U. S. ARMY, CORPS OF ENGINEERS

MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA

DESIGN MEMORANDUM NO. 1-C, CHANNELS
SUPPLEMENT NO. 1
STONE RETENTION DIKE EXTENSION

Prepared in the Office of the District Engineer
New Orleans District, Corps of Engineers

January 1966

LMVED-TD (NOD 11 Jan 66) 1st Ind
SUBJECT: Mississippi River-Gulf Outlet, La., Design Memorandum No. 1-C, Channels, Supplement No. 1, Stone Retention Dike Extension

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 31 Jan 66

TO: District Engineer, New Orleans District, ATTN: LMNED-PP

1. Subject supplement is approved as recommended. Our review comments follow.

2. Table 2 Page 4. The direction of current should be clarified as to whether the azimuth is from north or south. It should also be clarified as to whether the current is from or toward the given direction.

3. Plate 2. The tower numbers should be shown.

4. Plate 3. The end of existing south dike should be designated on the plan and profile.

5. Plate 4. a. The south side borrow pit for cast fill should be shown on Phase I section.

b. The slopes for Phase II section should be shown.

Ellsworth I. Davis

wd all incl

ELLSWORTH I. DAVIS
Major General, USA
Division Engineer

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

IN REPLY REFER TO
LMNED-PP

11 January 1966

SUBJECT: Mississippi River-Gulf Outlet, La., Design Memorandum No. 1-C, Channels, Supplement No. 1, Stone Retention Dike Extension

TO: Division Engineer
Lower Mississippi Valley Division
ATTN: LMVED-TD

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

2. Approval of subject supplement is recommended.

1 Incl (12 cys)
Supplement No. 1

THOMAS J. BOWEN
Colonel, CE
District Engineer

MISSISSIPPI RIVER-GULF OUTLET,
LOUISIANA
DESIGN MEMORANDUM NO. 1-C, CHANNELS
SUPPLEMENT NO. 1
STONE RETENTION DIKE EXTENSION

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MISSISSIPPI RIVER-GULF OUTLET,
LOUISIANA
DESIGN MEMORANDUM NO. 1-C, CHANNELS
SUPPLEMENT NO. 1
STONE RETENTION DIKE EXTENSION

1. Project authorization. The Mississippi River-Gulf Outlet, La., a modification of the existing project, "Mississippi River, Baton Rouge to the Gulf of Mexico," was authorized by the River and Harbor Act of 29 March 1956 (Public Law 455, 84th Congress, 2d Session), substantially in accordance with the report of the Chief of Engineers dated 5 May 1948 printed in House Document No. 245, 82d Congress, 1st Session. Submission of this supplement to Design Memorandum No. 1-C was authorized by LMVED-PH letter dated 7 December 1965, subject "Mississippi River-Gulf Outlet, La., Shoaling Problem."

2. Purpose. The purposes of this supplement are to demonstrate: that recirculation of spoil is a significant source of channel shoaling and that extension of the south dike will reduce the shoaling rate substantially; and to present the detail design of the dike extension.

3. Prior correspondence on shoaling. Reference is made to written report "Construction Procedures and Shoaling Problems on the Mississippi River-Gulf Outlet," which was presented by Messrs. B. M. Johnson and G. A. Price, U. S. Army Engineer District, New Orleans, to the Committee on Tidal Hydraulics, Corps of Engineers, U. S. Army, at their 51st meeting in New Orleans, La., on 20-22 October 1964, and to the Committee's report of October 1965 in response to requests for comments in the above report. Reference also is made to NOD letter to the Division Engineer, U. S. Army Engineer Division, Lower Mississippi Valley, dated 6 August 1965, subject "Mississippi River-Gulf Outlet, La. - Shoaling Problem."

4. Project status.

a. Dredging of the project channel, as shown on plate 1, was initiated 17 March 1958 and, except for the narrow restriction at Paris Road, was completed 22 July 1965, including a turning basin at the Inner Harbor Navigation Canal. An "interim channel" (-36' by 250' and -38' by 300') usable for shipping was completed 5 July 1963 and dedicated 25 July 1963 at which time the first ship traveled from New Orleans to the Gulf of Mexico via the Mississippi River-Gulf Outlet. The narrow restriction at Paris Road will be removed upon completion of the high-level bridge which is a feature of the project scheduled for completion in December 1966.

4.b.

b. Maintenance dredging during construction was initiated 4 September 1963 and is scheduled to be completed January 1966. Regular maintenance dredging, using operation and maintenance funds, was initiated 1 July 1965. All spoil from construction and maintenance dredging, beyond the outer end of the existing dikes, has been discharged not closer than 2,000 and 1,500 feet, respectively, to the project channel centerline.

5. Shoaling history.

a. Predicted shoaling rates, as shown in the general design memorandum, were based on current measurements, suspended sediment samples, and bottom samples collected in Breton Sound and the Gulf of Mexico, together with shoaling data obtained from a series of five test pits dredged to approximate depths of -30 feet. The test pit located in an original depth of less than -6 feet indicated the maximum shoaling rate, and dictated the decision to construct dikes from the shoreline at mile 23.0 to the -6-foot contour at mile 20.2. However, surveys have indicated that the shallow area extends beyond mile 20.2 to mile 14.9. A profile run in December 1965 along the centerline of the authorized south dike extension indicated ground elevation of -6.5 at mile 15.3, a maximum elevation of -5.7 at mile 19.6, and a minimum elevation of -6.8 at mile 18.0.

b. Based on maintenance dredging performed to date, the highest shoaling rate has occurred in Breton Sound, extending several miles beyond the outer end of the existing dikes at mile 20.2. The shoaling rates for the first and second maintenance dredging averaged 755,000 and 982,000 cubic yards per year per mile, respectively, for the reach from mile 20.2 to mile 14.9. The latter rate is 3.6 times higher than the average minimum rate estimated in the general design memorandum. The third maintenance dredging in this reach, now in progress, has not advanced sufficiently to determine a comparative average shoaling rate. The shoaling rates are shown on plate 2, in three curves, representing the rates between completion of: (1) construction and 1st maintenance dredging; (2) 1st and 2d maintenance dredging; and (3) 2d and 3d maintenance dredging. These computed rates are based on actual end areas used for payments to the contractors, tabulated at 2,000-foot intervals.

c. The shoaling rates as stated above for the first and second maintenance dredging, converted to total cubic yards per year for the reach from mile 20.2 to mile 14.9, are 4.0 and 5.2 million cubic yards per year, respectively. Based on shoaling estimates made by the Beach Erosion Board in connection with the preparation of "Design Memorandum No. 2, General Design," the average maximum shoaling rate from natural sources; i.e., sources other than recirculation of spoil, amounts to 520,000 cubic yards per mile per year for the

reach from mile 20.2 to mile 14.9. Determination of this value is shown on table 1. This rate, converted to total shoaling per year in the reach, is 2,800,000 cubic yards. Recirculation, then, accounted for at least 1,200,000 cubic yards of shoaling in the reach between project construction and first maintenance dredging, and 2,400,000 cubic yards between the first and second maintenance dredgings.

TABLE 1
DERIVATION OF SHOALING RATE FROM NATURAL SOURCES
Mi. 20.2-Mi. 14.9
From plate 13, Design Memorandum No. 1, General Design, Route "B"

Project channel station miles	20.2	14.9
Equivalent route "B" channel station miles	25.2	19.9
BEB predicted minimum shoaling rate	300,000	220,000
Avg. minimum shoaling rate	260,000 cy/yr/mi	
Avg. maximum shoaling rate (100% increase) (1)	520,000 cy/yr/mi	
Shoaling for the 5.3-mile reach	2,800,000 cy/yr	

(1) Design Memorandum No. 1, General Design, Appendix I, par. 14, p.81

d. Supply for shoaling from natural sources comes partly from in situ material in the shallow bed and bays of the sound, and partly from material contributed by the Mississippi River. This material is stirred from the bottom by wave action and is transported to the channel by tidal and wind-generated currents. This supply may be considered inexhaustible and if the dikes were not extended, shoaling rates for this material would remain constant within the reach in question for the life of the project.

e. Current observations made adjacent to the channel for the past one and one-half years indicate that there is no predominant direction of flow across the channel, but that they are about equally divided in time from the north and south side as shown in table 2. Accordingly, it is concluded that about equal amounts of natural shoal material will be contributed by the areas to each side of the channel.

TABLE 2
TABULATION OF CURRENT DIRECTION AT TOWER #2*
Record from 1/17/64 to 6/15/65

Direction in degrees	Percent of time prevailing in given direction
18-62	9.48
63-107	11.29
108-152	10.58
153-197	11.37
198-241	5.42
242-287	12.03
288-332	15.09
333-17	12.18
Indeterminate or no velocity	12.56

*Tower #2 located at mile 16.4 on the natural sound bottom 700 feet south of the channel centerline.

f. Table 3 summarizes shoaling contributions in the reach from mile 20.2 to mile 14.9.

TABLE 3
SHOALING CONTRIBUTION, MILE 20.2 TO MILE 14.9
(in 1,000,000 cu.yds./yr.)

	Natural Sources			
	North of channel	South of channel	Recirculation	Total
Preproject	1.4	1.4	0	2.8(1)
Project - 1st maint	1.4	1.4	1.2	4.0(2)
1st maint - 2d maint	1.4	1.4	2.4	5.2(2)

(1) Based on Beach Erosion Board estimates of maximum shoaling rates.
(2) Actual observed rates based on 1st maint and 2d maint dredging.

g. Analyses of sediment samples in the spoil area to the southwest of the channel, and the natural sound bottom on the northeast, indicate that the shoal material is being generated predominately in the former area. This is demonstrated by the fact that shoal material samples show a marked similarity to samples taken southwest of the channel and a marked dissimilarity to samples from the northeast, insofar as concentration of sand is concerned (see table 4).

TABLE 4
MISSISSIPPI RIVER-GULF OUTLET - BED MATERIAL
Percent of material retained on U.S. 230 sieve(1)

Channel mileage	4/13	4/27	5/11	5/26	6/8	6/22	7/21	8/18
		1964 Observations						
		1,000 ft north of channel centerline						
19.1	7.2	9.4	18.4	16.4	9.2	4.2	4.0	3.4
16.8	29.7	34.7	36.0	26.5	30.2	2.0	30.0	24.1
14.2	35.0	-	-	30.7	38.6	36.4	42.4	11.8
11.5	41.1	46.3	40.8	43.3	49.1	53.6	35.6	32.4
7.0	22.0	26.6	13.6	46.1	26.4	28.0	23.5	53.1
		125 ft north of centerline						
19.1	2.8	3.0	1.3	3.3	1.0	2.7	2.2	3.4
16.8	4.6	2.3	1.7	18.6	2.6	32.0	1.7	5.0
14.2	6.7	-	-	4.7	1.3	3.0	1.7	1.7
11.5	6.0	3.7	4.4	18.0	1.7	0.7	0.7	29.3
7.0	6.7	3.0	0.7	3.0	26.9	1.7	1.3	4.6
		125 ft south of centerline						
19.1	2.0	1.0	0.7	1.7	1.7	1.7	3.0	3.2
16.8	4.8	2.0	2.7	19.3	2.0	2.0	1.3	6.6
14.2	7.6	-	-	3.7	1.0	2.0	4.0	1.3
11.5	1.4	4.7	4.4	20.8	1.0	2.0	1.0	30.1
7.0	5.3	14.6	1.7	4.0	27.7	2.3	1.3	4.8
		1,000 ft south of channel centerline						
19.1	2.8	2.0	2.0	4.2	3.4	2.0	6.6	7.8
16.8	2.7	13.4	9.2	9.2	9.6	8.4	4.4	8.3
14.2	6.0	-	-	2.0	1.8	2.0	2.0	1.3
11.5	18.4	33.3	4.6	25.3	1.0	2.7	0.7	1.3
7.0	1.6	4.0	3.2	2.7	1.0	2.8	1.3	3.4

Summary of material retained on U.S. 230 sieve

	1,000 ft north of centerline	channel	1,000 ft south of centerline
19.1	9.0	2.2	3.9
16.8	26.7	6.9	8.1
14.2	32.5	3.3	2.5
11.5	42.8	8.2	10.9
7.0	29.9	6.9	2.5
Average	28.2	5.5	5.6

(1) The sand fraction is the material retained on the No. 230 sieve (0.062 mm). The silt fraction includes all of the fine material passing the No. 230 sieve.

6. Plan of improvement. The plan for the reduction of excessive shoaling presented herein and shown on plate 3 consists of the extension of the south dike from mile 20.2 to mile 14.9, including a 1,000-foot flanking dike at the outer end, behind which all future adjacent dredged spoil from maintenance dredging would be deposited. This plan will largely overcome the problem of recirculation in this reach of the channel.

7. Other plans considered. Consideration was given to reducing recirculation by increasing the distance between the channel centerline and the point of deposit of dredged spoil and by the use of hopper barges and rehandling the spoil therefrom to spoil areas on the shore. However, because of the excessive costs involved, these plans are considered impractical.

8. Soil conditions. Available soil borings along the Mississippi River-Gulf Outlet channel in Breton Sound indicate that the subsurface below the lake bottom is predominantly fat clay with a few thin layers of silt and lean clay. Water contents of the clay vary from about 50 to 98%.

9. Stability analysis. The shear strengths and the stability analysis on plate 16 of Design Memorandum No. 1-C are applicable to the dike extension. However, the factors of safety will be slightly higher than those shown on plate 16 because the extension grade will be 2 feet lower than the grade of the existing dike, which will result in lower soil loads.

10. Settlement. It is estimated that settlement due to displacement and consolidation of the foundation will be approximately one foot during construction of the first stage, one-half foot between the completion of the first stage and the beginning of the second-stage construction, one-half foot during construction of the second stage and one foot after the second stage is completed.

11. Method of construction. The dike will be constructed, as shown on plate 4, of clamshells, riprap, and derrick stone. Because of the low shear strength of the foundation, the dike will be constructed in two stages. In the initial construction stage, the shell will be placed to elevation -1.0 foot m.l.g. and riprap will be placed to elevation 1.0 foot m.l.g. as shown on plate 4. To prevent loss of shell during construction, the placement of the riprap will follow immediately behind placement of the shell. To add to the stability of the dike and help retain the shell during construction, material will be placed in the form of berms on both sides of the dike. In the second construction stage, derrick stone will be placed to elevation +3.0 feet m.l.g. with a crown 12 feet wide.

12. Cost estimate. The estimated cost for extending the south dike is $5,010,000, consisting of $4,674,000 for construction,

$56,000 for E&D, and $280,000 for S&A. A detailed cost estimate is shown in table 5.

TABLE 5
DETAILED ESTIMATE OF FEDERAL FIRST COST

Item	Quantity	Unit	Unit price	Total cost
		Phase I		
Riprap	260,700	tons	$7.70	$2,007,390
Shell	217,500	cubic yards	3.75	815,625
		Phase II		
Stone	175,160	tons	7.70	1,348,732
		Subtotal		$4,171,747
		Contingencies 12%+		502,253
				$4,674,000
		E&D		56,000
		S&A		280,000
		Total		$5,010,000

13. Schedule. The sequence of contracts and the schedule for design and construction are shown in table 6.

TABLE 6
SCHEDULE OF CONTRACTS

Item	Description	Est. quantity	Est. date of Advertise	Est. date of Award	Est. date of Completion	Est. cost (includes 12% cont.)
1	South dike, sta. 2420+00 to sta. 2525+00, phase I	94,400 tons riprap 77,000 cy shell	1 Mar 66	15 Apr 66	15 Nov 66	$1,138,000
2	South dike, sta. 2525+00 to sta. 2700+00, plus 1000 ft flanking dike, phase I	166,300 tons riprap 140,500 cy shell	1 Oct 66	15 Nov 66	15 Oct 67	$2,025,000

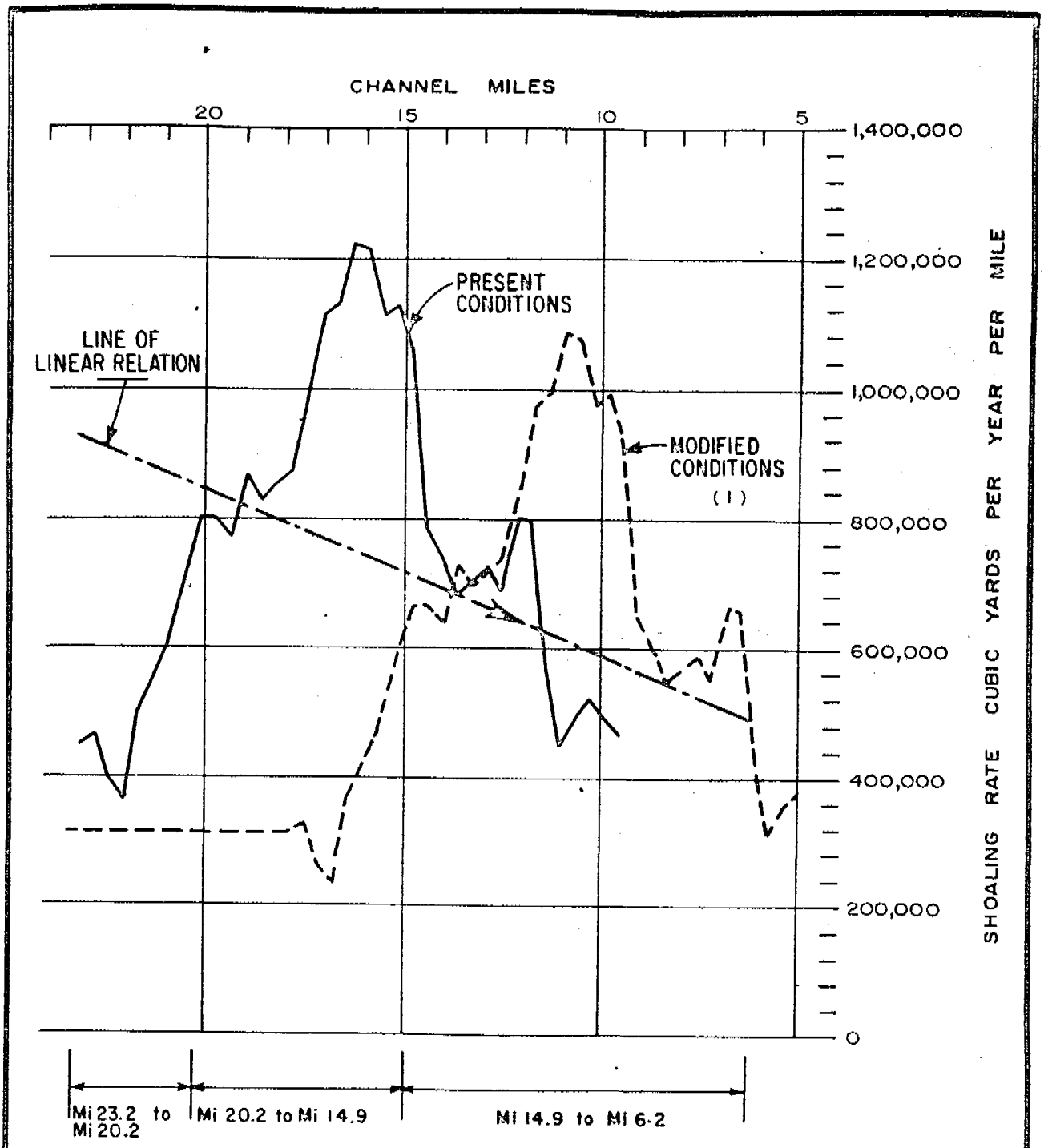
TABLE 6 (cont'd)

Item	Description	Est. quantity	Est. date of Advertise	Award	Completion	Est. cost (includes 12% cont)
3	South dike, sta. 2420+00 to sta. 2525+00 phase II	63,420 tons stone	1 Oct 67	15 Nov 67	15 Apr 67	$ 547,000
4	South dike, sta. 2525+00 to sta. 2700+00, plus 1000 ft flanking dike phase II	111,740 tons stone	1 Sep 68	15 Oct 68	15 Apr 69	$ 964,000
						$4,674,000

14. Reduction in maintenance dredging.

a. A study of experienced shoaling indicates that shoaling rates gulfward of the existing dikes tend to vary inversely with the depth of the water. Relatively high shoaling rates have been experienced both immediately gulfward and landward of the end of the existing dikes, indicating a tendency for shoal material to be transported parallel to the dikes and deposited in the channel gulfward of the end of the dikes and, to some extent, within the diked area of the channel as well. Within the diked area, a steep shoaling gradient with respect to distance from the gulfward end of the dikes is indicated. From mile 14.9 gulfward, shoaling rates change in a rather gradual manner while rate changes landward of that point tend to be more radical. It may be assumed that, in the absence of the existing dikes, shoaling rates would increase continuously as the distance from land decreased. Based on experienced shoaling patterns and the above assumption, a linear relationship between shoaling rates and distance from shore, considered to be representative of conditions without the present dikes in place, was developed. This relationship is shown on figure 1.

b. The shoaling pattern representing present conditions as determined for the period between the first and second maintenance dredging was then translated gulfward along the line representing the linear relationship as derived above for a distance of 5.3 miles to reflect the modified condition with the south dike extension in place (see figure 1).



(1) South dike extended to mile 14.9

SHOALING RELATIONSHIP AND TRANSLATION FROM PRESENT TO MODIFIED CONDITIONS

FIGURE 1

c. The portion of the channel coming under the influence of the dike as extended may be divided into three reaches as follows: mile 23.2 to mile 20.2, present diked reach; mile 20.2 to mile 14.9, south dike extension reach; and mile 14.9 to mile 6.2. The extended dike is not expected to influence shoaling rates significantly below about mile 6.

d. The total annual shoaling rate for each reach under present conditions is shown in table 7. These rates were obtained from data based on second maintenance dredging. The tabulation also shows the annual shoaling rates to be expected under conditions modified by the south dike extension, determined from the pattern described in paragraph 14.b. above, and the change in rate from present conditions for each of the three reaches that will be influenced by the south dike extension.

e. With the proposed extension of the south dike in place, forming an effective spoil retaining dike, it is anticipated that the annual shoaling rate will be reduced by 2,400,000 cubic yards as shown in table 5.

TABLE 7
ANNUAL SHOALING RATES BY REACH
(in 1,000,000 cy/yr)

Reach miles	Present conditions	Modified conditions(1)	Change in rate from present conditions (+)increase (-)decrease
23.2-20.2	1.5	0.9	-0.6
20.2-14.9	5.2	1.9	-3.3
14.9-6.2	5.2	6.7	+1.5
Net change in shoaling rate, decrease			-2.4

(1) With south dike extension of 5.3 miles from mile 20.2 to mile 14.9.

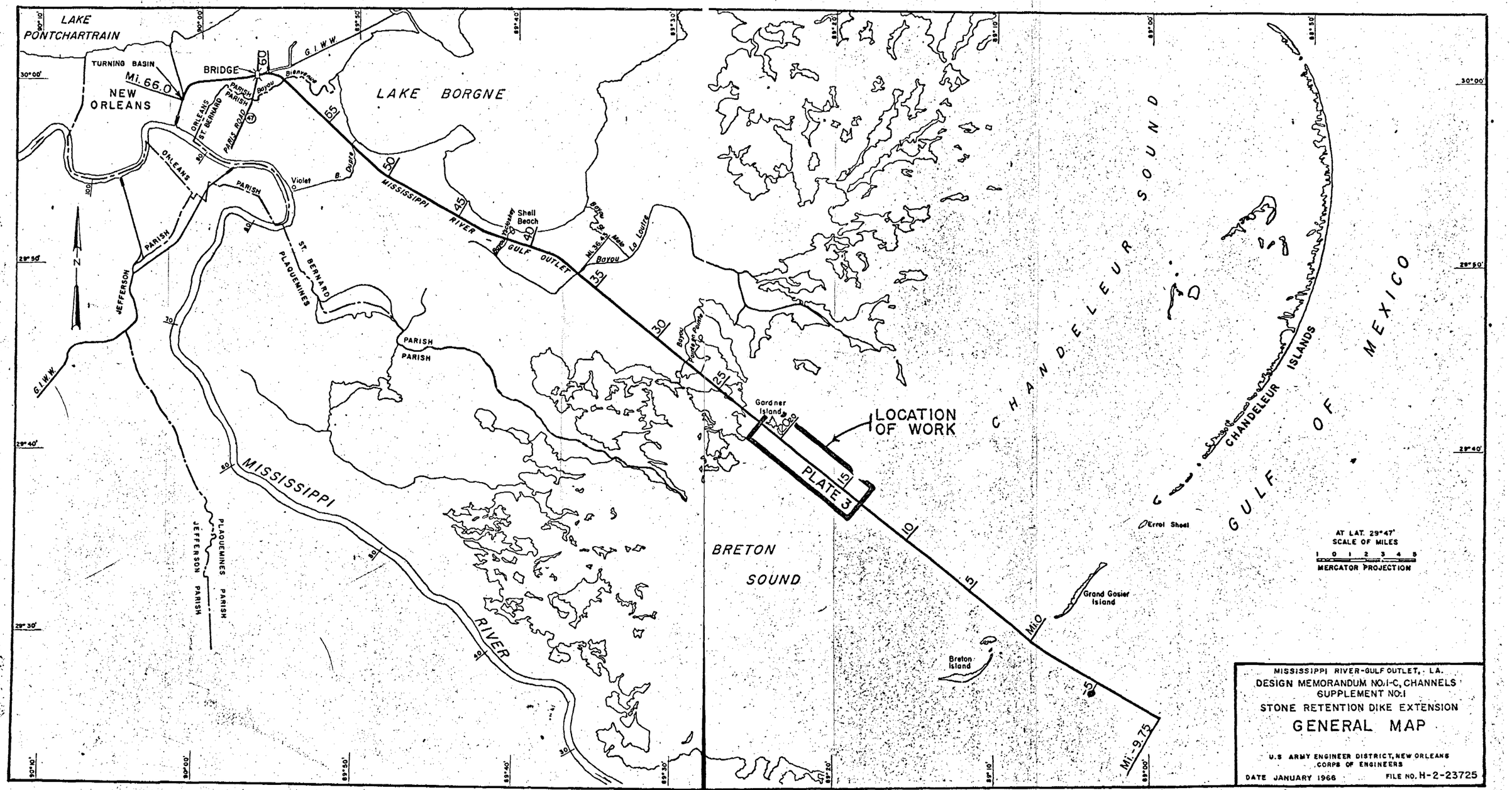
15. Benefits. Under present conditions, the total shoaling between mile 23.2 and mile 6.2 is estimated to be 11,900,000 cubic yards per year, distributed as shown in table 7. Based on current maintenance dredging unit prices (including E&D and S&A) of $0.11 per cubic yard in the existing diked area and $0.12 per cubic yard elsewhere, removal of the 11,900,000 cubic yards of shoal represents an expenditure of $1,413,000 annually. With the south dike extended as described herein, it is estimated that the annual shoaling rate will be reduced, by 2,400,000 cubic yards, leaving an annual maintenance dredging requirement of 9,500,000 cubic yards. Using a

unit price of $0.11 per yard between mile 23.2 and the end of the extended south dike and a unit price of $0.12 per yard elsewhere, the estimated annual cost is $1,112,000. This represents an annual reduction in dredging cost of $301,000.

16. Annual cost. The cost of extending the south dike as described is estimated to be $5,010,000. Interest and amortization on this amount is $181,100 (50-year life, 2-5/8%) and dike maintenance is estimated to be $30,000 annually. The total annual cost for extending the south dike would be $211,100.

17. Economic justification. The annual benefits of $301,000 and annual charges of $211,100 result in a favorable benefit-cost ratio of 1.4 to 1.

18. Recommendation. Extension of the south stone retention dike as presented herein is considered the most practicable method to reduce shoaling and is recommended for approval. Continued study to a possible future need for further extension of one or both dikes is also recommended.



MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO.1-C, CHANNELS
SUPPLEMENT NO.1
STONE RETENTION DIKE EXTENSION

GENERAL MAP

U.S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE JANUARY 1966 FILE NO. H-2-23725

PLATE 1

39181

LMVGG 18 Mar 64

SUBJECT: Mississippi River - Gulf Outlet, La., Supplement No. 2, General Design Memorandum No. 2, Relocation and Modification of Turning Basin

TO: Chief of Engineers
ATTN: ENGCW-V and ENGCW-E

Pursuant to par 20b, EM 1110-2-1150, (15 Jan 62), four copies of subject supplement together with copies of pertinent correspondence bound therein are forwarded for your information and retention.

FOR THE DIVISION ENGINEER:

1 Incl (quad)
as

A. J. DAVIS
Chief, Engineering Division

Copy furnished:
New Orleans District
ATTN: LMNGP-P

1507/03 (Miss. River-Gulf Outlet) 17 Mar 64 G.M. DESIGN MEMO

LMVGU (NOD 24 Feb 64) 1st Ind
SUBJECT: Mississippi River-Gulf Outlet, La., Supplement No. 2, General Design Memorandum No. 2, Relocation and Modification of Turning Basin

U. S. Army Engr Div, Lower Mississippi Valley, Vicksburg, Miss., 17 Mar 64

TO: District Engineer, ATTN: LMNGP-P, U. S. Army Engr Dist, New Orleans

Modified turning basin is approved for construction.

Ellsworth I. Davis

2 Incl
nc

ELLSWORTH I. DAVIS
Major General, USA
Division Engineer

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

LMNGP-P 24 February 1964

SUBJECT: Mississippi River-Gulf Outlet, La., Supplement No. 2, General Design Memorandum No. 2, Relocation and Modification of Turning Basin

TO: Division Engineer
U. S. Army Engineer Division
Lower Mississippi Valley
ATTN: LMVGU

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 and description of the project as recommended by the Chief of Engineers are given in detail in General Design Memorandum No. 2. Submission of this supplement to General Design Memorandum No. 2 was authorized by the second indorsement of ENGCW-EZ dated 13 December 1963 to the basic letter of LMNGN dated 3 October 1963.

2. Purpose. The purpose of this supplement is to relocate and modify the turning basin approved in General Design Memorandum No. 2, dated June 1959.

3. Plan. General Design Memorandum No. 2 provides for a turning basin, 1,000 feet wide by 2,000 feet long, at the junction of the Gulf Outlet channel with the channel connecting the authorized lock in the vicinity of Meraux to the Gulf Outlet. Local interests indicate a desire to construct new dock facilities to accommodate the expansion of shipping. A turning basin is required to make such facilities feasible. No indication of an early need for a turning basin at the authorized location exists. This supplement would locate an irregular shaped turning basin, as shown on plates 1 and 2, at the intersection of the Mississippi River-Gulf Outlet channel and the Inner Harbor Navigation Canal.

4. Cost estimates.

a. Total cost at the new location is estimated to be $415,100.00, which is the sum of $393,400.00 for construction, $3,900.00 for engineering and design, and $17,800.00 for supervision and administration. The original project provided $370,000.00 for construction cost.

LMNGP-P 24 February 1964
SUBJECT: Mississippi River-Gulf Outlet, La., Supplement No. 2, General Design Memorandum No. 2, Relocation and Modification of Turning Basin

b. A comparison of estimated costs for the turning basin at the new and original locations indicates an increase of $23,400.00 in construction cost. This increase is not significant in terms of the total project cost.

5. Schedules for performance of work. The work will require approximately three and one-half months to complete. Three percent of the funds will be required in the fourth quarter of the current fiscal year and the remainder in the first quarter of fiscal year 1965. All work will be accomplished by contract.

6. Benefit. The work recommended herein will accelerate dock construction, which in turn will stimulate the growth of shipping.

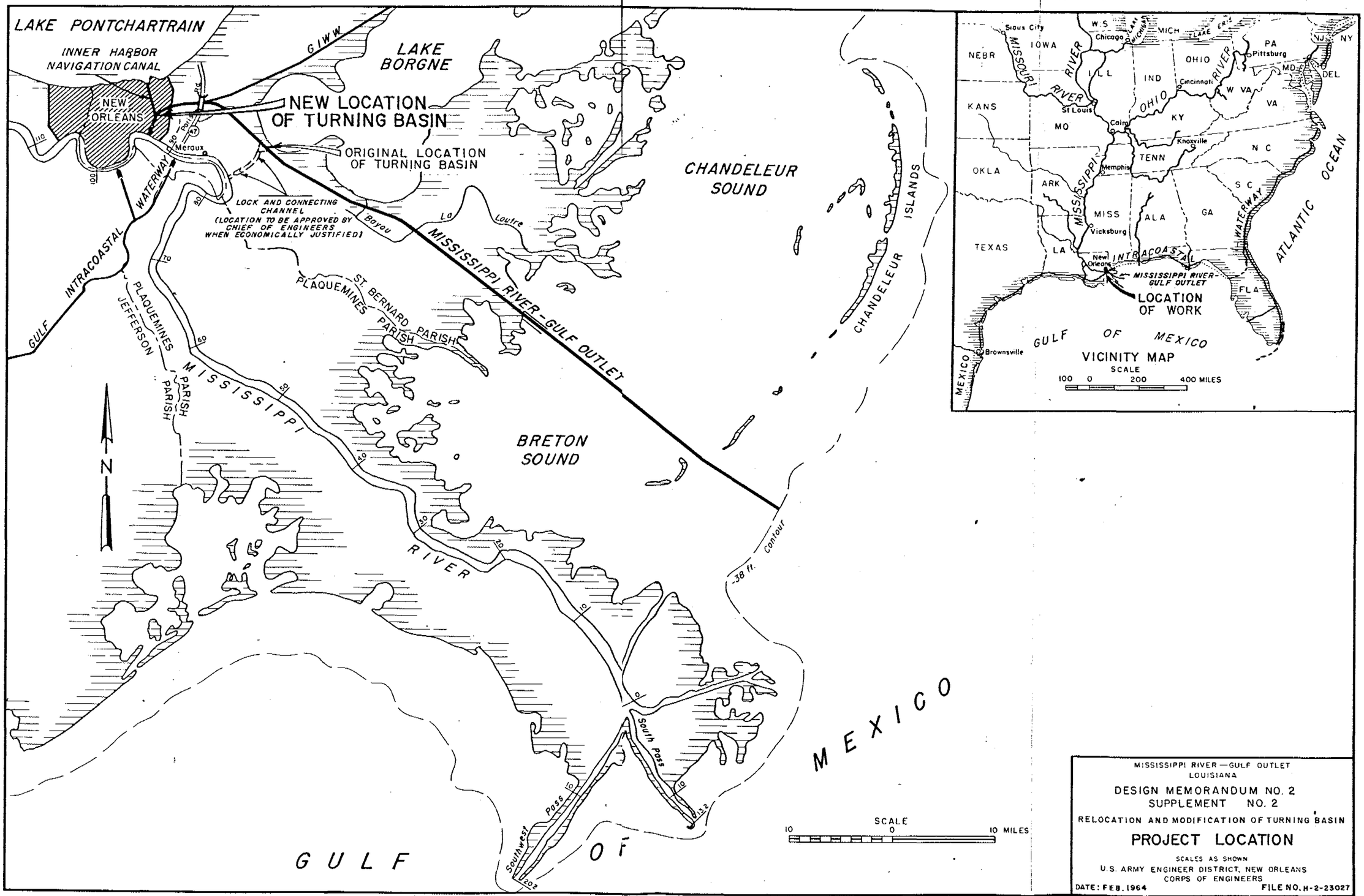
7. Benefit-to-cost ratio. The small additional annual charge does not materially influence the overall project benefit-cost ratio of 1.6 to 1.

8. Recommendation. The relocation and modification of the turning basin would provide a turnaround for vessels using proposed dock facilities. The need for the turning basin at this location is documented, and its construction is recommended.

Edward B. Jennings

EDWARD B. JENNINGS
Colonel, CE
District Engineer

2 Incl
1. Project location
2. Plan of improvement



MISSISSIPPI RIVER—GULF OUTLET
LOUISIANA

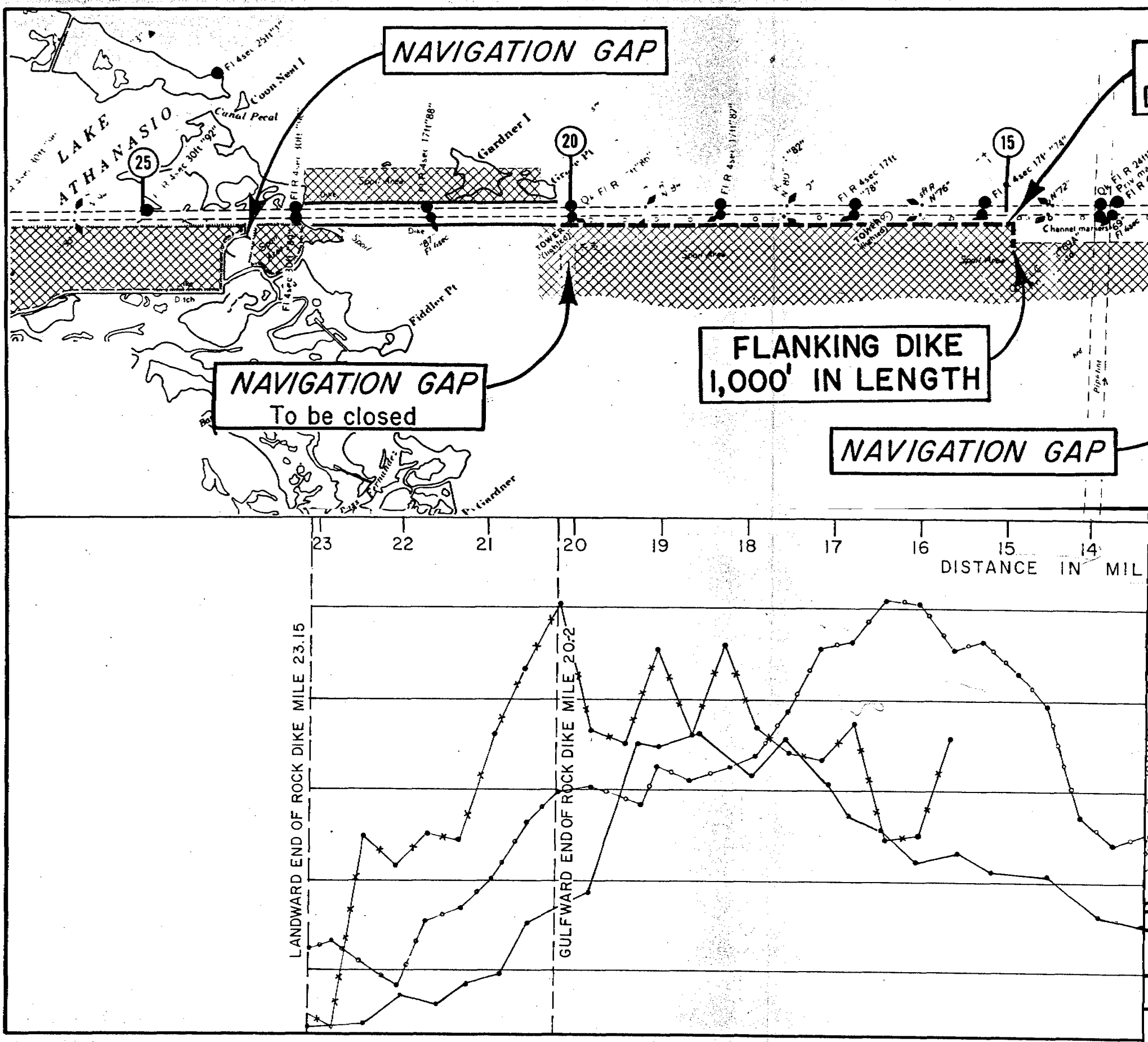
DESIGN MEMORANDUM NO. 2
SUPPLEMENT NO. 2

RELOCATION AND MODIFICATION OF TURNING BASIN

PROJECT LOCATION

SCALES AS SHOWN
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: FEB. 1964 FILE NO. H-2-23027

PLATE 1


NAVIGATION GAP
LAKE ATHANASIO
25
20
15
Gardner I
Fiddler Pt
NAVIGATION GAP
To be closed
FLANKING DIKE
1,000' IN LENGTH
NAVIGATION GAP
Pt Gardner
23
22
21
20
19
18
17
16
15
14
DISTANCE IN MIL
LANDWARD END OF ROCK DIKE MILE 23.15
GULFWARD END OF ROCK DIKE MILE 20.2

PROPOSED
DIKE EXTENSION

MISSISSIPPI RIVER GULF OUTLET

BRETON SOUND

SPOIL AREA

NAVIGATION GAP

NAVIGATION GAP

Mi. 12.6

Mi. 12.2

Mi. 6.4

Mi. 6.0

Breton I.

North Pt

Shoal Area

13 12 11 10 9 8 7 6 5

ES

MILE 6.2

1,200,000
1,000,000
800,000
600,000
400,000

QUANTITY OF MAINTENANCE DREDGING IN CU. YDS PER YEAR PER MI.

First maintenance dredging (first contract)
4 September 1963 to 22 October 1964

Second maintenance dredging (second contract)
9 December 1964 to 2 December 1965

Third maintenance dredging (second contract)
30 September 1964 to 23 January 1966

MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO.1-C, CHANNELS
SUPPLEMENT NO.1
STONE RETENTION DIKE EXTENSION

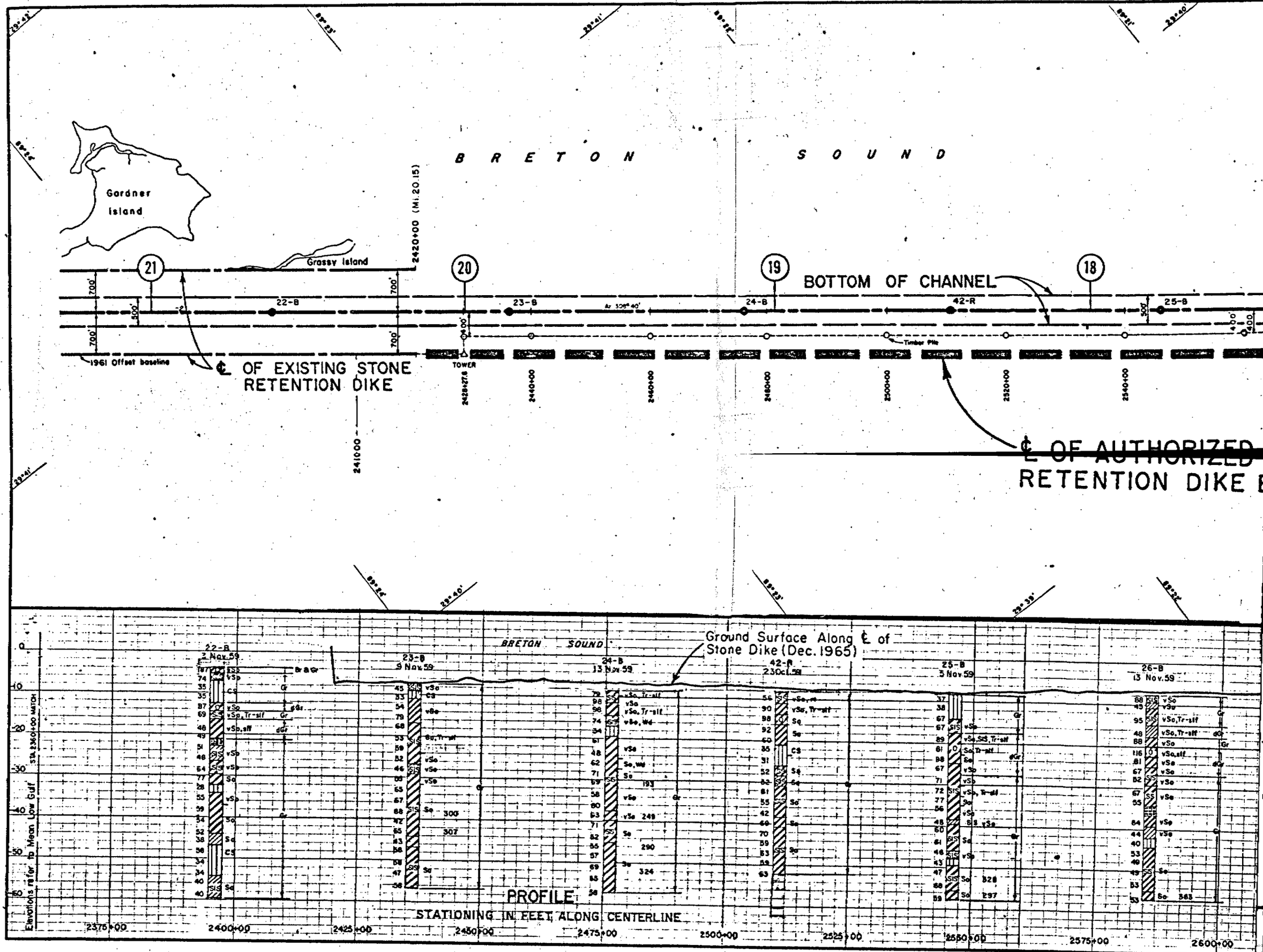
SHOALING RATES

MILE 6.2 TO MILE 23.15

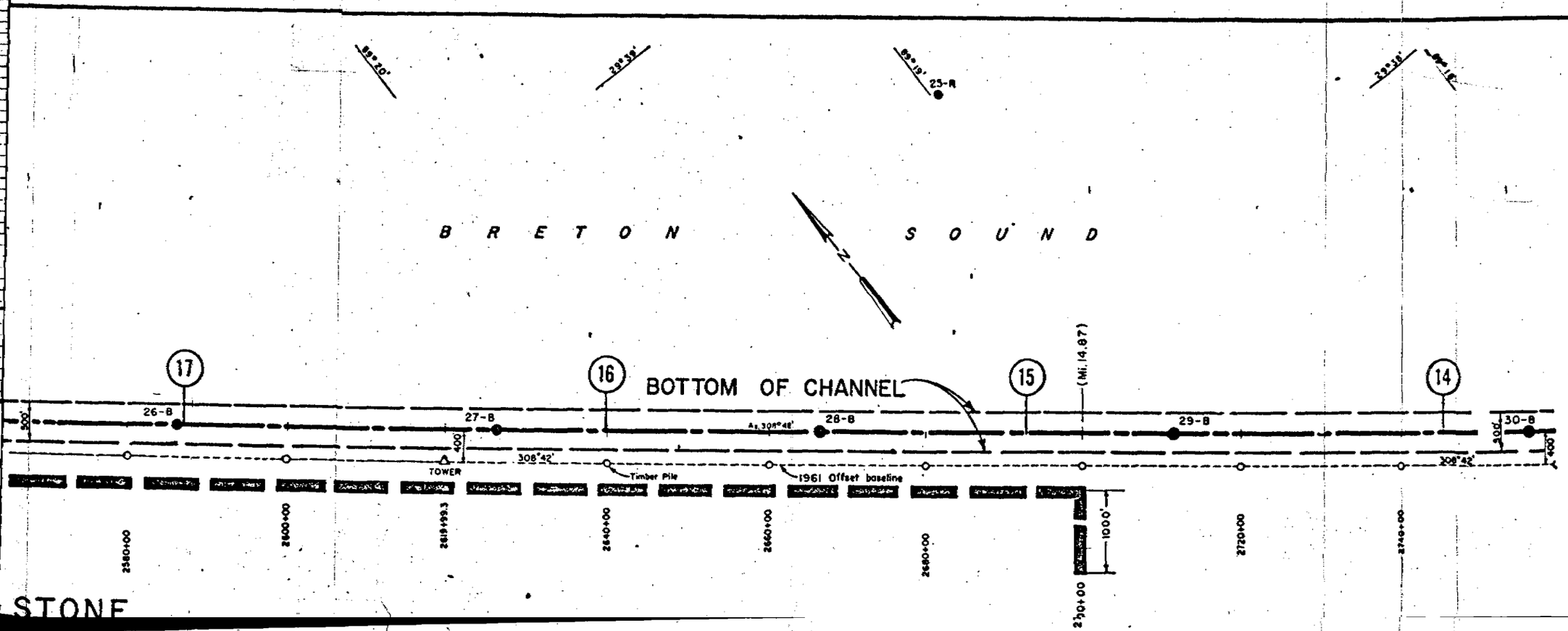
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE JANUARY 1966 FILE NO. H-2-23725

PLATE


B R E T O N S O U N D
Gardner Island
Grassy Island
2420+00 (Mi.20.15)
21
20
19
18
22-B
23-B
24-B
42-R
25-B
700'
500'
400'
1961 Offset baseline
℄ OF EXISTING STONE RETENTION DIKE
TOWER
BOTTOM OF CHANNEL
Timber Pile
℄ OF AUTHORIZED
RETENTION DIKE
2410+00
2420+27.8
2440+00
2460+00
2480+00
2500+00
2520+00
2540+00
Ground Surface Along ℄ of Stone Dike (Dec. 1965)
22-B 2 Nov.59
23-B 5 Nov.59
24-B 13 Nov.59
42-R 23 Oct.59
25-B 5 Nov.59
26-B 13 Nov.59
Elevations refer to Mean Low Gulf
Sta 2360+00 Match
PROFILE
STATIONING IN FEET ALONG CENTERLINE
2375+00
2400+00
2425+00
2450+00
2475+00
2500+00
2525+00
2550+00
2575+00
2600+00

STONE
EXTENSION



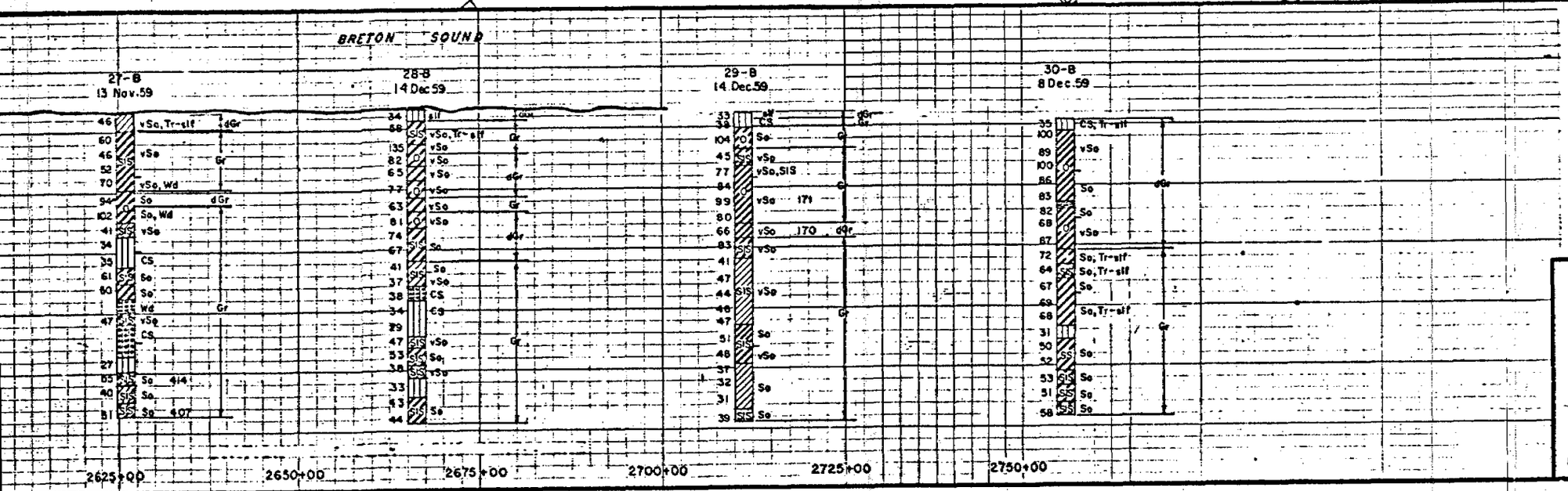
PLAN

Scale of Feet

1,000 0 1,000 2,000

Polyconic Projection-1927 North American Datum

25-B ● Location of Boring



NOTE:

Elevations are in feet and refer to Mean Low Gulf Datum.

(15) Distance in miles landward of Chandeleur Islands.

MISSISSIPPI RIVER-GULF OUTLET, LA.

DESIGN MEMORANDUM NO.1 C. CHANNELS SUPPLEMENT NO.1

STONE RETENTION DIKE EXTENSION

PLAN AND PROFILE

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

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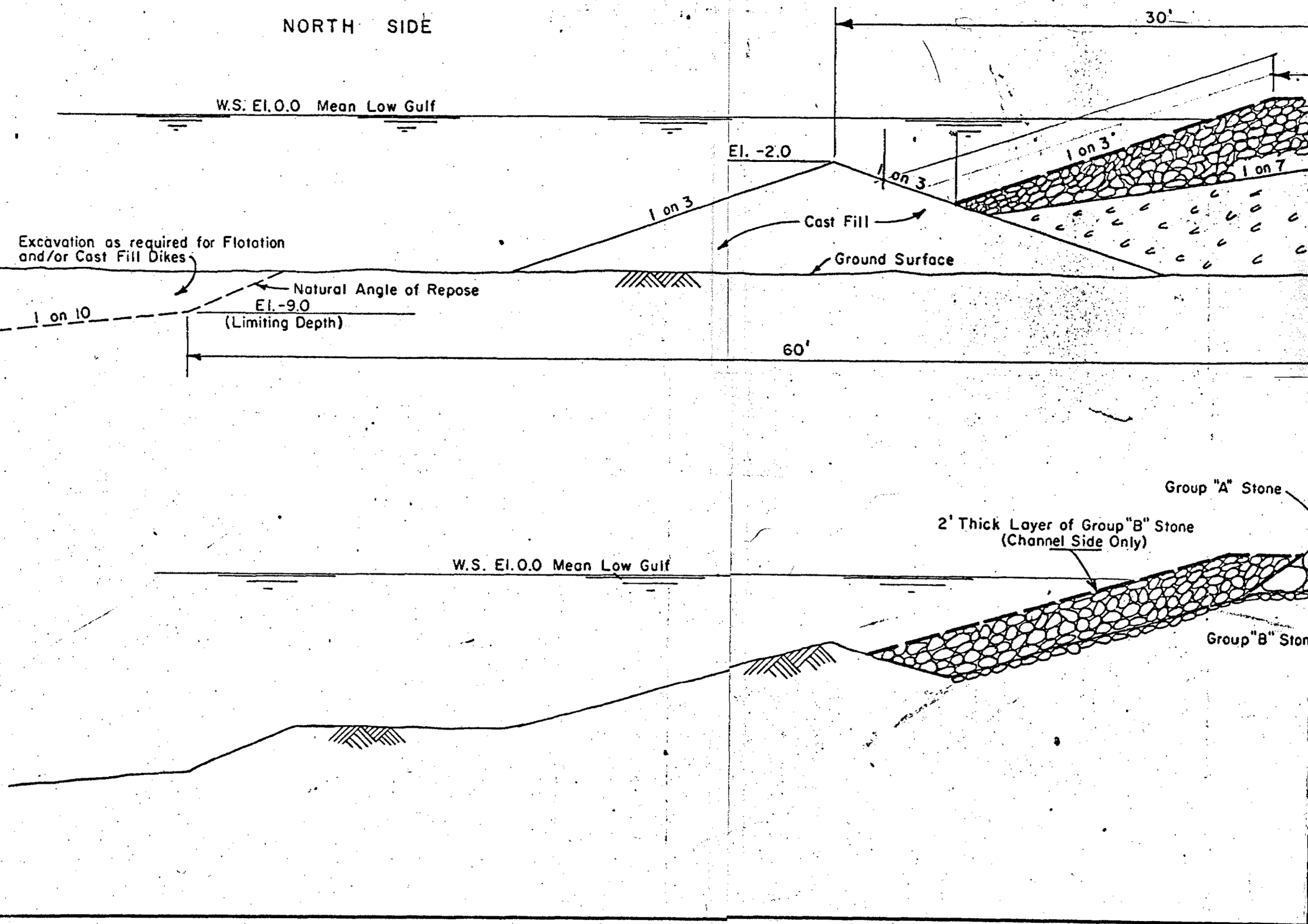
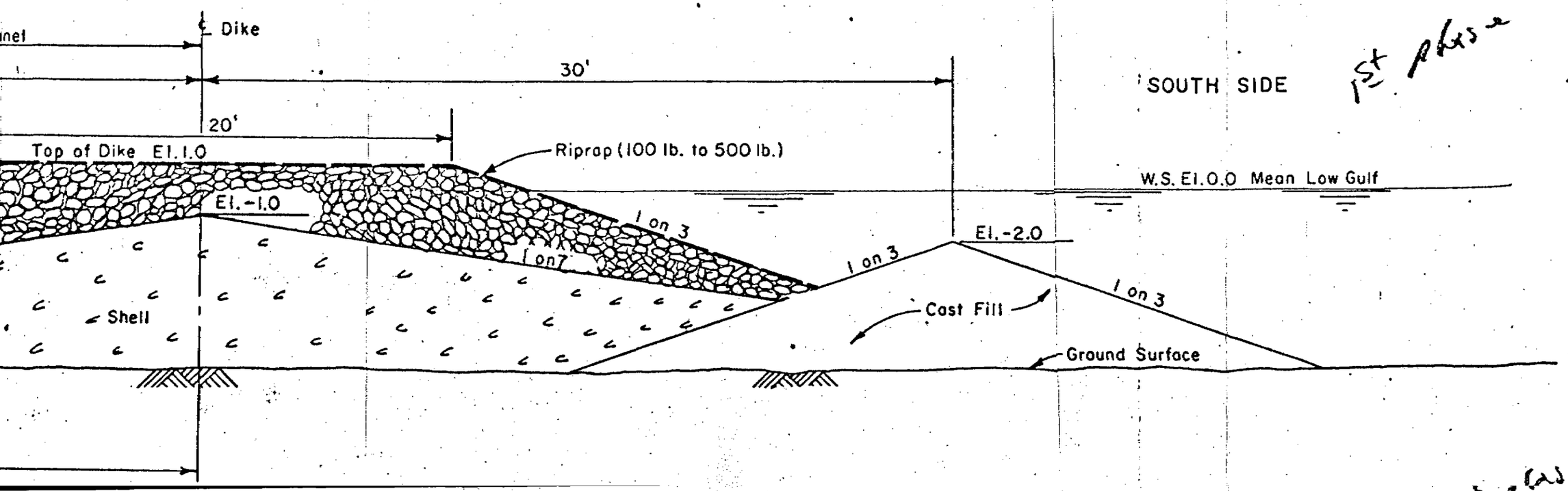
PLATE 3

NORTH SIDE


700' to ℄ Cha
30'
W.S. El. 0.0 Mean Low Gulf
El. -2.0
1 on 3
1 on 3
1 on 3
1 on 7
Cast Fill
Excavation as required for Flotation and/or Cast Fill Dikes
Ground Surface
Natural Angle of Repose
1 on 10
El. -9.0
(Limiting Depth)
60'
Group "A" Stone
2' Thick Layer of Group "B" Stone
(Channel Side Only)
W.S. El. 0.0 Mean Low Gulf
Group "B" Ston



DESIGN SECTIONS

SCALE IN FEET

5 0 5

MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO.I-C, CHANNELS
SUPPLEMENT NO.I
STONE RETENTION DIKE EXTENSION

TYPICAL SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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PLATE 4