (12% items B, C, & D; none on item A)				6,056,500	
TOTAL ITEM II				59,797,100	59,797,100
III BREAKWATERS AND SEAWALLS					
A. Dike on each side to El. -6.0 m.l.g., 4.9 miles x 2 = 9.8 miles					
1. Shell	C.Y.	348,000	2.00	696,000	
2. Stone (1.75 tons per cu. yd. @ $12.00)	C.Y.	330,000	21.00	6,930,000	
SUB-TOTAL				7,626,000	
B. Single deferred dike El. -6.0 to El. -20.0 m.l.g., 17.2 miles					
1. Shell	C.Y.	1,346,000	2.00	2,692,000	
2. Stone (1.75 tons per cu. yd. @ $12.00)	C.Y.	758,000	21.00	15,918,000	
Project Rounding				63,800	

TABLE 5 (Cont'd)

	ITEM	UNIT	QUANT.	UNIT COST	ITEM COST	TOTAL COST
	SUB-TOTAL				$18,673,800	
	SUB-TOTAL ITEM III				26,299,800	
	Contingencies (12%)				3,156,000	
	TOTAL ITEM III				29,455,800	29,455,800
IV	PREAUTHORIZATION STUDIES					33,000
V	ENGINEERING AND DESIGN (1.2%+)					1,156,400
VI	SUPERVISION AND ADMINISTRATION (7%+)					6,725,700
	TOTAL FEDERAL COST					$104,000,000

SCHEDULES FOR DESIGN AND CONSTRUCTION

79. Time of Construction. It is estimated that the project will require 10 years to construct. The project will be constructed in four phases. The first phase comprises the construction of the channel to full dimension in the future harbor area (Inner Harbor Navigation Canal to Highway 47 (Paris Road)) which was completed in May 1959. The second phase will be the construction of an access channel (18' x 140') from Highway 47 to Chandeleur Sound; this phase is scheduled for completion in 1960. The third phase will be the construction of an interim channel, 36' x 250' from Highway 47 to the Gulf which will be completed in December 1963. Upon completion of the interim channel the project will be usable by ocean going ships. The project channel, 36' x 500', and all features of the project except the deferred retention dike will be completed by 30 June 1967 as phase four. The deferred dike will not be constructed until justified by actual maintenance experience developed by operation of the project.

80. Schedule of Design. Design Memoranda covering the planning and design of the project are scheduled as follows:

Design Memo Number	Title	Status
1-A	CHANNELS, Mile 63.77-Mile 68.85	Approved 11 Sept 1957
1-B	CHANNELS, Mile 39.01-Mile 63.77	Approved 27 Jan 1959
1-C	CHANNELS, Gulf Entrance-Mile 39.01	*15 Nov 1959
2	General Design	*30 June 1959
3	Retention Dikes	*31 July 1960

* Scheduled submission date.

The plans and specifications for the project work will generally precede the award date of the various contracts listed in the following paragraph by approximately 2-1/2 months.

81. Construction Schedule. It is proposed that the project works be undertaken by contract, except items 10U and 10R, with the construction contracts to be awarded and completed on the following schedule:

Contract No.	Description	Est. Date of Award	Est. Date of Completion
	RELOCATIONS		
	Bridge, La. State Hwy. No. 47 (Paris Road)	July 59*	June 63
	CHANNELS		
	COMPLETED PROJECT CHANNEL: (36'x500'):		
1	Inner Harbor Navigation Canal (Sta. 0+00 to Sta. 130+00)	March 58	Dec 58
2	Sta. 130+00 to Sta. 268+00 (Vicinity of Paris Road)	June 58	May 59

Contract No.	Description	Est. Date of Award	Est. date of Completion
	ACCESS CHANNEL (18' x140'):		
3A	Gulf Intracoastal Waterway to Bayou Dupre (Awarded 28 April 1959)	April 59	June 60
4A	Bayou Dupre to Bayou Yscloskey	July 59	August 60
5A	Bayou Yscloskey to Bayou La Loutre	Oct 59	April 60
6A	Bayou La Loutre to Bayou Pointe-en-Pointe	Feb 60	July 60
7A	Bayou Pointe-en-Pointe to Flotation Depth (6 ft.) in Chandeleur Sound	March 60	Oct 60
	INTERIM CHANNEL (36' x 250')		
3U	Paris Road to Bayou Dupre	July 60	Sept 61
4U	Bayou Dupre to Bayou Yscloskey	April 61	Jan 63
5U	Bayou Yscloskey to Bayou La Loutre	April 60	June 61
6U	Bayou La Loutre to Bayou Pointe-en-Pointe	Feb 61	Nov 62
7U	Bayou Pointe-en-Pointe to 6-foot contour in Chandeleur Sound	April 62	Dec 63
8U	6-foot Contour in Chandeleur Sound to 15-foot contour in Chandeleur Sound	April 61	March 63
9U	15-foot contour in Chandeleur Sound to 15-foot contour in Gulf of Mexico	Dec 61	Dec 63
10U	15-foot contour in Gulf of Mexico to 38-foot contour in Gulf of Mexico	Initiate Sept 63**	Dec 63
	PROJECT CHANNEL (36' x 500')		
3P	Paris Road to Bayou Dupre	May 63	Feb 65
4P	Bayou Dupre to Bayou Yscloskey	Oct 63	June 65
5P	Bayou Yscloskey to Bayou La Loutre	Feb 64	June 65
6P	Bayou La Loutre to Bayou Pointe-en-Pointe	Sept 64	June 66
7P	Bayou Pointe-en-Pointe to 6-foot contour in Chandeleur Sound	May 65	Jan 67
8P	6-foot contour in Chandeleur Sound to 15-foot contour in Chandeleur Sound	July 65	March 67
9P	15-foot contour in Chandeleur Sound to 15-foot contour in Gulf of Mexico	March 66	June 67
10P	15-foot contour in Gulf of Mexico to 38-foot contour in Gulf of Mexico	Initiate March 67**	June 67
1TB	TURNING BASIN	March 64	June 64
	DIKES		
1RD	Dike on each side to El. -6.0 m.l.g. in Chandeleur Sound	Nov 60	June 62
1DD	Single deferred dike from El. -6.0 m.l.g. to El. -20.0 m.l.g.	Indefinite	Indefinite

* Cost Reimbursable Contract with Dept. of Highways, State of Louisiana

** Work by Government hopper dredge

The dredging of the deep water section of the channel in the Gulf of Mexico, Items 10U and 10P, will be performed by Government owned hopper dredges.

To maintain the above schedule, the following funds by Fiscal Years will be required:

Estimated Cost through	F. Y. 1959	$ 4,723,900
Appropriation Required	F. Y. 1960	5,713,100
	F. Y. 1961	10,000,000
	F. Y. 1962	15,500,000
	F. Y. 1963	14,100,000
	F. Y. 1964	9,845,000
	F. Y. 1965	8,000,000
	F. Y. 1966	6,900,000
	F. Y. 1967	6,871,300
After	F. Y. 1967	22,346,700
	TOTAL	$104,000,000

OPERATION AND MAINTENANCE

82. Federal. Except as specified in the following paragraph, operation and maintenance of the project will be accomplished by the U. S. Army, Corps of Engineers, under the organization presented in Figure 1. Maintenance of the channel cut in land or shallow water reaches (depth of less than approximately 12 feet) will be accomplished by pipeline dredging equipment; a hopper dredge or an overboard-disposal type dredge will be utilized to maintain the channel in waters with depths greater than approximately 12 feet. Federal maintenance charges are estimated to be $1,627,500 annually based on the following maintenance estimates:

Channel, land cut or adj. to dike (48 mi.)	$581,680
Channel, open water 27.6 mi.	927,060*
Retention dikes (dike on each side to El. -6.0 m.l.g., 4.9 mi. x 2 = 9.8 mi.)	118,760
Total	$1,627,500

* Includes maintenance without deferred retention dike in place.

83. Non-Federal. As specified in the authorizing Act and quoted in paragraph 2 hereof, local interests are responsible for the operation and maintenance of the Highway 47 (Paris Road) bridge as well as any maintenance required as a result of utility or other highway relocations or alterations. The estimated annual cost to local interests for maintenance amounts to $62,000, based on the following:

Highway 47 (Paris Road) Bridge	$ 50,000
Cable ferry at Hwy. 46	12.000
Total	$ 62,000

ECONOMICS

84. Benefits. The project channel and proposed improvements will permit the development of more efficient port terminal facilities in addition to those existing on the Mississippi River. These facilities will provide for relief of congestion at the existing terminals and for more efficient handling of cargo with resultant savings in cost of vessel operation since less time will be required in port. The report of the Board of Engineers for Rivers and Harbors dated April 20, 1948 noted that the capacity of existing general cargo terminals of the port of New Orleans is limited to about 4,250,000 tons per year for economic and efficient movement of commerce and that an additional 3,250,000 tons per year would be handled by the new facilities. This report estimated that 1,550 calls per year would be made by deep-draft vessels using the newer and more efficient terminal facilities, and that savings in ship turn-round time provided by those facilities would be a minimum of 1.25 days per call. Ship operating costs are now estimated at $130 per hour. This average hourly cost of $130 is based on latest available information obtained from the Board of Engineers. On this basis the savings in ship time in transporting cargo to and from the new terminals is estimated at $6,045,000 annually. In addition, relief of congestion at existing general cargo terminals and in the landward access facilities to all the present terminal wharves will save ship time in loading and unloading and provide benefits to industrial and commercial tonnage using those facilities estimated at $1,116,000 annually. Further benefits creditable to the improvement would result from reduced sailing time of coastwise vessels, reductions in hazards to navigation, savings in terminal handling charges and annual charges on wharves, and enhancement in value of water-front property. These additional benefits are estimated to have an annual value of $1,919,000. A summary of the annual benefits are as follows:

SUMMARY OF BENEFITS

ANNUAL BENEFITS

Savings in ships' time	$ 6,045,000
Savings in cargo handling charges	1,116,000
Other benefits	1,919,000
TOTAL	$9,080,000

85. Annual Cost. The estimated annual Federal Cost is $5,522,500 and annual non-Federal cost is $314,200 or a project annual cost of $5,836,700. A detailed estimate of the annual cost is given in Table 6.

86. Benefit to Cost Ratio. The annual benefits of $9,080,000 and annual charges of $5,836,700 given above provide the project with a favorable Benefit to Cost Ratio of 1.6 to 1.

TABLE 6

DETAILED ESTIMATE OF ANNUAL CHARGES

	FEDERAL	NON-FEDERAL	TOTAL
1. First Cost	$ 103,967,000*	$7,150,000	$111,117,000*
2. Interest during construction (1/2 of 5 yrs @ 2-1/2%)	6,498,000	-	6,498,000
3. Investment	110,465,000	7,150,000	117,615,000
4. Annual charges			
a. Interest on investment (2-1/2%)	2,761,600	178,800	2,940,400
b. Amortization (50 yrs. @ 2-1/2%)	1,133,400	73,400	1,206,800
c. Maintenance	1,627,500	62,000	1,689,500
d. Total annual charges	$5,522,500	$ 314,200	$ 5,836,700

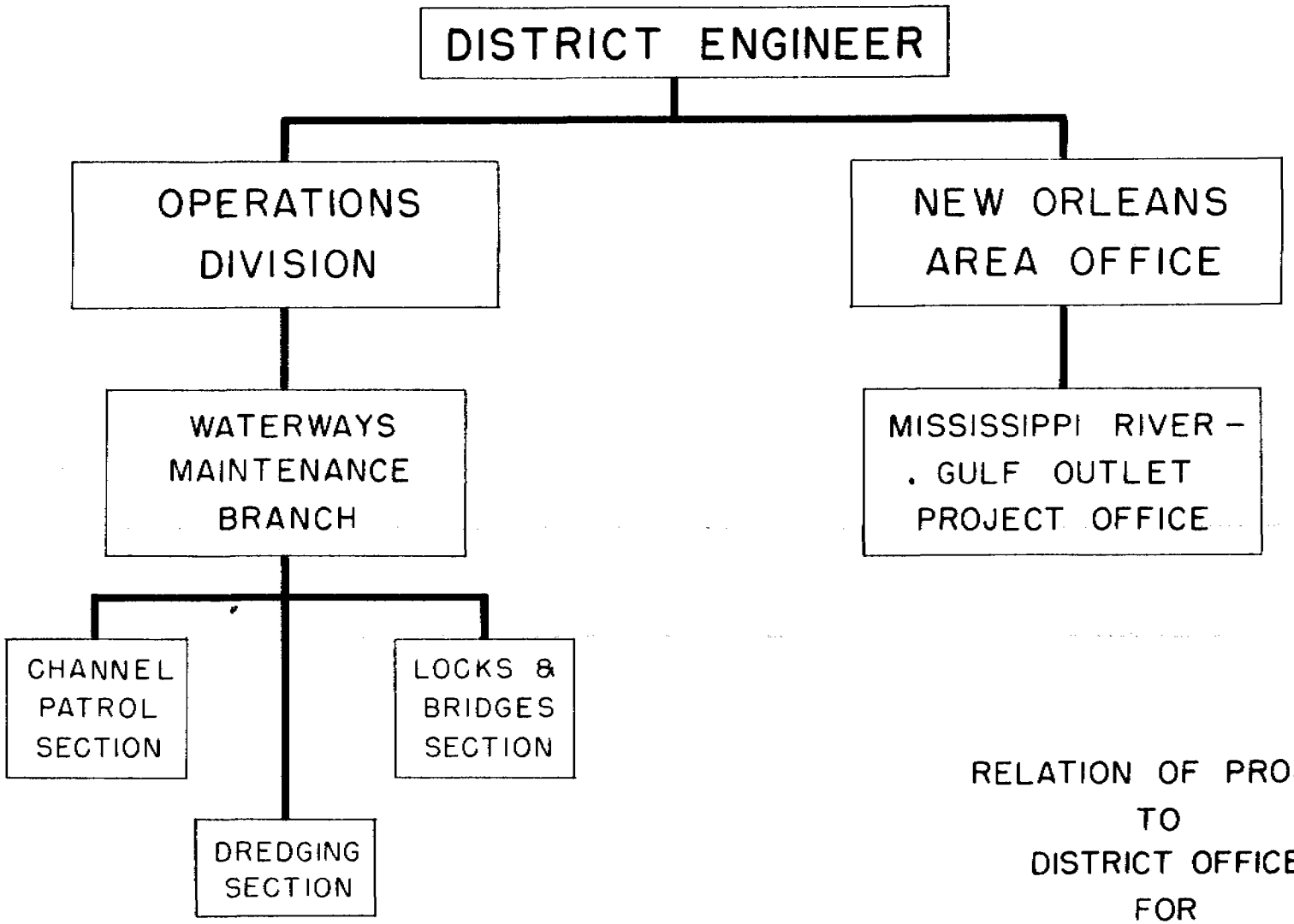
* Does not include $33,000 preauthorization studies

RECOMMENDATION

87. Recommendation. The plan of improvement as presented herein for the Mississippi River-Gulf Outlet project is considered the most economical plan to accomplish the work authorized by Congress and is recommended for approval.

CORPS OF ENGINEERS

U.S. ARMY



RELATION OF PROJECT
TO
DISTRICT OFFICE
FOR
OPERATION AND MAINTENANCE

FIG. 1

FIG. 1

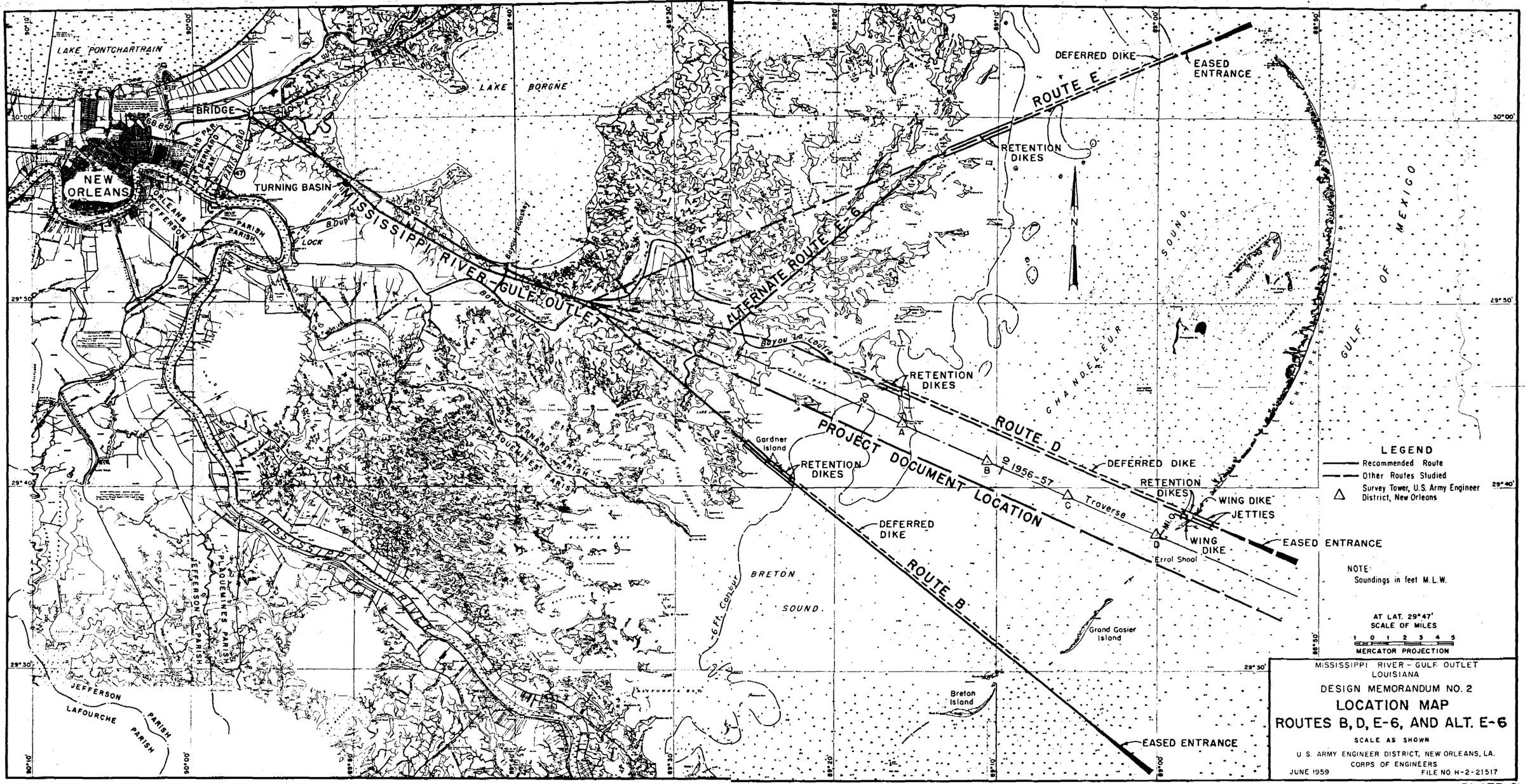
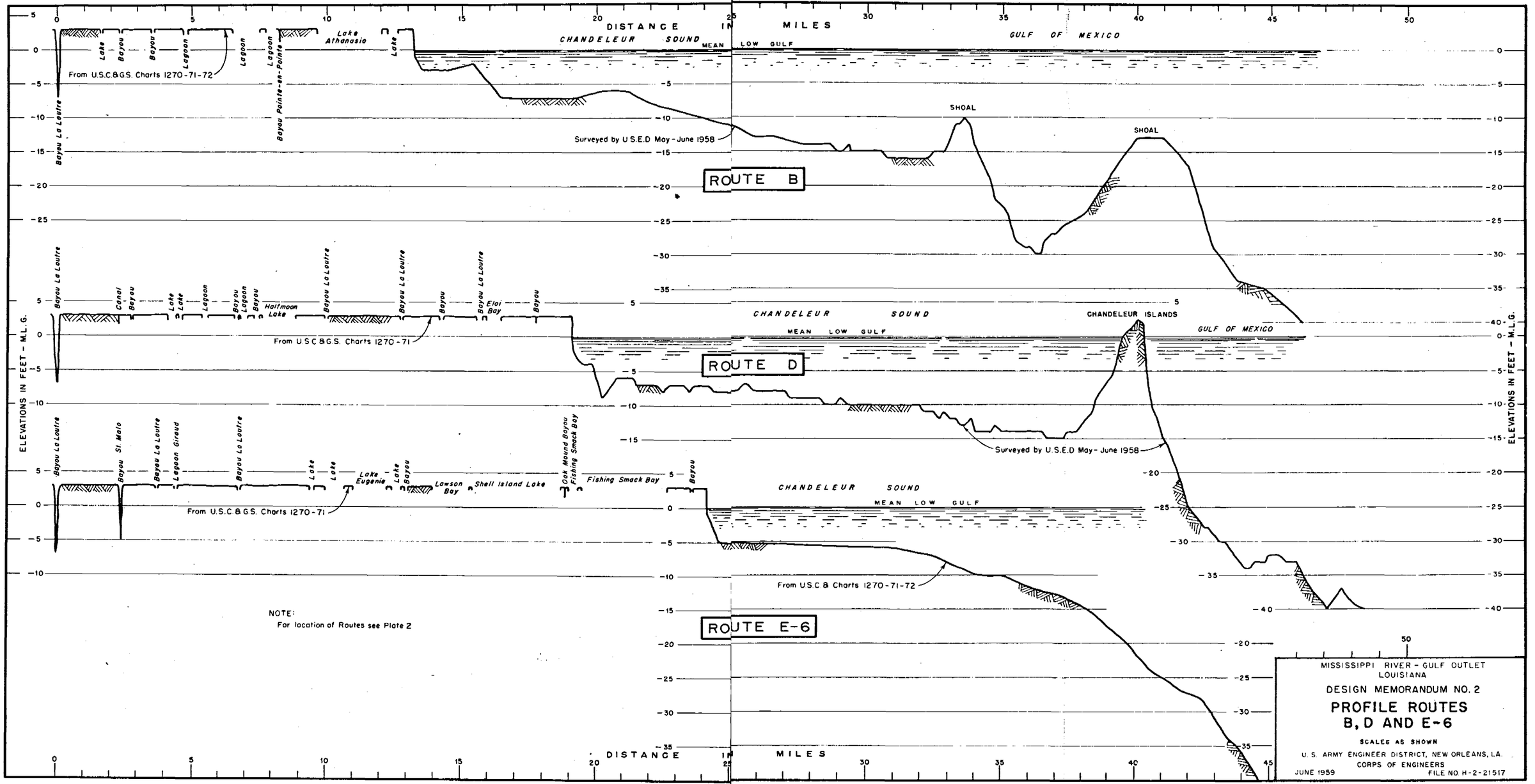

LAKE PONTCHARTRAIN
LAKE BORGNE
BRIDGE
NEW ORLEANS
TURNING BASIN
ORLEANS PARISH
JEFFERSON PARISH
ST. BERNARD PARISH
PLAQUEMINES PARISH
LAFOURCHE PARISH
MISSISSIPPI RIVER-GULF OUTLET
ALTERNATE ROUTE E-6
ROUTE E
ROUTE D
ROUTE B
PROJECT DOCUMENT LOCATION
DEFERRED DIKE
EASED ENTRANCE
RETENTION DIKES
WING DIKE JETTIES
WING DIKE
DEFERRED DIKE
Gardner Island
Grand Gosier Island
Breton Island
Errol Shoal
Traverse
1956-57
6 Ft. Contour
BRETON SOUND
CHANDELEUR SOUND
GULF OF MEXICO
Bayou La Loutre
Bayou Terre aux Boeufs
Bayou Yscloskey
MISSISSIPPI RIVER
LEGEND
Recommended Route
Other Routes Studied
Survey Tower, U.S. Army Engineer District, New Orleans
NOTE:
Soundings in feet M.L.W.
AT LAT. 29°47'
SCALE OF MILES
1 0 1 2 3 4 5
MERCATOR PROJECTION
MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
LOCATION MAP
ROUTES B, D, E-6, AND ALT. E-6
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO H-2-21517

PLATE 2



NOTE:
For location of Routes see Plate 2

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

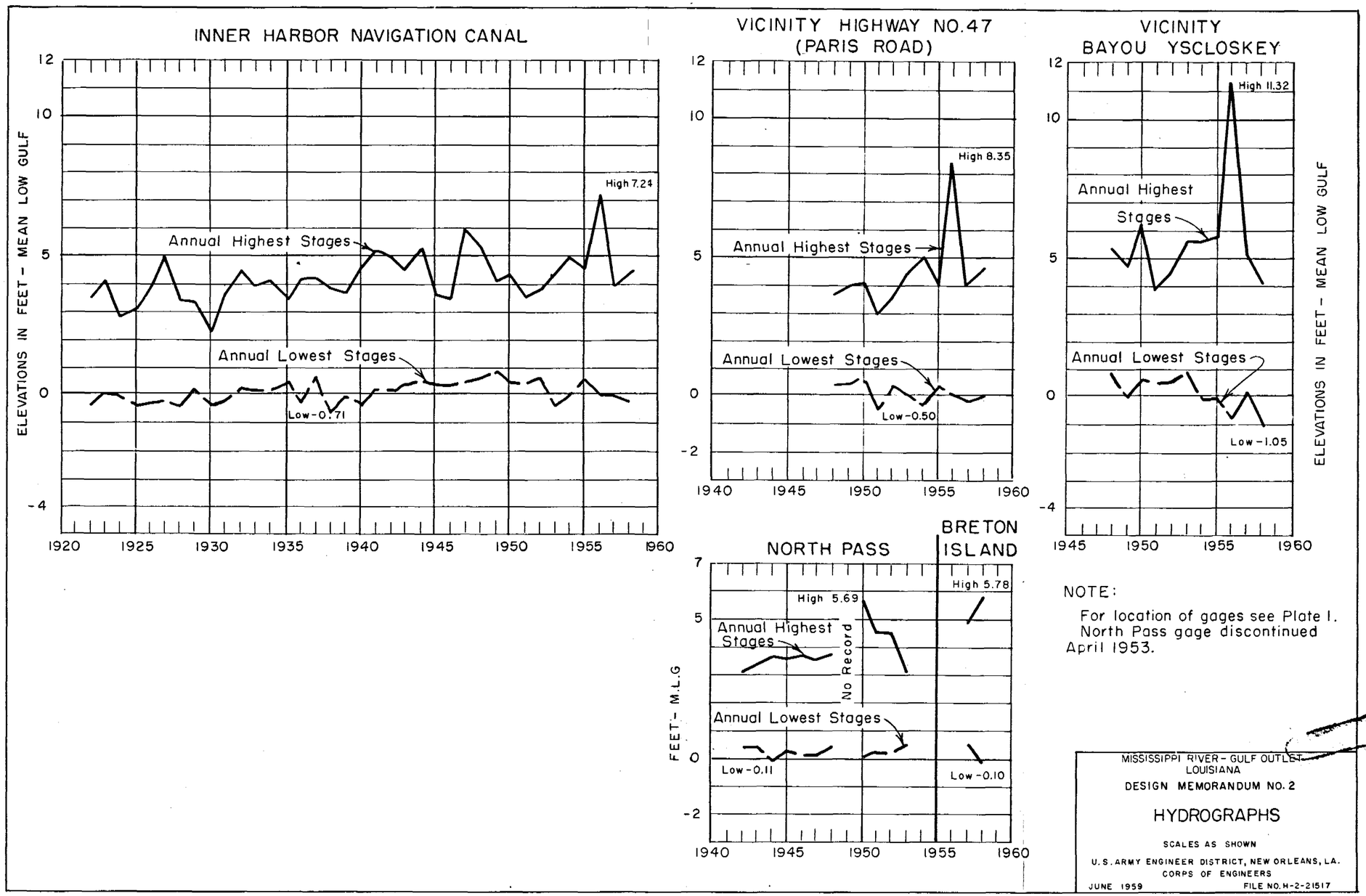
PROFILE ROUTES B, D AND E-6

SCALES AS SHOWN

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO H-2-21517

PLATE 3



NOTE:

For location of gages see Plate I.
North Pass gage discontinued April 1953.

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

HYDROGRAPHS

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 4

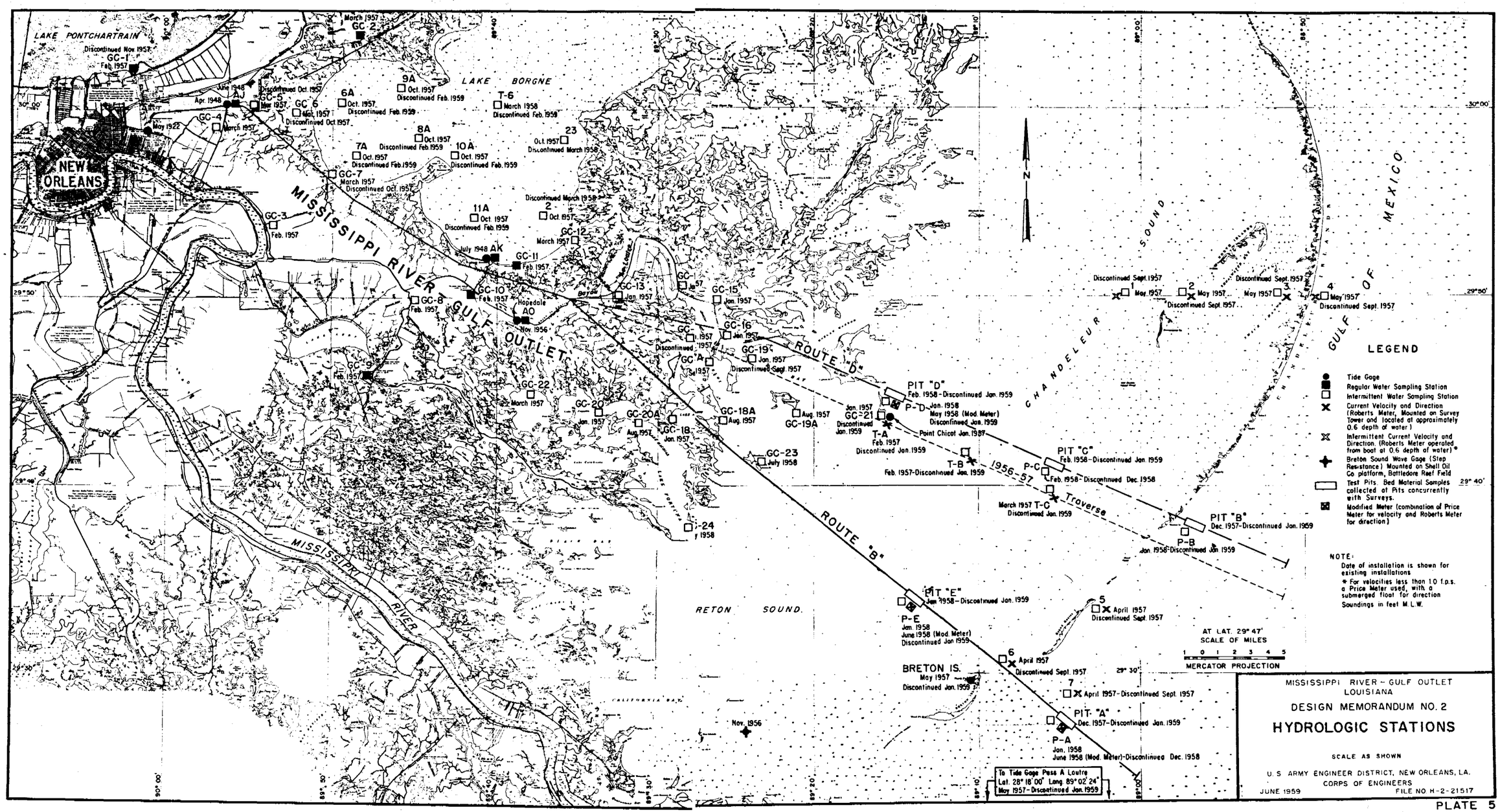
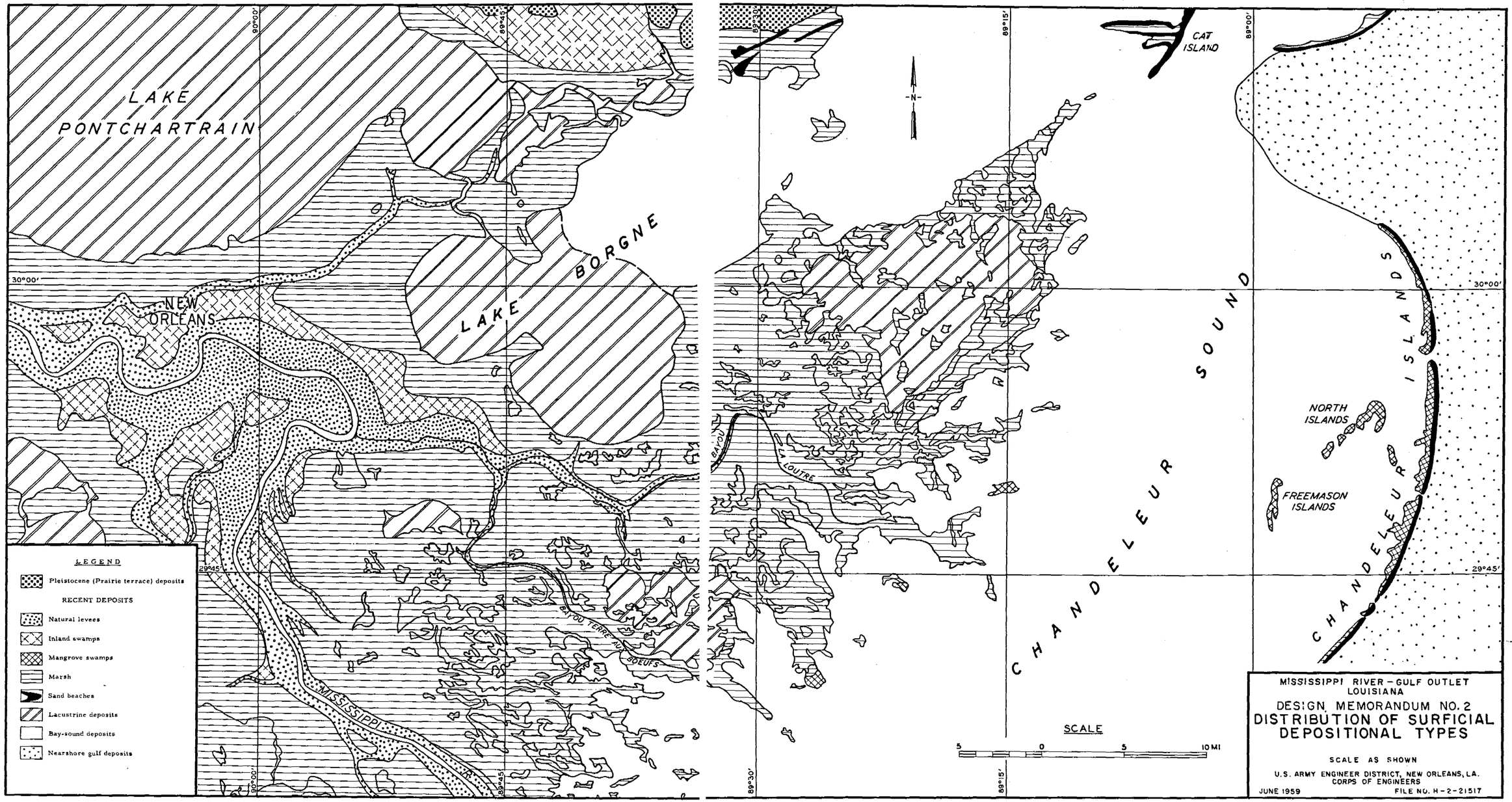

LAKE PONTCHARTRAIN
NEW ORLEANS
LAKE BORGNE
MISSISSIPPI RIVER GULF OUTLET
MISSISSIPPI RIVER
RETON SOUND
CHANDELEUR SOUND
GULF OF MEXICO
ROUTE "D"
ROUTE "B"
1956-57 Traverse
Hopedale
BRETON IS.
GC-1 Feb. 1957 Discontinued Nov. 1957
GC-2 March 1957
GC-3 Feb. 1957
GC-4 March 1957
GC-5 Mar. 1957 Discontinued Oct. 1957
GC-6 Mar. 1957 Discontinued Oct. 1957
GC-7 March 1957 Discontinued Oct. 1957
GC-8 Feb. 1957
GC-9 Feb. 1957
GC-10 Feb. 1957
GC-11 Feb. 1957
GC-12 March 1957
GC-13 Jan. 1957
GC-15 Jan. 1957
GC-16 Jan. 1957
GC-18 Jan. 1957
GC-18A Aug. 1957
GC-19 Jan. 1957 Discontinued Sept. 1957
GC-19A Aug. 1957
GC-20 Jan. 1957
GC-20A Aug. 1957
GC-21 Jan. 1957 Discontinued Jan. 1959
GC-22 March 1957
GC-23 July 1958
GC-24 1958
AJ June 1948 Apr. 1948
AK July 1948
AO Nov. 1956
T-6 March 1958 Discontinued Feb. 1958
T-A Feb. 1957 Discontinued Jan. 1959
T-B Feb. 1957-Discontinued Jan. 1959
T-C March 1957 Discontinued Jan. 1959
PIT "A" Dec. 1957-Discontinued Jan. 1959
P-A Jan. 1958 June 1958 (Mod. Meter)-Discontinued Dec. 1958
PIT "B" Dec. 1957-Discontinued Jan. 1959
P-B Jan. 1958-Discontinued Jan. 1959
PIT "C" Feb. 1958-Discontinued Jan. 1959
P-C Feb. 1958-Discontinued Dec. 1958
PIT "D" Feb. 1958-Discontinued Jan. 1959
P-D Jan. 1958 May 1958 (Mod. Meter) Discontinued Jan. 1959
PIT "E" Jan. 1958-Discontinued Jan. 1959
P-E Jan. 1958 June 1958 (Mod. Meter) Discontinued Jan 1959
1 May 1957 Discontinued Sept. 1957
2 May 1957 Discontinued Sept. 1957
3 May 1957 Discontinued Sept. 1957
4 May 1957 Discontinued Sept. 1957
5 April 1957 Discontinued Sept. 1957
6 April 1957 Discontinued Sept. 1957
7 April 1957-Discontinued Sept. 1957
2 Oct. 1957 Discontinued March 1958
23 Oct. 1957 Discontinued March 1958
6A Oct. 1957 Discontinued Feb. 1959
7A Oct. 1957 Discontinued Feb. 1959
8A Oct. 1957 Discontinued Feb. 1959
9A Oct. 1957 Discontinued Feb. 1959
10A Oct. 1957 Discontinued Feb. 1959
11A Oct. 1957 Discontinued Feb. 1959
May 1922
Nov. 1956
To Tide Gage Pass A Loutre Lat. 28° 18' 00" Long 89° 02' 24" May 1957-Discontinued Jan. 1959
AT LAT. 29° 47' SCALE OF MILES
1 0 1 2 3 4 5
MERCATOR PROJECTION
N
LEGEND
Tide Gage
Regular Water Sampling Station
Intermittent Water Sampling Station
Current Velocity and Direction (Roberts Meter, Mounted on Survey Tower and located at approximately 0.6 depth of water)
Intermittent Current Velocity and Direction (Roberts Meter operated from boat at 0.6 depth of water) *
Breton Sound Wave Gage (Step Resistance) Mounted on Shell Oil Co. platform, Battledore Reef Field
Test Pits Bed Material Samples collected at Pits concurrently with Surveys.
Modified Meter (combination of Price Meter for velocity and Roberts Meter for direction)
NOTE:
Date of installation is shown for existing installations
* For velocities less than 1.0 f.p.s. a Price Meter used, with a submerged float for direction
Soundings in feet M.L.W.
MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
HYDROLOGIC STATIONS
SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO H-2-21517

PLATE 5



MISSISSIPPI RIVER – GULF OUTLET
LOUISIANA

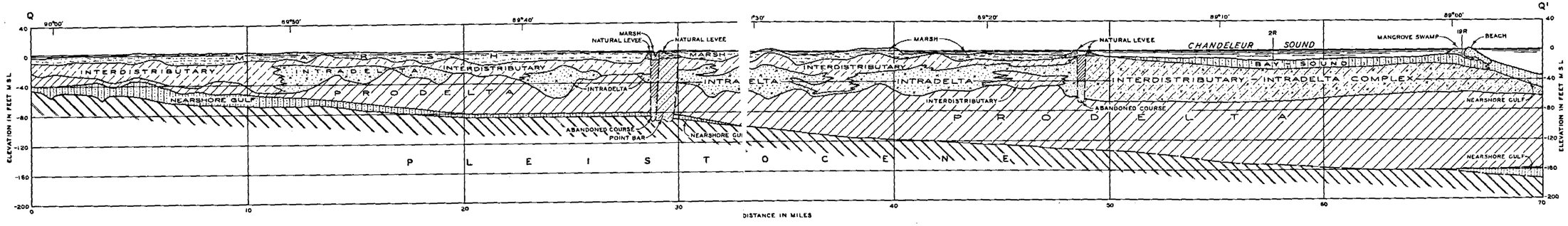
DESIGN MEMORANDUM NO. 2
DISTRIBUTION OF SURFICIAL DEPOSITIONAL TYPES

SCALE AS SHOWN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 6



NOTE:
For location of section see Plate 8

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
GEOLOGY
GENERALIZED SECTION Q - Q'

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 7

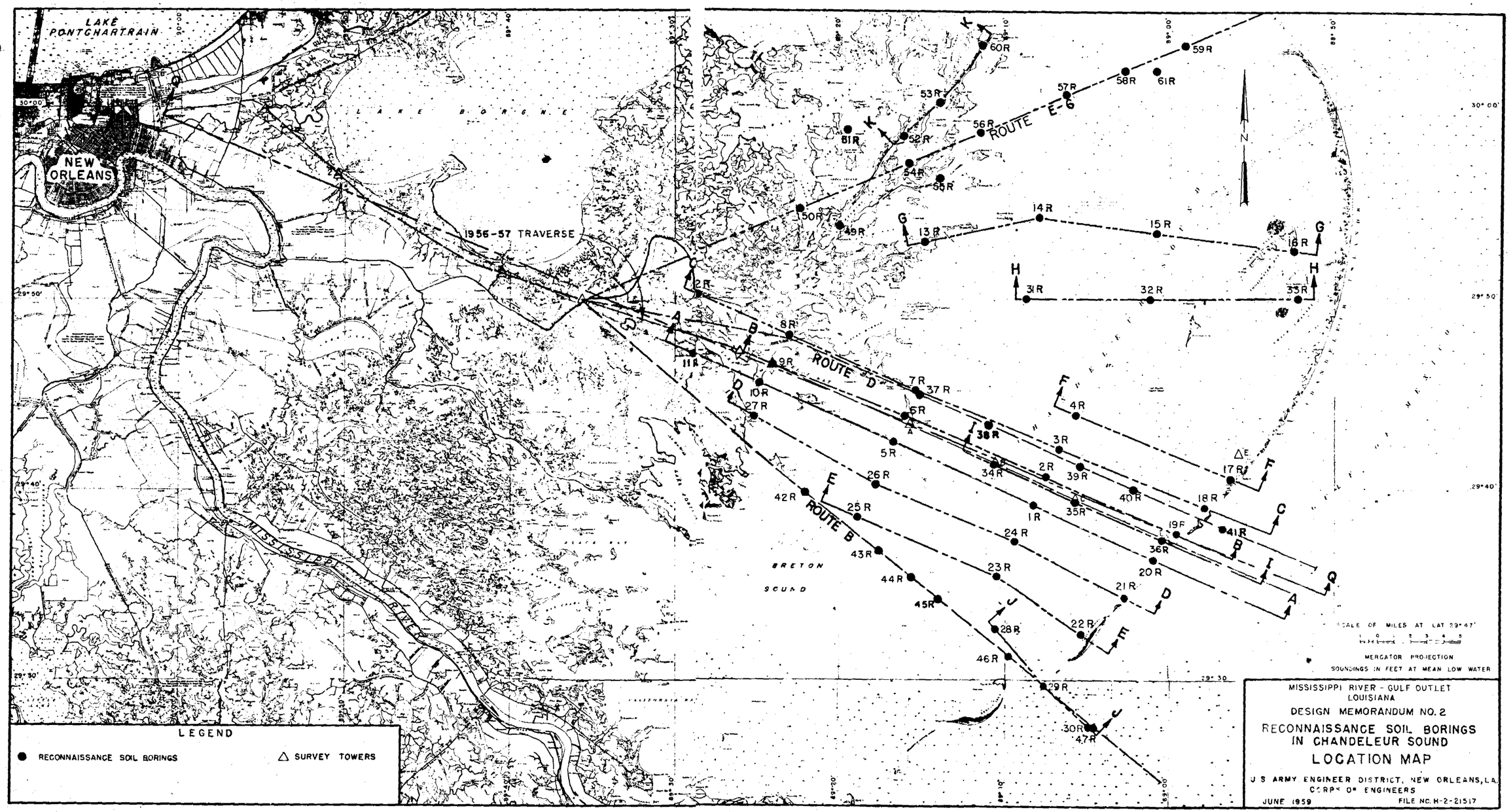
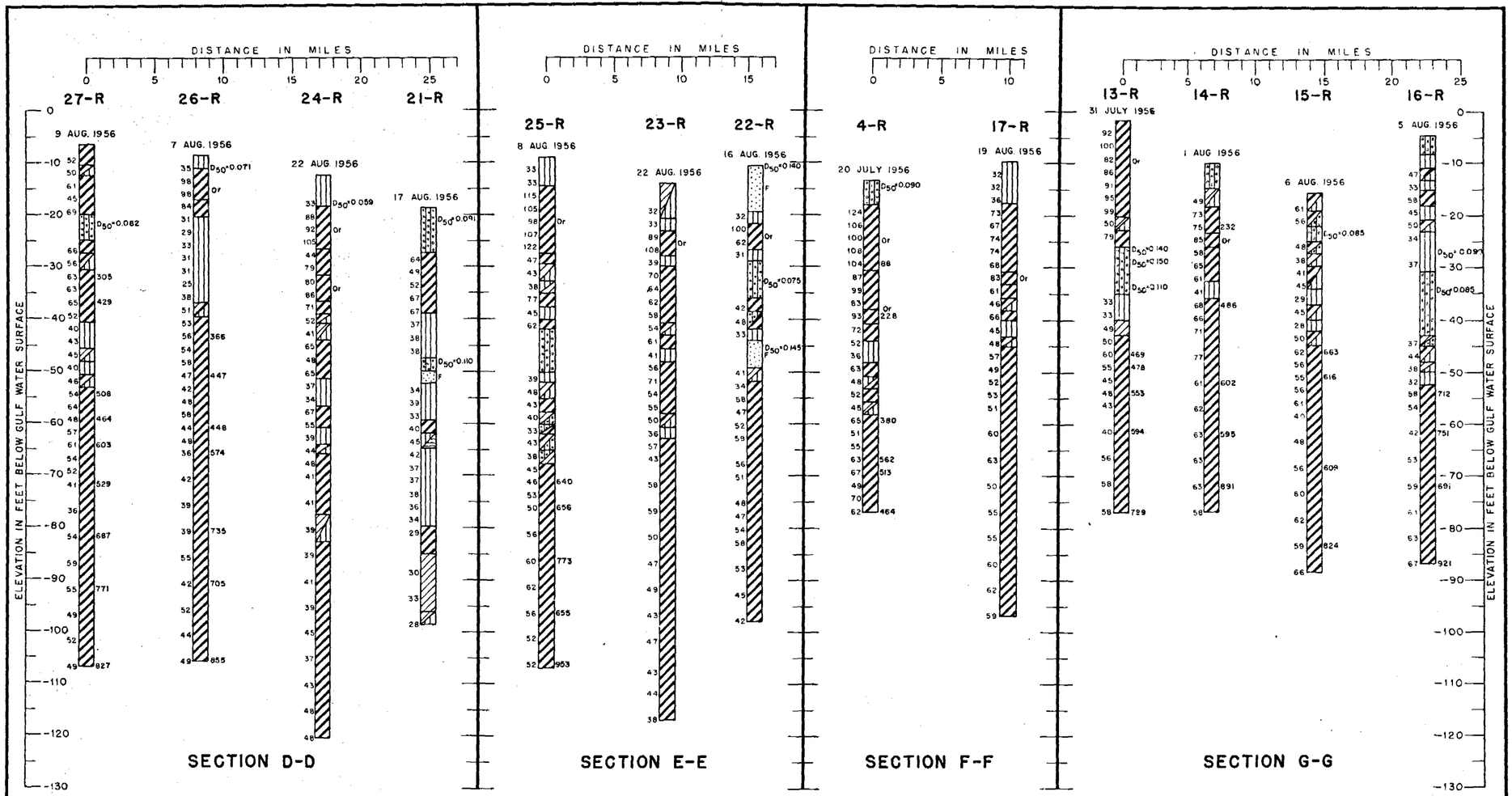

LAKE PONTCHARTRAIN
NEW ORLEANS
LAKE BORGNE
1956-57 TRAVERSE
MISSISSIPPI RIVER
BRETON SOUND
ROUTE B
ROUTE D
ROUTE E-G
LEGEND
RECONNAISSANCE SOIL BORINGS
SURVEY TOWERS
SCALE OF MILES AT LAT 29° 47'
MERCATOR PROJECTION
SOUNDINGS IN FEET AT MEAN LOW WATER
MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
RECONNAISSANCE SOIL BORINGS
IN CHANDELEUR SOUND
LOCATION MAP
U S ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO. H-2-21517

PLATE 8

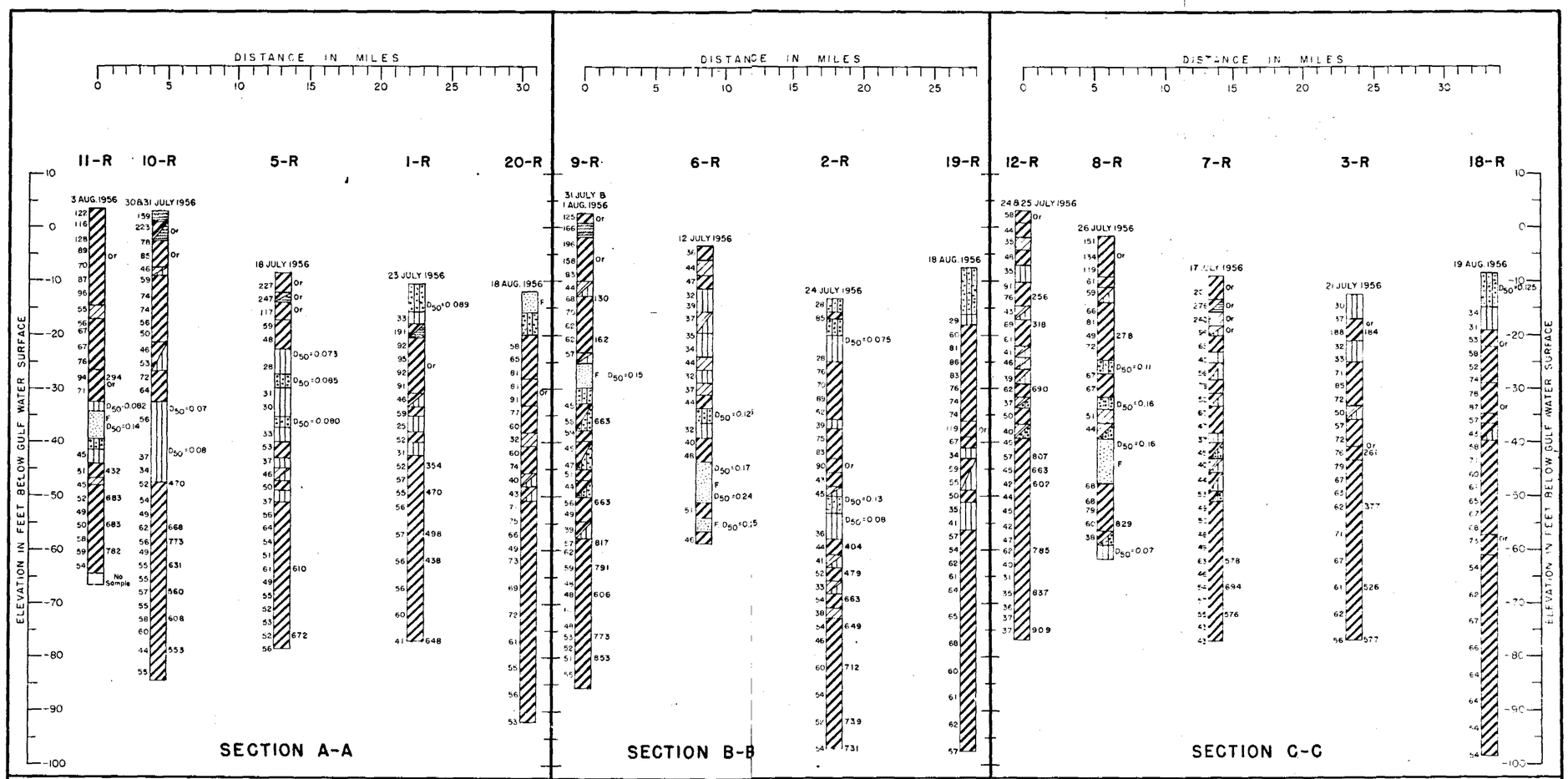


NOTES:
For location of borings, see Plate 8
For boring log legend, see Plate 9
Date of borings are above each log

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
RECONNAISSANCE SOIL BORINGS
IN CHANDELEUR SOUND
LOG OF BORINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959 FILE NO. H-2-21517

PLATE 10



LEGEND

- Peat
- Fat clay (CH)
- Lean clay (CL)
- Sandy silt (ML)
- Silty sand (SM)
- Sand poorly-graded (SP)

Or Organic matter
F Fine Sand
D_{50} Median (50%) grain size diameter in mm

NOTES:

Figures to left of boring logs indicate water content expressed as percent of oven dry soil weights.

Borings made at elevations shown with 1⅞" I.D. Wire-Line Core Barrel Sampler.

Date of borings are above each log.

For location of borings see Plate 8

Figures to right of borings other than D_{50} size are shear strength in lbs. per square foot based on results of unconfined compression tests on small core samples.

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

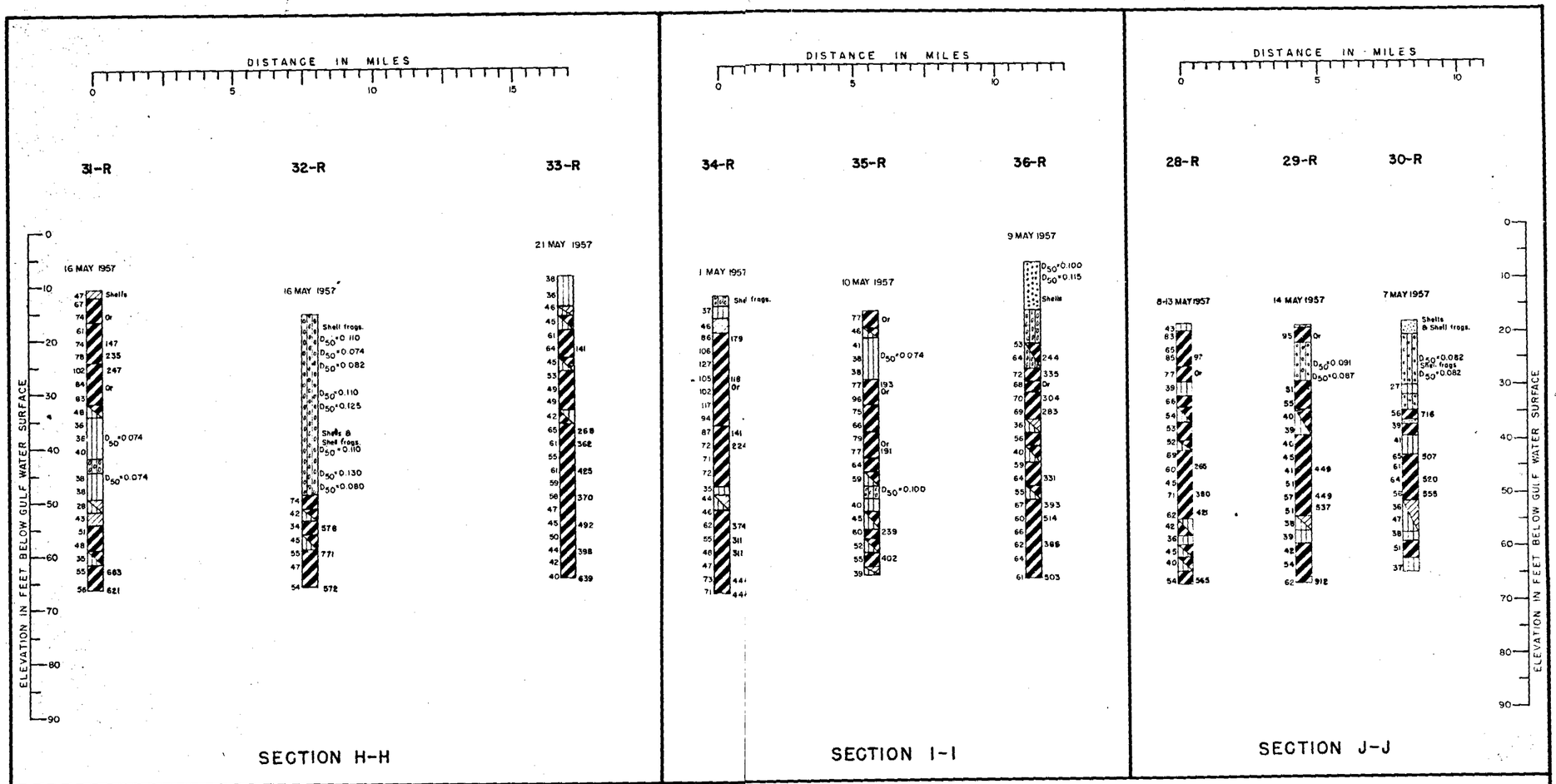
RECONNAISSANCE SOIL BORINGS IN CHANDELEUR SOUND

LOG OF BORINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 9

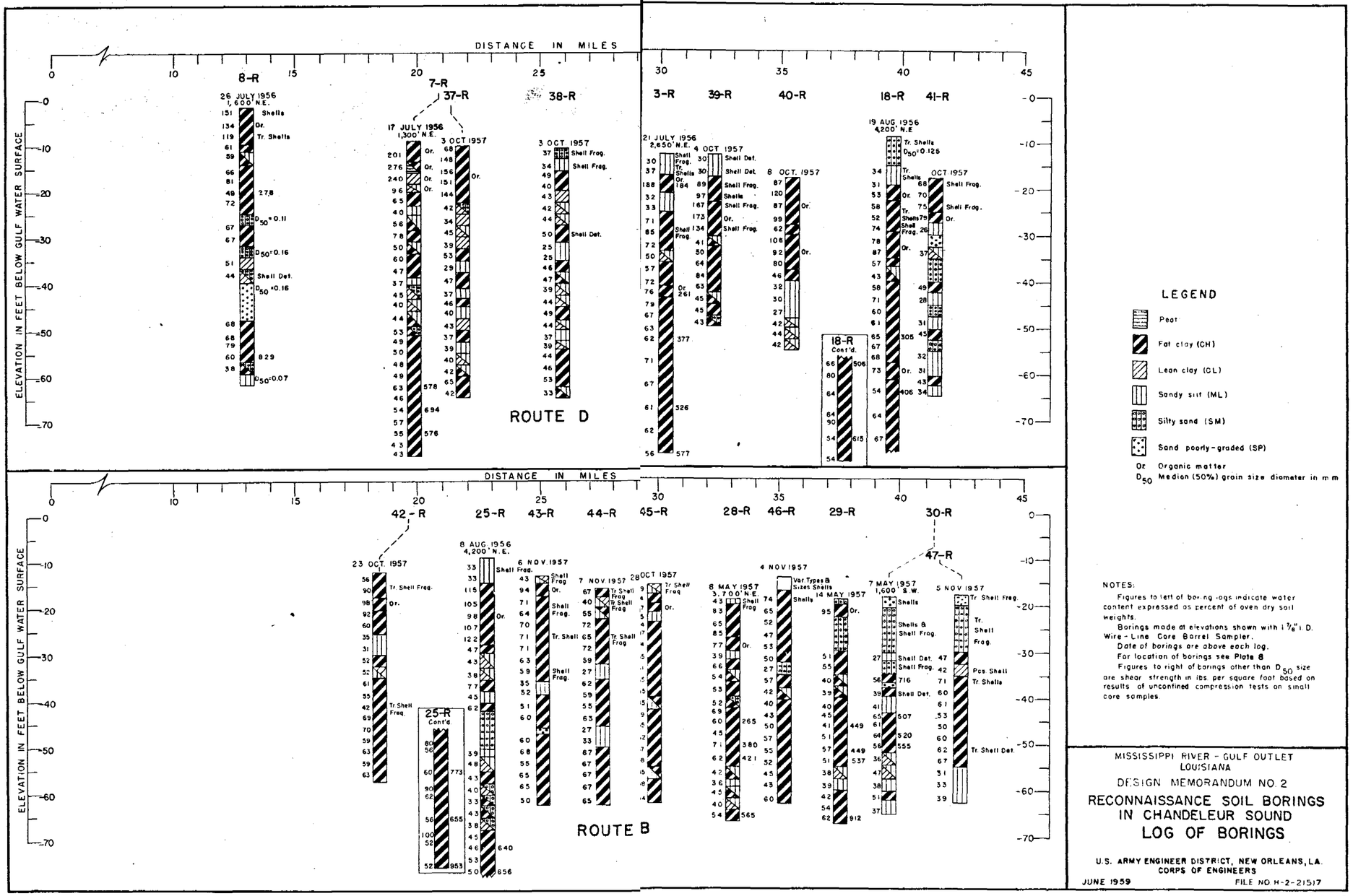


NOTES:
For location of borings, see Plate 8
For boring log legend, see Plate 9
Date of borings are above each log.

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
RECONNAISSANCE SOIL BORINGS
IN CHANDELEUR SOUND
LOG OF BORINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO. H-2-21517

PLATE 11



NOTES:

Figures to left of boring logs indicate water content expressed as percent of oven dry soil weights.

Borings made at elevations shown with 1 3/8" I. D. Wire-Line Core Barrel Sampler.

Date of borings are above each log.

For location of borings see Plate 8.

Figures to right of borings other than D_{50} size are shear strength in lbs per square foot based on results of unconfined compression tests on small core samples.

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

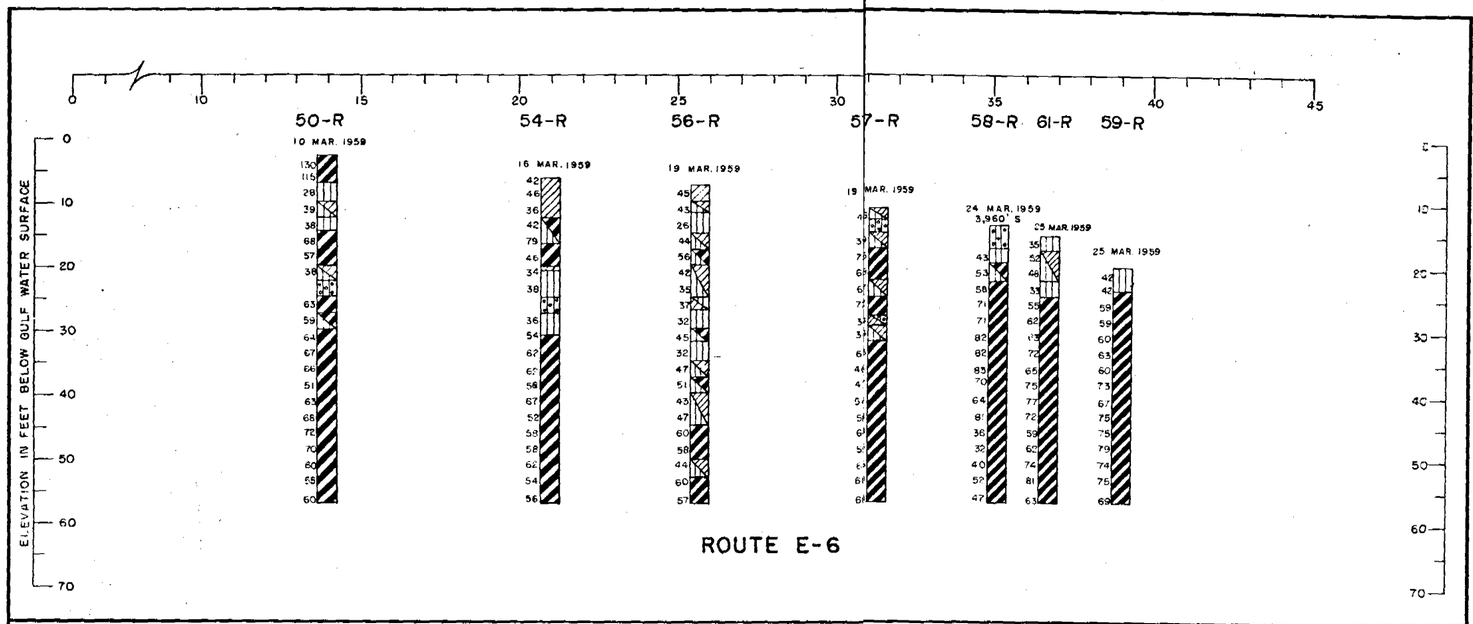
DESIGN MEMORANDUM NO. 2

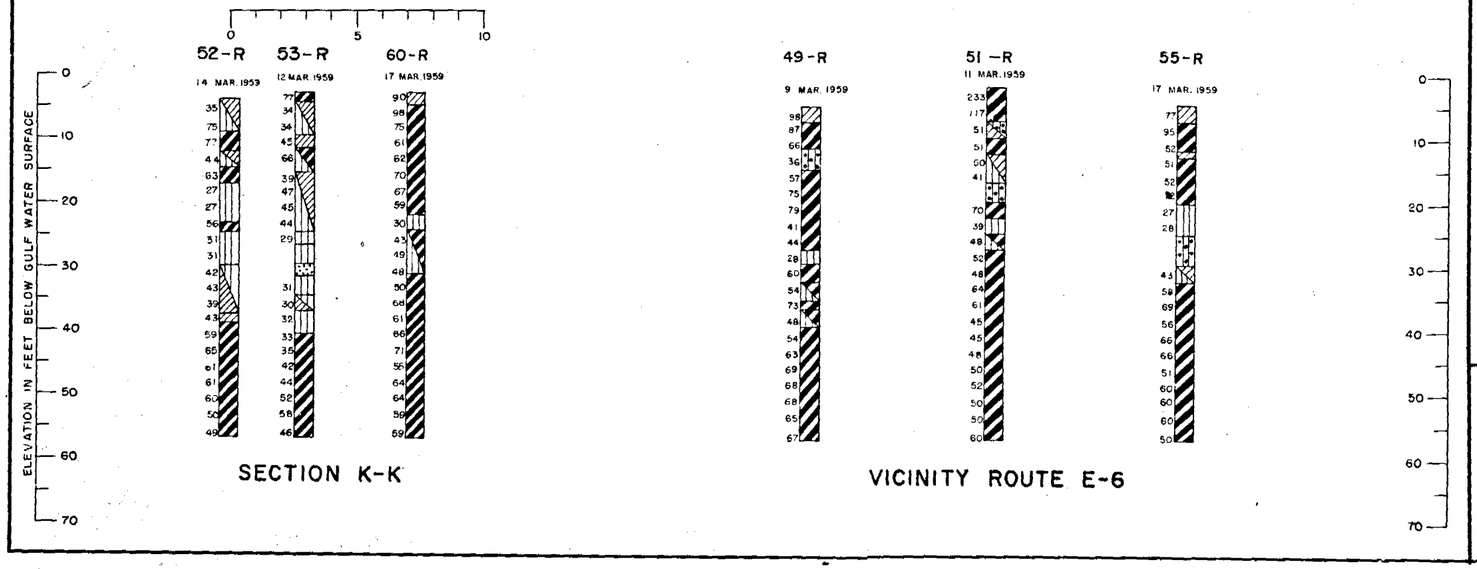
RECONNAISSANCE SOIL BORINGS IN CHANDELEUR SOUND
LOG OF BORINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 12





LEGEND

- Fat clay (CH)
- Lean clay (CL)
- Sandy silt (ML)
- Silty sand (SM)
- Sand poorly-graded (SP)

NOTES:

Figures to left of boring logs indicate water content expressed as percent of oven dry soil weights.

Borings made at elevations shown with 1 7/8" i. D. Core Barrel Sampler.

Date of borings are above each log.

For location of borings see Plate 6

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

RECONNAISSANCE SOIL BORINGS IN CHANDELEUR SOUND

LOG OF BORINGS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959

FILE NO. H-2-21517

PLATE 13

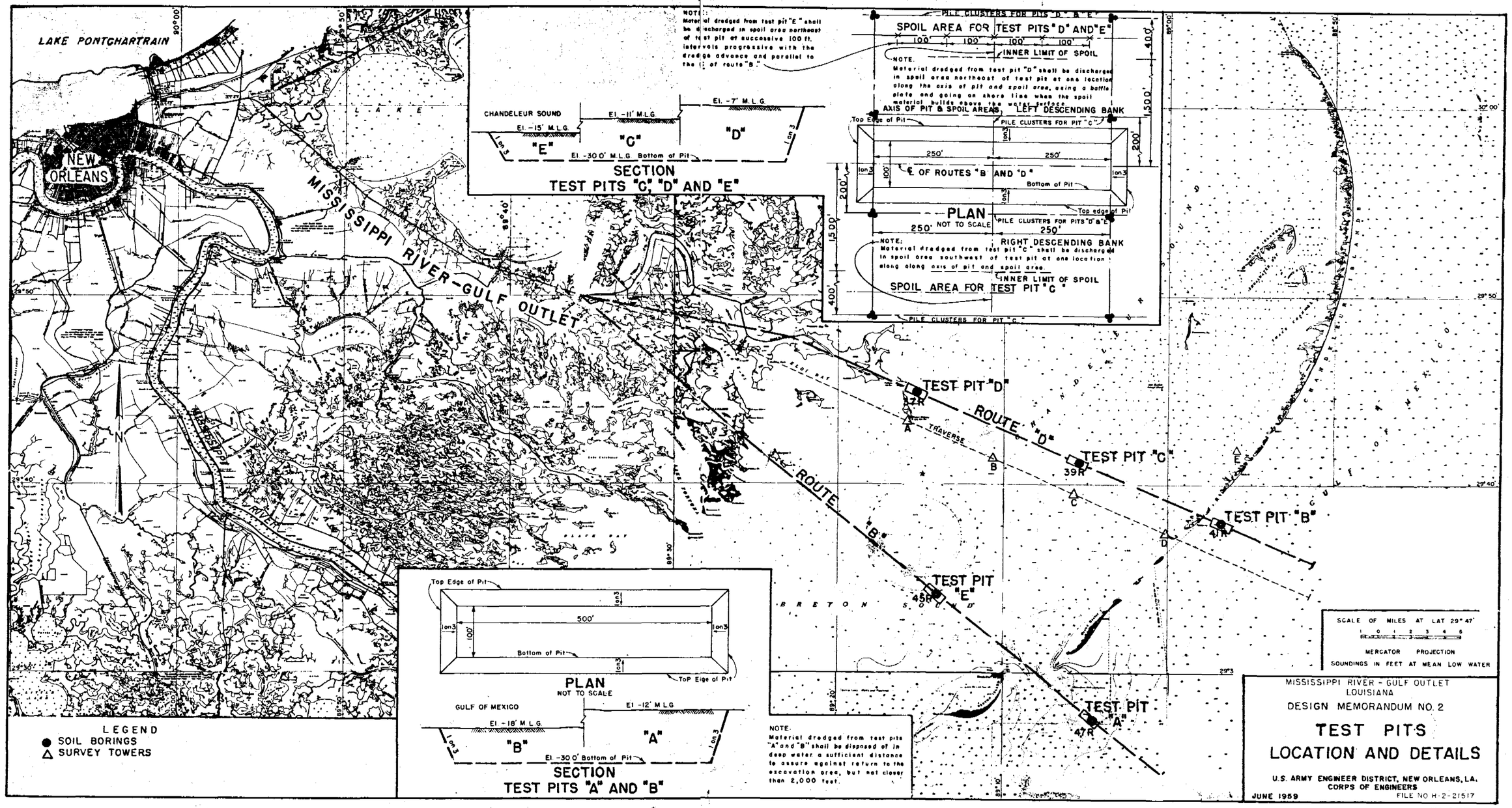

LAKE PONTCHARTRAIN
NEW ORLEANS
MISSISSIPPI RIVER-GULF OUTLET
MISSISSIPPI RIVER
LAKE
BRETON SOUND
TEST PIT "D"
12R
ROUTE "D"
TEST PIT "C"
39R
TEST PIT "B"
47R
ROUTE "B"
TEST PIT "E"
45R
TEST PIT "A"
47R
TRAVERSE
A
B
C
D
E
N
LEGEND
SOIL BORINGS
SURVEY TOWERS
CHANDELEUR SOUND
El. -15' M.L.G.
El. -11' M.L.G.
El. -7' M.L.G.
"E"
"C"
"D"
El. -30.0' M.L.G. Bottom of Pit
1on3
SECTION
TEST PITS "C", "D" AND "E"
NOTE:
Material dredged from test pit "E" shall be discharged in spoil area northeast of test pit at successive 100 ft. intervals progressive with the dredge advance and parallel to the ℄ of route "B".
PILE CLUSTERS FOR PITS "D" & "E"
SPOIL AREA FOR TEST PITS "D" AND "E"
100'
100'
100'
100'
400'
1500'
INNER LIMIT OF SPOIL
NOTE.
Material dredged from test pit "D" shall be discharged in spoil area northeast of test pit at one location along the axis of pit and spoil area, using a baffle plate and going on shore line when the spoil material builds above the water surface.
AXIS OF PIT & SPOIL AREAS
LEFT DESCENDING BANK
Top Edge of Pit
PILE CLUSTERS FOR PIT "C"
250'
250'
200'
℄ OF ROUTES "B" AND "D"
Bottom of Pit
PLAN
NOT TO SCALE
250'
250'
Top edge of Pit
PILE CLUSTERS FOR PITS "D" & "E"
RIGHT DESCENDING BANK
NOTE:
Material dredged from test pit "C" shall be discharged in spoil area southwest of test pit at one location along along axis of pit and spoil area.
INNER LIMIT OF SPOIL
SPOIL AREA FOR TEST PIT "C"
PILE CLUSTERS FOR PIT "C"
Top Edge of Pit
500'
100'
Bottom of Pit
PLAN
NOT TO SCALE
GULF OF MEXICO
El. -18' M.L.G.
El. -12' M.L.G.
"B"
"A"
El. -30.0' Bottom of Pit
SECTION
TEST PITS "A" AND "B"
NOTE:
Material dredged from test pits "A" and "B" shall be disposed of in deep water a sufficient distance to assure against return to the excavation area, but not closer than 2,000 feet.
SCALE OF MILES AT LAT 29° 47'
0 1 2 3 4 5
MERCATOR PROJECTION
SOUNDINGS IN FEET AT MEAN LOW WATER
MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
TEST PITS
LOCATION AND DETAILS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO H-2-21517

PLATE 14

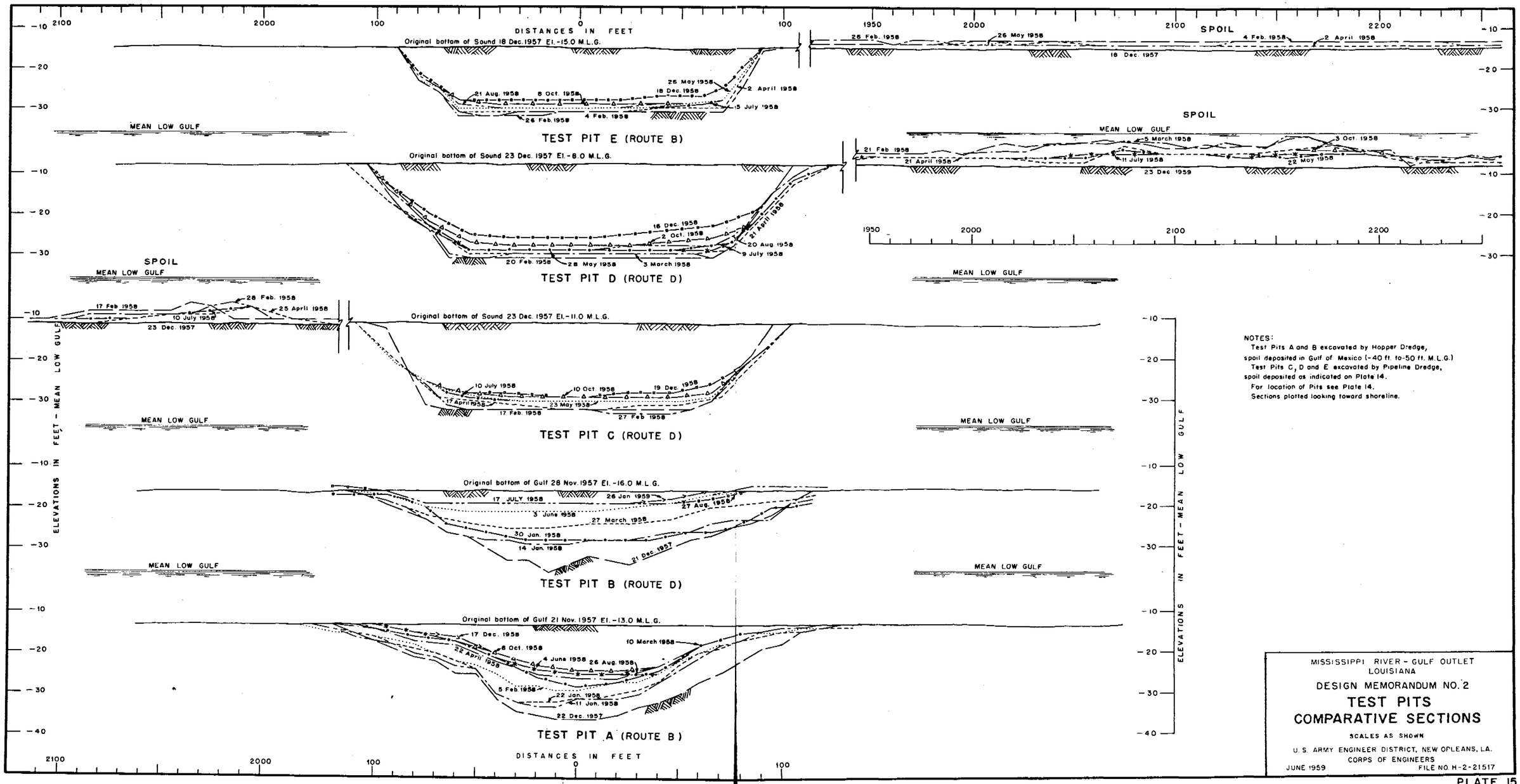
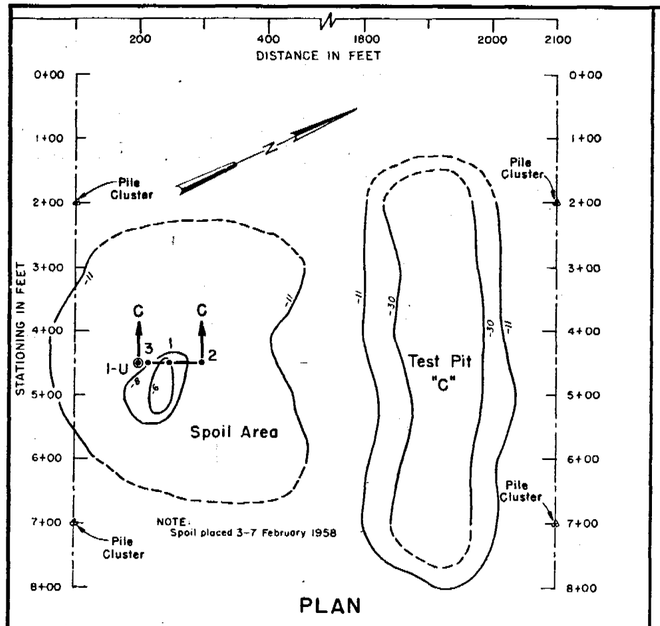
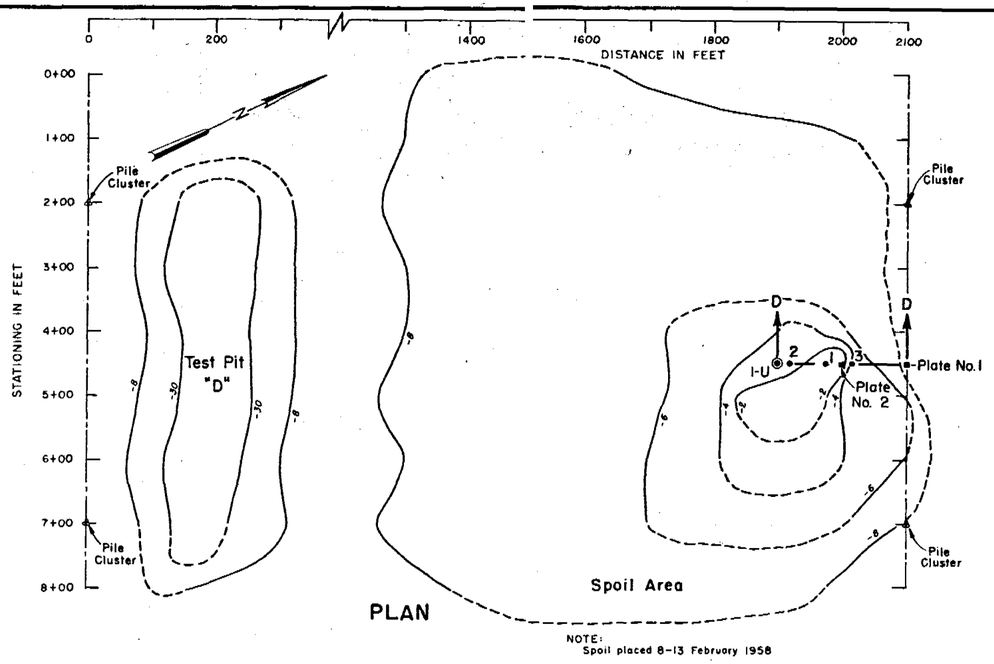

DISTANCES IN FEET
Original bottom of Sound 18 Dec. 1957 El. -15.0 M.L.G.
26 Feb. 1958
26 May 1958
4 Feb. 1958
2 April 1958
18 Dec. 1957
21 Aug. 1958
8 Oct. 1958
18 Dec. 1958
5 July 1958
SPOIL
MEAN LOW GULF
TEST PIT E (ROUTE B)
Original bottom of Sound 23 Dec. 1957 El. -8.0 M.L.G.
21 Feb. 1958
5 March 1958
3 Oct. 1958
21 April 1958
11 July 1958
22 May 1958
23 Dec. 1959
16 Dec. 1958
2 Oct. 1958
21 April 1958
20 Aug. 1958
9 July 1958
20 Feb. 1958
28 May 1958
3 March 1958
TEST PIT D (ROUTE D)
17 Feb. 1958
28 Feb. 1958
10 July 1958
25 April 1958
23 Dec. 1957
Original bottom of Sound 23 Dec. 1957 El. -11.0 M.L.G.
10 July 1958
10 Oct. 1958
19 Dec. 1958
17 April 1958
23 May 1958
17 Feb. 1958
27 Feb. 1958
TEST PIT C (ROUTE D)
Original bottom of Gulf 28 Nov. 1957 El. -16.0 M.L.G.
17 JULY 1958
26 Jan. 1959
27 Aug. 1958
3 June 1958
27 March 1958
30 Jan. 1958
14 Jan. 1958
21 Dec. 1957
TEST PIT B (ROUTE D)
Original bottom of Gulf 21 Nov. 1957 El. -13.0 M.L.G.
17 Dec. 1958
10 March 1958
6 Oct. 1958
22 April 1958
4 June 1958
26 Aug. 1958
5 Feb. 1958
22 Jan. 1958
11 Jan. 1958
22 Dec. 1957
TEST PIT A (ROUTE B)
ELEVATIONS IN FEET - MEAN LOW GULF
NOTES:
Test Pits A and B excavated by Hopper Dredge, spoil deposited in Gulf of Mexico (-40 ft. to-50 ft. M.L.G.)
Test Pits C, D and E excavated by Pipeline Dredge, spoil deposited as indicated on Plate 14.
For location of Pits see Plate 14.
Sections plotted looking toward shoreline.
MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2
TEST PITS
COMPARATIVE SECTIONS
SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959
FILE NO. H-2-21517

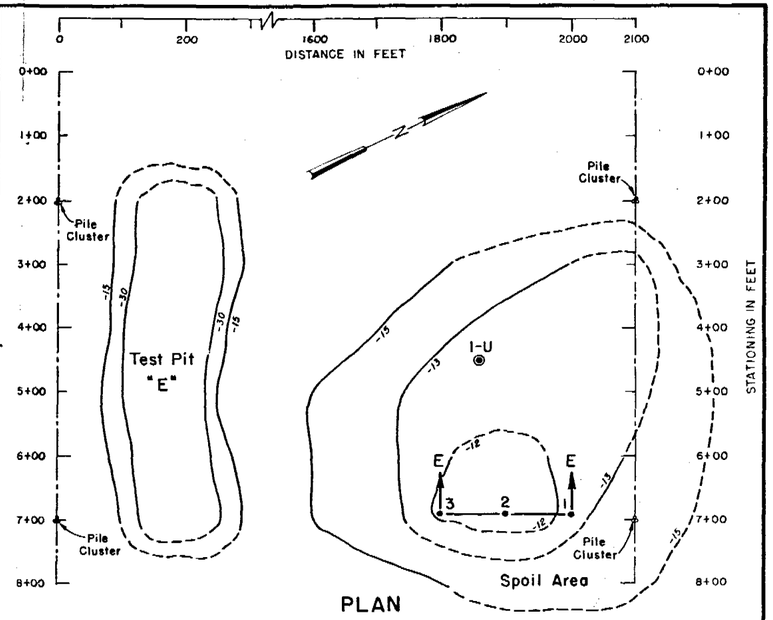
PLATE 15



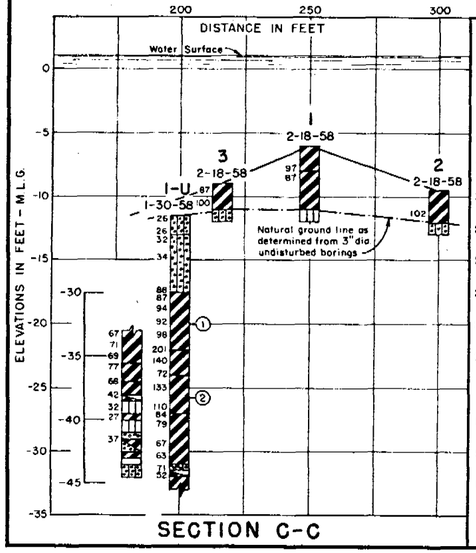
PLAN



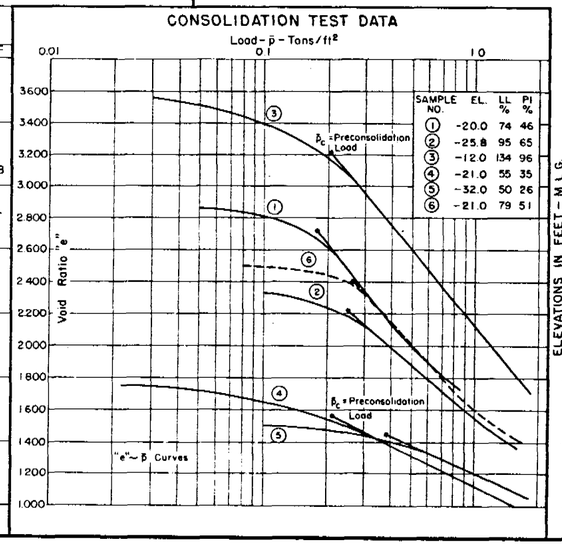
PLAN

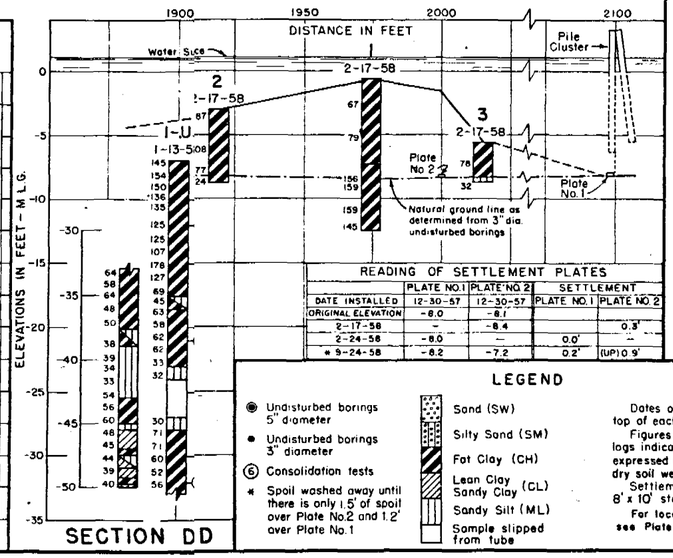


PLAN



SECTION C-C





SECTION DD

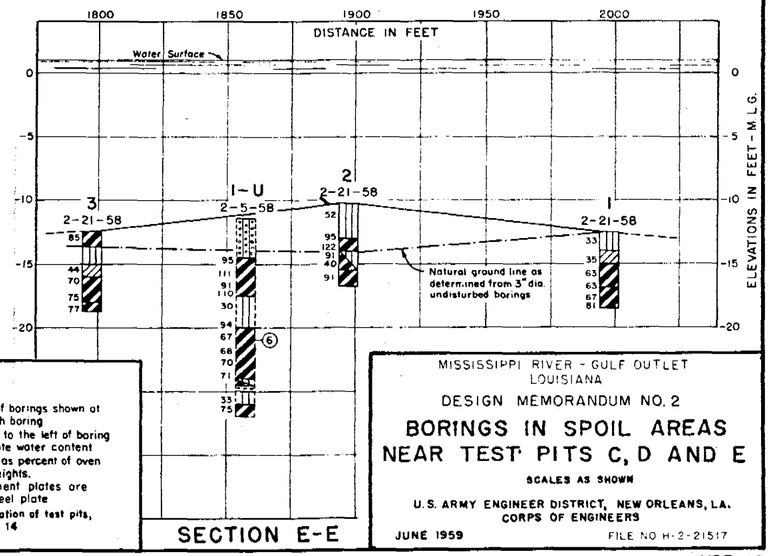
READING OF SETTLEMENT PLATES

	PLATE NO.1	PLATE NO.2	SETTLEMENT	
DATE INSTALLED	12-30-57	12-30-57	PLATE NO. 1	PLATE NO. 2
ORIGINAL ELEVATION	-8.0	-8.1		
2-17-58		-8.4		0.3'
2-24-58	-8.0		0.0'	--
* 9-24-58	-8.2	-7.2	0.2'	(UP) 0.9'

LEGEND

- Undisturbed borings 5" diameter
- Undisturbed borings 3" diameter
- (6) Consolidation tests
- * Spoil washed away until there is only 1.5' of spoil over Plate No.2 and 1.2' over Plate No.1
- Sand (SW)
- Silty Sand (SM)
- Fat Clay (CH)
- Lean Clay / Sandy Clay (CL)
- Sandy Silt (ML)
- Sample slipped from tube

Dates of borings shown at top of each boring
Figures to the left of boring logs indicate water content expressed as percent of oven dry soil weights.
Settlement plates are 8' x 10' steel plate
For location of test pits, see Plate 14



SECTION E-E

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

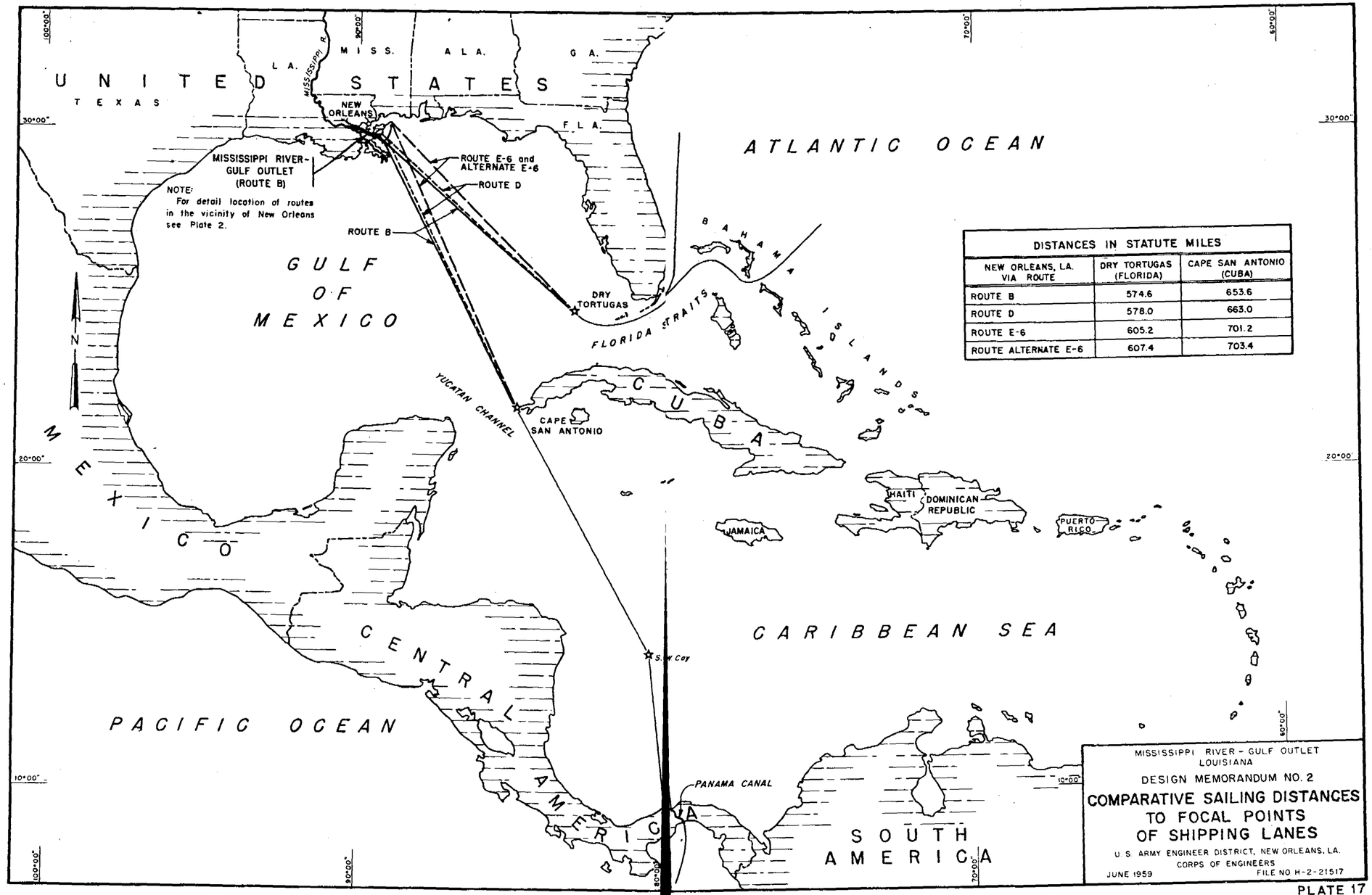
BORINGS IN SPOIL AREAS NEAR TEST PITS C, D AND E

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO H-2-21517

PLATE 16



DISTANCES IN STATUTE MILES		
NEW ORLEANS, LA. VIA ROUTE	DRY TORTUGAS (FLORIDA)	CAPE SAN ANTONIO (CUBA)
ROUTE B	574.6	653.6
ROUTE D	578.0	663.0
ROUTE E-6	605.2	701.2
ROUTE ALTERNATE E-6	607.4	703.4

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

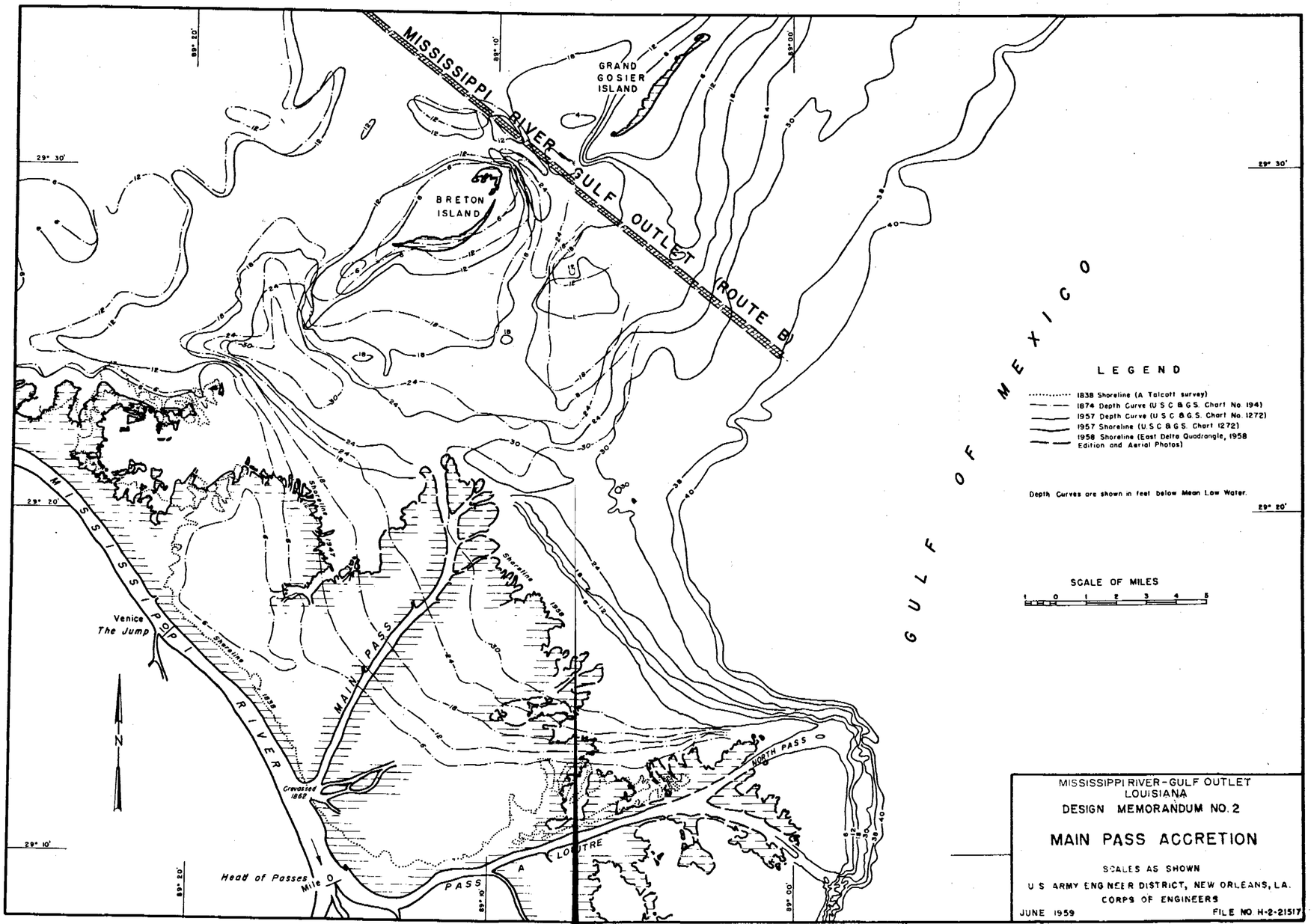
DESIGN MEMORANDUM NO. 2

COMPARATIVE SAILING DISTANCES TO FOCAL POINTS OF SHIPPING LANES

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO H-2-21517

PLATE 17

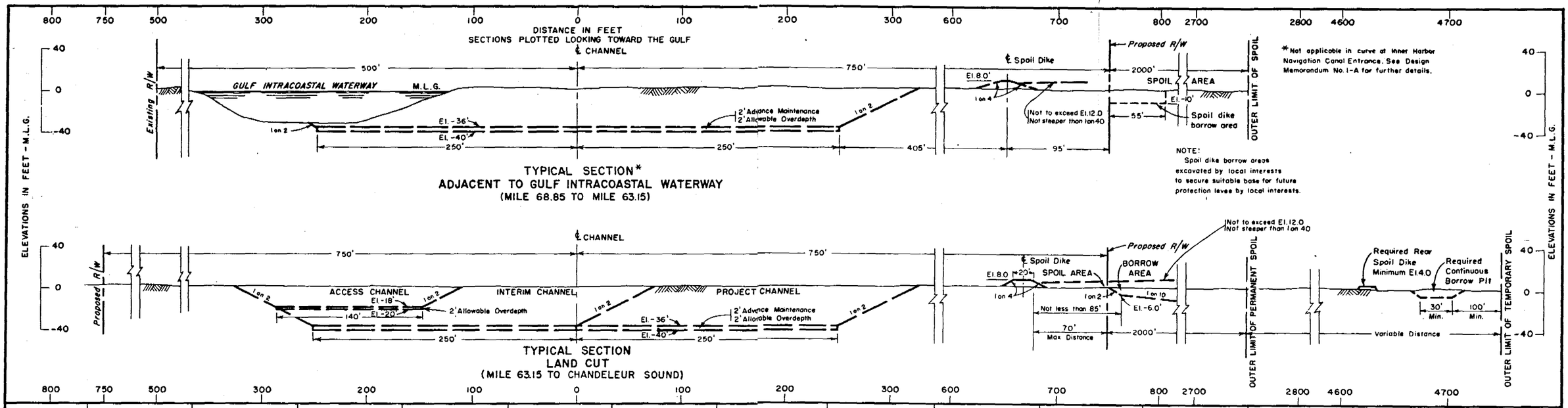


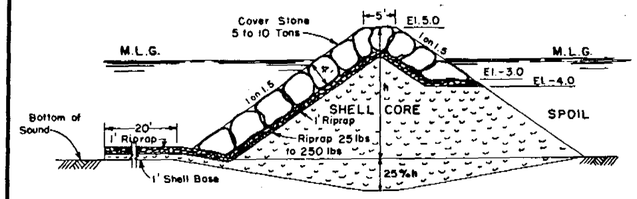
MISSISSIPPI RIVER-GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2

MAIN PASS ACCRETION

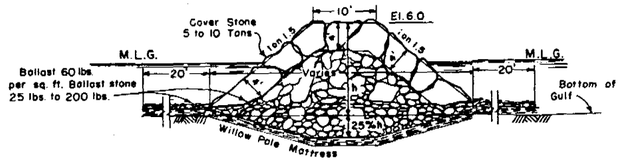
SCALES AS SHOWN
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959 FILE NO H-2-21517

PLATE 18

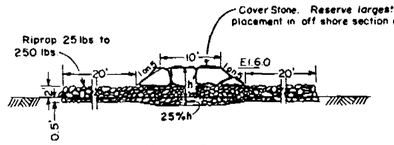




RETENTION AND DEFERRED DIKES



JETTY
(ROUTE D ONLY)



WING DIKE
(ROUTE D ONLY)

MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

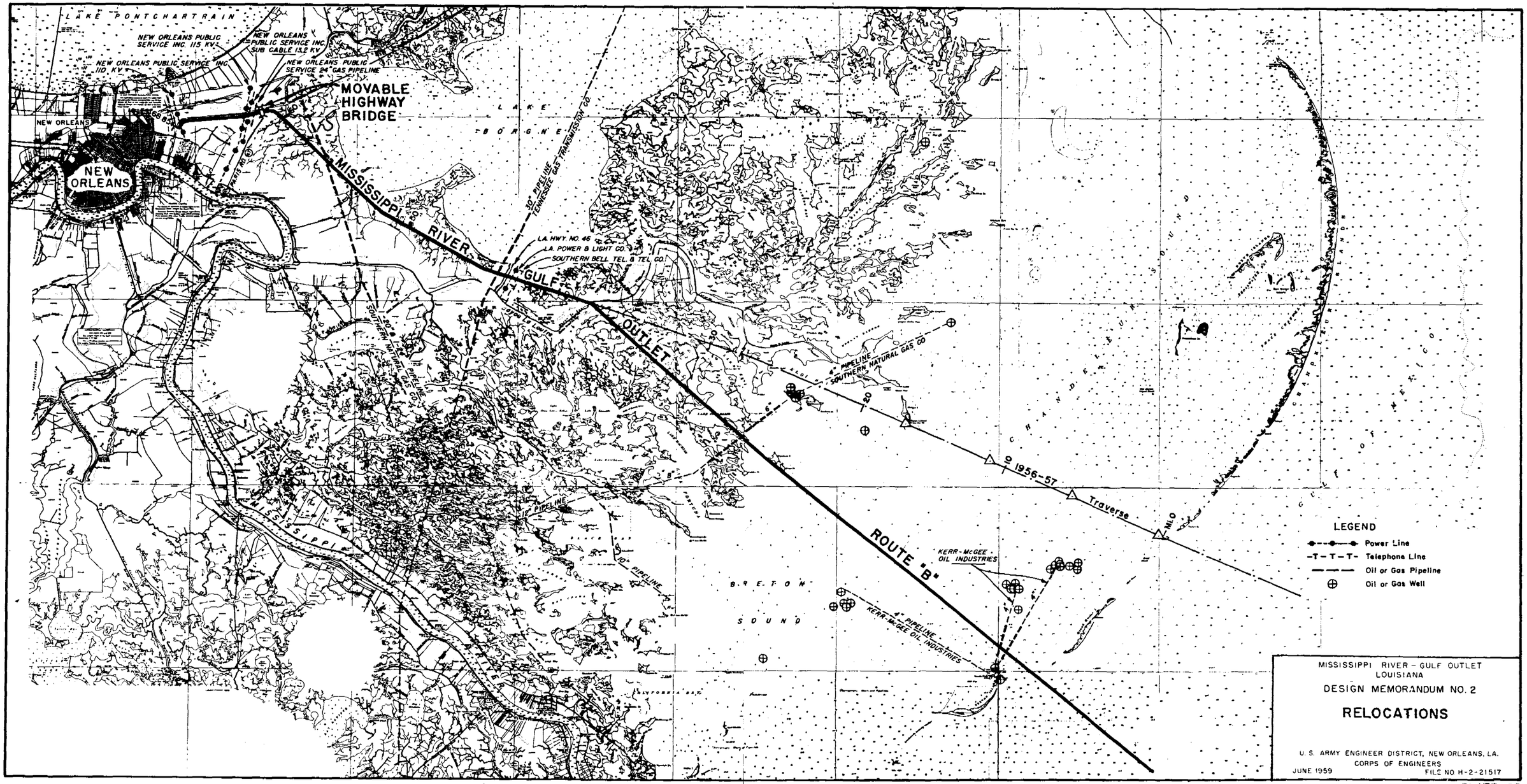
TYPICAL SECTIONS CHANNEL AND DIKES

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959

FILE NO. H-2-21517

PLATE 19

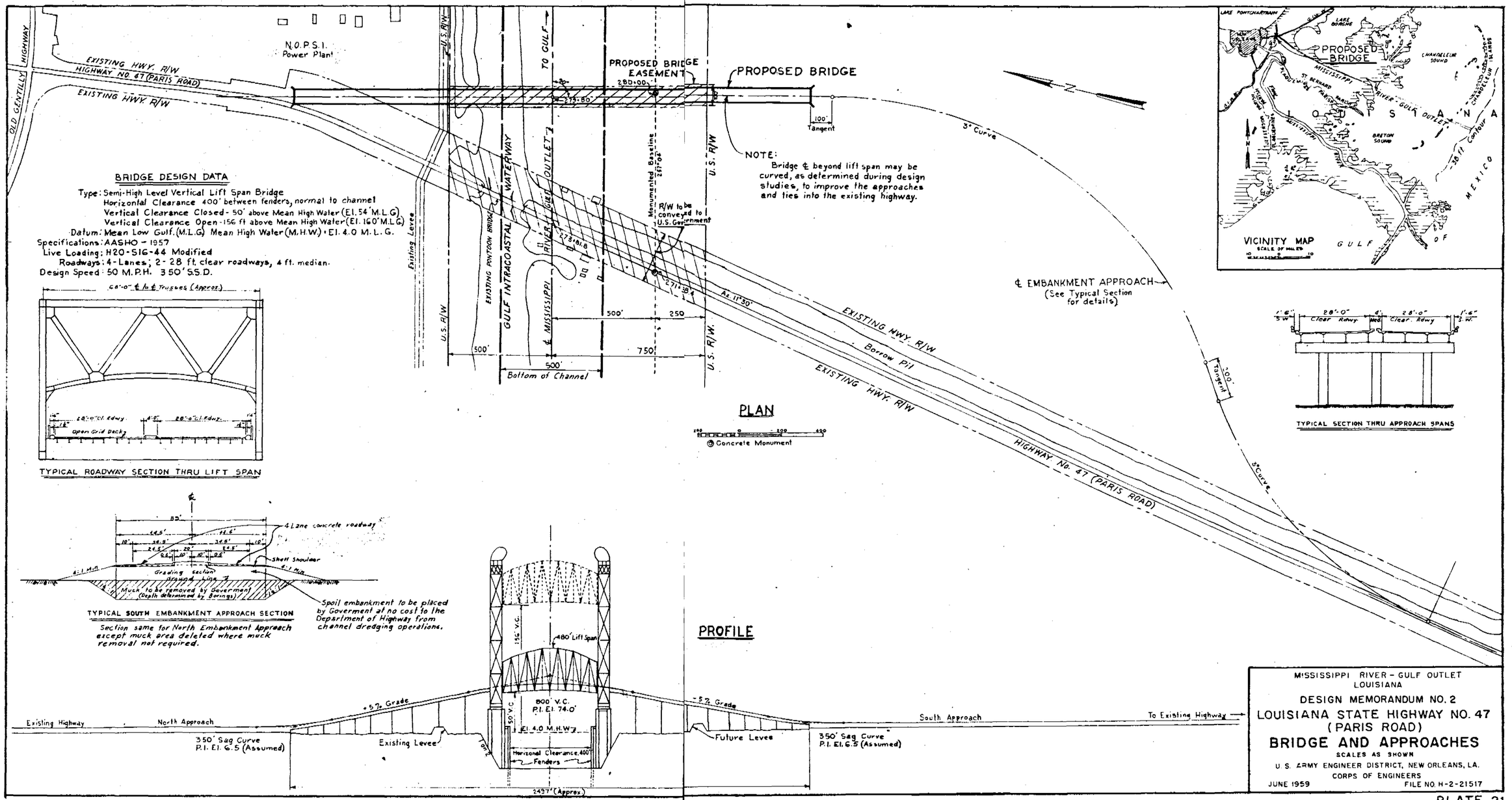


MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA
DESIGN MEMORANDUM NO. 2

RELOCATIONS

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
JUNE 1959 FILE NO H-2-21517

PLATE 20



MISSISSIPPI RIVER - GULF OUTLET
LOUISIANA

DESIGN MEMORANDUM NO. 2

LOUISIANA STATE HIGHWAY NO. 47
(PARIS ROAD)

BRIDGE AND APPROACHES

SCALES AS SHOWN

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS

JUNE 1959 FILE NO. H-2-21517

PLATE 21

MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA

GENERAL DESIGN MEMORANDUM NO. 2, GENERAL DESIGN

APPENDIX I

BEACH EROSION BOARD STUDIES

Table of Contents

LIST OF INCLOSURES

29 April 1959

BEACH EROSION BOARD STAFF STUDY ON LOCATION OF MISSISSIPPI GULF OUTLET CHANNEL

1. This report is the result of a study by the staff of the Beach Erosion Board for the purpose of aiding in a determination of the most favorable route through Chandeleur Sound to 38-foot depth in the Gulf of Mexico for the authorized Mississippi River-Gulf Outlet Channel. It is a supplement to a letter report with three Appendices from the Executive, Beach Erosion Board to the Division Engineer, Lower Mississippi Division dated 11 March 1957.

2. At a conference held 12-13 September 1957 available data were reviewed and agreement was reached between representatives of the Division Engineer, the Waterways Experiment Station, the Beach Erosion Board, and the District Engineer at New Orleans on a program for obtaining supplemental data designed primarily to permit evaluation of Routes B and D as shown on Inclosure 1. The program provided for excavation of 5 test pits along the two routes; periodic surveys at the test pits and adjoining spoil areas; borings and surface samples along the two routes and in the test pits; current observations near Route D at 3 points; and a geological study of the Chandeleur Sound area to be made by the Waterways Experiment Station. At a subsequent conference held 2 February 1959, it was determined that consideration would also be given to Route E-6 as shown on Inclosure 1, with additional data for that route to consist only of borings and airphoto coverage. Following is a summary and analysis of the data obtained subsequent to the report referred to in paragraph 1.

3. Test Pits. Locations of the 5 test pits are shown on the insert map on Inclosure 2. Each pit was dredged to an approximate depth of 30 feet MLW, with dimensions of approximately 100 by 500 feet alined along the axes of Routes B and D. Dredge spoil was deposited approximately 2,000 feet north of pits D and E, 2,000 feet south of pit C, and in deep water in the Gulf in the case of pits A and B. Pits A and B were excavated with a hopper dredge in December 1957 and pits C, D and E with a pipeline dredge in February 1958. Inclosure 2 is also a graph of the percent of shoaling in terms of original pit capacity plotted against time. Since the shoaling rate would be influenced to some extent by and slopes of these relatively short pits, shoaling volumes were computed for the central 300-foot length of each pit. Inclosure 3 is a graph of the shoaling volume thus computed for each pit plotted against time. The following tabulations list progressive shoaling rates between successive surveys for each pit.

Pit A
(Natural depth before dredging = 13 ft.)

Dates of Survey	Time Interval (days)	Shoaling from Range 3 to 6 (Pit Capacity Range 3-6=32150 cu. yds.) Interim cu. yds.	Cum. cu. yds.	Cu. yds./lin ft/day
12/22/57-1/22/58	31	7444	7444	0.800
1/22 -3/10	47	7537	14981	0.533
3/10 -6/4	86	2704	17685	0.105
6/4 -12/17	196	1882	19667	0.032

Pit B
(Natural depth before dredging = 16.0 ft.)

Dates of Survey	Time Interval (days)	Shoaling from Range 5 to 8 (Pit Capacity Range 5-8=27040 cu. yds.) Interim cu. yds.	Cum. cu. yds.	Cu. yds/lin ft/day
12/21/57-1/30/58	40	9410	9410	0.784
1/30 -3/27	55	4260	13670	0.258
3/27 -6/3	66	5600	19270	0.283
6/3 -7/17	44	3090	22360	0.234
7/17 -1/26/59	192	nil	-	-

Pit C
(Natural depth before dredging = 11.0 ft.)

Dates of Survey	Time Interval (days)	Shoaling between Range 3 to 6 (Pit Capacity Range 3-6=38,500 cu. yds.) Interim cu. yds.	Cum. cu. yds.	Cu. yds/lin ft./day
2/17/58-4/17	59	1650	1650	0.093
4/17 -8/22	127	1855	3505	0.049
8/22 -12/19	119	3737	7242	0.106

Pit D
(Natural depth before dredging = 8.0 ft.)

Dates of Survey	Time Interval (days)	Shoaling between Range 2 to 5 (Pit Capacity Range 2-5=47060 cu. yds.) Interim cu. yds.	Cum. cu. yds.	Cu. yds/lin ft/day
2/20/58-4/21	60	2544	2544	0.141
4/21 -8/20	121	3562	6106	0.098
8/20 -12/16	120	6904	13010	0.192

Pit E
(Natural depth before dredging = 15.0 ft.)

Dates of Survey	Time Interval (days)	Shoaling between Range 3 to 6 (Pit Capacity Range 3-6= 29360 cu.yds.) Interim cu.yds.	Cum. cu.yds.	Cu. yds/lin ft/day
2/4/58-4/2	57	1575	1575	0.092
4/2 - 8/21	141	2092	3667	0.049
8/21 - 12/18	121	3056	6723	0.185

4. The preceding data indicate that there is some seasonal effect upon the shoaling rate of the pits within Chandeleur Sound (C, D and E), the lowest rate occurring during the months of April through August. Pits A and B in the exposed Gulf, while shoaling much more rapidly, experienced a progressive deceleration of the shoaling rate indicating that the pit depth is an important factor in the shoaling rate at these sites. This would probably be true also at pits C, D and E after sufficient time elapses for the pits to shoal to depths nearer those of the natural bed. Inclosure 4 is a graph of the relative depths of pits A & B and the adjoining natural bottom plotted against time.

5. Character of shoaling material. Surface samples of shoal material were taken in each pit at approximately 2-month intervals for a year. Additional bed samples were taken in the areas surrounding pits A and B. The mechanical analyses of these samples, showing percentages of sand, silt and clay as well as median diameter, are tabulated in Inclosure 5. Results are summarized below:

a. Pit A. During the early stages of shoaling (while the pit shoaled to about 50% of its capacity) the samples indicate the shoaling material to be composed of both silt and sand, possibly in about equal proportion. Subsequent samples, taken when shoaling had reduced to a comparatively low rate (see Inclosure 3), were composed almost entirely of sand. Samples of the natural bottom surrounding the pit show the surface material to be composed almost entirely of fine sand. A few (4 out of 40) of the samples contained silt fractions as high as 10 to 18 percent. These were all taken during late spring and summer months. One sample, taken in July, contained 43 percent silt.

b. Pit B. The earliest sample taken in this pit, when the pit was 33% filled, contained a high proportion of sand. Subsequent samples, taken while the pit was shoaling to 82% of its capacity, were composed almost entirely of silt with median grain size about 30 microns. Samples taken after August 1958, when the shoaling had reduced to a nominal rate, contained increasing proportions of sand. The last sample, taken in January 1959, consisted

almost entirely of fine sand with median diameter of 90 microns, corresponding to material composing the natural bottom nearby. Additional beach and nearshore bottom samples to a depth of about 28 feet indicate that the silt fraction increases with depth, ranging from 1% on the beach to 25% or more at 28 feet depth.

c. Pit C. Shoaling in this pit was predominantly in the silt and clay range with the median diameter of samples ranging from 6 to 50 microns. Samples containing sand in excess of 20% were taken only in winter months. The natural bed in this region of Chandeleur and Breton Sounds, which includes the areas adjacent to Pits C and E, is composed of well-sorted fine material with median diameter from 60 to 80 microns. (See Report by L.S.U., 1 Sept. 1955, "Trafficability and Navigability of Louisiana Coastal Marshes"). The shoaling material is thus composed of material which would represent the finer fraction of surface material on the adjoining bed of the waterway.

d. Pit D. Shoaling material in this pit consisted almost entirely of silt and clay with median diameter less than 30 microns in 9 out of 10 samplings. A single sample taken from the spoil area 2,000 feet northeast of the pit and another taken midway between the pit and the spoil area contained negligible silt fractions and were of median diameter comparable to beach sand. Data contained in the L.S.U. report referred to above indicate that a substantial proportion of the bed material slightly seaward of this location may be in the silt and clay range.

e. Pit E. Silt and clay predominate in the shoaling of this pit although two samples on successive days in December 1958 showed the shoal surface to be composed of sand. Except for this occasion the median diameter of shoaling material did not exceed 30 microns.

f. Density of shoaling material. In December 1958 a number of observations were made at pits A, C, D and E with the Beach Erosion Board Sediment Density Probe. Results are shown in Inclosure 6. In general, the results at each pit showed relatively high density from the surface downward. The density, while generally increasing with depth as would be expected if the shoal material consisted entirely of mud, showed some departures which indicate the possibility of subsurface strata composed of mixed sand and mud. Surface sampling tends to support this possibility. Leadline penetration was generally only 0.1' to 0.2' (as compared with fathometer depth) except at Pit E where the lead penetrated 0.5' to 1.0'. The probe indicated a somewhat lower density in the shoal surface at this location as compared with other pits. Efforts to detect a density layer of suspended sediment near the bottom were unsuccessful.

6. Tide and Current Data. Recorded tide observations were made during 1958 at stations located at the entrance to Pass A Loutre, in Breton Sound near Breton Island, and in Chandeleur Sound near Point Chicot. Also available are U. S. C. & G. S. high and low tide

predictions for Chandeleur Light which is located at the northerly end of the Chandeleur Island arc. Comparison of the recorded tide data for Breton Island and predicted tide data for Chandeleur Light indicates that there is a time lag of high and low water at Chandeleur Light probably in the order of 2-2-1/2 hours. Also, the recorded tide data for Pass A Loutre, Breton Island, and Point Chicot indicate that, excluding occasional reversal by wind effects, there is generally a slight slope of the water surface between Pass A Loutre to Point Chicot throughout the tidal cycle. This general pattern would suggest that the tidal wave is propagated northward through Chandeleur Sound and that this may produce a tidal circulation pattern with slightly dominant flood flow into the Sound at the southern end of the Chandeleur Islands and slight ebb predominance at the northern end. Such a flow pattern would tend to provide a continuous source of supply, to waters in Chandeleur Sound, of the finer fraction of sediments discharged by Mississippi River distributaries. In the shallow waters of the Sound the turbulence created by wave action is sufficient to prevent settlement of the finer sediments. It is probable that such sediment does not reach final deposition until it reaches protected bays within the marshes or deeper waters in the Gulf.

7. Current observations were made fairly continuously for 23 months at Stations A, B, and C, located respectively in depths of about 3, 9 and 13 feet along a line parallel to Route D (see Inclosure 1). The data for Towers B and C were analyzed to determine the proportion of time the current direction had northerly or southerly directional components with respect to alinement of Route D and the mean of velocities for each component. (Tower A was omitted because of its proximity to the mainland). Results are tabulated below. These tend to confirm the predominance of northerly flow in the circulation pattern of Chandeleur Sound as discussed in the preceding paragraph.

Tabulation of Current Velocities from North & South of Channel Alignment "D"

Station C (Tower in Chandeleur Sound)

Current Vel. (ft./sec.)	No. Obs.	(300°-0-120°) Current Component from North to South	(121°-299°) Current Component from South to North
0.34	519	179	340
0.51	139	33	106
0.68	47	13	34
0.85	16	3	13
1.02	2	0	2
Totals	723	228	495

Tabulation of Current Velocities from North & South
of Channel Alignment "D" (Cont'd)

Station B (Tower in Chandeleur Sound)

Current Vel. (ft./sec.)	No. Obs.	(300°-0-120°) Current Component from North to South	(121°-299°) Current Component from South to North
0.34	367	122	245
0.51	99	35	64
0.68	27	3	24
0.85	13	2	11
1.02	3	2	1
1.19	2	1	1
Totals	511	165	346

8. Wave data. No recorded wave data were obatined but wave heights and directions were estimated in the vicinity of pits A, C, D and E whenever personnel were in the vicinity. Inclosure 7 is a graph of the wave height frequency with notes on predominant wave direction. While the observations were too limited to be of statistical value, they indicate a probability that wave heights sufficient to maintain silt and clay sediments in suspension in the depths throughout Chandeleur Sound are likely to occur more than half the time.

9. Discussion and analysis of data. The manner and rates of shoaling in the test pits demonstrate that there is probably an inexhaustible supply of fine sediment available for rapid and continuous shoaling of a channel along any route through Chandeleur Sound. The Mississippi River is the obvious primary source of shoaling material with transport effected by tidal and wind generated currents aided by the turbulence of wave action. Fine sediments now available in the beds of the bays and sounds of the delta area are sufficient to provide a shoaling source which would not diminish within the foreseeable future even if no continuing supply of river-borne sediment were available. Depths in Chandeleur Sound and the Gulf slopes beyond the Chandeleur Islands appear to be in a delicate state of balance between the abundant supplies of sediment available and the forces that tend to disperse and distribute the sediment. The high shoaling rate in Gulfport Harbor and in its access channel across Mississippi Sound indicates that a similar condition exists in those waters. It seems quite probable that the same condition exists throughout open water areas in the delta complex including Lake Borgne.

10. Shoaling observed at pits C, D and B indicate that while regular maintenance dredging will be required, no extraordinary difficulty may be expected in maintaining project depth through Chandeleur Sound. Shoaling could be reduced by construction of impermeable dikes on each side of the channel but the cost of building and maintaining such structures would exceed the cost of maintenance dredging many times. Any openings in the dikes, either terminal or intermediate, would permit the introduction of sediment-laden water with resulting shoaling over considerable lengths of channel. It is clear that material to be dredged, either initially or as maintenance, would be of no value for dike construction. Such dikes, on either of the 3 routes under consideration, would have far-reaching effects upon all natural processes in the delta area which would have to be carefully considered prior to a decision to provide them. In extremely shallow areas, where excessive shoaling sufficient to block the channel could occur as a result of an unusually severe storm, dike protection is considered advisable. Such conditions exist where each route enters Chandeleur Sound from the marshes and on the Sound side of the Chandeleur Islands in the case of Route D. It is believed that termination of such dikes at 6-foot depth in the Sound would provide adequate security against catastrophic shoaling.

11. Shore effects of jetties on Route D. Accretion may be expected on the Gulf shore north of the north jetty, probably closing present openings in that area of the island chain. The rate cannot be predicted from present data but it is probable that extension of the jetty would be required within a period of 10 to 20 years. Erosion would normally occur to the south of the south jetty but could be readily compensated by depositing initial and maintenance dredge spoil southward of the channel.

12. Estimated shoaling rates. Based upon shoaling rates observed in the 5 test pits, it seems apparent that average shoaling rates at any point will vary primarily with depth, however the rate in exposed Gulf waters will be much higher than in areas of corresponding depth within the Sound. In the case of Route D the channel would be protected by dikes on the Sound side and jetties on the Gulf side for a total length of about 2.2. miles. Tidal velocities in this channel, while expected to be quite low under all except possibly hurricane conditions, would be sufficient to introduce a large volume of sediment-laden water at each change of tide, both flood and ebb. Protection from wave action would result in comparatively rapid settlement of suspended sediment with a correspondingly high shoaling rate in that segment. Similar shoaling may be expected to occur in the diked sections of all 3 routes where they enter Chandeleur Sound from the marshes, however there should be little difference in the shoaling rate of any route in these reaches.

13. Inclosure 8 is a graphic explanation of estimated minimum shoaling rates for the 3 routes under consideration, extending in each case from the dike ends at 6 feet depth in Chandeleur Sound to project depth in the Gulf. Following is a tabulation of the resulting estimated minimum shoaling rate for each route.

Estimated Minimum Annual Shoaling Rates
(Mile 0 is the Gulf terminus of the channel)

Route D

Segment	Length (miles)	Shoaling rate per mile	Estimated annual shoaling, c.y.
Mile 0 to 5.6	5.6	430,000	2,408,000
5.6 to 7.8	2.2	400,000	880,000
7.8 to 8.7	0.8	350,000	315,000
8.7 to 14.3	5.6	220,000	1,232,000
14.3 to 25.8	11.5	260,000	3,010,000
Total 25.8 miles			7,845,000

Route B

Mile 0 to 3.4	3.4	210,000	714,000
3.4 to 6.4	3.0	500,000	1,500,000
6.4 to 10.2	3.8	250,000	910,000
10.2 to 19.9	9.7	180,000	1,746,000
19.9 to 27.6	7.7	280,000	2,156,000
Total 27.6 miles			7,026,000

Route E-6

Mile 0 to 5.1	5.1	50,000	255,000
5.1 to 7.3	2.2	100,000	220,000
7.3 to 15.9	8.6	250,000	2,150,000
Total 15.9 miles			2,625,000

14. It will be noted that the estimates above result primarily from extrapolating data from shoaling rates in the test pits whereas the project channel will be somewhat deeper and 5 times as wide. Inclosure 9 is a discussion of the shoaling potential based upon various quantities of suspended sediment in waters which will move across the channel. It is believed possible that actual shoaling rates might exceed the estimated minimum by as much as 100%, however the estimates are considered to be valid for the purpose of comparing relative maintenance problems and costs for the 3 routes. Available data on shoaling rates in various segment of the Gulfport Channel, while slightly higher in the shallow sound reach and within the harbor, tend to support in general the minimum estimate presented in the table above.

15. Alinement of Route E-6. A study of the air photos and topography indicate that considerable advantage might be gained by realining Route E-6 to a course between Fishing Smack and Drum Bays as shown by dashed line on Inclosure 1. While this would increase the channel length

approximately 3 miles, it would practically eliminate traversing open water within the marshes thus minimizing the shoaling potential and possible detrimental effect upon fish and wildlife.

16. Geological data. The Waterways Experiment Station Miscellaneous Paper No. 3-259, February 1958, and comments made in a letter from the Director, W.E.S. to the Division Engineer 7 March 1958 transmitting the report, have been carefully reviewed. All statements in the latter paper are concurred in except the last sentence in paragraph 10, quoted as follows: "And finally, judging from the direction of movement of the North and Freemason Groups of islands during the last 100 years, the spoil should be placed on the south side of the channel." It cannot be established with certainty that the change in area and position of these islands is truly a migration in the sense of indicating the direction of sediment transport within the Sound. It could be hypothesized that the changes might occur entirely as a result of infrequent severe storms or that the combined effects of subsidence and sediment accretion from the south could produce the changes in area and position of the islands. Surficial sediment would be transported primarily by wave induced currents whereas suspended sediments in deeper water would be less sensitive to wave direction than to the mass circulation pattern of the waterway. It is believed that available evidence more strongly supports a general northward dispersion of sediment within the Sound and for that reason disposal of spoil to the north would more probably minimize channel shoaling from dredged spoil. Statements contained in paragraphs 13 and 14 of the above-referenced letter have been particularly noted as being in complete accord with the findings of this report.

17. Dredging methods. Existing depths on any route through Chandeleur Sound would necessitate the use of shallow draft dredging equipment over a major portion of the route. It is presumed that conventional pipeline dredging equipment would be the only suitable plant where the existing depth is less than 12 feet. With such plant it is believed desirable to dispose of the dredged material as far north of the channel as may be economically practicable which should be at least 4,000 feet for any large modern dredge. For areas exceeding 12 feet in depth and for all maintenance dredging in open water, it is recommended that consideration be given to an overboard-disposal dredge of the "Sealanes" type. The "Sealanes", a converted T-2 tanker with twin pumps and drag-heads comparable to those on the "Essayons", has a dredging capability of about 5,000 cubic yards per hour in mud and discharges through a pipe boomed 250 feet off the side of the vessel. Productivity is dependent upon the proportion of material placed in suspension which is carried away from the channel by transverse currents and it is therefore most effective when the dredged material contains little or no sand. The "Sealanes" has just completed a channel 22 miles long, 34 feet deep and 400 feet wide through a bar composed almost entirely of silt and clay at the mouth of the Orinoco River. The original depth over a major portion of the route averaged 11 feet. The effective production rate of the dredge cannot be accurately determined since the shoaling rate from fresh riverborne sediment is not yet known but it was probably in excess

of 1-1/2 million cubic yards a month. The Chandeleur Sound area appears to be particularly suited for economical dredging by this method.

18. Summary and Conclusions. Data obtained in the course of this investigation are believed to establish conclusively that shoaling rates will be high on any route traversing Chandeleur Sound. It is evident that shoaling of comparable magnitude could be expected in any route through Mississippi Sound or Lake Borgne. While not included for consideration in this study it is believed that a similarly detailed study of Routes E-1 through E-5, previously considered and rejected by higher authority, would determine annual costs of any of those routes to be substantially higher than the costs of Routes E-6, B or D.

19. Comparative quantities of initial dredging or right-of-way costs required Gulfward from the common point of Routes E-6, B and D are not available here. Inspection of the chart indicates that the difference in these costs for the three routes is likely to be small in comparison with other factors. Route D in addition to requiring jetties at a first cost of $7.7 million and estimated annual maintenance of $80,000, which would not be needed on the other routes, has also the highest estimated shoaling rate and the most difficult maintenance problem. Route B, while considerably less costly than Route D, would likewise pose a difficult maintenance problem probably requiring semi-annual maintenance in the bar segment. Route E-6, with an estimated shoaling rate approximately a third that of the other routes and no foreseeable extraordinary maintenance problems, is outstandingly superior from a cost standpoint.

20. The Beach Erosion Board Staff concludes that:

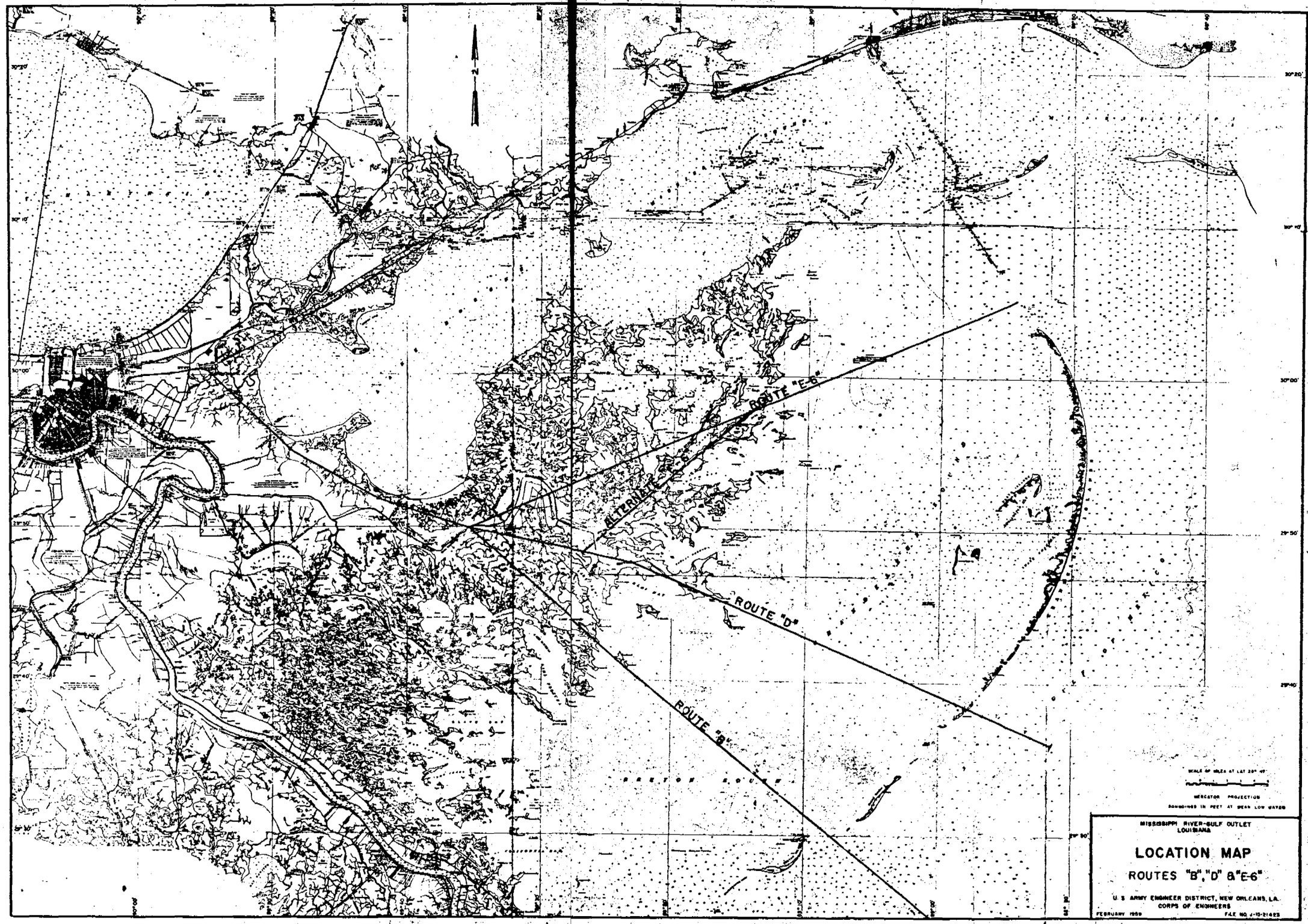
a. Route E-6 is first and Route B is second in order of preference of the three routes considered.

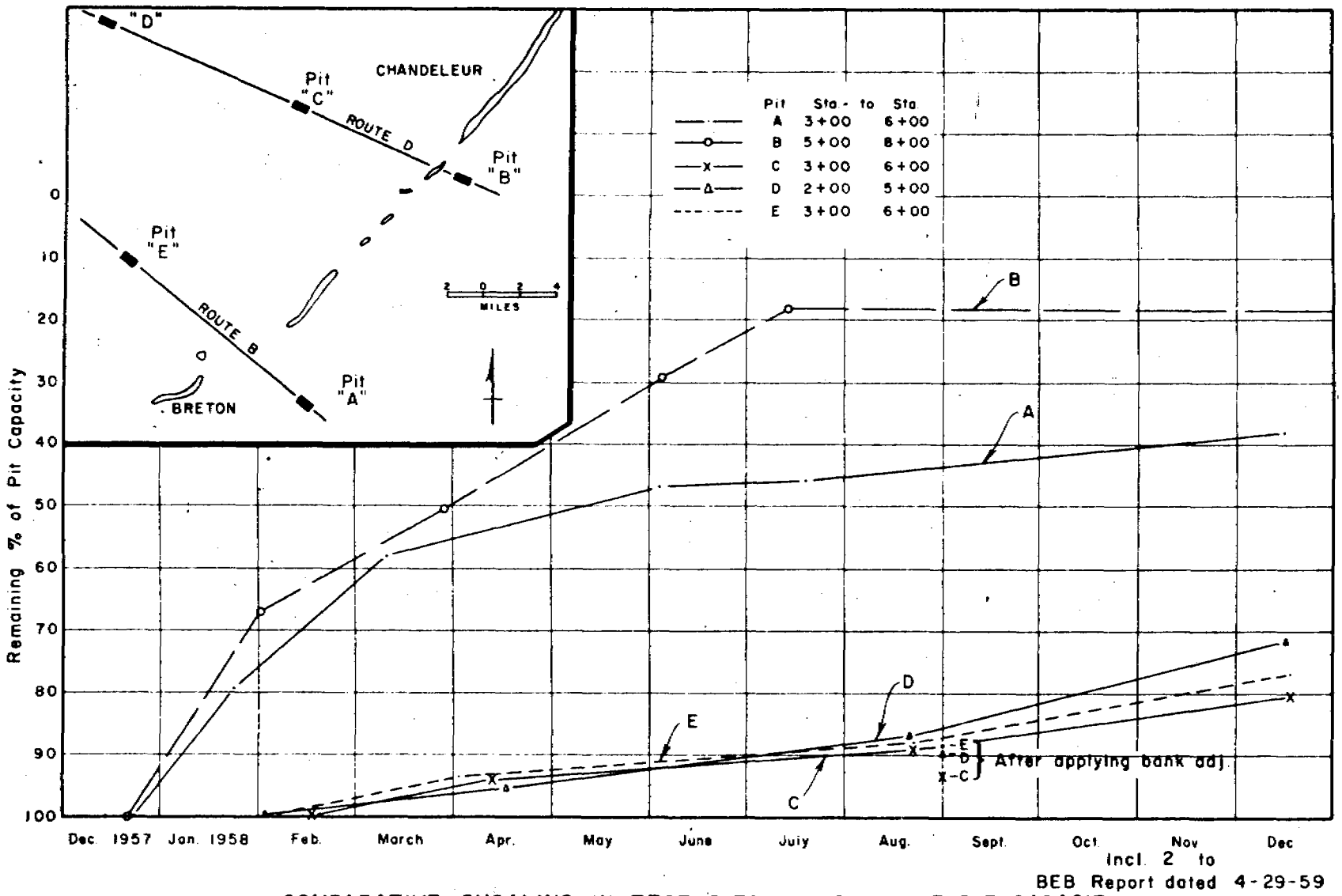
b. Consideration should be given to minor realinement of Route E-6 to avoid open water areas.

c. Retention dikes should be initially provided landward of approximately 6 feet depth in Chandeleur Sound.

d. Dredge spoil should be deposited north of the channel in Chandeleur Sound at the maximum distance practicable without increase in cost by loss of dredge production (probably about 4,000 feet).

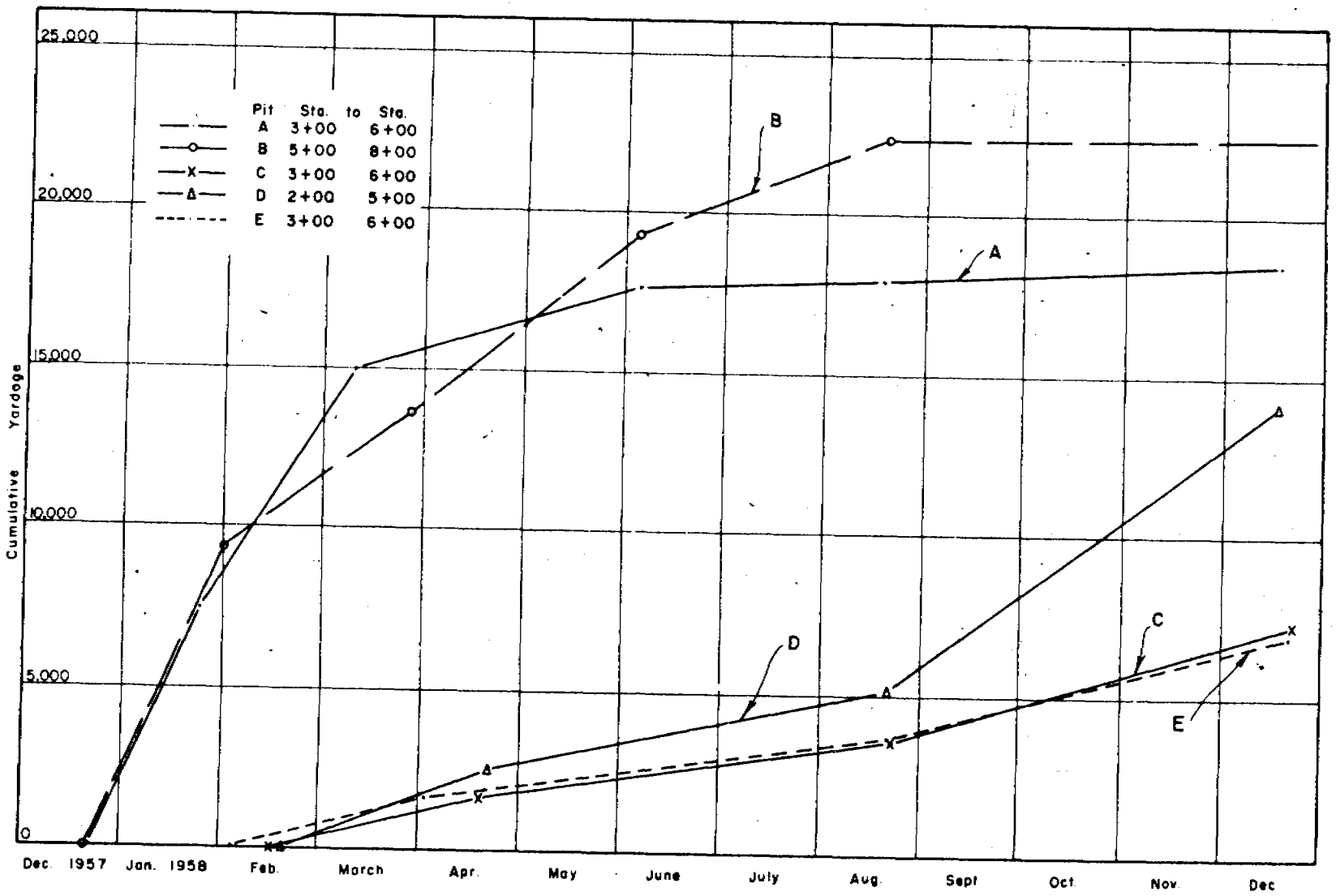
e. Consideration should be given to utilizing an "overboard disposal" dredge of the "Sealanes" type for channel maintenance in Chandeleur Sound.


ROUTE "E-6"
ALTERNATE
ROUTE "D"
ROUTE "B"
MERCATOR PROJECTION
MISSISSIPPI RIVER-GULF OUTLET
LOUISIANA
LOCATION MAP
ROUTES "B","D" & "E-6"
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
CORPS OF ENGINEERS
FEBRUARY 1959



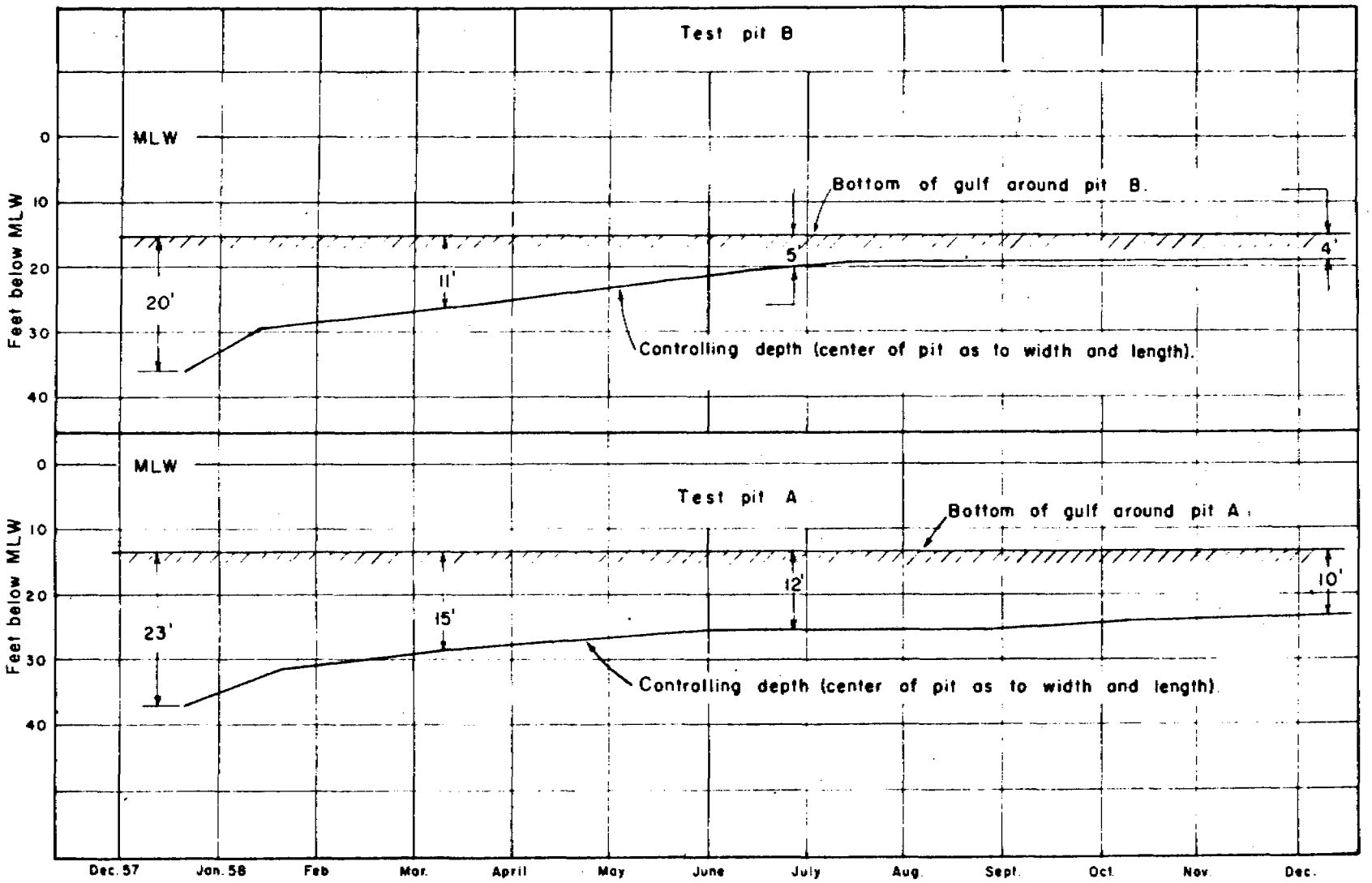
Incl. 2 to
BEB Report dated 4-29-59

COMPARATIVE SHOALING IN TEST PITS IN TERMS OF PIT CAPACITY



Incl. 3 to
BEB Report dated 4-29-59

COMPARATIVE SHOALING IN PITS IN TERMS OF CUMULATIVE VOLUME



Incl 4 to
BEB Report dated 4-29-59

COMPARATIVE REDUCTION IN DEPTH OF PITS A AND B DUE TO SHOALING

Incl. 5 to
BEB report dated
4-29-59

ANALYSIS OF BOTTOM SURFACE SAMPLES
TEST PIT A

Location of Sample	Date	% of Pit Filled	PERCENT Sand	Silt	S&C	Clay	Mdo mm.
Centerline of Pit	2/ 5/58	25	81		19		0.150
	4/22/58	48	8	76		16	0.030
	6/ 4/58	54	37	53		10	0.050
	7/18/58	55	99		1		0.180
	8/26/58	55	25	55		20	0.040
	10/ 6/58	58	90		10		0.150
	12/17/58	60	99		1		0.160
	1/28/59	63	98		2		0.160
3000 ft. SE of Pit	3/11/58		98		2		0.150
	4/22/58		88		12		0.150
	6/ 4/58		82		18		0.090
	8/26/58		98		2		0.190
	10/ 6/58		99		1		0.150
	12/17/58		99		1		0.180
8000 ft. SE of Pit	3/11/58		97		3		0.120
	4/22/58		94		6		0.100
	6/ 4/58		90		10		0.140
	7/18/58		98		2		0.120
	8/26/58		96		4		0.120
	10/ 6/58		98		2		0.140
	12/17/58		99		1		0.140
2500 ft. SW of Pit	3/11/58		99		1		0.170
	4/22/58		92		8		0.100
	6/ 4/58		96		4		0.150
	7/18/58		99		1		0.150
	8/26/58		98		2		0.170
	10/ 6/58		99		1		0.170
	12/17/58		99		1		0.160
3000 ft. NW of Pit	3/11/58		99		1		0.210
	6/ 4/58		99		1		0.160
	7/18/58		99		1		0.200
	8/26/58		98		2		0.160
	10/ 6/58		99		1		0.160
	12/17/58		98		2		0.160
10,000 ft. NW of Pit	3/11/58		99		1		0.190
	4/22/58		99		1		0.180
	6/ 4/58		99		1		0.150
	7/18/58		57	43			0.080
	8/26/58		87		13		0.150
	10/ 6/58		99		1		0.170
	12/17/58		97		3		0.130
2500 ft. NE of Pit	3/11/58		97		3		0.140
	4/22/58		98		2		0.140
	6/ 4/58		99		1		0.130
	7/18/58		99		1		0.140
	8/26/58		98		2		0.170
	10/ 6/58		99		1		0.180
	12/17/58		99		1		0.180

Incl. 5 to BEB report dated 4-29-59

ANALYSIS OF BOTTOM SURFACE SAMPLES

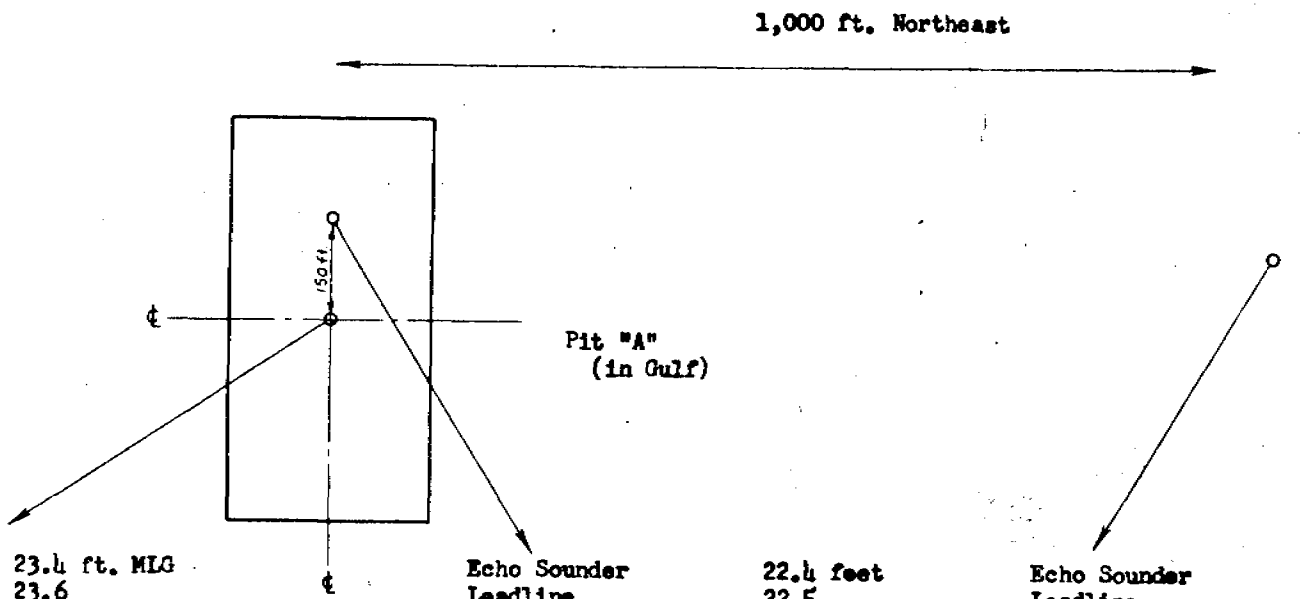
TEST PIT B

Location of Sample	Date	% of Pit Filled	PERCENT Sand	Silt	S&C	Clay	Md_o mm.
Centerline of Pit	1/30/58	33	75		25		0.080
	3/27/58	48	5	80		15	0.035
	6/ 3/58	70	3	82		14	0.030
	7/17/58	82	3	70		26	0.020
	8/27/58	82	3	33		64	0.001
	10/ 9/58	82	12	67		21	0.020
	1/26/59	82	90		10		0.090
6600 ft. SE of Pit	3/27/58		6	79		15	0.035
	6/ 3/58		79		21		0.100
	7/17/58		69		31		0.080
	8/27/58		78		22		0.085
	10/ 9/58		87		13		0.100
	1/26/59		32	26		42	0.040
2500 ft. SW of Pit	3/27/58		98		2		0.118
	6/ 3/58		85		15		0.090
	7/17/58		93		7		0.095
	8/27/58		90		10		0.100
	10/ 9/58		91		9		0.100
	1/26/59		93		7		0.120
1000 ft. NW of Pit	3/27/58		97		3		0.170
	6/ 3/58		94		6		0.095
	7/17/58		96		4		0.100
	8/27/58		93		7		0.110
	10/ 9/58		89		11		0.095
	1/26/59		90		10		0.090
2700 ft. NW of Pit	3/27/58		97		3		0.180
	6/ 3/58		99		1		0.140
	7/17/58		96		4		0.095
	8/27/58		94		6		0.100
	10/ 9/58		93		7		0.120
	1/26/59		96		4		0.110
MLW on Beach	3/27/58		99		1		0.180
	6/ 5/58		97		2		0.130
	10/ 9/58		100				0.160
MHW on Beach	3/27/58		99		1		0.180
	6/ 5/58		99		1		0.150
	10/ 9/58		100				0.160
2500 ft. NE of Pit	3/27/58		4	38		59	0.003
	6/ 3/58		77		23		0.095
	7/17/58		36	46		17	0.070
	8/27/58		76		24		0.095
	10/ 9/58		84		16		0.090
	1/26/59		20	31		49	0.005

Incl. 5 to
BEB report dated
4-29-59

ANALYSIS OF BOTTOM SURFACE SAMPLES

Location of Sample	Date	% of Pit Filled	PERCENT Sand	Silt	S&C	Clay	Md_o mm.
TEST PIT C							
Centerline of Pit	2/27/58	2	28	47		25	0.050
" " "	2/13/58	2	17	41		42	0.009
" " "	4/17/58	5	19	60		21	0.035
" " "	5/23/58	5	4	50		46	0.006
" " "	7/10/58	10	1	47		52	0.006
" " "	8/22/58	11	10	62		28	0.020
" " "	10/10/58	15	2	49		49	0.006
" " "	1/29/59	20	23	56		21	0.040
TEST PIT D							
Centerline of Pit	3/ 5/58	3	2	76		22	0.025
" " "	2/20/58	2	4	52		44	0.007
" " "	4/ 4/58	5	3	68		28	0.020
" " "	4/21/58	5	15	69		15	0.030
" " "	5/22/58	6	1	66		33	0.010
" " "	5/28/58	6	1	60		39	0.010
" " "	7/ 9/58	10	2	47		51	0.005
" " "	8/20/58	11	1	69		30	0.020
" " "	10/ 3/58	20	1	52		47	0.007
" " "	12/17/58	25	26		74		0.050
" " "	1/22/59	30	5	70		25	0.030
Spoil Area	1/22/59		99		1		0.160
1000 ft. SW of Pit	1/22/59		96		4		0.170
TEST PIT E							
Centerline of Pit	2/26/58	2	5	70		24	0.030
" " "	2/ 5/58	2	1	37		62	0.003
" " "	4/ 1/58	4	1	56		42	0.009
" " "	5/26/58	5	1	63		36	0.010
" " "	7/15/58	10	1	59		40	0.010
" " "	10/ 8/58	17	1	70		28	0.020
" " "	12/18/58	21	96		4		0.150
" " "	12/19/58	21	98		2		0.130
" " "	1/23/59	23	2	57		41	0.010



Echo Sounder	23.4 ft. MLG
Leadline	23.6
Probe 1020 at	21.7
(med. dia. = 0.16mm at -22')	
1580 at	24.7
1486 at	27.7
1465 at	28.7
1605 at	29.7
Dredged depth 150' from bouy line,	35.0
Original depth,	13.0

Echo Sounder	22.4 feet
Leadline	22.5
Probe 1715 at	23.2
1665 at	24.7
1475 at	26.2
1560 at	27.7
1460 at	29.0
1770 at	30.3
Dredged depth 150' from buoy line,	30.0
Original depth,	13.0

Echo Sounder	13.4 ft.
Leadline	13.6
Probe 1018 at	12.2
1940 at	14.2

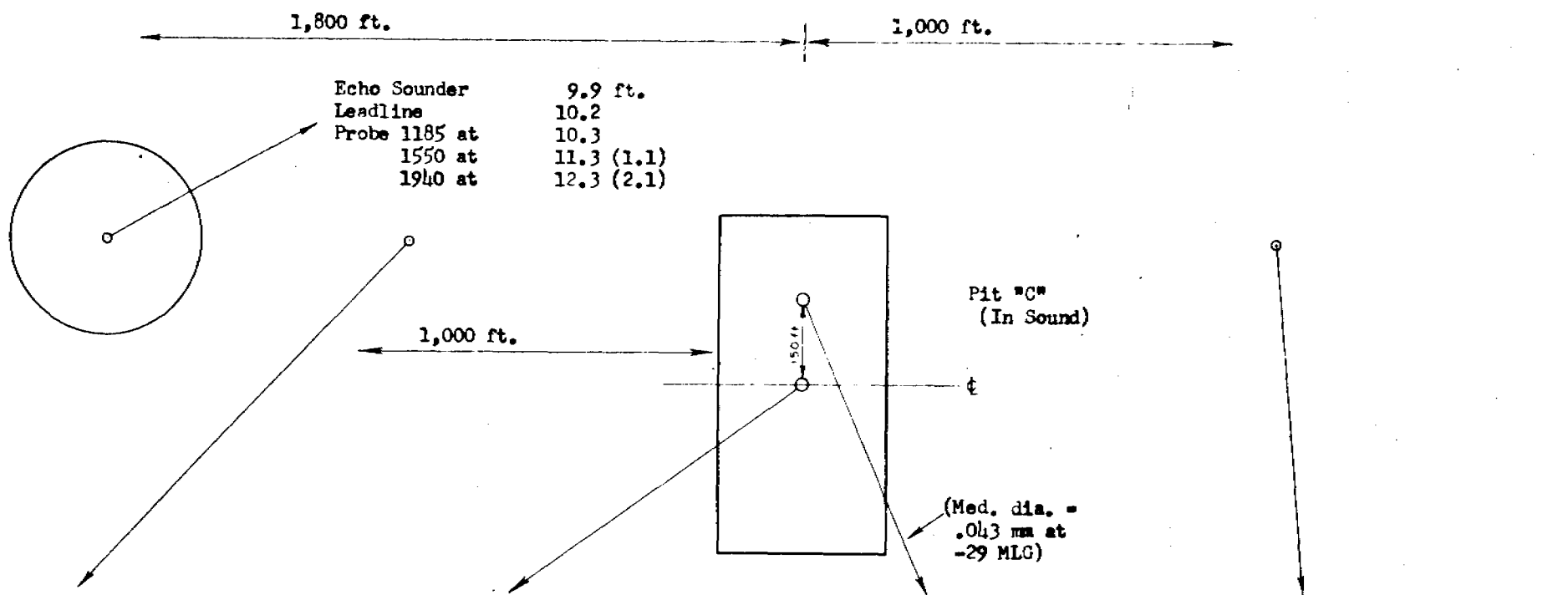
NOTE:

(1) All determinations based on a 5-minute count. Probable error ± 5 gr/liter.
(2) Seawater density = 1026 grams per liter.
(3) Depths are given in feet below mean low gulf (MLG).
(4) Densities are given in grams per liter (thus, 1377).
(5) The probe senses a layer about 1 foot thick centered on the depth given.
(6) Density of saturated fine sand is 1940 grams per liter.

BOTTOM DENSITIES IN GULF
OFF CHANDELEUR SOUND
28 January 1959

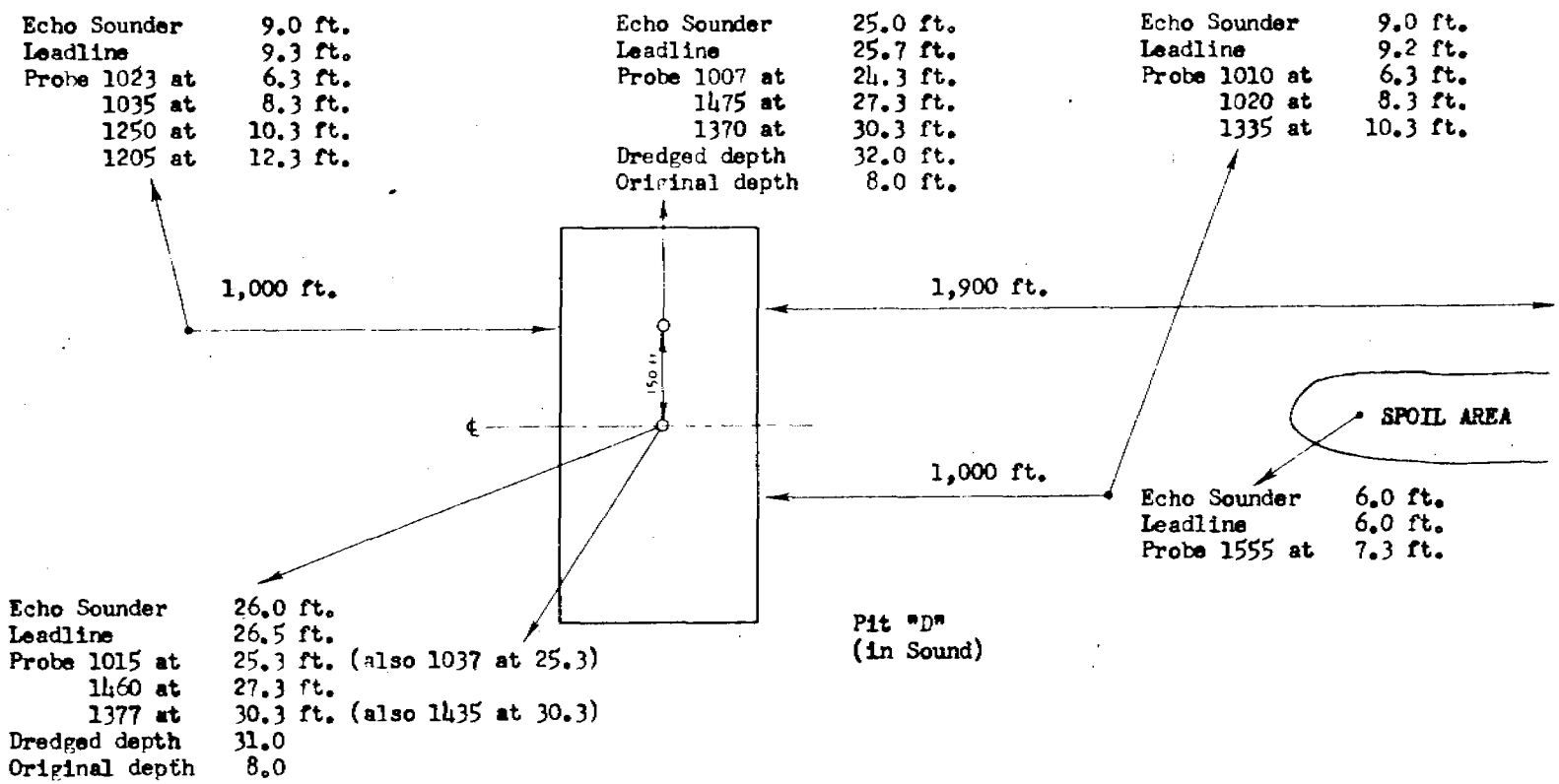
Incl. 6 to BEB report dated 4-29-59

PIT A



NOTE: Clean fine sand in water = 1940 grams per liter.
See sheet on Pit D for explanation.

BOTTOM DENSITIES IN
CHANDELEUR SOUND ON
29 January 1959

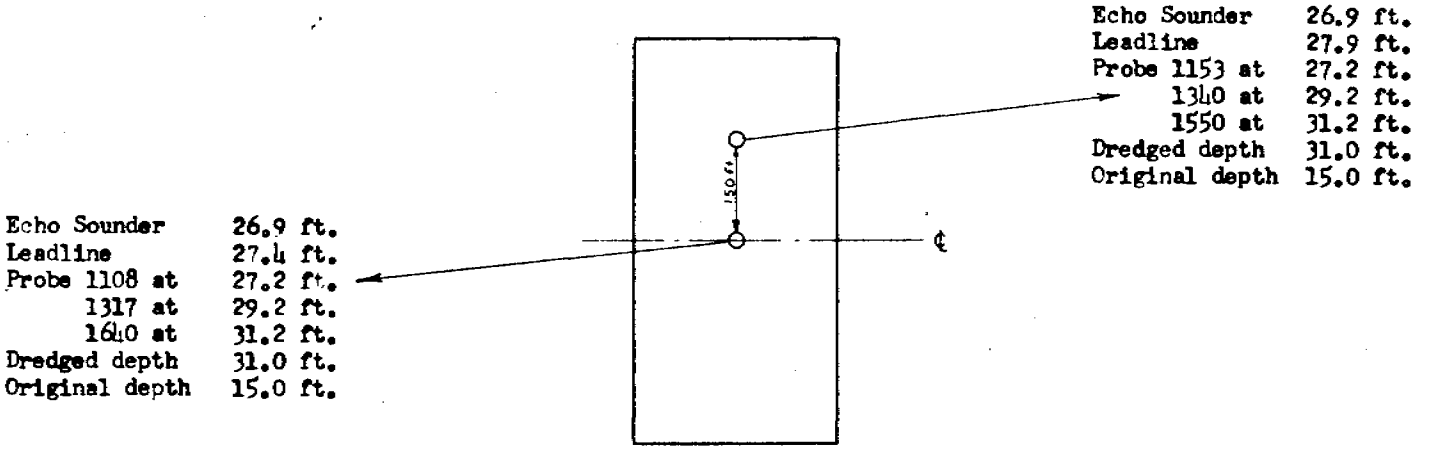


NOTE:

(1) All determinations based on a 5-minute count. Probable error ± 5 gr/liter.
(2) Seawater density = 1026 grams per liter.
(3) Depths are given in feet below mean low gulf.(MLG).
(4) Densities are given in grams per liter (thus, 1377).
(5) The probe senses a layer about 1 foot thick centered on the depth given.
(6) Density of saturated fine sand is 1940 grams per liter.

BOTTOM DENSITIES IN
CHANDELEUR SOUND ON
22 January 1959
Densities as determined with [redacted] Density Probe.

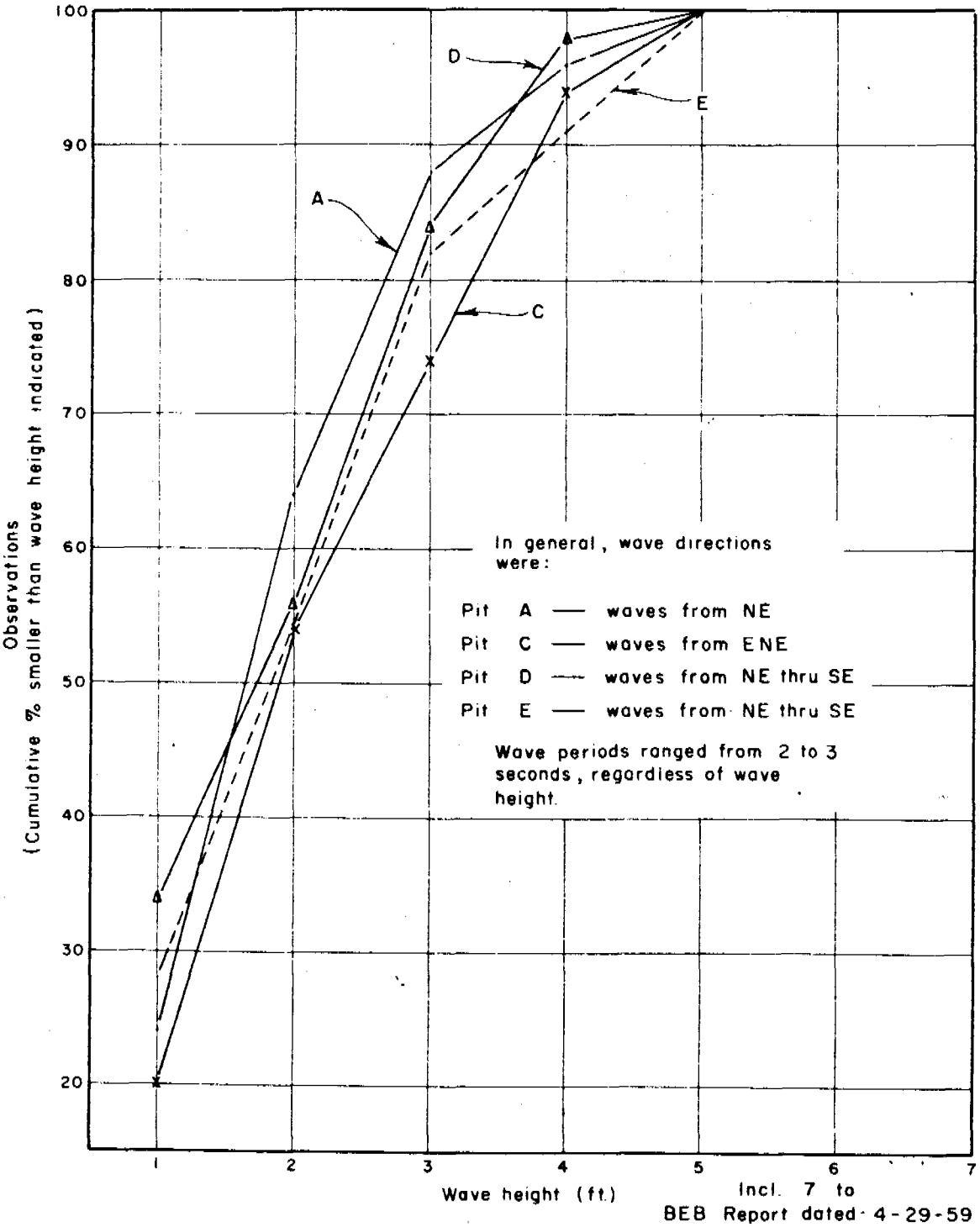
PIT E



BOTTOM DENSITIES IN
CHANDELEUR SOUND ON
23 January 1959
Densities as determined with BEB Density Probe.

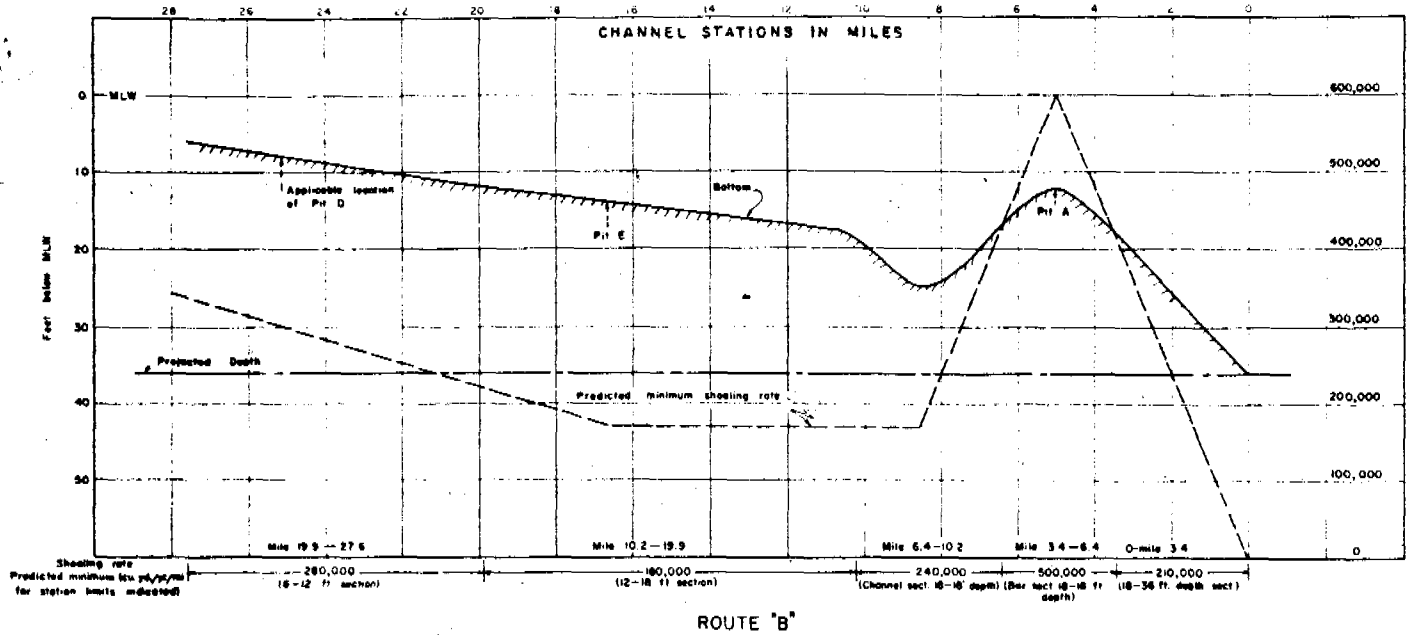
NOTE:
See sheet on Pit D
for explanation

Incl. 6 to BEB report dated 4-29-59

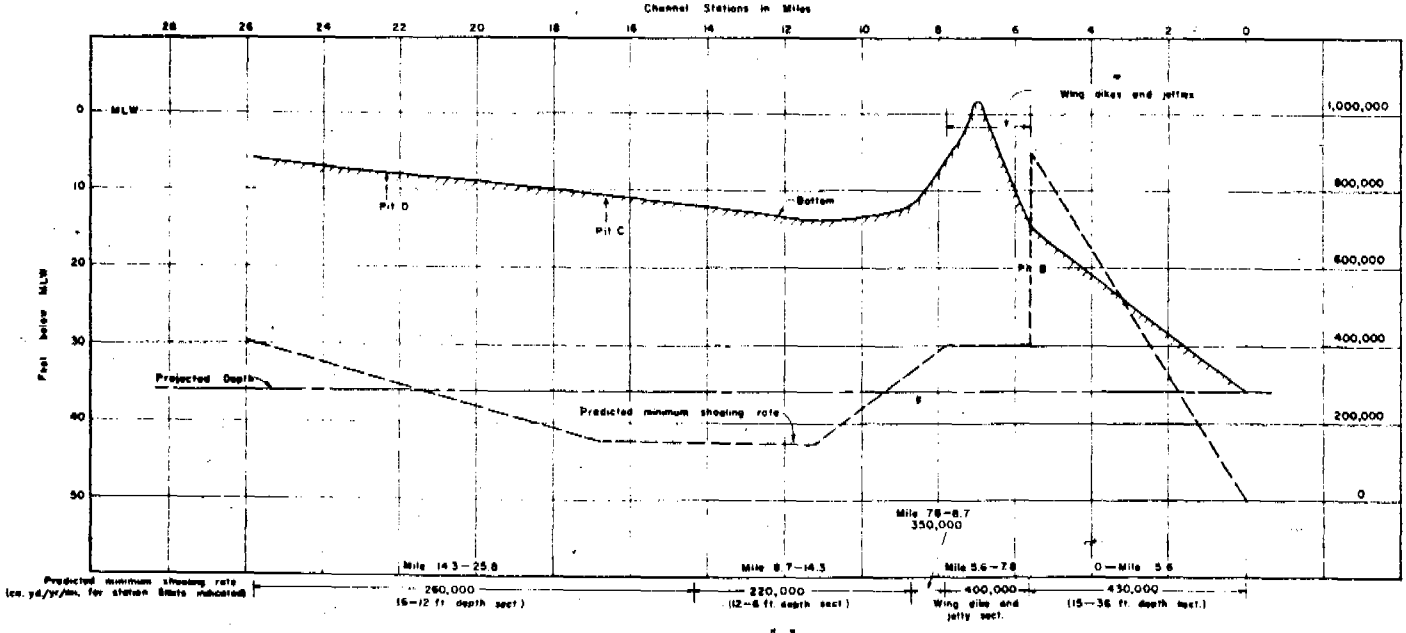


Incl. 7 to
BEB Report dated 4-29-59

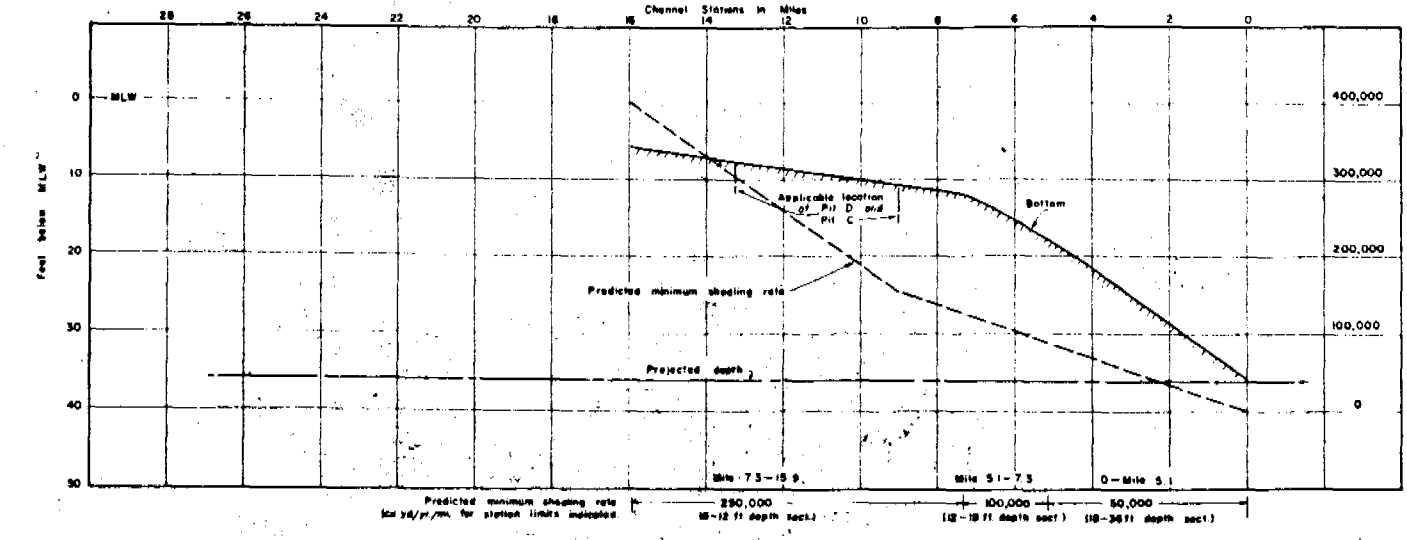
PLOT OF OBSERVED WAVE DATA AT TEST PITS



ROUTE "B"



ROUTE "D"



ROUTE "E-6"

Ind 8 to B.E.B. Report dated 4-29-59

PREDICTED MINIMUM SHOALING RATES BASED ON TEST PIT SHOALING DATA

BEACH EROSION BOARD
28 April 1959

Incl. 9 to BEB report dated
4-29-59

POTENTIAL SHOALING

IN

CHANDELEUR SOUND CHANNELS

1. The Mississippi River - Gulf Outlet Channel crosses the open waters of Chandeleur Sound for several miles. This channel will be 500 feet in width and 36 feet deep. The depth of the Sound varies from zero to about 18 feet.

2. The waters of the Sound are stirred by the tidal movements, the wind waves, and the wind-generated surges. The resulting turbulence of the waters of the Sound result in a turbid condition of the waters. The fine sand, silt, and clay composing the bottom of the Sound and the similar composition of the marshes, coupled with the sediment load fed into adjacent waters by the Mississippi River, make an almost unlimited supply of sedimentary materials available.

3. When the waters of the Sound are moved back and forth across the proposed deep water channels, the sediment in suspension in the water will tend to settle to bottom due to: (1) the decrease in velocity over the channel due to deepening the Sound to 36-feet for the channel; and (2) the decreased bottom turbulence over the channel due to surface wave action having less effect in the 36-foot depths.

4. The shoaling potential of the channel is, then, related to the sediment load normally in the water and the amount of water transported over the site of the channel. This potential shoaling is analyzed briefly in the following paragraphs. The various assumptions used in the analysis have not been arrived at through exhaustive analysis but appear reasonable from a brief study of the available data.

5. The suspended load (sediment load) concentration appears on the average to be in the order of 50 ppm by weight. Now let it be assumed, as an example, that as a cubic foot of water moves across the channel site, it drops 1 ppm of its load as a channel shoal.

6. This 1 ppm of solid material would have a weight of one-millionth of that of the cubic foot of water. At 64 lbs. per cubic foot for sea water, the wieght of the 1 ppm would be (0.000,001 x 64 =) 0.000,064 lbs.

7. Now, let it be assumed that the velocity of movement of the waters of the Sound averages about 0.1 foot per second and that the natural depth at the point of analysis is 10 feet. These figures

result in a rate of flow of (0.1 x 10=) 1.0 cu. ft./sec. per foot of channel length. In other words, the flow crossing the channel by entering from one side and leaving over the other side would be 1.0 cubic feet per second per foot of channel length.

8. There are (3600 x 24 x 365 =) 31,556,900 seconds in a year. Thus in a year's time, a total of about (31,500,000 x 1 =) 31,500,000 cu. ft. of water would move across each foot of length of channel. If each cubic foot dropped 1 ppm by weight of sediment, the total sediment dropped would be (31,500,000 x 0.000,064 =) 2,000 lbs. of dry sediment per foot of channel length per year.

9. Tests with an in-place density probe showed the shoal material in the test pits to have a bulk specific gravity of about 1.35; this indicates a sediment content of about 33 lbs. of dry sediment per cubic foot of shoal. Thus the 2,000 lbs. of dry sediment would produce a shoal volume of about 2,000/33 = 60 cu. ft. or about 2.2 cu. yds. per foot of channel length per year. Over a mile length of channel, the shoaling rate would be (2.2 x 5280 =) 12,000 cu. yds. per year.

10. The 12,000 cu. yds. per year per mile arrived at in the preceding paragraph is based on dropping only 1 ppm as shoal in the channel. Using 50 ppm as the average sediment content of the water, a table can be constructed as follows:

Dropout of 1 ppm =	12,000 cu. yds. shoal/yr/mile
Dropout of 5 ppm =	60,000 cu. yds. shoal/yr/mile
Dropout of 10 ppm =	120,000 cu. yds. shoal/yr/mile
Dropout of 20 ppm =	240,000 cu. yds. shoal/yr/mile
Dropout of 50 ppm =	600,000 cu. yds. shoal/yr/mile

11. The figure of 600,000 cu. yd/yr/mile would, in effect, be the full shoaling potential for the assumed conditions; it is, of course, very doubtful that this degree of shoaling would ever be reached. However, the figure does show that a shoaling potential of that order exists.

12. The actual shoal measurements in test pits C, D, and E in Chandeleur Sound showed the rate to be in the order of 150,000 to 250,000 cu. yds. per year per foot of channel for the test pit width of 100 feet. The project channel width is 500 feet, and it appears justified to state that the 500-foot channel could be expected to shoal at a greater rate per foot of length than did the 100-foot wide test pit.

13. In view of the above, it appears that shoaling rates for the Chandeleur Sound channels based directly on the shoaling rates in Pits C, D, and E should be considered as "not-less-than" figures and that a greater shoaling rate (as yet undetermined) can be expected.

MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA

GENERAL DESIGN MEMORANDUM NO. 2, GENERAL DESIGN

APPENDIX II

VIEWS OF LOCAL INTERESTS

Table of Contents

STATE OF LOUISIANA

Executive Department

Baton Rouge

Earl K. Long
Governor

December 10, 1956

Board of Commissioners
Port of New Orleans
P. O. Box 46
New Orleans, Louisiana

Gentlemen:

Public Law Number 455, 84th Congress, authorizes construction by the Corps of Engineers of a deep water navigation channel designated as the Mississippi River Gulf Outlet from the Mississippi River at New Orleans in an easterly direction across Orleans and St. Bernard Parishes to the Gulf of Mexico. The authorization provides that local interests furnish such lands, servitudes and rights-of-way necessary for the construction and maintenance of the project and that certain assurances as set forth in the law be given to the United States by a local agency.

After due consultation between Mr. Lorris Wimberly, Director of Public Works, and Dr. Robert W. French, Director of the Port of New Orleans, it has been decided that it is to the best interest of all concerned that the Board of Commissioners for the Port of New Orleans be designated as the state agency to give assurances of local cooperation to the Federal Government. I have, therefore, designated your body as the assuring agency and there is enclosed a copy of the Act of Designation for your information.

I am requesting Mr. Wimberly and his staff to cooperate with you in coordinating the project with the Corps of Engineers in order to bring about its completion at the earliest possible date. In laying out the alignment for the channel, it is requested that full consideration be given to the interest of all concerned and that a location be selected that will prove most beneficial to Orleans and St. Bernard Parishes and the State of Louisiana.

Sincerely yours,

/s/ EARL K. LONG

GOVERNOR

EKL:a
cc: U. S. Corps of Engineers
New Orleans, Louisiana

State Department of Public Works
Baton Rouge, Louisiana

ACT OF DESIGNATION

WHEREAS, upon the recommendation of the United States Army, Corps of Engineers, the Congress of the United States by Public Law No. 455, 84th Congress, approved March 29, 1956, has authorized the said Corps of Engineers to construct a deep water navigation channel or seaway canal from the Mississippi River at New Orleans, Louisiana to the Gulf of Mexico;

WHEREAS, the said navigation channel to be known as the Mississippi River-Gulf Outlet will pass through parts of the Parishes of Orleans and St. Bernard in which Parishes it will be necessary to secure lands, servitudes and rights-of-way necessary in connection with said construction and subsequent maintenance;

WHEREAS, the Congress of the United States has required that such lands, servitudes and rights-of-way necessary to said construction and maintenance be furnished by local interests and that certain assurances as set out in said law be given by said local interests to the United States:

WHEREAS, the construction of the said Mississippi-River-Gulf Outlet will be of inestimable value to -

1. The immediate area through which it passes.

2. The State of Louisiana and the City and Port of New Orleans.

3. The entire Mississippi Valley.

NOW, THEREFORE, by virtue of the authority vested in me by Section 81, Title 38, Louisiana Revised Statutes of 1950, I do hereby designate the Board of Commissioners of the Port of New Orleans to the extent to which they are lawfully empowered to acquire and furnish to the United States of America as required, such lands, servitudes and rights-of-way as are or may become necessary to the construction and maintenance of the Mississippi River-Gulf Outlet and to furnish to the United States the assurances of local participation required by said Public Law 455, 84th Congress.

THUS DONE AND SIGNED by me at my office in the City of Baton Rouge, Louisiana, on this 10th day of December, 1956.

/s/ EARL K. LONG
EARL L. LONG, GOVERNOR

I hereby certify that the original of the above and foregoing instrument was filed in the records of my office on this the 11th day of December, 1956.

/s/ Wade O. Martin, Jr.
Wade O. Martin, Jr.
Secretary of State

BOARD OF COMMISSIONERS OF THE PORT OF NEW ORLEANS
(An Agency of the State of Louisiana)
2 Canal Street
P. O. Box 46
New Orleans (6), La.

17 December 1956

The Honorable Earl K. Long
Governor
State of Louisiana
Baton Rouge

My dear Governor

On behalf of the Board of Commissioners of the Port of New Orleans I want to acknowledge receipt today of your letter of December 10, designating this Board as the assuring agency for the Mississippi River-Gulf Outlet project.

The Board is mindful of heavy responsibilities associated with its designation and will do its best to discharge those responsibilities to the interest of all concerned.

You may be sure that the Board will cooperate fully with the Department of Public Works, and with the Corps of Engineers in bringing this important project to completion at the earliest possible date.

Sincerely yours,

EDGAR A. G. BRIGHT
President

cc:
Mr. Lorris Wimberly
State Department of Public Works
Baton Rouge, Louisiana

Colonel William H. Lewis, USA
U.S.Corps of Engineers
New Orleans, La.

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Foot of Prytania Street
New Orleans 9, Louisiana

LMNGY

3 February 1959

Board of Commissioners of
the Port of New Orleans
No. 2 Canal Street
New Orleans, Louisiana

ATTENTION: Mr. R. W. French, Director

Gentlemen:

Reference is made to your letter dated 3 April 1957 approving the tentative alignment of the Mississippi River-Gulf Outlet Channel, generally as indicated by Route "D" on the inclosed map. This route has now been approved for construction from the Industrial Canal to Bayou LaLoutre Crossing.

For some time studies have been under way in Chandeleur Sound and the Gulf of Mexico with the view of determining the most economical crossing of Chandeleur Sound and the entrance into the Gulf. Two alternative routes, "E-6" and "B" are being studied in addition to Route "D".

Studies indicate that Routes "E-6" and "B" can be constructed without jetties and will be more economical to maintain. It is therefore requested that you review the several alignments of the project beyond Bayou LaLoutre and furnish the comments of your Board or any other planning groups or interests.

Since orderly prosecution of the project requires that the alignment be established at an early date, your prompt action in this matter will be appreciated.

Sincerely yours,

1 Incl.
Map, File J-15-21423

DUANE W. ACKERSON
Lt. Col., CE
Acting District Engineer

BOARD OF COMMISSIONERS OF THE PORT OF NEW ORLEANS
(An Agency of the State of Louisiana)
2 Canal Street
Post Office Box 46
New Orleans (6), La.

March 5, 1959

District Engineer
U.S. Army Engineer District, New Orleans
P.O. Box 267
New Orleans, Louisiana.

Dear Sir:

Reference is made to your letter, file No. LMNGY, dated February 3, 1959, requesting comments of this Board and other planning groups and interests, concerning the proposed routes for the Mississippi River-Gulf Outlet from Bayou La Loutre to the Gulf of Mexico. Reference is also made to the conference on this subject in your office on February 25, 1959.

Various aspects of this problem have been considered, including those pertaining to acquisition of rights-of-way, navigation, steamship operations, fish and wildlife values, development of terminal facilities and industrial sites, as well as engineering features. A number of other planning groups and interests have been consulted including experienced pilots, steamship organizations, fish and wildlife interests, civic organizations, and other state agencies. The facts and opinions obtained from these sources unanimously and strongly favor the selection of Route "D".

Route "D" represents decided advantages to navigation, industrial and other user interests. It will minimize the damage to fish and wildlife values. It will pass through an area through which the acquisition of rights-of-way unquestionably will be feasible. The selection of Route "D" would be consistent with the recommendations of the Chief of Engineers, as contained in House Document No. 245, 82d Congress, 1st Session. Accordingly, this Board recommends Route "D".

No advantages can be attributed to Route "E-6" by any of the agencies having cognizance of this project. To the contrary, the route presents serious disadvantages which militate strongly against its selection. The acquisition of rights-of-way would be more expensive and difficult. Over a portion of this route the ability of this Board to acquire timely the right-of-way is seriously questioned. Fish and wildlife values would be damaged to a serious degree. Navigation would be penalized by higher costs of operation

due to greater sailing distances. This route represents a wide excursion from the provisions of the project document alignment. Considering the various factors, this Board objects to the selection of Route "E-6," as being unsuitable and prejudicial to the interests of the Port of New Orleans, and the State of Louisiana.

Route "B" offers certain advantages which are outweighed, however, by its disadvantages. This route provides the shortest sailing distance and requires the least rights-of-way. However, it will cause serious damage to seed oyster beds and will interfere with extensive oil and gas productions in the Breton Sound area. Hazards to navigation are created by the lights of drilling rigs. The presence of these rigs will be confusing to pilots and navigators attempting passage of the channel through the Sound on Route "B". Furthermore, hazards to navigation exist in the approaches to this route. The selection of Route "B" is not favorably considered.

Additional remarks in extension of the above observations, together with certain economic factors, are contained in the following paragraphs. Correspondence received by this Board from other interests is attached for your information and records, being identified as Exhibits "A" through "D".

Navigation interests strongly favor Route "D" as indicated in the attached letter from the New Orleans Steamship Association, dated February 17, 1959 (Exhibit "A") and the letter from the American Merchant Marine Institute, Inc., dated February 20, 1959, (Exhibit "B"). In addition to the information contained in these letters, it is to be noted that the majority of vessels which will use the Mississippi River-Gulf Outlet in travelling to and from the Port of New Orleans will pass through either Yucatan Strait or the Straits of Florida. Using a focal point in Yucatan Strait the distances, in nautical miles, to the entrances of each of the proposed routes are: Route "B" - 497; Route "D" - 506.5; and Route "E-6" - 548.

It may be noted that the distance to Route "E-6" is 51 miles greater than to Route "B", and 41.5 miles greater than to Route "D". The distance to Route "D" is only 9.5 miles greater than to Route "B".

Making a similar comparison with reference to a focal point in the Straits of Florida the distances to the entrances of each of the proposed routes are: Route "B" - 464; Route "D" - 468.5; and Route "E-6" - 500.

The distance to Route "E-6" is 31.5 miles greater than to Route "D" and 36.0 greater than to Route "B". The difference between the distances to Route "B" and to Route "D" is only 4.5 miles.

Considering the greater sailing distances to Route "E-6" (average of 44 miles), the average vessel operating costs ($150 per hour), and average vessel speeds (10-12 knots), the cost is $1,200 per vessel trip greater for Route "E-6" than for either of Routes "B" or "D". Assuming that 1,500 vessels per year will use the new channel, when fully developed, the total additional costs for Route "E-6" are $1,800,000 per year.

Selection of Route "E-6" would materially reduce the benefits of this project attributable to savings in ships' time, and is considered to be detrimental to the project. Furthermore, the selection of Route "E-6" would eliminate all savings in distance over the Mississippi River route, either through South or Southwest Passes. In fact, the distance from the Straits of Florida through the Mississippi River-Gulf Outlet by Route "E-6" is 17.5 miles longer than through South Pass and three miles longer than through Southwest Pass. From Yucatan Strait the distance is 50.5 miles longer through Route "E-6" than through South Pass and 43 miles longer than through Southwest Pass. Finally, the additional costs in ships' time through Route "E-6" exceed any savings which may be realized in the annual costs ($250,000 estimated) of jetties in the event they may be eliminated on Route "E-6".

Considering the real estate aspects of the three routes, it is obvious that the route having the shortest land section will involve the least cost in rights-of-way. Route "B" is the shortest, involving 13 1/2 miles of right-of-way, Route "D" is next with 18 1/2 miles, and Route "E-6" is the longest involving 23 1/2 miles.

It is estimated that right-of-way in this area will cost from $12,800 to $32,000 per mile. Notwithstanding the fact that a large portion of the right-of-way on Route "E-6" involves the open water of bays and lakes for about one-half of its length, the costs of right-of-way on Route "E-6" will exceed the costs on either of the other two routes.

In addition to being longer, Route "E-6" passes through an area lying in the loop of Bayou La Loutre, east of Bayou St. Malo, which has been subdivided into multiple ownerships and has been partially developed. It is estimated that the costs of right-of-way on Route "E-6" will exceed those costs on Route "D" by $115,000 and those costs on Route "B" by $179,000. The real

estate costs on Route "D" are estimated to be $64,000 greater than on Route "B".

In considering the merits of Route "B" versus Route "D", it is observed that sand bar formations exist both north and south of Breton Island on Route "B". These constitute threats to navigation and will involve extensive maintenance operations which likewise will create obstructions to navigation. Other hazards to navigation are discussed in Exhibit "A" with which this Board concurs. It is estimated that channel maintenance costs on Route "B" will exceed those on Route "D" by $200,000 to $350,000 per year.

It is realized that the requirements for jetties at the entrances to each of these proposed routes will be the subject of detailed study by qualified experts. Navigation would greatly benefit if the construction of jetties at the entrance could be eliminated without creating other hazards or incurring higher maintenance costs and more frequent dredging. However, the advisability of locating the entrance of the channel in such a manner as to preclude the construction of jetties, if subsequently needed, is seriously questioned. This Board would favor a channel entrance with jetties over one without jetties if the latter required considerably more frequent periodic maintenance dredging. This Board would object to the construction of the channel on a route where the maintenance of the entrance was not assured either by dredging, by jetties, if needed, or by both.

It is considered that economic as well as other factors support and fully justify the selection of Route "D". Conversely, economic and other factors are not favorable to Routes "B" and "E-6".

This Board favors Route "D" and strongly recommends its selection in preference to the other two suggested routes.

Very truly yours,

Incl.
Exhibits A - D

Robert W. French
Director of the Port

Appendix II

NEW ORLEANS STEAMSHIP ASSOCIATION
308 Marine Building
New Orleans 12, La.

February 17, 1959

Mr. William H. Lewis
Planning Coordinator
Board of Commissioners
Port of New Orleans
2 Canal Street
New Orleans 6, La.

Dear Mr. Lewis:

This is in reply to your letter of February 9, 1959, to which was attached a map, File No. J-15-21423, reflecting three proposed alternate crossings of Chandeleur Sound and entrances to the Mississippi River-Gulf Outlet Channel. Your letter solicited our comments on each of the three possible Channel alignments.

Your letter and the accompanying map was referred to the Special Port Captains Committee of this Association and, as you may know, this Committee is composed exclusively of Master Mariners, all of whom have had many years of extensive experience at sea in command of all types of ocean vessels.

In the unanimous opinion of this Committee, Route "D" is by far the most preferable of the three shown on the aforementioned map. Proposed Route "D", our Committee feels, has much safer approaches from sea than the other two. The anchorage areas at this Route are good beyond the ten fathom curve, thus providing vessels with more sea room. In connection with this Route it will be noted that shallow water lies close in to Curlew Island and it is, in addition, a more direct route to the Gulf than the other two routes shown on the map. Moreover, our Committee believes that less fog should develop along Route "D" than would exist at the more southerly Route "B" due to the latter's closer proximity to the river passes and the cold water being discharged into the Gulf from the Mississippi River.

In connection with Route "E-6", we consider this route to be a totally unnecessary diversion for the majority of vessels which would be using the Gulf outlet. Additionally, route "E-6" has no advantages over Route "D" that our Committee could determine.

As respects Route "B", the approaches from sea are much more hazardous than they are at Route "D". Reference to the map shows clearly that the change in soundings occurs so quickly -- from 20 fathoms to

EXHIBIT "A"

unnavigable depths in about a mile -- that it would make this route very dangerous to navigate during periods of poor visibility. The concensus of opinion of our Committee was that Route "D", being located further away from both Pass a Loutre and North Pass than Route "B", would be much better from a navigational standpoint. In this connection it will be noted that the soundings to Route "D" are much better than those to Route "B" in that they gradually change from 40 fathoms to 13 fathoms over a distance of about 20 miles. This fact would give the navigator a much better fix by soundings, as the bottom contours are more clearly demarked than they are along the approaches to Route "B".

Another point which our Committee felt should be considered in connection with discussion of the alternate routes is pilot services, and it is our Committee's feeling that a pilot boat would enjoy just about as much sheltered water at Route "D" as at either of the other two routes, "B" and "E-6".

Due to the request for a rather prompt submission of our comments, we have not had the opportunity of submitting the foregoing thoughts and recommendations of our Special Port Captains Committee to our full Association for approval. However, it is our feeling that undoubtedly these recommendations will receive such approval when they are presented to the Association at the next monthly meeting, March 4, 1959. You may be sure we will let you know the outcome promptly after March 4.

We trust that the foregoing will be of some assistance to you and the Board in reviewing these possible alignments of the Mississippi River - Gulf Outlet beyond Bayou LaLoutre.

Yours very truly,

McVey F. Ward
Executive Secretary

McVFS/lp

cc: Mr. Frank G. Strachan
Capt. C. E. Biggers
Mr. O. B. Cloudman

EXHIBIT "A"

Appendix II

AMERICAN MERCHANT MARINE INSTITUTE, INC.
11 Broadway - New York 4

Air Mail

February 20, 1959

Mr. William H. Lewis
Planning Coordinator
Board of Commissioners
Port of New Orleans
2 Canal Street
New Orleans 6, La.

Dear Mr. Lewis:

MISSISSIPPI RIVER - GULF OUTLET CHANNEL - ROUTE TO GULF OF MEXICO ACROSS CHANDELEUR SOUND

Thank you for your letter of February 11 with accompanying map requesting our views as to which of the three alternative routes shown on the map should be recommended by the Board of Commissioners of the Port of New Orleans to the District Engineer, New Orleans District, Corps of Engineers, U. S. Army, for selection as the best route for the Mississippi River - Gulf Outlet Channel - from Bayou La Loutre through Chandeleur Sound to the Gulf of Mexico.

As the result of consultation with our member companies which plan to operate ocean going vessels through the Mississippi River - Gulf Outlet Channel from New Orleans to the Gulf of Mexico when it is completed, the Institute strongly urges that route "D" be recommended for selection by the District Engineer. The reasons in support of route "D" are adequately set forth in the letter dated February 17 addressed to you by Mr. McVey F. Ward, Executive Secretary of the New Orleans Steamship Association, upon the recommendation of the special Port Captain's Committee of that association.

Sincerely yours,

OLD/eb

O. Lincoln Cone
Assistant Secretary

c: Mr. McVey F. Ward, Executive Secretary, NOSA
Captain C. E. Biggers, Lykes Steamship Co., Inc.
Mr. H. X. Kelly, President, Mississippi Shipping Co.
Gen. J. H. Stratton, TAMS

EXHIBIT "B"

Appendix II

NEW ORLEANS TIDEWATER DEVELOPMENT ASSN.
P. O. Box 340
New Orleans, Louisiana

February 16, 1959

Colonel William H. Lewis
Planning Coordinator
Board of Commissioners of the Port of New Orleans
P. O. Box 46
New Orleans (6), Louisiana

Dear Colonel Lewis:

Your letter of February 9, 1959, together with the map attached thereto, dealing with possible routes of the Mississippi River-Gulf Outlet generally east of Bayou La Loutre has received our interested attention.

In our opinion, route "B" should be discarded from **further** consideration. It is probably the most objectionable to Fish and Wild Life interests. Its distance through open water in the Sound is the greatest and its entrance to the Gulf of Mexico north of Breton Island makes it the least desirable. There is much to be said in favor of route "E-6". That route entering the Gulf at deep water might obviate the necessity for jetties. In my opinion, the decision between route "D" and route "E-6" is one to be determined by engineering analyses, and also the consideration of Fish and Wild Life interests.

Sincerely,

George S. Dinwiddie
Acting President

EXHIBIT "C"

Appendix II

ST. BERNARD COUNCIL
CHAMBER OF COMMERCE OF THE NEW ORLEANS AREA
315 Camp Street - P. O. Box 1460 - New Orleans 5, La.

February 19, 1959

Board of Commissioners of the Port of New Orleans
2 Canal Street
New Orleans 6, Louisiana

Gentlemen:

Attached hereto is a copy of the third interim report of the Subcommittee of the Executive Committee of the St. Bernard Council, on the Mississippi River-Gulf Outlet. Since it deals with the alternate routes of the Gulf Outlet from Bayou La Loutre to the Gulf it may be of interest to you in connection with your conference with the U.S. District Engineer as outlined in your letter dated February 9, 1959, to Mr. A. N. Horcasitas, Jr.

There has not been sufficient time for the Executive Committee of the Council to act on this report and it therefore is released to you subject to the consideration of the said committee.

Sincerely,

Glenn Weekley
Chairman
ST. BERNARD COUNCIL

Encl.
cc: Mr. Andres Horcasitas, Manager
Waterways Development Committee
Chamber of Commerce of the New Orleans Area

EXHIBIT "D"

Appendix II

ST. BERNARD COUNCIL
CHAMBER OF COMMERCE OF THE NEW ORLEANS AREA
315 Camp Street - P. O. Box 1460 - New Orleans 5, La.

February 16, 1959

Mr. Glenn Weekley, Chairman,
and Members, Executive Committee,
ST. BERNARD COUNCIL
Chamber of Commerce of
the New Orleans Area

Gentlemen:

THIRD INTERIM REPORT OF THE SUBCOMMITTEE

Re: Mississippi River-Gulf Outlet
(Routes from Bayou La Loutre to Gulf)

There has been brought to the attention of the Subcommittee on Waterways Development a copy of a letter from the Board of Commissioners of the Port of New Orleans to Mr. A.N. Horcasitas, Jr., Manager of the Waterways Development Committee of the Chamber, and a map prepared by the U. S. Army District Engineer showing three alternative routes for the Gulf Outlet from Bayou La Loutre to the Gulf. The letter states that the Board is acting as the State coordinating agency of comments received from interested parties and requests his comments in anticipation of its conference with the District Engineer shortly after February 18, 1959. While comments of the St. Bernard Council are not requested in the letter, we feel that a short observation is justified.

From an inspection of the map on which the three alternative routes are projected, it would appear that route D is to be preferred because the route crosses more continuous land area than the others, thereby affording more land for possible industrial development. We are not equipped to review the desirability of this route from an engineering standpoint as to problems of construction and of maintenance, nor from the standpoint of its relationship to trade routes.

Sincerely,

Edwin M. Roy
Chairman

EXHIBIT "D"

Appendix II

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Foot of Prytania Street
New Orleans 9, Louisiana

LMNGY

23 March 1959

Board of Commissioners of
the Port of New Orleans
No. 2 Canal Street
New Orleans 6, Louisiana

ATTENTION: Dr. R.W. French, Port Director

Gentlemen:

Receipt is acknowledged of your letter dated 5 March 1959 relative to your preference of Route "D" over Routes "B" and "E-6" for the alignment of the Mississippi River-Gulf Outlet.

It is understood that your preference was based upon your thorough investigation of your interests as the agency designated to furnish "local assurances" as well as those of others interested in the project.

Your report and recommendations are appreciated and will be given due consideration in the selection of the project alignment.

Sincerely yours,

G. M. COOKSON
Colonel, CE
District Engineer

NEW ORLEANS STEAMSHIP ASSOCIATION
308 Marine Building
New Orleans 12, La.

March 5, 1959

Mr. William H. Lewis
Planning Coordinator
Board of Commissioners of
the Port of New Orleans
Post Office Box 46
New Orleans 6, Louisiana

Dear Mr. Lewis:

This will refer to our previous exchange of correspondence dealing with the three proposed alternate crossings of Chandeleur Sound and entrances to the Mississippi River-Gulf Outlet channel.

Under date of February 17, 1959, we wrote you at length furnishing the views, opinions and recommendations of our Special Port Captains Committee to the end that proposed outlet "D" is by far the most preferable of the three proposed routes.

Captain C. E. Biggers, Chairman of our Special Port Captains Committee, was present at the regular Association's meeting yesterday afternoon and reported fully to the Association on the Committee's activities in connection with this matter, and I am pleased to advise you that the recommendations of this Committee were fully concurred in and unanimously approved by the Members at the aforementioned meeting.

Thus, you may consider our letter of February 17 as now embracing the official views of the Association on these three proposed alternate outlets.

Yours very truly,

McVey F. Ward
Executive Secretary

McVFW/wnf
cc: Mr. Frank G. Strachan
Capt. C. E. Biggers
Mr. O. B. Cloudman
Mr. O. Lincoln Cone,
AMMI, New York

NEW ORLEANS STEAMSHIP ASSOCIATION
308 Marine Building
New Orleans 12, La.

June 10, 1959

Major General William A. Carter
Division Engineer
Lower Mississippi Valley Division
Vicksburg, Mississippi

Dear Sir:

We are advised that the District Engineer at New Orleans either has reported or shortly will submit to you his recommendations for the alignment of the Mississippi River-Gulf Outlet Channel from its intersection with Bayou la Loutre, across Chandeleur Sound, to the Gulf of Mexico.

It is understood that three proposed crossings of Chandeleur Sound are being studied. These three routes are identified as Routes "B", "D", and "E-6" on the map of U. S. Corps of Engineers, dated February 1959, File No. J-15-21423.

In February of this year this Association was asked by the Board of Commissioners of the Port of New Orleans to study the three proposed routes from the standpoint of deep sea navigation and ship operations and to furnish the Board with our views and recommendations as to which of the three proposed routes would be preferable. This Association placed the problem before its Technical Committee of Port Captains for study and recommendation. The report of this Committee, approving Route "D" and the reasons for this selection, was embraced in a letter dated February 17, 1959 addressed to Mr. William H. Lewis, Planning Coordinator for the Dock Board. The views and recommendations of the Committee were unanimously endorsed by the full Association at its regular monthly meeting on March 4, 1959 and the Dock Board was so advised by means of a second letter to Mr. Lewis, dated March 5, 1959. Copies of both of these letters are enclosed for your information.

In addition, the Association was represented at a conference on this subject held on February 25, 1959 in the District Engineer's office, which was also attended by representatives of the Dock Board and various other State agencies concerned with the project. In our opinion, it was the unanimous conclusion of all those attending this conference that proposed Route "D" was by far the most preferable of the three shown on the aforementioned map.

Since the formulation of this position by the Association earlier in the year, we are now informed that certain interests are advocating the

selection of Route "E-6". This favoring of Route "E-6", which is most difficult for practical shipping men to understand, has also had the recent attention of the Association's Port Captains Committee, with the result that they feel that the selection of Route "E-6" would completely negate any time and distance advantages the Gulf Outlet might have over the natural Mississippi River route.

This Gulf Outlet has long been considered as a shortcut to the Gulf, but the selection of Route "E-6" would simply nullify most if not all shortcut features, thus destroying to a large extent any incentive for vessels to use the canal. As a matter of fact, should Route "E-6" be selected, it would be shorter for vessels coming up through the Yucatan Channel or around the Forida Straits to use either South or Southwest Pass. "E-6" would be of advantage only to those vessels proceeding to or from the Gulf Ports located to the East of New Orleans -- and this is about the only point we can think of in favor of its selection.

The approaches from sea to either "E-6" or "D" are about on a par insofar as the depths and underwater contours are concerned. Thus, it is doubtful whether any entrance construction or maintenance features or advantages would inherently exist at one entrance to the exclusion of the other.

We are informed that Route "E-6" presents substantial difficulties in terms of acquisition of channel right-of-way as multi-owner problems are involved at one point along this route, and, as indicated above, it is the longest of the three routes. Moreover, we understand that damage to seed oyster beds and to other forms of fish and wild life will probably be more extensive if Route"E-6" were selected than would be the case along either of the other two routes.

Undoubtedly, the District Engineer in his report to you will discuss in detail all of the points touched on in this letter and others as well, including those contained in our earlier letter. By no means are we attempting in this letter to present complete arguments favoring the selection of Route "D" over the other two. We are merely mentioning some additional points not covered in our earlier letters.

We would, however, submit that from the standpoint of navigation and ship operation, there can be only one correct answer to the question of which of the three routes is best -- and this is Route "D". We sincerely trust you will arrive at the same conclusion following completion of your study of the problem.

We are sending copies of this letter to Senators Ellender and Long and Representatives Boggs and Hebert so that they may know the views of this Association on this vitally important matter.

Yours very truly,

NEW ORLEANS STEAMSHIP ASSOCIATION
McVey F. Ward
Executive Secretary

BOARD OF COMMISSIONERS OF THE PORT OF NEW ORLEANS
(An Agency of the State of Louisiana)

2 Canal Street

William H. Lewis
Planning Coordinator

Post Office Box 46
New Orleans (6), La.

June 10, 1959

District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 267
New Orleans, Louisiana.

Dear Sir:

Reference is made to letter dated March 5, 1959 from the Director of the Port to you regarding the proposed routes of the Mississippi River-Gulf Outlet from Bayou la Loutre to the Gulf of Mexico.

Supplementing other information previously furnished to you by the above referenced letter, there is furnished herewith a letter received from the New Orleans Tidewater Development Assn. dated May 26, 1959. It is requested that this letter be considered in connection with all other data received by you on this matter.

In addition to the above, this Board has received and noted a copy of a letter from the St. Bernard Council, Chamber of Commerce of the New Orleans Area, addressed to Major General William A. Carter dated May 25, 1959. A copy of this letter also is furnished herewith for your records.

It may be noted that these attached letters reinforce the recommendations previously submitted by this Board concerning the selection of Route "D". The preponderance of information received by this Board from the "user interests" favors the selection of Route "D" and indicates the unsuitability of Routes "B" and "E-6".

Based upon all information now available, it is strongly indicated that the selection of Route "D" would best serve the over-all purposes of this important project and we confidently anticipate that your recommendations will favor the selection of Route "D".

Sincerely yours,

William H. Lewis
Planning Coordinator

att. 2

NEW ORLEANS TIDEWATER DEVELOPMENT ASSN.
P. O. Box 340
New Orleans, Louisiana

Sponsoring "Mississippi River - Gulf Outlet"

May 26, 1959

Colonel William H. Lewis
Planning Coordinator
Board of Commissioners of the Port of New Orleans
P. O. Box 46
New Orleans 6, Louisiana

Dear Colonel Lewis:

We have given careful thought to your letter of May 13,1959, in which you discuss the merits and demerits of Route "D" and Route "E-6" for the Mississippi River-Gulf Outlet. We also considered your report to the District Engineer dated March 5, 1959, in which the various items leading to the selection of one of the two routes are discussed.

It is pertinent to recall that the Tidewater Association has been active in obtaining the authorization for the initial studies as well as in considering the various aspects of those studies and in testifying before the Congress to obtain the basic authorization and subsequent appropriation. Our interest has continued through the appointment by the Governor, of the Dock Board as the assuring agency for the State of Louisiana, the various site considerations and now the construction.

Through this long and sometimes tedious process, we have always leaned heavily upon the basic knowledge that the Corps of Engineers is the best qualified agency dealing with matters of navigation. The obvious fact that the Mississippi River has been changed from a source of annual destruction to a tremendous asset probably makes us more constantly aware of the abilities of the Corps of Engineers than others who do not have this daily reminder.

We agreed with the selection made in the Corps of Engineers report as published in House Document 245. That route was selected after many possibilities had been examined. We again agreed with the selection of that route in the recent reconsideration. We feel that Route "D" with some small local adjustments, as stated in the basic report, is the route for which the Governor appointed the Dock Board to act as the assuring agency, and is the route which has been presented to the Bureau of the Budget and the Congress.

Based upon the foregoing, we recommend and urge that Route "D" remain the route on which the channel will be constructed.

Sincerely,

G. S. Dinwiddie
Acting President

GSD/hma

ST. BERNARD COUNCIL
CHAMBER OF COMMERCE OF THE NEW ORLEANS AREA

315 Camp Street P. O. Box 1400 New Orleans 5, La.

Tel. Tulane 1131

May 25, 1959

Major General William A. Carter
Division Engineer
Lower Mississippi Valley Division
Vicksburg, Mississippi

Dear General Carter:

In your consideration of the three proposed routes of the Mississippi River Gulf Outlets from Bayou LaLoutre to the Gulf, we urge you to approve Route D.

Route D is a few miles farther north than the route described on the map attached as an exhibit to House Document No. 245, which was the basis for the Act of Congress approved 29 March 1956, Public Law No. 455, 84th Congress, 2nd session. The St. Bernard Council considers this deviation justified because Route D crosses a more continuous land area than either of the other proposed routes thereby affording more land for industrial development.

Route "E-6" would increase the distance to be travelled by ocean going ships to and from the Port of New Orleans to such an extent as to nullify the intended advantage in distance of the Gulf Outlet over the Mississippi River. It would destroy the opportunity for industrial development along its banks in St. Bernard Parish contemplated by the Act.

Sincerely,

Glenn Weekley
Chairman
ST. BERNARD COUNCIL

GW/ja

CC: Mr. William H. Lewis

MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA

GENERAL DESIGN MEMORANDUM NO. 2, GENERAL DESIGN

APPENDIX III

VIEWS OF FISH AND WILDLIFE AGENCIES

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U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Foot of Prytania Street
New Orleans 9, Louisiana

LMNGY

3 February 1959

Regional Director
United States Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta 23, Georgia

Dear Sir:

Reference is made to letter of 22 October 1957 from this District requesting a review of Routes "B" and "D" on the Mississippi River Gulf Outlet, and your views or preference for one of the routes.

Route "E-6" on the inclosed map, File No. J-15-21423, has now been determined to have merit and is being considered for the channel alignment.

It is requested that you inform this District if you know of any impediments to this route, as well as your views or preference for one of the routes from a fish and wildlife point of view.

Sincerely yours,

1 Incl.
Map, File J-15-21423

DUANE W. ACKERSON
Lt. Col., CE
Acting District Engineer

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Foot of Prytania Street
New Orleans 9, Louisiana

LMNGY

3 February 1959

The Director
State of Louisiana
Wild Life and Fisheries Commission
Civil Courts Bldg.
New Orleans, Louisiana

Dear Sir:

Reference is made to letter of 22 October 1957 from this District requesting a review of Routes "B" and "D" on the Mississippi River Gulf Outlet, and your views or preference for one of the routes and your reply dated 13 November 1957 in which you expressed the opinion that Route "D" would be less detrimental than Route "B".

Route "E-6" on the inclosed map, File No. J-15-21423, has now been determined to have merit and is being considered for the channel alignment.

It is requested that you inform this District if you know of any impediments to this route, as well as your views or preference for one of the routes from a fish and wildlife point of view.

Sincerely yours,

1 Incl.
Map, File J-15-21423

DUANE W. ACKERSON
Lt. Col., CE
Acting District Engineer

STATE OF LOUISIANA

WILD LIFE AND FISHERIES COMMISSION
126 Civil Courts Bldg.
New Orleans 16, La.

March 2, 1959

Colonel G.M. Cookson
District Engineer, U.S. Army
Engineer District, New Orleans
P.O. Box 267
New Orleans, La.

Dear Colonel Cookson:

Reference is made to your letter of February 3, 1959 relative to the Mississippi River-Gulf Outlet Project.

In this letter you requested that we inform your office of any impediments to route "E-6", as well as our views or preference for one of the routes described on the attached location map, Mississippi River-Gulf Outlet, Louisiana, February 1959, File No. J-15-21423, specifically routes "B", "D" and "E-6" from a fish and wildlife point of view.

These proposed routes have been considered as was done previously in our letter to you dated November 13, 1957. It is our opinion, based on the fish and wildlife resources of the overall area and without the benefit of biological studies or general engineering data, that route "D" would be the best alignment of the three alignments suggested. Previously, it has been established that the area south of route "D" which would be crossed by route "B", is an important oyster-seed ground area, and that the area north of Route "D", which would be crossed by route "E-6, is an important oyster bedding ground area. Thus, it is the consensus of opinion of our staff that the advantages offered by route "D" generally following the Bayou La Loutre Channel and its natural levees geologically derived as a distributary of the Mississippi River, would provide the most suitable materials for confining the anticipated salt water intrusion.

It is requested that your office furnish us with engineering data concerning route "E-6" when additional consideration is given for the channel alignment.

Sincerely yours,

F. L. CLEMENT
Director

FLC:iw
cc: Regional Director Bureau of Sport Fisheries & Wildlife
Regional Director, Bureau of Commercial Fisheries
Director, La. Dept. of Public Works

APPENDIX III

TELETYPE

NO AT 14 I-SFW

ATLANTA GA 6-5-59 0950R

DIST ENGINEER U S ARMY ENGINEER DIST NEW ORLEANS

FOOT OF PRYTANIA ST NO

REUR INQUIRY OUR PREFERENCE OF ROUTES B' D' AND E-6' MISSISSIPPI RIVER-GULF OUTLET PROJECT. STUDIES TO DATE INDICATE ROUTE D WOULD BE SIGNIFICANTLY LESS DETRIMENTAL TO FISH RESOURCES WITHIN MARSH AREA THAN ROUTES B OR E-6' PROVIDED../1/ SPOIL IS PLACED ON NORTH SIDE OF ALIGNMENT FROM BAYOU LA LOUTRE TO CHANDELEUR SOUND' AND /2/ REASONABLE FEATURES TO REDUCE SILTING EFFECT AND MAINTAIN PRESENT WATER CIRCULATION PATTERNS ARE INCLUDED IN YOUR CONTRACT SPECIFICATIONS IN CONSEQUENCE' WE PREFER ROUTE D' WITH CONSTRUCTION AS GENERALLY QUALIFIED ABOVE. THE REGIONAL DIRECTOR' BUREAU OF COMMERCIAL FISHERIES' ST PETERSBURG BEACH' FLORIDA' CONCURS IN THIS STATEMENT. PLEASE ADVISE IMMEDIATELY IF YOU ARE UNABLE TO RECOMMEND ROUTE D WITH NORTH SIDE SPOIL BANK

W L TOWNS' ACTG REGL DIR BUREAU OF SPORT FISHERIES AND WILDLIFE

FJ 0953R

A REPORT TO THE U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
ON THE POSSIBLE BIOLOGICAL EFFECTS OF VARIOUS PROPOSED
ROUTES OF THE MISSISSIPPI RIVER-GULF OUTLET

BY

GORDON GUNTER

INTRODUCTION

The proposed canal starts at a point where it connects with the Inner Harbor Navigation Canal of New Orleans, the "Industrial Canal" of the New Orleanian. From there it runs almost due east for about 5 miles following the Intracoastal Waterway. From this point on to where the channel will connect with waters of the open Gulf, several alternate routes have been considered and proposed by various groups and interests along the Mississippi and Louisiana coasts, as well as one State Government and one branch of the Federal Government.

A dozen or so individual routes have been suggested and appraised, at least in part, from the engineering standpoint. Various statements have been made with regard to the biological effects. By and large these are bald assertions or opinions backed by little supporting data or information. This is due to the intrinsic nature of the problem, namely, that no one knows precisely what will happen to the hydrographic and sedimentary regime of the region when the channel is dug, and no one can know until after the fact. The writer's ideas are subject to the same limitations. My general knowledge and acquaintance with the area involved are set forth in Appendix I.

The Area Involved

In shortest possible terms the areas which will be affected may be described as a tongue of marshy islands and interconnecting waters, of indescribable cartographic complexity, extending northwestward from the lower east bank of the Mississippi River, and the waters on either side. This area of some few thousand islands and interconnecting waters is known as the "Louisiana" marsh. Lying generally northwestward, between this marsh and the mainland shores of Louisiana and Mississippi are Lake Borgne with Mississippi Sound connecting on the east. To the south and east of the marsh are Breton and Chandeleur sounds, which extend from the lower river, in a slight arc, northeastward, and connecting with Mississippi Sound, and the open Gulf to the north. This is actually one large sound, with no geographic separation. It is partially separated from the Gulf of Mexico to the east by a chain of islands running in a gentle arc northward, known as the Chandeleur Islands.

In general the waters of Lake Borgne and the western part of Mississippi Sound are brackish or low salinity, and on rare occasions they

may be fresh, Cf. Gunter (1953) and Butler (1952). Data in the New Orleans office taken from seven stations in the eastern part of Lake Borgne in 1957 and 1958 show that the salinity ranged from less than 2 to less than 11 parts per thousand.

Similar stations in the inner marsh, south of Lake Borgne, show a range of salinity from 0.5 (fresh water) to 14.5 per mille. In the outer marsh, east of Lake Borgne, the salinity ranges were 2.3 to 26.0. Nine stations in Chandeleur and Breton Sounds showed a salinity range of 9.5 to 35.0 (sea water). In eastern Mississippi Sound the salinities are roughly equivalent to those of Chandeleur and Breton.

Lake Borgne and similar low salinity areas are prime nursery grounds for small white shrimp, blue crabs, croakers, menhaden, and several other common Gulf fishes. In general the salinity is too low for oysters. In west Mississippi Sound the salinity is higher and oyster reefs are present.

In Breton and Chandeleur Sounds the salinities are too high generally for oysters, probably because it is optimum for their enemies such as the oyster borer. In general, shrimp and fishes migrate into this area as they grow up, from the marsh and such low salinity waters as Lake Borgne. Thus, it is an excellent fishing area for menhaden and trash fish boats and for shrimp.

The Louisiana marsh is the primary seed oyster area of the State of Louisiana and it is also the chief producer of oyster canning stock for the Mississippi plants. It has some trapping value for muskrat and other fur producers. It also contains some 50,000 to 60,000 acres of so-called fresh water marsh along the southern shores of Lake Borgne. This is a prime hunting ground for several types of ducks (Cf. Resolution of Louisiana Wild Life and Fisheries Commission, May 29, 1957).

Appraisal of the Routes Suggested

a. Introductory remarks concerning evaluations.

Fishery production for the areas involved are given in Appendix II. They are not sharply separated by areas and it is impossible to say what percentage would be directly involved in the basic mile wide strip of the channel, resultant spoil, retaining dykes, etc. Furthermore, the matter is of little importance in comparison to hydrographic and sedimentary changes which could conceivably have both good and bad effects over a much wider area, or a predominance of one or the other. Here again we bump into the basic consideration that no one can prognosticate with much surety concerning hydrographic and sedimentary changes which will be brought about by the new channel.

In this connection, one general criticism of the channel should

be discussed. It has been stated by some officials of the Louisiana Wild Life and Fisheries Commission that the deep channel will permit and enhance the encroachment of high salinity water into normally low salinity areas where it will cause considerable damage, such as killing out the fresh water marsh, the oysters, etc. However, no one else seems to be greatly disturbed by this possibility and neither am I, because the chances seem to be rather remote. The salinity of Chandeleur Sound is now as high as sea water at times. High salinity water would encroach as a tongue along the bottom of the channel and would not become mixed with the lighter surface water except by heavy storms such as hurricanes, which force in much larger volumes of high salinity water over the marsh. Furthermore, any alignment of the channel which would lead to deep (high salinity) water would have the same general effect except that the longer routes would permit less encroachment and would possibly be more desirable from the wildlife and fisheries standpoint. Thus, we are not involved with this question in evaluating the different alignments proposed.

An examination of the map will show that none of the marsh area south of Bayou Terre aux Boeufs ridge would be affected by any proposed alignment of the channel. This comprises about one third of the total marsh area.

All of the several routes alternately proposed or considered for various reasons may be divided roughly into three and treated under those headings, because they coincide in general features and differ in only three ways so far as known probable biological effects are concerned.

b. The proposed outlet

This route skirts the southwestern shore of Lake Borgne to Bayou la Loutre. From there two or three alternate routes are under consideration. One would traverse the Bayou la Loutre ridge, as suggested by the Louisiana Wild Life and Fisheries Commission. One would go to the south of this and the other would go across the marsh to the northward to end south of Cat Island. Since the chief effect of these routes would be in bisecting the sound with spoil banks or retaining dykes, and the differences between an effect in one part of the sound as compared to another is unknown, there seems to be little to choose from with regard to the three outlets.

The first part of the channel, skirting Lake Borgne, is a different matter. The Louisiana Commission has pointed out that it will cut through 60,000 acres of the finest fresh water duck marsh in the State. At a minimum the mile wide channel and dyke, twenty miles long, will destroy about 13,000 acres of this marsh and ensuing industrial development will take some more. On the other hand, it has been pointed out that the growth of New Orleans will encroach upon this area within the next fifteen years or so.

Some minimization of damages may be effected by the judicious selection of cuts through the dykes, as recommended by the State biologists, to permit as normal flow of water as possible. Similarly, fresh water locked out of the river through the Industrial Canal may tend to prevent salt water encroachment. In addition, it should be feasible to pump large amounts of fresh water out at this point, as has already been suggested for other points along the lower river.

c. The Louisiana Wild Life and Fisheries Commission proposal.

With the hope of avoiding damage to the above mentioned duck marsh, the Commission Biologists suggested a channel differing from the proposed one as follows: The channel would continue eastward a few miles on the Intracoastal Waterway and then turn southward across the southwestern part of Lake Borgne, across Proctor Point and connecting with the proposed channel along the Bayou la Loutre ridge. Secretary of the Interior Fred H. Seaton, in letters dated 30 July 1958 and 13 October 1958, to Secretary of the Army Wilbur M. Brucker indicated his approval of the State of Louisiana proposal, and requested that this route be adopted. This proposal has the disadvantage that it traverses water in an area of soupy, uncompacted sediments and will be very hard to hold without virtually complete retaining dykes along both sides. This would cut off fresh water flow from Lake Pontchartrain and the Pearl River, which are very important influences on the salinity of Lake Borgne and the marshes to the south. If such an eventuality develops then the duck marsh as well as the remainder of the marsh to the south may be seriously damaged rather than helped. On the other hand, if construction and maintenance costs are not prohibitive and if suitable openings can be maintained consonant with channel maintenance, the proposal is worth consideration. The question is closely related to engineering problems, outside of my purview. In any case, this proposal is not the simple answer to the problem that it might at first appear to be.

d. The Mississippi proposal

Various private interests in Mississippi have proposed various northerly routes for the channel. These would entail the utilization of the Intracoastal Waterway eastward to Shell Point or the Rigolets and thence eastward by various routes across Lake Borgne or Mississippi Sound to deep water north of Chandeleur Sound.

This has nothing biologically to recommend it so far as I can see. The spoil or silt from the channel would endanger, if not destroy, Half Moon and Grand Bank reefs in Louisiana and St. Joe reef in Mississippi, the last producing reef in the State but one.

The channel would cross water for a large portion of its length and the spoil or dykes would materially affect the present hydrography, most probably by shunting the Pontchartrain and Pearl River flows to the eastward. This would doubtless benefit the reefs off Pass Christian,

but it would certainly harm the "Louisiana Marsh" oysters from which most Mississippi production has come for years. It would have similar effects on the shrimp and menhaden producing areas in the marsh, as well as the duck marsh, and in the long run the State of Mississippi would be harmed.

The so-called E-6 route of the Engineers would satisfy other aims of the Mississippians without running the chance of great damage and biologically, it is much to be preferred.

Respectfully submitted,

January 8, 1959

Gordon Gunter
Consultant

APPENDIX I

The writer began work on the Gulf of Mexico with the Shrimp Investigations of the former U. S. Bureau of Fisheries in July 1931, and has more or less been at it ever since. The attached sheets outline the general professional activities.

My present position is director of the Gulf Coast Research Laboratory. I also carry nominal appointments as Professor of Biology in Mississippi Southern College, Professor of Zoology in Mississippi State University, and Professor of Biology in the University of Mississippi.

I am currently a member of the Committee on Marine Mammals of the American Society of Mammalogists, a member of the Committee on Water Pollution of the American Fisheries Society, and a member of the Board of Governors of the American Society of Ichthyologists and Herpetologists. With Dr. J. E. McKee, Professor of Sanitary Engineering in the California Institute of Technology, I am a member of a two-man board appointed by the Water Pollution Control Commission of the State of Washington to set up a water use standard with relation to the oyster and pulp mill industries. I am also a member of various committees of the Gulf States Marine Fisheries Commission.

The writer has kept up with the general situation regarding the Mississippi-Gulf Outlet through discussions at the meetings of the Gulf States Marine Fisheries Commission. In addition, I have recently discussed all phases of the biological situation with almost all of the State and Federal biologists now involved. In general they are of the same mind as the writer. They do not know precisely what will happen, but they are collecting basic data to compare with future, so that they can determine with some precision what does take place. This is a matter of considerable importance and this biological work should be continued during the time and after the outlet is dug.

APPENDIX II

Due to the short period of time involved, we have not been able to collect fishery statistics from all of the areas involved. However, as the writer has stated above, these figures are not as important as they might at first appear because the influences that cause them to vary may be considerably restricted, or by the same token, widely extended, in ways that are completely unknown.

The following figures are furnished by the New Orleans office of the U. S. Fish and Wildlife Service and they constitute the best available information. These are the heads off or tail weight of shrimp. For conversion to heads on weight these figures should be multiplied by 1.68.

Area	1956	1957	Jan-Jun, 1958
Inside Chandeleur Island	59,402	16,261	-
Chandeleur & Breton Sounds	2,469,632	1,279,126	95,305
Mississippi Sound, Western Area	523,889	638,211	202,875
Lake Borgne	8,492	202,875	141,861

MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA

GENERAL DESIGN MEMORANDUM NO. 2, GENERAL DESIGN

APPENDIX IV

INVESTIGATIONS OF OTHER ROUTES

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KENNEDY MARINE ENGINE COMPANY
Marine Engines and Boat Equipment
Biloxi, Mississippi

June 30, 1958

Mr. Leo Seal, Jr.
Hancock Bank
Gulfport, Miss.

Dear Leo:

Regarding the location of the Mississippi River-Gulf Outlet I am enclosing map showing engineers' proposed channel, and routing which I would suggest. There are many advantages to the north route, one, of course, is the closeness to Gulfport and Pascagoula. Disadvantages to the proposed route are outlined below and also advantages to the north route:

Disadvantages to proposed channel -

(1) Longer route making dredging costs higher and ship traveling distance in channel greater.
(2) Channel will enter Gulf at a point where there is heavy surf and many shifting sand bars which will make it necessary to construct expensive jetties and which later on will need expensive maintenance.

Advantages if channel is routed north of Chandeleur Is.-

(1) Route is more direct and approximately thirteen and one half (13-1/2) miles shorter which will lower dredging costs.
(2) Channel will enter deep water northwest of Chandeleur Island behind shelter of island and no jetties will be necessary to build or to maintain.
(3) A new survey should be made for a great savings in costs and maintenance will result.

It would be a good thing for Mississippi and a great savings for the government if the proposed routing can be changed to the North.

Very truly yours,

KENNEDY MARINE ENGINE COMPANY

/s/ W.P. Kennedy, Jr.

NM

WPKjr/nm

W.P. Kennedy, Jr.

Incl 1

APPENDIX IV

STATE OF MISSISSIPPI
EXECUTIVE DEPARTMENT
JACKSON

J.P. Coleman
Governor

July 22, 1958

Honorable John C. Stennis
United States Senate
Washington, D.C.

Dear Senator Stennis:

A delegation from the Coast has talked with me about the proposed location of the Mississippi River - Gulf Outlet, as per the attached map.

They argue strenuously for the northern route as inked in on the attached map.

Since this seems to be a Corps of Engineers matter, I am sure that you are thoroughly familiar with it, and I, of course, know that you will do all within your power to protect the best interest of Mississippi as the facts may justify.

In acknowledging this communication, I will appreciate it if you will send copies to Honorable Leo Seal, Bay St. Louis, to Mr. W.P. Kennedy, Jr., to Honorable Clarence E. Morgan, Sr., Kosciusko, and to Mr. Horace Steele, Vice President, Deposit Guaranty Bank and Trust Company, Jackson, Mississippi.

With best wishes, I remain

Your friend,

/s/ J.P. Coleman
Governor

JPC/nc

Encs.

UNITED STATES SENATE
COMMITTEE ON APPROPRIATIONS

July 25, 1958

Major General Emerson C. Itschner
Corps of Engineers
Department of Defense
Washington 25, D.C.

Dear General Itschner:

I enclose herewith a letter which I have received from the Honorable J.P. Coleman, Governor of the State of Mississippi, regarding the Mississippi River-Gulf Outlet, together with attached map and correspondence.

It will be greatly appreciated if you will carefully consider this matter and advise me as to the current status and plans in connection with points raised as to the proposed location.

With every good wish, I remain

Sincerely yours,

/s/ John Stennis
John Stennis
United States Senator

JSaci
Encs.

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
Washington 25, D.C.

ENGWO

29 August 1958

Honorable John Stennis

United States Senate

Dear Senator Stennis:

Further reference is made to your letter of 25 July 1958, inclosing a letter from the Honorable J.P. Coleman, Governor of the State of Mississippi, with attachments regarding the location of the Mississippi River-Gulf Outlet Channel.

The Mississippi River-Gulf Outlet authorized by Public Law 455, 84th Congress, approved 29 March 1956 provides essentially for construction of a seaway canal 36 feet deep from a point south of the Intracoastal Waterway at Micheaud to and along the south shore of Lake Borgne and through the marshes to and across Chendeleur Sound to Chandeleur Island at or north of Errol Island with protective jetties at the entrance. Work on the authorized project was commenced during March 1958 and is presently underway with the Inner Harbor Navigation Canal and Highway 47 (Paris Road) Section nearing completion. Local interests have furnished the prescribed assurances of local cooperation and are presently engaged in acquiring the right-of-way necessary for the construction work.

Prior to authorization of the project by Congress numerous routes were studied some of which are shown on the inclosed map. The proposed route suggested by Mr. Kennedy is almost the same as route E-4. This route was not recommended because of the many additional miles of open water which the channel would traverse across Lake Borgne, Mississippi Sound and Chandeleur Sound. In addition, the cost to maintain a channel in these reaches of open water was considered to be prohibitive. The route of the canal which is now under construction was recommended for authorization as the most economical of those studied.

Your interest in the project is appreciated, and I trust that the foregoing information is sufficient for your present needs.

Sincerely yours,

STANLEY G. REIFF
Colonel, Corps of Engineers
Acting Assistant Chief of Engineers
for Civil Works

2 Incl
Ltr Gov Coleman w/incls
Map

cc: Lower Mississippi Valley Division
New Orleans District

APPENDIX IV

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
Washington, D.C.
August 29, 1958

Major General E. C. Itschner
Chief of Engineers, Department of the Army
Washington 25, D.C.

Dear General Itschner:

I am enclosing a copy of The Dixie Guide relating to the proposed Mississippi River Channel.

I would appreciate your comments on whether the proposed channel (running almost due East from New Orleans) is feasible from a navigational standpoint. In addition, if such figures or estimates are available, I would like information as to the cost of constructing and maintaining the proposed channel as compared with the new authorized channel.

Thanking you, I am,

Sincerely yours,

JOHN BELL WILLIAMS

JBW/mch
Enclosure

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
Washington 25, D.C.

ENGWO

30 September 1958

Honorable John Bell Williams
House of Representatives

Dear Mr. Williams:

Further reference is made to your letter dated 29 August 1958 inclosing a clipping from "The Dixie Guide" regarding the location of the Mississippi River-Gulf Outlet Channel.

The Mississippi River-Gulf Outlet project authorized by Public Law 455, 84th Congress, approved 29 March 1956 provides essentially for the construction of a seaway canal 36 feet deep from a point south of the Intracoastal Waterway at Micheaud to and along the south shore of Lake Borgne and through the marshes to and across Chandeleur Sound to the Chandeleur Islands at or north of Errol Island with protective jetties at the entrance. Work on the authorized project was commenced during March 1958 and is presently underway with the Inner Harbor Navigation Canal and Highway 47 (Paris Road) Section nearing completion. Local interests have furnished the prescribed assurances of local cooperation and are presently engaged in acquiring the rights-of-way for the remaining construction work.

Prior to authorization of the project by Congress numerous routes were studied, some of which are shown on the inclosed map. The proposed route shown in "The Dixie Guide" clipping is almost the same as route E-4. This route, as well as the other routes, was considered feasible from a navigational standpoint. However, the route of the canal which is now under construction was recommended for authorization as the most economical of those studied.

Concerning the cost of construction and maintenance of the channel as proposed in the inclosure accompanying your letter, since a route through Lake Borgne has not been authorized, surveys, soil boring, soil investigation and sediment studies have not been made in sufficient detail to permit the preparation of a reliable estimate of the suggested route. Preliminary examinations reveal that it would be more expensive to build and to maintain a channel through the open waters of Lake Borgne as compared to the land cut along the authorized route.

Your interest in the project is appreciated.

Sincerely yours,

STANLEY G. REIFF
Colonel, Corps of Engineers
Acting Assistant Chief of Engineers
for Civil Works

2 Incls
1. "The Dixie Guide"
2. Map

cc Lower Mississippi Valley Division
New Orleans District

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
LOWER MISSISSIPPI VALLEY DIVISION
Vicksburg, Mississippi

LMVVE 10 December 1958

SUBJECT: Mississippi River-Gulf Outlet

TO: District Engineer
U. S. Army Engineer District, New Orleans
New Orleans, Louisiana

1. Your 3d indorsement, 19 November 1958, supplemented by the comparative cost estimates and map furnished with your letter of 28 November 1958, should provide the Chief of Engineers with information for a specific reply to the Secretary of Interior letter of 13 October 1958. However, information in the press and information received informally from the Office of the Chief of Engineers indicate that this information will not end the controversy the State of Mississippi is raising concerning the waterway route.

2. I believe that we can expect further inquiries similar to that of Congressman John Bell Williams in his letter to General Itschner of 29 August 1958 and that of Senator John Stennis in his letter of 25 July 1958 concerning the comparative costs of constructing an alternative route generally along the alignment of E-4 or E-1 discussed in the review report. As you know, we did not furnish any comparative cost estimates or other specific facts in replying to these letters. In addition to further Congressional inquiry, I expect questions pertaining to these routes from the appropriations committees when I appear before Congress.

3. All working files pertaining to this project were transferred to your office 5 June 1956. Review these working files; develop more specific information as to the alternative costs and other disadvantages of route E-4 from them, if practicable, If not, prepare a cost estimate of route E-4 on the same basis as that inclosed in your letter of 28 November 1958. Advise me of the date on which you can submit the estimate.

W. A. CARTER
Major General, USA
Division Engineer

ENGMR 3rd Ind.
SUBJECT: Mississippi River-Gulf Outlet (LMVD ltr 15 Dec 58)

Office of the Chief of Engineers, Washington, D.C., 30 January 1959

TO: The Division Engineer, U.S. Army Engineer Division, Lower Mississippi Valley, Vicksburg, Mississippi

1. The Chief of Engineers has authorized the continuance of the Gulf Outlet from the Gulf Intracoastal Waterway along the route authorized to the junction of routes E-6 and E-7 shown on Map file J-15-21398 which accompanied the foregoing first indorsement. The Secretary of the Army has informed the Secretary of the Interior of this action.

2. The Chief of Engineers has not authorized a specific route gulfward of the junction of routes E-6 and E-7 and has directed that the studies now being made by the New Orleans District and the Beach Erosion Board in this area include a detailed study of route E-6. The General Design Memorandum for the project should show the results of the study and should be forwarded as soon as practicable with your recommendation as to an appropriate alignment.

FOR THE CHIEF OF ENGINEERS:

Incls w/d

J. L. PERSON
Brigadier General, USA
Assistant Chief of Engineers
for Civil Works

8 January 1959

TABLE I

SUMMARY

FEDERAL COST ESTIMATES

MISSISSIPPI RIVER - GULF OUTLET PROJECT

ROUTES E-1 THRU E-7

Item	Route E-1 Total length 72.3 miles Quantity	Route E-1 Cost	Route E-2 Total length 70.0 miles Quantity	Route E-2 Cost	Route E-3 Total length 70.5 miles Quantity	Route E-3 Cost	Route E-4 Total length 68.3 miles Quantity	Route E-4 Cost	Route E-5 Total length 77.3 miles Quantity	Route E-5 Cost	Route E-6 Total length 74.6 miles Quantity	Route E-6 Cost	Route E-7 Total length 77.0 miles Quantity	Route E-7 Cost
Channel Excavation (under contract)	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700	19,819,000 cu. yds.	$ 3,700,700
Channel Excavation (land cut)	95,928,000 cu. yds.	19,618,115	100,878,000 cu. yds.	20,630,434	82,917,000 cu. yds.	16,957,252	102,837,000 cu. yds.	21,031,067	81,835,000 cu. yds	16,735,973	185,293,000 cu. yds.	37,894,041	215,830,000 cu. yds.	44,139,125
Channel Excavation (open water)	113,422,000 cu. yds.	24,601,596	139,572,000 cu. yds.	30,273,617	154,880,000 cu. yds.	33,593,971	121,241,000 cu. yds.	26,297,538	186,149,000 cu. yds.	40,376,310	96,712,000 cu. yds.	20,977,145	62,200,000 cu. yds.	13,491,330
Turning Basin	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931	1,830,000 cu. yds.	396,931
Retention Dike (5 ft. crown @ El. 5.0 m.l.g.)	39.2 miles	65,766,296	38.9 miles	43,221,913	43.1 miles	47,679,741	42.6 miles	46,218,359	51.5 miles	52,152,652	30.5 miles	32,212,278	19 miles	23,725,494
Jetties (10 ft. crown @ El.6.0 m.l.g.)	None	-	None	-	None	-	None	-	0.8 miles (each side)	5,135,029	None	-	1.63 miles (each side)	7,696,965
Bridge Highway No. 47 (Paris Road (Semi-high level lift bridge)	1	8,056,405	1	8,056,405	1	8,056,405	1	8,056,405	1	8,056,405	1	8,056,405	1	8,056,405
Sub-total (First Cost)		$122,140,000		$106,280,000		$110,385,000		$105,701,000		$126,554,000		$103,237,500		$101,207,000
Interest during construction (1/2 of 5 years @ 2-1/2%)		$ 7,633,750		$ 6,642,500		$ 6,899,062		$ 6,606,312		$ 7,909,625		$ 6,452,300		$ 6,325,400
Investment		129,773,750		112,922,500		117,284,062		112,307,312		134,463,625		109,689,800		107,532,400
Interest on Investment 2-1/2%		3,244,300		2,823,062		2,932,100		2,807,700		3,361,600		2,742,245		2,688,300
Amortization 50 years @ 2-1/2%		1,331,500		1,158,584		1,203,300		1,152,300		1,379,600		1,125,417		1,103,282
Channel Maintenance (Land cut or adjacent to dike)	64.2 miles	397,860	64.0 miles	396,623	64.5 miles	399,722	63.9 miles	396,000	73.4 miles	454,877	70.3 miles	435,566	69.2 miles	428,710
Channel Maintenance (Open water)	8.1 miles	250,980	6.0 miles	185,917	6.0 miles	185,917	4.4 miles	136,300	3.9 miles	72,508	4.3 miles	133,241	7.8 miles	145,201
Retention Dike Maintenance	39.2 miles	485,860	38.9 miles	482,114	43.1 miles	534,161	42.6 miles	528,000	51.5 miles	638,353	30.5 miles	378,031	19 miles	235,495
Jetty Maintenance	None	-	None	-	None	-	None	-	1.6 miles	39,662	None	-	3.26 miles	80,812
Annual Costs		$ 5,710,500		$ 5,046,300		$ 5,255,200		$ 5,020,300		$ 5,946,600		$ 4,814,500		$ 4,681,800

Criteria for Estimates

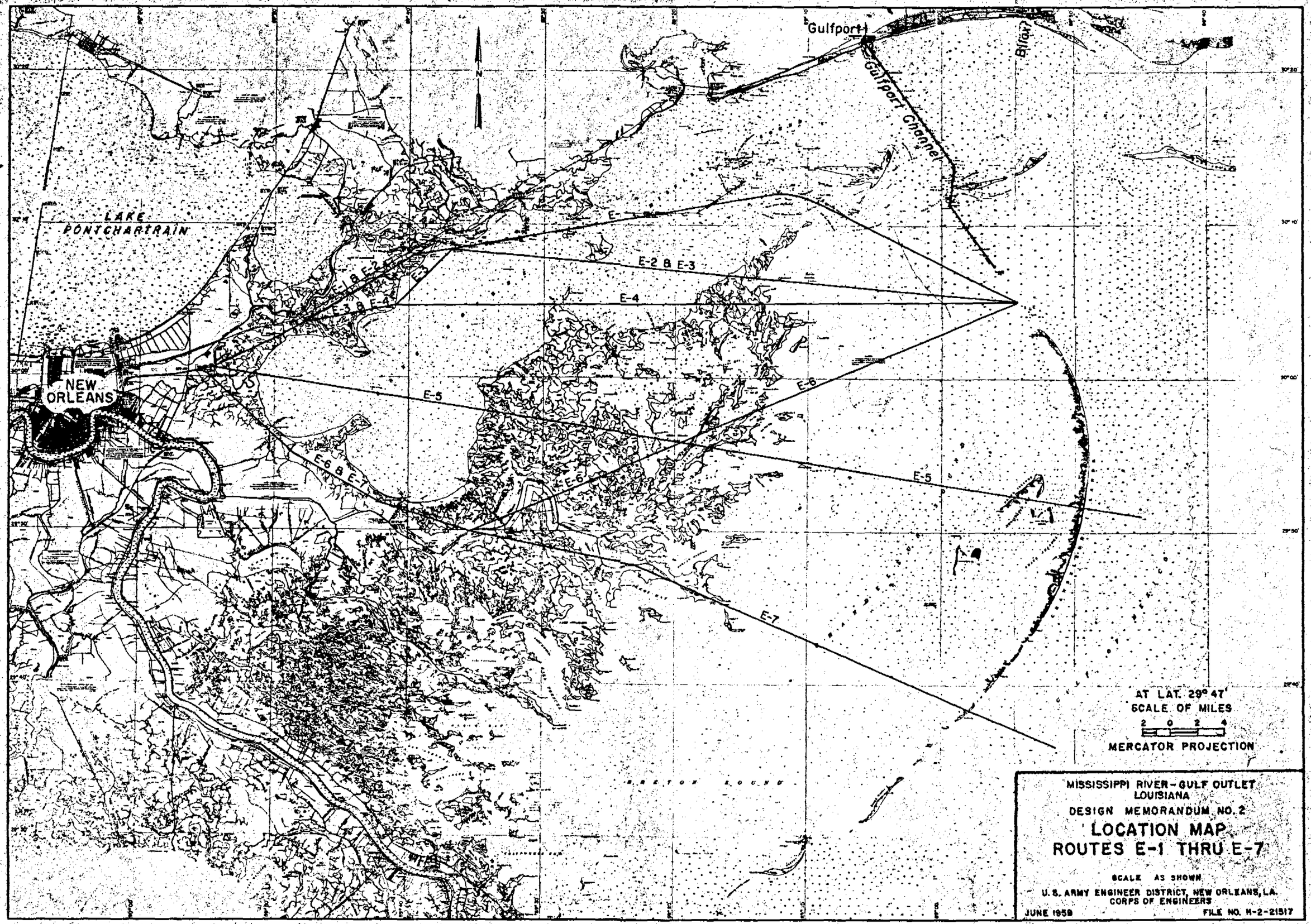
Construction

Excavation, Land Cut	$ .165 per cu. yd.
Excavation, Open Water	.175 per cu. yd.
Excavation, Turning Basin	.175 per cu. yd.
Shell, for dike	2.00 per cu. yd.
Stone, for dikes (1.75 tons per cu. yd. @ $11.00 per ton)	19.25 per cu. yd.
Stone, for Jetties (1.75 tons per cu. yd. @ $12.00 per ton)	21.00 per cu. yd.
Pole mattress under jetties	30.00 per square
Contingencies (Work under contract 5%)	15%
Engineering and Design	1.2%
Supervision and Administration	6.5%

Annual Maintenance

Channel land cut or adjacent to dike	$ 5,000 per mile
Channel, Open Water Chandeleur Sound	25,000 per mile
Channel, in Gulf beyond jetty	15,000 per mile
Retention Dike	10,000 per mile
Jetty	20,000 per mile

APPENDIX IV



APPENDIX IV PLATE 1

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS

Study of

NAVIGATION CLEARANCES

for

PARIS ROAD BRIDGE

over the

Mississippi River - Gulf Outlet
and
Gulf Intracoastal Waterway
in New Orleans, Louisiana.

30 October 1958

CONTENTS

INCLOSURES

Study of

NAVIGATION CLEARANCES

for

PARIS ROAD BRIDGE

over the

Mississippi River - Gulf Outlet & GIWW
in New Orleans, Louisiana

March, 1958
Revised 30 October 1958

1. General.

a. The Act of Congress approved 29 March 1956 (P.L. 455 - 84th Congress), which authorizes construction of the Mississippi River-Gulf Outlet, provides for construction of a "suitable highway bridge with approaches," to carry State Highway #47 (Old #61) (Paris Road) across the waterway. The project dimensions of the new waterway are 500' wide by 36' deep and the channel coincides with the Gulf Intracoastal Waterway at the location of the new bridge. Previous congressional authorization (P.L. 675 - 77th Congress) for relocation of the Gulf Intracoastal Waterway also authorized the construction of a "4-lane highway bridge" at Paris Road.

b. The Board of Commissioners for the Port of New Orleans (Dock Board) has been designated by the Governor of Louisiana as the agency to carry out the requirements for local cooperation in construction of the project, which include furnishing all rights-of-way; acceptance of ownership, maintenance, operation, and future replacement or alteration of the highway bridge at Paris Road; provide any other bridges required; accomplish utility and other highway alterations; hold and save the United States free from damages; and construct, maintain and operate terminal facilities commensurate with requirements of the expanded port. The Department of Highways of the State of Louisiana has agreed with the Dock Board to accept ownership of the bridge, to assume responsibilities for maintenance and operation and to make future replacements or alterations which may be required by conditions as they exist at time of construction and not as a result of changes or alteration of the waterway or needs of navigation.

c. Existing Bridges. The Corps of Engineers has installed and operates a pontoon bridge across the Intracoastal Waterway at Paris Road as an interim arrangement pending construction of the new bridge. Three bridges cross the Inner Harbor Navigation Canal (Industrial Canal), which forms a connection with the Mississippi River from the new Mississippi River-Gulf Outlet Channel. These are bascule spans at

St. Claude Avenue and at Florida Avenue with 75' and 94' horizontal clearance respectively, and the Seeber Bridge at North Claiborne Avenue which has 40' vertical clearance when closed, a lift span to 156' above M.H.W. and 300' horizontal clearance.

2. Purpose and Scope. This study is made to determine the reasonable requirements for both navigation and land traffic at this crossing and to recommend the type of bridge and clearances which will fulfill the requirements of the authorizing legislation for a "suitable bridge with approaches" for crossing the waterway. Types of crossings considered are:

a. Low level lift bridge with 300' horizontal clearance and lifts of 100, 135 and 160 feet above M.L.W. (156' above M.H.W.)

b. Semi-high level lift bridges with horizontal clearances of 300', 400' and 500' and vertical clearances in the closed position of 40 and 50 feet with lifts to 100, 135 and 160 feet.

c. High level fixed bridges with horizontal clearances of 300 and 750 feet and vertical clearances of 100, 135 and 160 feet.

d. Tunnels with 300' and 750' horizontal clearances at depths of 42 and 50 feet, respectively.

All crossings are for 4-lane highway traffic.

3. Land Traffic.

a. Land traffic using Paris Road in May, 1956, averaged approximately 2,500 vehicles per day and 4,000 VPD on Sundays. Peak traffic was approximately 227 vehicles per hour. The Louisiana Highway Department estimates average daily traffic for the 20-year period following completion of the project will be 15,000 VPD of which 15% or 2,250 will be commercial vehicles exclusive of light trucks.

b. Paris Road is a secondary State road located in St. Bernard Parish and the City of New Orleans (Orleans Parish). The bridge will be located in the limits of the City of New Orleans.

c. This road provides a direct connection between U. S. Route 90 and State Route 39, which are major routes to the east and south of New Orleans. The master street plan for future development of the City of New Orleans includes Paris Road as a principal outer belt artery and a proposed route for approach to a future bridge crossing the Mississippi River below the city. On completion of the Mississippi River-Gulf Outlet the road will provide one of the principal routes of access into the port and industrial area adjoining the new waterway.

d. The Louisiana Department of Highways has stated that a semi-high level, 4-lane, movable bridge similar to the North

Claiborne Avenue Bridge would be considered an adequate facility for highway needs. The Bureau of Public Roads offers no objection to this type of bridge. (See Incl. #9)

4. Waterway Traffic.

a. Intracoastal Waterway.

(1) Records of traffic through the existing pontoon bridge across the GIWW at Paris Road indicate that an average of 19.7 tows per day passed the site in 1957. Based on conservative projection of present trends, it is estimated that GIWW traffic will increase an average of 1% per year for the next 50 years. Thus the average increase for the next 50 years will be 25%. Applying this increase to existing traffic gives (19.7 + 25%) 24.6 tows daily as average future GIWW traffic.

(2) The Seeber Bridge at N. Claiborne Avenue over the Inner Harbor Navigation Canal (which coincides with the GIWW at this point) provides 40' vertical clearance in closed position. Actual records show that this bridge was opened an average of 5.5 times per day in 1957-58. An average of 1.5 of these daily openings were for ships. The remaining 4.0 openings per day were for the combined GIWW and miscellaneous harbor traffic requiring clearances greater than 40'.

(3) It is estimated that the additional harbor activity expected to develop as a result of completion of the Mississippi River-Gulf Outlet, will result in an average increase of approximately 35% in this type of traffic over the next 50 years. Therefore, bridge openings for traffic other than ships (combined GIWW and harbor traffic) would be increased 60% (25% + 35%) after development of the waterway and would result in an average of 6.4 openings per day for a bridge with 40' clearance when closed. It is estimated that 20% or 1.3 of these openings would be for derricks and special equipment, and 5.1 openings for towboats.

(4) Records indicate the following heights of towboats, which are the principal vessels of these heights using the waterway:

22% are more than 40' high.
7.6% are more than 45' high.
2.6% are more than 50' high.

In considering a bridge with 50' vertical clearance when closed and based on 5.1 average daily openings for towboats for a bridge with 40' clearance, the bridge with 50' clearance would require approximately 1/8 as many openings (2.6% ÷ 22%) for towboats, or 0.6 average per day. 62% of derricks and special equipment are more than 40' high and 35% are more than 50' high. Therefore (35 ÷ 62 X 1.3) = 0.7 passages per day would be required for this type of plant. Total average passages would be (0.6 + 0.7)

= 1.3 per day for combined GIWW and harbor traffic.

b. Mississippi River - Gulf Outlet.

(1) The growth trend for the Port of New Orleans is indicated by the fact that in 1946 total general cargo through the Port was 4,254,000 tons, moved in 2,060 vessels, and in 1956 general cargo traffic reached a total of 8,393,000 tons with a total of 3,992 ships visiting the port. Approximately 2,593 were foreign ships.

(2) To determine the probable maximum ship traffic which might pass the Paris Road bridge site at some future date, it may be assumed that approximately 24,000 linear feet of water frontage will be available on each side of the canal for marginal docks. Based on 231 tons average cargo handled per linear foot of wharf frontage in 1956 and 2,000 tons average cargo per ship, a maximum of approximately 5,544 ships annually could be accommodated in the area landward of Paris Avenue, at some future date when all available space is fully developed. Using 1/2 this figure as average gives 2,772 ships annually or an average of 7.5 ships daily which would enter and leave the port area. Thus, the ultimate development would result in an average of 15 ship passages of the bridge site daily.

c. Summary.

Estimated average daily passages:

	Average Total Passages	Average Max. Passages Requiring Greater than 40' Height	Average Max. Passages Requiring Greater than 50'Height
Ships (using average of ultimate development)	15.0	15.0	15.0
GIWW and harbor traffic	24.6	6.4	1.3
Total	39.6	21.4	16.3

5. Costs to Navigation.

a. Closed Position Conditions. Assuming delays to 1 out of 5 vessels due to waiting or slow down for bridge operation.

(1) Low Level Lift Bridge.

GIWW tows: 24.6 passages daily X 3 min. delay per tow X 1/5 of tows delayed @ $30 per hr.- Annual cost .....$ 2,737

Ships: 15.0 passages X 1/5 of vessels delayed X 8 min. average delay each @ $110 per hr. - Annual cost.....$16,060

Total annual cost to navigation.....$18,797

(2) 25' Clearance in Closed Position.

GIWW traffic:

80% of towboats are higher than 25 feet.
24.6 X 80% X 3 min. delay per tow X 1/5 of tows delayed @ $30 per hr. - $ 2,190
Ships: Same as low level 16,060

Est. total annual cost $18,250

(3) Semi-High Level Lift Bridge - 40' in Closed Position.

GIWW traffic:

6.4 tows over 40' X 1/5 of tows delayed X 3 min. delay each @ $30 per hr. - Annual cost..... $ 700
Ships: Same as (1) above..... 16,060

Total annual cost to navigation $16,760

(4) Semi-High Level Lift Bridge - 45' in Closed Position.

GIWW traffic:

(7.6% ÷ 22%) = 1/3 X 5.1 = 1.7 towboats desiring passage are over 45' high.
(48% ÷ 62%) X 1.3 = 1.0 derricks and spec. equip. desiring passage are over 45'.
2.7 tows X 1/5 of tows delayed X 3 min. delay each @ $30 per hr. - Annual cost..... $ 292
Ships: Same as above..... 16,060

Total annual cost.....$16,352

(5) Semi-High Level Lift Bridge - 50' in Closed Position.

GIWW traffic:
1.3 tows daily X 1/5 of tows delayed X 3 min. delay each @ $30 per hr.....$ 146
Ships: Same as above..... 16,060

Total annual cost.....$16,206

b. Clearance in Open Position.

NOTE: In computing relative costs due to restricted maximum vertical clearances when the bridge is fully open, the volume of ship traffic and sailing hours used in the project document have been used. These figures are less than would result from the possible maximum development of the port area as discussed in paragraph 4b. However, they are on the conservative side and give satisfactory values for comparison of costs.

(1) 100' Maximum Vertical Clearance.

Approximately 88% of American ships are more than 100' high. Percentage of foreign ships is assumed to be approximately the same. Since the channel is justified only because of use by these ships and savings are in excess of $1,380,000 annually, this restrictive clearance could not be considered.

(2) 120' Maximum Vertical Clearance.

Approximately 39% of American Registry Ships operating from the Gulf and Atlantic Ports are more than 120' high.

Cost for delay sailing up river in lieu of new channel. 2500 hrs. (From Proj. Doc.) X 39% X $110 =	$107,250
Added cost for lockage and tugs cost - 1550 ships X 39% X 4 hrs. X $210 =	$507,360
Added hazards cost (insurance, etc.)	10,000
Est. total added annual cost.....	$624,610

(3) 135' Maximum Vertical Clearance.

Approximately 0.9% of ships are more than 135' high

Delays for sailing coastwise - 2500 hrs. X 0.9% X $110 =	$ 2,475
Added cost for lockage and tugs - 14 ships X 4 hrs. @ $210 =	11,760
Added hazards -	Nominal
Est. total added annual cost	$ 14,235

(4) 150' Maximum Vertical Clearance.

Approximately 0.5% of ships are more than 150' high.

Delays for sailing coastwise - 2500 hrs. X 0.5% X $110 =	$ 1,375

Added cost for lockage and tugs -
1550 ships X 0.5% X 4 hrs. X $210 = $ 6,510

Total added annual cost.....$ 7,885

(5) 160' Maximum Vertical Clearance above MLW - 156' Above MHW.

Only 17 ships in the world are higher than 160' consisting principally of major ocean liners.
No use of canal is contemplated by these ships. No cost

6. Costs to Land Traffic.

Costs computed by Louisiana Highway Department (Report dated March 1958 with supplementary data 15 July 1958)

Vertical Clearance in Closed Position	Added Cost of Vehicular Operations
Lift Bridge - 10' (Min.)	$57,353 **
" " 40'	49,319 **
" " 50' Closed	34,951 *
Fixed Bridge 100'	36,792
" " 135'	48,728
" " 160'	56,830
Tunnel - 42' deep	22,543
" 50' deep	27,300

* Figure supplied by C. of E. based on extension of La. H. D. figures.

** La. H. D. figure adjusted for revised number of bridge openings.

7. Summary of Costs.

a. Construction Cost of Bridges and Tunnels.

Type	Clearances Horizontal	Clearances Vertical	Construction Cost
High Level Fixed	300 ft.	100 ft.	$ 10,144,135
	"	135	13,560,030
	"	160	16,049,000
	750	160(156' MHW)	21,340,000

Type	Clearances Horizontal	Clearances Vertical	Construction Cost
Semi-High Level Lift - 40' Closed	300 ft.	100 ft.	$ 6,172,085
		135	6,362,028
		160(156' MHW)	6,500,169
Semi-High Level Lift - 50' Closed	300	160(156' MHW)	6,791,920
	400	160 " "	7,345,460
	500	160 " "	7,899,000
Low Level Lift	300	100	4,390,311
		135	4,608,111
		160(156' MHW)	4,766,511
Tunnel	300	-42	15,907,219
	750	-50	21,628,000

b. Annual Costs.

Type	Clearance Horiz.	Clearance Vert.	Annual Charge on Const.Cost	Operation & Maintenance	Added Cost to Vehicular Traffic	Navigation Costs (1)	Navigation Costs (2)	Total Annual Costs
HLF	300'	100'	$ 364,239	$ 18,160	$ 36,792	-	$1,380,000	$ 1,799,191
	"	135	479,198	22,498	48,728	-	14,235	564,659
	"	160	566,530	25,220	56,800	-	0	648,550
	750	160	753,302	36,000	56,800	-		846,102
SHLL 50' Closed	300	160	242,256	32,310	34,951 (4)	$ 16,206	0	325,723
	400	160	262,000	35,810	34,951 (4)	4,966 (3)	0	337,727
	500	160	281,758	39,000	34,951 (4)	4,966 (3)	0	360,675
SHLL 40' Closed	300	100	220,837	32,011	49,319 (5)	16,760	1,380,000	1,698,927
		135	227,542	32,011	49,319 (5)	16,760	14,235	339,867
		160	232,524	32,011	49,319 (5)	16,760	0	330,614
LLL	300	100	168,893	25,687	57,353 (5)	18,797	1,380,000	1,650,730
		135	176,581	25,687	57,353 (5)	18,797	14,235	292,653
		160	182,173	25,687	57,353 (5)	18,797	0	284,010
Tunnels	300	42	563,464	20,062	22,543	0	0	606,069
	750	50	765,149	30,000	27,300	0	0	822,449

NOTE: (1) Added costs due to limited height in closed position.
(2) Added costs due to limited maximum vertical height.
(3) Adjusted for savings due to increased horizontal clearance (See Par. 8).
(4) Figure supplied, based on extension of La. Highway Dept. figures.
(5) La. Highway Dept. figures adjusted for revised number of bridge openings.

8. Horizontal Clearances.

a. Three hundred feet has been used as the basic horizontal clearance for these studies. Representatives of the pilots association have indicated that horizontal clearance of 300 ft. would be sufficient for one-way passage of ships or large tows. Advantages of horizontal clearances of 400 ft. and 500 ft. (project channel width) have also been investigated. A few lift bridges with clear spans of 500 ft. have been built in the United States. Such a span with 4 traffic lanes was built over Rockaway Inlet, Jamaica Bay, N. Y., in 1935 and a 2-lane highway bridge with 500 ft. clear span was built over the Delaware River at Bristol, Pa., in 1931. The Buzzards Bay railroad bridge over Cape Cod Canal, built by the Corps of Engineers in 1935, has a single track vertical lift span 544 ft. long. A similar railway bridge was built across Arthur Kill, at Elizabeth, N. J., in 1957, replacing an old swing bridge. Two other railway bridges are being studied by the Corps of Engineers at the present time for modification to vertical lift spans to provide 500 ft. horizontal clearances. No movable bridges of this span have been built in the Gulf Coast Area.

b. It may be assumed that ships and large tows would not pass other similar vessels between bridge piers with 300 ft. horizontal clearance and that they would pass with slight delay between piers with 400 ft. clearance and without delay in a 500 ft. channel. Economic benefits and operating advantages can be attributed to the wider span as follows:

Average maximum daily ship movements.....15 passages
Average daily GIWW movements are 24.6 tows,
of which 25% may be assumed to be large
tows which would be delayed by bridge
restriction.....6.1 passages
Estimated total large vessel traffic
requiring wide clearances.....21.1 passages
Assuming that 20% of the large vessels would
be involved in situations where two tows
or ships would pass at the bridge site,
then the total number of vessels suffering
delay due to bridge with 300 ft. horizontal
clearance would average..... 4.2 daily
Assuming an average delay of 4 minutes per
vessel on each occasion due to inability
to pass another vessel opposite the bridge
site, then costs would be 4.2 x 4 min. at
$110 per hr. x $\frac{365}{60}$ = ...$11,240 per annum

NOTE: Cost per hour of $110 is used for both ships and tows inasmuch as only the largest size tows are assumed to be involved.

This annual savings, attributed to a 400 ft. span in lieu of 300 ft. span, would support

initial expenditure of approximately $320,000 additional construction costs. This savings plus additional benefits due to reduction of hazards, avoiding congestion and fewer accidents, indicate definite advantages attributable to a span with 400 ft. horizontal clearance.

c. There is no precedent for construction of a bridge with 500 ft. movable span in this area and sufficient engineering studies have not been made to establish the feasibility or accurately estimate the cost. The approximate costs listed herein are extrapolated by the State Highway Department from costs of smaller span structures. Due to these unresolved technical problems and lack of tangible benefits to offset the known higher costs, further consideration of a 500 ft. span movable bridge is not recommended.

9. Economic Height in Closed Position.

A substantial number of large towboats and 7 harbor tugs operating in New Orleans Harbor have vertical heights between 40 and 45 feet. Three harbor tugs and about 5% of towboats have vertical heights between 45 and 50 feet. Costs for a lift bridge with 300 ft. horizontal clearance and 45 ft. vertical clearance in the closed position would be approximately $150,000 more than for 40 ft. vertical clearance. Costs for 50 ft. clearance in closed position are approximately $291,000 more than for 40 ft. clearance. (La. Highway Dept. estimates.) Annual charges on this added construction cost would be approximately $5,289 for the 45 ft. bridge and $9,732 for the 50 ft. bridge. By taking into account other factors such as maintenance and operation, eliminating some delay and inconvenience to waterway traffic and reducing the number of bridge openings which will reduce the stops and delays for vehicular traffic, a net savings of $4,891 can be realized for the 50 ft. bridge over that attributed to a bridge with 40 ft. clearance in the closed position. Other intangible benefits would accrue due to reduction in the number of bridge openings which would reduce congestion and inconvenience to the motoring public.

These comparisons of bridge heights are based on the various clearances above a mean high tide which is approximately +4.0 M.L.G. Hurricane tides up to +9.0 M.L.G. occur during tropical disturbances usually in the summer and early fall months. Under such circumstances a bridge with normal clearance of 50 ft M.H.W. would have only 45 ft. clearance during hurricane conditions. Since it is sometimes impractical to open the navigation span of a bridge during the height of a hurricane, a bridge with 50 ft. clearance in closed position would provide an additional factor of safety during these storms.

While many of the towboats and harbor tugs using this waterway could be altered to reduce their heights from say 45 ft. to 40 ft., there are no means to require such alterations and since the bridge will be movable to provide clearances for ships and other higher

clearance vessels, it must be realistically assumed that a bridge of 40 ft. or 45 ft. clearance would be opened to pass vessels with heights only slightly greater than the closed position clearance in lieu of altering these vessels. With 50 ft. clearance only occasional openings would be required for GIWW and harbor traffic.

Actual vessel heights have been used in the preceding tabulations for comparison with actual bridge heights above M.H.W. During normal tide conditions of 0.0 to +2.0 M.L.G., this provides a margin of safety of 2 ft. to 4 ft. between the vessel height and bridge. This is the minimum margin of safety which should be considered and during extreme high tides this clearance will be progressively reduced. For these reasons a bridge to provide safe navigation clearances for vessels up to 45 ft. high during high tides and hurricane conditions should have a height of 50 ft. above M.H.W.

10. Discussion.

a. Fixed bridge. A high level fixed bridge at this site would offer least interference to both land and water traffic. The first cost and annual costs for a fixed bridge are much greater than for other comparable types and are approximately equal to those for a tunnel. Since costs for this type of bridge increase in direct proportion to increase in vertical clearance, the economic height would be approximately 135 ft., whereas the economic height for a lift bridge bridge is approximately 160 ft. (See Incl. 5 and Paragraph 7 b.)

Based on anticipated land and water traffic at this site and the usual cost factors which can be attributed to bridges of various vertical clearances, a high level bridge is not economically justified.

b. Tunnel. Several local organizations, including the New Orleans Chamber of Commerce and the Board of Commissioners for the Port of New Orleans, advocate a tunnel for this location. This type of crossing would be most desirable from the viewpoint of complete separation of waterway and land traffic without vertical limitation and would to a large extent eliminate obstruction created by piers in the waterway. Tunnels have been constructed within the past few years across the Gulf Intracoastal Waterway at Harvey and near Belle Chasse, La., near New Orleans. No tunnels have been constructed under deep draft ship channels in this area.

Estimated first cost and combined annual costs for a tunnel are approximately equal to those for a fixed bridge with 160 ft. vertical clearance, which are the highest costs for any type of crossing having acceptable clearances. Costs for the minimum clearance tunnel of 42 ft. depth for 300 ft. channel width are approximately twice those for a suitable lift bridge.

First costs for a tunnel 50 ft. deep and channel width of 750 ft., as advocated by the New Orleans Port Commission (Dock Board), are approximately three times the cost for a suitable lift bridge with 50 ft. vertical clearance when closed, 160 ft. open, with 400 ft. horizontal

clearance. Combined annual costs are approximately 2-1/2 times greater.

Preliminary estimates for two tunnels with different clearances and two high level bridges with comparable clearances indicate that costs for these types of crossings are approximately the same. In evaluating the features of a tunnel vs. high level bridge, the tunnel offers the advantage of less rise and fall for highway traffic, less obstruction to the waterway, and shorter approaches resulting in less interference to adjoining port and industrial activity.

When all factors usually attributed to separation of the two types of traffic are evaluated and the usual economic benefits assigned, a tunnel cannot be economically justified when compared with the economics of a crossing such as the semi-high level lift bridge.

c. Low level lift bridge. A low level bridge with a lift span would have the lowest initial cost and the combined annual costs would be less than any other type, when costs to land traffic are computed in accordance with the U. S. Department of Commerce procedures used by the State Highway Departments. However, there are intangible costs and other factors which make a low level bridge undesirable. The frequency of opening for the estimated increased volume of waterway traffic will cause undesirable interference with both land and water traffic, which will result in general impediment to commerce and retard business development in the area served by the bridge. The additional economic losses resulting from such interference, and congestion of traffic when contemplated development occurs, are considered sufficient to rule out consideration of a low level bridge for this location.

d. Semi-high level lift bridges. A semi-high level lift bridge with 300 ft. horizontal clearance and with 40 ft. clearance above M.H.W. when closed and a lift to 156 ft. and 160 ft. above M.H.W. and M.L.W., respectively, would offer reasonable freedom to navigation and would not cause undue interference with land traffic. A bridge with these clearances has recently been completed over the Inner Harbor Navigation Canal (Industrial Canal) at North Claiborne Avenue. This bridge would require opening for all ship traffic and for the larger towboats, harbor tugs, derricks and other special equipment. The North Claiborne Avenue Bridge has been opened an average of 5.5 times per day since its completion. Openings for ships have averaged 1.5 per day and for GIWW and harbor traffic 4.0 per day. The 300 ft. horizontal clearance is sufficient for normal one-way traffic but, since the new channel width at this point is 500 ft., the piers would restrict the channel to a degree that passing of large tows or ships at the bridge site would be hazardous. Initial costs for this bridge are not excessive and combined annual costs of $330,614 make this one of the most acceptable types from an economic viewpoint.

Further consideration of economic benefits, as well as reduction in the amount of interference with both land and water traffic, indicate that a bridge with 50 ft. clearance in the closed position would be justified. Such a bridge would pass all the normal commercial

GIWW and harbor traffic without opening and would require opening only for ships and occasional derricks or other special equipment. Delays to land traffic would be reduced substantially and movement of water traffic facilitated. Increase in horizontal clearance to provide 400 ft. between fenders also offers additional economic benefits and reduces safety hazards. Combined annual costs for a lift bridge with 50 ft. vertical clearance when closed, 400 ft. horizontal clearance and lift to 156 ft. and 160 ft. above M.H.W. and M.L.W., respectively, are $337,727, which are near the minimum for any type bridge having acceptable clearances. The slight increase in annual costs over those for a 40 ft. bridge with 300 ft. horizontal clearance are considered justified by benefits to navigation in reduction of safety hazards and facilitating movement of both waterway and land traffic.

11. Recommendations. A semi-high level lift bridge with 50 ft. vertical clearance in the closed position, 400 ft. horizontal clearance and lift to 156 ft. and 160 ft. above M.H.W. and M.L.W., respectively, is determined to be a suitable crossing of the GIWW and Mississippi River-Gulf Outlet at Paris Road and is recommended.

C O P Y

U. S. Department of Commerce
BUREAU OF PUBLIC ROADS
Division Six

502 U. S. Courthouse
Fort Worth 2, Texas

323 Post Office Building
Baton Rouge, Louisiana
October 31, 1957

Colonel William H. Lewis, District Engineer
Corps of Engineers
Foot of Prytania Street
New Orleans 9, Louisiana

Dear Sir:

During the conference held in your office on October 17, 1957 concerning the Mississippi River Gulf Outlet Project at its crossing of Paris Road in St. Bernard Parish you requested that we inform you as to the eligibility of Paris Road for future improvements with the use of Federal-aid Highway funds. This is to advise that Paris Road is a part of the Federal-aid Secondary System and is eligible for improvement with Federal-aid Highway funds. A portion of this road lies within the Urban area of New Orleans and is not eligible for secondary funds, however, urban funds can be expended on this section within the urban area. Therefore, the entire route is eligible for improvement with some type of Federal-aid Highway funds.

There was considerable discussion regarding the possibility of betterments over and above that which is considered the obligation of the U. S. Government towards a permanent crossing on Paris Road. The position of the Bureau of Public Roads as far as Federal-aid Highway funds are concerned, any betterment will have to be financed by others. In other words, we feel that the Corps of Engineers has the obligation of building a suitable crossing of this stream. Any crossing that is suitable to your organization and the Louisiana Department of Highways as well as the Bureau of Public Roads would,in our opinion, be all of the improvement that can be financed with Federal funds of any type.

The proposed structure as outlined at the meeting was for a semi-high level bridge providing for 40' clearance in the closed position and a 156' vertical clearance in the open position. The bridge was to have a 300' horizontal clearance. This office sees no objection to the use of these clearances insofar as highway traffic is concerned. Any change to increase the horizontal clearance should be borne by parties other than those interested in highway improvements.

We wish to thank you for the consideration shown the Bureau of Public Roads in coordinating the matter of this crossing, as well as others, between these two Federal Agencies.

Very truly yours,

J. S. Logan
Division Engineer

cc: Mr. E. J. James
Incl. #9

BRIDGES AT MAJOR U. S. PORTS

October, 1957

Port	Type	Clearance Horizontal	Clearance Vertical M.H.W.	Waterway
New York	F.S.(S.)		237	Proposed Narrows Br.
New York	F.S.	760	135	Hudson R. (Mills Pt.,N.Y.)
New York	F.S.(S.)	3418	248	G. Washington Br.
New York	F.S.(S.)	2265	135	E. River Bronx-Whitstone
New York	F.S.	947	133	E. River Queensboro
New York	F.S.(S.)	1546	127	Brooklyn Br.
Newark Bay Area	V.L.	216	135	Controlling Clearances
Bayonne	F.S.	1640	150	Kill VanKull
Bristol	V.L.	500	134	Delaware River (Upper)
Philadelphia	F.S.	1686	135	Delaware River (above major port)
Mobile	V.L.	300	135	Mobile R. (Upper)
Richmond, Calif.	F.S.	1000	185	S.F. Bay
Oakland, Calif.	F.S.	1329	184	S.F. Bay
San Francisco	F.S.(S.)	4028	213	Golden Gate Br.
San Francisco	F.S.	1068	218	S.F. Bay Br.
Wilmington, Del.	F.S.(S.)	1500	175	Del. R.
Jacksonville, Fla.	V.L.	350	135	St. Johns R.
St. Petersburg	F.S.	800	140	Tampa Bay
Chesapeake City	F.S.	523	140	Ches.-Del. Canal
Annapolis	F.S.	1500	186	Ches. Bay
Boston	V.L.	500	135	Cape Cod Canal
Ottawa	F.S.	500	150	St. Lawrence R.

Incl. #8

APPENDIX V

BRIDGES AT MAJOR U. S. PORTS (Cont'd)

Port	Type	Clearance Horizontal	Clearance Vertical	Waterway
Portland	-	157	144	Willamette R.
Charleston	F.S.	1000	150	Cooper R.
Port Arthur	F.S.	600	168	Neches R.
Newport News	V.L.	250	145	James R.
Tacoma	V.L.	200	135	Controlling clearances
Vancouver	V.L.	255	135	Columbia River
New Orleans	F.S.	750	133	Miss. R. Huey Long Br.
New Orleans	F.S.	1400	150	Greater N. O. Br.
New Orleans	V.L.	300	156	IHNC - Claiborne Ave.

F.S. - Fixed steel truss

F.S.(S.) - Fixed steel suspension

V.L. - Vertical lift

NEW ORLEANS HARBOR & MISS. R. BRIDGES

VERT. CLEARANCE

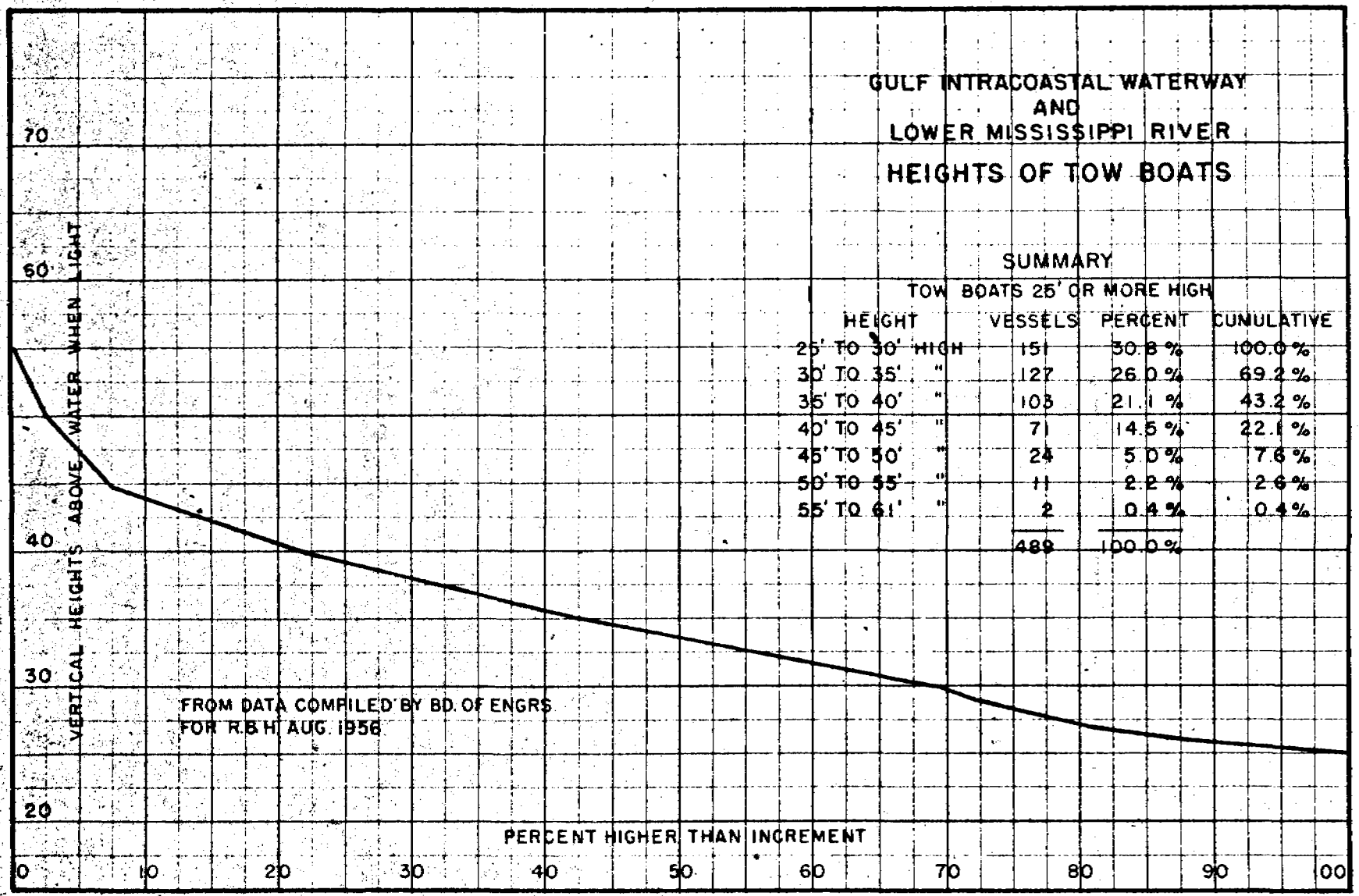
	Above H.W.	H. W.	Above M.L.W.
Miss. R. Br. (Thalia St.)	150	20	170.0
Huey Long Br.	135	18	153.0
N. Claiborne Ave. Br. Ind. Canal	156	4	160.0
St. Claude Ave. Br.	Bascule - no limit		
Florida Ave.	"	" "	
Harvey Lock	"	" "	
Harvey R. R.	"	" "	
Harvey Tunnel			-18.0
Algiers Lock Lift	100	3	103.0
Belle Chasse R. R.	100	3	103.0
" " Tunnel			-18.0

WORLD'S SHIPS OVER 135' HIGH

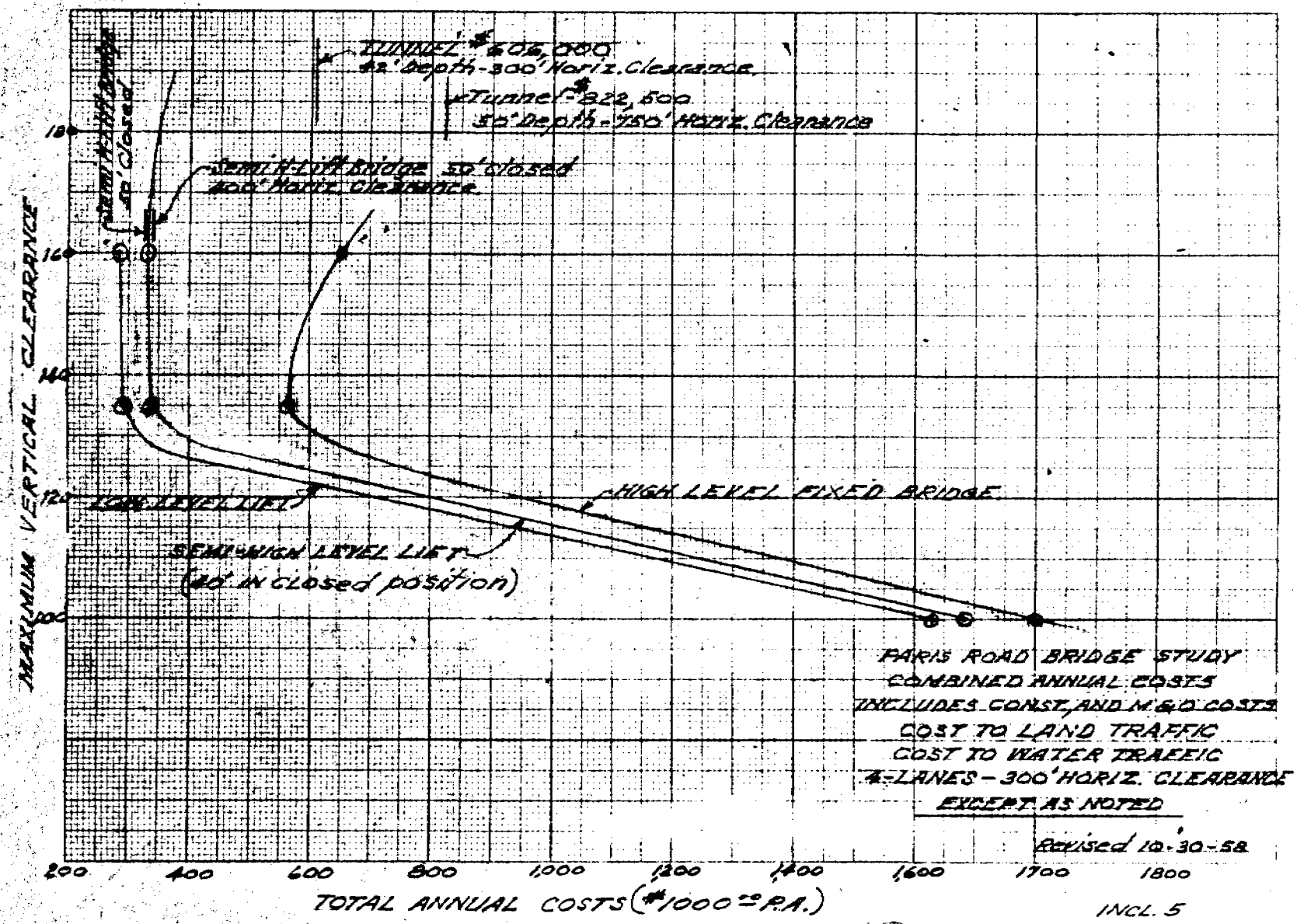
	Number of Ships Higher Than Increment	
	U. S.	Foreign
200'		2
180'	1	4
170'	3	7
160'	9	8
150'	14	9
140'	18	12
135'	35	44
Delta Line Ships		112 and 114 feet high
S.S. Flandre & Antilles		156'
S. S. Veendam (highest ever in N.O.)		164'
S.S. Queen Mary		214'

Incl. #7

APPENDIX V


GULF INTRACOASTAL WATERWAY
AND
LOWER MISSISSIPPI RIVER
HEIGHTS OF TOW BOATS
SUMMARY
TOW BOATS 25' OR MORE HIGH
HEIGHT VESSELS PERCENT CUMULATIVE
25' TO 30' HIGH 151 30.8 % 100.0 %
30' TO 35' " 127 26.0 % 69.2 %
35' TO 40' " 103 21.1 % 43.2 %
40' TO 45' " 71 14.5 % 22.1 %
45' TO 50' " 24 5.0 % 7.6 %
50' TO 55' " 11 2.2 % 2.6 %
55' TO 61' " 2 0.4 % 0.4 %
489 100.0 %
VERTICAL HEIGHTS ABOVE WATER WHEN LIGHT
70
60
40
30
20
FROM DATA COMPILED BY BD OF ENGRS
FOR R.B.H. AUG. 1956
PERCENT HIGHER THAN INCREMENT
0 10 20 30 40 50 60 70 80 90 100

INCL. 6



PARIS ROAD BRIDGE STUDY
COMBINED ANNUAL COSTS
INCLUDES CONST. AND M & O COSTS
COST TO LAND TRAFFIC
COST TO WATER TRAFFIC
4-LANES - 300' HORIZ. CLEARANCE
EXCEPT AS NOTED

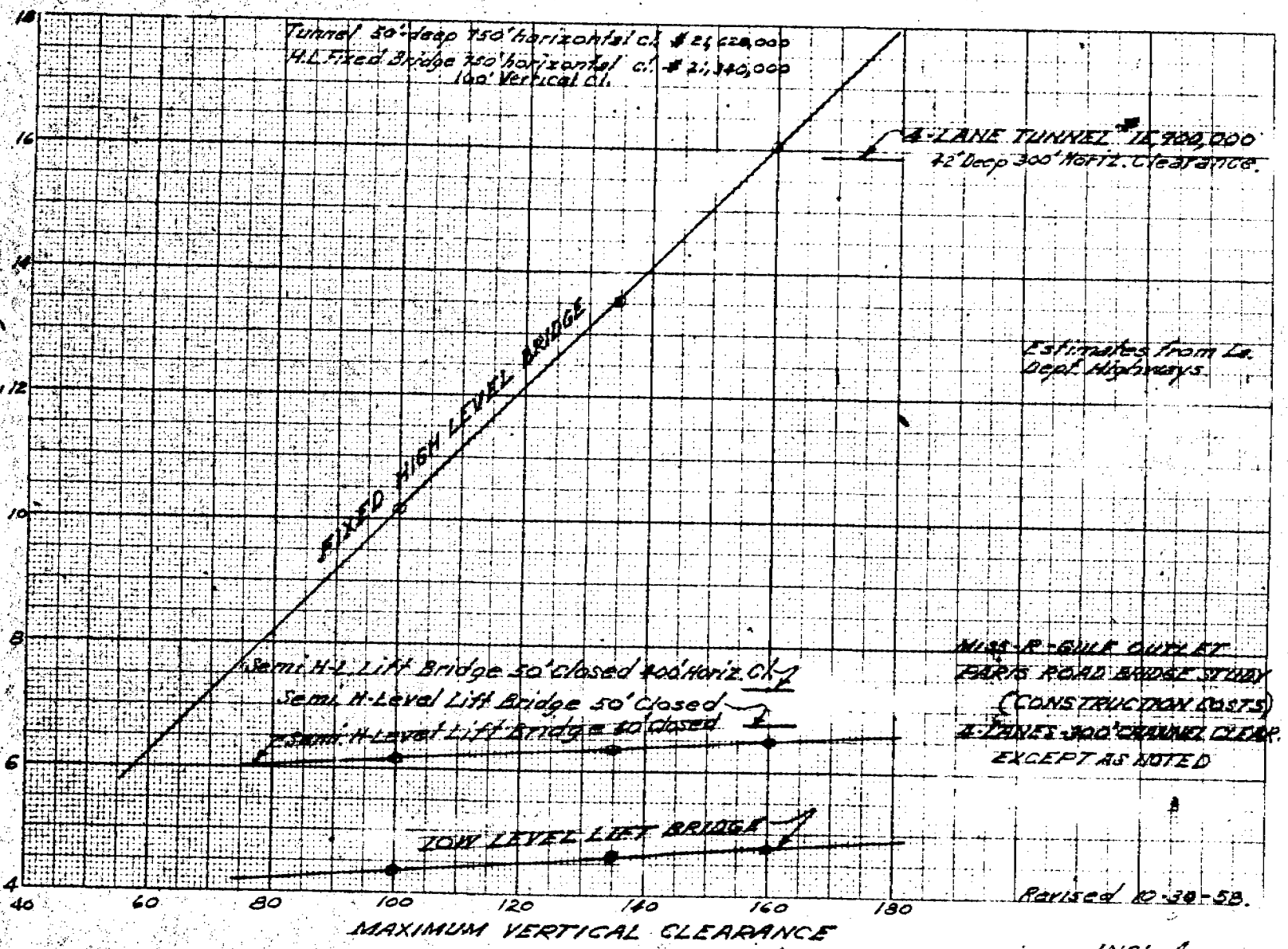
Revised 10-30-58

INCL. 5

APPENDIX V

NO. 340 -20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.



INCL-4.

APPENDIX V

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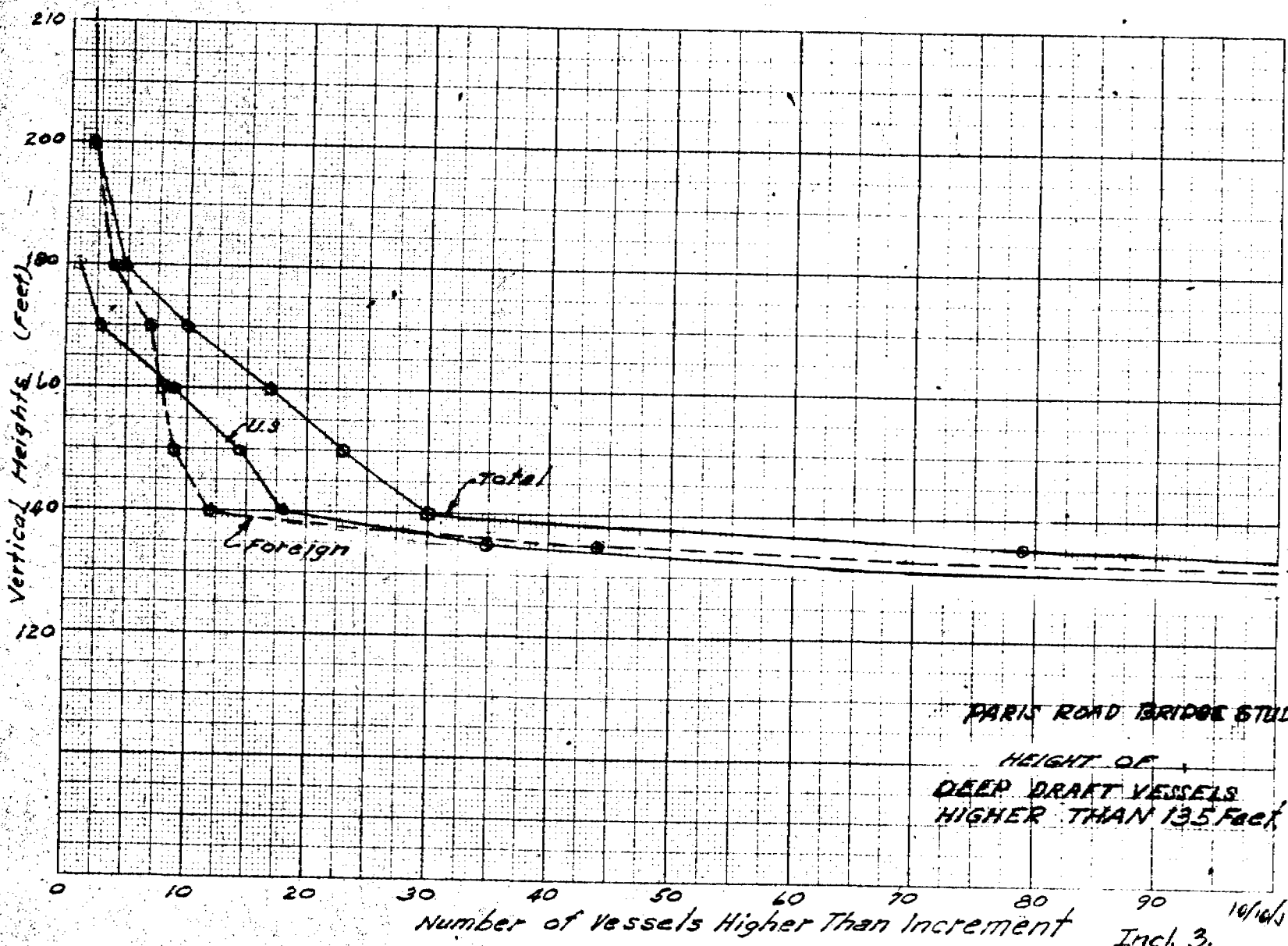


PARIS ROAD BRIDGE STUDY

HEIGHT OF
DEEP DRAFT VESSELS
HIGHER THAN 135 Feet

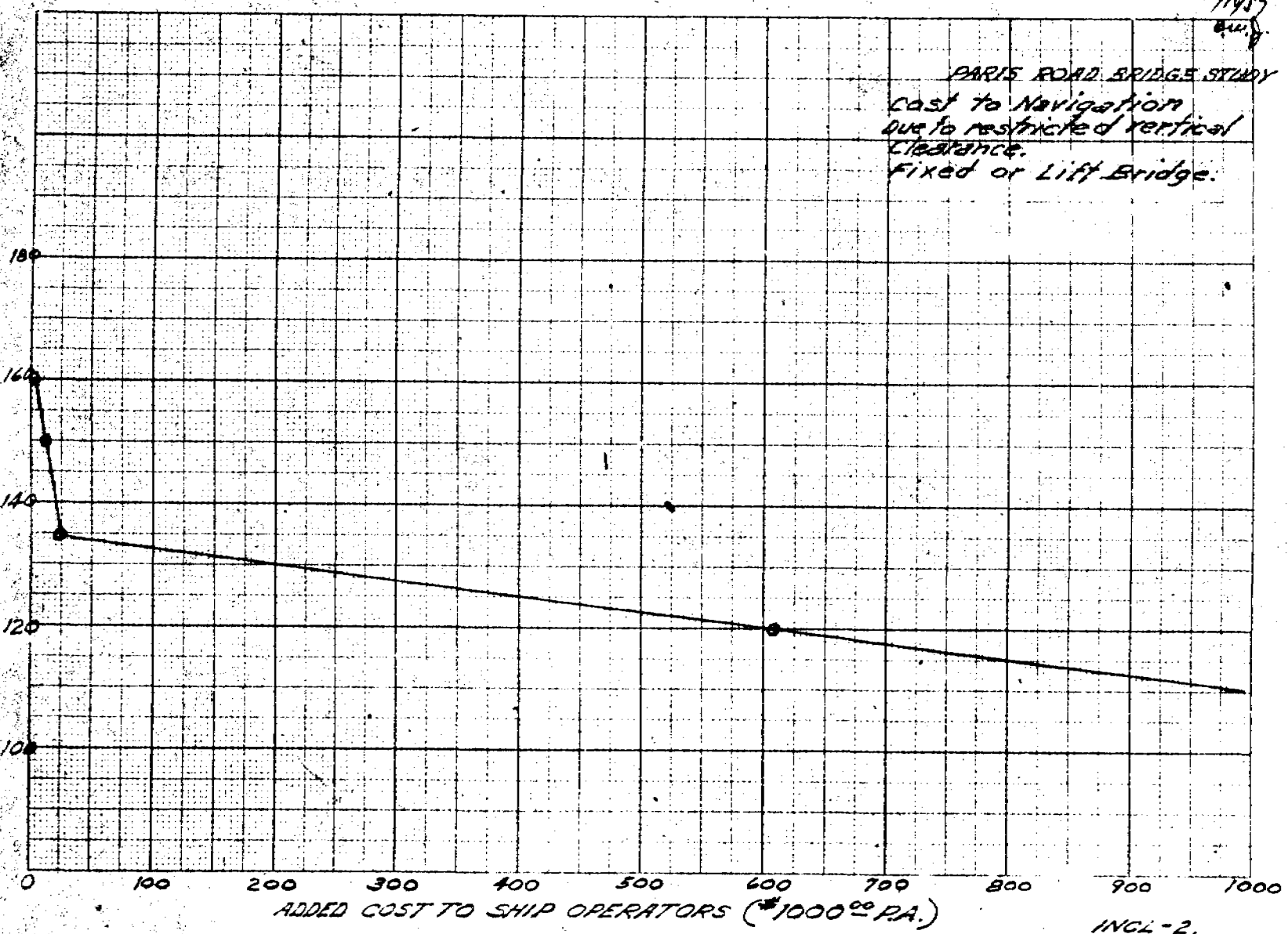
10/16/57

Incl. 3.

ATTACHMENT 4

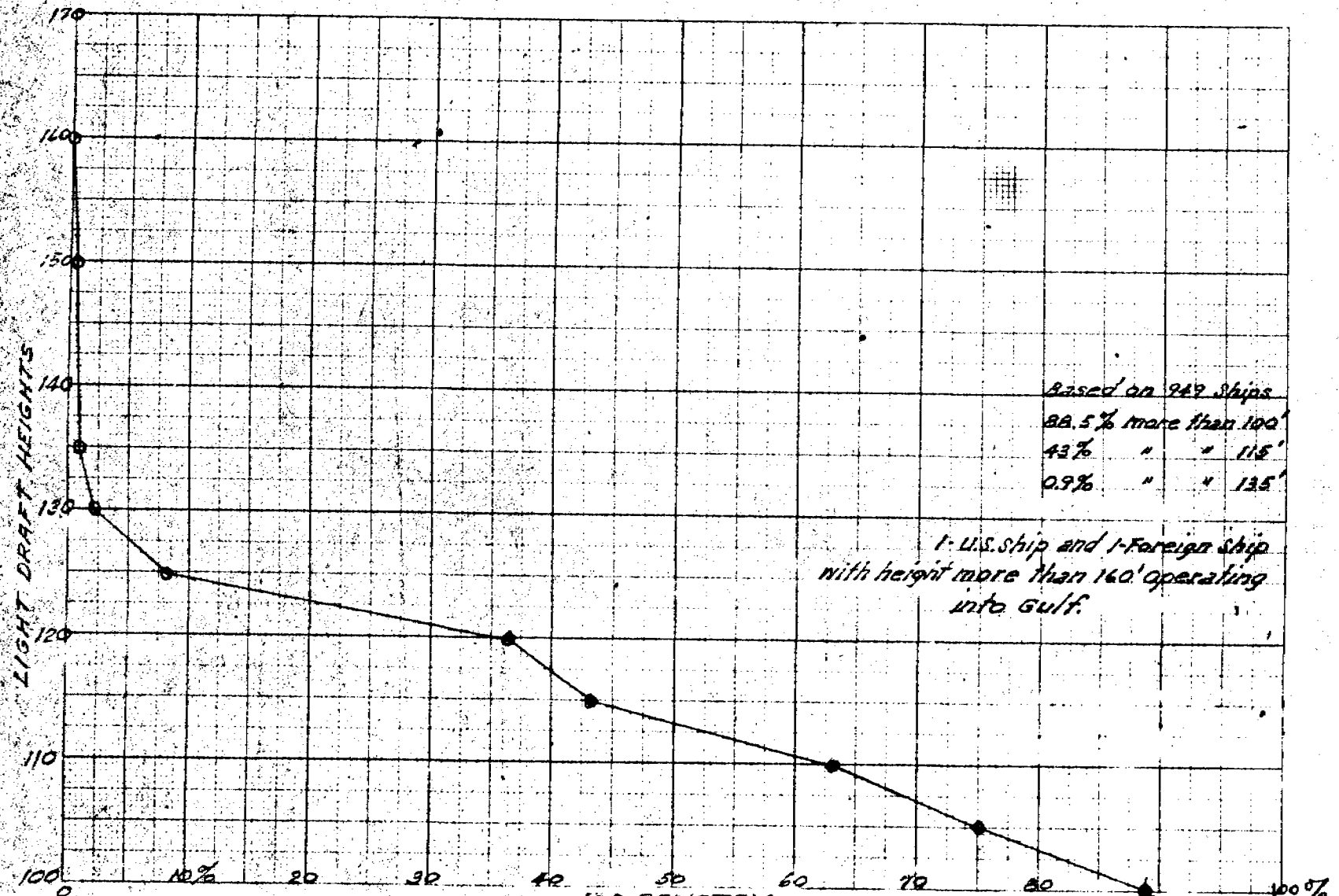
15/11/57
Bw.

PARIS ROAD BRIDGE STUDY
Cost to Navigation
due to restricted vertical
clearance.
Fixed or Lift Bridge.



INCL - 2.

APPENDIX A



U.S. REGISTRY
DEEP DRAFT VESSELS - GULF COAST OPERATORS
PERCENT HIGHER THAN INCREMENT

Incl. 1.

DIFFERENTIALS IN SHIPS' OPERATION COSTS
ROUTES B, D, E-6 AND ALT. E-6

1. A comparison of the ship operation over the various Routes (B, D, E-6 and Alt. E-6) under study in connection with the Mississippi River-Gulf Outlet is as follows.

2. The original estimate of benefits for the project credited a total of 1,550 calls of vessels to the facilities to be constructed along the tidewater canal. General cargo traffic in ocean-going vessels consists of approximately 41% coastwise and 59% foreign. The following are the estimated divisions of coastwise and foreign trade:

COASTWISE TRAFFIC	PERCENT OF TOTAL
To Atlantic Coast Ports	90
To Pacific Coast Ports	10
FOREIGN TRAFFIC	
To the east	60
To the west (including South America)	40

The routes used from the Mississippi River-Gulf Outlet to European and Atlantic Coast ports is by way of the Florida Strait, while on voyages to the West Coast Ports, South America, and the Far East the route is by way of the Yucatan Channel. The common point on the route through the Florida Strait is Dry Tortugas, while on the Yucatan Channel route the common point is Cape San Antonio. Based on the estimated 1,550 calls by sea-going, general-cargo vessels, the following number of trips will be made by vessels handling cargo over the channel:

NUMBER OF VOYAGES	
VIA DRY TORTUGAS	VIA CAPE SAN ANTONIO
2,241	859

The distances to the common points on the two routes are shown below:

VIA ROUTE	DISTANCE IN STATUTE MILES TO 38-FT. CONTOUR	DISTANCE IN STATUTE MILES FROM 38-FT. CONTOUR TO DRY TORTUGAS	DISTANCE IN STATUTE MILES FROM 38-FT. CONTOUR TO CAPE SAN ANTONIO
Route B	75.6	499.0	578.0
Route D	77.0	501.0	586.0
Route E-6	74.2	531.0	627.0
Route Alt. E-6	76.4	531.0	627.0

It is estimated that ships utilizing the project will average about 9.25 statute miles an hour inshore of the 38-foot contour and on the sea leg will average approximately 13.8 statute miles an hour. Resolving these hourly rates into time results in the following transit times over the various legs of the three routes:

TO AND FROM ATLANTIC COAST AND EUROPEAN PORTS

	Time to 38-ft. Contour	Time from 38-ft. Contour to Dry Tortugas	Total Time
Via Route B	8.2 hours	36.2 hours	44.4 hours
Via Route D	8.3 hours	36.3 hours	44.6 hours
Via Route E-6	8.0 hours	38.5 hours	46.5 hours
Via Route Alt. E-6	8.3 hours	38.5 hours	46.8 hours

TO AND FROM WEST COAST, SOUTH AMERICAN, AND FAR EAST PORTS

	Time to 38-ft. contour	Time to Cape San Antonio	Total Time
Via Route B	8.2 hours	41.9 hours	50.1 hours
Via Route D	8.3 hours	42.5 hours	50.8 hours
Via Route E-6	8.0 hours	45.4 hours	53.4 hours
Via Route Alt. E-6	8.3 hours	45.4 hours	53.7 hours

The total estimated annual operating time over the various routes are shown below:

TOTAL OPERATING HOURS VIA

	TO DRY TORTUGAS	TO CAPE SAN ANTONIO	Total Time
Route B	99,500 hours	43,036 hours	142,536 hours
Route D	99,949 hours	43,637 hours	143,586 hours
Route E-6	104,207 hours	45,871 hours	150,078 hours
Route Alt. E-6	104,879 hours	46,128 hours	151,007 hours

The average cost of operating the various vessels while at sea is estimated at $155 an hour. Based on an hourly rate of $155, annual operation cost of vessels over the three routes are:

TOTAL OPERATING COST

Via Route B	$ 22,093,080
Via Route D	22,255,830
Via Route E-6	23,262,090
Via Route Alt. E-6	23,406,085

The annual cost of operation is less over Route B than the other three routes considered. The estimated annual savings which might be realized by the use of Route B compared to Routes D and E-6 and Alt. E-6 are as follows:

ANNUAL SAVINGS IN OPERATION COSTS ROUTE B OVER ROUTE D	ANNUAL SAVINGS IN OPERATION COSTS ROUTE B OVER ROUTE E-6	ANNUAL SAVINGS IN OPERATION COSTS ROUTE B OVER ALT. ROUTE E-6
$162,750	1,169,010	1,313,005