MISSISSIPPI RIVER OUTLETS VICINITY OF VENICE, LA.

GENERAL DESIGN MEMORANDUM

SUPPLEMENT NO. 1 JETTIES DESIGN

+ DYNIX

DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

23

CH 1978

HENRY

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REMARKS

Subj: Miss. River Outlets - Jetties DM

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LMVED-TD (NOD 29 Mar 78) 1st Ind
SUBJECT: Mississippi River Outlets, Vicinity of Venice, Louisiana, General Design Memorandum, Supplement No. 1, Jetties Design

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 11 MAY 78

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

1. Supplement 1 is approved pursuant to para 21c, ER 1110-2-1150, subject to the comments below:

a. Para 10, page 4. The jetty-design procedure outlined in this report should be expanded to present the criteria utilized in the development of the armor capstone portion of the structure. This information should include, but not be limited to, such details as the need for, and the benefits assumed from, this portion of the structures and the method utilized in sizing the capstone. If the capstone is needed for jetty stability, this larger stone may be needed over the entire section since the side slopes normally are required to absorb most of the wave energy.

b. Para 11a, page 4.

(1) We have no objection to the use of filter cloth in the test sections. However, the reasons for the proposed use should be indicated in the design memorandum. For instance, we assume that the reason for the proposed placement of the filter cloth between the clamshell and the in-situ foundation is to prevent migration of the clamshell material down into the foundation. In this regard, a nonwoven cloth should be considered for this use. The reason for placing filter cloth between the 2-ft outer stone layer and the clamshell should also be given. The different types of filter cloth proposed and the test sections in which they are to be used should be identified in the design memorandum. The details of installation of the filter cloth should be cited. It is noted that, apparently, most of the installation will have to be accomplished underwater; i.e., el 0 to -6.

(2) As designed, there is a possibility of jetty failure in those segments which do not include filter cloth. The minimum-diameter stone contained in the 2-ft-thick bedding layer will be 0.67 ft, neglecting spalls (see para 13c(2)). With this size stone, the voids in the bedding layer will be large enough to permit leaching of the clamshell core unless a filter is provided between the shell core and the overlying rock. Consideration should, therefore, be given to overlaying the entire core section with a filter layer of smaller material such as quarry spalls.

c. Para 11b, page 4. In order to be meaningful to the review and relate to this project, the installations cited, together with details of materials (filter-cloth type, rock, shell, foundation, etc.) used, should be described.

LMVED-TD (NOD 29 Mar 78) 1st Ind 11 MAY 78
SUBJECT: Mississippi River Outlets, Vicinity of Venice, Louisiana, General Design Memorandum, Supplement No. 1, Jetties Design

d. Paras 19a(2), 19b(1), and 19b(2), pages 10 and 11. The matters related to settlement analyses and percent consolidation cannot be evaluated as neither the consolidation tests results nor settlement calculations have been included in the design memorandum. These data should be included.

e. Plates 4 and 9. Reference is made to notes on these drawings which read "Bedding layer of shell (min. 1 foot thick) to be placed between rock and natural ground in all areas, except test reaches." We assume this refers to placement of shell only beneath the outer 2 ft of stone covering the clamshells, which is satisfactory. However, it should be noted that the outer 2 ft of "stone" is also termed 2-ft-thick bedding layer in para 13c(2), page 8. In order to avoid confusion, the term "2 ft thick bedding layer" in para 13c(2) should be changed to read "2-ft-thick layer of stone."

f. Plates 6 and 7. The design shear strengths for clay shown on Plate 7 do not agree with shear strengths used in the analysis on Plate 6. For example, for Stratum 10 (between el -40 and el -60), the design shear strength is 440 psf (0.22 tsf) at the midstratum and 520 psf (0.26 tsf) at the bottom of the stratum on Plate 7, whereas Plate 6 shows 520 psf at the midpoint and 600 psf at bottom of this stratum. Although this difference in design shear strength between Plates 6 and 7 will probably not affect the dike design, the discrepancy should be corrected.

g. Minor annotation on page 16.

2. In regard to para 5, basic letter, and para 13d, ER 11-2-240, action requesting reclassification from deferred to active category will be initiated by LMVD through programming channels.

FOR THE DIVISION ENGINEER:

1 Incl
wd 15 cy

R. H. RESTA
Chief, Engineering Division

CF:
DAEN-CWE-B (14 cy)
w 14 cy bas ltr and Incl 1

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

IN REPLY REFER TO
LMNED-MP

29 March 1978

SUBJECT: Mississippi River Outlets, Vicinity of Venice, Louisiana, General Design Memorandum, Supplement No. 1, Jetties Design

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject GDM Supplement No. 1 is submitted herewith for review and approval in accordance with the provisions of ER 1110-2-1150 dated 1 October 1971. Authority for preparation of the supplement is contained in LMVED-T first indorsement dated 6 December 1976 to LMNED-MP letter dated 19 October 1976, subject: Mississippi River Outlets, Vicinity of Venice, Louisiana, Request to Proceed with Jetty Design.

2. A cultural resources survey of the project area has been completed. No sites were discovered that would warrant nomination to the National Register of Historic Places. No cultural resources will be destroyed, damaged, or endangered by the project. A draft of the report has been reviewed by Mr. Paul Hartwig, a member of the State Historic Preservation Officer's staff. He stated in a letter dated 8 February 1978 that since the proposed construction project will have no direct impact on known cultural resources, he had no objection to the implementation of this project.

3. The Environmental Impact Statement was filed with the Council on Environmental Quality on 10 September 1976.

4. The requirements of Section 404, Federal Water Pollution Control Act of 1972 have been met. A notice was issued on 18 November 1976 and compliance was completed on 14 July 1977.

5. Approval of this supplement is recommended. Also, approval to reinstate Feature 10 (Breakwater and Seawalls) in the project cost estimate (PB-3) is recommended.

FOR THE DISTRICT ENGINEER:

FREDERIC M. CHATRY
Chief, Engineering Division

1 Incl (16 cy)
as fwd sep

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LOUISIANA
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

STATUS OF DESIGN MEMORANDA AND ENVIRONMENTAL REQUIREMENTS

Document/Requirement	Title	Status
General Design Memorandum (GDM)	Mississippi River Outlets, Vicinity of Venice, Louisiana	Approved 31 Dec 75
Environmental Impact Statement	Mississippi River Outlets, Vicinity of Venice, Louisiana	Filed with CEQ on 10 Sep 76
Section 404, Federal Water Pollution Act of 1972		Notice issued 18 Nov 76; compliance complete on 14 Jul 77
GDM Supplement No. 1	Jetties Design	Submitted Mar 78

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PERTINENT DATA

Feature purpose

Provision of twin shell and rock fill jetties at the distal ends of Baptiste Collette Bayou and Tiger Pass to reduce the cost of maintenance dredging.

Location of project

Extreme southeast Louisiana, Plaquemines Parish, Mississippi River Delta.

Jetty Cost Data	Baptiste Collette Bayou $	Tiger Pass $	Total Project $
1. First costs	2,030,000	2,230,000	4,260,000
2. Annual costs	202,000	145,000	347,000
Annual Dredging Cost Data			
1. Dredging w/o jetties	1,020,000	534,000	1,554,000
2. Dredging w/jetties	- 579,000	- 277,000	- 856,000
3. Dredging savings	441,000	257,000	698,000
Incremental B/C ratio			
1. Dredging savings	441,000	257,000	698,000
2. Jetties annual cost	202,000	145,000	347,000
3. Incremental B/C ratio	2.2	1.8	2.0
Overall B/C ratio			
1. Annual cost w/o jetties	1,020,000	534,000	1,544,000
2. Annual cost w/jetties	781,000	422,000	1,203,000
3. Overall B/C ratio	1.3	1.3	1.3

MISSISSIPPI RIVER OUTLETS
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PERTINENT DATA (cont'd)

Physical features

Jetties - shell and rock fill

a.	Baptiste Collette Bayou 3/	
	(1) Length	
	(a) east jetty to 6-foot depth contour	9,000 feet
	(b) west jetty	7,000 feet
	(2) Elevation	
	(a) east jetty	+6 feet 1/
	(b) west jetty	+3 feet
	(3) Side slopes	
	(a) to 3' height	1 on 3
	(b) from 3-6 feet height	1 on 2
b.	Tiger Pass	
	(1) Length	
	(a) south jetty to 6-foot depth contour	4,700 feet
	(b) north jetty	2,700 feet
	(2) Elevation	
	(a) south jetty	+6 feet 2/
	(b) north jetty	+3 feet
	(3) Side slopes	
	(a) to 3-foot height	1 on 3
	(b) from 3-6-foot height	1 on 2

1/ Elevations contained herein are in feet referred to mean low gulf (m.l.g.) datum, unless otherwise noted. Zero m.l.g. equals -0.78 foot mean sea level (m.s.l.).

2/ To +3 feet for Phase 1 Construction.

3/ Includes four 500' filter cloth test sections (total: 2,000').

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LOUISIANA
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AUTHORIZATION

1. Authority. The Mississippi River Outlets, Vicinity of Venice, Louisiana, project was authorized by Public Law 90-483, 90th Congress, 2d Session, approved 13 August 1968, in accordance with the plans and subject to the conditions recommended by the Chief of Engineers in his report dated 3 June 1968 and contained in House Document No. 361, 90th Congress, 2d Session, Mississippi River Outlets, Vicinity of Venice, Louisiana.

2. Authorized improvement. The Chief of Engineers, in his report, concurred in the views and recommendations of the Board of Engineers for Rivers and Harbors which are as follows:

> "...Accordingly, the board recommends adoption of a project to provide for additional navigation outlets in the vicinity of Venice, Louisiana, by enlargement of the existing channels of Baptiste Collette Bayou and Grand-Tiger Passes to a depth of 14 feet over a bottom width of 150 feet, with entrance channels in open water 16 feet deep over a bottom width of 250 feet and jetties to the 6 foot depth contour, if and when justified, to reduce the cost of maintenance dredging, generally in accordance with the plan of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable;..."

INVESTIGATIONS

3. GDM Supplement No. 1 investigations. Studies and investigations made in connection with GDM supplement no. 1 consisted of:

a. Soil borings and tests
b. Hydraulic studies to determine typical jetty sections
c. Design and cost estimates

LOCAL COOPERATION AND VIEWS OF LOCAL INTERESTS

4. Requirements of local cooperation. Requirements of local cooperation are as follows:

"a. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids for navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of spoil material, and also necessary retaining dikes, bulkheads and embankment therefor or the costs of such retaining works;

"b. Accomplish without cost to the United States such alterations as required in pipelines, cables, and other improvements, as well as their maintenance; and

"c. Hold and save the United States free from damages due to the construction and maintenance of the project, including but not limited to erosion beyond the rights-of-way furnished, and damages to oyster beds and other fisheries."

5. Status of local cooperation. The Plaquemines Parish Commission Council furnished an acceptable "letter of intent" dated 8 December 1969 stating its capability and willingness to provide the requirements of local cooperation for the project. The Council also furnished an acceptable "formal assurance" of local cooperation dated 28 May 1970. The council has furnished an amended assurance which added the provisions of two new laws: The "Flood Control Act of 1970" (Public Law 91-611) and the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970" (Public Law 91-646). This amended assurance was executed by the council on 16 June 1977 and accepted by the District Engineer, New Orleans District, on behalf of the Government on 7 July 1977. The amended assurances were accepted by the Chief of Engineers on 5 August 1977. The principal officer and representative responsible for fulfilling the requirements of local cooperation is:

Mr. Chalin O. Perez, President
Plaquemines Parish Commission Council
Pointe-a-la-Hache, Louisiana 70082

PROJECT AREA LOCATION AND DESCRIPTION

6. Project location. The project area is located in the vicinity of the Mississippi River near its mouth. (See plate 1). This area is a prolific producing area for petroleum and for commercial fishing. It is also a heavily used recreational area for sportfishing and hunting. Venice, Louisiana, is located in the coastal marsh area on the right descending bank of the Mississippi River at about mile 10.8 above the Head of Passes (AHP) of the river, about 70 airline miles southeast of New Orleans. It is at the terminus of Louisiana Highway 23 on the right descending bank of the river. Venice is the most southerly point in the general area accessible by land transportation.

7. Baptiste Collette Bayou. This bayou is an east bank distributary of the Mississippi River opposite Venice. It extends about 6 miles in a northeasterly direction from the river to Breton Sound. The bayou is wide and deep at the river and reduces in width and depth at each of its major distributaries, Emeline Pass and Kimbel Pass. It has a controlling depth of about -8 feet over a bottom width of 80 feet from the river to near its mouth. River sediments have formed a large bar at the mouth of the bayou which is exposed at extreme low tide. Channels dredged by oil companies between the bayou and Breton Sound remain usable for only a short time. The inland channel is extensively used for the onshore oilfield operations and sports and commercial fishing.

8. Tiger Pass. This stream is a west bank distributary of the Mississippi River just below Venice. It generally parallels Grand Pass in a southerly direction for about 6 miles and then turns southwestward to enter the Gulf of Mexico approximately 5 miles northwest of the mouth of Grand Pass. The controlling dimensions from Grand Pass to mile 5 are about -10 feet over a width of 70 feet and -6 feet over a width of 60 feet to near the coastline. The depth over a large bar in the Gulf of Mexico at the mouth of Tiger Pass is about -1 foot.

PROJECT PLAN

9. General. The plan of improvement consists of the enlargement and maintenance of Baptiste Collette Bayou between the Mississippi River and Breton Sound, and Grand-Tiger Passes between the Mississippi River and the Gulf of Mexico, to a depth of -14 feet over a bottom width of 150 feet, with entrance channels in open water -16 feet over a bottom width of 250 feet and jetties to the -6-foot contour, if and when justified, to reduce the cost of maintenance dredging. The plan of

improvement is shown in the GDM. The jetties part of the plan has been reconsidered and revised as shown in subsequent paragraphs and plates of this supplement.

10. Jetties. The jetties portion of the plan of improvement now consists of twin shell and rock fill jetties as described herein.

a. Baptiste Collette Bayou. The east jetty will be constructed to elevation +6 feet m.l.g. for a distance of 9,000 linear feet; the west jetty will be constructed to elevation +3 feet m.l.g. for a distance of 7,000 linear feet. Refer to plates 2 and 3.

b. Tiger Pass. The south jetty will be constructed to elevation +6 feet m.l.g. (+3 feet for Phase I construction; then to +6 feet for Phase II construction approximately 2 years later) for a distance of 4,700 linear feet; the north jetty will be constructed to elevation +3 feet m.l.g. for a distance of 2,700 linear feet. Refer to plate 8.

11. Filter cloth.

a. Baptiste Collette Bayou test sections. In an effort to determine the validity of utilizing filter cloth in the construction of jetties in the project area, it is planned to use filter cloth in four 500-foot test sections. Filter cloth will be placed atop insitu material from stations 320 to 325 and 405 to 408 for the east jetty and from stations 385 to 388 for the west jetty. Filter cloth will be placed between the shell core and the rock cover from stations 408 to 410 for the east jetty and from stations 320 to 325 and 388 to 390 for the west jetty. Filter cloth with different tensile strengths and physical characteristics will be utilized in the test sections. Field inspections of these test sections will determine the need and/or feasibility of using filter cloth construction for the Tiger Pass portion of the project.

b. Use on other projects. It is noted that the use of filter cloth has been successful in two locations at Grand Isle, Louisiana; the revetment for the Coast Guard Station and a jetty-groin at the west end. These installations have performed well since 1970 and 1972, respectively, with no signs of significant settlement. Filter cloth has also been used successfully under rock revetments in the Calcasieu Lock chambers. Further, the use of filter cloth is recommended under jetties by the Coastal Engineering Research Center in their publication "Small Craft Harbors, Special Report No. 2."

DEPARTURES FROM THE PROJECT DOCUMENT PLAN

12. Departures. There are no significant postauthorization changes recommended herein which are considered to be outside the discretionary authority of the Chief of Engineers and for which further congressional action would be required.

HYDROLOGY

13. Hydrology. This section is extracted from paragraph 3, Sedimentation, littoral drift and associated problems, and paragraph 4, Design criteria for considered jetties: appendix A, Hydrology, of the general design memorandum. For the purpose of clarification, some additional information is presented as shown by the sedimentation quantities in parentheses and in tables 1 and 2. Also, appendix A, Hydrology and Sedimentation Analysis, of this design memorandum gives details concerning the methodology of obtaining the sedimentation quantities.

a. Sedimentation and littoral drift into Baptiste Collette Bayou navigation channel.

(1) Inland reach. Of the 2,390,000 cu yd/yr of sediment diverted into Baptiste Collette Bayou, 33.5 percent or 800,000 cu yd/yr will reach Main Pass due to the increased conveyance for the proposed channel. In the pass from mile 1.6 to mile 6.0 estimated deposits are 112,000 cu yd/yr for the proposed channel. This gives a rate of deposition of 0.6 ft/yr.

(2) Offshore reach. In the offshore reach, from mile 6.0 to mile 8.0, the estimated channel deposits are 688,000 cu yd/yr (800,000 cu yd/yr - 112,000 cu yd/yr) for the proposed channel. This gives a shoaling rate of 4.3 ft/yr. In addition to the suspended channel sediments in the offshore reach, littoral drift contributes an estimated 548,000 cu yd/yr with a shoaling rate of 3.4 ft/yr. If jetties are not built at Baptiste Collette Bayou, the annual dredging requirements will be 1,348,000 cu yd (112,000 cu yd/yr + 688,000 cu yd/yr + 548,000 cu yd/yr) with most of the sediment, 1,236,000 cu yd/yr, (688,000 cu yd/yr + 548,000 cu yd/yr) depositing in the offshore reach. The combined shoaling rate for suspended sediments, bed load, and littoral drift in the offshore reach will average 7.7 ft/yr. To keep the channel open at navigation depths, dredging would be required at least twice a year.

(3) Considered jetty reach. A jetty built at the mouth of the proposed channel would in effect carry suspended channel sediments out into deeper water and prevent littoral drift from being deposited in

the jetty reach (approximately mile 6.0 to mile 7.5). The sediment within the jetty channel is estimated to be 80,000 cu yd/year. This gives a rate of shoaling of 0.7 ft/yr. In the gulfward reach beyond the jetty, channel sediments will be 304,000 cu yd/yr and the littoral drift will be 274,000 cu yd/yr; this gives shoaling rates of 0.8 and 0.7 ft/yr, respectively. The combined shoaling rate is 1.5 ft/yr and will require maintenance dredging at an interval of 2 years.

(4) Summary. The construction of the jetties will provide a reduction of 578,000 cu yd/yr in the quantity of annual deposits to be dredged. The expected quantities of sedimentation with and without jetties for Baptiste Collette Bayou are shown in table 1.

TABLE 1
BAPTISTE COLLETTE BAYOU
QUANTITIES OF SEDIMENTATION WITH
AND WITHOUT JETTIES (cu. yd./yr)

	INLAND REACH	OFFSHORE REACH		GULFWARD OF JETTIES		TOTAL
	Shoaling	Shoaling	Littoral Drift	Shoaling	Littoral Drift	
Without jetties	112,000	688,000	548,000	-	-	1,348,000
With jetties	112,000	80,000	0	304,000	274,000	770,000
Difference	0	-608,000	-548,000	+304,000	+274,000	-578,000

b. Sedimentation and littoral drift into Grand-Tiger Passes navigation channel.

(1) Inland reach. Of the 2,893,000 cu yd/yr of sediment diverted into Grand-Tiger Passes, 25 percent or 723,000 cu yd/yr goes into Tiger Pass. Seventeen percent of this sediment load, or 492,000 cu yd/yr reaches the lower reaches of Tiger Pass due to increased conveyance of the proposed channel. The sediment deposition from mile 0.0 to mile 1.0 will be 15,000 cu yd/yr, and the associated shoaling rate is 0.3 ft/yr. In the inland reach from mile 1.0 to mile 5.5, deposits will be 84,000 cu yd/yr for the proposed channel with a

shoaling rate of 0.4 ft/yr. In the remaining inland reach from mile 5.5 to mile 12.2, deposits will be 123,000 cy yd/yr for the proposed channel with a shoaling rate of 0.4 ft/yr. Total deposits for the inland reach are 222,000 cu yd/yr with a total shoaling rate of 0.4 ft/yr.

(2) Offshore reach. In the offshore reach from mile 12.2 to mile 14.2, estimated channel deposits for the proposed channel will be 270,000 cu yd/yr. This gives a shoaling rate of 1.7 ft/yr. Littoral drift in the same offshore reach will contribute 215,000 cu yd/yr which will give a shoaling rate of 1.3 ft/yr. The predominant direction of littoral drift is towards the north. If jetties are not built at Tiger Pass, the annual dredging requirement will be 707,000 cu yd, with most of the sediment, 485,000 cu yd/yr, depositing in the offshore reach. The combined shoaling rate for suspended sediments, bed load, and littoral drift will average 3.0 ft/yr. In order to keep the channel open at navigation depths, dredging will be required on an annual basis.

(3) Considered jetty reach. A jetty built from mile 12.2 to mile 13.3 will carry most of the channel sediments gulfward of the jetty. The littoral drift will be trapped by the jetty and prevented from being deposited in the jetty reach. The channel sediment deposited within the jetty is estimated to be 49,000 cu yd/yr with a shoaling rate of 0.4 ft/yr. In the gulfward reach beyond the jetty, channel sediments will be 55,000 cu yd/yr with littoral drift contributing an additional 54,000 cu yd/yr. Respective shoaling rates are 0.2 and 0.2 ft/yr. The combined shoaling rate for suspended sediments and littoral drift gulfward of the jetties will be 0.4 ft/yr and will require maintenance dredging at intervals of 8 years.

(4) Summary. The construction of the jetties will provide a reduction of 327,000 cu yd/yr in the quantity of annual deposits to be dredged. The expected quantities of sedimentation with and without jetties for Grand-Tiger Passes are shown in table 2.

TABLE 2

GRAND-TIGER PASSES QUANTITIES
OF SEDIMENTATION WITH AND WITHOUT
JETTIES (cu. yd./yr)

	INLAND REACH	OFFSHORE REACH		GULFWARD OF JETTIES		TOTAL
	Shoaling	Shoaling	Littoral Drift	Shoaling	Littoral Drift	
Without jetties	222,000	270,000	215,000	-	-	707,000
With jetties	222,000	49,000	0	55,000	54,000	380,000
Difference	0	-221,000	-215,000	+55,000	+54,000	-327,000

c. Design criteria for recommended jetties.

(1) Design wave criteria. The design wave height H_S is 4.5 feet, and the associated wave period is 5.0 seconds. This wave criteria is based on a storm surge elevation of 4.0 feet m.l.g. Higher storm surges would tend to ride over the structure and would be less critical to the jetty.

(2) Jetties rock gradations. The following rock gradations are required for the jetties at Baptiste Collette Bayou and Tiger Pass:

Item	Percent Lighter by weight	Limits of Stone Weight (in pounds)	Stone Diameter (feet)
3 ft thick	100	2,000 - 4,800	2.30 - 3.07
armor capstone	50	1,000 - 2,000	1.82 - 2.30
(exposed side)	15	100 - 600	0.85 - 1.54
2 ft thick	100	800 - 1,400	1.69 - 2.04
bedding layer	50	300 - 500	1.22 - 1.45
	15	50 - 150	0.67 - 0.97

GEOLOGY

14. General. General geology, physiography, subsidence, erosion, and mineral resources information, as presented in the general design memorandum concerning Baptiste Collette Bayou and Grand-Tiger Passes is also applicable to the sites of the proposed jetties. See plate 1.

SOILS

15. General. This section covers the subsurface investigation and foundation design for the shell and rock fill jetties.

16. Field investigations. In addition to the 17 general type borings previously made to design channel improvements along Baptiste Collette Bayou and Grand-Tiger Pass, a total of nine borings were made along the proposed jetty alinements to determine the stratification and engineering characteristics of the foundation soils. Along the proposed jetty alinement for Baptiste Collette Bayou, three general type and one undisturbed boring (BBC-7, BBC-9, BBC-11, and BBC-10-U) were made to depths of 50 feet. Along the proposed alinement for Grand-Tiger Pass, three general type and two undisturbed borings (BGT-12, BGT-14, BGT-16, BGT-13-U, and BGT-15-U) were made to depths of 50 feet. The locations of the borings are shown on plates 2, 3, and 8. The logs of all the borings are shown on plates 4, 7, 9, 12, and 13.

17. Laboratory tests. Visual classifications were made on all soil samples obtained and water content determinations were made on all cohesive samples. Unconfined compression (UC) shear tests were performed on representative cohesive soil samples. Unconsolidated-undrained (Q) triaxial compression tests and consolidation tests were performed on selected soil samples of the undisturbed borings. In addition, Atterburg limit determinations were performed on each sample subject to a shear or consolidation test. Results of all laboratory tests performed are shown on the boring logs, plates 4, 7, 9, 12, and 13.

18. Soil conditions and shear strengths. Based on the soil borings made for the jetty design, separate soil conditions and shear strengths were used to investigate stability and settlement of the jetties along Baptiste Collette Bayou and Grand-Tiger Pass. The following is a generalization of the soils encountered along the proposed jetty alinements.

a. Baptiste Collette Bayou.

(1) Soil conditions. Borings taken along the Baptiste Collette Bayou jetty alinement indicate that marsh deposits, consisting

of very soft clays, were encountered from ground surface to approximate elevation -10 m.s.l. These marsh deposits were underlain by inter-distributary deposits very soft to medium clays with a few silt layers, to the maximum depth of borings.

(2) Shear strengths. Design shear strengths for clays were based on the results of unconfined compression (UC) and unconsolidated-undrained triaxial compression (Q) tests performed on undisturbed samples. See plate 7 for the design strength and unit weight for clays. A unit weight of 117 PCF and a shear strength of $\emptyset=15^{o}$, C=200 PCF were used for all silts. Unit weights of 120 PCF and 98 PCF were used for rockfill and shell, respectively. A shear strength of $\emptyset=40^{o}$, C=0 psf was used for both riprap and shell.

b. Grand-Tiger Pass.

(1) Soil conditions. Borings taken along Grand-Tiger Pass disclosed similar soil conditions to those found along Baptiste Collette Bayou. However, the organic clay marsh deposits were found to extend to approximate elevation -20 m.s.l. These marsh deposits were underlain by interdistributary deposits of very soft to medium clays with silt layers.

(2) Shear strengths. Design shear strengths for clays were based on the results of unconfined compression (UC) and unconsolidated-undrained triaxial compression (Q) tests performed on undisturbed samples. See plates 12 and 13 for the design shear strength and unit weight for clays. Design shear strengths and unit weights for silt, rockfill, and shell are the same as those used for Baptiste Collette Bayou.

19. Stability and settlement analyses. The primary jetty for both Baptiste Collette Bayou and Grand Tiger Pass is to be constructed with a shell core to elevation +1 and rock fill to elevation +6 (+3 for Tiger Pass Phase I construction) with a 4-foot-wide crown. The proposed navigation channel excavation will serve as a flotation canal for the construction equipment required for material placement. A control distance of 90 feet from the jetty centerline to the top of channel cut (at elevation -6) was used for design. The results of stability and settlement analyses performed for the Baptiste Collette Bayou and Grand Tiger Pass jetties are presented below.

a. Baptiste Collette Bayou.

(1) Stability analysis. The stability analysis for the rock jetty along Baptiste Collette Bayou is presented on plate 6. The

minimum safety factor for the design section is equal to 1.32. Based on the results of this analysis, this rock jetty can be constructed to design section and grade in one lift.

(2) Settlement analysis. Based on the results of consolidation tests performed on undisturbed samples, it is estimated that the total foundation consolidation settlement will be approximately 4 feet. While the jetty cannot be overbuilt to allow for this projected settlement, it can be maintained at elevation +6 with future additions of rock fill.

b. Grand-Tiger Pass.

(1) Stability analysis. In order to satisfy minimum stability requirements, the jetty along Grand-Tiger Pass should be constructed in two phases. The first phase will consist of a shell core to elevation +1 with rock cover to elevation +3. This section, shown on plate 10, has a minimum safety factor of 1.23. It is calculated that a period of 2 years is required for the foundation clays to consolidate 50 percent under the Phase 1 load. A corresponding increase in cohesive strength of clays under the jetty centerline, equal to the product of the increase in the vertical effective stress at 50 percent consolidation and the ratio of c/p equal to 0.25, was added to the design strengths used to analyze Phase 1. Phase 2 construction (placement of rock fill to elevation +6 with a 4-foot-wide crown) was then analyzed with the increased cohesive strength. The minimum safety factor for Phase 2 construction was calculated to be 1.20 immediately after construction. After 100 percent consolidation has been completed, the safety factor of the jetty will be increased to 1.30 due to the additional strength gain caused by the remaining foundation consolidation. The stability analyses for Phase 2 construction are shown on plate 11.

(2) Settlement analysis. Based on the results of consolidation tests performed on undisturbed samples, it is estimated that the Phase 1 jetty will settle approximately 2 feet during the 2-year period prior to Phase 2 construction. After construction of Phase 2, it is estimated that the jetty will continue to settle an estimated 2 feet.

This additional settlement will have to be maintained at elevation +6 with future additions of rockfill.

20. Jetty section recommendations.

a. Baptiste Collette Bayou. It is recommended that the jetties along the dredged channel offshore of the mouth of Baptiste Collette Bayou be constructed and maintained to the sections shown on plate 4.

b. Tiger Pass. It is recommended that the south jetty along the dredged channel gulfward of the mouth of Tiger Pass be initially constructed to the Phase 1 section shown on plate 10. Two years after Phase 1, the south jetty may be enlarged and maintained to the Phase 2 section shown on plate 11. The north jetty will be constructed in one phase to the section as shown on plate 10.

COST ESTIMATES

21. Baptiste Collette Bayou Jetties, summary of costs. The total estimated cost for construction of this portion of the authorized project based on November 1977 price levels is $2,030,000, of which $2,000,000 is US Army Corps of Engineers cost, and $30,000 is US Coast Guard cost. Details of the Federal first cost estimates are shown in table 3.

TABLE 3

BAPTISTE COLLETTE BAYOU JETTIES
DETAILED ESTIMATE OF FEDERAL FIRST COSTS
(November 1977 Price Levels)

Cost Acct. No.	Item	Quantity	Unit Cost	Estimated Cost
10	Breakwaters and seawalls			
	Jetties to 6-foot depth			
	Mobilization & demob.	L.S.		$ 25,000
	2/Plastic filter cloth	13,000 s.y.	$ 4.00	52,000
	Clam shells	39,000 c.y.	8.00	312,000
	Cover stones	58,000 tons	15.00	870,000
	Capstones	15,000 tons	18.00	270,000
	Subtotal			$1,529,000
	Contingencies 10% 1/			153,000
	Subtotal			$1,682,000
30	Engineering and design 8%±			135,000
	Subtotal			$1,817,000
31	Supervision and administration 10%±			183,000
	Subtotal			$2,000,000
	U.S. Coast Guard			30,000
	Total cost			$2,030,000

1/ Contingencies considered adequate because of shoaling conditions in project area.

2/ Plastic filter cloth used in "test sections."

22. Baptiste Collette Bayou jetties, comparison of estimates. A comparison of cost estimates is shown in table 4.

TABLE 4

BAPTISTE COLLETTE BAYOU JETTIES
(Comparison of Estimates)

	Item	Project Document Jul 67 Prices	GDM	Sup 1	Difference between GDM and Sup 1
	FEDERAL	$	$	$	
10	Breakwaters and seawalls	1,120,000	4,000,000	1,682,000	-2,318,000
30	Engineering and design	20,000	320,000	135,000	- 185,000
31	Supervision administration	70,000	432,000	183,000	- 249,000
	Total Federal first cost - deferred construction	1,210,000	4,752,000	2,000,000	-2,752,000 1/

1/ Decrease due to detailed redesign of jetty configuration and length.

23. Baptiste Collette Bayou jetties, average annual charges. The total estimated average annual charges for constructing the project are $202,000 of which all are Federal costs. Average annual charges are shown in table 5.

TABLE 5

BAPTISTE COLLETTE BAYOU JETTIES
ESTIMATE OF ANNUAL CHARGES
(November 1977 Price Levels)

Item	Federal
Summary of project costs	
Jetties first cost	$2,000,000
Annual economic costs	
Interest (3¼%)	65,000
Amortization (50 years)	17,000
Jetties maintenance ($40,000/mile)	120,000*
Total annual charges	$202,000

*Based on maintenance costs over the past 28 years for the jetties at the end of the waterway from Empire, Louisiana, to the Gulf of Mexico.

24. Tiger Pass jetties summary of costs. The total estimated costs for construction of this portion of the authorized project based on June 1977 price levels is $2,230,000, of which $2,200,000 is US Army Corps of Engineers cost, and $30,000 is US Coast Guard cost. Details of the Federal first cost estimates are shown in table 6.

TABLE 6

TIGER PASS JETTIES
DETAILED ESTIMATE OF FEDERAL FIRST COSTS 1/
(November 1977 Price Levels)

Cost Acct. No.	Item	Quantity	Unit Cost	Estimated Cost
10	Breakwater and seawalls			
	Jetties to 6-foot depth			
	Mobilization & demob.	L.S.	-	$ 50,000
	Clam shells	77,000 c.y.	8.00	616,000
	Cover stones	58,000 tons	15.00	870,000
	Cap stones	8,000 tons	18.00	144,000
	Subtotal			$1,680,000
	Contingencies (10%±) 2/			168,000
	Subtotal			$2,046,000
30	Engineering & design (8%±)			152,000
	Subtotal			$2,000,000
31	Supervision & administration (10%±)			200,000
	Subtotal			$2,200,000
	U.S. Coast Guard			30,000
	Total cost			$2,030,000

1/ Costs include both Phase 1 and Phase 2 construction.

2/ Contingencies considered adequate because of shoaling conditions in project area.

25. Tiger Pass jetties, comparison of estimates. A comparison of cost estimates is shown in table 7.

TABLE 7

TIGER PASS JETTIES
(Comparison of Estimates)

	Item	Project Document Jul 67 Prices	GDM	Sup 1	Difference between GDM and Sup 1
	FEDERAL	$	$	$	$
10	Breakwaters and seawalls	1,110,000	2,875,000	1,848,000	-1,027,000
30	Engineering and design	20,000	230,000	152,000	- 78,000
31	Supervision and administration	70,000	311,000	200,000	- 111,000
	Total Federal first cost - deferred construction	1,200,000	3,416,000	2,200,000	-1,216,000[1/]

[1/] Decrease due to detailed redesign of jetty configuration and length.

26. Tiger Pass jetties average annual charges. The total estimated average annual charges for constructing the project are $145,000 of which all are Federal costs. Average annual charges are shown in table 8.

TABLE 8

TIGER PASS JETTIES
ESTIMATE OF ANNUAL CHARGES
(November 1977 Price Levels)

Item	Federal
Summary of project costs	
Jetties first cost	$2,200,000
Annual economic costs	
Interest (3¼%)	72,000
Amortization (50 yrs)	18,000
Jetties maintenance ($40,000/mile)	55,000
Total annual charges	$ 145,000

*Based on maintenance costs over the past 28 years for the jetties at the end of the waterway from Empire, Louisiana, to the Gulf of Mexico.

JETTY ECONOMIC ANALYSIS

27. Baptiste Collette Bayou. The following conclusion was stated in the general design memorandum (July 1974 price levels):

"...Therefore, since the annual cost of maintenance dredging without jetties ($485,000) is less than the annual cost of maintenance dredging and jetties ($651,000), it is concluded that jetties are not economically justified at this time."

An analysis at November 1977 price levels is as follows:

1.	Annual maintenance dredging without jetties		1,348,000 c.y.
2.	Annual maintenance dredging with jetties		770,000 c.y.
3.	Annual cost of maintenance dredging w/o jetties:		
	60¢/c.y. plus 20% cont. x 1,348,000 c.y.	=	$ 970,000
	2 mobilizations	=	50,000
	Annual cost of dredging w/o jetties	=	$1,020,000
4.	Annual cost of maintenance dredging with jetties:		
	60¢/c.y. plus 20% cont. x 770,000 c.y.	=	$ 554,000
	1 mobilization	=	25,000
	Annual cost of dredging with jetties	=	$ 579,000
5.	Dredging savings (no. 3 minus no. 4):		
	No. 3	=	$1,020,000
	No. 4	=	-579,000
	Dredging savings	=	$ 441,000
6.	Jetties annual cost (table 5)	=	$ 202,000
7.	Incremental jetty B/C ratio:		
	Dredging savings / Jetties annual cost	=	$ 441,000 / $ 202,000 = 2.2

28. Tiger Pass. The following conclusion was stated in the general design memorandum (July 1974 price levels):

"...Therefore, since the annual cost of maintenance dredging without jetties ($225,000) is less than the annual cost of maintenance dredging and jetties ($396,000), it is concluded that jetties are not economically justified at this time."

An analysis at November 1977 price levels is as follows:

1. Annual maintenance dredging without jetties = 707,000 c.y.
2. Annual maintenance dredging with jetties = 380,000 c.y.
3. Annual cost of maintenance dredging without jetties:

60¢/c.y. plus 20% cont. x 707,000 c.y.	=	$509,000
1 mobilization	=	25,000
Annual cost of dredging w/o jetties	=	$534,000

4. Annual cost of maintenance dredging with jetties:

60¢/c.y. plus 20% cont. x 380,000 c.y.	=	$274,000
mobilization ($25,000/10 yrs.)	=	3,000
Annual cost of dredging with jetties	=	$277,000

5. Dredging savings (no. 3 minus no. 4):

No. 3	=	$534,000
No. 4	=	277,000
Dredging savings	=	$257,000

6. Jetties annual cost (table 8) = $145,000

7. Incremental jetty B/C ratio:

$$\frac{\text{Dredging savings}}{\text{Jetties annual cost}} = \frac{\$257{,}000}{\$145{,}000} = 1.8$$

CONSTRUCTION METHOD AND SCHEDULE

29. Method of construction. All jetty work contemplated herein will be performed by contract after formal advertisement for bids.

30. Baptiste Collette Bayou jetties, schedule of construction. The plans and specifications for this portion of the project are scheduled for approval and advertisement in February 1979.

31. Tiger Pass jetties, schedule of construction. The plans and specifications for this portion of the project are scheduled for approval and advertisement in February 1980 (Phase I) and February 1982 (Phase 2).

32. Fiscal year funding. To accomplish the schedules shown in tables 9 and 10, the following Federal funds (excluding a U.S. Coast Guard cost of approximately $60,000) by fiscal year will be required.

Funding Schedule

Work Item	FY 78	FY 79	FY 80	FY 82
Baptiste Collette Jetty	0	$2,000,000	0	0
Tiger Pass Jetty (Phase 1)	0	0	$2,038,000	0
Tiger Pass Jetty (Phase 2)	0	0	0	$162,000
Totals	0	$2,000,000	$2,038,000	$162,000

TABLE 9
BAPTISTE COLLETTE BAYOU JETTIES
Schedule for Design and Construction

Contract	Plans and Specifications Start	Plans and Specifications Approved	Construction Advertise	Construction Award	Construction Complete	All Costs, Estimated
Baptiste Collette Bayou Jetties	Sep 78	Feb 79	Feb 79	Mar 79	Sep 79	$2,000,000

TABLE 10
TIGER PASS JETTIES
Schedule for Design and Construction

Contract	Plans and Specifications Start	Plans and Specifications Approved	Construction Advertise	Construction Award	Construction Complete	All Costs, Estimated
Phase 1 Tiger Pass Jetties	Sep 79	Feb 80	Feb 80	Mar 80	Sep 80	$2,038,000
Phase 2	Sep 81	Feb 82	Feb 82	Mar 82	Jul 82	$ 162,000

OPERATION AND MAINTENANCE

33. Maintenance by the Corps of Engineers.

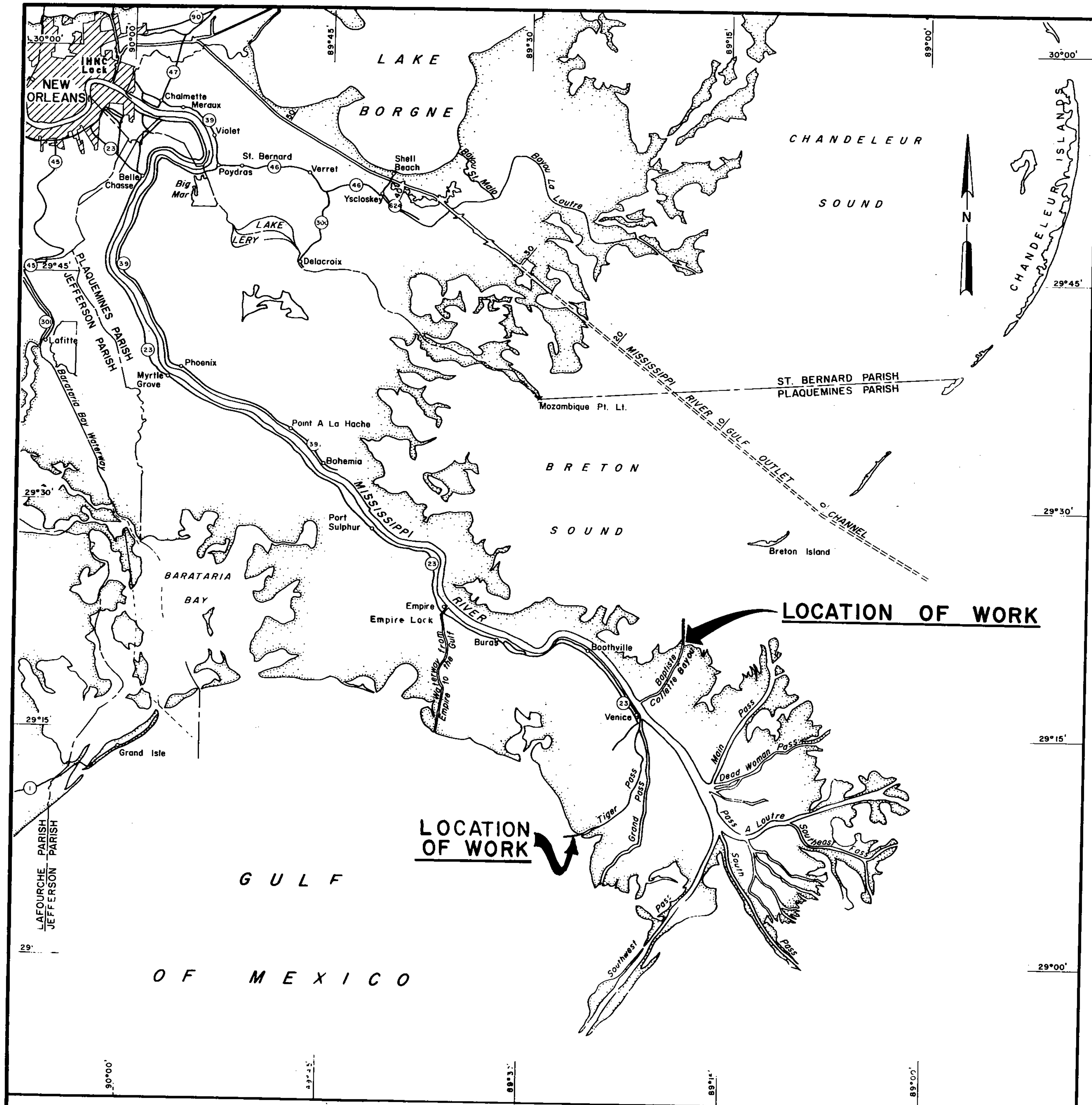
a. Baptiste Collette Bayou jetties. The jetties will be maintained by the Federal Government at an estimated average annual cost of $120,000 per maintenance cycle. It is estimated that maintenance will be required about every 12 years after construction.

b. Tiger Pass Jetties. The jetties will be maintained by the Federal Government at an estimated average annual cost of $55,000 per maintenance cycle. It is estimated that maintenance will be required about every 12 years after construction.

34. Maintenance by the US Coast Guard. The average annual maintenance cost required for aids to navigation in the jetty area is estimated to be $2,500 for Baptiste Collette Bayou and $2,500 for Tiger Pass.

RECOMMENDATION

35. Recommendation. The jetties portion of the Mississippi River Outlets, Vicinity of Venice, Louisiana, project, as presented in this document, is recommended for construction because it provides a significant reduction of the estimated annual maintenance dredging cost and has an incremental benefit-cost ratio of 2.0 to 1.0.



LOCATION MAP

SCALE OF MILES

VICINITY MAP

SCALE OF MILES

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

LOCATION AND VICINITY MAPS

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

JANUARY 1978

FILE NO. H-2-28275

PLATE 1

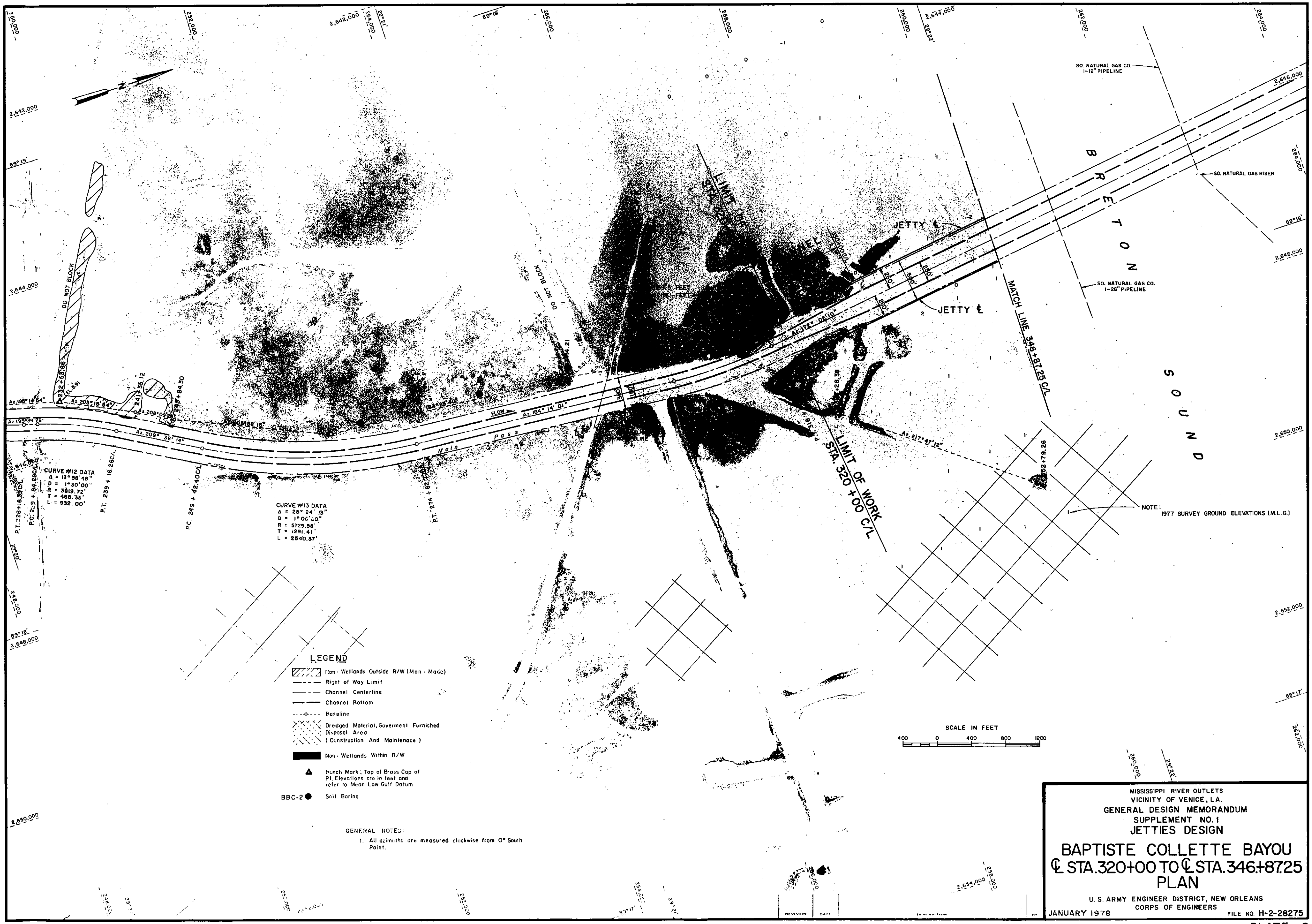
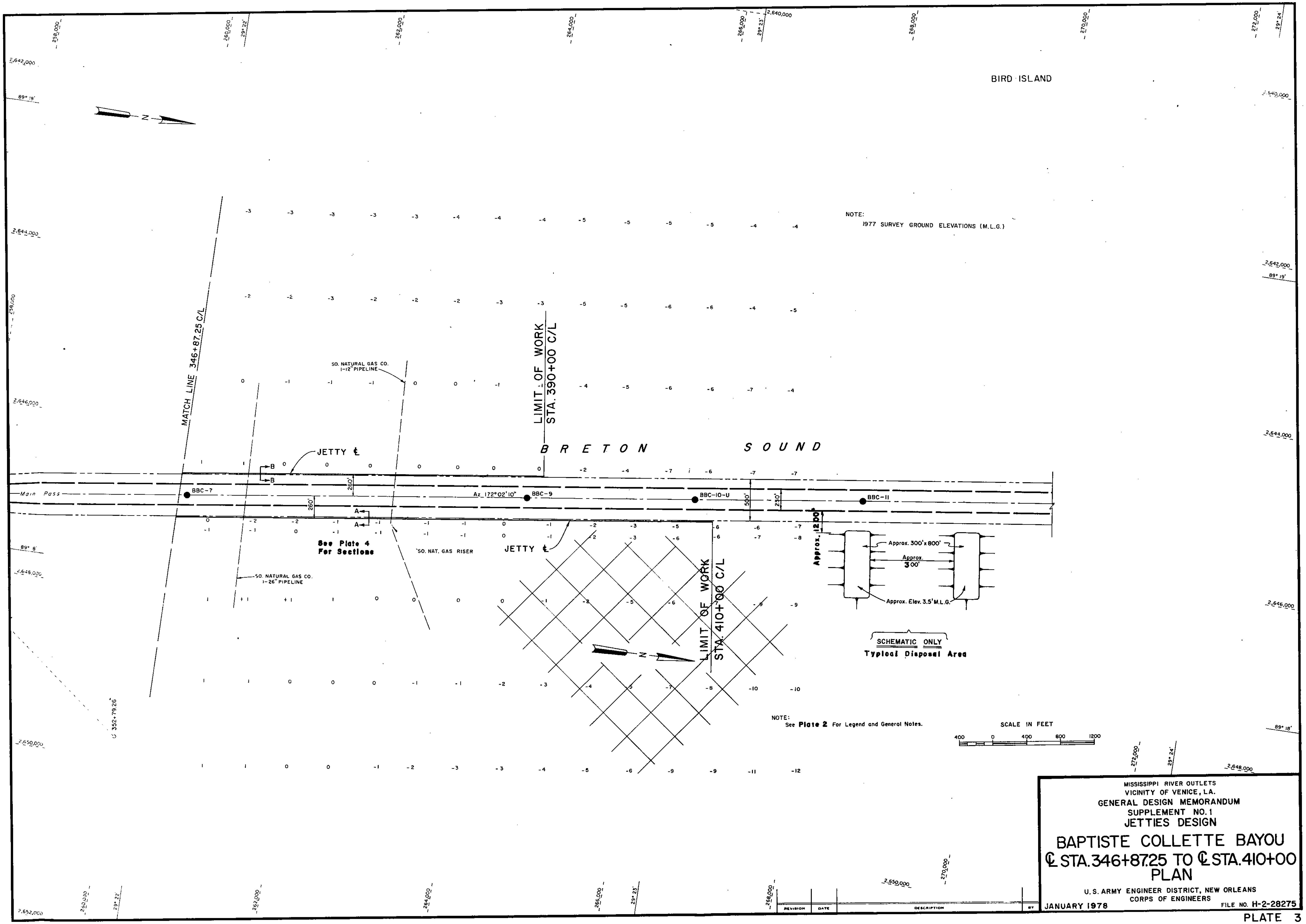

SO. NATURAL GAS CO.
1-12" PIPELINE
BRETON SOUND
SO. NATURAL GAS RISER
SO. NATURAL GAS CO.
1-26" PIPELINE
JETTY ℄
JETTY ℄
MATCH LINE 346+87.25 C/L
LIMIT OF WORK
STA. 320+00 C/L
DO NOT BLOCK
DO NOT BLOCK
Main Pass
FLOW
CURVE #12 DATA
Δ = 13° 58' 48"
D = 1° 30' 00"
R = 3819.72'
T = 468.33'
L = 932.00'
CURVE #13 DATA
Δ = 25° 24' 13"
D = 1° 00' 00"
R = 5729.58'
T = 1291.41'
L = 2540.37'
NOTE:
1977 SURVEY GROUND ELEVATIONS (M.L.G.)
LEGEND
Non - Wetlands Outside R/W (Man - Made)
Right of Way Limit
Channel Centerline
Channel Bottom
Baseline
Dredged Material, Goverment Furnished Disposal Area (Construction And Maintenace)
Non - Wetlands Within R/W
Bench Mark; Top of Brass Cap of Pt. Elevations are in feet and refer to Mean Low Gulf Datum
BBC-2 Soil Boring
GENERAL NOTES:
1. All azimuths are measured clockwise from 0° South Point.
SCALE IN FEET
400 0 400 800 1200
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN
BAPTISTE COLLETTE BAYOU
℄ STA. 320+00 TO ℄ STA. 346+87.25
PLAN
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1978
FILE NO. H-2-28275

PLATE 2



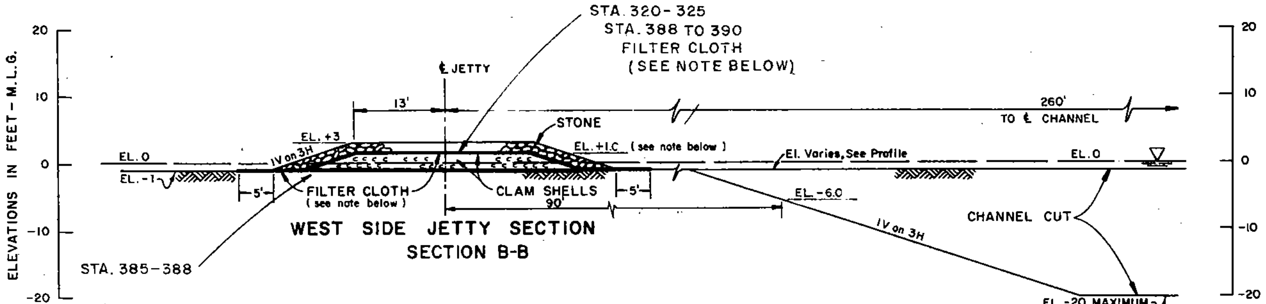
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

BAPTISTE COLLETTE BAYOU
℄ STA. 346+87.25 TO ℄ STA. 410+00
PLAN

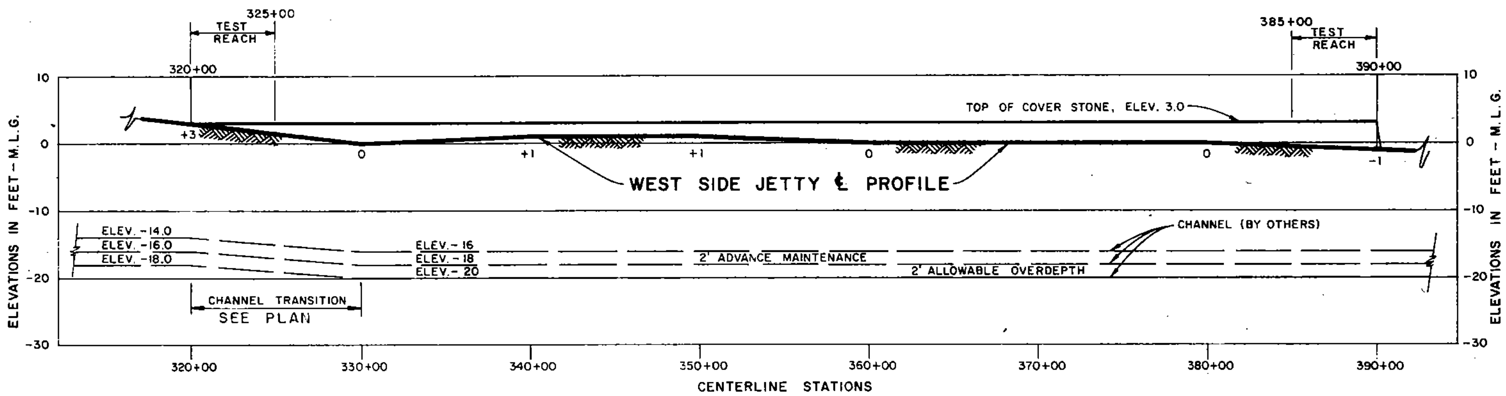
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

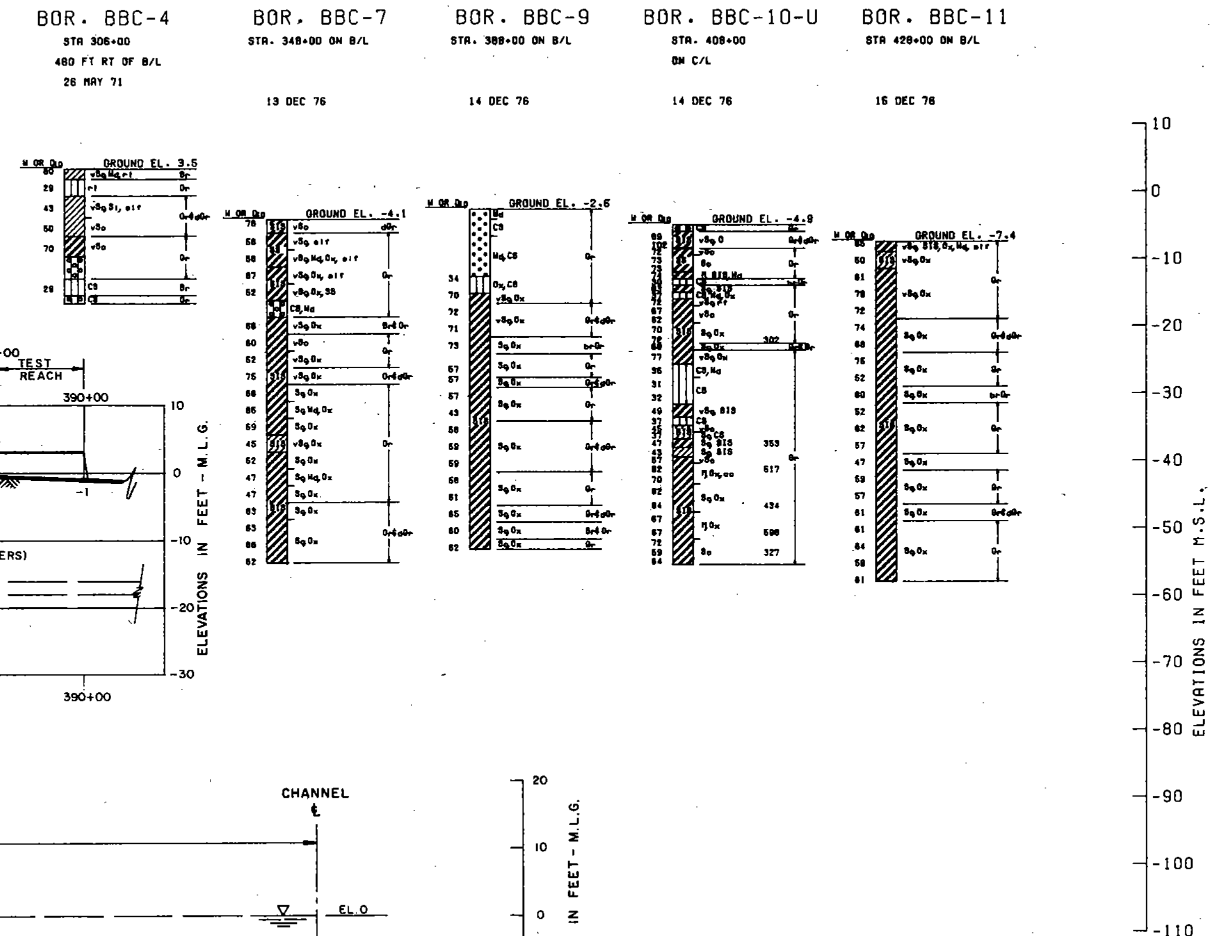
REVISION	DATE	DESCRIPTION	BY

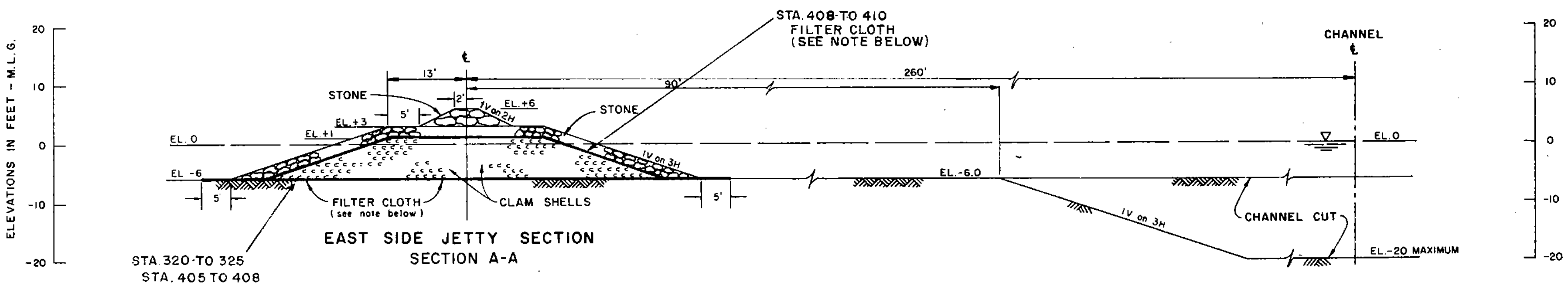
JANUARY 1978 FILE NO. H-2-28275



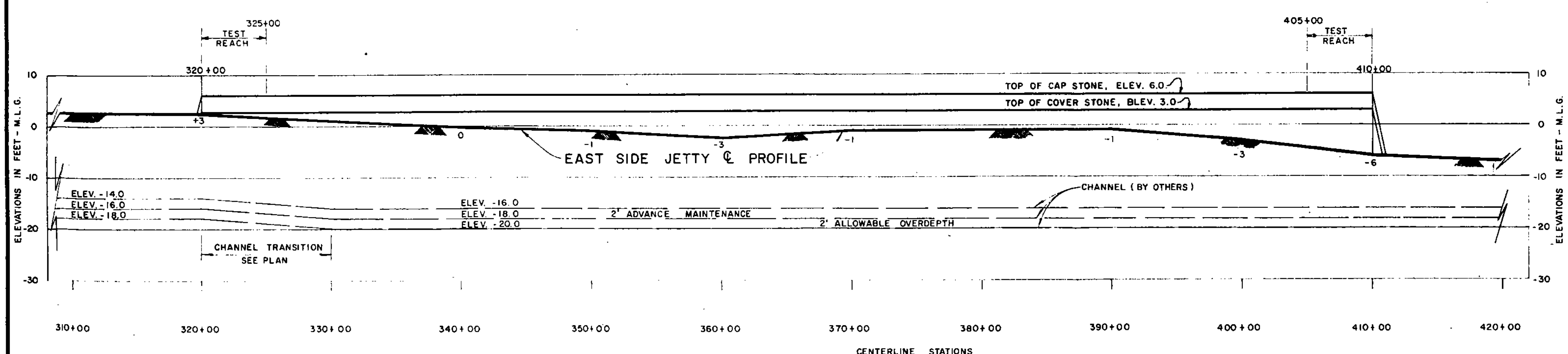
NOTE: Filter cloth to be placed between C/L stations 320+00 and 325+00 and between C/L stations 385+00 and 390+00 only. Stone thickness from EL.+3.0 to EL.+1.5 (18 inches) in "test" reaches only.
Bedding layer of shell (min. 1 foot thick) to be placed between rock and natural ground in all areas, except test reaches.







NOTE: Filter cloth to be placed between C/L stations 320+00 and 325+00 and between C/L stations 405+00 and 410+00 only.
Bedding layer of shell (min 1 foot thick) to be placed between rock and natural ground in all areas, except test reaches.



REVISION	DATE	DESCRIPTION	BY

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

BAPTISTE COLLETTE BAYOU SECTIONS, CENTERLINE PROFILE AND SOIL BORINGS

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

JANUARY 1978 FILE NO. H-2-28275

PLATE 4

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	TYPICAL NAMES
COARSE - GRAINED SOILS (More than half of material is larger than No. 200 sieve size)	GRAVELS (More than half of coarse fraction is larger than No. 4 sieve size)	CLEAN GRAVEL (Little or No Fines)	GW	GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
			GP	GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable Amount of Fines)	GM	SILTY GRAVEL, gravel-sand-silt mixtures
			GC	CLAYEY GRAVEL, gravel-sand-clay mixtures
	SANDS (More than half of coarse fraction is smaller than No. 4 sieve size)	CLEAN SAND (Little or No Fines)	SW	SAND, Well-Graded, gravelly sands
			SP	SAND, Poorly-Graded, gravelly sands
		SANDS WITH FINES (Appreciable Amount of Fines)	SM	SILTY SAND, sand-silt mixtures
			SC	CLAYEY SAND, sand-clay mixtures
FINE - GRAINED SOILS (More than half the material is smaller than No. 200 sieve size)		SILTS AND CLAYS (Liquid Limit <50)	ML	SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
			CL	LEAN CLAY; Sandy Clay; Silty Clay; of low to medium plasticity
			OL	ORGANIC SILTS and organic silty clays of low plasticity
		SILTS AND CLAYS (Liquid Limit >50)	MH	SILT, fine sandy or silty soil with high plasticity
			CH	FAT CLAY, inorganic clay of high plasticity
			OH	ORGANIC CLAYS of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt	PEAT, and other highly organic soil
WOOD			Wd	WOOD
SHELLS			Sl	SHELLS
NO SAMPLE				

NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols

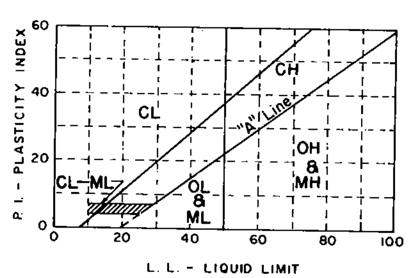
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	BK
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH-GRAY	br Gr
GRAYISH-BROWN	gy Br
GREENISH-GRAY	gn Gr
GRAYISH-GREEN	gy Gn
GREEN	Gn
BLUE	Bl
BLUE-GREEN	Bl Gn
WHITE	Wh
MOTTLED	Mot

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS./SQ. FT. FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	vSo
SOFT	250-500	So
MEDIUM	500-1000	M
STIFF	1000-2000	St
VERY STIFF	2000-4000	vSt
HARD	> 4000	H



PLASTICITY CHART
For classification of fine-grained soils

MODIFICATIONS

MODIFICATION	SYMBOL
Traces	Tr-
Fine	F
Medium	M
Coarse	C
Concretions	cc
Rootlets	rt
Lignite fragments	lg
Shale fragments	sh
Sandstone fragments	sds
Shell fragments	slf
Organic matter	O
Clay strata or lenses	CS
Silt strata or lenses	SIS
Sand strata or lenses	SS
Sandy	S
Gravelly	G
Boulders	B
Slickensides	SL
Wood	Wd
Oxidized	Ox

NOTES:

FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D_{10}"

Are natural water contents in percent dry weight

When underlined denotes D_{10} size in mm*

FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"

Are liquid and plastic limits, respectively

SYMBOLS TO LEFT OF BORING

- ▽ Ground-water surface and date observed
- (C) Denotes location of consolidation test**
- (S) Denotes location of consolidated-drained direct shear test**
- (R) Denotes location of consolidated-undrained triaxial compression test**
- (Q) Denotes location of unconsolidated-undrained triaxial compression test**
- (T) Denotes location of sample subjected to consolidation test and each of the above three types of shear tests**
- FW Denotes free water encountered in boring or sample

FIGURES TO RIGHT OF BORING

Are values of cohesion in lbs./sq. ft. from unconfined compression tests

In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler (1 3/8" I.D., 2" O.D.) and a 140 lb. driving hammer with a 30" drop

Where underlined with a solid line denotes laboratory permeability in centimeters per second of undisturbed sample

Where underlined with a dashed line denotes laboratory permeability in centimeters per second of sample remoulded to the estimated natural void ratio

*The D_{10} size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than D_{10}

**Results of these tests are available for inspection in the U.S. Army Engineer District Office, if these symbols appear beside the boring logs on the drawings

TYPICAL NOTES:

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract.

Ground-water elevations shown on the boring logs represents ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water data is available, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of these borings.

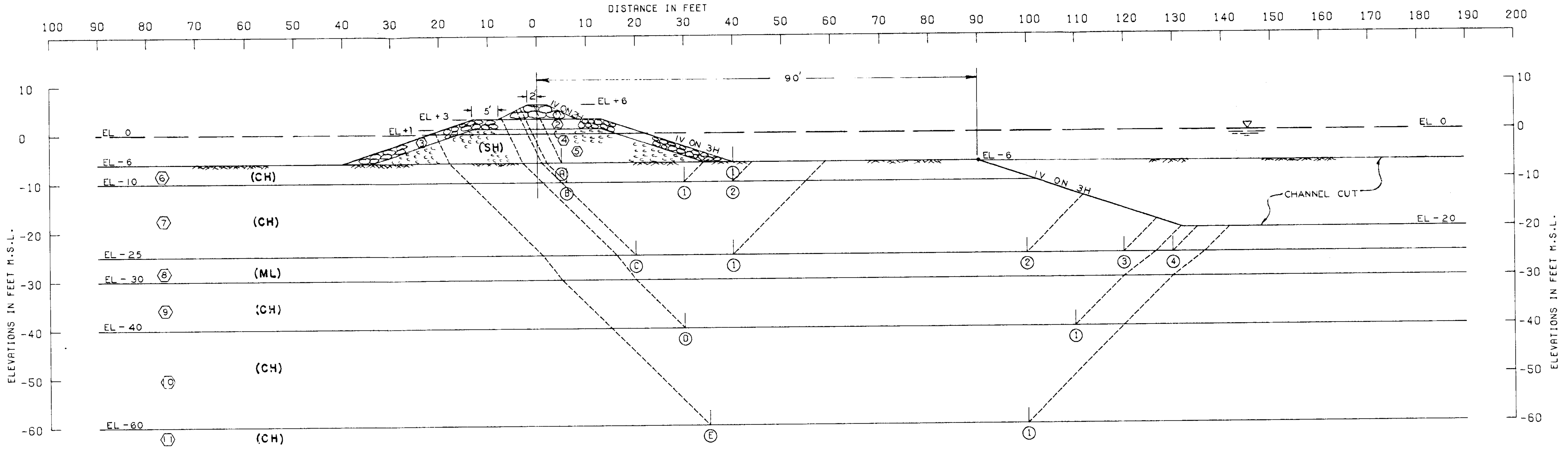
Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown.

REVISION	DATE	DESCRIPTION	BY

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

SOIL BORING LEGEND

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1978
FILE NO. H-2-28275



GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS.AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.SEE BORING DATA PLATES.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	RK	120.0	120.0	0.0	0.0	0.0	0.0	40.0
2	RK	120.0	120.0	0.0	0.0	0.0	0.0	40.0
3	RK	58.0	58.0	0.0	0.0	0.0	0.0	40.0
4	SH	98.0	98.0	0.0	0.0	0.0	0.0	40.0
5	SH	36.0	36.0	0.0	0.0	0.0	0.0	40.0
6	CH	33.0	33.0	150.0	150.0	150.0	150.0	0.0
7	CH	33.0	33.0	260.0	260.0	320.0	320.0	0.0
8	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
9	CH	40.0	40.0	400.0	400.0	440.0	440.0	0.0
10	CH	40.0	40.0	520.0	520.0	600.0	600.0	0.0
11	CH	40.0	40.0	600.0	600.0	600.0	600.0	0.0

ASSUMED FAILURE SURFACE			RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.		ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	-6.00	4815	3988	0	6153	0	8803	6153	1.431
B	1	-10.00	6365	3600	1610	9880	1257	11575	8623	1.342
B	2	-10.00	6365	5100	1200	9880	263	12665	9617	1.317
C	1	-25.00	13994	6400	9000	23072	5954	29394	17118	1.717
C	2	-25.00	13994	25600	5710	23072	3035	45304	20036	2.261
C	3	-25.00	13994	31723	3110	23072	1001	48827	22071	2.212
C	4	-25.00	13994	34371	2200	23072	434	50565	22638	2.234
D	1	-40.00	24577	35200	14261	43025	10836	74038	32189	2.300
E	1	-60.00	43861	39000	34674	83908	38744	117535	45164	2.602

NOTES

ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

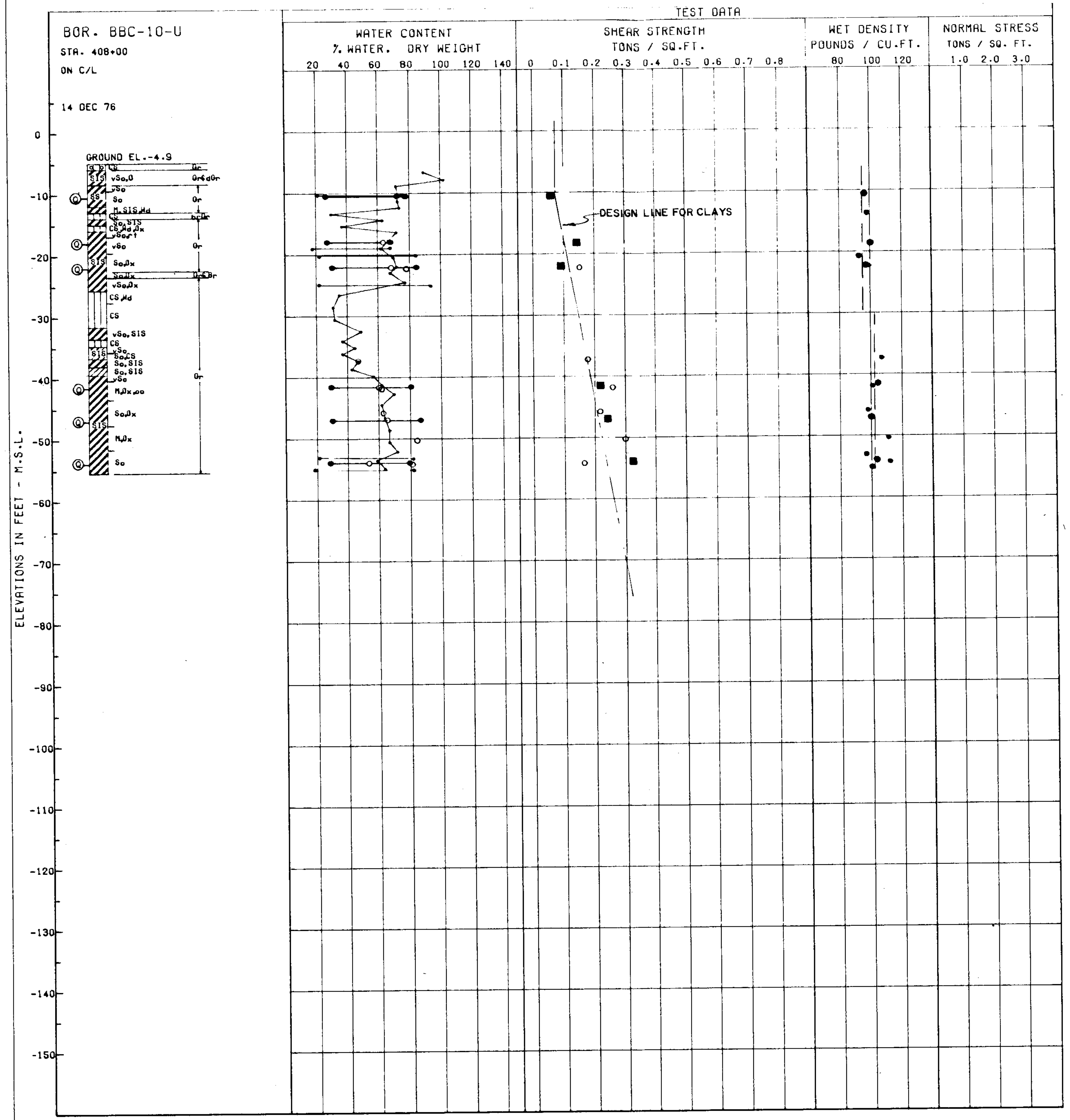
BAPTISTE COLLETTE

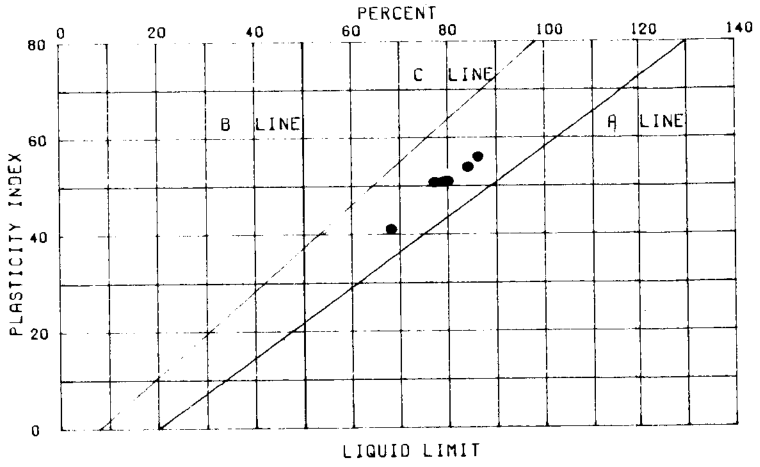
ROCK JETTY

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

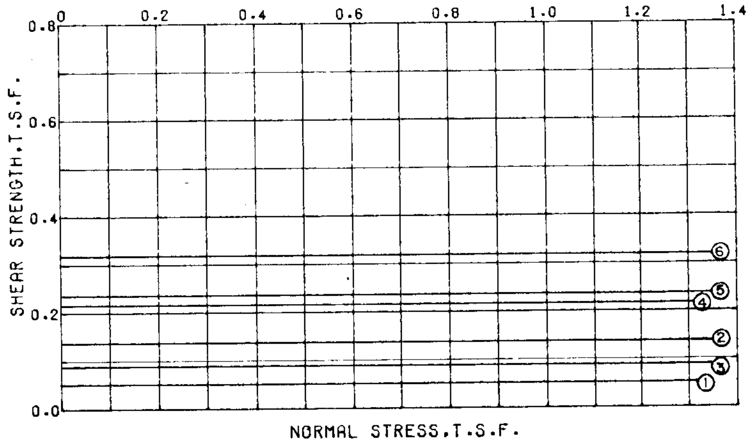
BAPTISTE COLLETTE BAYOU STABILITY ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1978 FILE NO H-2-28275



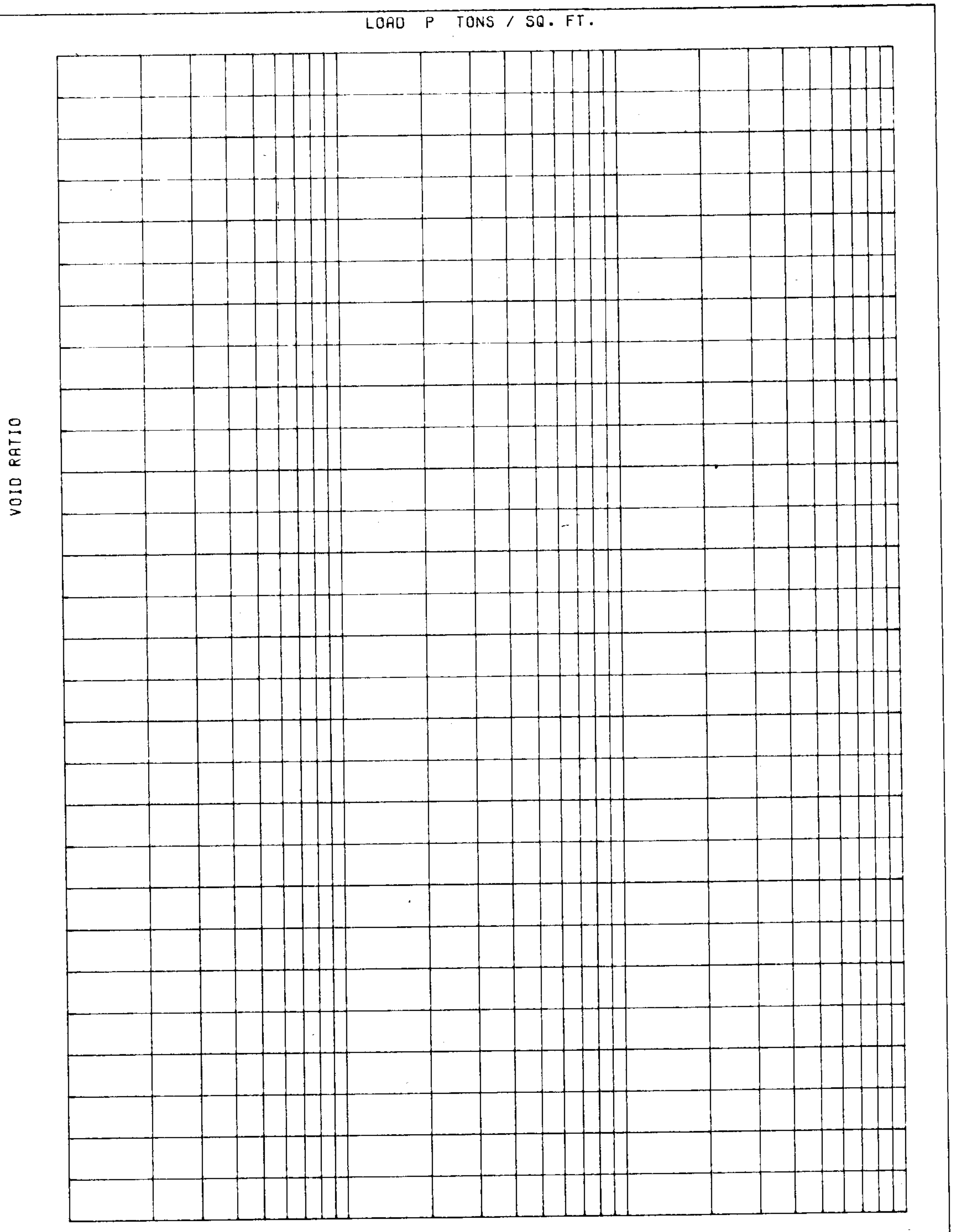


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
1	-10.4			0.055	
2	-17.9			0.14	
3	-21.9	Q	0	0.09	CH
4	-41.5			0.215	
5	-46.8			0.24	
6	-53.9			0.32	



CONSOLIDATION DATA

○- (UC) UNCONFINED COMPRESSION TEST
■- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
△- (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE

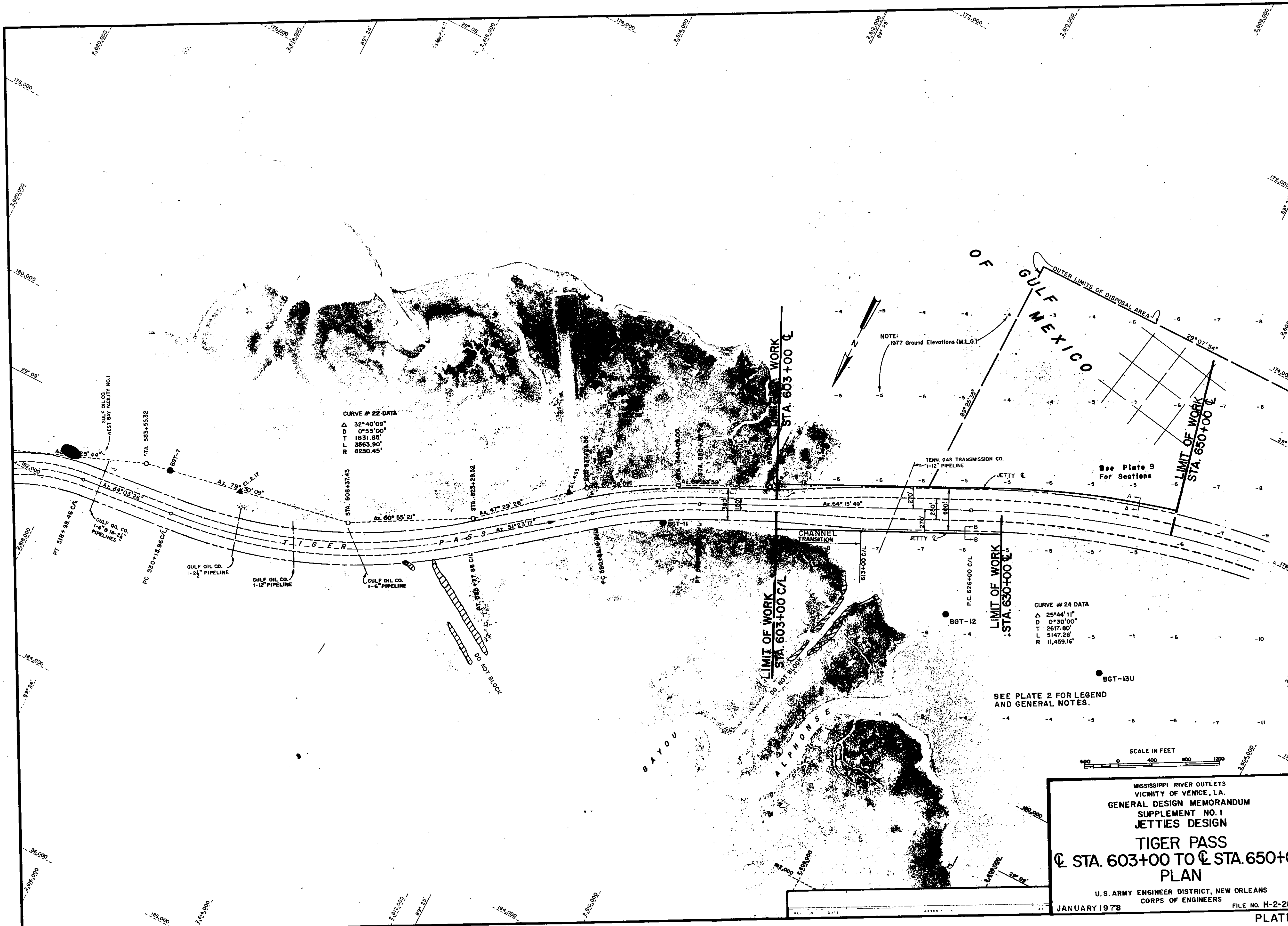
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

BAPTISTE COLLETTE BAYOU UNDISTURBED BORING DATA BORING BBC-10-U

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

JANUARY 78

FILE NO. H-2-28275



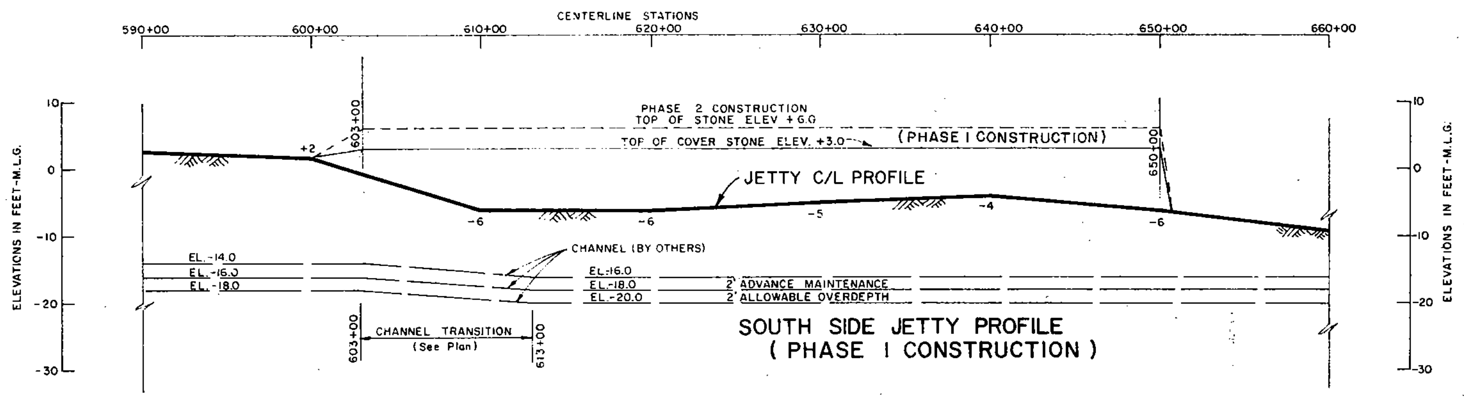
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

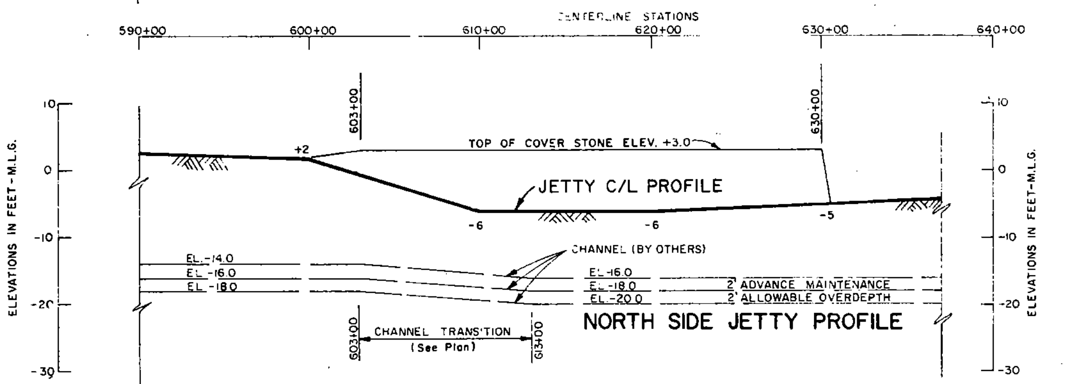
TIGER PASS
℄ STA. 603+00 TO ℄ STA. 650+00
PLAN

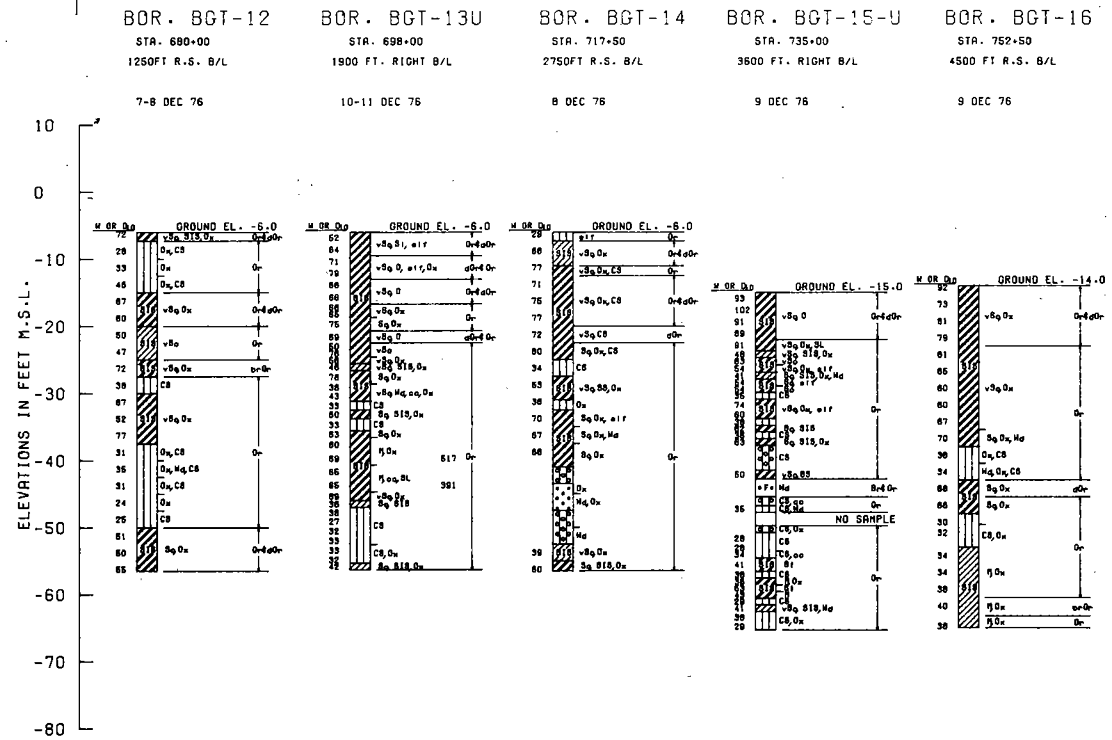
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

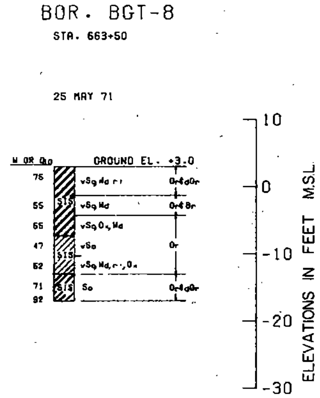
JANUARY 1978 FILE NO. H-2-28275

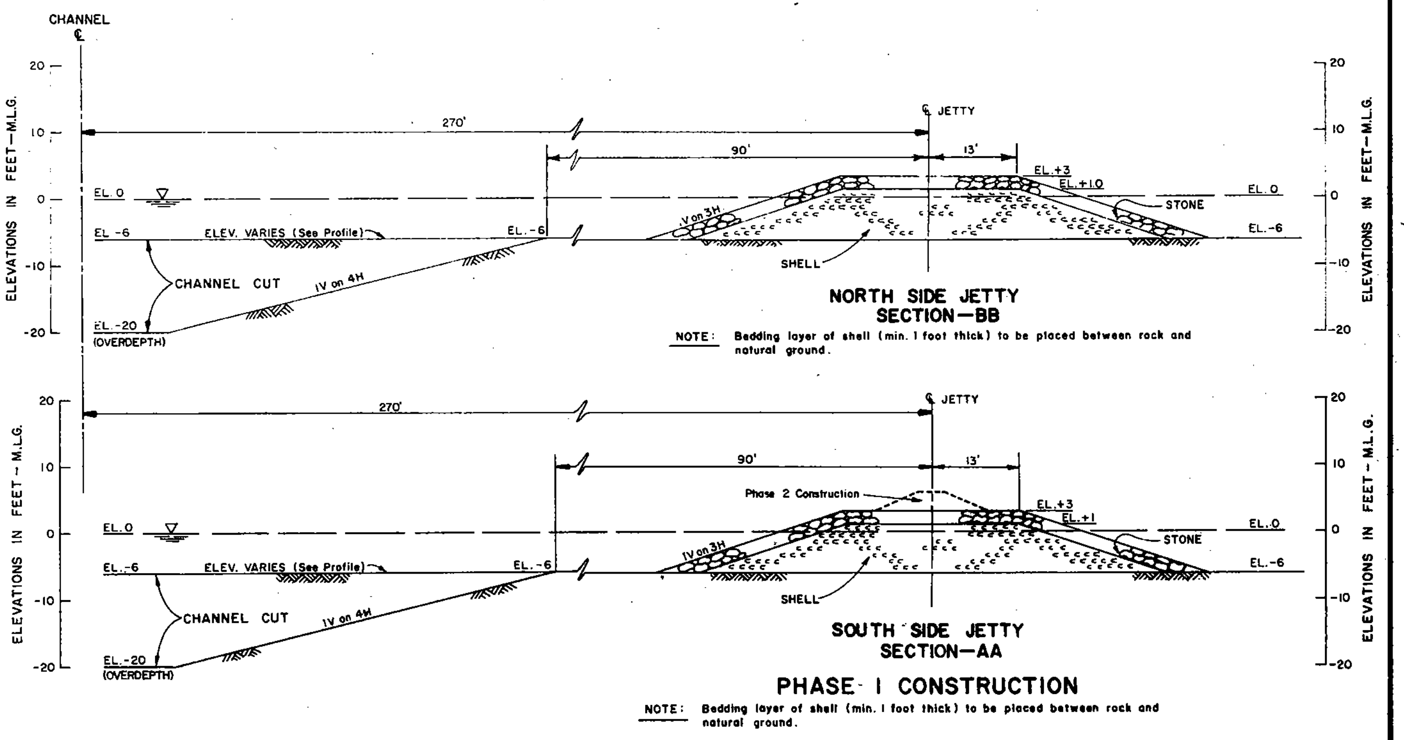
PLATE 8











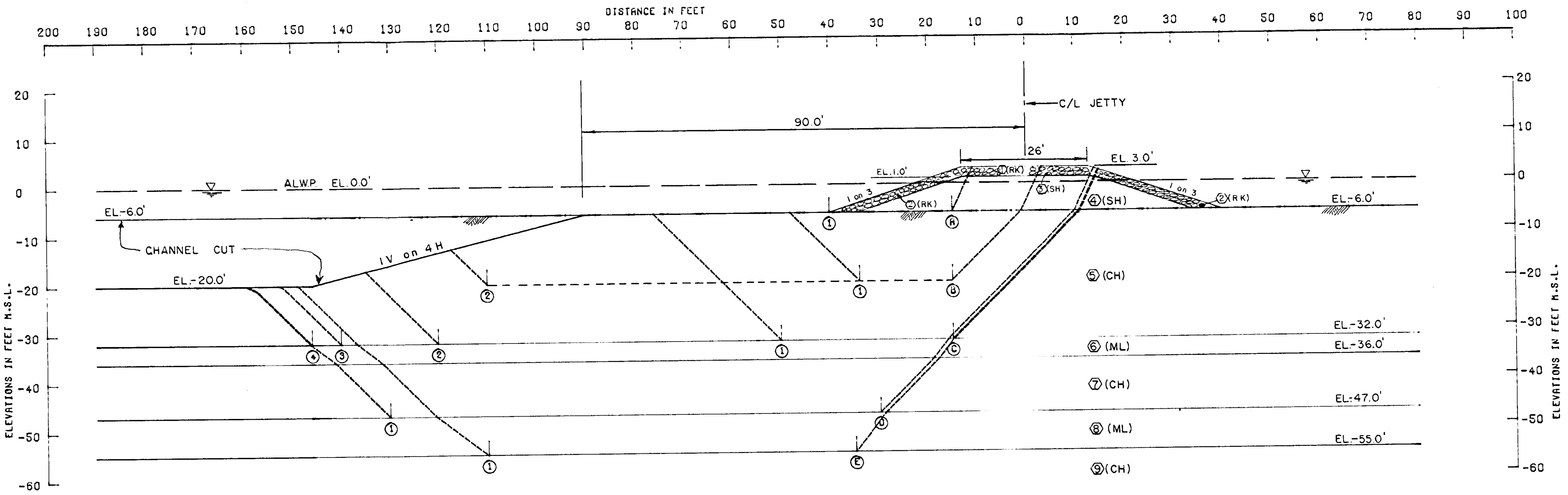
REVISION	DATE	DESCRIPTION	BY

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

TIGER PASS
SECTIONS, CENTERLINE PROFILE AND SOIL BORINGS

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

JANUARY 1978 FILE NO. H-2-26275



GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
①	RK	120.0	120.0	0.0	0.0	0.0	0.0	40.0
②	RK	58.0	58.0	0.0	0.0	0.0	0.0	40.0
③	SH	98.0	98.0	0.0	0.0	0.0	0.0	40.0
④	SH	36.0	36.0	0.0	0.0	0.0	0.0	40.0
⑤	CH	33.0	33.0	150.0	150.0	150.0	150.0	0.0
⑥	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑦	CH	33.0	33.0	445.0	445.0	630.0	630.0	0.0
⑧	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑨	CH	33.0	33.0	900.0	900.0	900.0	900.0	0.0

ASSUMED FAILURE SURFACE		RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
NO.	ELEV.	R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
Ⓐ ①	-6.00	2402	2822	0	3070	0	5224	3070	1.702
Ⓑ ①	-20.00	6712	2850	4200	14137	3579	13762	10557	1.304
Ⓑ ②	-20.00	6712	14250	2160	14137	1068	23122	13069	1.769
Ⓒ ①	-32.00	10179	5250	7800	28536	11150	23229	17386	1.336
Ⓒ ②	-32.00	10179	15750	4440	28536	4515	30369	24021	1.264
Ⓒ ③	-32.00	10179	18750	3604	28536	2128	32533	26408	1.232
Ⓒ ④	-32.00	10179	19650	3608	28536	2379	33437	26157	1.278
Ⓓ ①	-47.00	23548	57037	16945	[illegible]	14198	97530	36358	2.682
Ⓔ ①	-55.00	31878	67500	29453	65295	27099	128921	38196	3.375

NOTES

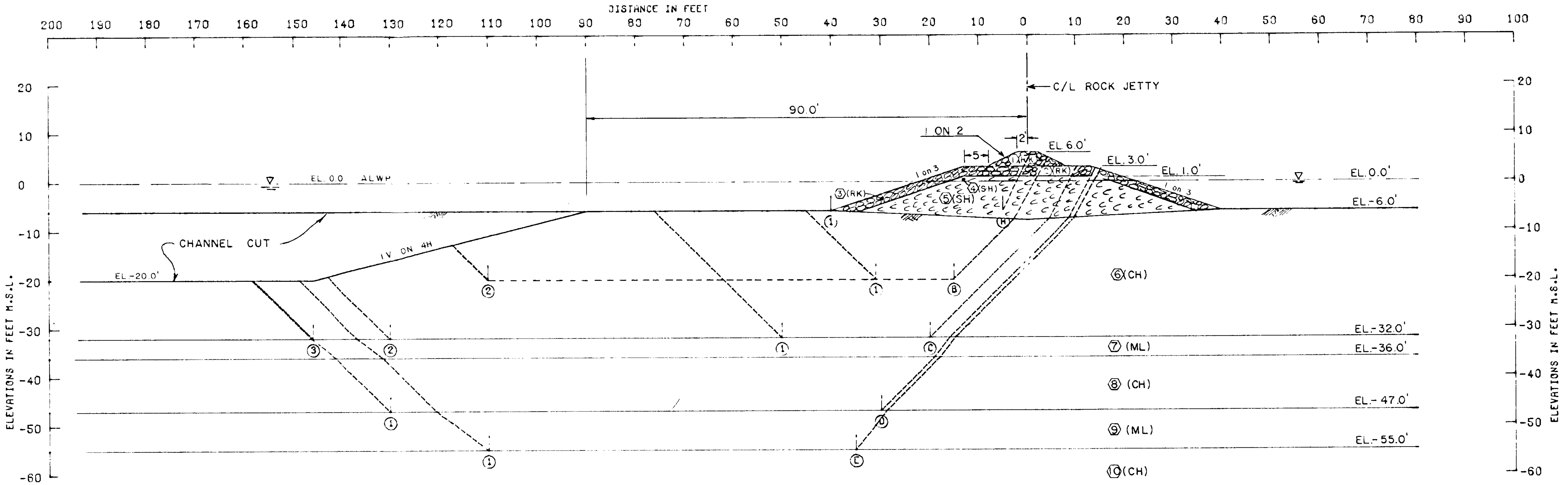
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT REFERS TO PASSIVE WEDGE

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

TIGER PASS
PHASE I CONSTRUCTION
STABILITY ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1976 FILE NO H-2-28275



GENERAL NOTES

CLASSIFICATION STRATIFICATION SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATES.

SHEAR STRENGTHS BETWEEN VERTICALS 1 AND 2 WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F. VERT. 1	EFFECTIVE UNIT WT. P.C.F. VERT. 2	C** UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1	C** UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 2	C** UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 1	C** UNIT COHESION - P.S.F. BOTTOM OF STRATUM VERT. 2	FRICTION ANGLE DEGREES
①	RK	120.0	120.0	0.0	0.0	0.0	0.0	40.0
②	RK	120.0	120.0	0.0	0.0	0.0	0.0	40.0
③	RK	58.0	58.0	0.0	0.0	0.0	0.0	40.0
④	SH	98.0	98.0	0.0	0.0	0.0	0.0	40.0
⑤	SH	36.0	36.0	0.0	0.0	0.0	0.0	40.0
⑥	CH	33.0	33.0	215.0	150.0	205.0	150.0	0.0
⑦	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑧	CH	33.0	33.0	490.0	445.0	675.0	630.0	0.0
⑨	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
⑩	CH	33.0	33.0	940.0	900.0	940.0	900.0	0.0

** COHESIVE STRENGTH OF CLAYS UNDER VERTICAL I INCREASED DUE TO 50% CONSOLIDATION UNDER PHASE I LOAD

ASSUMED FAILURE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES R_A	RESISTING FORCES R_B	RESISTING FORCES R_P	DRIVING FORCES D_A	DRIVING FORCES $-D_P$	SUMMATION OF FORCES RESISTING	SUMMATION OF FORCES DRIVING	FACTOR OF SAFETY 50% C.	FACTOR OF SAFETY 100% C.
Ⓐ	①	-6.00	5019	5045	0	6413	0	10064	6413	1.569	1.677
Ⓑ	①	-20.00	10854	2774	4291	19007	3981	17919	15026	1.193	1.305
Ⓑ	②	-20.00	10854	14680	2160	19007	1068	27694	17939	1.544	1.637
Ⓒ	①	-32.00	13303	4775	7800	31709	11150	25878	20559	1.259	1.387
Ⓒ	②	-32.00	13303	16775	3840	31709	3377	33918	28332	1.197	1.290
Ⓒ	③	-32.00	13303	19175	3600	31709	2374	36078	29335	1.230	1.320
Ⓓ	①	-47.00	27064	57037	16943	54156	14200	101044	39956	2.529	2.606
Ⓔ	①	-55.00	35518	67513	29451	68895	27368	132482	41527	3.190	3.247

*PHASE 2 CONSTRUCTION TO BEGIN 2 YRS. AFTER COMPLETION OF PHASE I - ASSUME 50 % CONSOLIDATION AFTER 2 YRS.

NOTES

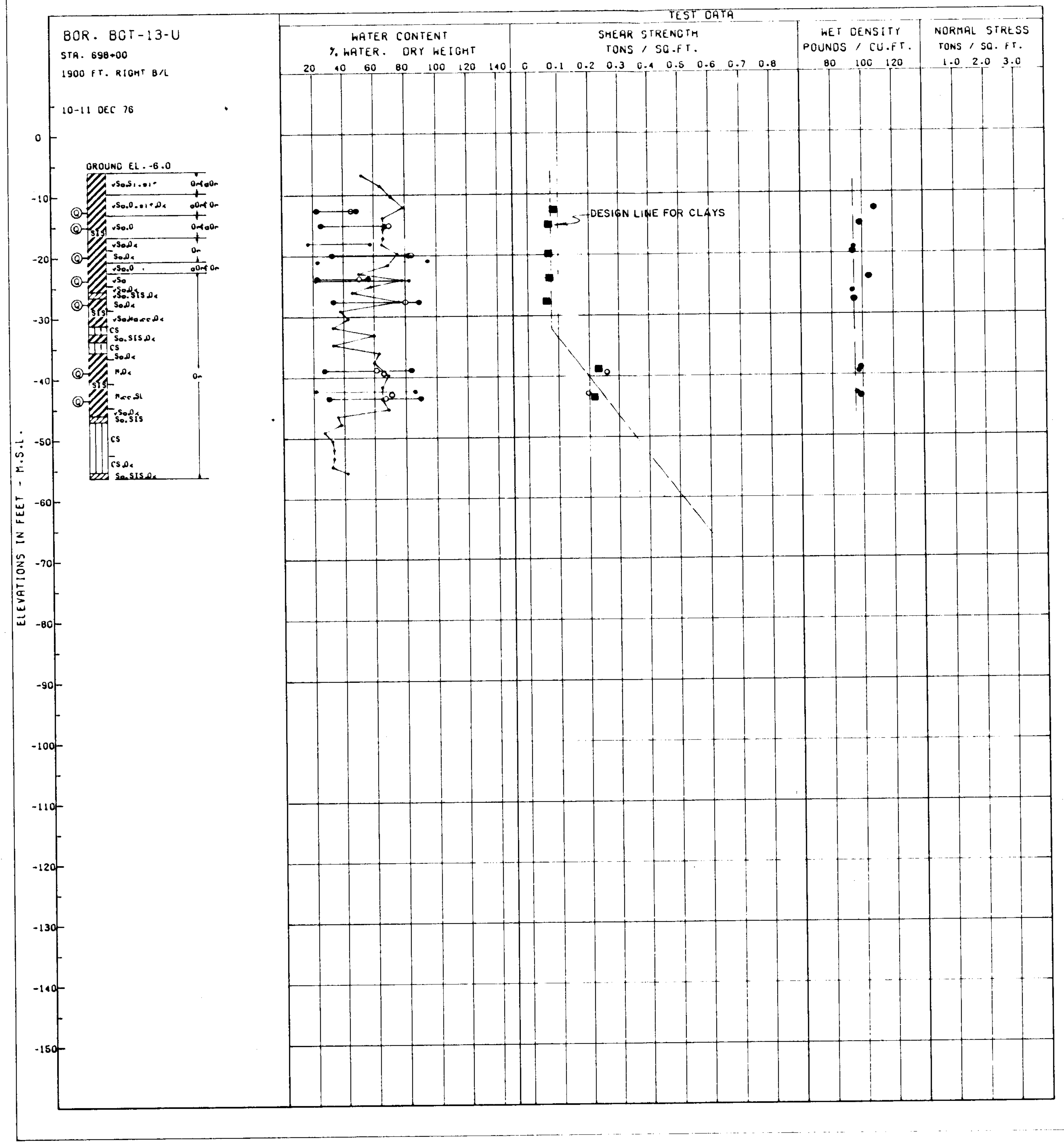
ANGLE OF INTERNAL FRICTION, DEGREES — Ø
UNIT COHESION, P.S.F. — C
STATIC WATER SURFACE — ∇
HORIZONTAL DRIVING FORCE IN POUNDS — D
HORIZONTAL RESISTING FORCE IN POUNDS — R
AS A SUBSCRIPT REFERS TO ACTIVE WEDGE — A
AS A SUBSCRIPT REFERS TO CENTRAL BLOCK — B
AS A SUBSCRIPT REFERS TO PASSIVE WEDGE — P

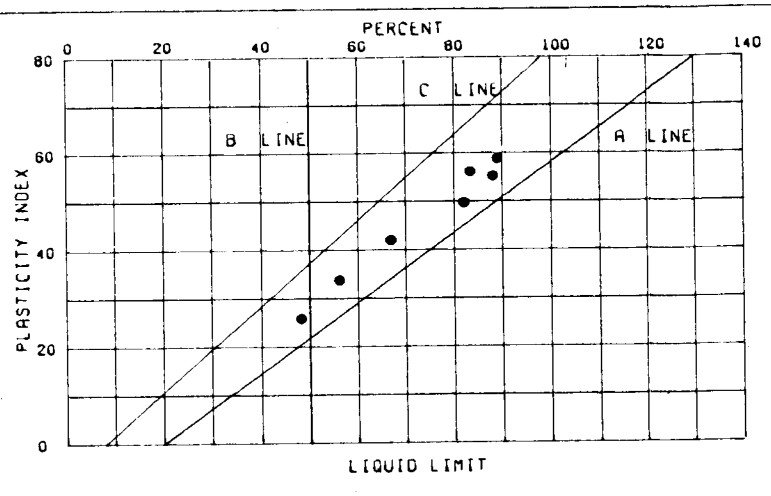
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

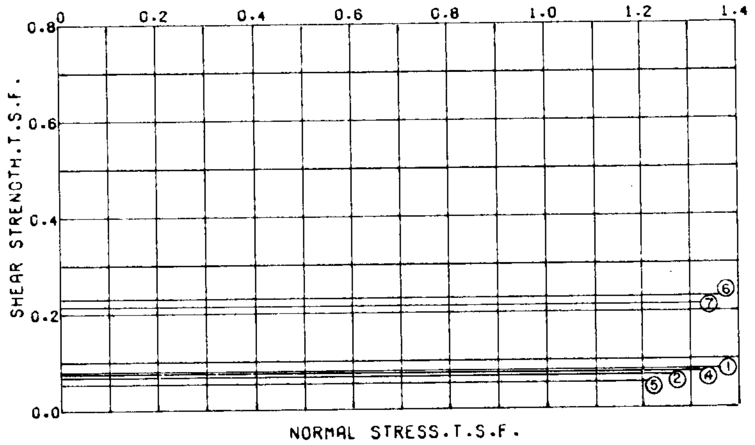
TIGER PASS
PHASE 2 CONSTRUCTION
STABILITY ANALYSIS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1978 FILE NO. H-2-28275



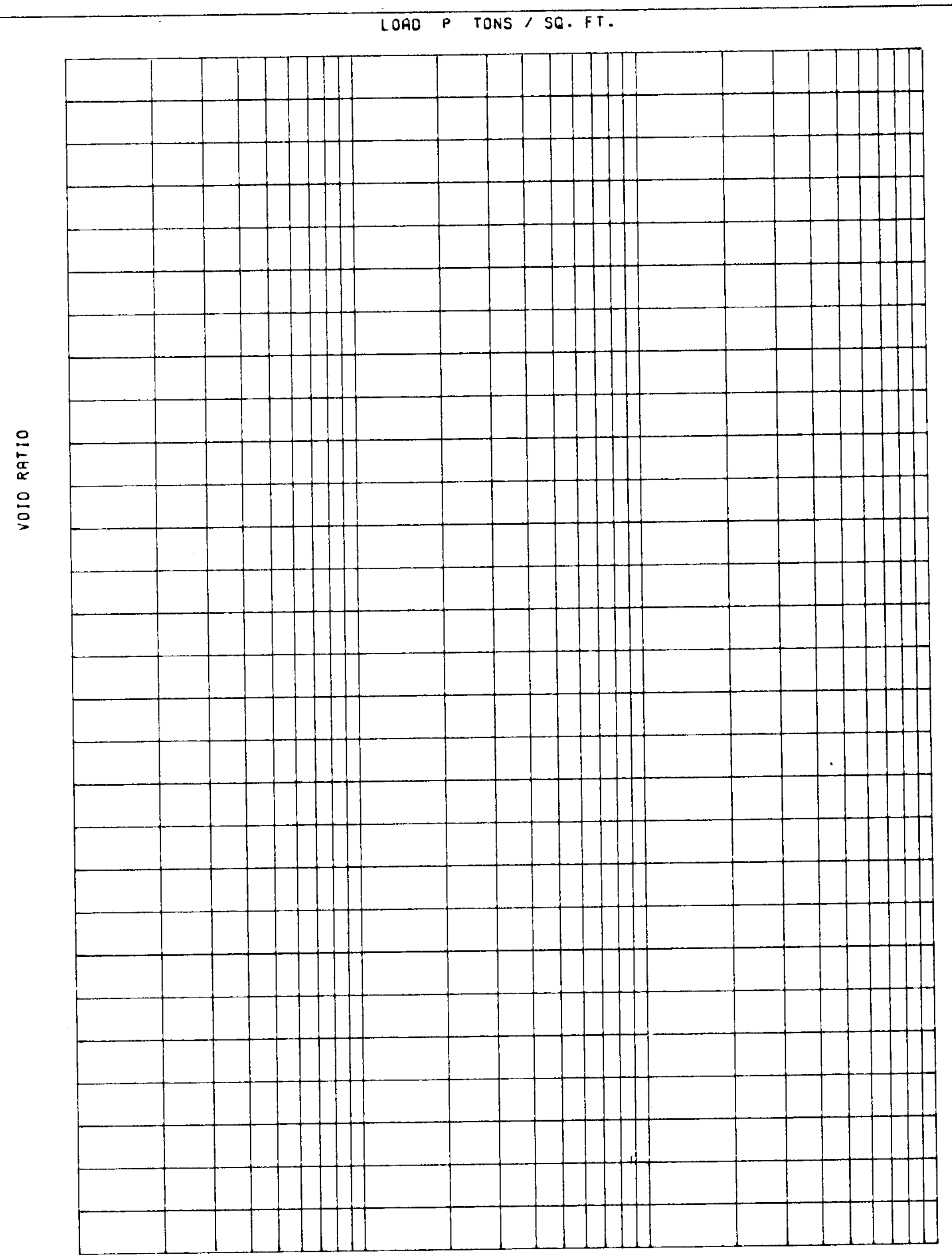


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
2	-15.0'			0.065	
3	-19.8'			0.065	
4	-23.9			0.07	
5	-27.5	Q	0	0.06	CH
6	-38.9			0.23	
7	-43.3			0.215	
1	-12.4			0.08	



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
△ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE

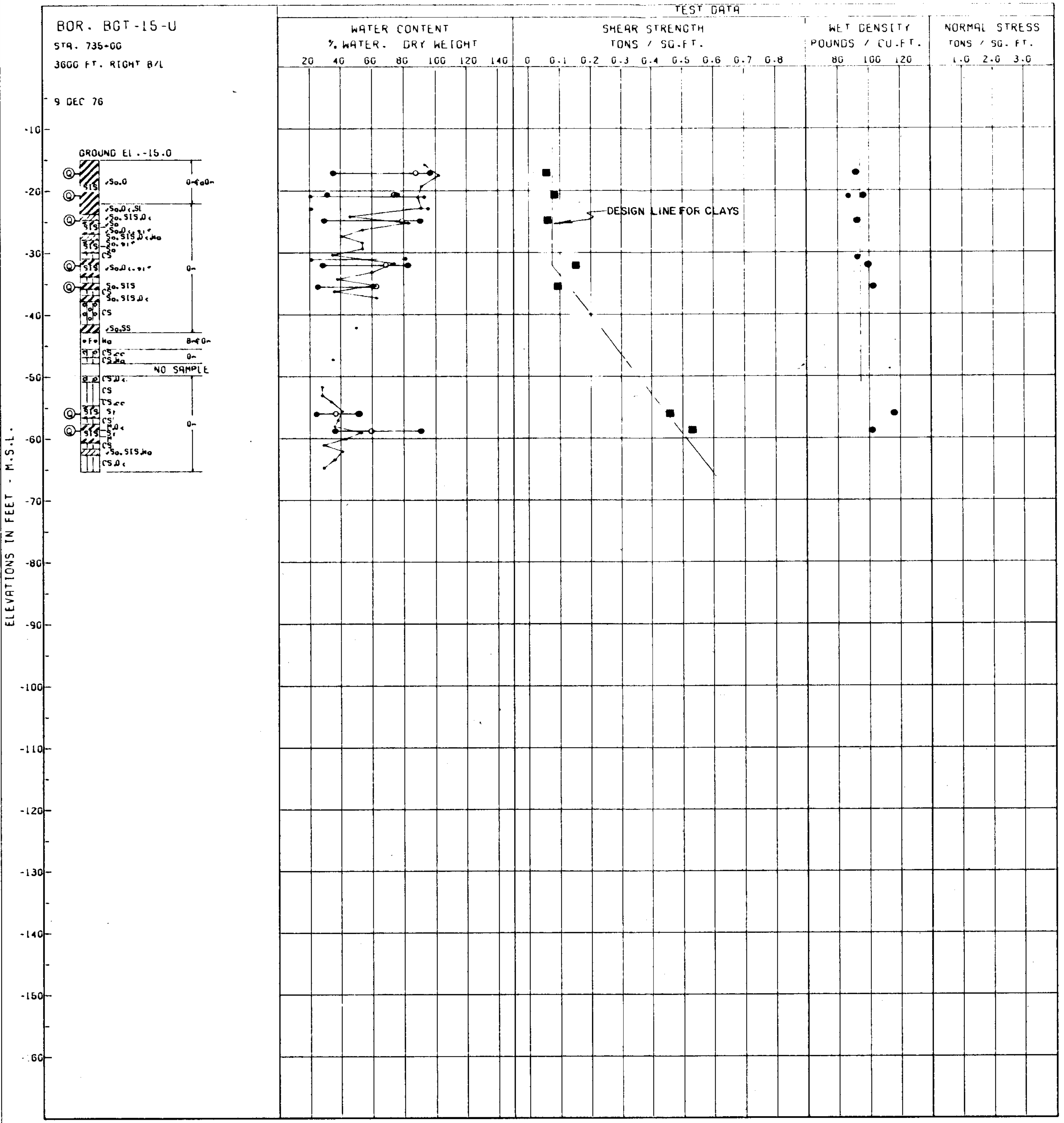
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

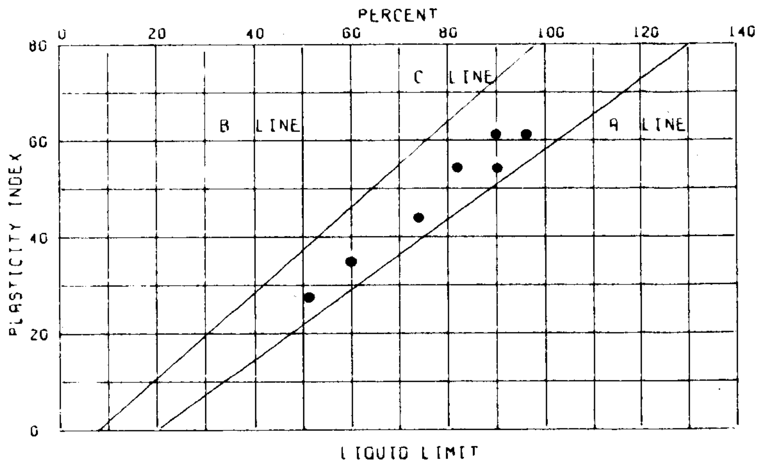
TIGER PASS
UNDISTURBED BORING DATA
BORING BGT-13-U

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

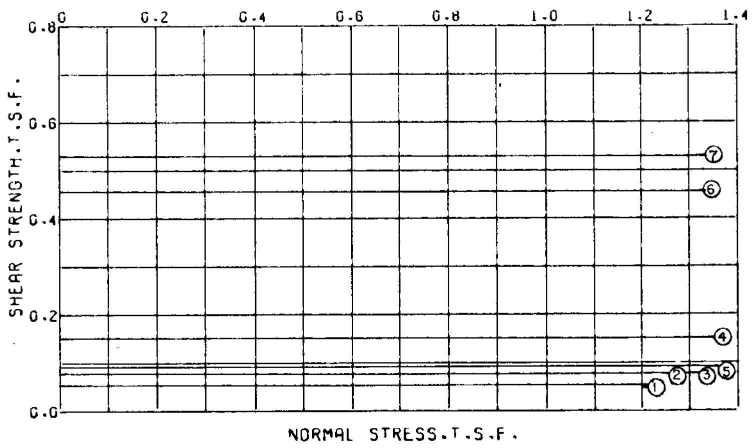
JANUARY 1976

FILE NO. H-2-28275



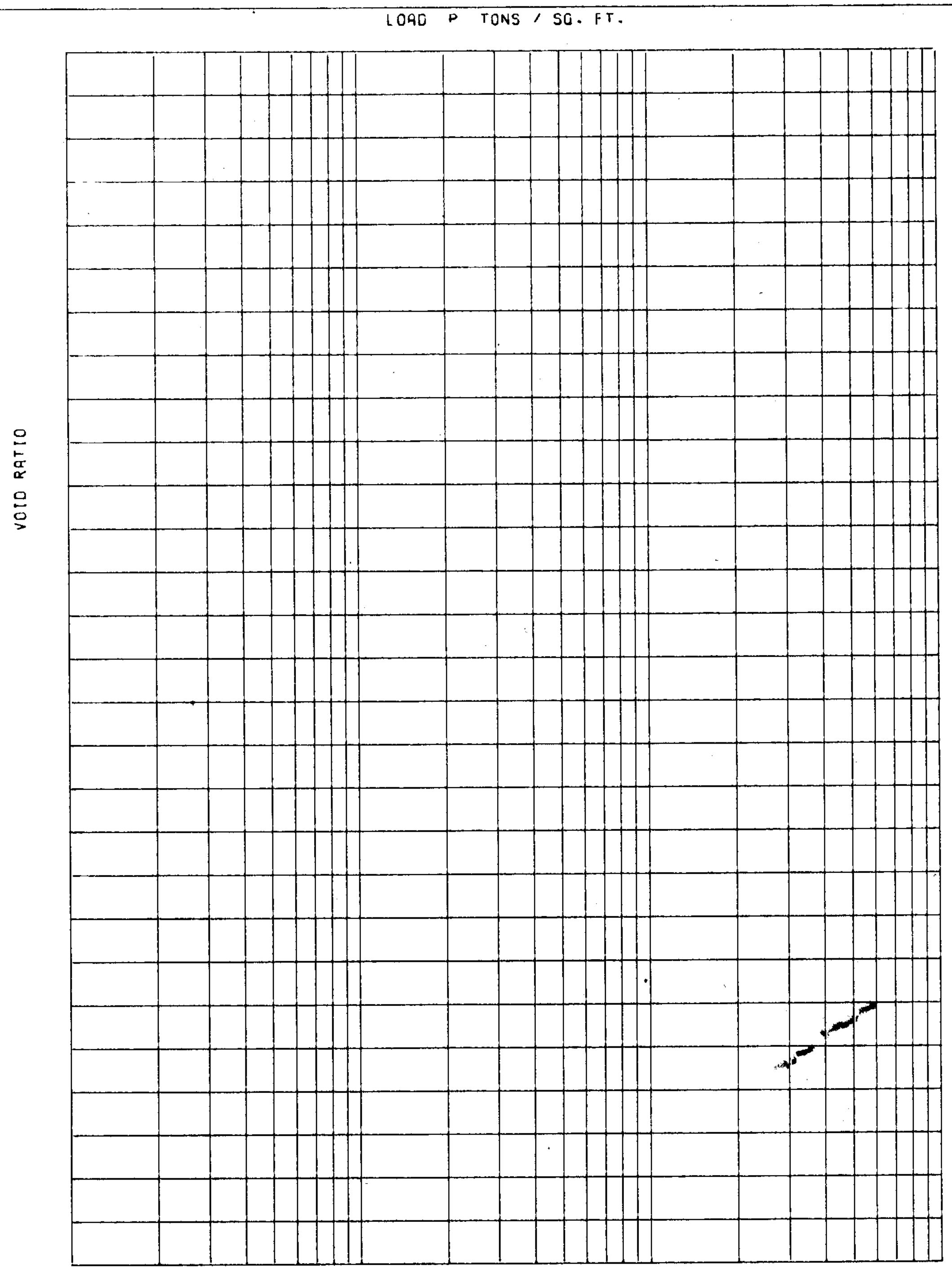


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1	-17.0'			0.055	
2	-20.5			0.08	
3	-24.9	Q	0	0.06	CH
4	-32.0			0.15	
5	-35.3			0.09	
6	-56.0			0.455	
7	-58.0			0.53	



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
△ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE 9

FOR LOCATION OF BORINGS SEE PLATE

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

TIGER PASS
UNDISTURBED BORING DATA
BORING BGT-15-U

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

JANUARY 1978 FILE NO. H-2-28275

PLATE 13

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LOUISIANA
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

APPENDIX A

HYDROLOGY AND SEDIMENTATION ANALYSIS

MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LOUISIANA
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

APPENDIX A
HYDROLOGY AND SEDIMENTATION ANALYSIS

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FIGURES

APPENDIX A
HYDROLOGY AND SEDIMENTATION ANALYSIS

1. General hydraulic data and rationale used for sedimentation analysis.

a. General. Total suspended loads entering both Baptiste Collette and Tiger Passes were based on average discharges of 19,000 c.f.s. and 23,000 c.f.s., respectively. Suspended concentration loads were used along with duration data to arrive at total suspended loads in cubic yards per year. Distributions of flow from previous observations were then used to route percentage of the total sediment load from the heads of these passes to the lower reaches. Velocities within the channel, bank elevations, cross sectional areas, and the number of existing outlets were investigated in order to assign annual sediment deposition rates for various reaches for each channel.

b. Rationale - Baptiste Collette Bayou. The inland reach (mile 1.6 to mile 6.0) of Baptiste Collette is generally self-maintaining. The relatively high banks act to confine the flows and maintain velocities in a range of 1.8 to 3.5 ft per second. The velocities near the overbanks of the channel tend to be lower and during high flows the banks themselves are inundated with significant amounts of sediments being deposited in the overbanks and the adjacent marshes. Based on previous estimates, bank elevations, cross sectional areas, and five existing outlets, 14 percent of the total sediment flowing down Baptiste Collette is estimated to be lost or deposited in the inland reaches of Main Pass (Baptiste Collette) from mile 1.6 to mile 6.0. The remaining sediments (86 percent) stay in suspension until the channel enters the shallow bay on Breton Sound where velocities approach zero or become insufficient to keep the sediments from settling to the bottom. Analysis of limited hydrographic data in the offshore reaches indicates that the bulk of the sediments reaching the offshore reaches falls within 2 miles from the shoreline. Sand bars form within this reach and restrict navigation. Barge groundings are common within this reach. Continuous maintenance dredging will have to be scheduled to keep the pass open. Increased conveyance of Main Pass of Baptiste Collette will increase the existing flow distribution from 25 percent of the total flow entering the head of Baptiste Collette from the Mississippi River, to 33.5 percent of the total. Flow from the Mississippi River will not change significantly. The increased conveyance of the project channel accounts for the 800,000 cu yds per yr of sediment estimated to flow down Main Pass (Baptiste Collette). The remaining sediments depositing in the offshore reaches were determined by considering longshore transport and tidal currents.

c. Rationale - Tiger Pass. In the inland reaches of Tiger Pass more sediments are lost from the main channel due to the greater number of outlets, approximately 15, and the lower bank elevations in the lower reaches of Tiger Pass. Velocities are slightly lower in Tiger Pass than Baptiste Collette and normally range between 1.6 to 2.5 ft per second. These factors combine to allow more sediments, 45 percent, to be lost or deposited in the inland reaches. The remaining sediments, 55 percent, stay in suspension until the channel enters the shallow offshore reaches where velocities approach zero or become insufficient to keep the sediments from settling to the bottom. Analysis of limited hydrographic data indicates that the bulk of the sediments reaching the offshore reaches is estimated to settle within a 2-mile offshore reach. To keep the offshore reaches open, maintenance dredging will be necessary on a continuous basis, at intervals as indicated in this appendix. Shallow offshore bars form within this reach and obstruct navigation. Increased conveyance of Tiger Pass will increase the existing flow distribution from 13 percent of the total flow entering Grand-Tiger Pass from the Mississippi River to 17 percent of the total. The total flow from the Mississippi River will not change significantly. The increased conveyance of the project channel accounts for the 492,000 cu yds per yr of sediment that is estimated to flow down Tiger Pass. The remaining sediments depositing in the offshore reaches were determined by considering longshore transport and tidal currents.

2. Flow distributions in the outlets.

a. General. The distribution of flow at the heads of Baptiste Collette and Grand-Tiger Pass will not change significantly as a result of this project. The entrance of both passes from the Mississippi River have cross sectional areas that far exceed the project dimensions of the proposed channels.

b. Baptiste Collette Bayou. The total flow entering Baptiste Collette will remain the same. At the junction with Emeline Pass at mile 1.6, 50 percent is routed into Emeline Pass and the remaining 50 percent is equally distributed under existing conditions at the lower junction of Main Pass and Kimbel Pass. Below the junction with Kimbel Pass, the conveyance of Main Pass (Baptiste Collette) will essentially be twice as much as the existing channel due to the new project dimensions. This increased conveyance will redistribute the flow so that 33.5 percent will flow through Main Pass (Baptiste Collette) and 16.5 percent will flow through Kimbel Pass.

c. Tiger Pass. Under existing conditions, Grand Pass carries 75 percent of the total flow at the entrance from the Mississippi River. Tiger Pass from its head down to the junction of the connecting canal of Red Pass and Pass Tante Phine, mile 2.7, carries 25 percent of the total flow. This distribution of flow remains the same down to mile 2.7.

From this junction to mile 12.2 of Tiger Pass, the conveyance will be essentially twice that of the existing cross sectional area. The distribution of flow between Tiger Pass and the canal under existing conditions is 13 percent for Tiger Pass and 12 percent for the canal at mile 2.7. The increased conveyance of Tiger Pass due to the project dimensions will redistribute this flow so that 17 percent flows down Tiger Pass and 8 percent will flow through the canal at mile 2.7.

d. Summary. In summary, the main effects of channelization or increased dimensions for both Baptiste Collette Bayou and Tiger Pass will be felt in the lower reaches. The upper reaches of both of these channels have sufficiently large cross sectional areas so that the hydraulic regime at the head of these outlets would not be altered significantly.

3. Suspended sediment.

a. Interpolations. Observations in Southwest Pass indicate a suspended sediment concentration of 317 p/m within a zone from the surface to a depth of 20 feet, for stages of 2 feet m.s.l. or above, and 50 p/m for stages below 2 feet m.s.l. at Venice, La. Average discharges at the headwaters of each project distributary were interpolated from stage-discharge curves and were 19,000 ft^3/s for Baptiste Collette Bayou and 23,000 ft^3/s for Grand-Tiger Passes.

b. Total annual volume. Using the above data, computations of total sediment loads diverted by each pass were based on the flow duration relations for the Mississippi River at Red River Landing. These flow duration relations indicate that a flow corresponding to a stage of 2.0 feet m.s.l. or above at Venice, La., occurs 146 days per year. This flow carries a total suspended load of 1,757,000 cu yd/yr into Baptiste Collette Bayou and 2,127,000 cu yd/yr into Grand-Tiger Passes annually. Flows corresponding to a Venice stage lower than 2.0 feet m.s.l., which will occur the remainder of the year, carry 416,000 cu yd/yr and 503,000 cu yd/yr into Baptiste Collette Bayou and Grand-Tiger Passes, respectively. The high and low discharge sediment loads were combined to determine the total annual volume of suspended sediments in each system. The bed load contribution is estimated to be 10 percent of the suspended load. The total sediment transport diverted into the distributaries is 2,173,000 + 217,000 = 2,390,000 cu yd/yr into Baptiste Collette Bayou and 2,630,000 + 263,000 = 2,893,000 cu yd/yr into Grand-Tiger Passes. See tables 1 and 2.

4. Sedimentation and littoral drift in the Baptiste Collette Bayou navigation channel.

a. Inland reach. Of the 2,390,000 cu yd/yr of sediment diverted into Baptiste Collette Bayou, 33.5 percent or 800,000 cu yd/yr will reach Main Pass due to the increased conveyance for the proposed channel. See table 2. In the pass from mile 1.6 to mile 6.0 estimated deposits are 112,000 cu yd/yr for the proposed channel. This gives a rate of deposition of 0.6 ft/yr. (See table 4.) For location of shoaling reaches see figure A-1.

b. Offshore reach. In the offshore reach, from mile 6.0 to mile 9.0, the estimated channel deposits are 688,000 cu yd/yr for the proposed channel. This gives a shoaling rate of 4.3 ft/yr. (See table 4.) In addition to the suspended channel sediments in the offshore reach, littoral drift contributes an estimated 548,000 cu yd/yr with a shoaling rate of 3.4 ft/yr. (See table 3.) If jetties are not built at Baptiste Collette Bayou, the annual dredging requirements will be 1,348,000 cu yd/yr with most of the sediment, 1,236,000 cu yd/yr, depositing in the offshore reach. The combined shoaling rate for suspended sediments, bed load, and littoral drift in the offshore reach will average 7.7 ft/yr. (See table 4.) To keep the channel open at navigation depths, dredging would be required at least twice every year.

c. Considered jetty reach. A jetty built at the mouth of the proposed channel would in effect carry suspended channel sediments out into deeper water and prevent littoral drift from being deposited in the jetty reach (approximately mile 6.0 to mile 7.7). The channel sediment within the jetty is estimated to be 80,000 cu yd/yr or the bed load portion (10 percent) of the total sediment load of 800,000 cu yds/yr. This gives a rate of shoaling of 0.7 ft/yr. In the 2-mile offshore reach beyond the jetty, channel sediments would be 304,000 cu yd/yr and the littoral drift would be 274,000 cu yd/yr; this gives shoaling rates of 0.8 and 0.7 ft/yr, respectively. The combined shoaling rate is 1.5 ft/yr and would require maintenance dredging at an interval of 2 years.

d. Summary. The construction of the jetties would reduce the total quantities of annual deposits to be dredged from 1,348,000 cu yd/yr to 770,000 cu yd/yr and would cause 304,000 cu yd/yr to be carried out into deep water. (See table 4.)

5. Sedimentation and littoral drift in Grand-Tiger Passes navigation channel.

a. Inland reach. Of the 2,893,000 cu yd/yr of sediment diverted into Grand-Tiger Passes, 25 percent or 723,000 cu yd/yr goes into Tiger Pass. Seventeen percent of this sediment load, or 492,000 cu yd/yr reaches the lower reaches of Tiger Pass due to increased conveyance of the proposed channel. (See table 2.) The sediment deposition from mile 0.0 to mile 1.0 will be 15,000 cu yd/yr, and the associated shoaling rate is 0.3 ft/yr. In the inland reach from mile 1.0 to mile 5.5, deposits will be 84,000 cu yd/yr for the proposed channel with a shoaling rate of 0.4 ft/yr. In the remaining inland reach from mile 5.5 to mile 12.2, deposits will be 123,000 cu yd/yr for the proposed channel with a shoaling rate of 0.4 ft/yr. (See table 5.) For location of shoaling reaches see figure A-2.

b. Offshore reach. In the offshore reach from mile 12.2 to mile 14.2, estimated channel deposits for the proposed channel will be 270,000 cu yd/yr. This gives a shoaling rate of 1.7 ft/yr. Littoral drift in the same offshore reach will contribute 215,000 cu yd/yr will give a shoaling rate of 1.3 ft/yr. (See tables 3 and 5.) If jetties are not built at Tiger Pass, the annual dredging requirement will be 707,000 cu yd/yr, with most of the sediment, 485,000 cu yd/yr, depositing in the offshore reach. The combined shoaling rate for suspended sediments, bed load, and littoral drift will average 3.0 ft/yr. In order to keep the channel open at navigation depths, dredging will be required on an annual basis.

c. Considered jetty reach. A jetty built from mile 12.2 to mile 13.5 would carry most of the channel sediments offshore of the jetty. The littoral drift would be trapped by the jetty and prevented from being deposited in the jetty reach. The channel sediment deposited within the jetty is estimated to be 49,000 cu yd/yr or the bed load portion (10 percent) of the total sediment load of 492,000 cu yd/yr with a shoaling rate of 0.4 ft/yr. In the offshore reach beyond the jetty, channel sediments would be 55,000 cu yd/yr with littoral drift contributing an additional 54,000 cu yd/yr. Respective shoaling rates are 0.2 and 0.2 ft/yr. The combined shoaling rate for suspended sediments and littoral drift offshore of the jetties would be 0.4 ft/yr and would require maintenance dredging at intervals of 8 years.

d. Summary. The construction of the jetties would reduce the total quantities of annual deposits to be dredged from 707,000 cu yd/yr to 380,000 cu yd/yr and would cause 166,000 cu yd/yr to be carried out into deep water. (See table 5.)

6. Previous emergency maintenance dredging. In April 1972 and April 1973, due to emergency operations on the Inner Harbor Navigation Canal, it became necessary to dredge an alternate navigation channel of dimensions 9 feet by 125 feet through the offshore reach of Baptiste Collette Bayou. The alinement followed a northerly direction through North Pass to avoid existing pipelines. The total dredging required in 1972 was 265,520 cu yd, and in 1973 was 395,916 cu yd for an average of 330,718 cu yd. After 1 week had elapsed, the channel was no longer at project depth and consequently navigation was very limited. During the 1973 emergency dredging, strong winds of approximately 40-45 mi/h were experienced from the north, northeast, and southeast. These winds are attributed with being the primary cause for the rapid shoals which occurred.

7. <u>Navigation problems</u>. The inland reaches of both Baptiste Collette Bayou and Tiger Pass are generally navigable to depths of at least 10 feet below mean low gulf (m.l.g.), and some reaches exceed the project depths. However, there are some isolated reaches, such as in the vicinity of Mercantile Bayou on Tiger Pass, which have a controlling depth of only 6 feet m.l.g. The major sedimentation and navigation problems are in the offshore reaches. The velocities within the land cut are generally sufficient to keep most of the suspended sediment load from settling. As the flow enters the Gulf of Mexico the velocities approach zero and the sediments will fall out and combine with the littoral drift moving alongshore to cause restrictive navigational depths. Immediately offshore of both Baptiste Collette Bayou and Tiger Pass, scour holes form relatively deep navigation depths. This condition is caused by the momentum of the flow as it enters the Gulf of Mexico and Breton Sound. Jetties would trap littoral drift which would otherwise move into the channel and would channel the flow and suspended sediments into deeper water. Due to the extensive shoal areas that exist in the offshore reaches, barge tows will have difficulty following the alinement of the channel during inclement weather. An offshore jetty system will prevent waves from reaching the navigation channel. The exposed jetty system will allow navigation interests to find the channel alinement during rough weather.

TABLE A-1

TOTAL SUSPENDED LOADS

Q-Average Discharge cfs	Concentrated or Suspended Load p/m or mg/l	Conversion Factor (Short Tons) 0.0027	(1) Sediment Load Qs (Tons/day)	(2) Conversion Factor from Tons/day to cu yds/day	Days for Specific Concentrated Load	Sediment Load Qs cu yds/yr
BAPTISTE COLLETTE (ENTRANCE FROM MISSISSIPPI RIVER)						
19,000	317	0.0027	16,262	0.74	146	1,757,000
19,000	50	0.0027	2,565	0.74	219	416,000
						2,173,000
GRAND-TIGER PASSES (ENTRANCE FROM MISSISSIPPI RIVER)						
23,000	317	0.0027	19,686	0.74	146	2,127,000
23,000	50	0.0027	3,105	0.74	219	503,000
						2,630,000

(1) Qs=QwxCsxk; Qs = Sediment discharge (tons/day) Qw = water discharge (cfs).
Cs = Concentration of suspended sediment (mg/l) k = conversion factor.
Qs (Tons/day) = Q_w(cfs) x concentrated load (p/m) x 0.0027

(2) $Qs\ (\text{cu yds/day}) = \dfrac{Qs\ (\text{Tons/day})}{(\gamma = 100\ \text{lbs/cu ft})\ (27\ \text{cu ft/cu yd})} = 0.74$

TABLE A-2

DISTRIBUTION OF SEDIMENT LOAD

Location	Total Suspended Load (cu yds/yr)	Bed Load 10% of Suspended Load (cu yds/yr)	Total Load = Suspended Load + Bed Load at Head of Outlets (cu yds/yr)	Distribution of Total Load Due to Channel Sediment and Flow Distribution (cu yds/yr)			
Baptiste Collette	2,173,000	217,300	2,390,000	Emeline Pass 50%	Kimbel Pass 25%	Main Pass 25%	
Existing Channel				1,195,000	598,000	598,000	
				50%	16.5%	33.5%	
Project Channel(1)				1,195,000	394,000	800,000	
Grand-Tiger Passes	2,630,000	263,000	2,893,000	Grand Pass 75%	Tiger Pass above Mile 2.7 25%	Tiger Pass below Mile 2.7 13%	Pass Tante Ph 12%
Project Channel				2,170,000	723,000	376,000	347,000
				75%	25%	17%	8%
Project Channel(2)				2,170,000	723,000	492,000	231,000

(1) Additional conveyance of project channel increases flow in channel from 25% to 33.5% of total load.

(2) Additional conveyance of project channel increases flow in channel from 13% to 17% of total load.

TABLE A-3

LITTORAL DRIFT

Wave Direction	Wave Height H (ft)	Period T (sec)	Wave Length L (ft)	Water Depth d (ft)	Number of Waves/Day N	Energy Coefficient (1) M	Energy (2) Per Wave ET (ft-lb/ft)	Energy of (3) Forward Motion EF	Refraction Coefficient KR	Angle Between Wave & Beach α	Along Shore (4) Energy Ea	Longshore (5) Transport cu yds/day	Longshore Transport cu yds/yrs	Total (6) Littoral Drift cu yds/yr
							BAPTISTE COLLETE							
NE	2	5	128	300	1,973	4.9	4,121	2,060	1	45°	2,032,190	265	96,725	
E	2	5	128	300	1,087	4.9	4,121	2,060	1	45°	1,119,610	140	51,100	
SE	2	5	128	300	1,973	4.9	4,121	2,060	1	45°	2,032,190	265	96,725	
NW	2	5	128	300	590	4.9	4,121	2,060	1	45°	607,700	80	29,200	
Total													273,750	548,000
							TIGER PASS							
S	2	5	128	300	986	4.9	4,121	2,060	1	45°	1,015,580	135	49,275	
SW	2	5	128	300	590	4.9	4,121	2,060	1	45°	607,700	80	29,200	
W	2	5	128	300	396	4.9	4,121	2,060	1	45°	407,880	50	N/A	
NW	2	5	128	300	590	4.9	4,121	2,060	1	45°	607,700	80	29,200	
Total													107,675	215,000

(1) $M = \Pi^2/2 \tanh^2(2\Pi d/L)$

(2) $ET = \frac{WH^2L}{8}\left(1 - M\frac{H^2}{L^2}\right)$

(3) EF = 1/2 ET for deep water

(4) $Ea = \left(\frac{ET}{2}\right) N \sin\alpha \cos\alpha K_r^2$

(5) From TR-4, Figure 2-22

(6) Totals adjusted to account for storms and waves greater than 2 ft and additional transport by tidal currents across an extensive shoal area

Note: Wave statistics are based on Beach Erosion Board, Technical Report No. 87 "Wave Statistics for the Gulf of Mexico off Burrwood, Louisiana"

TABLE A-4
SEDIMENTATION RATES FOR BAPTISTE COLLETTE

Reach	Existing Channel: Sediment Quantity (yd³/yr)	Existing Channel: Rate of Deposits ft/yr	Proposed Channel: Sediment Quantity yd³/yr	Proposed Channel: Rate of Deposits (ft/yr)	Reach	Proposed Channel with Jetty: Sediment Quantity (yd³/yr)	Proposed Channel with Jetty: Rate of Deposits (ft/yr)
Baptiste Collette							
Total channel sediment load	598,000		800,000			800,000	
Inland reach mile 1.6 to mile 6.0	84,000[3]	0.4[1]	112,000[3]	0.6[1]	Inland reach mile 1.6 to mile 6.0	112,000[3]	0.6[1]
Offshore reach mile 6.0 to mile 8.0					Offshore jetty reach mile 6.0 to mile 7.7		
Channel sediment	514,000[4]	3.2	688,000[4]	4.3	Channel sediment	80,000[2]	0.7
Total littoral drift[8] (includes all material moved by waves and currents)	548,000	3.4	548,000	3.4	Total littoral drift[8]	0	N/A
		6.6	1,236,000	7.7	Offshore reach mile 7.7 to mile 9.7		
					Channel sediment	304,000[5]	0.8
					Littoral drift	274,000[6]	0.7
							1.5
Sediments lost to deep water	Negligible		Negligible		800,000-112,000-80,000-304,000 =	304,000	N/A
Dredging due to channel deposits	598,000		800,000		112,000+80,000+304,000 =	496,000	
Dredging due to littoral drift	548,000		548,000			274,000[7]	
Total dredging required	1,146,000		1,348,000		112,000+80,000+304,000+274,000 =	770,000	
Total deposits	1,146,000		1,348,000			1,348,000	

[1]Rate of deposits is based on length of reach and channel dimensions and total sediments depositing within the respective reaches. Significant deposition in the offshore reaches is based on a width of 1,000 ft.

[2]Channel sediment within jetty reach is estimated at 10% of the total suspended load. Velocities within the jetty reach are estimated to be between 0.7 ft/sec to 1.0 ft/sec. Salt water flocculation will cause sediments moving along the bed to deposit within the jetty reach.

[3]14% of total channel sediment load.

[4]86% of total channel sediment load.

[5]800,000-112,000-80,000 = 608,000 - 50% lost to deep water = 304,000.

[6]548,000 - 50% trapped by jetties.

[7]50% of littoral drift trapped by jetties or 50% X 548,000 = 274,000.

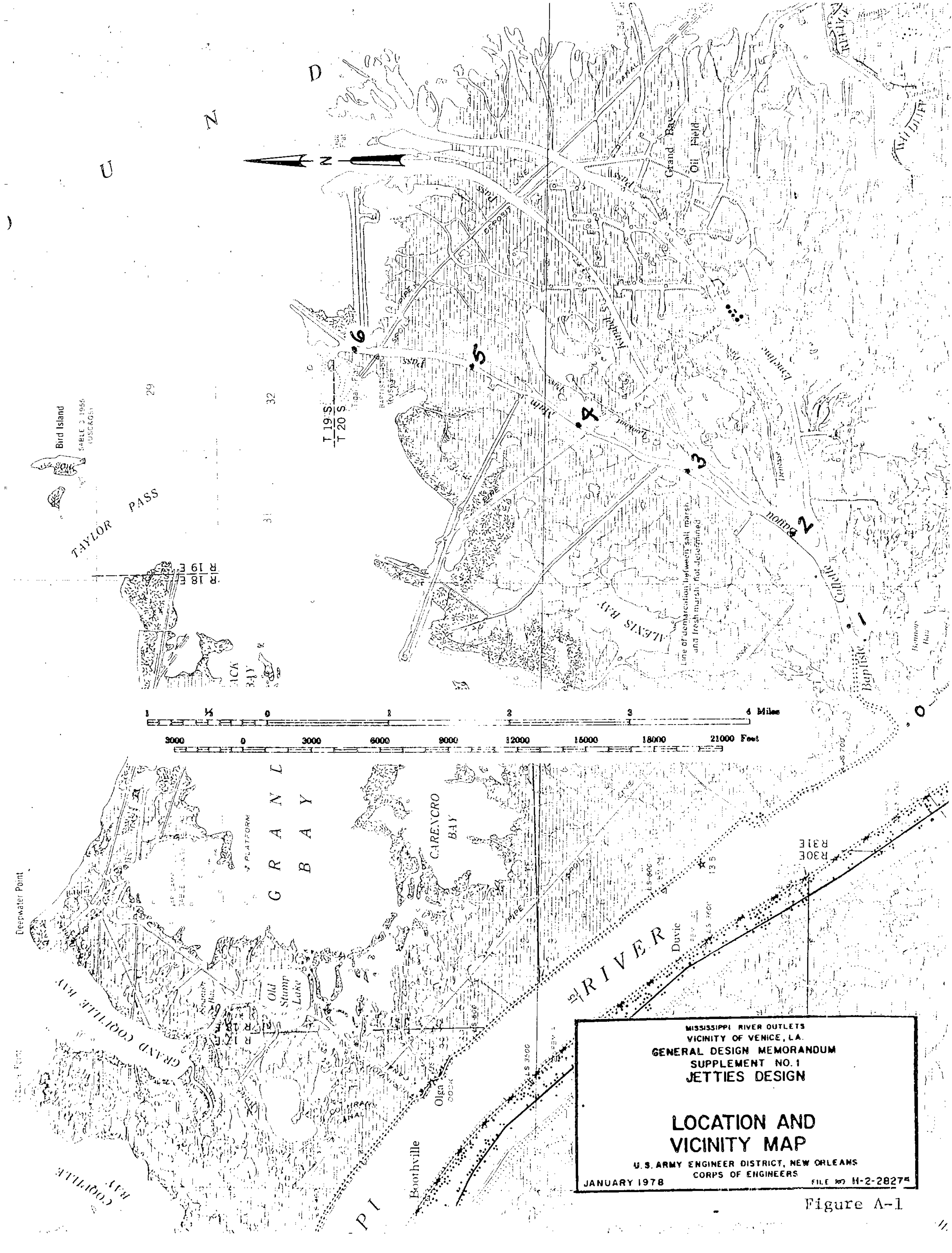
[8]Includes all or total sedimentary material moved in the littoral zone by both waves and currents.

[9]See figure 1 for location of respective reaches.

TABLE A-5
SEDIMENTATION RATES FOR TIGER PASS

Reach Tiger Pass	Existing Channel Sediment Quantity (yd³/yr)	Existing Channel Rate of Deposits ft/yr	Proposed Channel Sediment Quantity yd³/yr	Proposed Channel Rate of Deposits (ft/yr)	Reach	Proposed Channel with Jetty Sediment Quantity (yd³/yr)	Proposed Channel with Jetty Rate of Deposits (ft/yr)
Total channel sediment load	376,000		492,000			492,000	
Inland reach mile 0.0 to mile 1.0	11,000[3]	0.2[1]	15,000[3]	0.3[1]	Inland reach mile 0.0 to mile 1.0	15,000[3]	0.3[1]
Inland reach mile 1.0 to mile 5.5	64,000[4]	0.3	84,000[4]	0.4	Inland reach mile 1.0 to mile 5.5	84,000[4]	0.4
Inland reach mile 5.5 to mile 12.2	94,000[5]	0.3	123,000[5]	0.4	Inland reach mile 5.5 to mile 12.2	123,000[5]	0.4
Offshore reach mile 12.2 to mile 14.2					Offshore jetty reach mile 12.2 to mile 13.5		
Channel sediment	207,000	1.3	270,000	1.7	Channel sediment	49,000[2]	0.4
Total littoral drift[9]	215,000	1.3	215,000	1.3	Total littoral drift[9]	0	N/A
		2.6	485,000	3.0			
					Offshore reach mile 13.5 to 15.5		
					Channel sediment	55,000[6]	0.2
					Littoral drift	54,000[7]	0.2
							0.4
Sediments lost to deep water	Negligible		Negligible		492,000-15,000-84,000-123,000-49,000-55,000=	166,000	N/A
Dredging due to channel deposits	376,000		492,000		15,000+84,000+123,000+49,000+55,000 =	326,000	
Dredging due to littoral drift	215,000		215,000			54,000[8]	
Total dredging required	591,000		707,000		15,000+84,000+123,000+49,000+55,000+54,000=	380,000	
Total deposits	591,000		707,000			707,000	

1 Rate of deposits is based on length of reach and channel dimensions and total sediments depositing within the respective reaches. Width of significant deposition in the offshore reaches is based on a width of 1,000 feet.
2 Channel sediment within jetty reach is estimated at 10% of the total suspended load. Velocities within the jetty reach are estimated to be between 0.7 ft/sec to 1.0 ft/sec. Salt water flocculation will cause sediments moving along the bed to deposit within the jetty reach.
3 3% of total channel sediment.
4 17% of total channel sediment.
5 25% of total channel sediment.
6 492,000-15,000-84,000-123,000-49,000 = 221,000 - 75% lost to deep water = 55,000.
7 215,000 - 75% trapped by jetties = 54,000.
8 75% of littoral drift trapped by jetties. 75% X 215,000 = 161,000 25% X 215,000 = 54,000
9 Includes all or total sedimentary material moved in the littoral zone by both waves and currents.
10 See figure 2 for location of respective reaches.



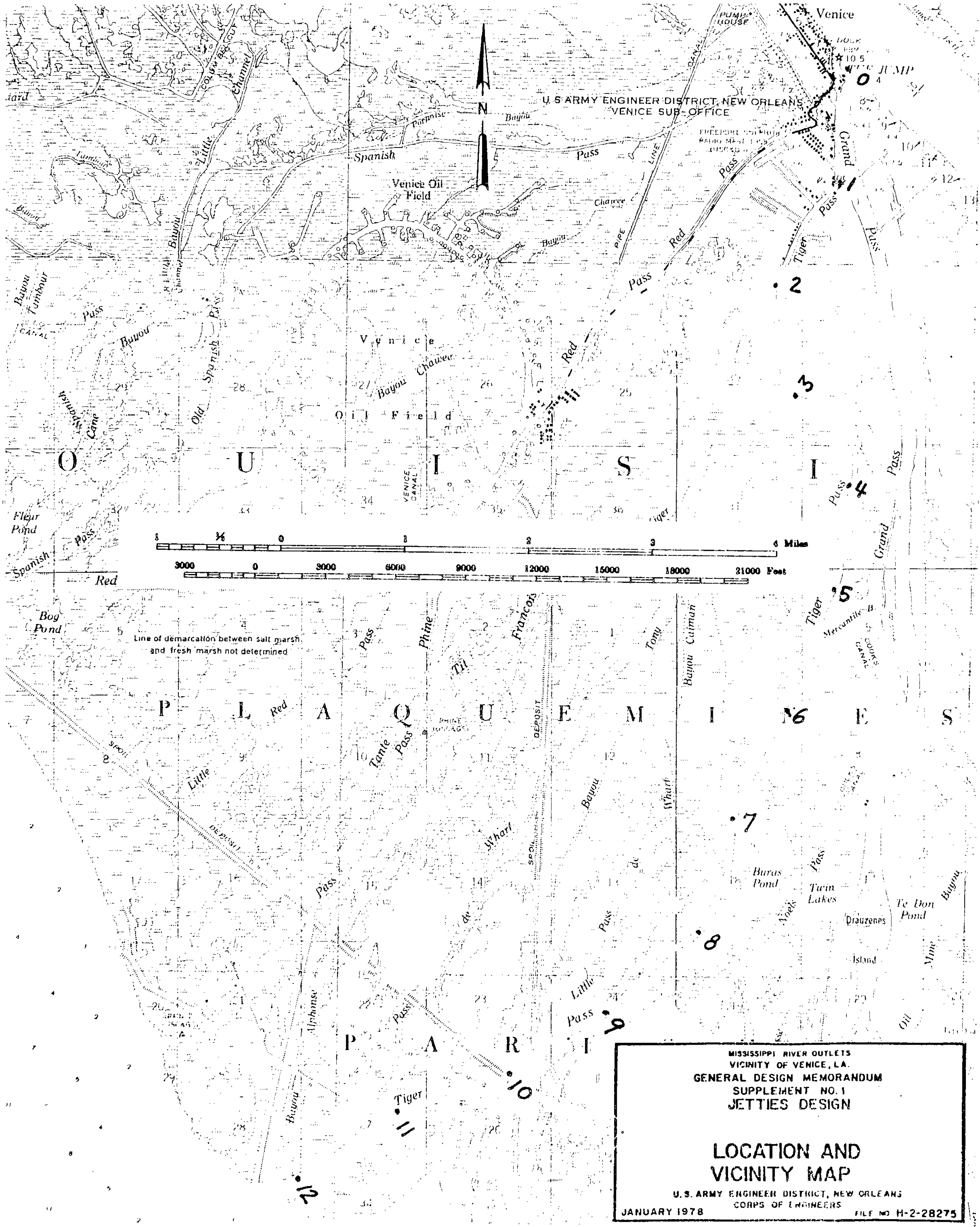
MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
GENERAL DESIGN MEMORANDUM
SUPPLEMENT NO. 1
JETTIES DESIGN

LOCATION AND VICINITY MAP

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

JANUARY 1978 FILE NO. H-2-28275

Figure A-1



MISSISSIPPI RIVER OUTLETS
VICINITY OF VENICE, LA.
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LOCATION AND
VICINITY MAP
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JANUARY 1978
FILE NO. H-2-28275
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
VENICE SUB-OFFICE
Venice
Venice Oil Field
Spanish Pass
Red Pass
Tiger Pass
Grand Pass
Line of demarcation between salt marsh and fresh marsh not determined
Bog Pond
Fleur Pond
Buras Pond
Twin Lakes
Te Don Pond
N
4 Miles
21000 Feet

Figure A-2