NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SUPPLEMENT NO. 4

# REACH B2
# FORT JACKSON TO VENICE

DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

NEW ORLEANS, LOUISIANA

AU[illegible]972

LMVED-TD (NOD 23 Aug 72) 1st Ind
SUBJECT: New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General Design, Supplement No. 4, Reach B2 - Fort Jackson to Venice

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 31 Oct 72

TO: HQDA (DAEN-CWE-B) WASH DC 20314

1. The subject design memorandum is forwarded for review pursuant to para 21a, ER 1110-2-1150. Approval is recommended subject to the following comments.

2. Para 27a(1), Page 13. In the third sentence, the design factor of safety for retaining dike sections should be changed from 1.3 to 1.2 to conform with the analyses on Plates 53, 54, and 55.

3. Para 33a, Page 19. a. 4th Sentence. This sentence states that "Material excavated from the sand core trench will be spoiled in spoil and ponding area No. 1, and in the temporary area diked off in spoil and ponding area No. 3." The reasons for not using ponding area No. 2 and all of ponding area No. 3 should be given since additional cost will be incurred in pumping this spoil.

b. 12th Sentence. This sentence states that the net levee section will be overbuilt to allow for additional settlement. The amount of overbuild should be stated and the final levee sections analyzed for stability should reflect this overbuild.

4. Para 37e, Page 23. After the third sentence, insert: "It is assumed, however, that the wall transfers any unbalanced load from the soil into the base of the wall."

5. Para 41a, Page 24 and Plate 5. B/L stationing for the 6-inch oil line, and 12-inch United Gas Pipeline Co. line does not agree. These discrepancies should be resolved.

6. Para 47, Pages 27 and 28. The environmental analysis should include the acreages in ponding areas, borrow areas (river or marsh), and permanent levees and dikes.

7. Para 48, Page 28. The latest scheduled date for submission of the final EIS to CEQ is February 1973.

8. Table 2, Pages 29-32. a. Listed under Cost Account No. 11 is an item of non-hydraulic excavation as "Other," 700,000 cubic yards, which is shown as a first lift cost. It would appear that the estimate covers all such excavation such as ponding dikes, retaining dikes, transverse dikes and the sand core trench; therefore, this item should be explained.

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b. A minor error in the estimate of first cost, page 31, is corrected in red. Table 3 will require correction as will Table 4 and paragraph 53 where applicable.

c. The amount included in Lands and Damages to cover the costs of relocation assistance required by PL 91-646 should be indicated.

9. Para 54, Pages 36, 37, and 38. The schedule indicates that the second lift will be placed on the reach from 0+00 to 48+00 before the first shaping is accomplished. This sequence should be checked.

10. Plates 2-6. All necessary ponding area dikes should be shown.

11. Plates 9 & 10. The sections should be clarified. Profiles on Plates 2-8 show ground line varying from -5 to -10 MSL, whereas sections on Plates 9 and 10 indicate the ground line varies from 0 to -2 MSL.

12. Plate 9. A clay cutoff can be made as shown provided the depth below the ground water table is not too great. If this depth is significant, the 1 on 4 slopes may not be stable. In areas where the depth is considerable, alternate means for providing a cutoff as discussed in comment 14 below should be considered. ✓

13. Plate 10. This plate shows four reaches where a second lift of hydraulic clay fill is to be provided, presumably because sufficient material will not be available for the first shaping. Conditions requiring a second lift in these particular reaches should be discussed.

14. Plate 14, Note 4. The locations where the cast-clay cutoff will be used should be given. The note indicates that there are areas other than that at Sta 0+00 where this cutoff is to be used. Also, the construction procedure including dewatering, bracing, excavation, and backfill should be discussed in the text. Two alternatives to this cast clay cutoff that appear viable and, therefore, should be considered are: ✓

a. Facing the floodside of the levee section with a clay blanket.

b. Casting a clay dike cutoff after excavating for the sand core but before pumping the sand.

15. Plate 16. The proposed pipeline crossing for Sta 53+00 should be shown also.

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16. Plate 18. a. In light of the existing scour hole at the end of the Venice Pump Station discharge lines, the proposed riprap protection shown may not be heavy enough and should be reconsidered.

b. A joint should be placed at the bends in the T-wall at Sta 2+75.5+W/L and Sta 5+23.5+W/L. Otherwise, according to EM 1110-2-2501, dated Jan 1948, a separate stability analysis and structural design should be submitted for these corner monoliths.

17. Plate 19. During the preparation of the plans and specifications, consideration should be given to modifying the joint between the discharge pipe and the T-wall by adding an annular plate to stiffen the pipe in the area of the wall.

18. Plates 20 & 9. The borings and geologic profile on Plate 20 indicate that the sand core trench from Sta 0+00 to 45+00 should be excavated to approximately el -18 in order to remove most of the very soft marsh deposit. If this is the case, Plate 9 should be revised accordingly.

19. Plates 53 to 55 and 57 and 58. The cutoff trenches shown on these plates have an inside slope of 1 on 10, whereas Plate 9 shows all 1 on 4 slopes for the cutoffs. This discrepancy should be clarified.

20. Plates 59-64. The distance from the levee centerline or the centerline of the sand core to the edge of the dike borrow varies considerably from the distances specified in Table 1 on Plate 9, e.g., Plate 59 shows 376 ft from the sand core centerline to the edge of the borrow area, while Plate 9 shows 346 ft. These discrepancies should be resolved.

21. Plate 65. a. This plate shows the distance from the centerline of the retaining dike to the centerline of the sand core to be 153 ft. The design section on Plate 9 shows 262 ft. This discrepancy should be resolved.

b. Stability analyses for retaining dikes for the stations other than those shown on this plate should be presented.

22. Plate 66. a. The cross retaining dike analyzed on this plate is referred to as a transverse dike on Plate 14. The terminology should be made consistent.

b. The berm width is shown as 20 ft on Plate 66 and as 25 ft on Plate 14. This discrepancy should be resolved.

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23. Plate 67. a. The neutral block resistance $R_B$ for assumed failure surface B-1 appears wrong. (See computations in red). These computations should be verified.

b. The need for the cross retaining dikes at Sta 245+00 should be given.

24. Plate 69. The slope stability factor of safety for the existing levee is shown as 1.09. A comparison of the centerline strength profile for this reach with Reach B-1 shows that higher design strengths are being used in Reach B-2 below el -10.0. Since these centerline strength profiles were developed from tests on single borings, a more representative strength profile should be developed by using all the data from both borings. This will lower somewhat the centerline design strengths below el -10.0 and hence the already low slope stability factor of safety. Therefore, means for improving the stability of the existing back levee should be investigated.

25. Plate 72. a. The overall stability analysis for the I-type floodwall section should be shown.

b. In the General Notes, the value $N_h$ is defined. The value used in computing the theoretical subgrade modulus should be given.

c. The reasons for obtaining different subgrade moduli for tension and compression piles should be explained.

d. The strength (Q&S) profile used to compute the pile design loads versus tip elevations should be presented.

26. Refer to comments marked in red on page 31, Plates 16, 18, 19, 36, 51, 59, 69, 67, 71, and 72.

FOR THE DIVISION ENGINEER:

1 Incl (14 cy)
wd 2 cy ea

HOMER B. WILLIS
Chief, Engineering Division

CF: New Orleans District

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SUPPLEMENT NO. 4
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## STATUS OF DESIGN MEMORANDUMS

| Design Memo No. | Title | Status |
|---|---|---|
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design Reach B1 - Tropical Bend to Fort Jackson | Approved 8 Aug 67 Revision approved 16 Feb 72 |
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Reach B1 - Tropical Bend to Fort Jackson, Supplement No. 1, Alteration of Method of Constructing Stream Closures | Approved 2 Dec 68 |
| 2 | New Orleans to Venice, La., Design Memorandum No. 2, Detail Design, Reach B1 - Tropical Bend to Fort Jackson, Empire Floodgate | Approved 9 Mar 71 |
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 3, Reach C - Phoenix to Bohemia | Submitted 11 May 72 |
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 2 - East Bank Barrier Levee Plan | Scheduled Nov 72 |
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 4, Reach B2 - Fort Jackson to Venice | Submitted 23 Aug 72 |
| 1 | New Orleans to Venice, La., Design Memorandum No. 1 - General Design, Supplement No. 5, Reach A - City Price to Tropical Bend | Scheduled Mar 73 |

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## PERTINENT DATA

| | | |
|---|---|---|
| Location of project | | Mississippi River Delta, Coastal Louisiana, Plaquemines Parish |
| **Hydrologic data** | | |
| Temperature: | Monthly means | |
| | Maximum | 83° Fahrenheit |
| | Minimum | 57° Fahrenheit |
| | Average annual | 70° Fahrenheit |
| Annual precipitation: | Maximum | 85.73 inches |
| | Minimum | 31.04 inches |
| | Average annual | 60.8 inches |
| **Hydraulic design criteria--tidal** | | |
| Design hurricane | | |
| Frequency | | 1 in 100 years |
| Central pressure index (CPI) | | 28.00 inches of mercury |
| Maximum 5-minute average wind | | 96 m.p.h. |
| **Levees** (clay fill with sand core) | | |
| Method of construction | | Hydraulic lifts and shapeups |
| Levee length (approximate) | | 9.0 miles |
| Elevation | | 15.0[1] |
| Crown width | | 8 feet |
| **Floodwalls** (at Venice pumping station) | | |
| Elevation | | 19.0 |
| **Estimated first cost** | | |
| Levees and floodwalls | | $18,492,000 |
| Engineering and design | | 2,219,000 |
| Supervision and administration | | 1,314,000 |
| Relocations | | 432,000 |
| Lands and damages | | 243,000 |
| Total | | $22,700,000 |

[1]Elevations herein are in feet referred to mean sea level datum unless otherwise noted.

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PROJECT AUTHORIZATION

1. Authority.

a. Public Law. Public Law 874-87th Congress, 2d Session, approved 23 October 1962, authorized the project "Mississippi River Delta at and below New Orleans, Louisiana (renamed 'New Orleans to Venice, Louisiana,' after authorization)," substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 550, 87th Congress, 2d Session.

b. House Document. The report of the Chief of Engineers, dated 30 July 1962, submitted for transmittal to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers. The Chief of Engineers in his report concurred in the recommendations of the Board of Engineers for Rivers and Harbors. The recommendations of the Board are as follows:

> ...Accordingly, the Board recommended improvements along the Mississippi River below New Orleans, Louisiana, for prevention of hurricane tidal damages by increasing the heights of the existing back levees and modifying the existing drainage facilities where necessary in four separate reaches consisting of:
>
> Reach A on the west bank for about 15 miles between City Price and Empire;
>
> Reach B on the west bank for about 21 miles between Empire and Venice and with such modifications of the main levee as may be required;
>
> Reach C on the east bank for about 16 miles between Phoenix and Bohemia; and
>
> Reach E on the east bank for about 8 miles between Violet and Verret;
>
> generally in accordance with the plans of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable,....

c. Division of Reach B. The Plaquemines Parish Commission Council, representing local interests, requested the division of Reach B into two units--one between Empire and Fort Jackson and the other between Fort Jackson and Venice. Detailed information and background material regarding this division are presented in "New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson," approved 8 August 1967, and in the revised design memorandum approved 16 February 1972.

2. Purpose and scope. This supplement presents the essential data, assumptions, criteria, and computations which were used to develop the plan, design, and cost for the New Orleans to Venice Reach B2 protective works in sufficient detail to provide an adequate basis for preparing plans and specifications for construction of this project feature without the need for additional design memorandums.

3. Local cooperation. The conditions of local cooperation pertinent to this supplement and as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in, in the report of the Chief of Engineers, are as follows:

"...that prior to construction local interests give assurances satisfactory to the Secretary of the Army that they will, without cost to the United States:

"a. Provide all lands, easements, and rights-of-way, including borrow areas and spoil-disposal areas necessary for the construction of the project;

"b. Accomplish all necessary alterations and relocations to roads, pipelines, cables, wharves, and other facilities required by the construction of the project;

"c. Bear 30 percent of the first cost [for the entire New Orleans to Venice hurricane protection project], a sum presently estimated at $3,216,000 to consist of items listed in subparagraphs a and b above and a cash contribution presently estimated at $1,844,000, to be paid either in a lump sum prior to initiation of construction or in installments prior to start of pertinent work items, in accordance with construction schedules as required by the Chief of Engineers, or, as a substitute for any part of the cash contribution, accomplish in accordance with approved construction schedules items of work of equivalent value as determined by the Chief of Engineers, the final apportionment of costs to be made after actual costs and values have been determined;

"d. Hold and save the United States free from damages due to the construction works;

"e. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army;

"f. Prevent any encroachment on ponding areas unless substitute storage capacity or equivalent pumping is provided promptly; and

"g. At least annually, notify those affected that the project will not provide complete protection from tidal flooding and that further local actions must be taken during hurricane emergencies."

## INVESTIGATIONS

4. Investigations made in connection with the project document. Studies and investigations made in connection with the project document (H.D. No. 550, 87th Congress, 2d Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in history and records of hurricane damages and characteristics of hurricanes; extensive tidal hydraulics investigations; an economic survey; field topographic and hydrographic surveys of reconnaissance scope; and design and cost studies. A public hearing was held in New Orleans, Louisiana, on 13 March 1956 to determine the views of local interests. Appropriate Federal and state agencies were consulted. The District Engineer made a personal reconnaissance of the area.

5. Investigations made subsequent to project authorization. Studies and investigations made subsequent to project authorization include:

a. Aerial and topographic surveys of the project area;

b. Soils investigations including general type and undisturbed borings and associated laboratory evaluations;

c. Tidal hydraulic studies required for establishing design grades for protective works based on revised hurricane parameters furnished by the National Weather Service (formerly U. S. Weather Bureau) subsequent to project authorization;

d. Detailed design studies for construction of levee and floodwalls;

e. Determination of real estate requirements and costs;

f. Cost estimates for levee, floodwall, pumping station modifications, and relocations;

g. Economic evaluation of recommended protective works; and

h. Environmental studies required by the National Environmental Policy Act of 1969.

6. Planned future investigations. Additional soil borings and tests will be made prior to each levee lift subsequent to the first. Design analyses, utilizing information obtained from the additional borings, will be made and preparation of plans and specifications for each lift will be based on these analyses. Also, a bearing pile test will be conducted to determine pile lengths for construction of T-wall at the Venice pumping station.

LOCAL COOPERATION

7. Status of local cooperation.

a. Assurances in connection with the items of local cooperation specified in the project document were requested from the Plaquemines Parish Commission Council on 7 January 1963. The act of assurances and supporting resolution adopted by the Commission Council on 6 March 1964 covering Reaches A, B, and C were accepted for and on behalf of the United States on 14 April 1965.

b. The Attorney General of the State of Louisiana in his opinion of 7 April 1971 stated that local assuring agencies for projects were not vested with adequate legal authority to comply with the provisions of Sections 210 and 305 of Public Law 91-646 (the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970"). However, in view of the 1 February 1972 passage of a constitutional amendment, local agencies are now in a position to provide the additional assurances required by the act. Accordingly, the assurances of local cooperation for the New Orleans to Venice hurricane protection project have been revised; however, formal acceptance by local interests is pending.

c. Since construction of the New Orleans to Venice hurricane protection project commenced prior to 1 January 1972, Section 221 of the Flood Control Act of 1970 (Public Law 91-611) is not applicable.

d. The principal officers of the Plaquemines Parish Commission Council (the local assuring agency) are as follows:

Plaquemines Parish Commission Council
Pointe a la Hache, Louisiana 70082
Mr. Chalin O. Perez, President
Mr. Clarence T. Kimble, Vice-President and Commissioner of Finance
Mrs. Edna Lafrance, Secretary-Treasurer

8. Views of local interests. The Plaquemines Parish Commission Council represents local interests and is in general agreement with the plan presented herein.

9. Required non-Federal cost. The total required non-Federal cost for constructing the Reach B2 project feature in accordance with the plan presented herein is estimated to be $6,810,000 which includes $243,000 for lands and damages, $432,000 for relocations, and a cash contribution and/or equivalent work valued at $6,135,000.

LOCATION OF PROJECT AND TRIBUTARY AREA

10. Location of project. The Reach B2 project area is located in the Mississippi River delta region of coastal Louisiana and on the right descending bank of the Mississippi River from the vicinity of Fort Jackson to Venice, Louisiana. The project area is presently provided a marginal degree of protection from gulf tides by an existing non-Federal back levee. The area remains vulnerable, however, to the ravages of major tropical storms and hurricanes. A general plan, index map, and vicinity map are shown on plate 1.

11. Tributary area. The project area comprises approximately 2,300 acres of land which are essentially bounded by the existing non-Federal back levee and the Mississippi River west levee. Interior drainage is provided by an existing system of canals and pumping facilities.

PROJECT PLAN

12. Project plan. The project plan, shown on plates 2 through 8, provides for construction of a hurricane protective levee with appurtenant features from the vicinity of Fort Jackson to Venice, Louisiana. The levee will be approximately 9 miles in length and will have a net elevation of 15.0.[1] Floodwalls will be

[1]Elevations herein are in feet referred to mean sea level datum unless otherwise noted.

constructed at the Venice pumping station to elevation 19.0. The pumping station discharge pipes will be modified to accommodate the floodwall. Modifications will be made to seven pipelines, and one facility in the project area will be relocated. The Venice pumping station will continue to provide drainage for the project area.

DEPARTURES FROM PROJECT DOCUMENT PLAN

13. Departures from project document plan. The project document plan (H.D. 550, 87th Congress, 2d Session) recommends enlargement of the existing back levee system and modifying the existing drainage facilities where necessary in four reaches. Revisions of the project document plan pertinent to Reach B2 are as follows:

a. Division of Reach B. The Plaquemines Parish Commission Council, representing local interests, requested the division of Reach B into two units--one between Empire and Fort Jackson and the other between Fort Jackson and Venice. Detailed information and background material regarding this division is presented in "New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson," approved 8 August 1967, and in the revised design memorandum approved 16 February 1972.

b. Revision of levee grade. The net levee grade for Reach B2 was revised upward in accordance with the results of tidal hydraulic studies utilizing the latest hurricane parameters developed by the National Weather Service subsequent to project authorization.

HYDROLOGY AND HYDRAULICS

14. Hydrology and hydraulics.

a. General. Detailed results of the hydrology and hydraulic analyses for Reach B2 are presented in appendix A in three sections. Section I presents the climatology and hydrology of the area. Section II presents detailed descriptions and analyses of tidal hydraulic procedures used in the tidal hydraulic design. Included in the descriptions and analyses are the essential data, assumptions and criteria used, and the results of studies which provide the bases for determining design wind-tide level, wave runup, overtopping, and frequency of the design hurricane. Section III furnishes information concerning the interior drainage of the project area.

b. Hurricanes of record. Since 1856, about 20 hurricanes have caused flooding in or near the project area. However, reliable hurricane surge heights are available only since 1915. Some of the most severe hurricanes which were critical to the area and caused high stages occurred in September 1915, September 1956 (Flossy), September 1965 (Betsy), and August 1969 (Camille). Some observed stages experienced at or near the project area during these hurricanes were: 1915, 12 feet at Pointe a la Hache and 7.6 feet at Buras; 1956 (Flossy), 12.1 feet at Ostrica lock and 8 feet at Grand Isle; 1965 (Betsy), 14.8 feet at Bohemia, 14.4 feet at West Pointe a la Hache, 12.6 feet at Ostrica lock, 9.7 feet at Empire, 7.9 feet at Venice, and 7.6 feet at Lake Grand Ecaille; 1969 (Camille), 15.1 feet at Ostrica lock, 12.6 feet at Buras, 12.7 feet at Fort Jackson, 13.8 feet at the National Weather Service station near Boothville, and 8.2 feet at Venice.

c. Frequencies. Stages critical to the project area are generated by hurricanes that approach the project area from a southerly direction. Records indicate that approximately two-thirds of all hurricanes that strike the Louisiana coast approach from the south while one-third approach from the east. The average azimuth of tracks from the south is 180° while tracks from the east have an average azimuth of 117°. Therefore, in the computation of stage-frequencies, 67 percent or two-thirds of the observed hurricanes were used to reflect stage probabilities for the back protective levee of Reach B2. Normally, hurricane stages observed in a project area are used in determining stage frequencies. However, due to a scarcity of observed stages along the back levee of the project area, the frequency relationships determined for Grand Isle were used to assist in determining the probability of occurrences in the project area.

d. Design hurricane. A hurricane that would produce the 100-year stage was selected as the design hurricane. A hurricane of lesser intensity would require a lower levee grade and expose the protected area to hazards to life and property that would be disastrous in the event a hurricane occurred with the intensity and destructive capability of the design hurricane. The design hurricane for the project area has a central pressure index of 28.0 inches and a maximum overwater windspeed of 96 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 11 knots and is assumed to progress along a track critical to the project area.

e. Design hurricane wave characteristics. The data used to determine design hurricane wave characteristics for the project area are as follows:

| Pertinent factors | Fort Jackson to Venice |
|---|---|
| Length of fetch, miles | 5 |
| Windspeed, m.p.h. | 96 |
| Stillwater level, feet m.s.l. | 11.5 |
| Average depth of fetch, feet | 7.2 |
| Depth at toe of structure, feet | 8.7 |

From the above data, the design wave height for levee design was computed to be 3.3 feet, and the design wave height for floodwall design is 5.7 feet. The project is designed to prevent overtopping by waves of height equal to the deepwater significant wave or the highest one-third of the waves in a wave train.

f. Design elevation of protective structures. The design wave runup and elevations of protective structures are as follows:

| Location | Design runup feet | Design elevation of structures feet, m.s.l. |
|---|---|---|
| Fort Jackson to Venice | | |
| Levee | 3.5 | 15 |
| Floodwall | 7.5 | 19 |

The design wave runup and design elevations of the protective structures listed above are dependent on the levee configuration on the flood side of the structures.

g. Interior drainage. Local interests have provided drainage in the project area, and construction of the Reach B2 hurricane protective levee in accordance with the plan presented herein will not affect the capability of the existing interior drainage system. The major portion of runoff caused by direct rainfall is drained by gravity through existing canals and evacuated from the project area by the Venice pumping station, except for a small area of about 520 acres at the western end of the project which is drained by gravity and finally evacuated by the Grand Liard pumping station located in the project area of the Reach B1 feature of the New Orleans to Venice project. The discharge pipes of the Venice pumping station will require minor modification to accommodate construction of floodwall at the site of the pumping station. In addition to serving the primary purposes of providing flotation access for excavation of the sand core trench and borrow area for construction of ponding dikes, the flotation channel to the Venice pumping station site will also serve as an outfall to allow drainage flow into open water.

## GEOLOGY

15. Physiography. The project area is located within the Central Gulf Coastal Plain. More specifically, the area is situated on the deltaic plain of the Mississippi River, a region of extremely low relief. Dominant physiographic features are the natural levees of the Mississippi River and its abandoned distributaries, and the marshlands and inland bodies of water that lie between the natural levee ridges. Elevations range from a maximum of approximately 5 along the crests of the natural levees to a minimum approaching mean sea level in the marshlands between the natural levee ridges.

16. General geology.

a. For this project, only the geologic history since the end of the Pleistocene Epoch is relevant. At that time, with sea level about 450 feet below its present level, the Mississippi River began to aggrade the final entrenchment which it had cut to the west of the project area during the last glacial period. Initial alluvial sedimentation was confined to the central portion of the alluvial valley. Concomitantly, downwarping of the Pleistocene Prairie surface and some faulting occurred resulting in a gulfward dip of the Prairie surface averaging about 3 feet per mile and increasing southward towards the coastline. The continued rise in sea level resulted in the reworking and redepositing of minor amounts of fluvial sediments in the project area. When sea level reached within tens of feet of its present level, the first marine and fluvial marine sediments of any significance were carried into the project area.

b. About 4,800 to 5,000 years ago, as sea level approached its present stand, the Mississippi River began to migrate laterally back and forth across the deltaic plain. Deltaic marine sediments were first carried into the project area about 3,500 years ago when the Mississippi occupied the Teche course near the western margin of the valley. The first major advance of sediments into the project area occurred approximately 2,800 years ago when the Mississippi River shifted eastward and began to develop the LaLoutre-St. Bernard Delta. About 1,500 years ago, the Mississippi River shifted westward to the Lafourche course and for a period of several hundred years the project area was subjected to only minor amounts of sedimentation and deltaic deterioration and subsidence became important. When the river again shifted eastward about 1,200 years ago and began to occupy the present Plaquemine course, sedimentation again became the predominant process in the project area. With the construction of levees along the Mississippi River, floodwaters have been eliminated from the area and at present no sediments are being introduced into the project area. Subsidence and erosion have become the dominant factors, particularly in the marshlands and inland bodies of water, and unless sediment-laden water is introduced into the area, the land mass along the edges of the project area will continue to decrease.

17. Subsidence and erosion. Progressive subsidence and downwarping have been occurring in the project area since the end of the Pleistocene Epoch. The surface of the Pleistocene has been downwarped towards the south and west to a maximum of about 500 feet at the edge of the continental shelf which is about 30-40 miles south of the project area. At present, the rate of subsidence within the project area varies from about 0.5 to 1.0 foot per century at the northern limit to about 5 feet or more per century along the seaward-facing extremities of the area, gulfward of the project alinement. In addition, as a result of subsidence and wave erosion, the seaward-facing edges of the shoreline and the shorelines of the ponds, lakes, and bays within the marshlands are retreating.

18. Investigations performed. General type borings extending to a maximum elevation of about -80, and 5-inch core undisturbed borings extending to a maximum elevation of about -150 were made in association with this project. In addition, the logs of borings made in conjunction with other projects as well as other geologic information were available for the interpretation of the subsurface conditions in the area.

19. Foundation conditions.

a. The subsurface, as shown on plates 20 through 24, consists of Recent deposits varying in thickness from approximately 208 feet at the upstream end of the project to approximately 260 feet at the downstream end. The Recent deposits are underlain by Pleistocene materials. Generally, the Recent consists of a surface layer of marsh deposits varying in thickness from 3 feet at station 458+22 to 17 feet at station 0+00. The marsh deposits consist generally of very soft to soft clays with peat and organic matter. The surface materials between stations 410+00 and 430+00, and between stations 467+50 and 480+31 represent areas of artificial fill which were brought in to replace the soft marsh deposits and consist of alternating layers of clay and silt, and silt. Between station 0+00 and 4+50, the marsh deposits are underlain by very soft to soft interdistributary clays with lenses and layers of silt. The marsh deposits between stations 4+50 and 480+31 are underlain by very soft to medium intradelta clays with alternating lenses and layers of silt, silty sand, and sand. Exceptions to this are between stations 457+60 and 460+60, and stations 466+00 and 469+00 where abandoned distributaries are located. The abandoned distributary deposits between stations 457+60 and 460+60, consist of very soft to soft clays, silts, silty sands, and sands. Deposits filling the other abandoned distributary, located between station 466+00 and 469+00, are predominantly clays, silts, and silty sands. Exact depths of the abandoned distributaries cannot be determined from the available borings; however, a minimum depth of 70 feet is indicated.

b. The intradelta deposits between stations 4+50 and 480+31 are underlain by interdistributary deposits. Consistencies of the major portion of these interdistributary deposits are medium which indicates higher values of cohesion than normally encountered in this type of deposit. In addition, the lower water contents and homogenous nature of this material are also unusual for this type deposit. The thickness of the interdistributary deposits varies from approximately 28 feet at station 170+00 to approximately 64 feet at station 0+00. The average thickness of this type deposit in the remainder of the project area is between 40 and 50 feet.

c. The intradelta, interdistributary, and abandoned distributary deposits are underlain by medium to stiff prodelta clays, except between approximate stations 83+00 and 323+00. In this area there is a wedge of intradelta deposits approximately 50 feet thick between the interdistributary and prodelta clays. These intradelta deposits consist primarily of silts and silty sands with a few layers of soft and medium clay. The thickness of the prodelta clays varies from approximately 124 feet at station 0+00 to approximately 135 feet at station 480+31, except beneath the wedge of intradelta material between approximate stations 150+00 and 255+00, where it is only about 75 feet thick.

d. The prodelta deposits are underlain along the entire reach by nearshore gulf sands containing shell and shell fragments. The nearshore deposits vary in thickness from approximately 4 feet at station 0+00 to approximately 30 feet at station 480+31.

e. The approximate thickness of deposits not penetrated by borings along the project alinement are extrapolated from deeper borings previously taken along the banks and levees of the Mississippi River, and a few isolated borings taken west of the project area.

f. The entire sequence of Recent deposits throughout the project area is underlain by stiff to very stiff Pleistocene clays located at elevations varying between approximately -208 at station 0+00, and approximately -260 at station 480+31.

20. Mineral resources. Extensive oil and gas production occur in the vicinity of the project area and it is expected that future exploration will also take place. However, existing and future exploration and production of these natural resources will not be adversely affected by the project, nor will the project be adversely affected by exploration and production.

21. Conclusions. The subsurface investigations and analyses of all existing and new data indicate that conditions for construction of the proposed earth levee and floodwalls along the established

alinement are not favorable; however, considering the various geological environments and nature of the deposits represented in the borings, foundation conditions are those normally encountered in this region of Recent unconsolidated materials. As with most deltaic areas, one of the primary problems to be anticipated is that of settlement beneath the structures. The subsurface materials immediately below the marsh are almost exclusively intradelta deposits which contain some relatively thick wedges of very soft to soft clays with high-water content. Settlement will be more pronounced in these soft clay areas than in the areas which contain considerable amounts of silt, silty sand, and sand. Since the levees will be constructed primarily of hydraulic fill with a sand core, construction materials are readily available. Hydraulic fill can be pumped from areas immediately adjacent to the proposed levee alinement; sand can be secured from the nearby Mississippi River; and shell, aggregate, and riprap can be barged and hauled to the work site as required. Suitable materials for topping the levees can be obtained from the existing earthfill back levee.

## SOILS AND FOUNDATIONS INVESTIGATION AND DESIGN

22. General. This section covers the soils and foundations investigation and design for the hurricane protective works for Reach B2.

23. Field investigation. A total of 39 general type and 9 undisturbed borings were made in association with the Reach B2 project. Twenty general type borings were made by the Louisiana Department of Highways to locate a source of sand for borrow between mile 12 and mile 18.5 in the Mississippi River. Nineteen 1 7/8-inch I.D. core barrel and nine 5-inch diameter undisturbed borings were taken by the Corps of Engineers, New Orleans District. The bottom elevations of the general type and undisturbed borings range from -45 to -79 and -71 to -237, respectively. Plates 25 through 27 show logs of all borings taken along the project alinement. Plates 31 and 32 show logs of the borings taken in the Mississippi River to locate the sand borrow area. Prior to the preparation of plans and specifications, additional general type borings will be taken in the sand and clay borrow areas.

24. Laboratory tests. Visual classifications were made on all samples obtained from the soil borings, and water content determinations were made on all cohesive samples. Unconfined compression (UC), unconsolidated undrained (Q), consolidated undrained (R), consolidated drained (S), and consolidation (C) tests were performed on selected samples from the undisturbed borings. Unconfined compression tests were made on selected samples from the general type borings. Liquid and plastic limit determinations were made on all samples tested for shear and/or consolidation. Results of laboratory tests are shown on plates 33 through 51.

25. Foundation conditions. A generalized soil profile delineating the subsurface conditions along the project alinement is shown on plates 20 through 24. This profile shows that the subsurface consists of Recent deposits of very soft to medium clay soils with peat, silt, and sand layers. The upper 5 to 18 feet of marsh deposits generally consist of very soft organic clays, clays, and peat. Between stations 0+00 and 4+50 the marsh deposits are underlain by interdistributary deposits of soft clay with layers of silt. Between station 4+50 and 480+31 the marsh deposits are underlain by 20 to 40 feet of intradelta deposits consisting primarily of very soft to medium clays with alternating lenses and layers of silt, sand, and silty sand. These deposits are in turn underlain by interdistributary deposits consisting of soft to medium clays with very few lenses and layers of silt. Two abandoned distributaries are located below the marsh deposits--one between stations 457+60 and 460+60 and the other between stations 466+00 and 469+00. These abandoned distributaries are composed of alternate layers of clay, silt, silty sand, and sand. The dominant feature in the design of all the levee sections is the very soft marsh deposits in the upper 5 to 18 feet of the foundation.

26. Types of protective works. The Reach B2 levee will consist of a hydraulic clay fill embankment with a sand core. Cantilever I-type and inverted T-type floodwalls will be constructed in the vicinity of the Venice pumping station to avoid relocation or major modification to this facility.

27. Stability.

a. Levees and dikes.

(1) Using levee sections and (Q) shear strengths representative of conditions along the project alinement, slopes and minimum berm distances for the levee and dike sections were determined by the method of planes. Levee sections were designed for a minimum factor of safety of 1.3 with respect to shear failure in the levee and foundation, and 1.5 for failure into the adjacent borrow pit. The retaining dike sections were designed for a minimum factor of safety of 1.3 for failure into either the sand core trench or the retaining dike borrow pit. The ponding dike sections were designed for a minimum factor of safety of 1.2 for failure into the interior dike borrow pit and a minimum factor of safety of 1.3 for failure into the marsh borrow area. The critical surfaces governing design and corresponding stability analyses are shown on plates 52 through 71. The shear strength criteria used in the analyses are shown on plate 51.

(2) The Reach B2 levee terminus at Venice (station 475+33) will tie into the proposed highway ramp for relocation of Louisiana Highway 23. Detailed analyses concerning the levee

transition from station 472+29 to station 475+33 will be presented in the appropriate set of plans and specifications for Reach B2. The highway ramp will be completed prior to preparation of these plans and specifications.

b. Floodwalls. A combination of I-type and inverted T-type floodwalls will be used at the Venice pumping station. The use of I-wall along the existing back levee at this location was not feasible because a minimum levee crown elevation of 10.0 would be required to prevent excessive deflection of the wall. A stability analysis was performed with the levee crown at elevation 10.0 and the I-wall in place. In order to maintain the required factor of safety of 1.30, large stability berms would be necessary in both the landside and flood-side drainage pits resulting in either relocation or major modifications to the pumping station. Therefore, a 365-foot length of T-wall with the levee degraded to elevation 5.0 will be used along the existing back levee with I-wall joining the T-wall to the full earthen levee section as shown on plate 18. For the stability analyses, the wave effect was applied as a line force acting at the centroid of the wave pressure diagram. The water pressure diagram resulting from the wave action alone was considered effective only to the levee crown.

(1) Cantilever I-wall. The stability and required penetration of the steel sheet piling below the fill surface was determined by the method of planes. The long-term (S) shear strengths (c=0) governed for design. Prior to the preparation of plans and specifications for the I-wall tying the full earthen levee section to the T-wall at the Venice pumping station, additional borings and analyses will be performed. A factor of safety of 1.25 was applied to the friction angle as follows: $\phi_d$ (developed friction angle) = $\tan^{-1} \left(\frac{\tan \phi_A}{F.S.}\right)$. This developed angle was used to determine $K_A$ and $K_p$ (lateral earth pressure coefficients) as follows: $K_A = \tan^2 \left(45° - \frac{\phi_d}{2}\right)$, and $K_p = \frac{1}{K_A}$. Using the resulting shear strengths, and net horizontal static water pressure, the earth pressure diagrams were determined for movement toward each side of the sheet pile. Using these pressure diagrams and the wave force, the summation of horizontal forces was equated to zero for various tip penetrations. The tip penetration required for stability was determined as that elevation at which the summation of overturning moments about the bottom of the sheet piling approached zero. See plate 72.

(2) Inverted T-wall.

(a) Steel sheet pile cutoff. A steel sheet pile cutoff will be used beneath the T-wall to provide protection against seepage. The recommended tip elevation of the cutoff below the T-wall is shown on plate 72. The stability analysis of the T-wall is shown on plate 71. The analysis was based on the following:

1. Conventional (Q) shear stability analyses were performed at 1-foot intervals from the bottom of the structure base to the sheet pile tip, utilizing a factor of safety of 1.3 applied to the soil strength parameters.

2. The value of $R_b$ at the bottom of the base of the structure was assumed equal to zero.

3. The net force equals $D_a - (D_p+R_a+R_b+R_p)$ and was determined at each increment of depth.

4. The driving force above the base of the structure and the horizontal hydrostatic load are carried by the structure.

5. The algebraic difference in the net forces at the top and bottom of each 1-foot interval was used to develop the pressure diagram.

6. If the algebraic difference is negative, the available horizontal soil resistance is in excess of the unbalanced waterload, and the bearing piles are not required to carry any additional lateral load acting on the sheet pile cutoff.

(b) Bearing pile foundation.

1. The T-wall will be supported by piling, battered as required, to provide stability against the unbalanced lateral waterloads. In compression, a factor of safety of 1.75 was applied to the shear strength and a lateral earth pressure coefficient of $K_o$=1.0 was used for determining the normal pressure on the pile surface. In tension, a factor of safety of 2.0 was applied to the shear strengths and a coefficient of $K_o$=0.7 was used. Design of the T-wall pile foundation was performed for both the (Q) and (S) cases. The (Q) case governed. Pile design loads vs. tip elevations, and subgrade moduli vs. tip elevations are shown on plate 72. Settlement of the piles due to consolidation is not expected since the major loads are caused by hurricane-induced stages of insufficient duration for consolidation of the foundations clays to ensue.

2. During construction, one 12-inch square concrete pile will be driven to the design tip elevation (-50.4) in the vicinity of the Venice pumping station as shown on plate 18. The test site will be located in the vicinity of boring 28-B2UC. The pile will be tested in compression to 78 tons (twice the design load). If the pile fails before this load is reached, the spacing will be appropriately adjusted. To eliminate a tension pile test and have only one form for casting concrete piles, tension piles will be the same length as compression piles (60 feet) and spaced a maximum of 10 feet on centers thereby reducing the design load to 22.5 tons which is well below the theoretical allowable tension load of 30 tons (see figures B-7, B-8, and plate 72). If the spacing of compression piles has to be reduced, the spacing of tension piles will be reduced by the same ratio.

28. Settlement. Based on foundation conditions and consolidation test data from the undisturbed borings, estimates of settlement beneath the levee were made. Available laboratory test data indicate that, from the surface down to the depth where the stress induced by the weight of the recommended levee is negligible, the soils are normally consolidated. The organic clays and peat in the upper 5 to 18 feet of the subsurface are very compressible and consolidate much faster than the underlying fat inorganic clays. For this reason, more settlement occurs in the areas of highly organic soil. By removing the organic soils under the project levee from station 0+00 to station 472+29 and replacing them with a sand core, the amount of settlement at the levee centerline is greatly reduced. Between stations 45+00 and 265+00, and 355+00 and 420+00, the settlement at the levee centerline will be less than the settlement at the edge of the sand core because the sand core is seated on the silt and sand layers underlying the marsh deposits in these reaches. Between stations 0+00 and 45+00, 265+00 and 355+00, and 420+00 and 472+29, the settlement at the centerline and the settlement at the edge of the sand core will be approximately equal. Estimates of the ultimate settlements of the foundation for the project levee in various subreaches are shown in table 1.

29. Settlement observations. Settlement observations will be made for all floodwalls promptly after construction and yearly thereafter until settlement is essentially complete. The sheet piling in the tie-in levees will not be capped immediately after they have been driven because of predicted large settlements. Settlement observations will be made and a field settlement curve will be used to determine when all detrimental settlement has occurred. Before-and after-construction profiles and sections will be obtained promptly after each levee construction stage and yearly thereafter until settlement is essentially complete. Settlement of the T-type floodwall is not expected since the major loads are caused by hurricane-induced stages of insufficient duration for consolidation to occur.

TABLE 1
ULTIMATE LEVEE SETTLEMENT
REACH B2

| Reach | Construction method | Crown | | Sand core trench | | Settlement | |
|---|---|---|---|---|---|---|---|
| | | Elev. ft. | Width ft. | Elev. ft. | Width ft. | Center-line ft. | Edge sand core ft. |
| Sta. 0+00 to sta. 45+00 | Sand core Hydraulic fill | 15 | 8 | -12 | 70 | 6.3 | 6.0 |
| Sta. 45+00 to sta. 180+00 | " " | 15 | 8 | -15 | 52 | 4.3 | 4.5 |
| Sta. 180+00 to sta. 265+00 | " " | 15 | 8 | -18 | 34 | 4.3 | 5.3 |
| Sta. 265+00 to sta. 355+00 | " " | 15 | 8 | -12 | 70 | 4.8 | 4.6 |
| Sta. 355+00 to sta. 420+00 | " " | 15 | 8 | -10 | 82 | 3.5 | 3.7 |
| Sta. 420+00 to sta. 472+29 | " " | 15 | 8 | -12 | 70 | 5.2 | 5.4 |

30. Erosion protection. Due to the short duration of hurricane flood stages and the resistant nature of the clayey soils, no erosion protection, other than sodding, is considered necessary on the levee slopes along most of the levee alinement. However, foreshore protection will be constructed on the flood side levee toe in the Bay Carrion Crow area from station 232+00 to station 263+00 to protect the levee from damages which could occur from waves generated by other than hurricane winds. The foreshore protection will consist of 21 inches of riprap on a 9-inch thick shell bedding. The design section for the foreshore protection is shown on plate 11. At the Venice pumping station, protection against erosion will consist of 18 inches of riprap over a 9-inch thick shell bedding as shown on plates 18 and 19.

## DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

31. Levees. The general location and alinement of the Reach B2 hurricane protective levee are shown on plate 1. The detailed alinement and profile of the levee and features contiguous thereto are shown on plates 2 through 8. The Reach B2 project will consist of a sand core hydraulic clay fill levee, and extend from a junction with the terminus of the proposed Reach B1 project levee in the vicinity of Fort Jackson (station 0+00) for about 9 miles southeast to a junction with the proposed highway ramp for relocation of Louisiana Highway 23 at Venice (station 475+33). Typical levee design sections are shown on plates 9 through 12. The proposed realined Mississippi River levee will join the opposite side of the highway ramp to complete the Reach B2 project. The Reach B2 levee, the realined river levee, and the highway ramp will be constructed to elevation 15, thereby forming a uniform net grade for the Reach B2 levee system. The Reach B2 levee centerline will be approximately 190 feet marshward and generally parallel to the existing non-Federal back levee. Minor changes in levee centerline location will be permitted in the field where the changes will result in a more favorable alinement.

32. Floodwalls at Venice pumping station. The Venice pumping station is located on the protected side of the existing back levee with discharge pipes passing through the levee just below the road surface on the levee crown. To provide continuous protection at minimum cost, the new levee will tie into the existing back levee approximately 100 feet to each side of the discharge pipe crossings as shown on plate 18. Inverted T-type floodwall in the existing levee and I-type floodwall in the tie-in levees will be constructed to elevation 19 (see plates 18 and 19). The tie-in levees will have an 8-foot crown width at elevation 10. Stability of the existing levee requires that it be degraded to elevation 5 and the slopes be regraded to 1 on 3. Where the discharge pipes pass through the floodwall, provisions to accommodate settlement

or deflection of the wall or any small movements of the pipes will be provided as shown on plate 19.

33. General method and sequence of construction.

a. Levees. Reach B2 will consist of a sand core hydraulic clay fill levee. A sand core trench will be excavated to the dimensions and elevations shown on plates 9 and 10. A temporary flood side flotation channel, as shown on plates 2, 15, and 16, will be excavated around the elevated Southern Natural Gas pipelines to provide access for hydraulic excavation of the sand core trench between stations 0+00 and 64+25. Material excavated from the sand core trench will be spoiled in spoil and ponding area No. 1, and in the temporary area diked off in spoil and ponding area No. 3 (see plates 2, 4, and 5). Sand will then be pumped from the Mississippi River borrow areas (see plate 17), into the sand core trench and retaining dike base area as shown on plates 15 and 16. Sand will be pumped to elevations that will provide sufficient material for shapeup of the sand core and retaining dike base as shown on plates 9 and 10. A flood side hydraulic clay fill retaining dike will then be constructed from adjacent borrow as shown on plates 9 and 10. Clay cutoffs as shown on plates 14 through 16 and clay cutoff trenches will be constructed as shown on plate 9. Hydraulic clay fill from the clay borrow areas, which will be stripped of the upper 10 feet of poor quality cover material, will then be pumped between the existing back levee and the flood side retaining dike over the shaped sand core fill (see plates 9 and 10). When the hydraulic clay fill has sufficiently dried, approximately 2 years after placement, undisturbed borings and shear tests will be made to more accurately design the final levee sections. Where a second lift is not required, the hydraulic clay fill will be shaped to the net section shown on plates 11 and 12 plus some overbuild to compensate for settlement. After the major settlement is essentially complete, approximately 1 year after the first shaping, the levee will be reshaped and the back levee degraded and used as topping material to overbuild the net levee section to allow for any additional settlement. A second hydraulic clay fill lift will be provided where it is anticipated that sufficient material will not be available for the first shaping (see plate 10). Shapeups following the second lift will be essentially the same as those previously described. It is estimated that ultimately, due to settlement, a clay cover of at least 10 feet will be provided on the flood side slope of the levee, including the wave berm.

b. Floodwalls. Subsequent to completion of the pile test in the vicinity of the Venice pumping station, the existing back levee between approximate stations 430+44 and 433+18 will be degraded to elevation 5 and the T-wall constructed (see plates 18 and 19). The tie-in levees at the pumping station will be constructed as soon as practicable after construction of the first lift levee. Sheet piling for the I-wall will not be capped until a field settlement curve indicates that detrimental settlement of the tie-in levees is complete.

## OTHER PLANS CONSIDERED

34. Alternate plans. In addition to the proposed hydraulic clay, sand core levee, two alternate levee designs were considered:

a. Alternate A provides for a straddle enlargement of the existing back levee by relocating the landside drainage canal approximately parallel and 200 feet on the riverside of the existing back levee with the excavated material used in the landside levee berm. The borrow required to complete the landside and flood side berms would be obtained from flood side marsh borrow pits. The required select fill for the center levee section would be obtained by excavating, loading, and barging the material from the Pointe a la Hache Relief Outlet, across the Mississippi River, stockpiling, and then trucking to the construction site where the material would be dumped, spread, and semicompacted.

b. Alternate B provides for an all-hydraulic clay fill levee with the centerline approximately parallel and 240 feet marshward of the existing back levee. The construction of the levee would be similar to the sand core levee except the sand core would be eliminated and the volume of fill, number of lifts, and size of the levee berms would be greatly increased.

35. Comparison of plans. Sufficient analyses were accomplished to determine that the most economical and practical type levee is the recommended plan utilizing hydraulic clay fill with a sand core. A cost comparison between the recommended plan and the alternate plans follows:

| Plan | Total cost<br>$ |
|---|---|
| Hydraulic clay with sand core (recommended plan) | 22,700,000 |
| Straddle enlargement of existing back levee (Alternate A) | 27,000,000 |
| All-hydraulic clay levee (Alternate B) | 48,700,000 |

## ACCESS ROADS

36. General. The construction site may be reached via Louisiana Highway 23 and local Plaquemines Parish roads. No additional access roads or improvements to existing roads are anticipated.

## STRUCTURAL DESIGN

37. Criteria for structural design. The structural design of the floodwalls presented herein complies with standard engineering practice and criteria set forth in Engineering Manuals for Civil Works Construction published by the Office of the Chief of Engineers, subject to modifications indicated by engineering judgment and experience to meet local conditions. Wave forces were computed using guidelines outlined in Technical Report No. 4, third edition, 1966, "Shore Protection Planning and Design" published by the U. S. Army Coastal Engineering Research Center with the exception that breaking waves were not considered to act on the total structures (see WES Research Report H-68-2, dated September 1968, "Shock Pressures Caused by Waves Breaking Against Coastal Structures").

a. Basic data.

| | |
|---|---|
| Stillwater level (SWL), flood side | 11.5 |
| Assumed water elevation landside of floodwall | -5.0 |
| Wave characteristics (see tables A-5 & A-6, appendix A) | |
| Wave pressures (see figures B-1 through B-4, appendix B) | |
| Unit weight of water | 62.5 p.c.f. |
| Unit weight of reinforced concrete | 150.0 p.c.f. |

b. Allowable working stresses. The allowable working stresses for concrete and structural steel are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101, dated 1 November 1963 and amendment 1, dated 14 April 1965. The basic minimum 28-day compression strength for concrete will be 3,000 p.s.i., except for prestressed concrete piling where the minimum will be 5,000 p.s.i. Prestressed concrete piles will be 12-inch by 12-inch square and meet the requirements of the Joint AASHO and PCI Committee Standard Specifications for "Square Concrete Prestressed Piles." Steel for sheet piling will meet the requirements of ASTM A 328-69, "Standard Specifications for Steel Sheet Piling." For convenient reference, pertinent allowable stresses are tabulated below:

Reinforced concrete (except for concrete piles)

| | |
|---|---|
| $f'_c$ | 3,000 p.s.i. |
| $f_c$ | 1,050 p.s.i. |
| $v_c$ | 60 p.s.i. |
| $f_s$ | 20,000 p.s.i. |
| Minimum area steel | 0.0025 bd. sq.in. |
| Shrinkage and temperature steel area | 0.0020 bt. sq.in. |

Structural steel

| | |
|---|---|
| Basic working stress (ASTM A-36) | 18,000 p.s.i. |
| Basic working stress (steel sheet piling) | 19,250 p.s.i. |

c. Foundations. The results of subsurface exploration, soil tests, and foundation studies are presented in the "Soils and Foundations Investigation and Design" section of this design memorandum. For structural design, soil pressures and concrete pile capacities are based on soil properties as shown on plate 72.

d. I-type floodwall. I-type floodwall will be constructed between wall line stations 0+00 and 2+17, and stations 5+82 to 7+99 (see plates 18 and 19). The I-wall will consist of sheet piling driven into the final levee sections and capped with concrete (see plate 19). The sheet piling will be driven to elevation -7.0 with 1 foot of piling extending above the levee crown. The concrete portion of the floodwall will extend from elevation 8 to the net floodwall design elevation of 19.0. Wave load computations for the I-wall are shown on figures B-1 through B-3, appendix B. For design of the I-wall, two loading cases were considered:

Case I - Static water to the SWL, elevation 11.5; 1.5 factor of safety in the soil; and no wave force.

Case II - Static water to SWL, elevation 11.5; 1.25 factor of safety in the soil; and wave load from non-breaking wave.

Since Case II proved to be the most critical, only computations for this case are presented (see figure B-11).

e. T-type floodwall. T-type floodwall will be constructed between wall line stations 2+17 and 5+82 (see plates 18 and 19). The reinforced concrete T-wall section will be supported by battered prestressed concrete piles driven into the levee section as shown on plate 19. The sheet pile cutoff wall below the T-wall base is assumed to be self-supporting and, therefore, does not cause or resist any load on the T-wall. Wave load computations for the T-wall are shown on figures B-1, B-2, and B-4, and design calculations are shown on figures B-5 through B-10. The T-wall was designed assuming the following loading cases:

Case I - Static water to SWL, elevation 11.5; no wave force; and impervious sheet pile cutoff.

Case II - Static water to SWL, elevation 11.5; no wave force; and pervious sheet pile cutoff.

Case III - Static water to SWL, elevation 11.5; wave load from non-breaking wave; impervious sheet pile cutoff; and 33 1/3 percent increase in allowable stresses.

Case IV - Static water to SWL, elevation 11.5; wave load from non-breaking wave; pervious sheet pile cutoff; and 33 1/3 percent increase in allowable stresses.

f. Protective measures against corrosion. All steel sheet piling in contact with new levee fill will be coated with 20 mils of coal tar epoxy. The coal tar epoxy coating will extend from a minimum of 2 feet below existing ground to 3 inches into the concrete cap. Sheet piling will be electrically bonded together with a No. 6 reinforcing bar welded to the piles near the top. Flexible jumpers will be provided at each expansion joint.

## SOURCES OF CONSTRUCTION MATERIALS

38. Sources of construction materials. In addition to the information presented herein relative to borrow material for construction of the Reach B2 levee, supplemental information concerning construction materials sources is contained in "New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 -Tropical Bend to Fort Jackson," revised 30 August 1971, and approved 16 February 1972.

## REAL ESTATE REQUIREMENTS

39. General. All rights-of-way and construction easements will be acquired by local interests and furnished without cost to the United States. There will be no acquisition by the United States. Rights-of-way and construction easement limits are shown on plates 2 through 8.

## RELOCATIONS AND MODIFICATIONS

40. General. The authorizing act specifies that local interests, prior to initiation of construction, give assurances satisfactory to the Secretary of the Army that they will without cost to the

United States "...accomplish all necessary alterations and relocations to roads, pipelines, cables, wharves, and other facilities required by construction of the project...."

41. Pipelines.

a. Relocation of the following pipelines is required for construction of the Reach B2 levee:

| Location (approximate B/L station) | Type | Size (inches) |
|---|---|---|
| 53+00 | Gas | 8 |
| 64+50 | Gas | 8 |
| 64+50 | Gas | 10 |
| 406+15 | Oil | 12 |
| 406+50 | Oil | 8 |
| 413+30 | Oil | 6 |
| 416+10 | Gas | 12 |

b. The designs for pipeline relocations will be submitted to and approved by the New Orleans District, U. S. Army Corps of Engineers, prior to the initiation of construction. Pipeline locations are shown on plates 2, 5, 6, and 8, and typical relocation details are shown on plate 16.

c. Marina. The Bay Side Marina quarters boat at approximate baseline station 250+00 will be relocated to accommodate construction of the project levee (see plate 4). Relocation assistance under Public Law 91-646 will be provided as appropriate and the cost therefor ($5,000) has been included in the total estimated relocation cost.

d. Pumping station modifications. The discharge pipes of the Venice pumping station will be modified to accommodate construction of floodwall at the pumping station (see plates 18 and 19).

## COORDINATION WITH OTHER AGENCIES

42. Louisiana Wild Life and Fisheries Commission.

a. Review and recommendations.

(1) The Director, Louisiana Wild Life and Fisheries Commission, was informed by letter dated 1 October 1971 of the Reach B2 levee plan and was requested to furnish views and comments. The Director in his letter of response dated 7 October 1971 states

"...We feel our original letter reports would be sufficient in establishing our interest and recommendations regarding the proposed work...." The original reports of the Commission requested that fish and wildlife resources, expecially oyster-producing areas, in waters south of the project area be protected from hydraulic dredging spoil. A copy of the 7 October 1971 letter from the Commission is included in appendix C.

(2) In the Director's letter response of 7 October 1971, he also states "...because of the absence of sufficient discharges of waters from the Mississippi River into the marshes on either side possibly at some later date some consideration could be given to establishing fresh water introduction features in the levee system of the hurricane protection project...."

b. Proposed actions.

(1) Hydraulic clay fill retaining dikes and an extensive spoil and ponding dike system should combine to prevent any significant adverse effects in adjacent oyster-producing waters.

(2) The authorized Mississippi Delta Region, La., project consists of four control structures with appurtenant channels for the diversion of fresh water from the Mississippi River into adjacent marsh areas. Based on the currently proposed locations for the control structures, provisions in the Reach B2 levee alinement are not required to accommodate the diversion of fresh water to these marsh areas. It appears at this time that appropriate structural features will be required in the Reach A levee alinement. This matter will be the subject of further discussion in "New Orleans to Venice, Louisiana, General Design Memorandum No. 1, Supplement No. 5, Reach A - City Price to Tropical Bend," currently underway.

43. U. S. Department of the Interior, Fish and Wildlife Service.

a. Review and recommendations. The Regional Director, U. S. Fish and Wildlife Service, Atlanta, Georgia, was informed by letter dated 1 October 1971 of the proposed Reach B2 levee plan and requested to furnish views and comments. By letter dated 8 November 1971, the Regional Director states "...our previous reports...will suffice in establishing the fish and wildlife implications of the hurricane protection plan...." Based on extensive coordination between the U. S. Fish and Wildlife Service and the Louisiana Wild Life and Fisheries Commission regarding the New Orleans to Venice project, the previous reports of the former agency reflect essentially the same views as those provided by the Louisiana Wild Life and Fisheries Commission. A copy of the Director's 8 November 1971 response is included in appendix C.

b. Proposed actions. Since the U. S. Fish and Wildlife Service comments are essentially the same as those provided by the Louisiana Wild Life and Fisheries Commission, proposed actions are the same as those presented in paragraph 42b above.

44. Environmental Protection Agency, Air and Water Programs Division.

a. Review and recommendations. By letter dated 15 October 1971, the Environmental Protection Agency, Region VI, Dallas, Texas, was informed of the project plan and requested to furnish views and comments. In a letter response dated 26 November 1971, a representative of the Environmental Protection Agency, Air and Water Programs Division, states "...We would like to know more about the construction methods and methods that will be used to protect environmental values during and after construction of the project...An Environmental Statement that would include this project would permit our agency to evaluate more fully the potential adverse effects on environmental values within our area of responsibility...." A copy of the 26 November 1971 letter is included in appendix C.

b. Proposed actions. Preparation of a draft environmental statement for the entire New Orleans to Venice hurricane protection project is underway. Subsequent to completion, a copy of the draft statement will be furnished to the Environmental Protection Agency for review and comments.

45. State of Louisiana Stream Control Commission.

a. Review and recommendations. The Louisiana Stream Control Commission, by letter dated 15 October 1971, was informed of the proposed Reach B2 levee plan and requested to furnish views and comments. The Commission's 19 January 1972 letter of response states:

"...1. Spoil bank control to prevent water pollution from turbid conditions is recommended.

"Areas adjacent to reaches A and B2 are oyster growing areas; therefore, siltation of these water bottoms could be most harmful.

"2. State and federal water pollution control and health laws, rules, and regulations should be complied with by the contractor."

A copy of the Commission's letter of response is included in appendix C.

b. Proposed actions.

(1) Hydraulic clay fill retaining dikes and an extensive spoil and ponding dike system should combine to prevent any significant adverse effects in adjacent oyster-producing waters.

(2) Plans and specifications for the Reach B2 levee work will include requirements that the construction contractor comply with appropriate state and Federal water pollution control and health laws.

46. Louisiana State Board of Health.

a. Review and recommendations. The President, Louisiana State Board of Health, was informed by letter dated 15 October 1971 of the project plan for Reach B2 and requested to furnish views and comments. At the direction of the President, State Board of Health, the Louisiana Air Control Commission responded to the above request. The Commission states "...If there will be such materials [combustible materials], we believe that any contract could provide for compliance with the Louisiana Air Control Commission's standards and regulations...." A copy of the response is included in appendix C.

b. Proposed actions. Plans and specifications for Reach B2 levee construction will include requirements that the construction contractor comply with appropriate Louisiana Air Control Commission's standards and regulations.

ENVIRONMENTAL ANALYSIS

47. General.

a. During construction of the Reach B2 levee, there will be an adverse, but transitory, impact of a relatively minor nature. Specifically, during construction there will be tailings washed into adjacent streams and marshes by the effluent water from hydraulic fill operations. Although the hydraulic fill will be controlled by retaining dikes, with the bulk of excess materials settled out in ponding areas, there will be some residual material washed into adjacent open waters. Portions of this material will be trapped by vegetation and some will ultimately settle to the water bottoms. The predominant effect will be a temporary increase in turbidity which, by reducing the penetration of sunlight, will have a deleterious effect upon the primary production of biotic life in waters immediately adjacent to the project area. It is not anticipated that the larger organisms used for commercial or sports purposes will be damaged. The material in ponding areas will cover most of the bottoms after settlement but within a reasonable period of time the land will be restored with vegetation.

The replacement vegetation will offer some degree of variety to the area so that the relatively small effects of damage and recovery will balance out.

b. Following construction, substantial benefits are expected to accrue as a result of the proposed project plan. The leveed area will offer a high degree of protection from hurricane flood damages, and also provide an incentive which will tend to limit human habitat and most commercial development to the protected area. Efficient use of land within the protected area will limit future expansion to an orderly instead of a random, somewhat wasteful, expansion.

48. Environmental statement. The final environmental statement for the entire New Orleans to Venice hurricane protection project will be made available to the President, Council on Environmental Quality in about November 1972.

49. Aesthetics. The floodwalls in the vicinity of the Venice pumping station will be blended into the physical surroundings by planting fig vines (Fiscus Pumila) 8 feet on centers within 1 foot of the floodwalls on the protected side. Measures normally associated with levee construction; i.e., grading and sodding, will be provided along the entire levee length and are considered adequate to preserve existing aesthetic values along the project alinement.

50. Recreation resources. There are adequate public boat-launching facilities and other access points for water users to serve the needs of the project area. However, the levee will provide an area for informal, unstructured recreation.

51. Historic and cultural environment. There are no known sites, structures, and objects of historical, architectural, or archeological significance within the Reach B2 project area which would fall within the provisions of Executive Order 11593, "Protection and Enhancement of the Cultural Environment." Fort Jackson and Fort St. Philip are listed in the National Register of Historic Places, and both are located in the general vicinity of but outside the project area. It is likely that memorabilia pertaining to early sulphur production, power generation, and pumping equipment are present within the project area and will be protected by the Reach B2 levee.

## ESTIMATE OF COST

52. General. The estimated first cost, based on July 1972 price levels, for constructing the Reach B2 protective works is $22,700,000. This estimate consists of $18,492,000 for levees and floodwalls, $2,219,000 for engineering and design, $1,314,000 for supervision and administration, $243,000 for lands and damages, and $432,000 for relocations. The detailed estimate of first cost is shown in table 2. Table 3 shows the apportionment of costs between Federal and non-Federal interests.

TABLE 2
DETAIL ESTIMATE OF FIRST COST
(July 1972 prices)
REACH B2

| Cost acct. No. | Item | Quantity | Unit | Unit price $ | Total cost $ |
|---|---|---|---|---|---|
| 11 | LEVEES AND FLOODWALLS | | | | |
| | 1. Levee embankment (sta. 0+00 to 475+33) | | | | |
| | a. First lift | | | | |
| | Mob. & demob. | | Lump sum | | 166,000 |
| | Clearing | 600 | acre | 350.00 | 210,000 |
| | Hydraulic fill clay | 5,230,000 | cu.yd. | 1.10 | 5,753,000 |
| | Hydraulic fill sand (includes shaping) | 3,338,000 | cu.yd. | 1.00 | 3,338,000 |
| | Hydraulic excavation | | | | |
| | Levee sand core trench | 990,000 | cu.yd. | 0.30 | 297,000 |
| | Strip clay borrow areas | 3,650,000 | cu.yd. | 0.30 | 1,095,000 |
| | Non-hydraulic excav. | | | | |
| | Levee sand core trench | 120,000 | cu.yd. | 0.30 | 36,000 |
| | Other | 700,000 | cu.yd. | 0.30 | 210,000 |
| | Cast clay | | | | |
| | Retaining dikes | 2,230,000 | cu.yd. | 0.30 | 669,000 |
| | Ponding dikes | 2,800,000 | cu.yd. | 0.30 | 840,000 |
| | Levee cutoff fill | 470,000 | cu.yd. | 0.30 | 141,000 |
| | Transverse dikes @ floodwalls | 3,334 | cu.yd. | 0.30 | 1,000 |
| | Temporary ponding dikes | 26,000 | cu.yd. | 0.50 | 13,000 |
| | Transverse dike cutoffs | 1,200 | cu.yd. | 2.50 | 3,000 |
| | Cast shell | | | | |
| | Transverse dikes @ floodwalls | 15,000 | cu.yd. | 5.00 | 75,000 |
| | Ponding dike base | 5,800 | cu.yd. | 5.00 | 29,000 |
| | Sheet piling for cutoffs | 21,333 | sq.ft. | 3.00 | 64,000 |
| | Subtotal, first lift | | | | 12,940,000 |
| | b. Second lift | | | | |
| | Mob. & demob. | | Lump sum | | 65,000 |
| | Clearing | 200 | acre | 100.00 | 20,000 |
| | Hydraulic fill clay | 311,818 | cu.yd. | 1.10 | 343,000 |
| | Hydraulic excavation | | | | |
| | Strip clay borrow areas | 180,000 | cu.yd. | 0.30 | 54,000 |
| | Non-hydraulic excav. | 60,000 | cu.yd. | 0.30 | 18,000 |
| | Cast clay | | | | |
| | Retaining & ponding dikes | 1,000,000 | cu.yd. | 0.30 | 300,000 |
| | Subtotal, second lift | | | | 800,000 |

TABLE 2 (cont'd)

| Cost acct. No. | Item | Quantity | Unit | Unit price $ | Total Cost $ |
|---|---|---|---|---|---|
| | c. Final levee (two shapings) | | | | |
| | Mob. & demob. | | Lump sum | | 35,000 |
| | Clearing | 1,060 | acre | 100.00 | 106,000 |
| | Shaping | | | | |
| | Material handled once | 1,830,000 | cu.yd. | 0.40 | 732,000 |
| | Material handled twice | 450,000 | cu.yd. | 0.80 | 360,000 |
| | Trash guard | | Lump sum | | 7,000 |
| | Fertilizing & seeding | 900 | acre | 150.00 | 135,000 |
| | Subtotal, final levee | | | | 1,375,000 |
| | d. Levee slope protection (vicinity Venice pumping station) | | | | |
| | Riprap | 3,250 | ton | 8.00 | 26,000 |
| | Subtotal, levee embankment | | | | 15,141,000 |
| | Contingencies (20%±) | | | | 2,968,000 |
| | Subtotal, levee embankment | | | | 18,109,000 |
| | 2. Foreshore protection (Bay Carrion Crow) | | | | |
| | Riprap | 4,625 | ton | 8.00 | 37,000 |
| | Shell | 2,000 | cu.yd. | 5.00 | 10,000 |
| | Subtotal, foreshore protection | | | | 47,000 |
| | Contingencies (20%±) | | | | 9,000 |
| | Subtotal, foreshore protection | | | | 56,000 |
| | Subtotal, levee embankment and foreshore protection | | | | 18,165,000 |
| | E&D (12%±) | | | | 2,182,000 |
| | S&A (7%±) | | | | 1,280,000 |
| | Total, levee embankment and foreshore protection | | | | 21,627,000 |
| | 3. Floodwall (Venice pumping station) | | | | |
| | Mob. & demob. | | Lump sum | | 13,000 |
| | Test pile | | Lump sum | | 5,000 |
| | Degrade existing back levee | 3,600 | cu.yd. | 0.75 | 2,700 |
| | Levee fill | 2,800 | cu.yd. | 1.25 | 3,500 |
| | Structure excavation | 800 | cu.yd. | 1.50 | 1,200 |
| | Structure backfill | 440 | cu.yd. | 1.25 | 550 |
| | Piling, steel sheet, MA22 | 4,890 | sq.ft. | 5.00 | 24,450 |

TABLE 2 (cont'd)

| Cost acct. No. | Item | Quantity | Unit | Unit price | Total cost |
|---|---|---|---|---|---|
| | | | | $ | $ |
| | Piling, steel sheet, Z-27 (epoxy coated both sides) | 11,300 | sq.ft. | 6.50 | 73,500 |
| | Piling, concrete prestressed (12" x 12") | 5,000 | lin.ft. | 8.00 | 40,000 |
| | Concrete in stab. slab | 40 | cu.yd. | 40.00 | 1,600 |
| | Concrete in T-wall base | 270 | cu.yd. | 60.00 | 16,200 |
| | Concrete in walls | 560 | cu.yd. | 100.00 | 56,000 |
| | Portland cement | 1,182 | bbls. | 5.50 | 6,500 |
| | Steel reinforcement | 90,000 | lbs. | 0.20 | 18,000 |
| | Waterstops | 350 | lin.ft. | 3.50 | 1,230 |
| | Compacted shell | 690 | cu.yd. | 8.00 | 5,520 |
| | Riprap | 530 | ton | 15.00 | 7,950 |
| | Shell bedding | 150 | cu.yd. | 6.00 | 900 |
| | Cut off of sheet pile | 440 | lin.ft. | 5.00 | 2,200 |
| | Fig vine (beautification) | | Lump sum | | 500 |
| | Subtotal, floodwall | | | | 280,500 |
| | Contingencies (20%±) | | | | 55,500 |
| | Subtotal, floodwall | | | | 336,000 |
| | E&D (11%±) | | | | 37,000 |
| | S&A (10%±) | | | | 34,000 |
| | Total, floodwall | | | | 407,000 |
| | Subtotal, embankment, foreshore protection, & floodwall, less contingencies | | | | 15,468,500 |
| | Contingencies | | | | 3,023,500 |
| 30 | E&D | | | | 2,219,000 |
| 31 | S&A | | | | 1,314,000 |
| | Total, levees & floodwalls | | | | 22,025,000 |
| 01 | LANDS AND DAMAGES | | | | |
| 1. | Rights-of-way | | | | |
| | Marina area | 2.4 | acre | 30,000.00 | 71,000 |
| | Landside of existing levee | 60 | acre | 100.00 | 6,000 |
| | Marsh | 240 | acre | 50.00 | 12,000 |
| 2. | Easements | | | | |
| | Construction | | | | |
| | Marshland | 4,040 | acre | 12.50 | 50,500 |
| 3. | Improvements | | Lump sum | | 40,000 |
| | Subtotal, lands & damages | | | | 179,500 |
| | Contingencies (20%±) | | | | 36,500 |
| | Acquisition | | | | 27,000 |
| | Total, lands & damages | | | | 243,000 |

TABLE 2 (cont'd)

| Cost acct. No. | Item | Quantity | Unit | Unit price | Total cost |
|---|---|---|---|---|---|
| | | | | $ | $ |
| 02 | RELOCATIONS & MODIFICATIONS | | | | |
| | 1. Facilities | | | | |
| | Marina quarters boat | | Lump sum | | 15,000 |
| | Pumping station discharge lines modification | | Lump sum | | 13,000 |
| | Subtotal, facilities | | | | 28,000 |
| | Contingencies (20%±) | | | | 5,500 |
| | Subtotal, facilities | | | | 33,500 |
| | E&D (10%+) | | | | 3,200 |
| | S&A (7%±) | | | | 2,300 |
| | Total, facilities | | | | 39,000 |
| | 2. Pipelines | | | | |
| | 12" gas line | | Lump sum | | 70,000 |
| | 10" gas line | | Lump sum | | 31,000 |
| | 8" gas line | | Lump sum | | 27,000 |
| | 8" gas line | | Lump sum | | 26,000 |
| | 12" crude oil line | | Lump sum | | 57,000 |
| | 8" crude oil line | | Lump sum | | 40,000 |
| | 6" crude oil line | | Lump sum | | 33,000 |
| | Subtotal, pipelines | | | | 284,000 |
| | Contingencies (20%±) | | | | 55,000 |
| | Subtotal, pipelines | | | | 339,000 |
| | E&D (10%+) | | | | 32,000 |
| | S&A (7%±) | | | | 22,000 |
| | Total, pipelines | | | | 393,000 |
| | Total, relocations & modifications | | | | 432,000 |
| | TOTAL PROJECT COST | | | | 22,700,000 |

TABLE 3
APPORTIONMENT OF COST BETWEEN
FEDERAL & NON-FEDERAL INTERESTS
REACH B2

| | | |
|---|---|---|
| Project first cost | | |
| Construction | | $22,025,000 |
| Lands, damages, and relocations | | 675,000 |
| Total | | $22,700,000 |

Apportionment of cost

| | Federal (70%) | Non-Federal (30%) |
|---|---|---|
| | $15,890,000 | $6,810,000 |
| Less cost of lands, damages, and relocations | | 675,000 |
| Cash contribution | | $6,135,000 |

53. Comparison of estimates.

a. GDM versus PB-3. The current estimate of $22,700,000 for the Reach B2 levee represents an increase of $260,000 over the PB-3 effective 1 July 1972. The estimate presented in the PB-3 is based on the estimate included in "New Orleans to Venice, Louisiana, Design Memorandum No. 1 - General Design, Reach B1 - Tropical Bend to Fort Jackson," revised 30 August 1971, approved 16 February 1972, and escalated to projected July 1972 price levels. Table 4 shows a comparison of the project document, PB-3, and general design memorandum estimates. The increase of $260,000 over the latest PB-3 reflects the net effect of more detailed analyses accomplished during preparation of this design memorandum.

TABLE 4
COMPARISON OF ESTIMATES
REACH B2

| | Feature | Project document | PB-3 eff. 1 Jul 72 | GDM No. 1 Supp. No.4 | Difference Supp.No.4 - PB-3 | Difference Supp. No. 4 - Proj. document |
|---|---|---|---|---|---|---|
| | | $ | $ | $ | $ | $ |
| 11 | Levees & floodwalls | 1,358,000 | 18,372,000 | 18,492,000 | +120,000 | +17,134,000 |
| 30 | Engineering & design | 95,200 | 2,140,000 | 2,219,000 | + 79,000 | +2,123,800 |
| 31 | Supervision & administration | 108,800 | 1,260,000 | 1,314,000 | + 54,000 | +1,205,200 |
| | Subtotal | 1,562,000 | 21,772,000 | 22,025,000 | +253,000 | +20,463,000 |
| 01 | Lands & damages | 200,000 | 279,000 | 243,000 | -36,000 | +43,000 |
| 02 | Relocations | 96,000 | 389,000 | 432,000 | +43,000 | +336,000 |
| | Subtotal | 296,000 | 668,000 | 675,000 | +7,000 | +379,000 |
| | Total | 1,858,000 | 22,440,000 | 22,700,000 | +260,000 | +20,842,000 |

b. GDM versus project document. The estimate of $22,700,000 for the Reach B2 levee also represents an increase of $20,842,000 over the project document estimate. Reasons for the difference between the design memorandum and project document estimates are as follows:

(1) Levees and floodwalls. The increase of $17,134,000 reflects: (a) added costs for constructing the protective works to a higher net grade, based on hurricane parameters developed by the National Weather Service subsequent to preparation of the project document; (b) an additional increase in the height of the project works above natural ground of approximately 1 foot resulting from releveling by the National Ocean Survey (formerly the U. S. Coast and Geodetic Survey) in 1965; (c) a review of design procedures and price escalations subsequent to preparation of the project document estimate; and (e) the more detailed analyses accomplished during preparation of this design memorandum.

(2) Engineering and design. The increase of $2,123,800 reflects current engineering and design percentages greater than that used in the project document, and proportionate increases based on the increases in construction costs subsequent to preparation of the project document estimate.

(3) Supervision and administration. The increase of $1,205,200 represents proportionate increases based on the increases in construction costs subsequent to preparation of the project document estimate.

(4) Lands and damages. The increase of $43,000 reflects the net effect of price escalation and reanalyses of requirements subsequent to preparation of the project document.

(5) Relocations. The increase of $336,000 reflects the net effect of price escalations and reanalyses of requirements subsequent to preparation of the project document.

## SCHEDULES FOR DESIGN AND CONSTRUCTION

54. Schedules for design and construction. The sequence of contracts and schedules for design and construction is shown below:

| Contracts[1] | Design Start | Design Complete | Construction Advertise | Construction Award | Construction Complete | Estimated construction cost, including contingencies (rounded) $ |
|---|---|---|---|---|---|---|
| Sand core excavation[2] (412+00 to 418+00) | Aug 72 | Jan 73 | Feb 73 | Mar 73 | Apr 73 | 85,000 |
| First lift[3] (0+00 to 245+00) | Nov 72 | Sep 73 | Oct 73 | Nov 73 | Nov 74 | 8,097,000 |
| First lift (245+00 to 475+33) | Jan 73 | Nov 73 | Dec 73 | Jan 74 | Jan 75 | 7,276,000 |
| Second lift (0+00 to 48+00) | Jan 76 | Sep 76 | Oct 76 | Nov 76 | May 77 | 283,000 |
| First shaping (48+00 to 245+00) | Jan 76 | Sep 76 | Oct 76 | Nov 76 | May 77 | 393,000 |
| Second lift (286+00 to 355+00) (419+00 to 430+13) (433+50 to 475+33) | Mar 76 | Nov 76 | Dec 76 | Jan 77 | Jul 77 | 673,000 |
| First shaping (245+00 to 286+00) (355+00 to 419+00) | Mar 76 | Nov 76 | Dec 76 | Jan 77 | Jul 77 | 224,000 |

| Contracts[1] | Design Start | Design Complete | Advertise | Construction Award | Construction Complete | Estimated construction cost, including contingencies (rounded) $ |
|---|---|---|---|---|---|---|
| Final section (48+00 to 245+00) | Jul 77 | Mar 78 | Apr 78 | May 78 | Nov 78 | 368,000 |
| Final section (245+00 to 286+00) (355+00 to 419+00) | Sep 77 | May 78 | Jun 78 | Jul 78 | Jan 79 | 230,000 |
| First shaping (0+00 to 48+00) | Jul 78 | Mar 79 | Apr 79 | May 79 | Nov 79 | 82,000 |
| First shaping (286+00 to 355+00) (419+00 to 430+13) (433+50 to 475+33) | Sep 78 | May 79 | Jun 79 | Jul 79 | Jan 80 | 178,000 |
| Floodwall, test pile (428+68) | Jan 79 | May 79 | Jun 79 | Jun 79 | Aug 79 | 6,000 |
| Floodwall, pump. sta. (excludes concrete capping of I-wall) (428+58 to 435+05) | Jan 79 | Sep 79 | Oct 79 | Nov 79 | May 80 | 270,000 |
| Final section (0+00 to 48+00) | Jan 80 | Sep 80 | Oct 80 | Nov 80 | May 81 | 64,000 |

| Contracts[1] | Design Start | Design Complete | Advertise | Construction Award | Construction Complete | Estimated construction cost, including contingencies (rounded) |
|---|---|---|---|---|---|---|
| | | | | | | $ |
| Final section (286+00 to 355+00) (419+00 to 430+13) (433+50 to 475+33) | Mar 80 | Nov 80 | Dec 80 | Jan 81 | Jul 81 | 203,000 |
| Floodwall, concrete capping of I-wall (428+58 to 430+16) (433+37 to 435+33) | Jan 81 | Sep 81 | Oct 81 | Nov 81 | May 82 | 60,000 |
| Total | | | | | | 18,492,000 |

[1]When feasible, contracts will be combined.

[2]Excavation of the levee sand core trench between the Getty Oil Co., Marathon Oil Co., and United Gas Pipeline Co. pipelines prior to relocating the pipelines over the proposed levee will eliminate the additional costs that would be required to provide access for the excavation after the pipeline relocations have been accomplished (see plates 5 and 15).

[3]Considerable savings could be realized by eliminating the need for the flotation channel around the 8-inch and 10-inch diameter Southern Natural Gas Company pipelines at baseline station 64+50 (see plate 2). This could be achieved by including the excavation for the levee sand core trench and the pumping of the hydraulic sandfill (station 0+00 to station 64+50) in the construction contract for the easternmost section of Reach B1. An alternate approach that would accomplish the same objective would be the addition of the Reach B2 levee construction from station 0+00 to approximate station 64+50 to the construction contract for the easternmost section of Reach B1.

55. Funds required by fiscal year. To maintain the above schedules for design and construction of the Reach B2 levee, funds[2] will be required by fiscal year as follows:

| | | |
|---|---|---|
| Cost through | FY 72 | $ 200,000 |
| Funds required for | FY 73 | 207,000 |
| | FY 74 | 7,416,000 |
| | FY 75 | 8,916,000 |
| | FY 76 | 106,000 |
| | FY 77 | 1,234,000 |
| Balance to complete | | 3,946,000 |
| Total | | $22,025,000 |

OPERATION AND MAINTENANCE

56. General. As specified in the authorizing act, local interests are to maintain and operate the completed works in accordance with regulations prescribed by the Secretary of the Army and good maintenance practices. The estimated annual cost for maintenance of the levee and floodwall is $10,000.

ECONOMICS

57. Benefits.

a. The New Orleans to Venice, Louisiana, hurricane protection project is being designed to provide protection from flooding by hurricane-generated surges having a return frequency of once in 100 years on the average. In Reach B2, the project works will provide protection to the 2,300 acres which comprise the Reach B2 project area. In 1970, there were approximately 1,200 acres of residential, commercial, and industrial development along the Mississippi River within this reach.

b. Benefits consist of non-crop flood damages prevented on existing and future development.

c. A detailed analysis of the benefits for Reach B2 is presented in New Orleans to Venice, Louisiana, Design Memorandum No. 1, General Design, Reach B1 - Tropical Bend to Fort Jackson, revised 30 August 1971. The data presented herein on flood damages prevented represent updatings of those presented in the above-referenced design memorandum.

[2] Includes all funds required for construction (including contingencies), engineering & design, and supervision & administration.

d. Average annual flood damages prevented on existing and future development amount to $749,000 and $296,000, respectively. Increases in these benefits over those reported in the Reach B1 design memorandum reflect the ENR price level change between July 1971 and July 1972.

e. The total average annual benefits are, therefore, $1,045,000.

58. Project first costs and annual charges. First costs and annual charges for the Reach B2 levee are displayed in table 5.

TABLE 5
ESTIMATE OF PROJECT COSTS AND ANNUAL CHARGES
REACH B2

| | Federal | Non-Federal | Total |
|---|---|---|---|
| | $ | $ | $ |
| Construction | 22,025,000 | - | 22,025,000 |
| Lands, damages, relocations | - | 675,000 | 675,000 |
| | 22,025,000 | 675,000 | 22,700,000 |
| Cash contribution | -6,135,000 | 6,135,000 | - |
| First cost | 15,890,000 | 6,810,000 | 22,700,000 |
| Interest during construction[1] (8 yrs @ 2 7/8%) | 1,827,000 | 783,000 | 2,610,000 |
| Total project investment | 17,717,000 | 7,593,000 | 25,310,000 |
| Annual economic costs | | | |
| Interest (2 7/8%) | 590,400 | 218,300 | 727,700 |
| Amortization (100 years) | 31,800 | 13,600 | 45,400 |
| Operations and maintenance | - | 10,000 | 10,000 |
| Replacements | - | 0 | 0 |
| Economic loss on lands[2] | - | 6,300 | 6,300 |
| Total annual economic costs | 541,200 | 248,200 | 789,400 |

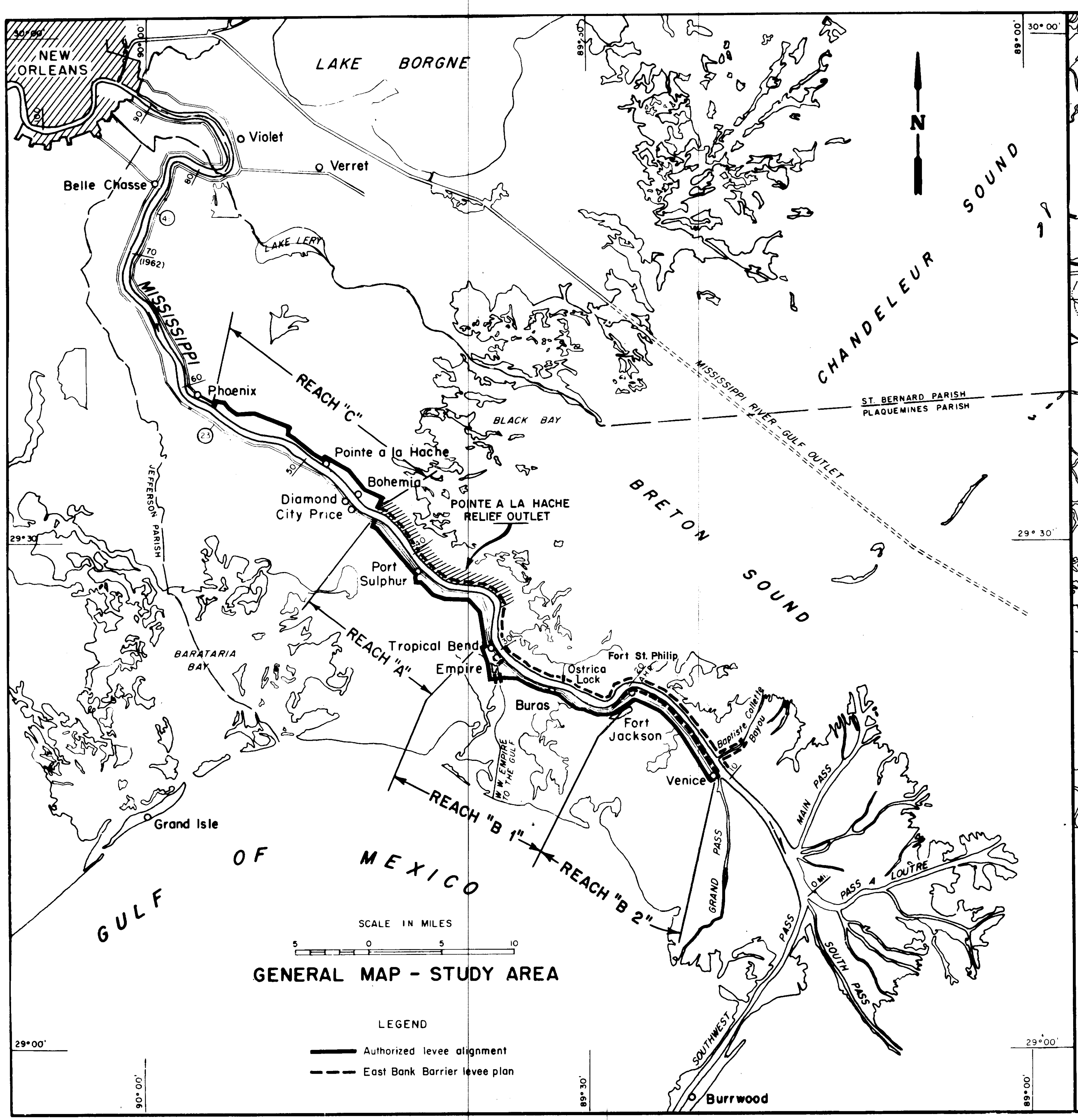
[1]Interest during construction is based on total Federal and non-Federal expenditure of $22,700,000 during 8-year period.

[2]$200,000 for loss of lands x (6% - 2 7/8%) = $6,250, say $6,300.

59. Economic justification. The average annual benefits of $1,045,000 and average annual charges of $789,400 result in a benefit-cost ratio of 1.3 for the Reach B2 portion of the New Orleans to Venice project.

## RECOMMENDATIONS

60. Recommendations. The plan of improvement presented herein for Reach B2 consists of levee enlargement from Fort Jackson to Venice, a distance of approximately 9 miles. The levee will consist of a hydraulic clay fill embankment with a sand core. The plan also provides for floodwalls at the Venice pumping station and modifications to pipelines and facilities as necessary. The plan is considered to be the best means of accomplishing the project objectives and is recommended for approval.

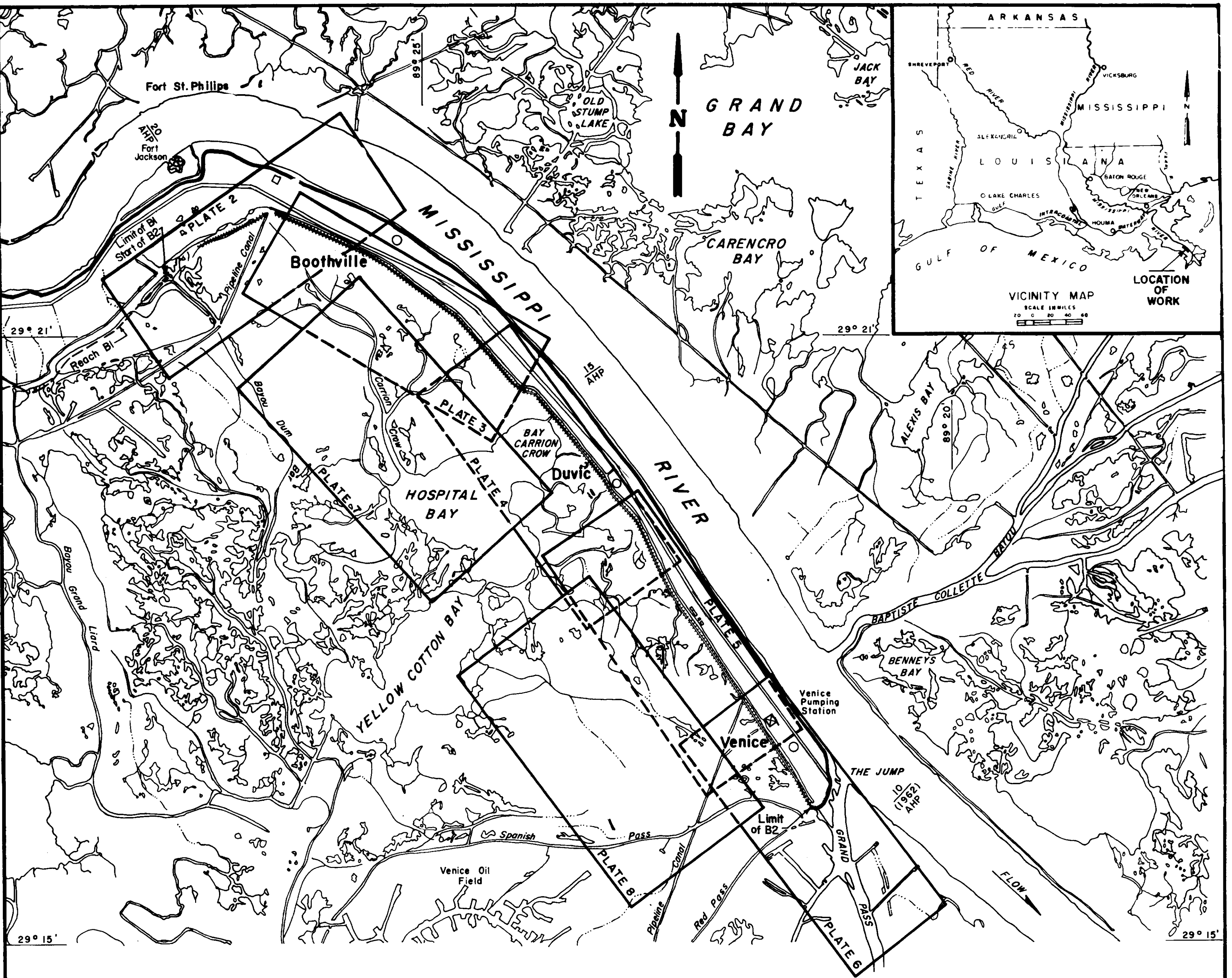



GENERAL MAP - STUDY AREA

LEGEND

Authorized levee alignment

East Bank Barrier levee plan




LEGEND

New levee construction, hurricane protection

Existing Mississippi River Levee

Pumping station alteration

## REACH B2
## GENERAL PLAN & INDEX MAP

SCALE IN FEET

4,000 0 4,000 8,000

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

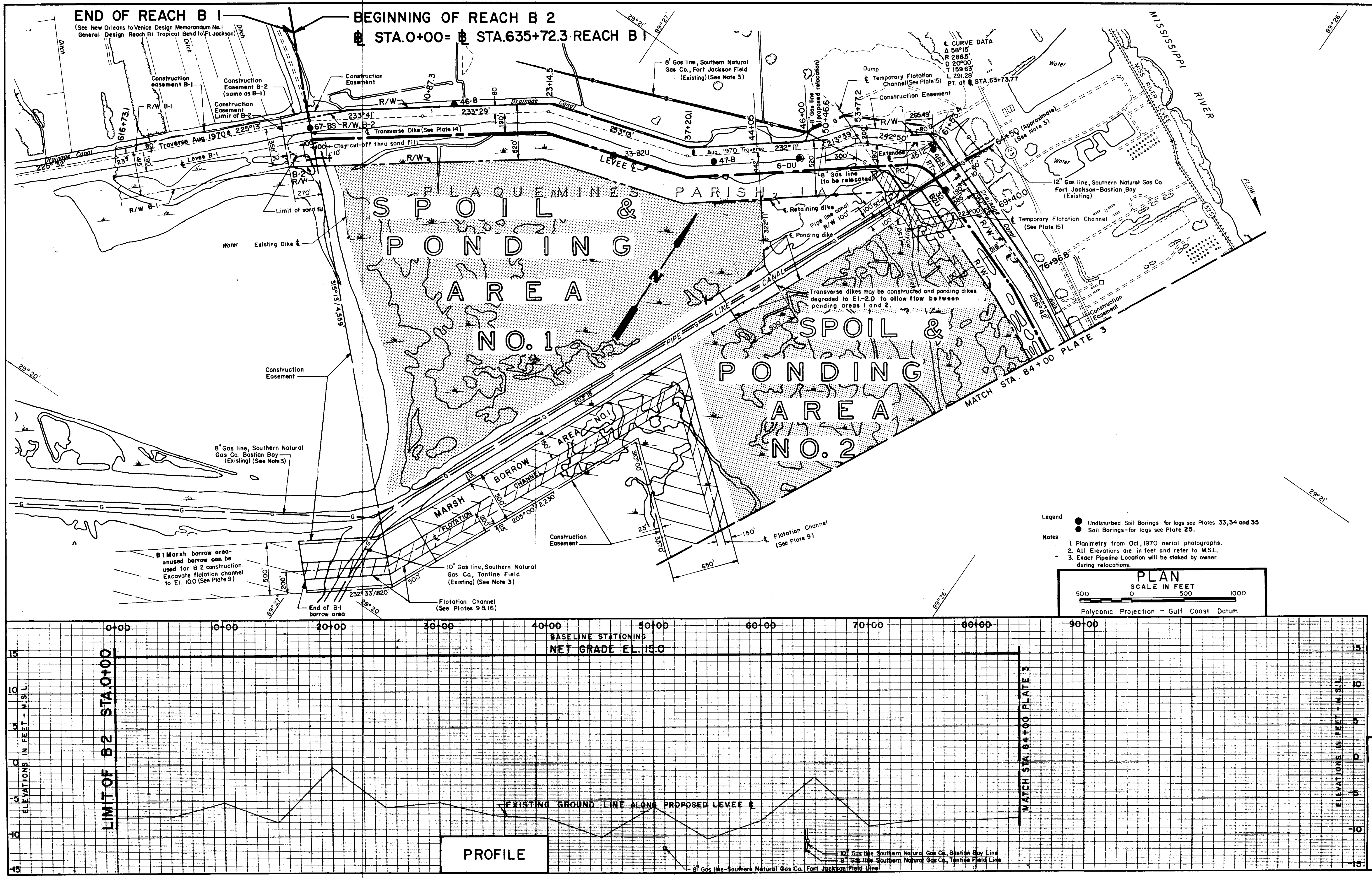
REACH B2—FORT JACKSON TO VENICE

## GENERAL PLAN, INDEX AND VICINITY MAP

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

JULY 1972 FILE NO. H-2-25953

PLATE 1




NEW ORLEANS TO VENICE, LA.

DESIGN MEMORANDUM NO. I — GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2—FORT JACKSON TO VENICE

## PLAN AND PROFILE

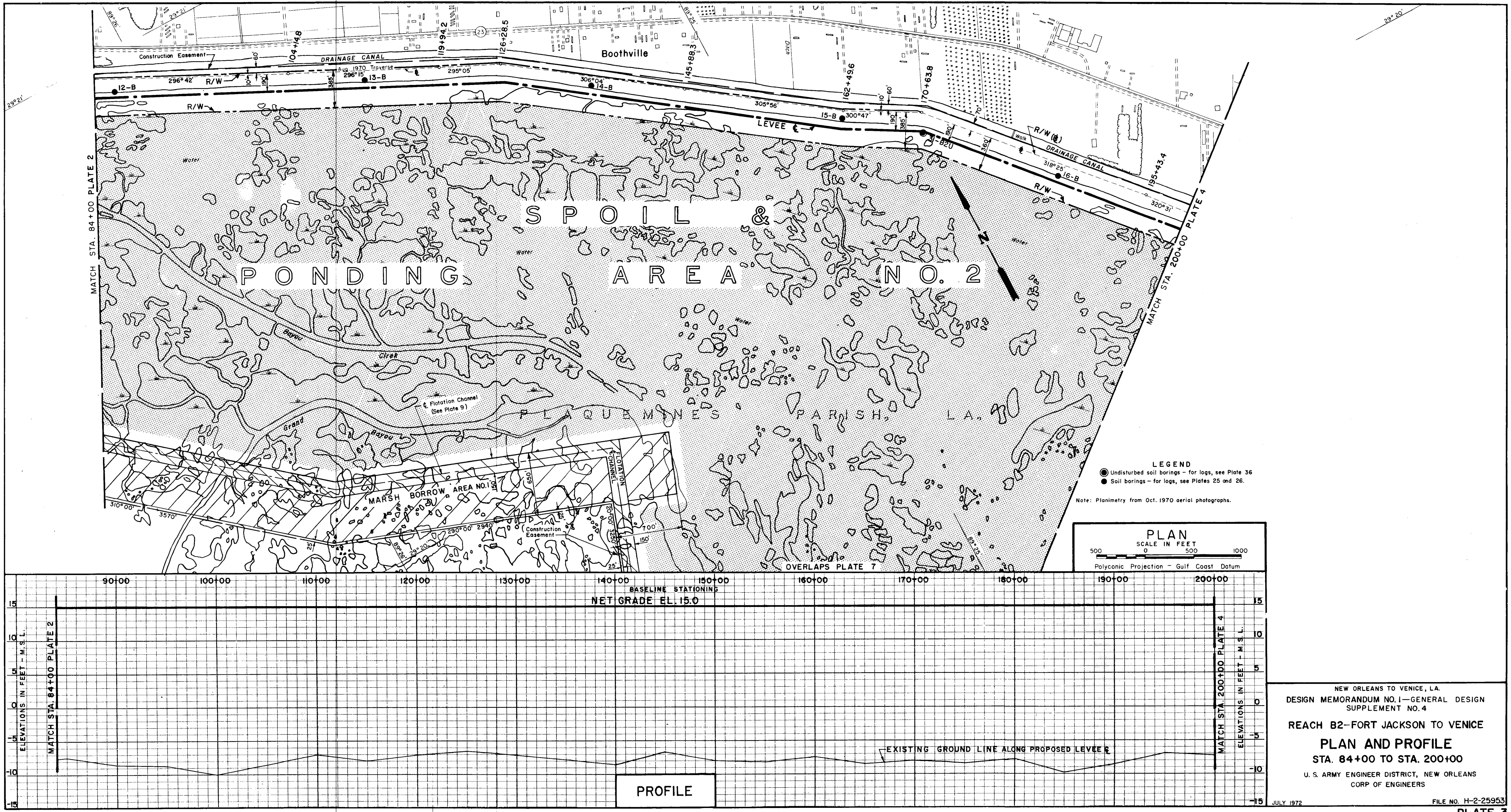
STA. 0+00 TO STA. 84+00

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

JULY 1972

FILE NO. H-2-25953

PLATE 2




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

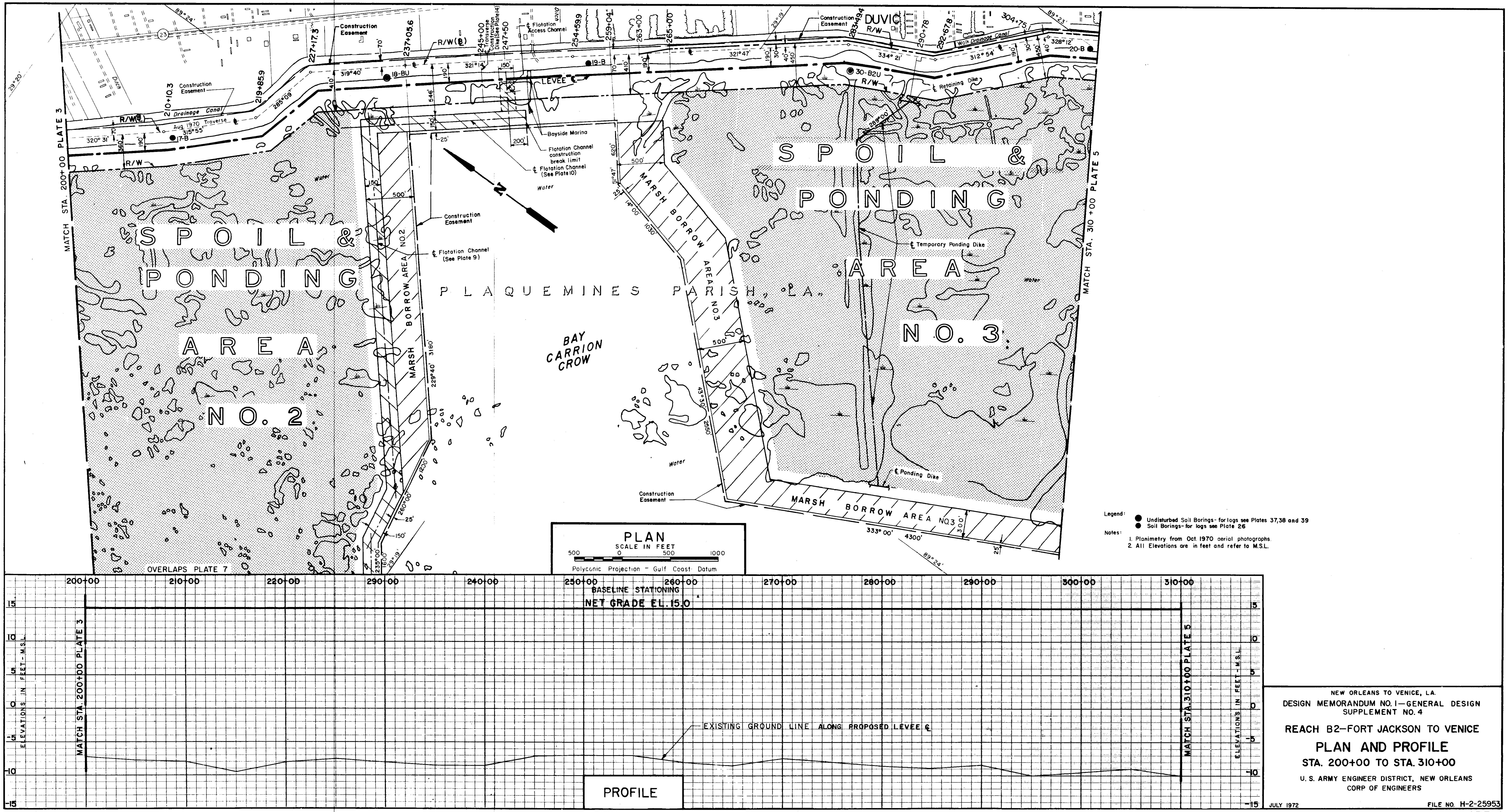
REACH B2—FORT JACKSON TO VENICE

PLAN AND PROFILE
STA. 84+00 TO STA. 200+00

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

JULY 1972 FILE NO. H-2-25953

PLATE 3




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2—FORT JACKSON TO VENICE

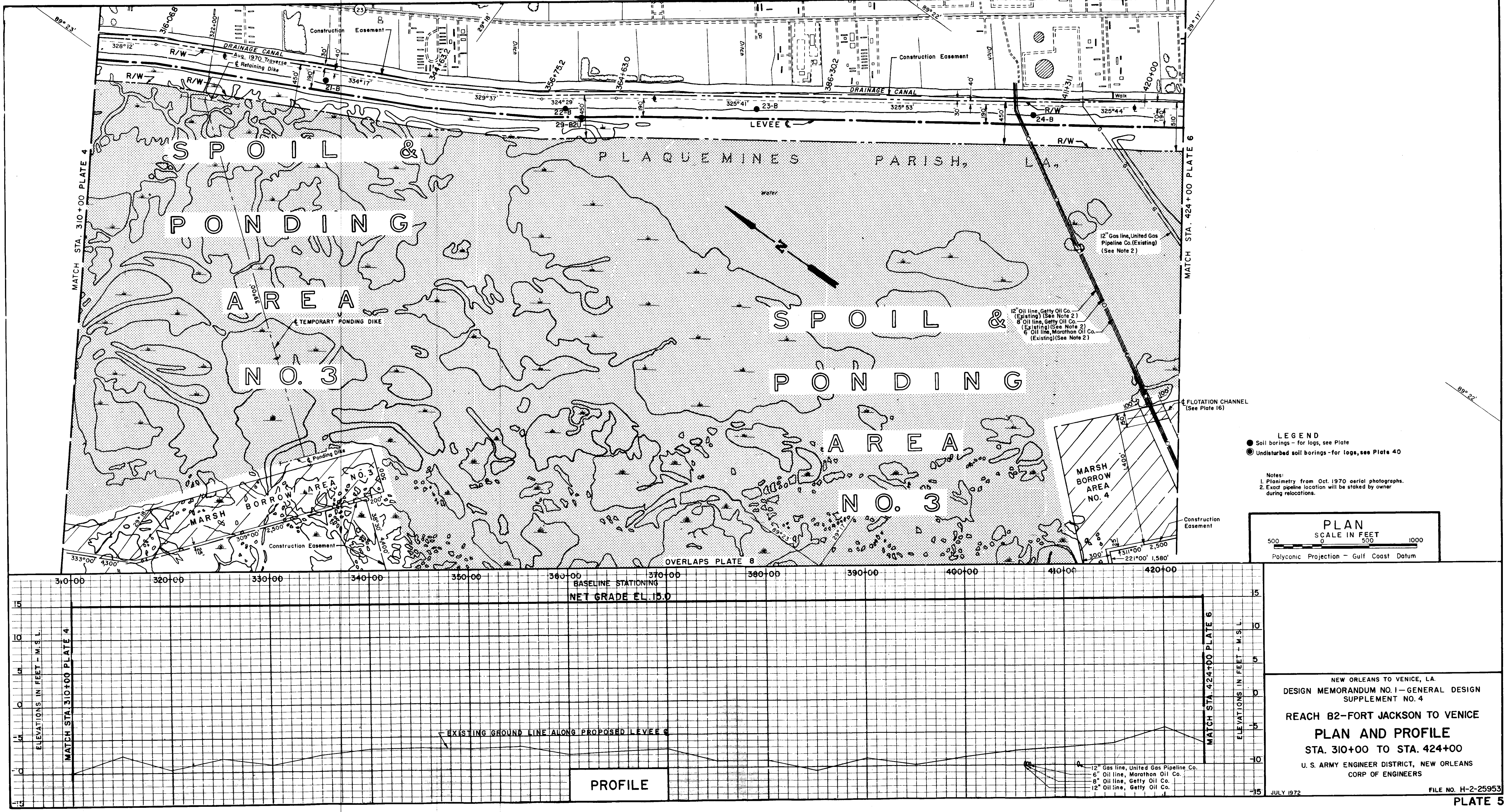
**PLAN AND PROFILE**

**STA. 200+00 TO STA. 310+00**

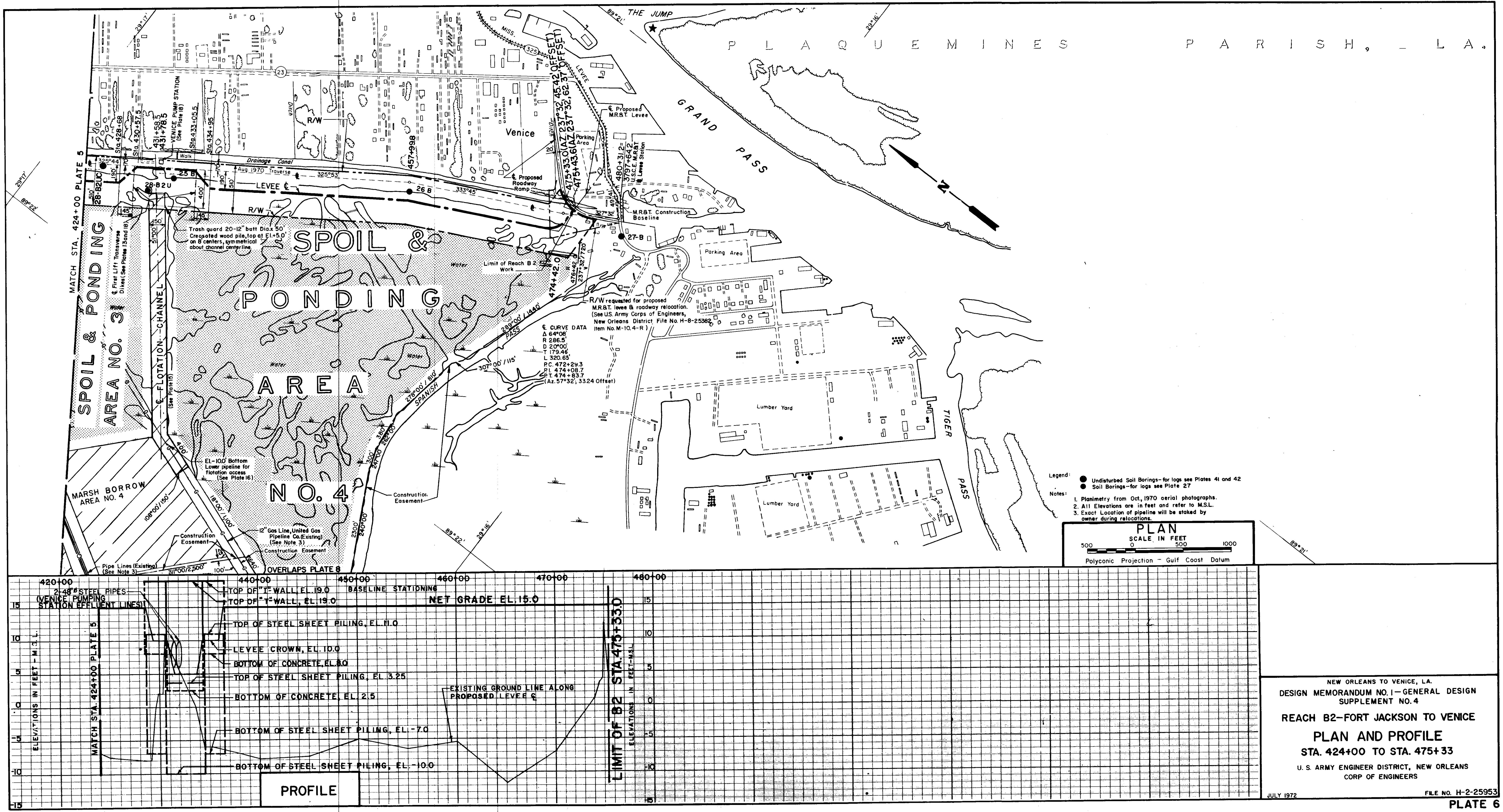
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS

JULY 1972 FILE NO. H-2-25953

**PLATE 4**



SPOIL & PONDING AREA NO. 3
SPOIL & PONDING AREA NO. 3
PLAQUEMINES PARISH, LA.
MARSH BORROW AREA NO. 3
MARSH BORROW AREA NO. 4
DRAINAGE CANAL
LEVEE ℄
R/W
Construction Easement
Aug. 1970 Traverse
℄ Retaining Dike
℄ TEMPORARY PONDING DIKE
℄ Ponding Dike
℄ FLOTATION CHANNEL (See Plate 16)
12" Gas line, United Gas Pipeline Co. (Existing) (See Note 2)
12" Oil line, Getty Oil Co. (Existing) (See Note 2)
8" Oil line, Getty Oil Co. (Existing) (See Note 2)
6" Oil line, Marathon Oil Co. (Existing) (See Note 2)
MATCH STA. 310+00 PLATE 4
MATCH STA. 424+00 PLATE 6
OVERLAPS PLATE 8
Walk
Water
LEGEND
Soil borings - for logs, see Plate
Undisturbed soil borings - for logs, see Plate 40
Notes:
1. Planimetry from Oct. 1970 aerial photographs.
2. Exact pipeline location will be staked by owner during relocations.
PLAN
SCALE IN FEET
500 0 500 1000
Polyconic Projection - Gulf Coast Datum
BASELINE STATIONING
NET GRADE EL. 15.0
EXISTING GROUND LINE ALONG PROPOSED LEVEE ℄
ELEVATIONS IN FEET - M.S.L.
12" Gas line, United Gas Pipeline Co.
6" Oil line, Marathon Oil Co.
8" Oil line, Getty Oil Co.
12" Oil line, Getty Oil Co.
PROFILE
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
PLAN AND PROFILE
STA. 310+00 TO STA. 424+00
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
JULY 1972
FILE NO. H-2-25953
PLATE 5




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2–FORT JACKSON TO VENICE

## PLAN AND PROFILE

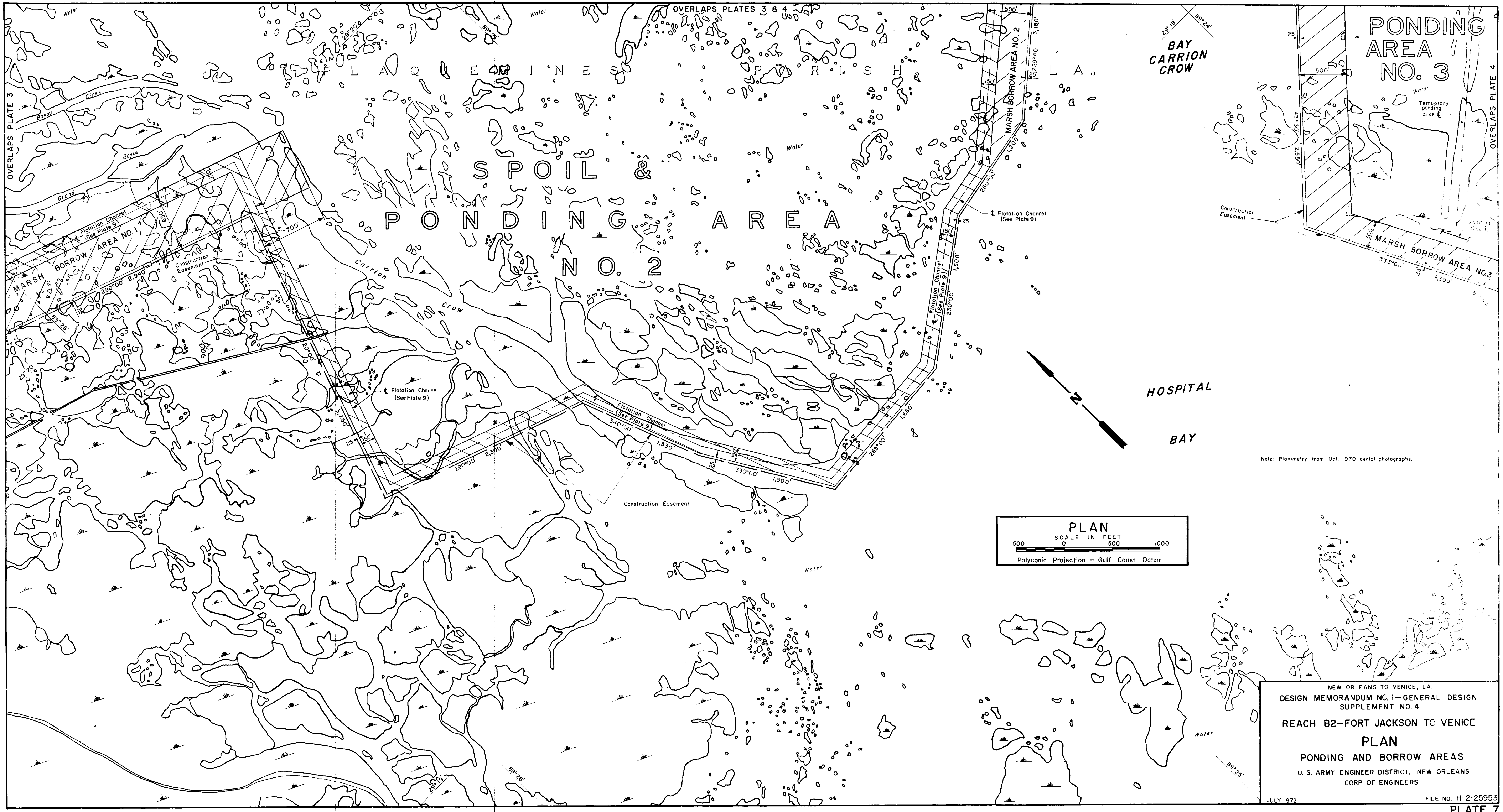
STA. 424+00 TO STA. 475+33

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

JULY 1972

FILE NO. H-2-25953

PLATE 6




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1–GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2–FORT JACKSON TO VENICE

**PLAN**

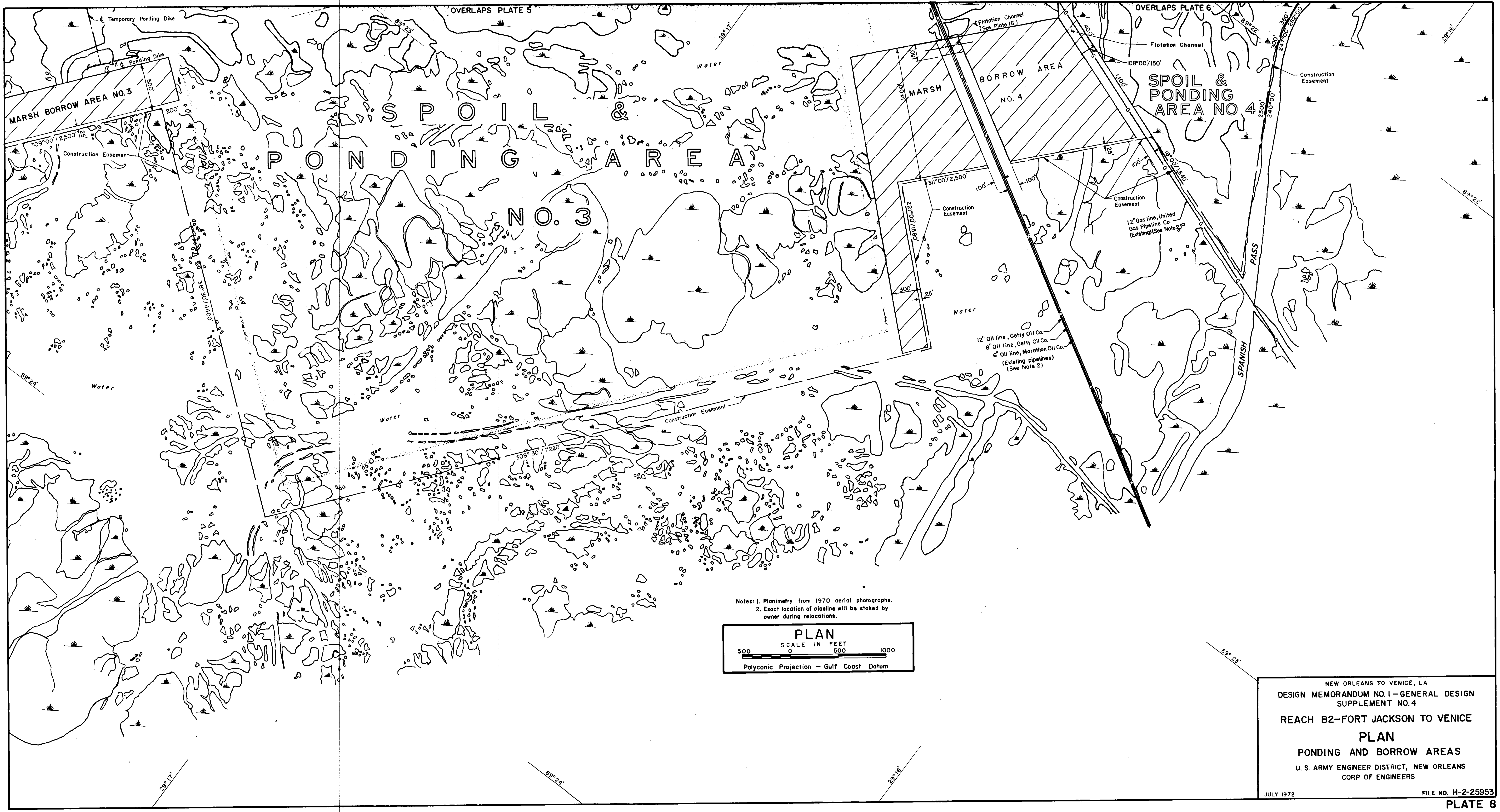
PONDING AND BORROW AREAS

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

JULY 1972

FILE NO. H-2-25953

PLATE 7




Notes: 1. Planimetry from 1970 aerial photographs.
2. Exact location of pipeline will be staked by owner during relocations.

**PLAN**
SCALE IN FEET
500 0 500 1000
Polyconic Projection – Gulf Coast Datum

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 – FORT JACKSON TO VENICE

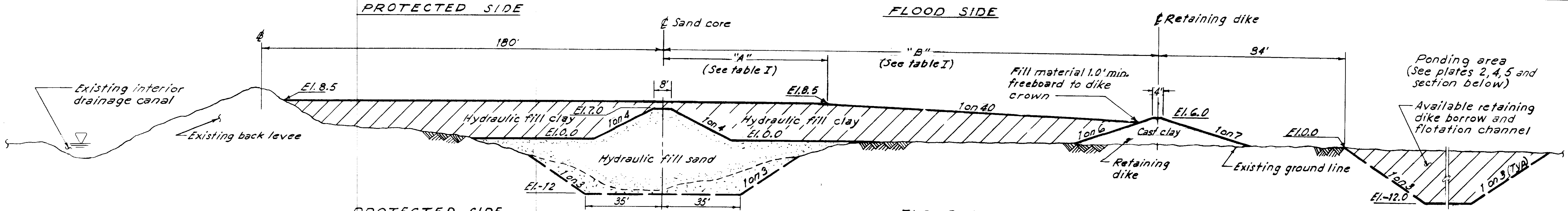
## PLAN

PONDING AND BORROW AREAS

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

JULY 1972 FILE NO. H-2-25953

PLATE 8

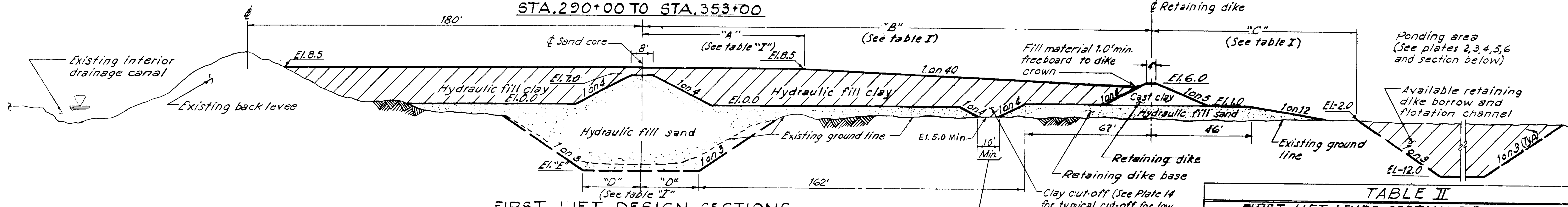



PROTECTED SIDE FLOOD SIDE

FIRST LIFT DESIGN SECTIONS

STA. 0+00 TO STA. 45+00

STA. 290+00 TO STA. 353+00




FIRST LIFT DESIGN SECTIONS

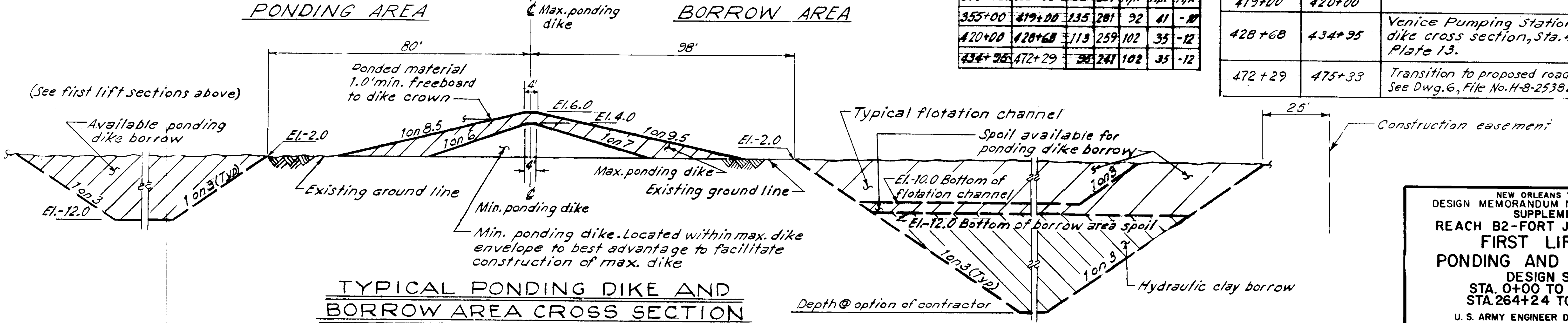
STA. 48+00 TO STA. 180+00
STA. 181+00 TO STA. 231+09.6
STA. 265+00 TO STA. 286+00
STA. 355+00 TO STA. 419+00
STA. 420+00 TO STA. 428+68
STA. 434+95 TO STA. 472+29

Notes:

1. Sections not to scale.
2. All elevations are in feet and refer to M.S.L.
3. Contractor to provide adequate controls and spill boxes in ponding dikes during hydraulic clay fill construction to clarify effluent.

| TABLE I | | | | | | |
|---|---|---|---|---|---|---|
| CROSS SECTIONS STA. | | DIMENSION (FT.) | | | | ELEV. |
| FROM | TO | "A" | "B" | "C" | "D" | "E" |
| 0+00 | 45+00 | 114 | 262 | N/A | N/A | N/A |
| 48+00 | 180+00 | 95 | 241 | 95 | 26 | -15 |
| 181+00 | 231+09.6 | 95 | 241 | 95 | 17 | -18 |
| 265+00 | 286+00 | 156 | 302 | 95 | 35 | -12 |
| 290+00 | 353+00 | 53 | 201 | N/A | N/A | N/A |
| 355+00 | 419+00 | 135 | 281 | 92 | 41 | -10 |
| 420+00 | 428+68 | 113 | 259 | 102 | 35 | -12 |
| 434+95 | 472+29 | 95 | 241 | 102 | 35 | -12 |

| TABLE II — FIRST LIFT LEVEE SECTION TRANSITIONS | | |
|---|---|---|
| BASELINE STATIONS | | REMARKS |
| FROM | TO | |
| 635+72.3 (B 1) | 0+00 | No transition required following construction of B1 First Lift. |
| 45+00 | 48+00 | |
| 180+00 | 181+00 | |
| 231+09.6 | 231+85.6 | See Plate 10 for section Sta. 231+85.6 to Sta. 264+24 |
| 264+24 | 265+00 | |
| 286+00 | 290+00 | |
| 353+00 | 355+00 | |
| 419+00 | 420+00 | |
| 428+68 | 434+95 | Venice Pumping Station. See transverse dike cross section, Sta. 430+13 and Sta. 435+50 Plate 13. |
| 472+29 | 475+33 | Transition to proposed roadway ramp. See Dwg. 6, File No. H-8-25382 reference. |



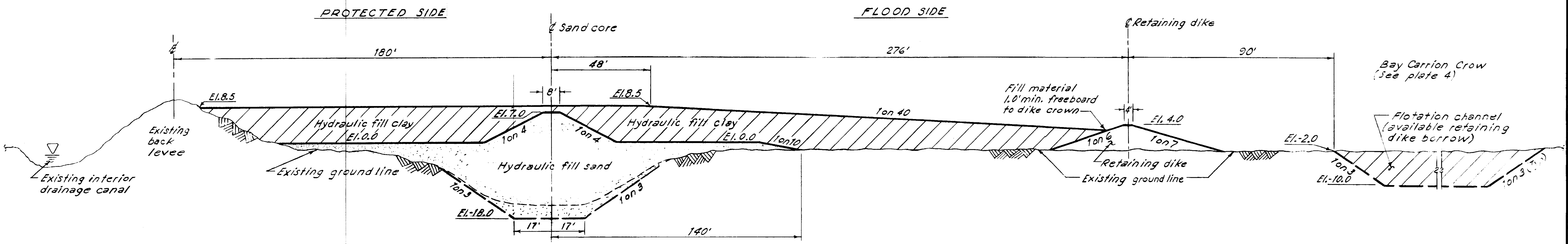

TYPICAL PONDING DIKE AND BORROW AREA CROSS SECTION

(SEE PLATES 2, 3, 4, 5, 6, 7 AND 8)

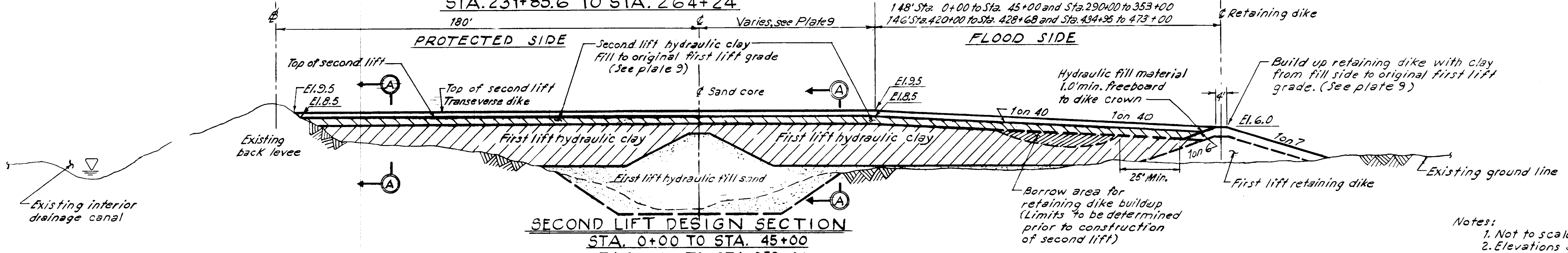
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE
FIRST LIFT LEVEE
PONDING AND BORROW AREA
DESIGN SECTIONS
STA. 0+00 TO STA. 231+85.6
STA. 264+24 TO STA. 475+33
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS

JULY 1972 FILE NO. H-2-25953

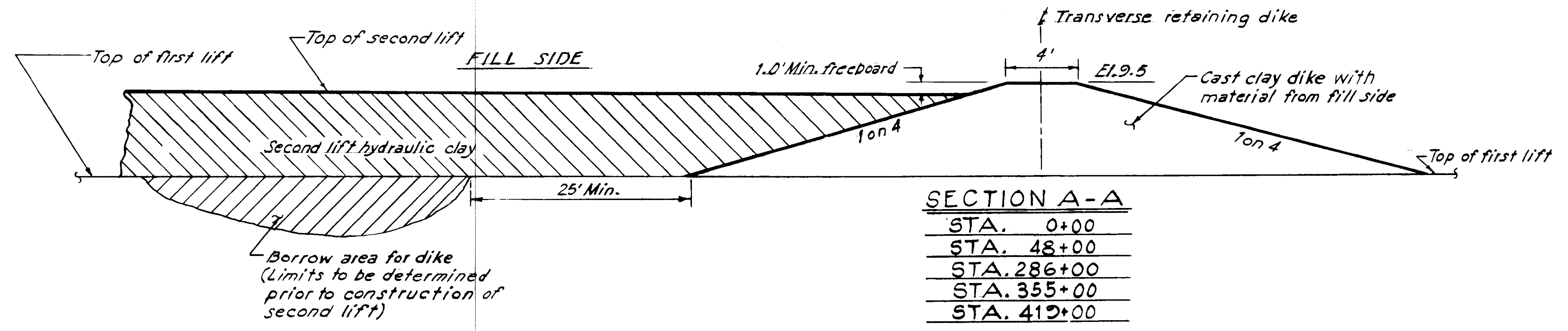
PLATE 9




FIRST LIFT DESIGN SECTION
STA. 231+85.6 TO STA. 264+24




SECOND LIFT DESIGN SECTION
STA. 0+00 TO STA. 45+00
STA. 290+00 TO STA. 353+00
STA. 420+00 TO STA. 428+68 (See note 3)
STA. 434+95 TO STA. 472+29 (See note 3)

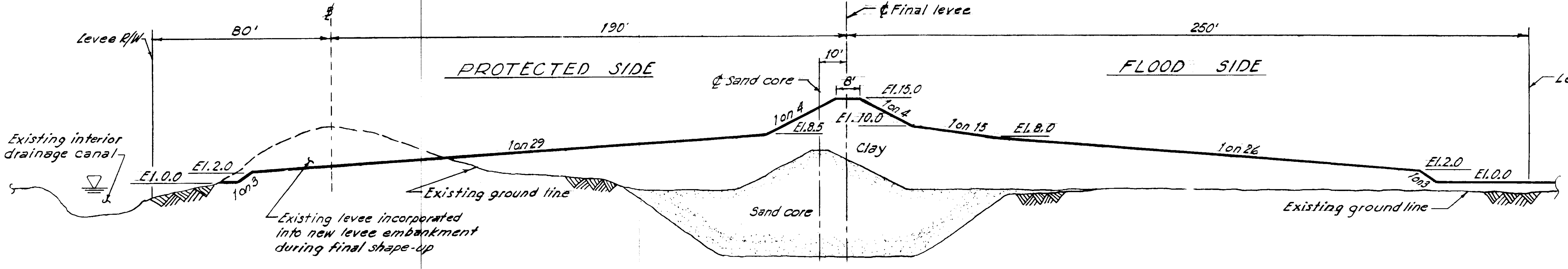



SECTION A-A
STA. 0+00
STA. 48+00
STA. 286+00
STA. 355+00
STA. 415+00

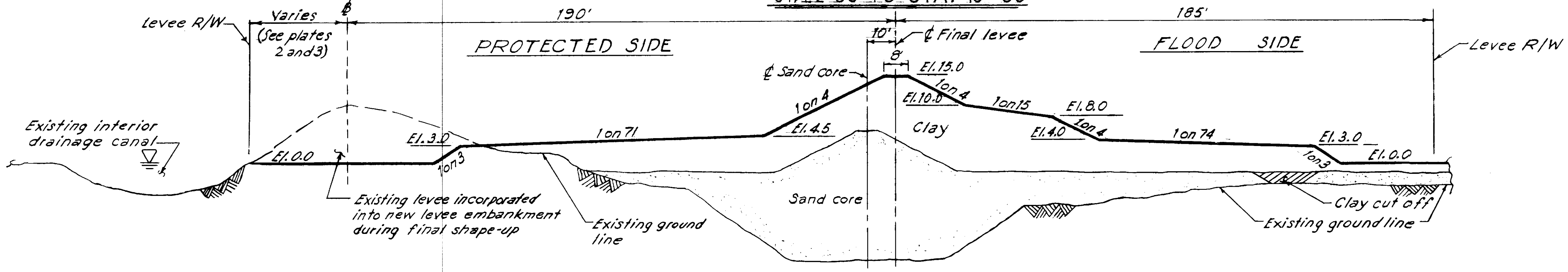
Notes:
1. Not to scale.
2. Elevations are in feet and refer to M.S.L.
3. See Sta. 430+13 and Sta. 433+50 transverse dike, Plate 13, for second lift details at Venice Pumping Station.
4. Contractor to provide adequate controls and spill boxes in ponding dikes during hydraulic clay fill construction to clarify effluent to acceptable limits.
5. See Plate 9, Table II for first lift levee section transitions.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

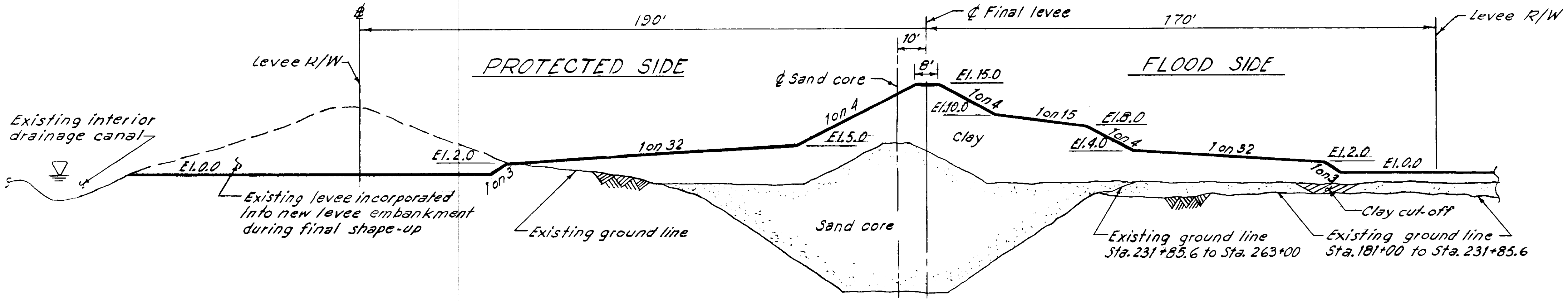
REACH B2-FORT JACKSON TO VENICE
FIRST LIFT DESIGN SECTION
STA. 231+85.6 TO STA. 264+24
SECOND LIFT DESIGN SECTION
STA. 0+00 TO STA. 472+29
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
JULY 1972 FILE NO. H-2-25953




STA. 2+00 TO STA. 45+00

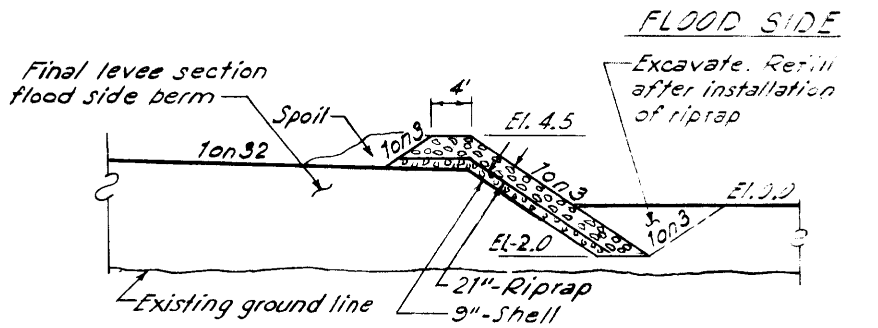



STA. 48+00 TO STA. 180+00




STA. 181+00 TO STA. 263+00

| TABLE I | | |
|---|---|---|
| FINAL LEVEE SECTION TRANSITIONS | | |
| BASELINE STATIONS | | REMARKS |
| FROM | TO | |
| 0+00 | 2+00 | See Plate 2 |
| 45+00 | 48+00 | |
| 180+00 | 181+00 | |
| 263+00 | 265+00 | |




SLOPE PROTECTION STA. 232+00 TO 263+00

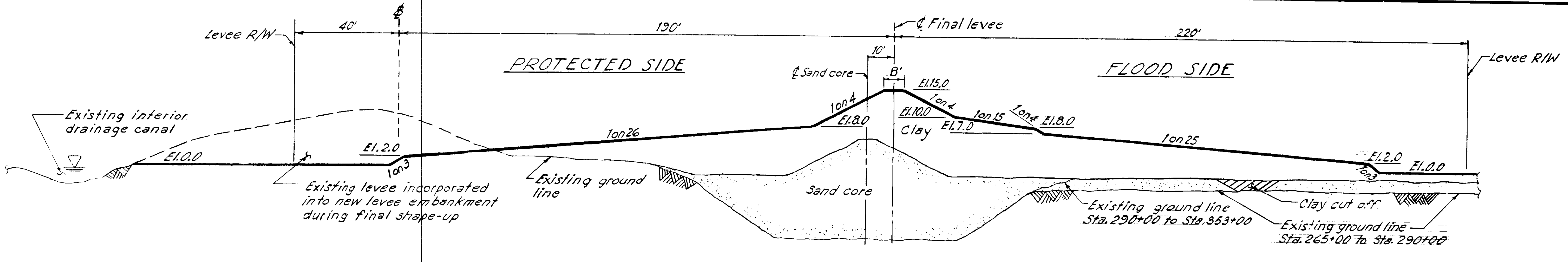
Notes:
1. Sections not to scale.
2. All elevations are in feet and refer to M. S. L.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

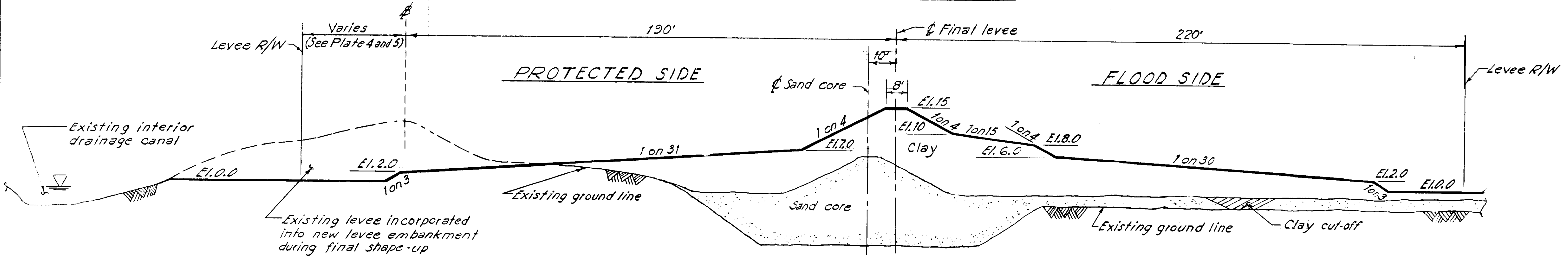
REACH B2—FORT JACKSON TO VENICE
FINAL LEVEE
DESIGN SECTIONS
STA. 0+00 TO STA. 265+00

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

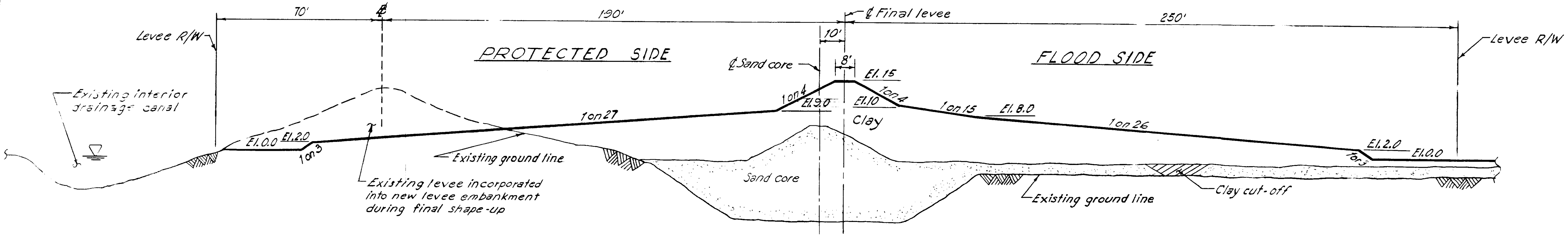
JULY 1972 FILE NO. H-2-25953




STA 265 +00 TO STA. 353+00




STA. 355+00 TO STA. 419 +00




STA. 420+00 TO STA. 428+58

STA. 435+05 TO STA. 472 +29

## TABLE I

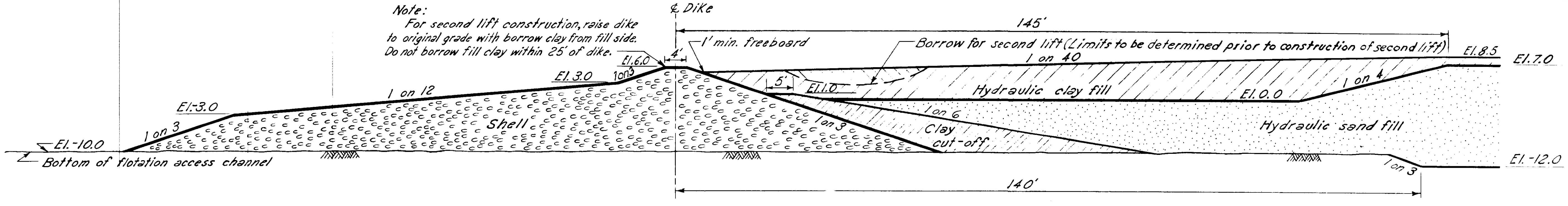
| FINAL LEVEE SECTION TRANSITIONS | | |
|---|---|---|
| BASELINE STATIONS | | REMARKS |
| FROM | TO | |
| 353+00 | 355+00 | |
| 419+00 | 420+00 | |
| 428 +58 | 435+05 | Venice pumping station floodwall. See Plate 18. |
| 472+29 | 475+33 | Transition to proposed roadway ramp. See Dwg. 3, File No. H-8-25382 reference. |

Notes:
1. Sections not to scale.
2. All elevations are in feet and refer to M.S.L.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

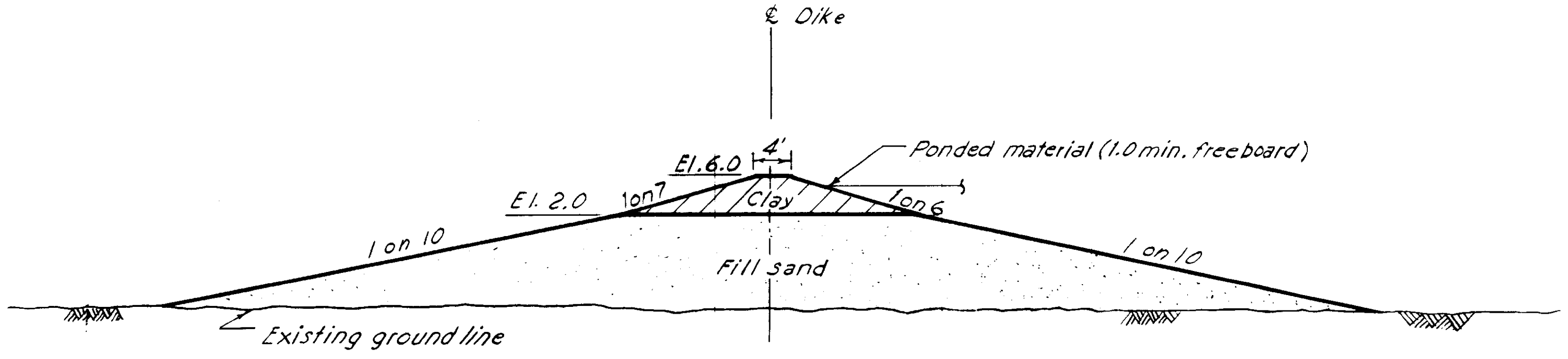
REACH B2–FORT JACKSON TO VENICE
**FINAL LEVEE**
DESIGN SECTIONS
STA. 265+00 TO STA. 475+33
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS

JULY 1972 FILE NO. H-2-25953



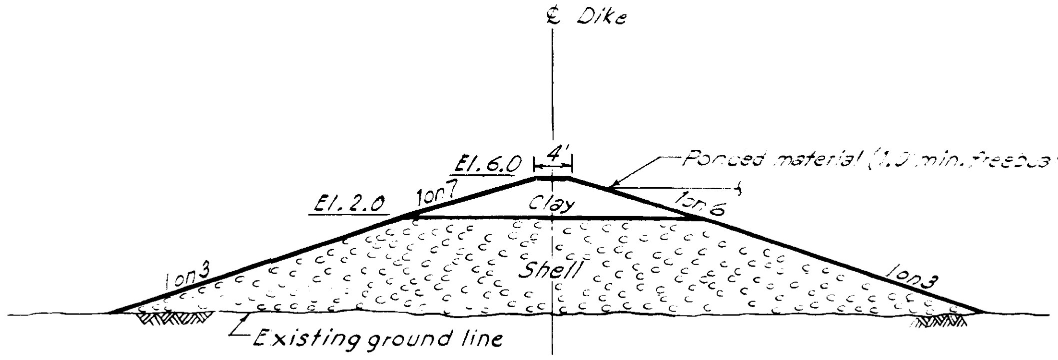

TRANSVERSE DIKE

STA. 430+13 AND STA. 433+50



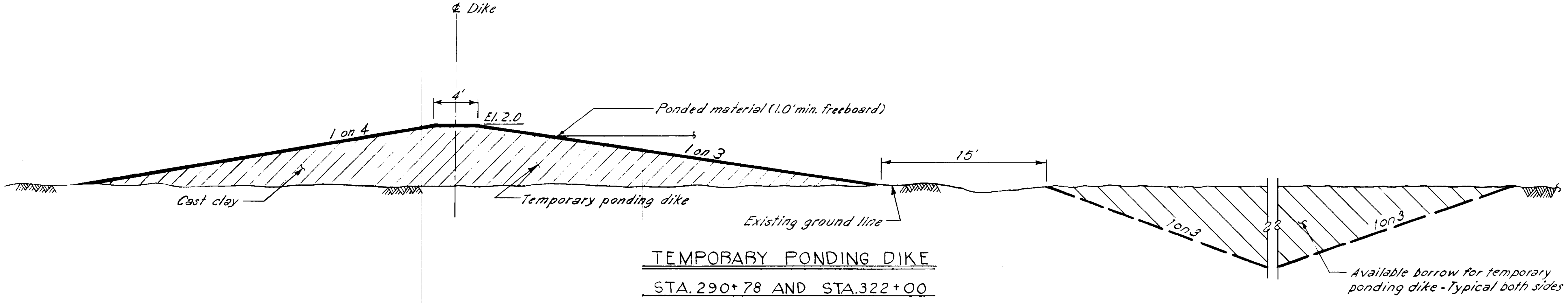

TYPICAL PONDING DIKE FOR CANALS, BAYOUS, AND LOW AREA CLOSURES

(SEE PLATES 2, 3, 4, 5, 6, 7 and 8)




TYPICAL SHELL BASE PONDING DIKE FOR FLOTATION CHANNEL CLOSURES

(SEE PLATES 2, 3, 4, 5, 6, 7 AND 8)




TEMPORARY PONDING DIKE

STA. 290+78 AND STA. 322+00

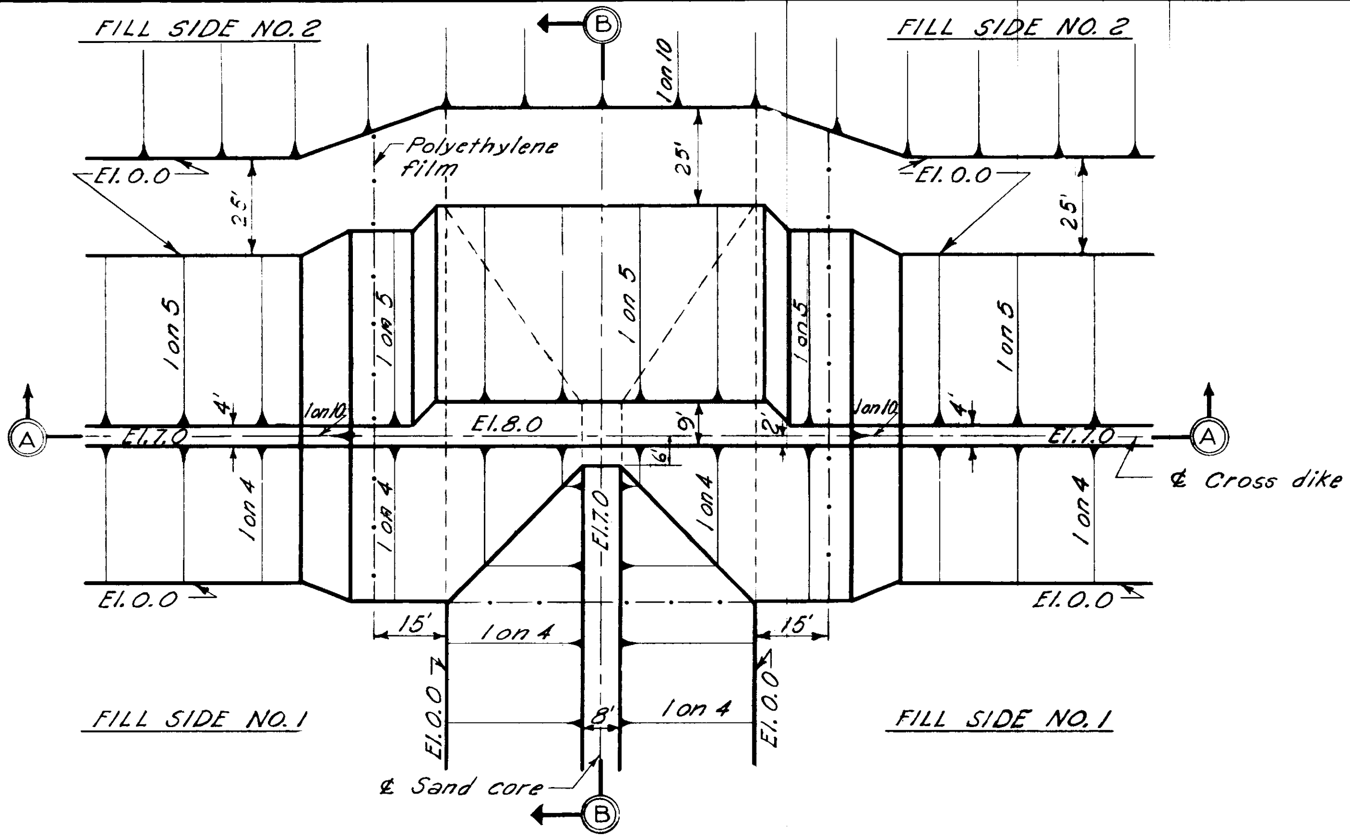
Notes:
1. Sections not to scale.
2. All elevations are in feet and refer to M.L.G.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2—FORT JACKSON TO VENICE

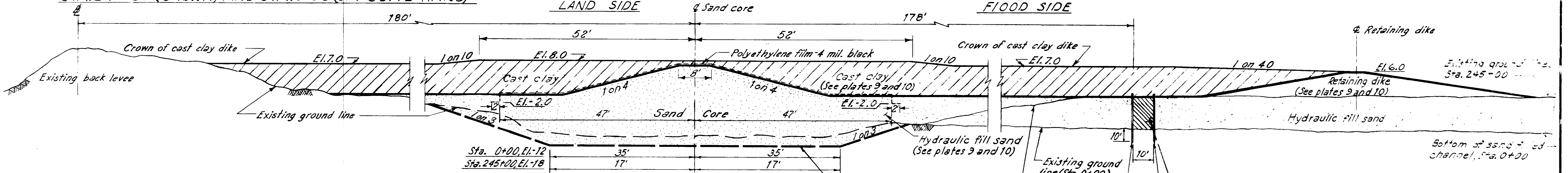
## TRANSVERSE AND TYPICAL PONDING DIKES

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

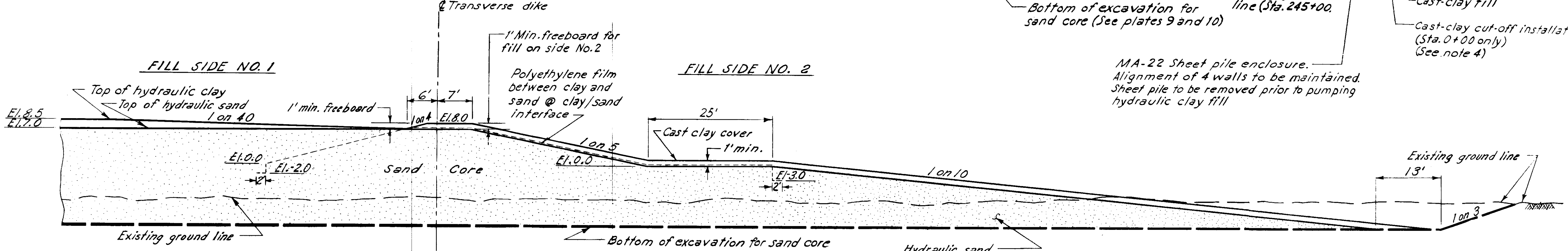
JULY 1972 FILE NO. H-2-25953




TRANSVERSE DIKE PLAN
STA. 245+00 (SHOWN) AND STA. 0+00 (OPPOSITE HAND)




SECTION A-A




SECTION B-B

Notes:

1. Sections not to scale.
2. All elevations are in feet and refer to M.S.L.
3. For second lift, Sta. 0+00 only, and to fill side No. 2, Sta. 0+00 and Sta. 245+00, raise dike to original grade with hydraulic fill clay. Do not remove clay within 25' of dike and do not remove or alter sand fill. See plate 10.
4. Cast clay cut-off installation is typical for Reach B-2 locations with low elevation channels that intersect and pass under the floodside of levee.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

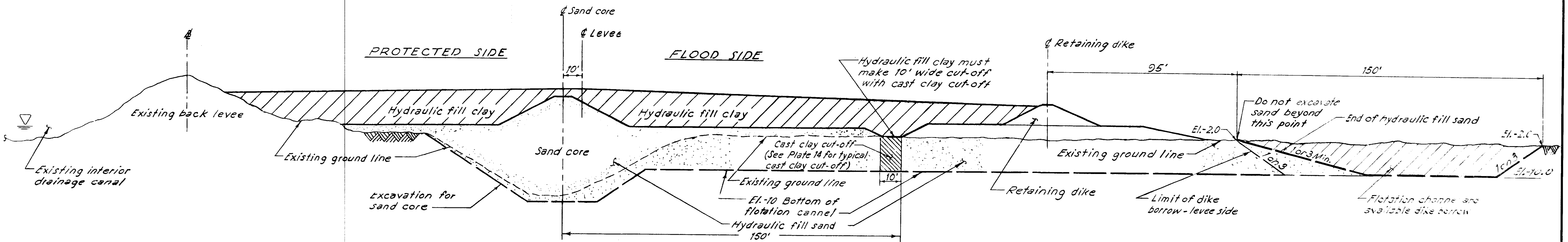
REACH B2-FORT JACKSON TO VENICE
FIRST AND SECOND LIFT
TRANSVERSE DIKES
STA. 0+00 AND STA. 245+00

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

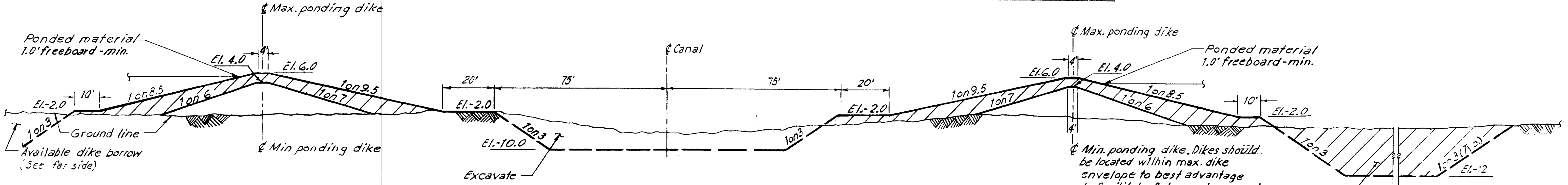
JULY 1972

FILE NO. H-2-25953

PLATE 14

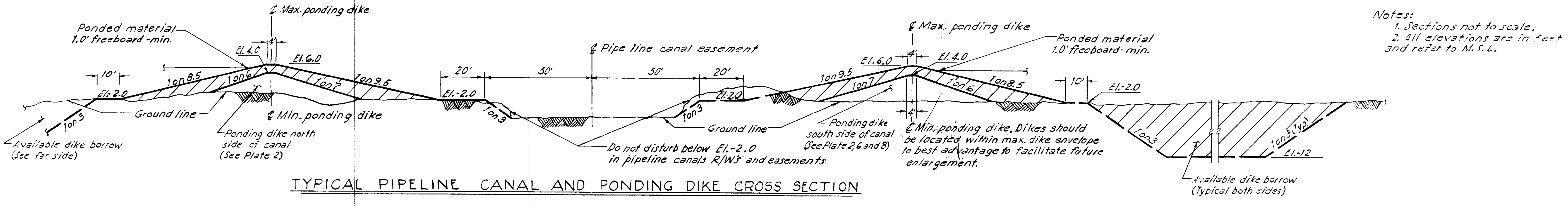



TYPICAL LEVEE CROSS SECTION @ FLOTATION CHANNELS
STA. 53+77.2, STA. 69+40 AND STA. 247+50




VENICE PUMPING STATION FLOTATION CHANNEL

Notes:
1. Sections not to scale.
2. All elevations are in feet and refer to M. S. L.




TYPICAL PIPELINE CANAL AND PONDING DIKE CROSS SECTION

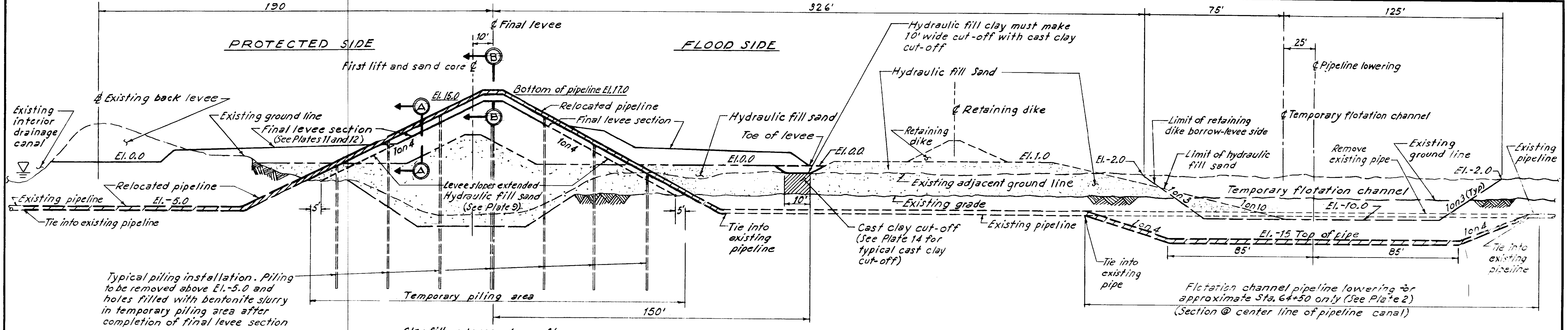
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 – FORT JACKSON TO VENICE

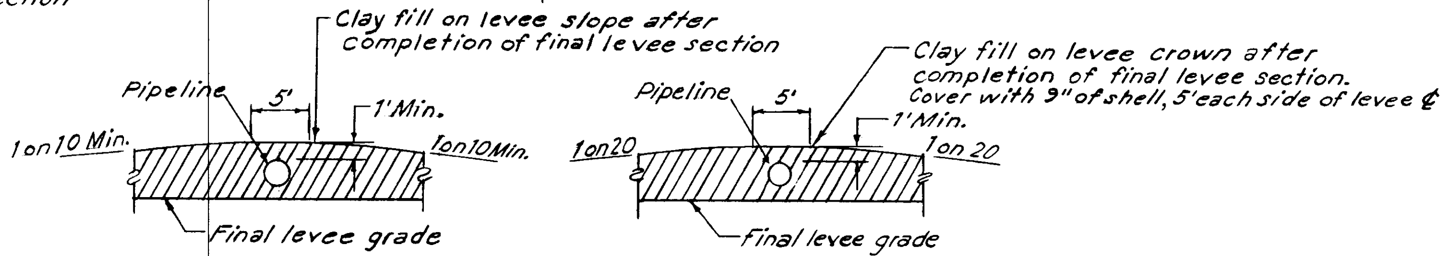
CANAL AND CHANNEL
DESIGN SECTIONS

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

JULY 1972 FILE NO. H-2-25953

PLATE 15



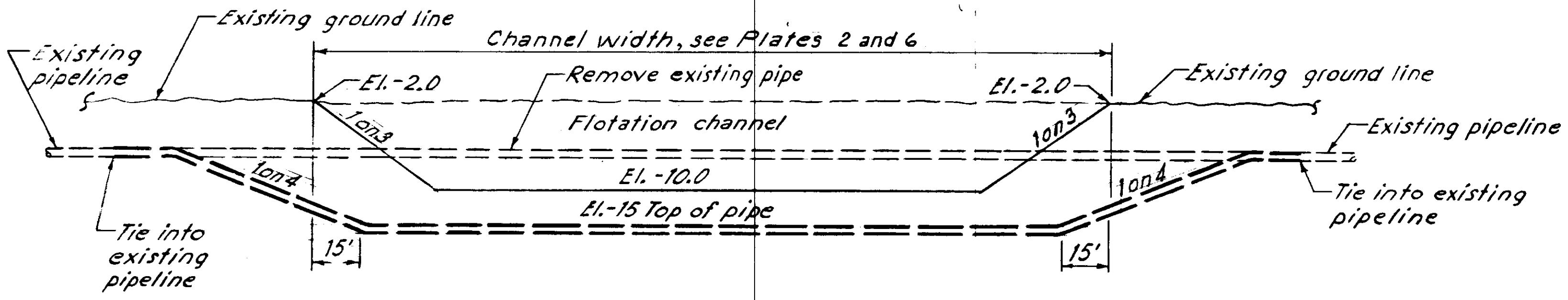




## PROPOSED TYPICAL PIPELINE LEVEE SURFACE CROSSING

STA. 64+50, STA. 416+10, STA. 406+15, STA. 406+50 AND STA. 413+30

Notes:

1. Sections not to scale.
2. All elevations are in feet and refer to M.S.L.
3. Pipelines will cross levee right-of-way at 90° to levee centerline.
4. Pipeline owners will design pipeline relocations and submit designs to U.S. Army, Corp. Of Engineers, New Orleans District for approval prior to construction.




## TYPICAL PIPELINE LOWERING

(SEE PLATES 2 AND 6)

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

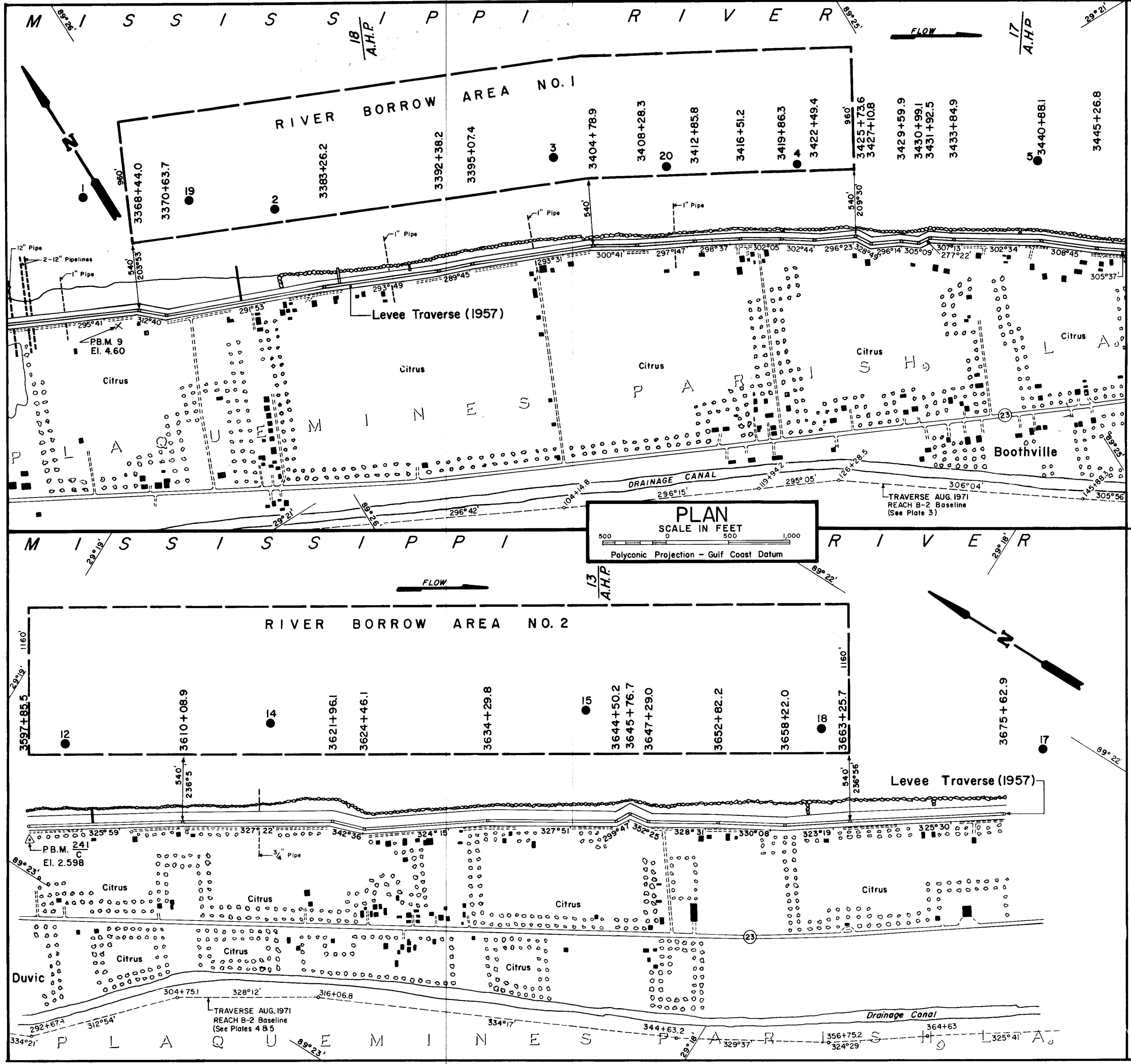
REACH B2—FORT JACKSON TO VENICE

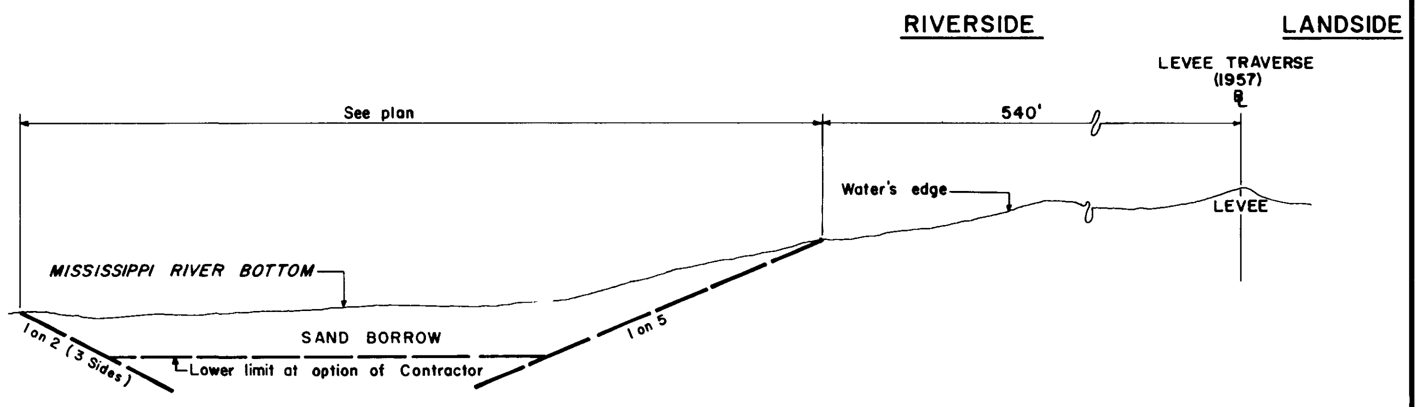
TYPICAL PIPELINE
RELOCATION DETAILS

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

JULY 1972 — FILE NO. H-2-25953

PLATE 16




TYPICAL RIVER BORROW AREA

NOT TO SCALE

LEGEND

● Soil borings taken by State of Louisiana, Department of Highways, 1966. See PLATES 31 AND 32

NOTES:
All elevations are in feet and refer to M. S. L.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2–FORT JACKSON TO VENICE

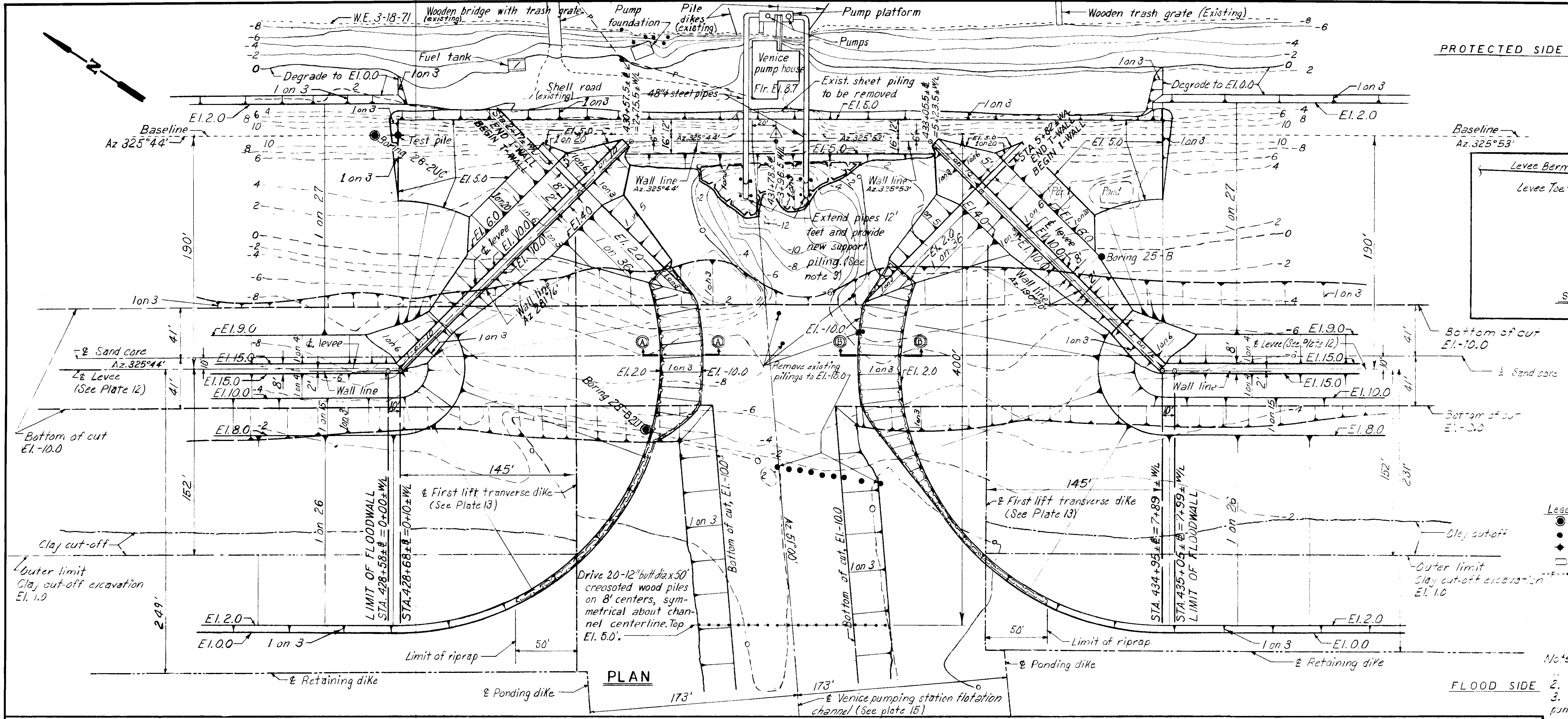
**RIVER SAND BORROW AREAS AND SOIL BORING LOCATIONS**

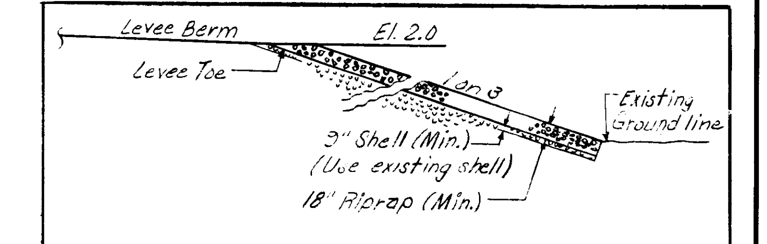
MILE 12 TO MILE 19 A. H. P.

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

JULY 1972 FILE NO. H-2-25953

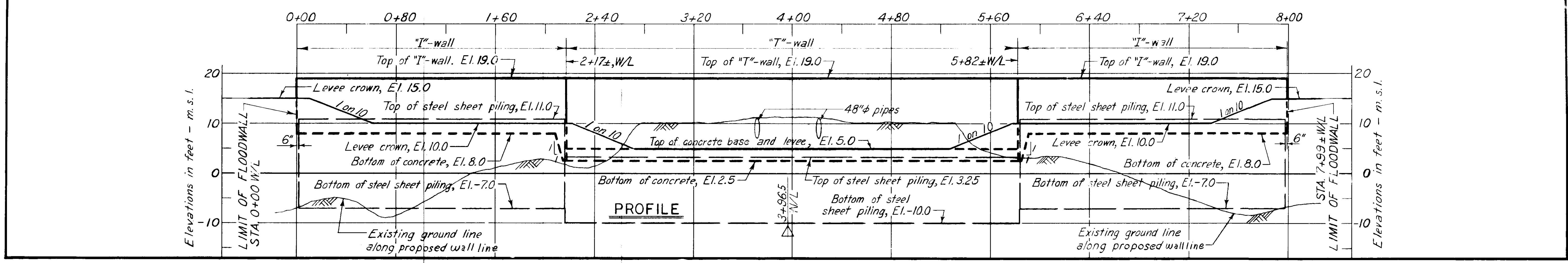
**PLATE 17**




SECTION A-A
SECTION B-B (Opposite hand)

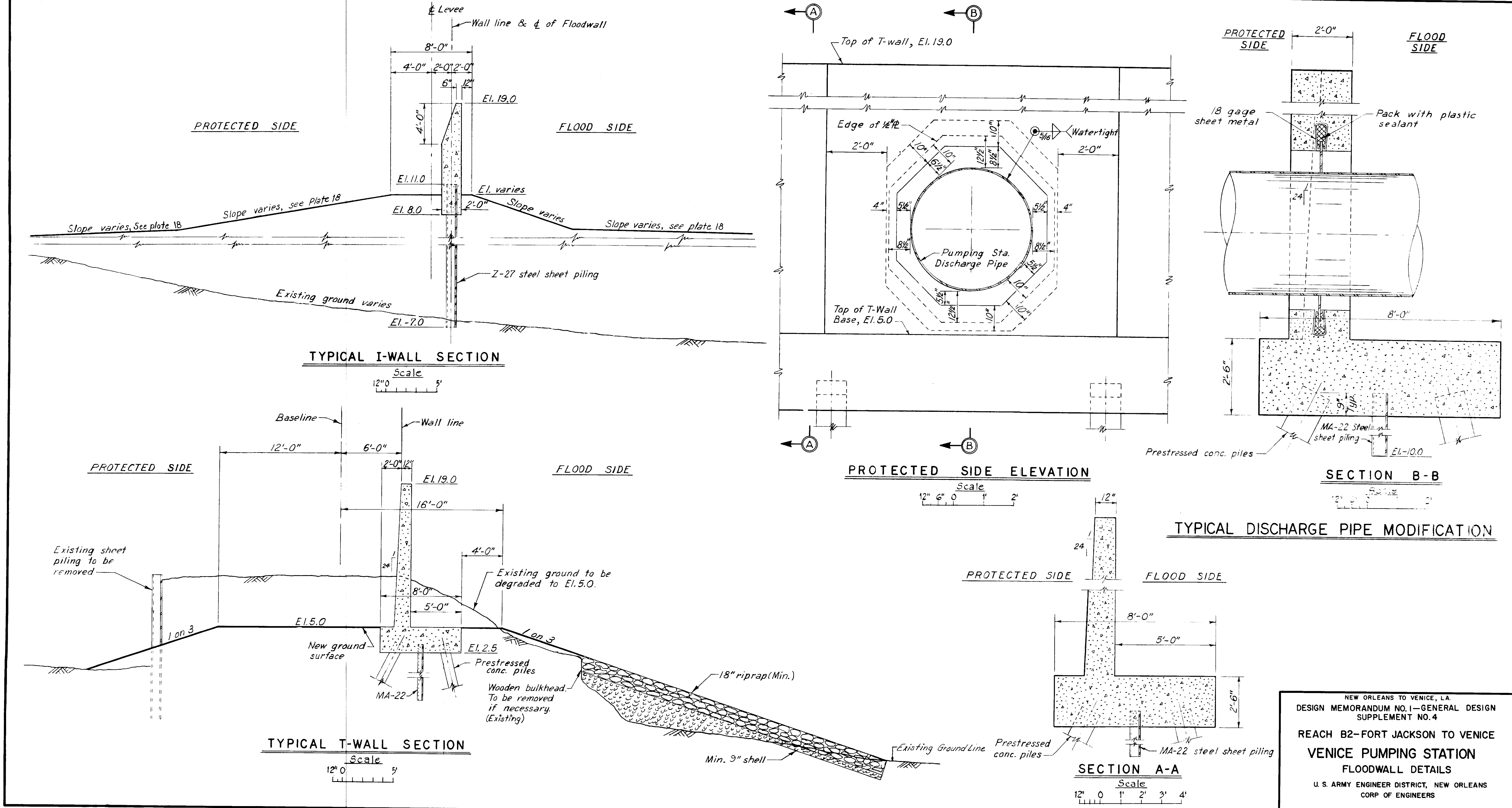
Legend
- Undisturbed soil borings - For logs see plate...
- Soil borings - For logs see plate 27.
- TEST PILE - 12" square concrete.
- Limit of riprap.
- --p---•-- Existing Electrical Power line.




Notes:
1. Not to scale.
2. Elevations are in feet and refer to M.S.L.
3. Fuel tank, pumps, pump house, pump foundation, pump platform, and 48" dia. Steel pipes are existing installations except as noted.
4. Extension of pipes and support piling installation to be accomplished by local interests.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
## VENICE PUMPING STATION
PLAN AND PROFILE
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORP OF ENGINEERS
JULY 1972
FILE NO. H-2-25953

PLATE 18




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1—GENERAL DESIGN
SUPPLEMENT NO. 4

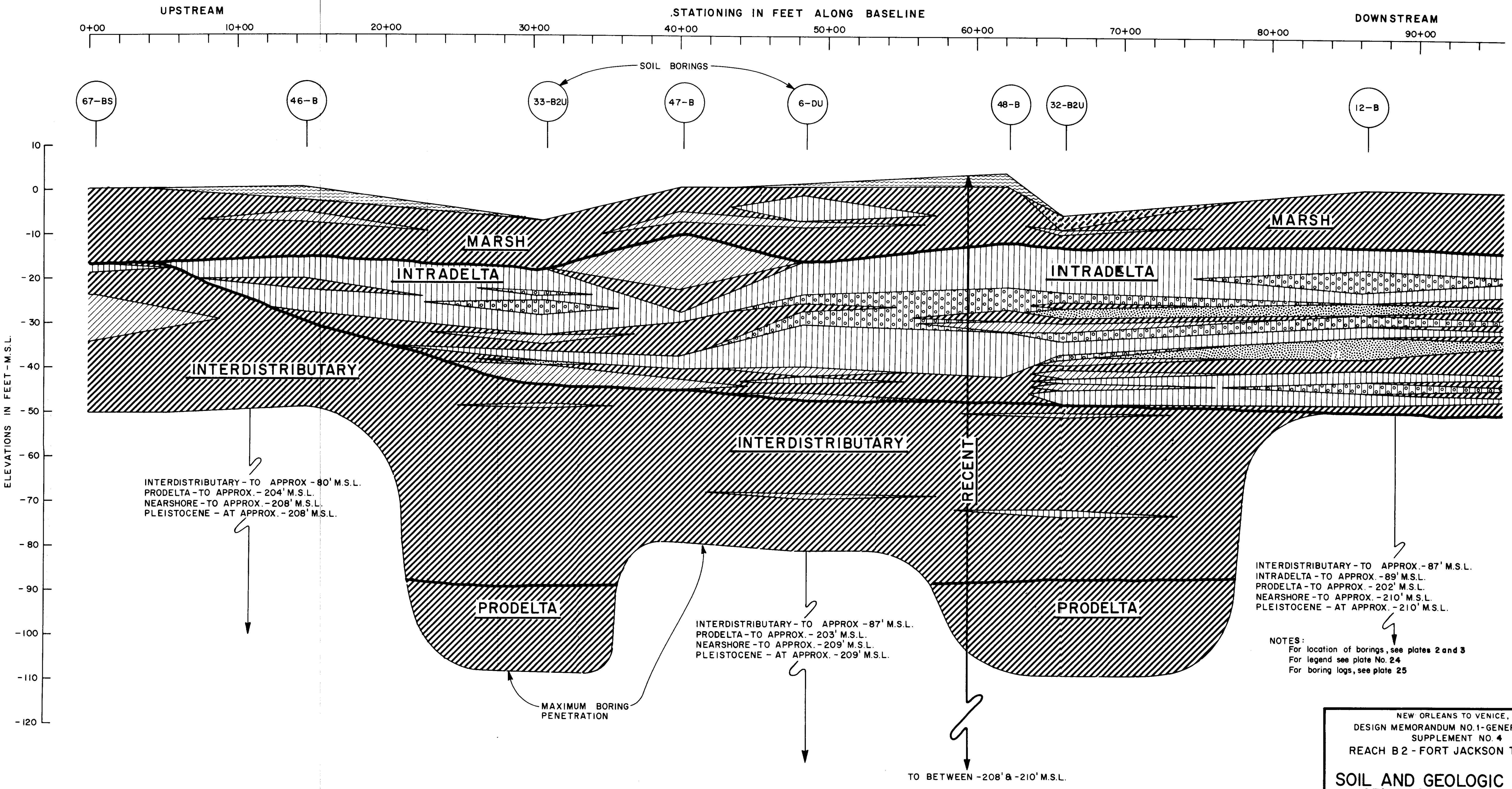
REACH B2—FORT JACKSON TO VENICE

**VENICE PUMPING STATION**

FLOODWALL DETAILS

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

JULY 1972 FILE NO. H-2-25953



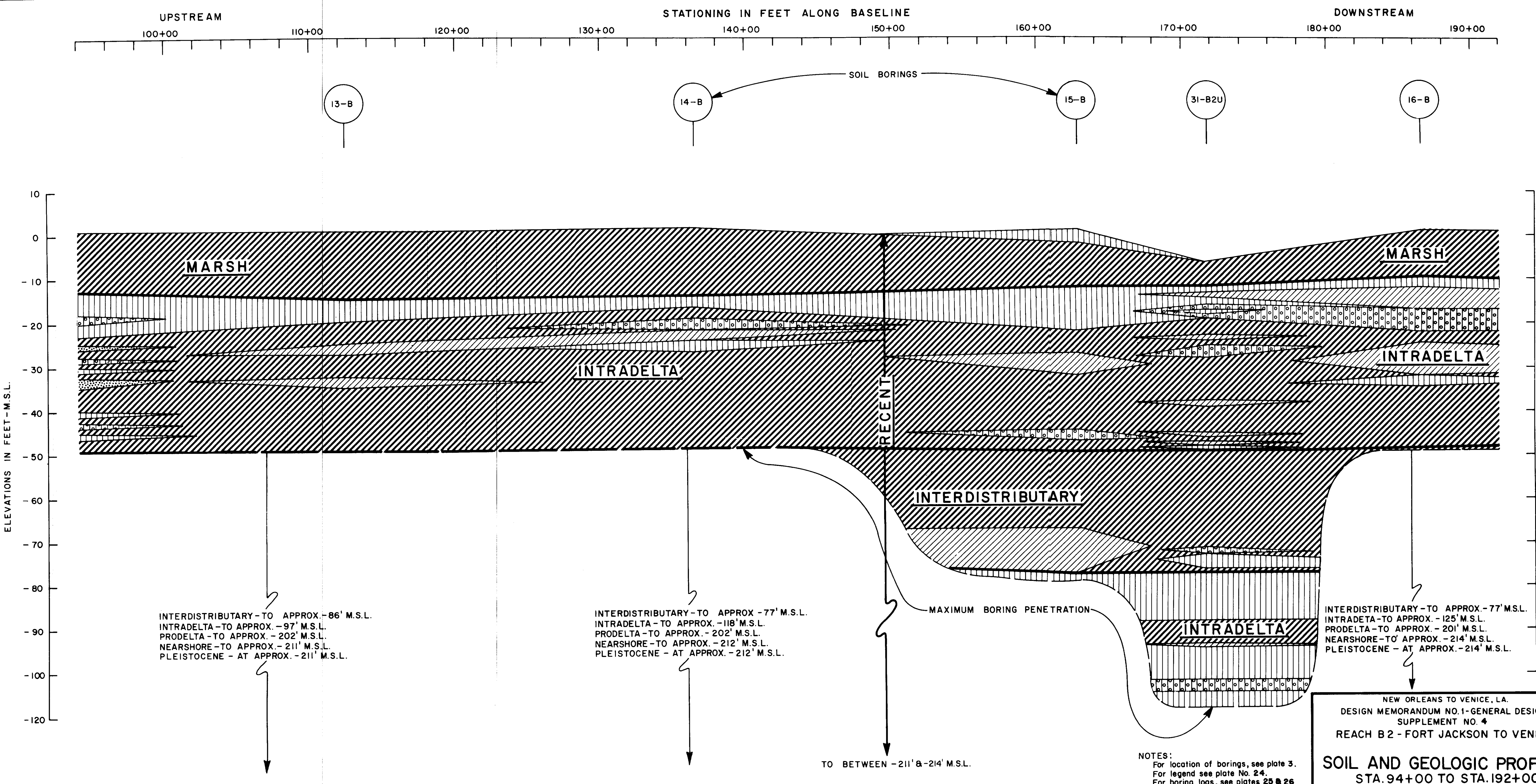

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# SOIL AND GEOLOGIC PROFILE
## STA. 0+00 TO STA. 94+00

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

JULY 1972 FILE NO. H-2-25953

PLATE 20




NOTES:
For location of borings, see plate 3.
For legend see plate No. 24.
For boring logs, see plates 25 & 26

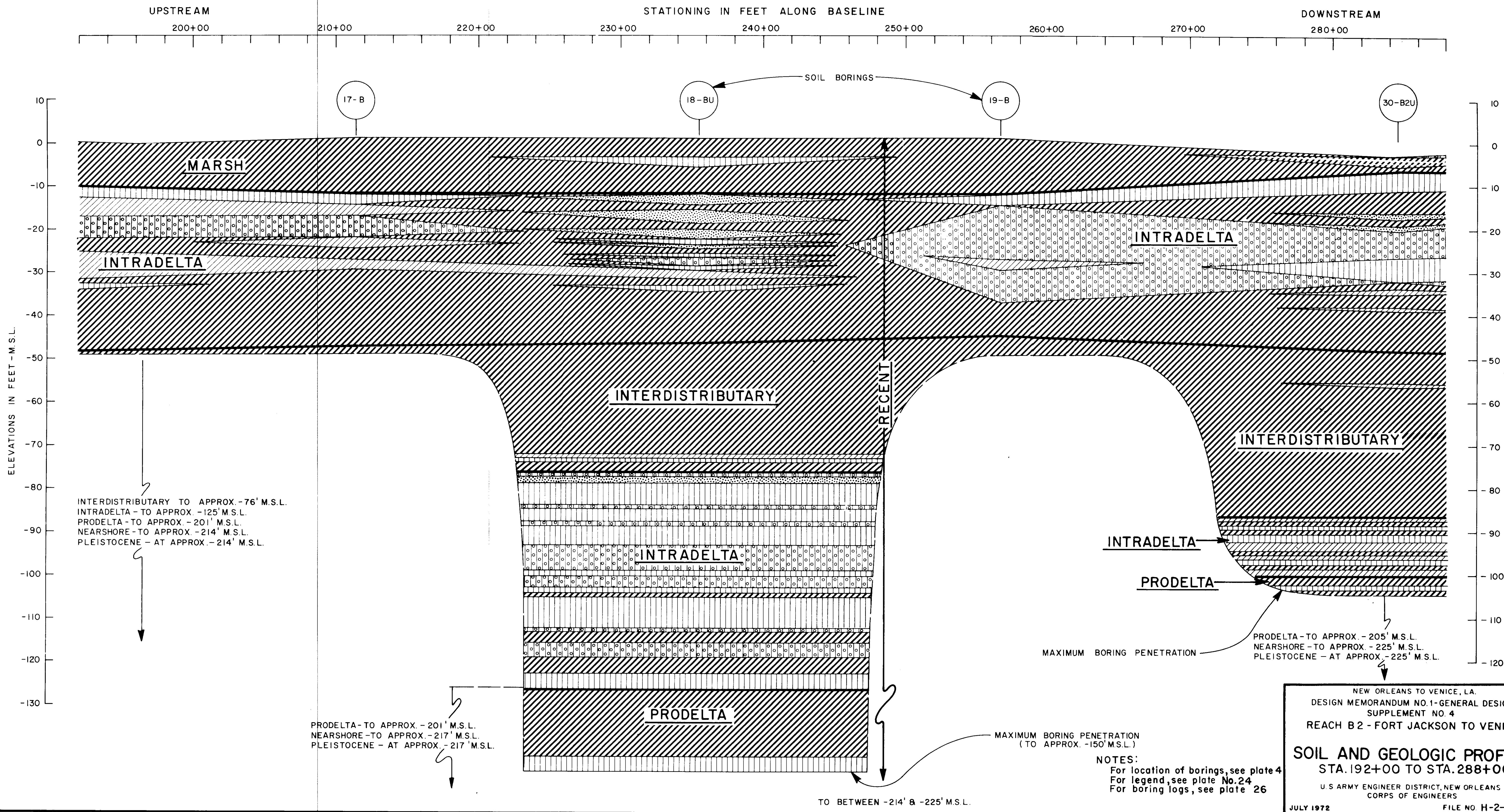
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# SOIL AND GEOLOGIC PROFILE
STA. 94+00 TO STA. 192+00

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

JULY 1972 FILE NO. H-2-25953

PLATE 21



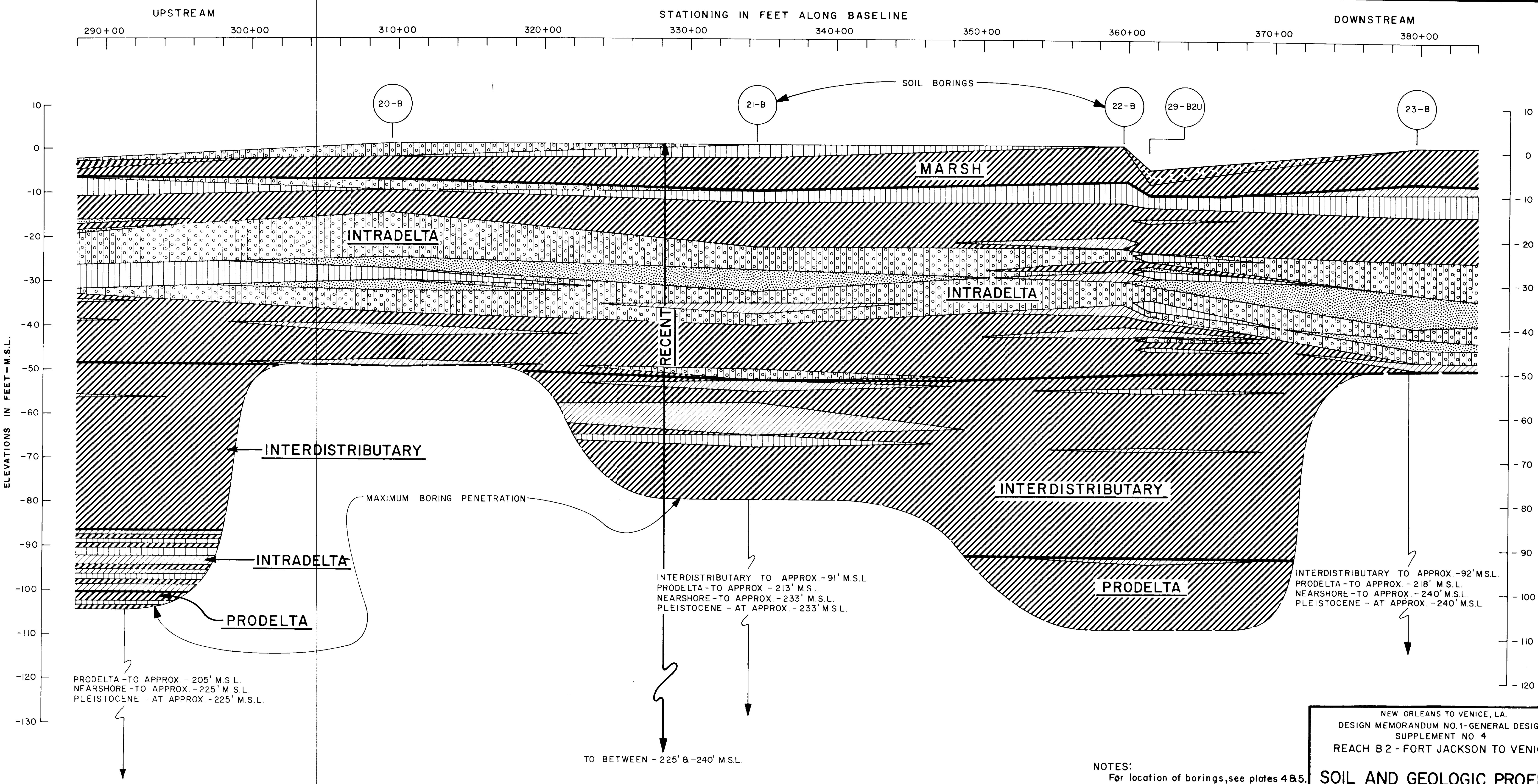

NOTES:
For location of borings, see plate 4
For legend, see plate No. 24
For boring logs, see plate 26

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# SOIL AND GEOLOGIC PROFILE
STA. 192+00 TO STA. 288+00

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

JULY 1972 FILE NO. H-2-25953




NOTES:
For location of borings, see plates 4 & 5.
For legend, see plate No. 24.
For boring logs, see plates 26 & 27.

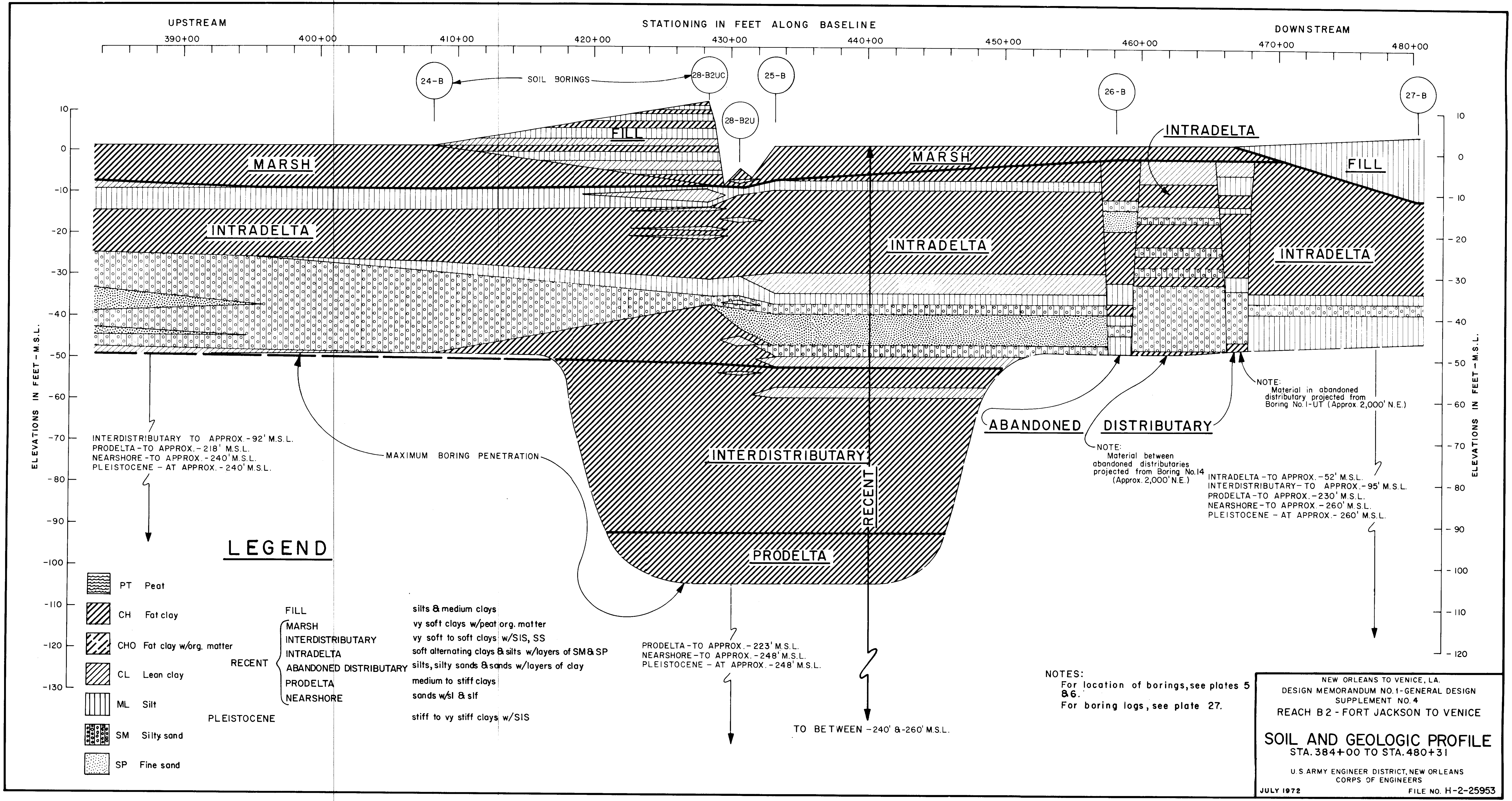
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# SOIL AND GEOLOGIC PROFILE

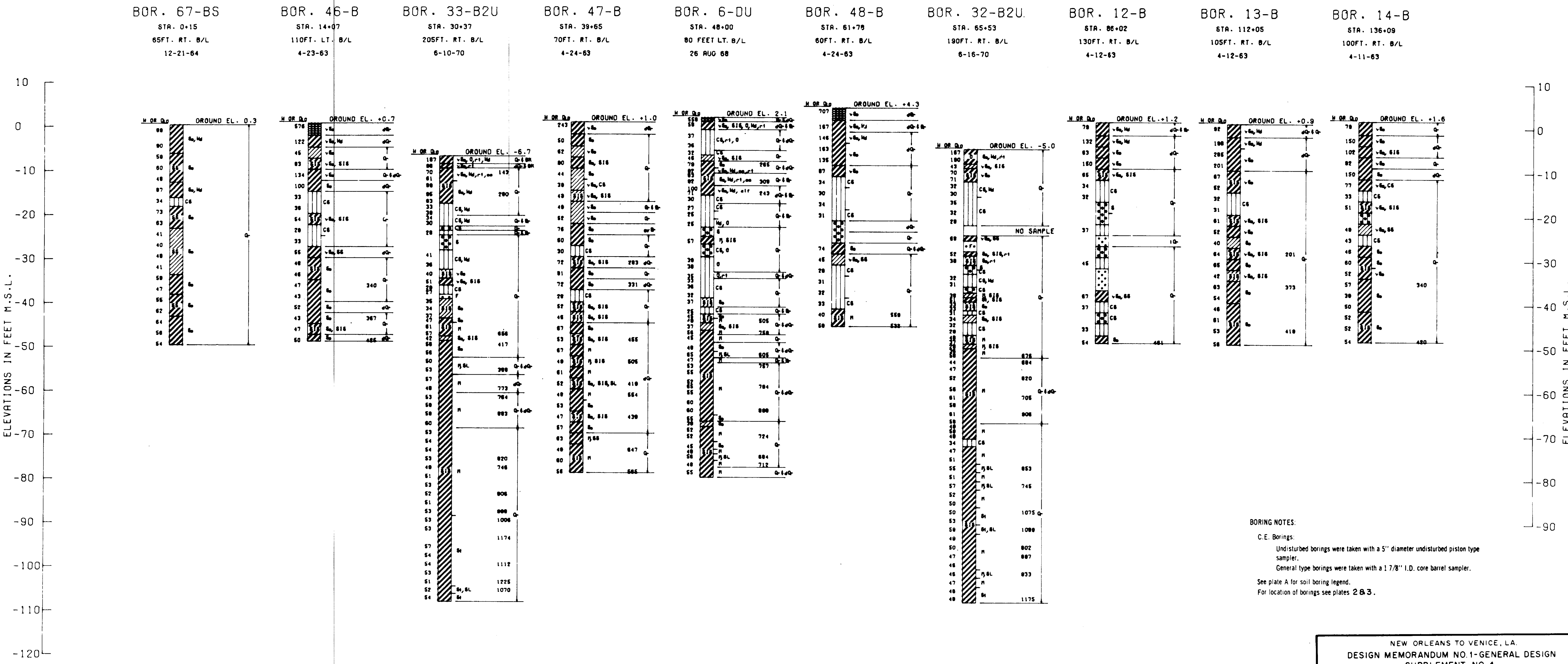
STA. 288+00 TO STA. 384+00

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

JULY 1972 FILE NO. H-2-25953



UPSTREAM
STATIONING IN FEET ALONG BASELINE
DOWNSTREAM
390+00
400+00
410+00
420+00
430+00
440+00
450+00
460+00
470+00
480+00
24-B
SOIL BORINGS
28-B2UC
25-B
28-B2U
26-B
27-B
FILL
MARSH
INTRADELTA
INTERDISTRIBUTARY
PRODELTA
RECENT
ABANDONED DISTRIBUTARY
ELEVATIONS IN FEET-M.S.L.
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
INTERDISTRIBUTARY TO APPROX.-92' M.S.L.
PRODELTA-TO APPROX.-218' M.S.L.
NEARSHORE-TO APPROX.-240' M.S.L.
PLEISTOCENE - AT APPROX.-240' M.S.L.
MAXIMUM BORING PENETRATION
NOTE: Material in abandoned distributary projected from Boring No. 1-UT (Approx. 2,000' N.E.)
NOTE: Material between abandoned distributaries projected from Boring No.14 (Approx. 2,000' N.E.)
INTRADELTA-TO APPROX.-52' M.S.L.
INTERDISTRIBUTARY-TO APPROX.-95' M.S.L.
PRODELTA-TO APPROX.-230' M.S.L.
NEARSHORE-TO APPROX.-260' M.S.L.
PLEISTOCENE - AT APPROX.-260' M.S.L.
PRODELTA-TO APPROX.-223' M.S.L.
NEARSHORE-TO APPROX.-248' M.S.L.
PLEISTOCENE - AT APPROX.-248' M.S.L.
TO BETWEEN -240' & -260' M.S.L.
LEGEND
PT Peat
CH Fat clay
CHO Fat clay w/org. matter
CL Lean clay
ML Silt
SM Silty sand
SP Fine sand
FILL silts & medium clays
RECENT
MARSH vy soft clays w/peat org. matter
INTERDISTRIBUTARY vy soft to soft clays w/SIS, SS
INTRADELTA soft alternating clays & silts w/layers of SM & SP
ABANDONED DISTRIBUTARY silts, silty sands & sands w/layers of clay
PRODELTA medium to stiff clays
NEARSHORE sands w/sl & slf
PLEISTOCENE stiff to vy stiff clays w/SIS
NOTES:
For location of borings, see plates 5 & 6.
For boring logs, see plate 27.
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE
SOIL AND GEOLOGIC PROFILE
STA. 384+00 TO STA. 480+31
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972
FILE NO. H-2-25953




BORING NOTES:

C.E. Borings:

Undisturbed borings were taken with a 5" diameter undisturbed piston type sampler.

General type borings were taken with a 1 7/8" I.D. core barrel sampler.

See plate A for soil boring legend.

For location of borings see plates 2 & 3.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

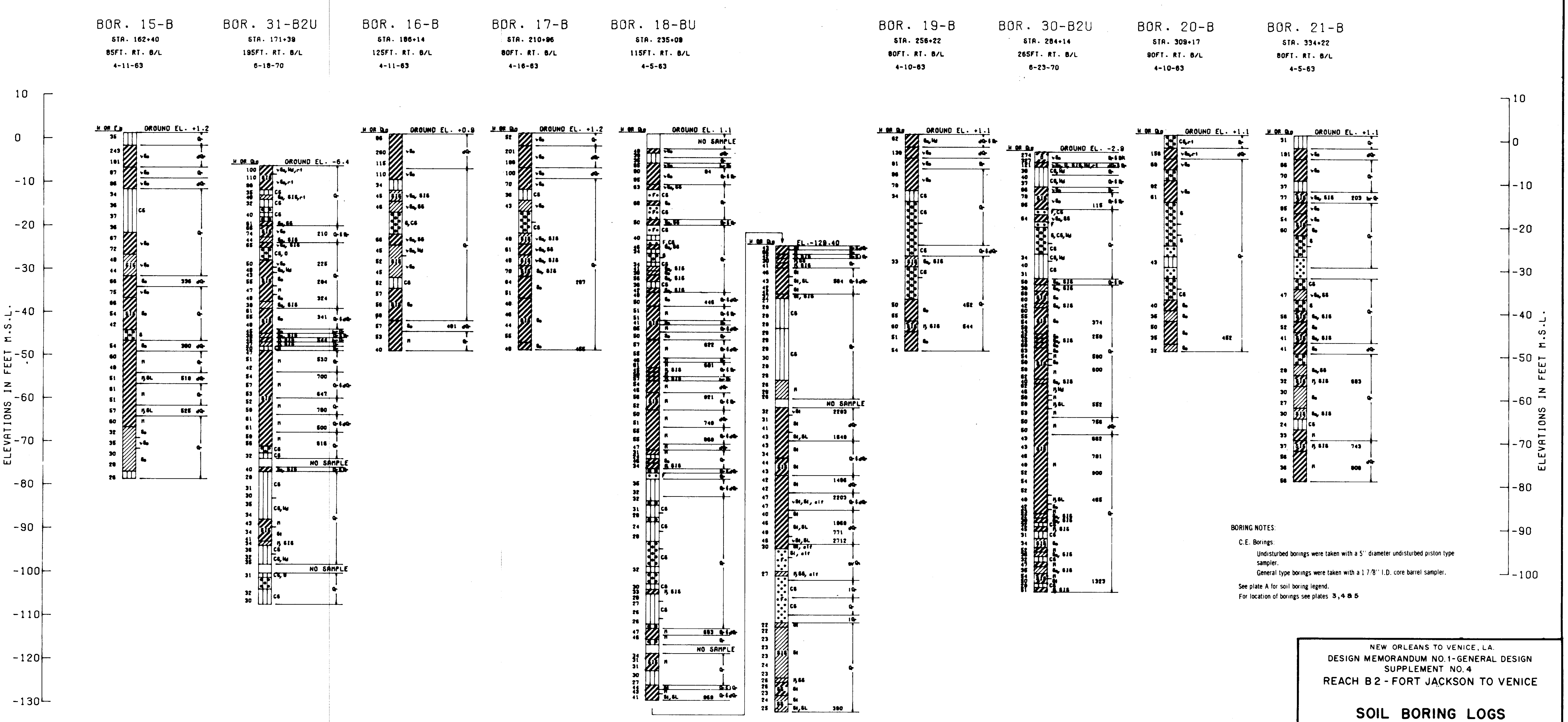
# SOIL BORING LOGS

STA. 0+00 TO STA. 150+00

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953

PLATE 25




BORING NOTES:

C.E. Borings:

Undisturbed borings were taken with a 5'' diameter undisturbed piston type sampler.

General type borings were taken with a 1 7/8'' I.D. core barrel sampler.

See plate A for soil boring legend.

For location of borings see plates 3,4 & 5

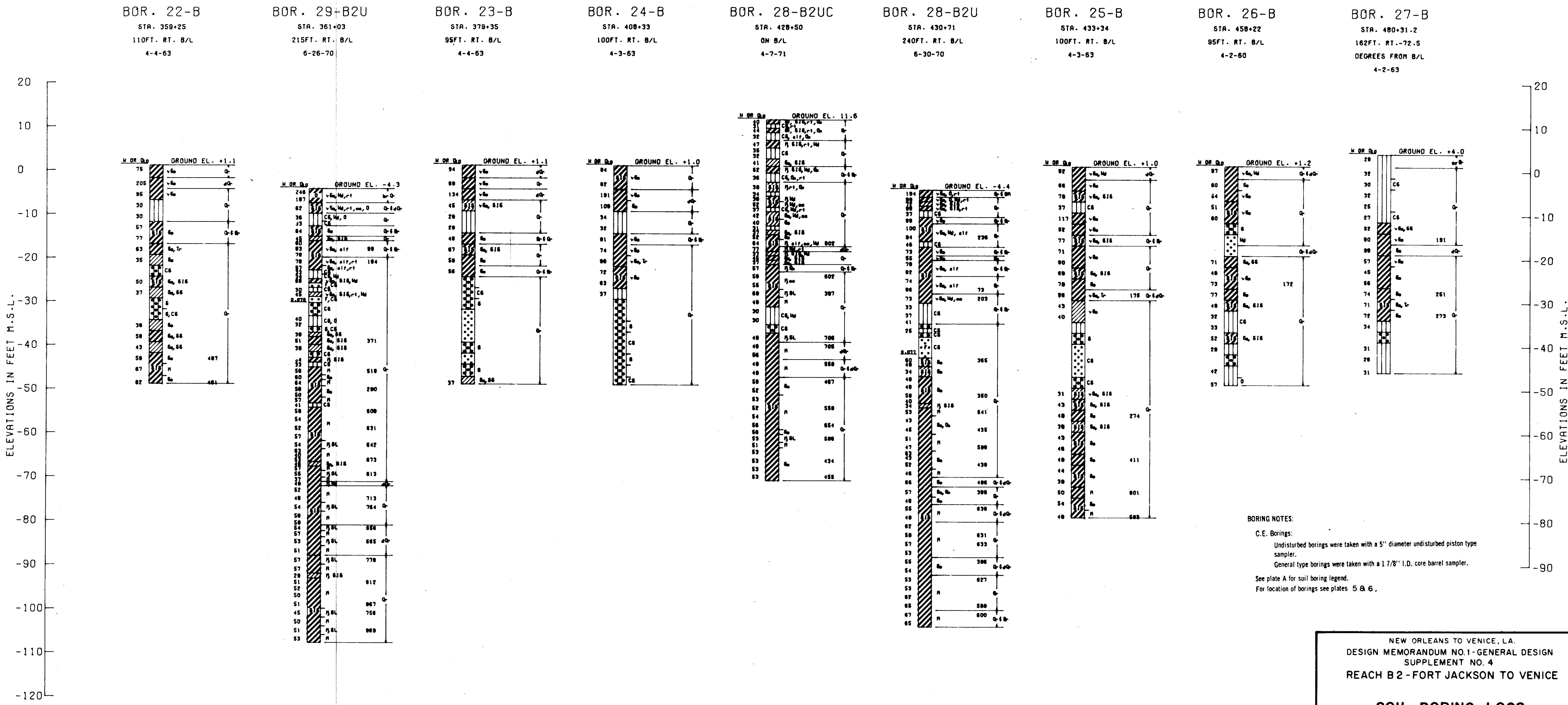
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## SOIL BORING LOGS

STA. 150+00 TO STA. 340+00

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

JULY 1972 FILE NO. H-2-25953




BORING NOTES:

C.E. Borings:

Undisturbed borings were taken with a 5" diameter undisturbed piston type sampler.

General type borings were taken with a 1 7/8" I.D. core barrel sampler.

See plate A for soil boring legend.

For location of borings see plates 5 & 6.

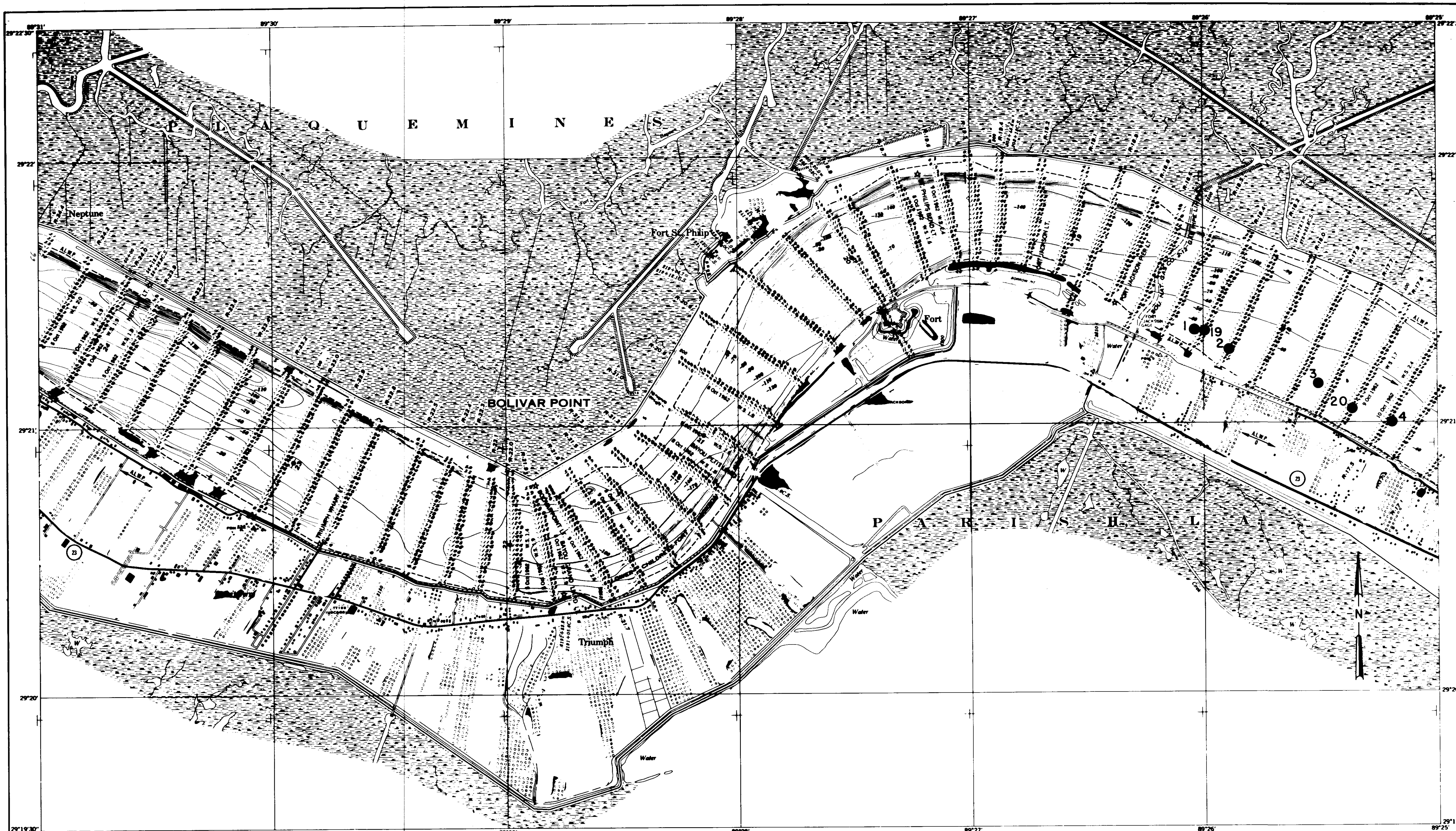
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## SOIL BORING LOGS

STA. 340+00 TO STA. 480+31

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

JULY 1972 FILE NO. H-2-25953




All elevations are expressed in feet and refer to Mean Sea Level
Contours below Average Low Water Plane are expressed in feet at 5 and 10 ft intervals
Contours above Average Low Water Plane are expressed in feet at 5 ft intervals
Planimetry from aerial photographs flown November 1962
Distances on Mississippi River above Head of Passes are shown at 1 mile intervals
1962 and 1942 surveys
Polyconic Projection, North American Datum
Polyconic Projection, Gulf Coast Datum is indicated by ticks
A.L.W.P. —Average Low Water Plane

NOTE:
FOR SOIL BORING LOGS SEE PLATE 31

SCALE
FEET 1000 0 1000 2000
METERS 100 0 100 500 1000
MILES 0 ¼ ½

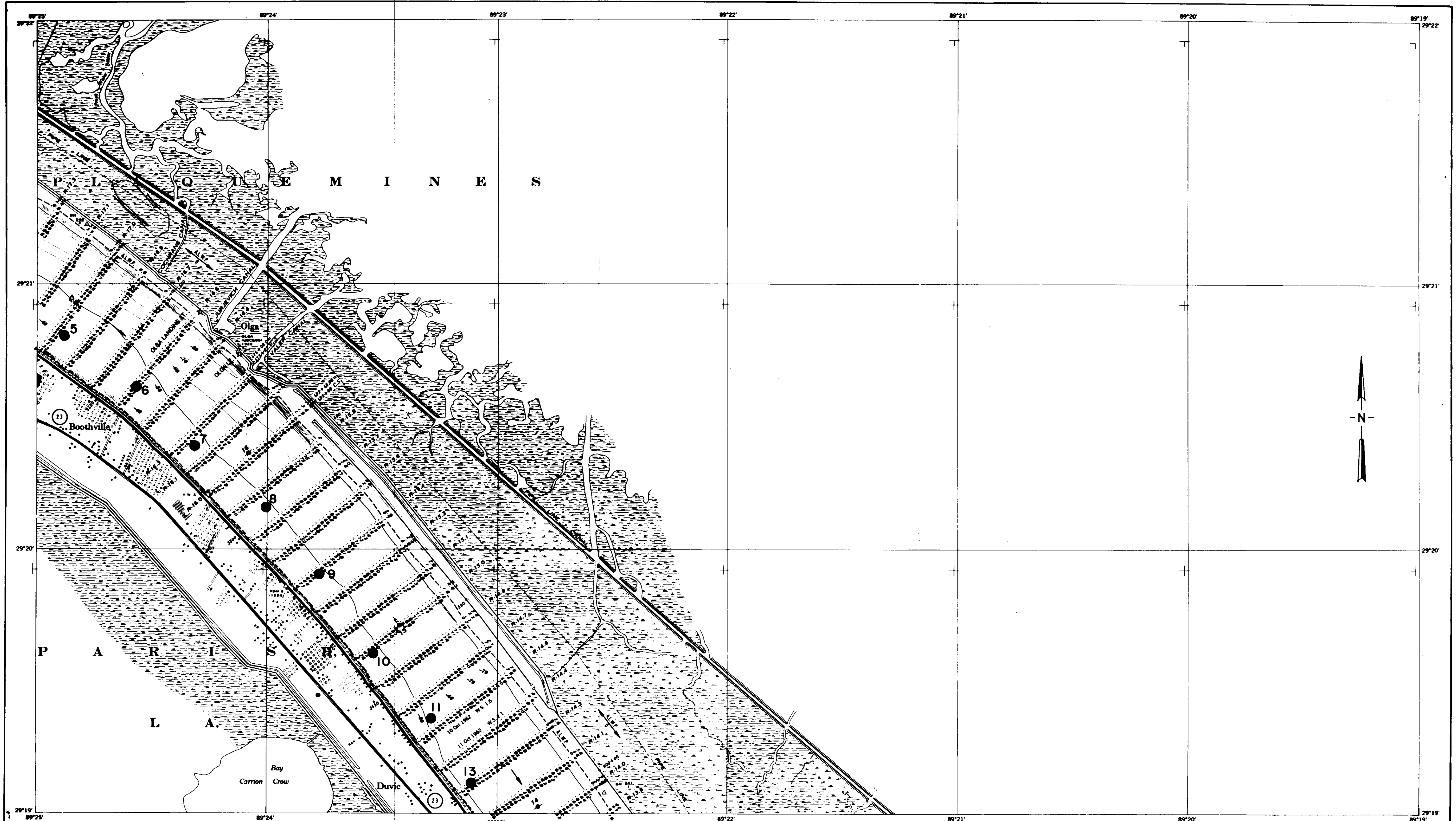
LEGEND:
● SOIL BORINGS TAKEN BY STATE OF LOUISIANA, DEPARTMENT OF HIGHWAYS

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# BORROW BORING LOCATIONS FOR HYDRAULIC SAND FILL

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

JULY 1972 FILE NO. H-2-25953




All elevations are expressed in feet and refer to Mean Sea Level
Contours below Average Low Water Plane are expressed in feet at 5 and 10 ft intervals
Contours above Average Low Water Plane are expressed in feet at 5 ft intervals
Planimetry from aerial photographs flown February 1963.
-●- Distances on Mississippi River above Head of Passes are shown at 1 mile intervals. 1962 and 1942 surveys
Polyconic Projection. North American Datum
Polyconic Projection. Gulf Coast Datum is indicated by ticks.
A.L.W.P.—Average Low Water Plane

NOTE:
FOR SOIL BORING LOGS SEE PLATES 31 & 32

SCALE
FEET
1000 0 1000 2000
METERS
100 0 100 500 1000
MILES
0 1/8 1/4 3/8 1/2 5/8 3/4 7/8 1

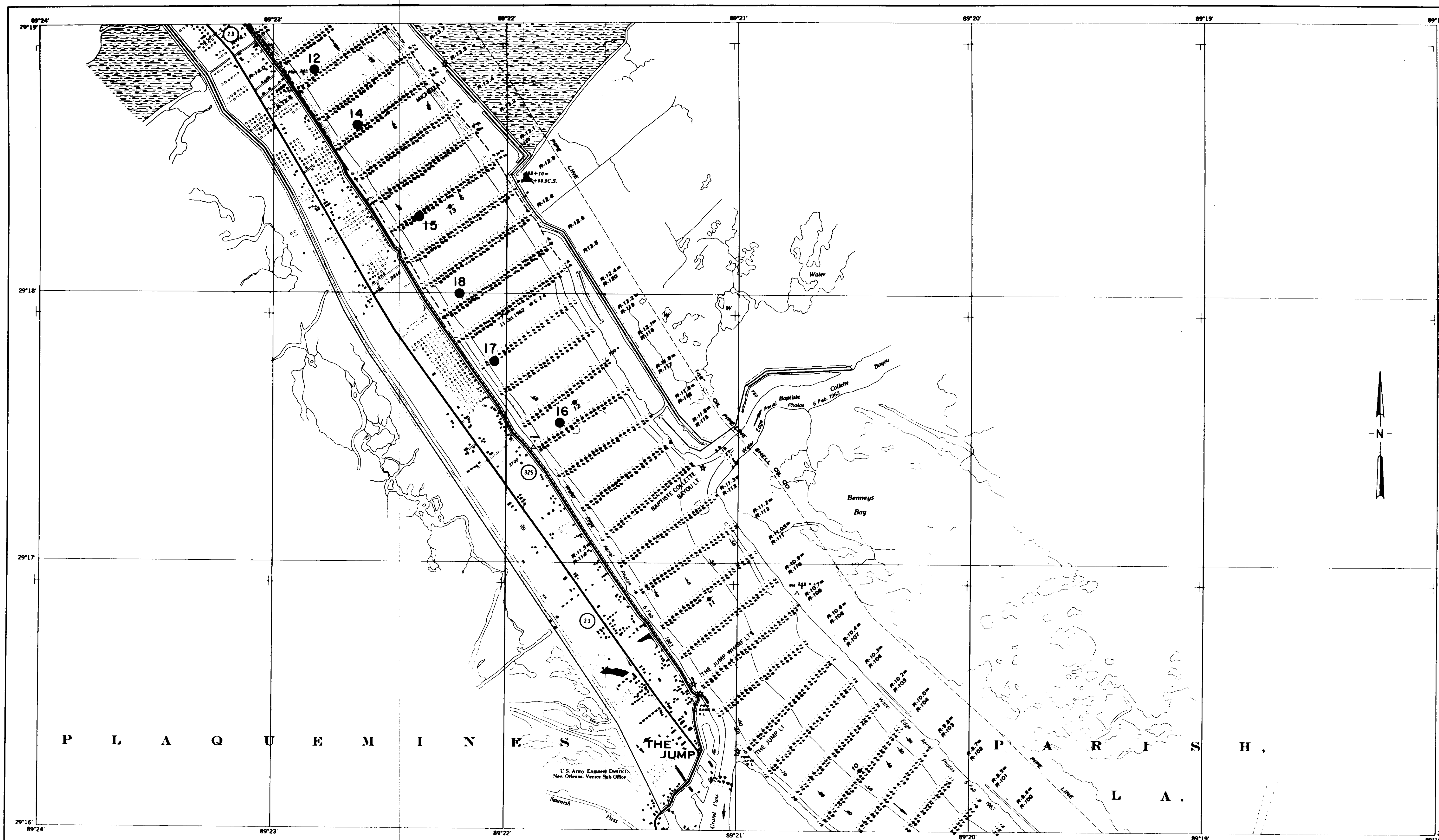
LEGEND:
● SOIL BORINGS TAKEN BY STATE OF LOUISIANA, DEPARTMENT OF HIGHWAYS

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## BORROW BORING LOCATIONS FOR HYDRAULIC SAND FILL

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

JULY 1972 FILE NO. H-2-25953




All elevations are expressed in feet and refer to Mean Sea Level
Contours below Average Low Water Plane are expressed in feet at 5 and 10 ft intervals
Contours above Average Low Water Plane are expressed in feet at 5 ft intervals
Planimetry from aerial photographs flown February 1963
—●— Distances on Mississippi River above Head of Passes are shown at 1 mile intervals
1962 and 1942 surveys
Polyconic Projection North American Datum
Polyconic Projection Gulf Coast Datum is indicated by ticks
A L W P —Average Low Water Plane

NOTE:
FOR SOIL BORING LOGS SEE PLATE 32

SCALE
FEET: 1000 0 1000 2000
METERS: 100 0 100 500 1000
MILES: 0 1 (in fractions)

LEGEND:
● SOIL BORINGS TAKEN BY STATE OF LOUISIANA, DEPARTMENT OF HIGHWAYS

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

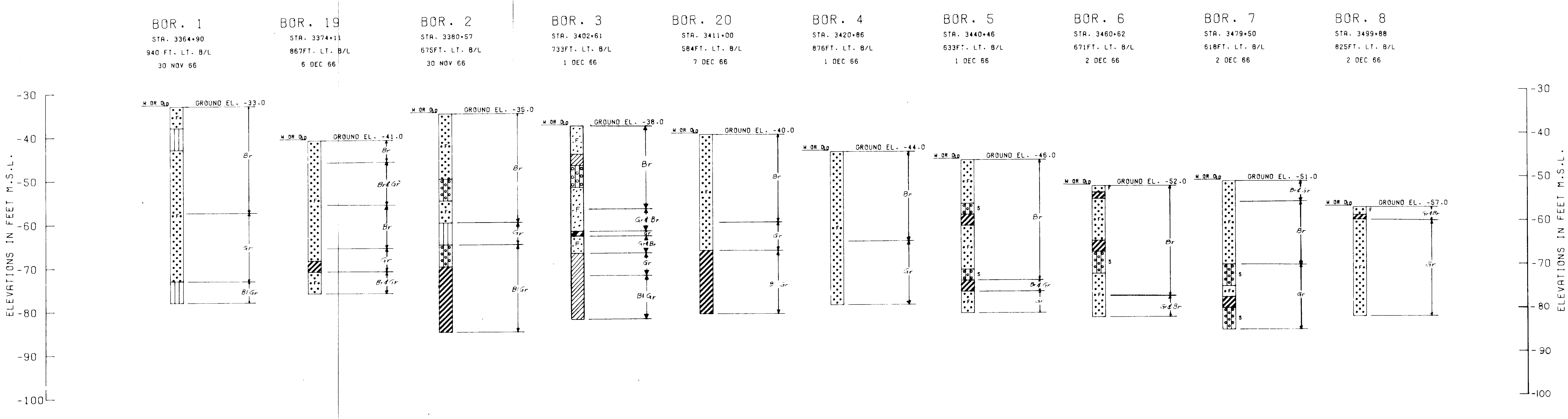
# BORROW BORING LOCATIONS FOR HYDRAULIC SAND FILL

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

JULY 1972

FILE NO. H-2-25953

PLATE 30




NOTES:
Borings were taken by the State of Louisiana, Dept. of Highways, classified according to AASHO designation M 145 specifications and converted to the unified soil classification by Corps of Engineers.

Data shown is all that was available.

For location of borings see Plates 28 & 29.

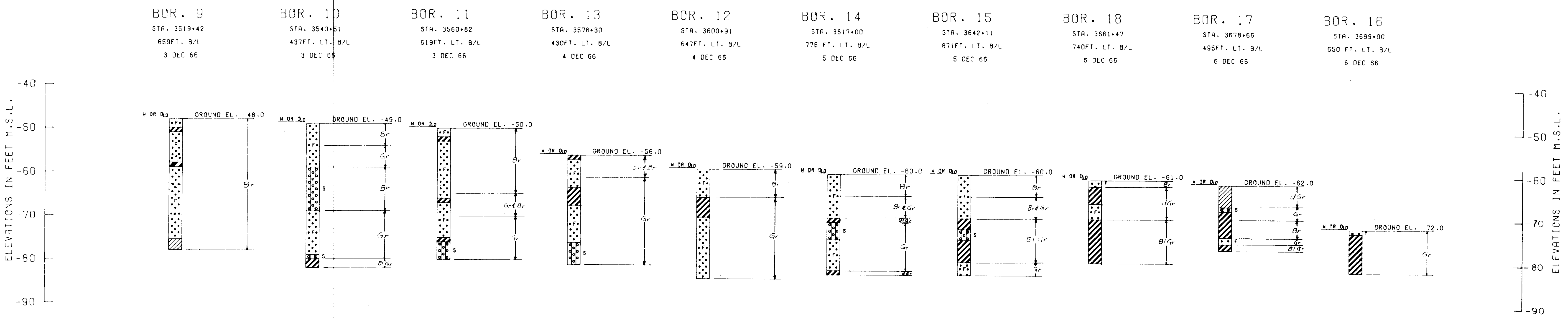
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## BORROW BORING LOGS FOR HYDRAULIC SAND FILL

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953

PLATE 31




NOTES:
Borings were taken by the State of Louisiana, Dept. of Highways, classified according to AASHO designation M 145 specifications and converted to the unified soil classification by Corps of Engineers.

Data shown is all that was available.

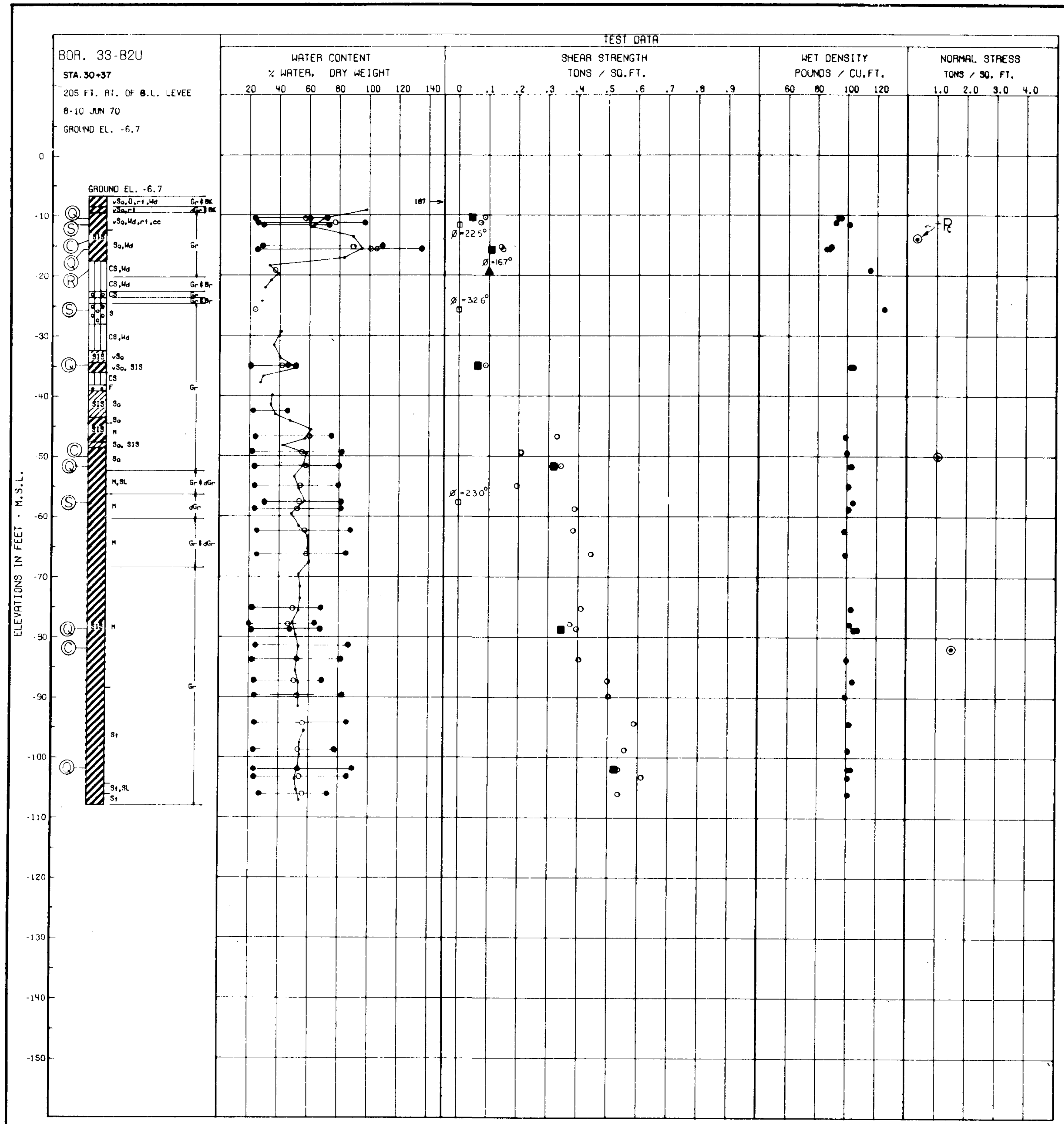
For location of borings see Plates 29 & 30

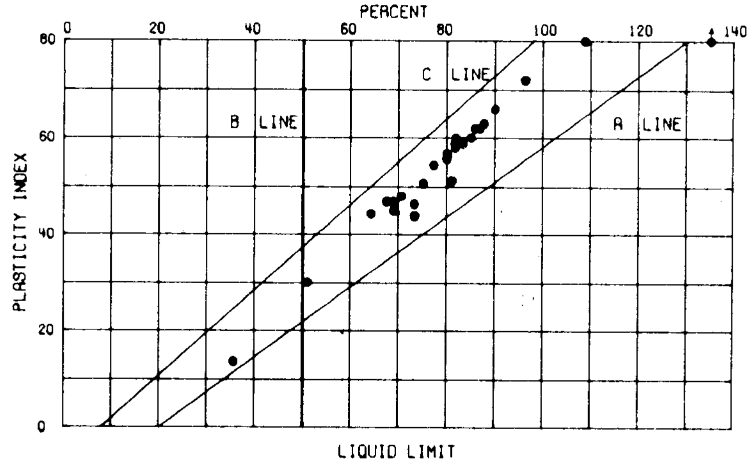
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## BORROW BORING LOGS FOR HYDRAULIC SAND FILL

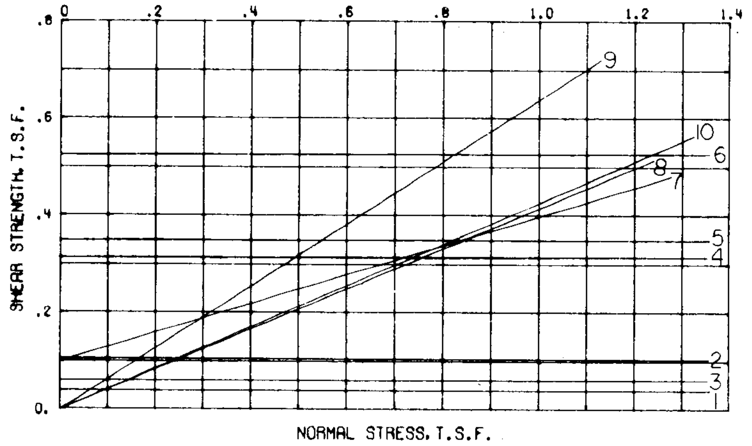
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953



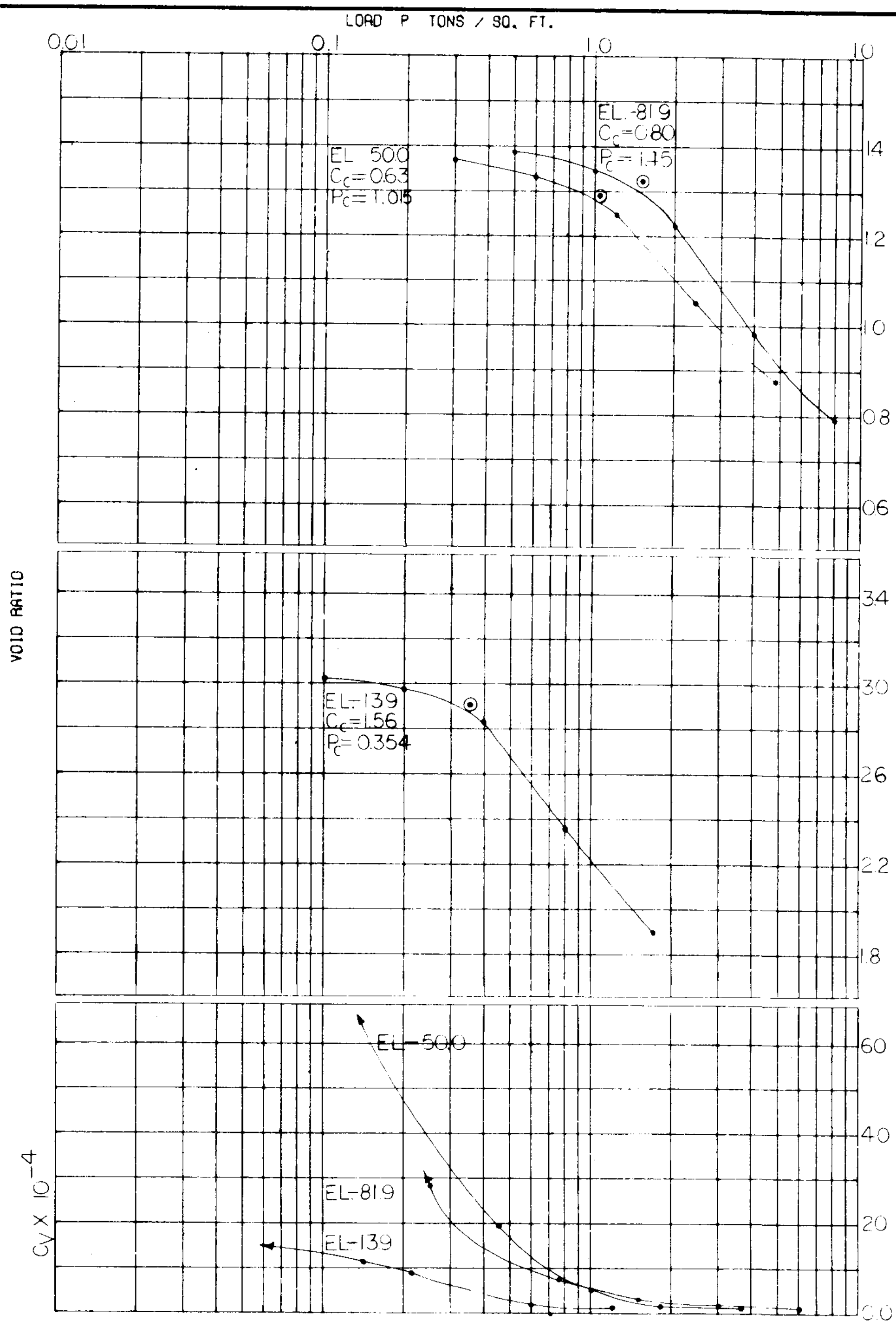




PLASTICITY CHART




SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ° | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 33-B2U | 1 | -10.6 | Q | 0 | .040 | CH |
| | 2 | -15.7 | | 0 | .108 | CH |
| | 3 | 34.8 | | 0 | .060 | CH |
| | 4 | -51.6 | | 0 | .318 | CH |
| | 5 | -78.7 | | 0 | .345 | CH |
| | 6 | -101.9 | | 0 | .525 | CH |
| | 7 | -19.2 | R | 16.7 | .100 | ML |
| | 8 | -11.5 | S | 22.5 | 0 | CH |
| | 9 | -25.7 | | 32.6 | 0 | SM |
| | 10 | -57.7 | | 23.0 | 0 | CH |



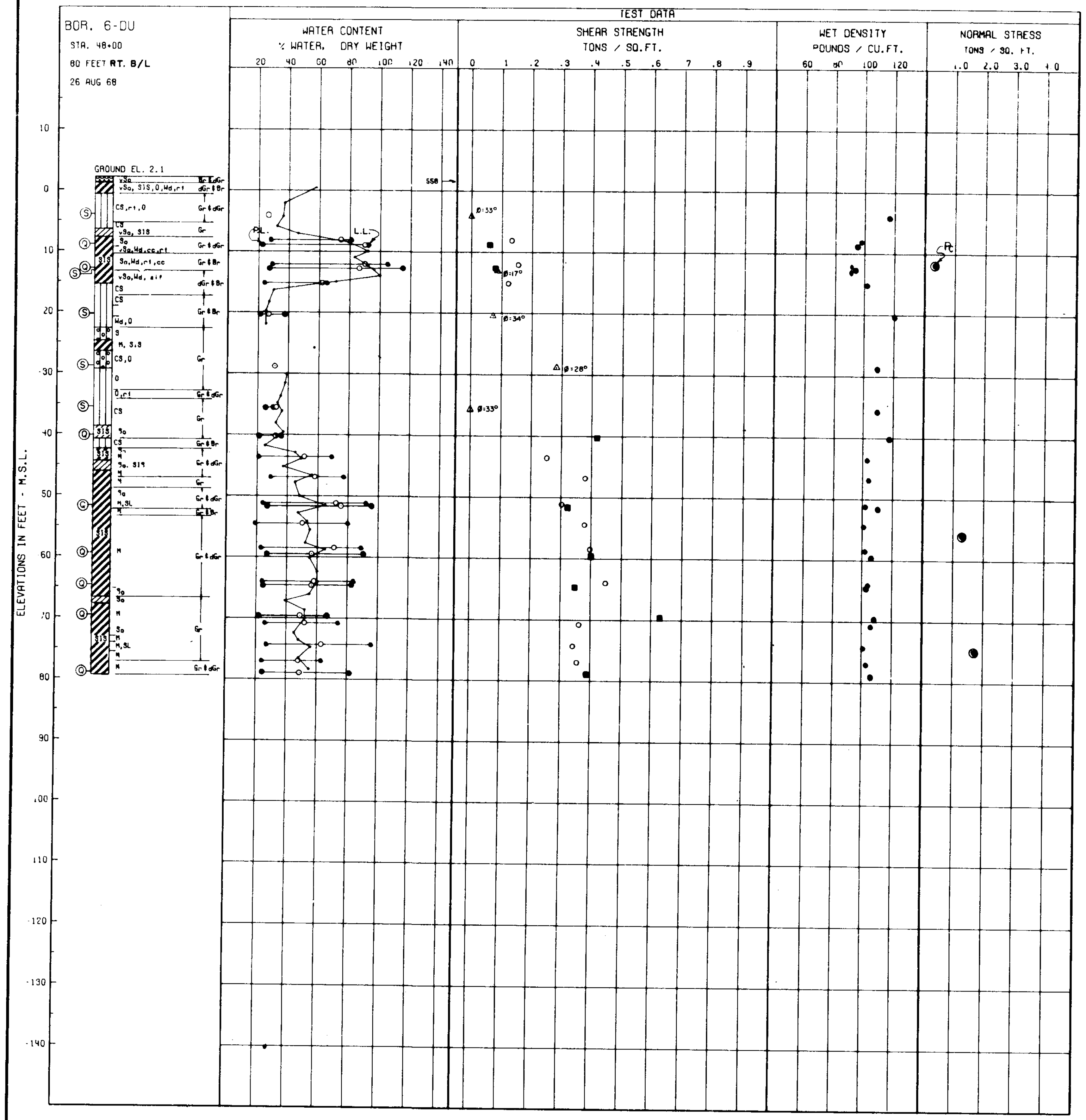

CONSOLIDATION DATA

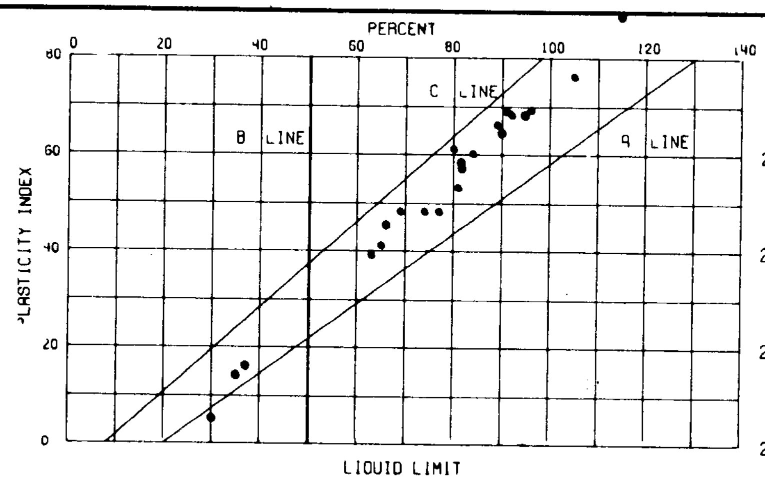
o- (UC) UNCONFINED COMPRESSION TEST
■- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
▫- (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 2

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

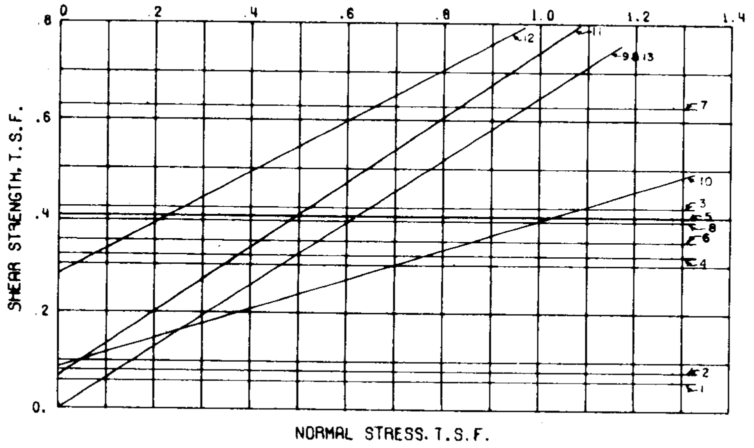
# UNDISTURBED BORING 33-B2U DATA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953



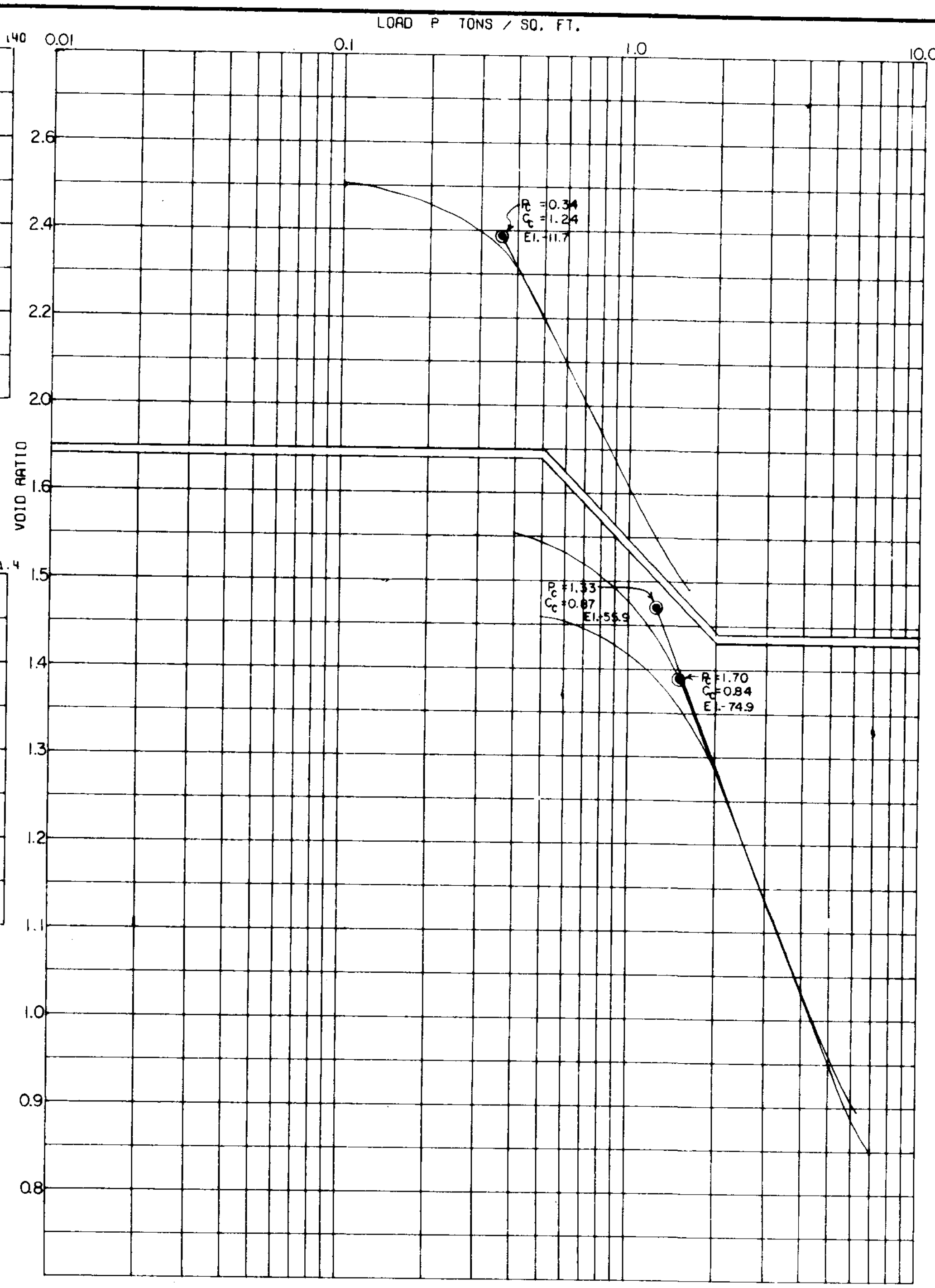




PLASTICITY CHART




SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 6-DU | 1 | -8.7 | Q | 0° | .06 | CH |
| | 2 | -12.5 | | 0° | .08 | CH |
| | 3 | -40.1 | | 0° | .42 | CL |
| | 4 | -51.8 | | 0° | .32 | CH |
| | 5 | -59.6 | | 0° | .40 | CH |
| | 6 | -64.6 | | 0° | .35 | CH |
| | 7 | -69.8 | | 0° | .63 | CH |
| | 8 | -78.1 | | 0° | .39 | CH |
| | 9 | -4.0 | S | 33° | .0 | ML |
| | 10 | -13.0 | | 17° | .09 | CH |
| | 11 | -20.2 | | 34° | .07 | CL |
| | 12 | -28.7 | | 28° | .28 | ML |
| | 13 | -35.6 | | 33° | .0 | ML |




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

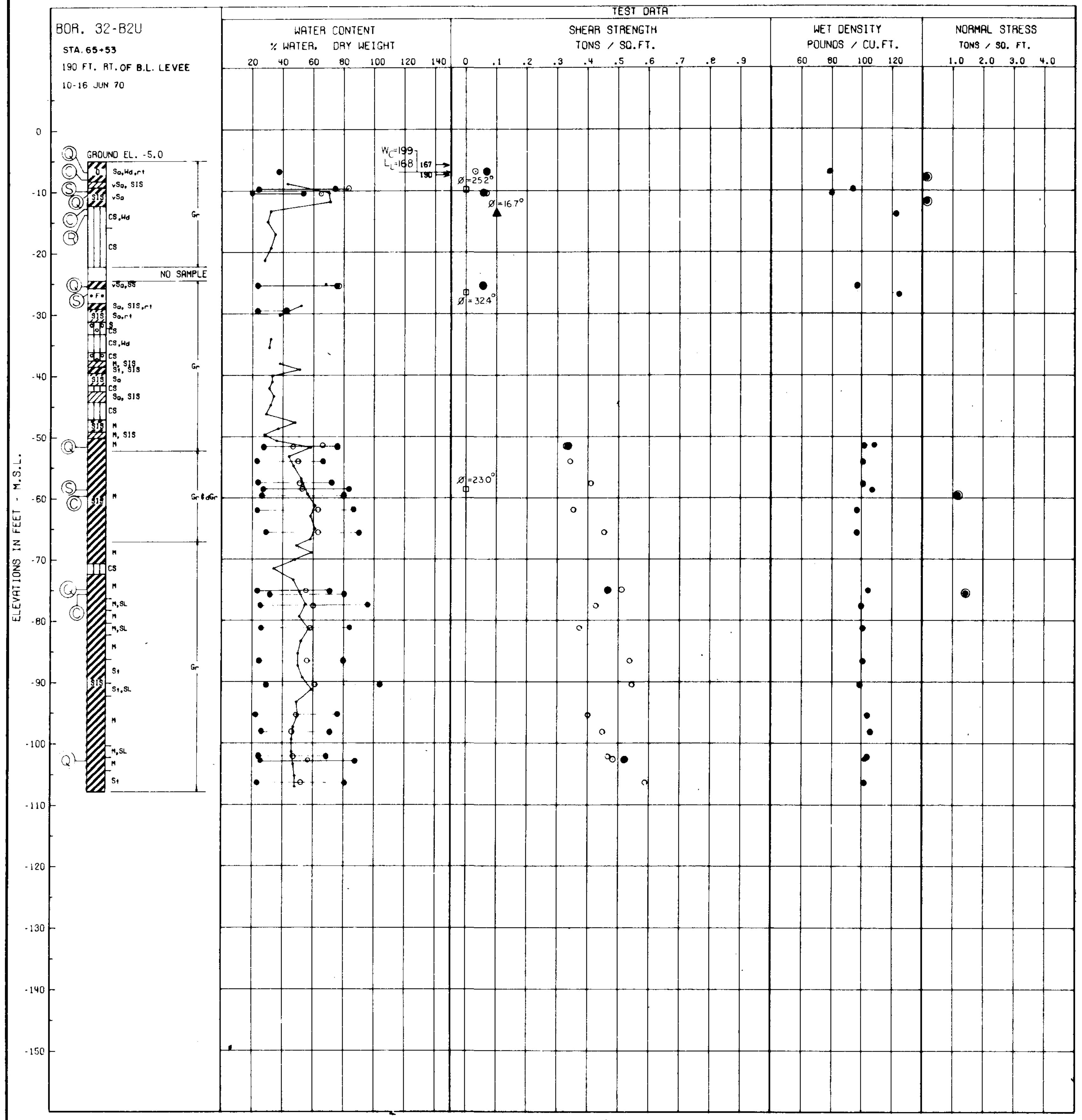
FOR LOCATION OF BORINGS SEE PLATE 2

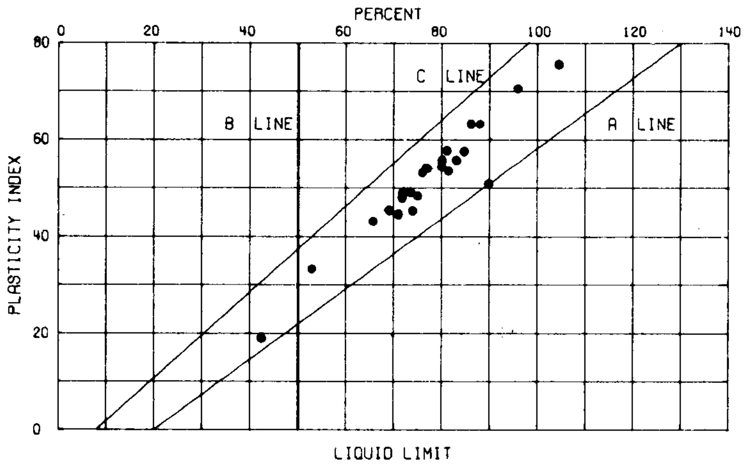
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

**UNDISTURBED BORING**
**6-DU DATA**

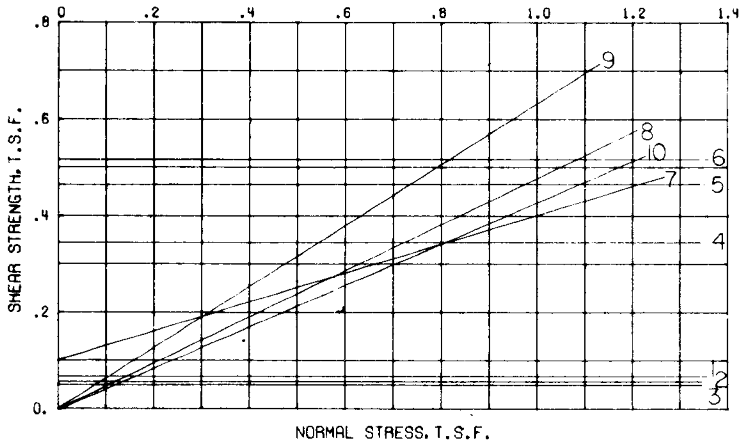
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953



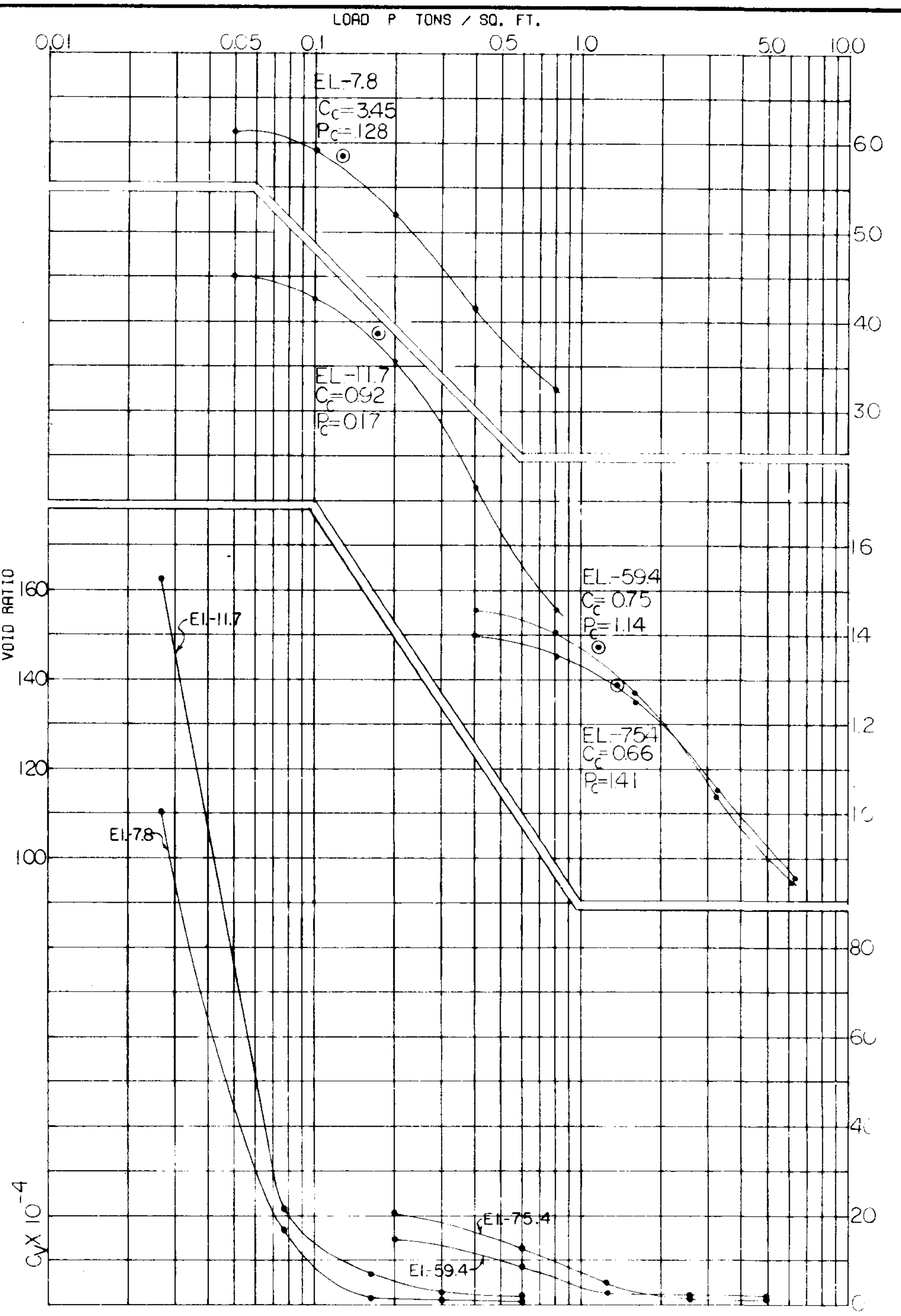




PLASTICITY CHART




SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH $\Phi$ | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 32-B2U | 1 | -6.9 | Q | 0 | .065 | CH |
| | 2 | -10.5 | | 0 | .055 | CH |
| | 3 | -26.3 | | 0 | .050 | CH |
| | 4 | -51.5 | | 0 | .335 | CH |
| | 5 | -74.8 | | 0 | .463 | CH |
| | 6 | -102.8 | | 0 | .518 | CH |
| | 7 | -13.8 | R | 16.7 | .100 | ML |
| | 8 | -9.8 | S | 25.2 | 0 | CH |
| | 9 | -26.4 | | 32.4 | 0 | SM |
| | 10 | -58.6 | | 23.0 | 0 | CH |




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

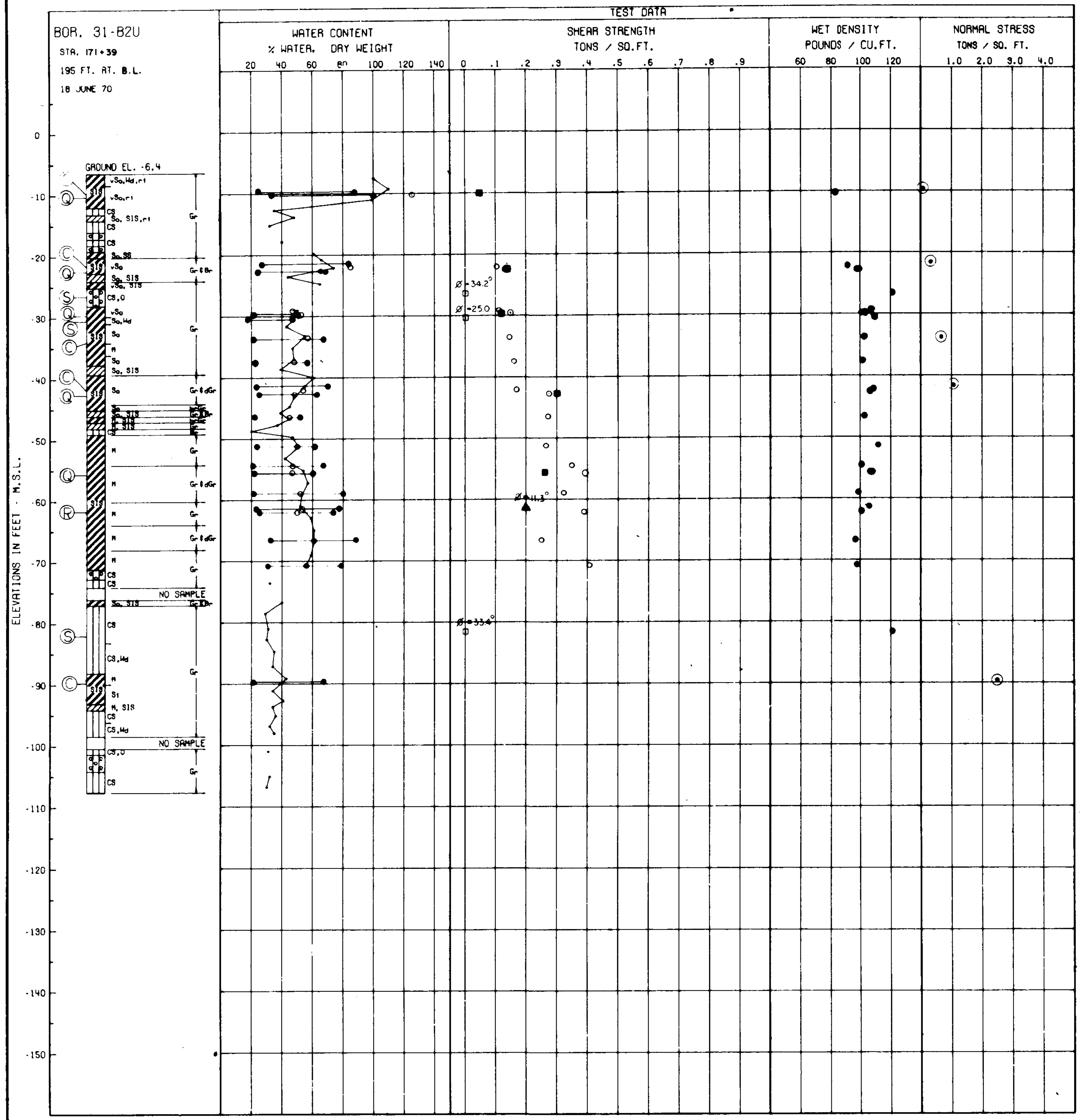
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 2

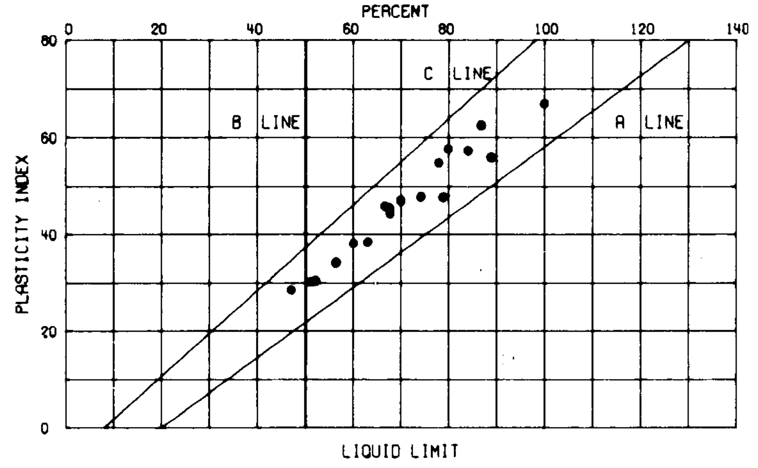
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

**UNDISTURBED BORING 32-B2U DATA**

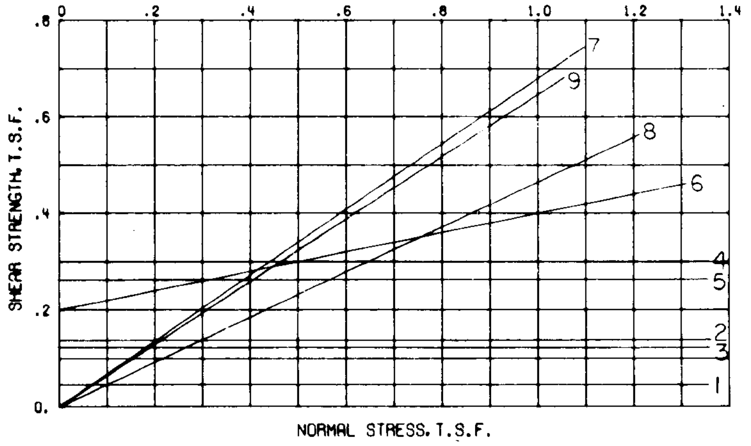
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953

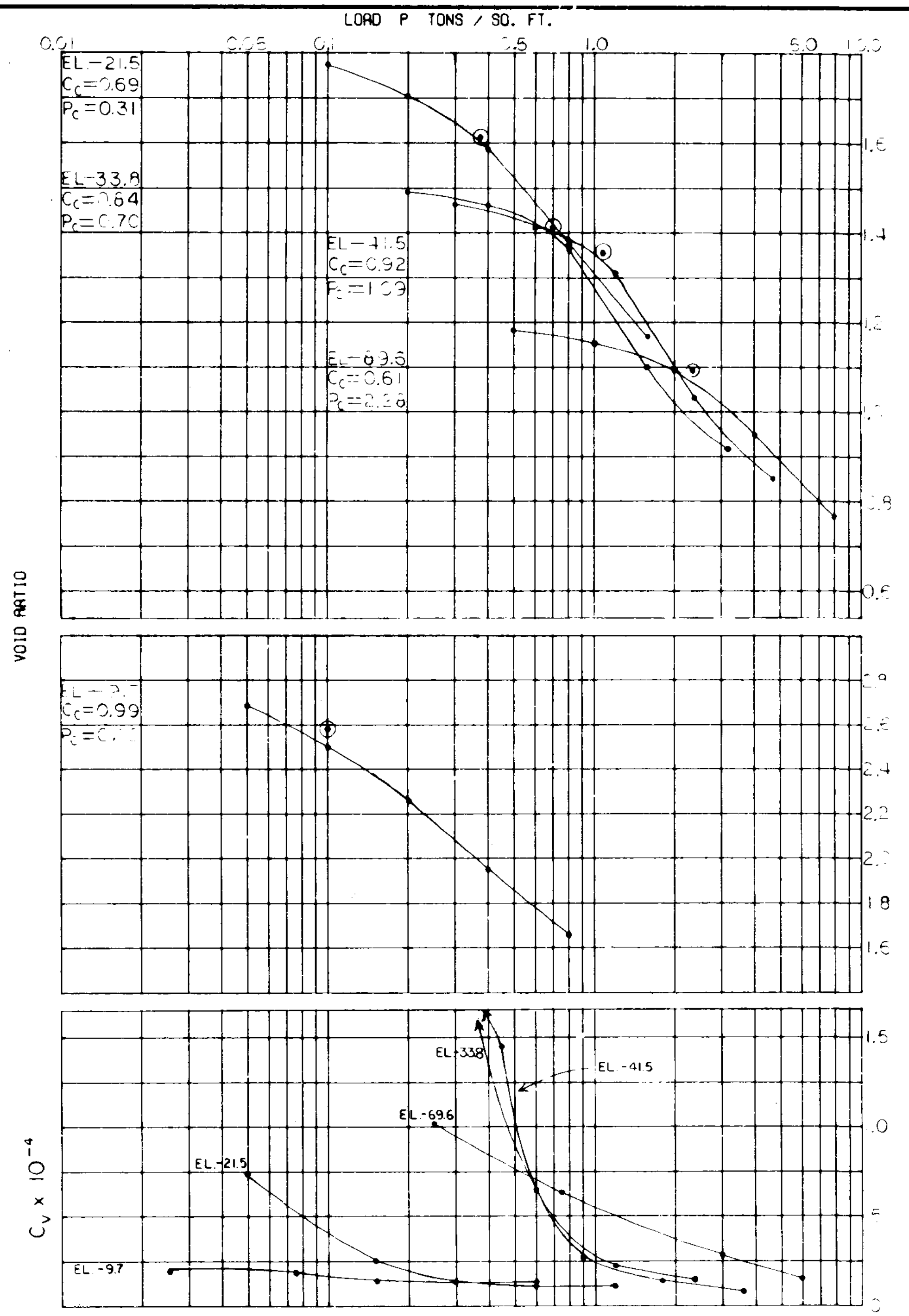



PLASTICITY CHART




SHEAR STRENGTH DATA




CONSOLIDATION DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ° | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 31-B2U | 1 | -102 | Q | 0 | 045 | CH |
| | 2 | -224 | | 0 | 135 | CH |
| | 3 | -294 | | 0 | 120 | CH |
| | 4 | -424 | | 0 | 300 | CH |
| | 5 | -554 | | 0 | 260 | CH |
| | 6 | -614 | R | 11.3 | 200 | CH |
| | 7 | -264 | S | 34.2 | 0 | SM |
| | 8 | -304 | | 25.0 | 0 | CH |
| | 9 | -818 | | 33.0 | 0 | ML |

○ - (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

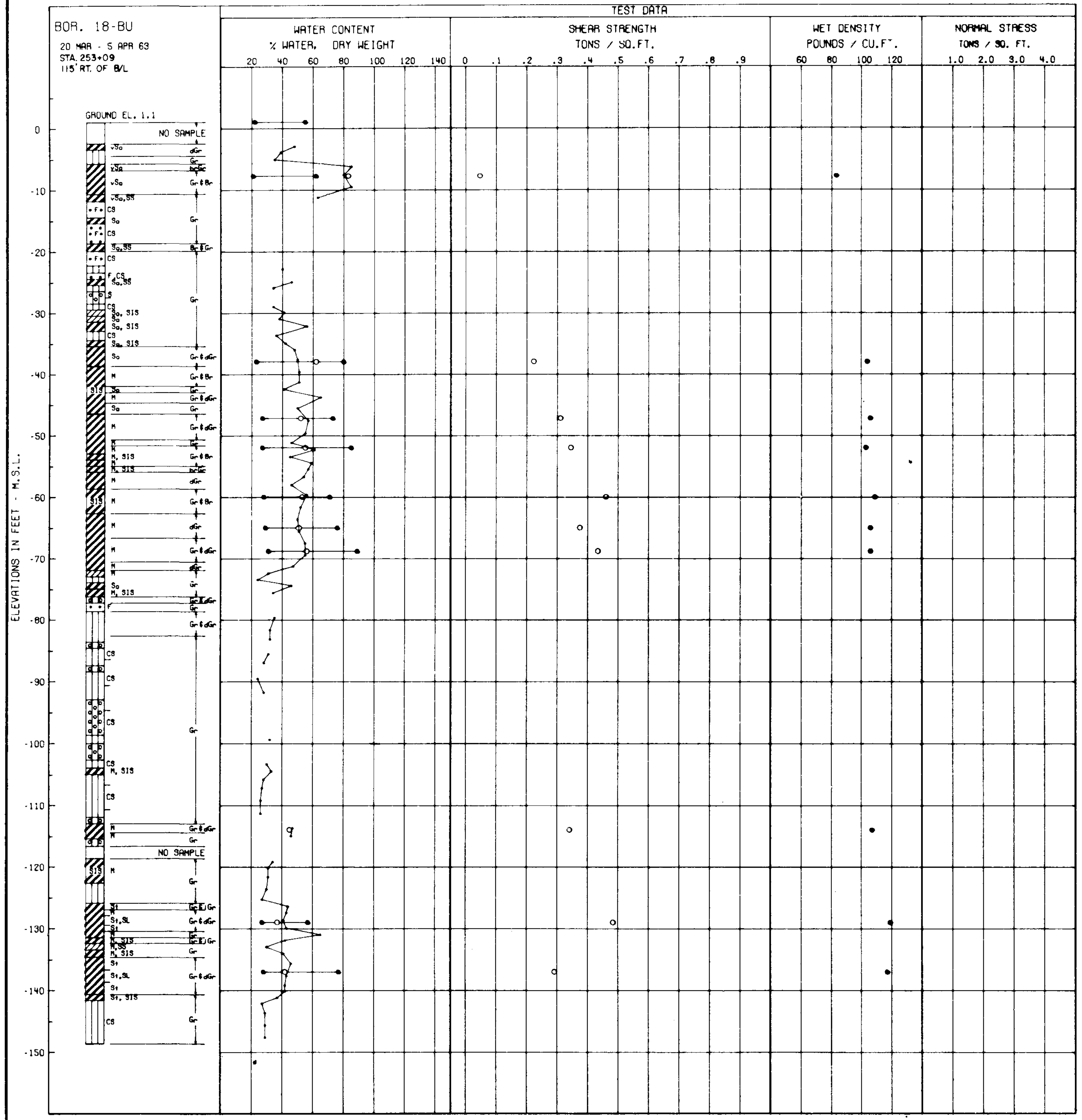
FOR LOCATION OF BORINGS SEE PLATE 3

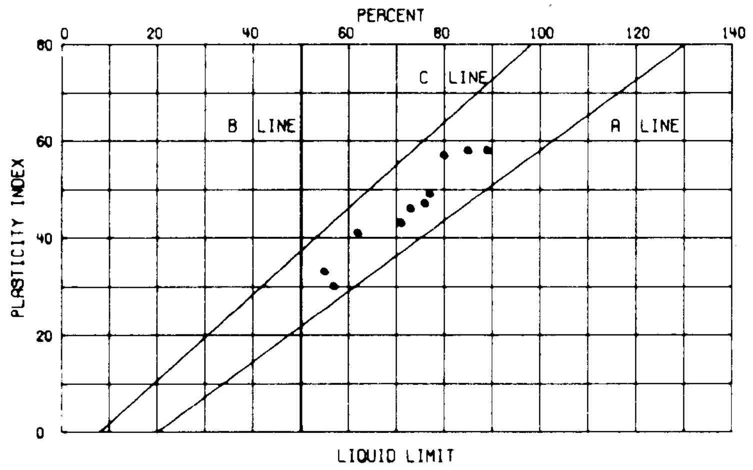
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# UNDISTURBED BORING 31-B2U DATA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953




PLASTICITY CHART

o- (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 4.

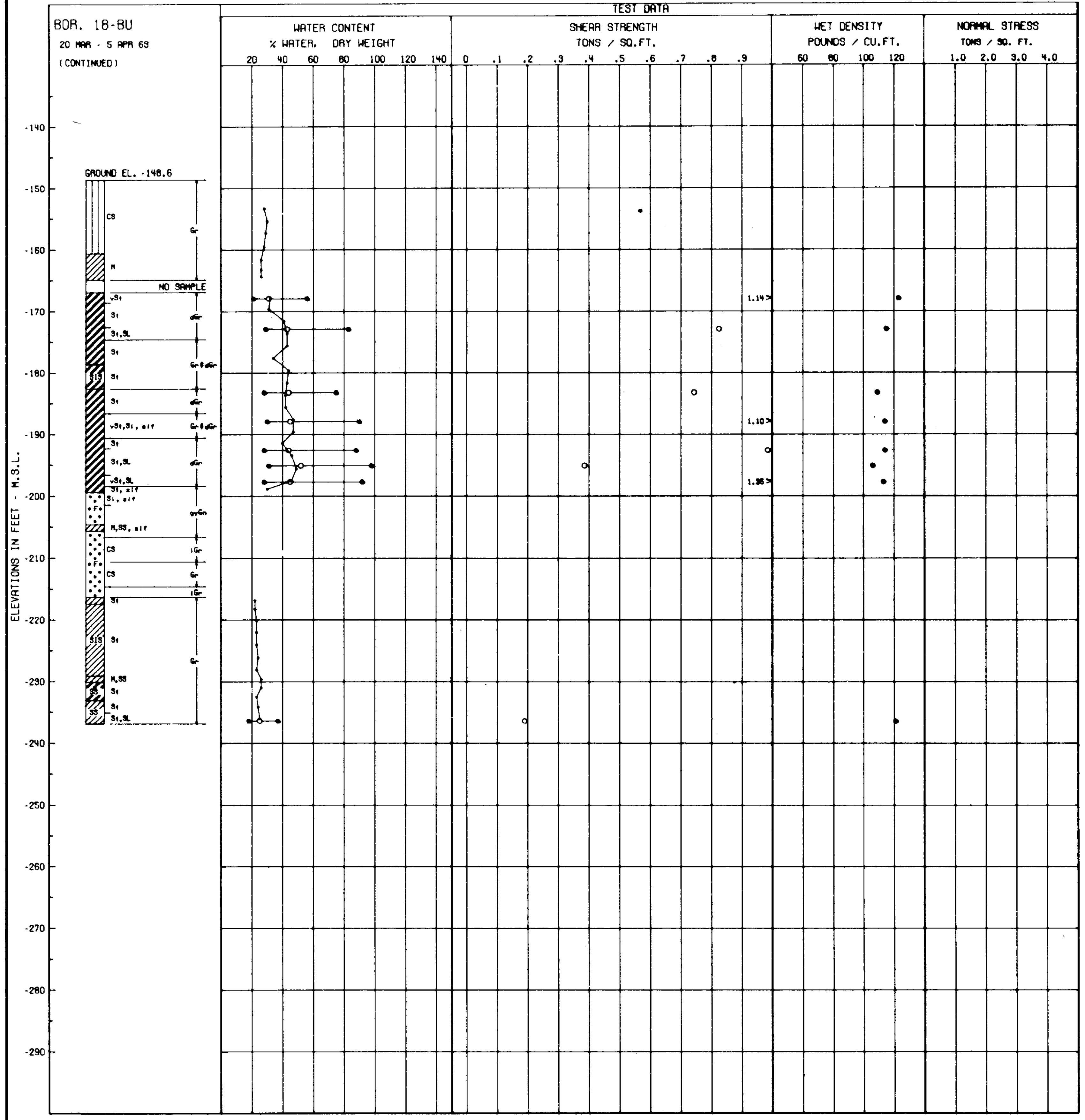
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

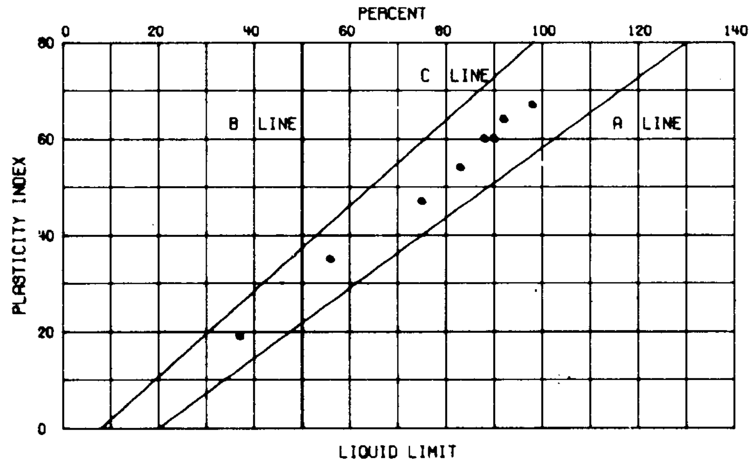
**UNDISTURBED BORING**

**18-BU DATA**

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

JULY 1972 FILE NO. H-2-25953




PLASTICITY CHART

○ - (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 4.

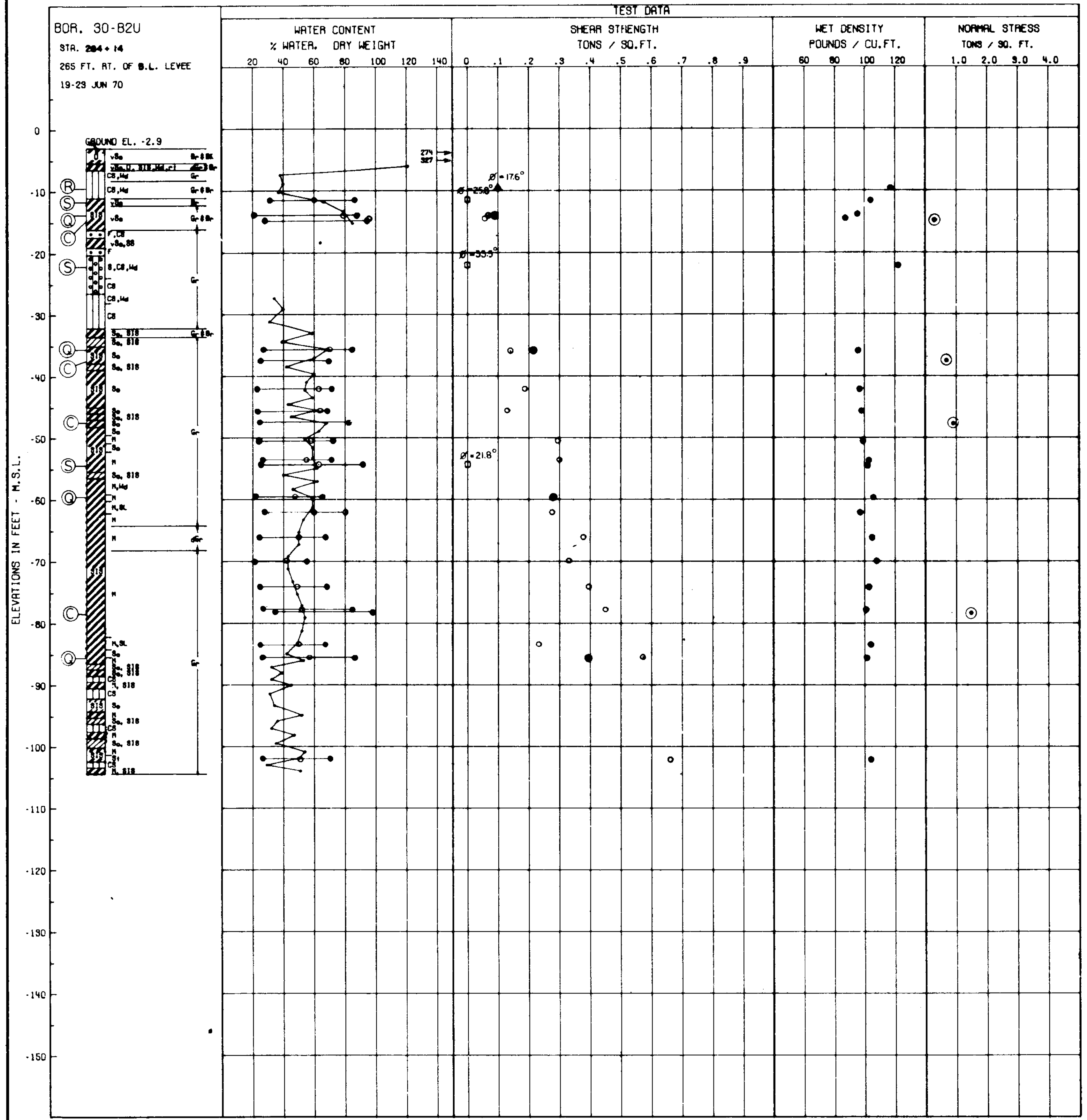
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

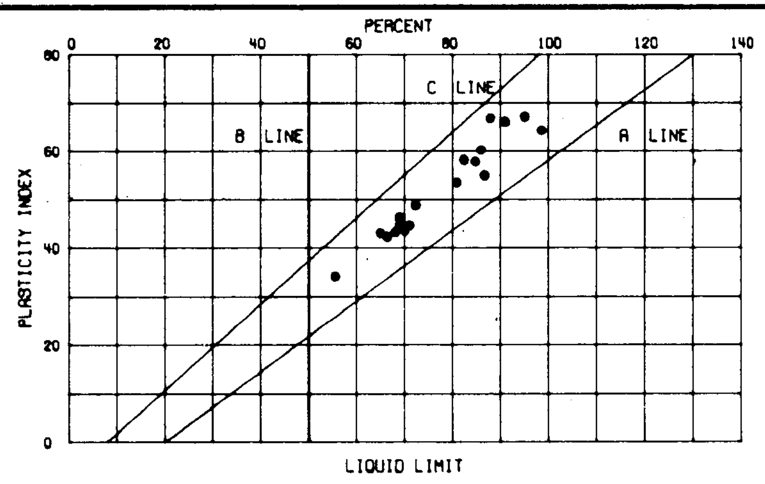
**UNDISTURBED BORING**
**18-BU DATA (CONT.)**

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

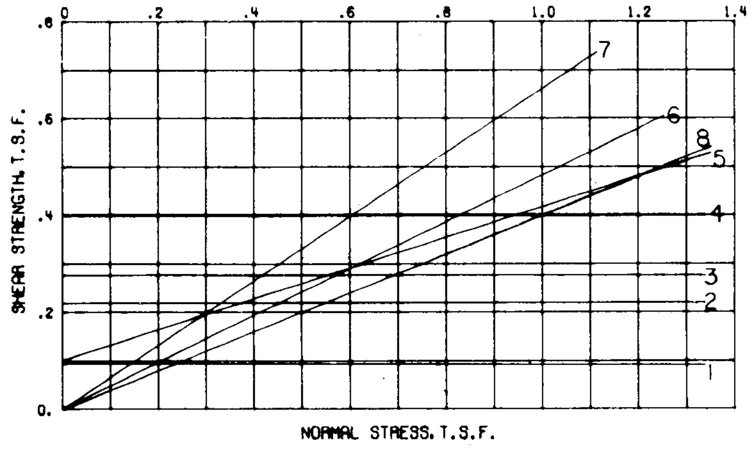
JULY 1972 FILE NO. H-2-25953

**PLATE 38**



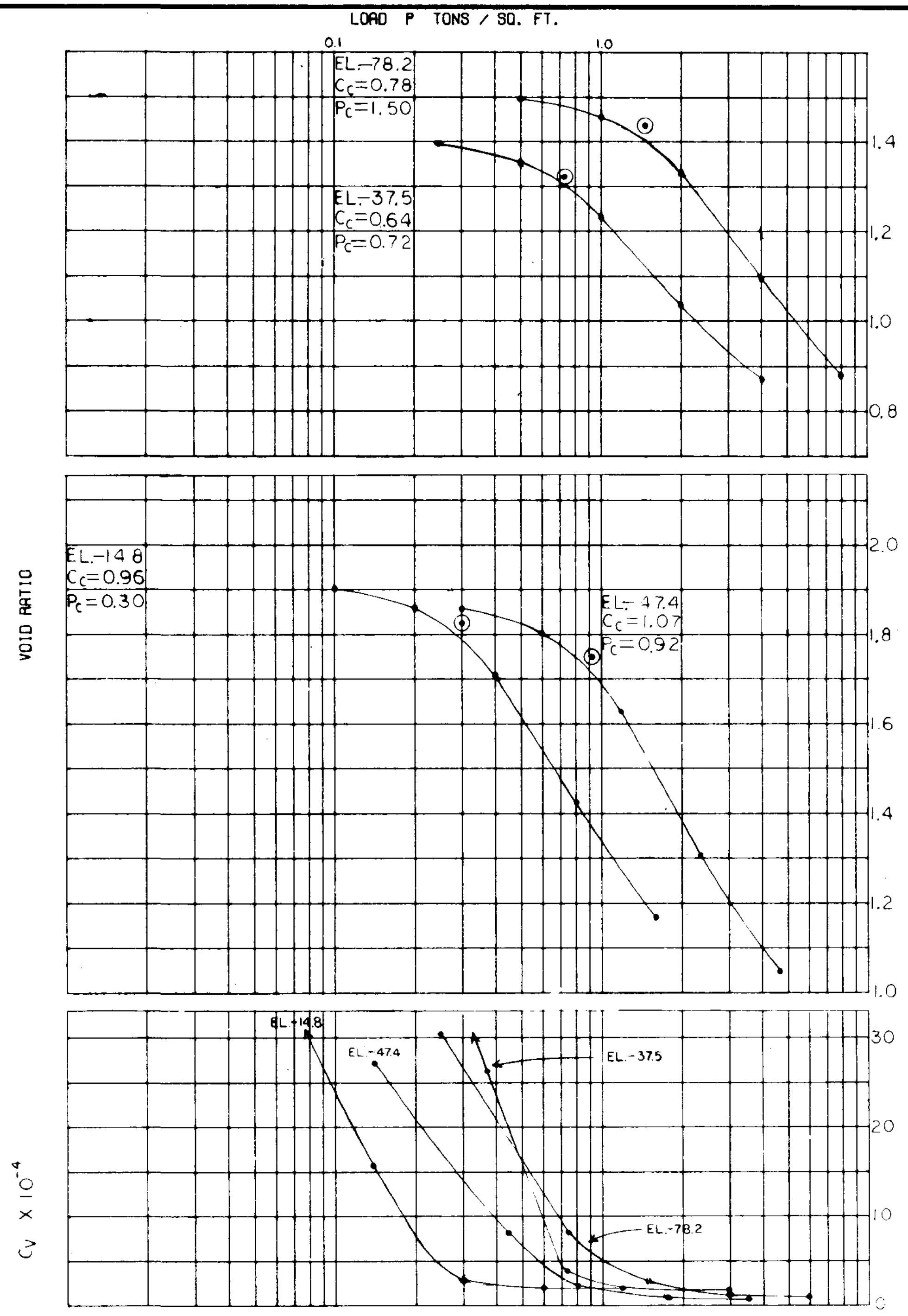




PLASTICITY CHART




SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ° | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 30-B2U | 1 | -13.9 | Q | 0 | .090 | CH |
| | 2 | -35.4 | | 0 | .215 | CH |
| | 3 | -59.4 | | 0 | .280 | CH |
| | 4 | -85.9 | | 0 | .395 | CH |
| | 5 | -9.5 | R | 17.6 | .100 | ML |
| | 6 | -11.4 | S | 25.8 | 0 | CH |
| | 7 | -22.0 | | 33.5 | 0 | SM |
| | 8 | -54.4 | | 21.8 | 0 | CH |



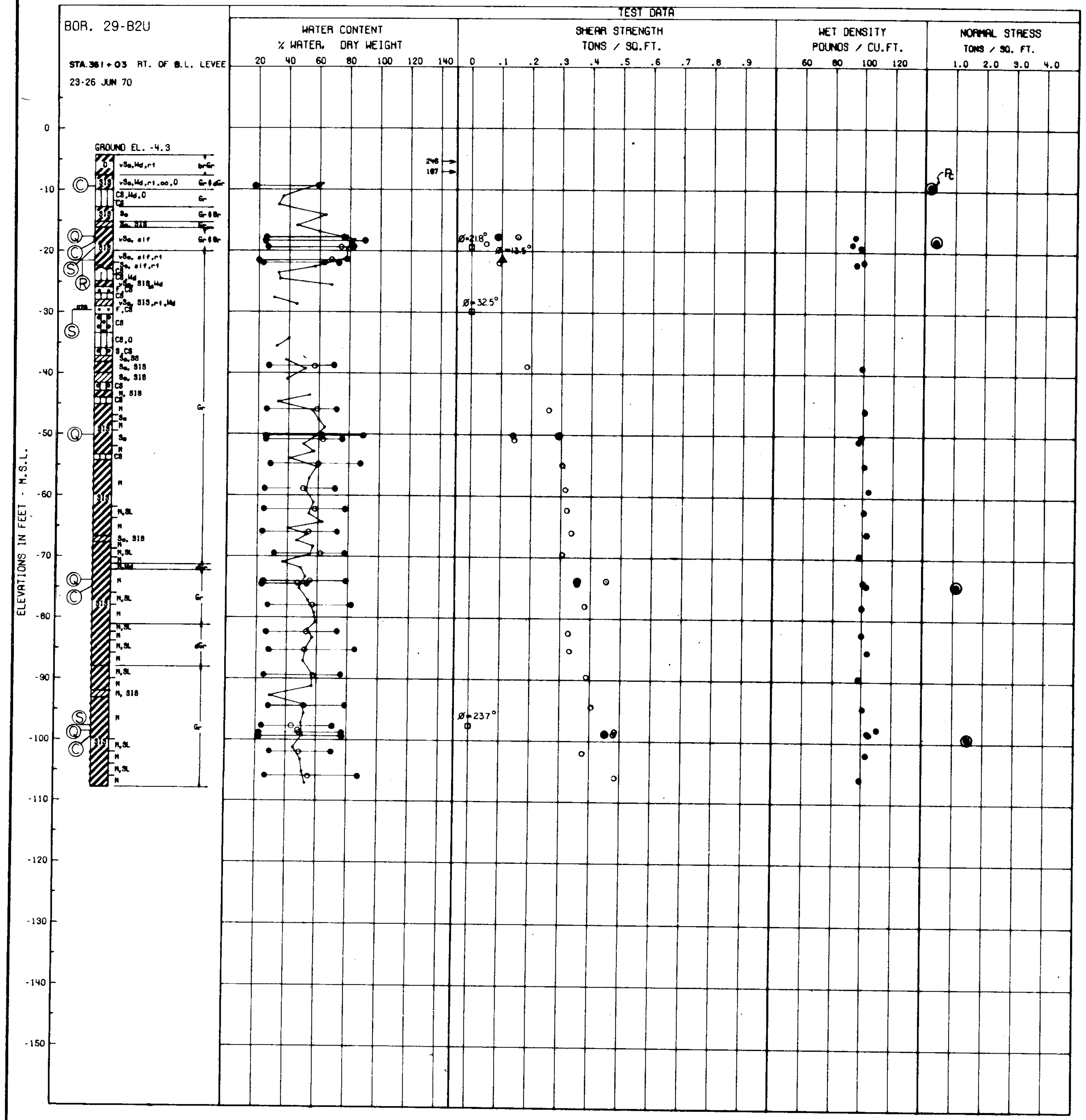

CONSOLIDATION DATA

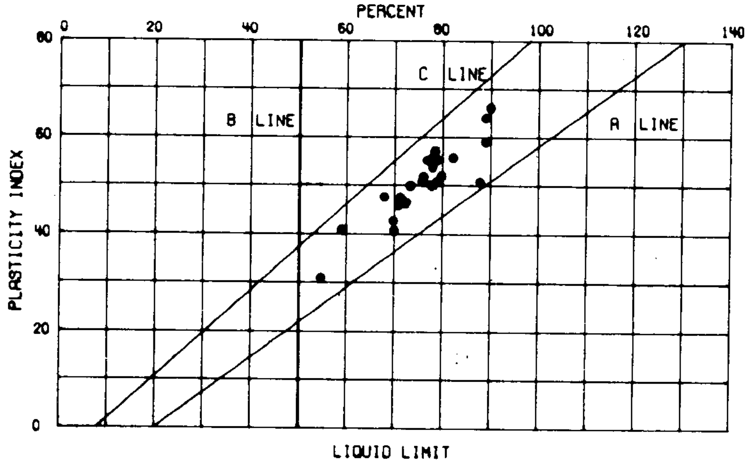
o- (UC) UNCONFINED COMPRESSION TEST
●- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
▫- (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 4

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO 4
REACH B2 - FORT JACKSON TO VENICE

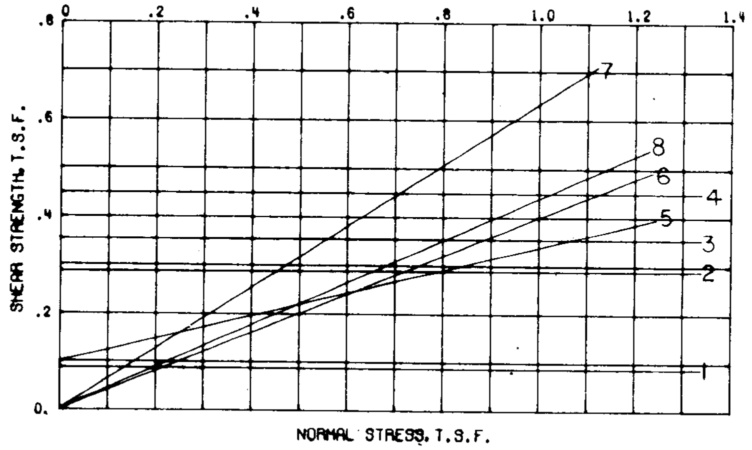
**UNDISTURBED BORING**
**30-B2U DATA**

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953



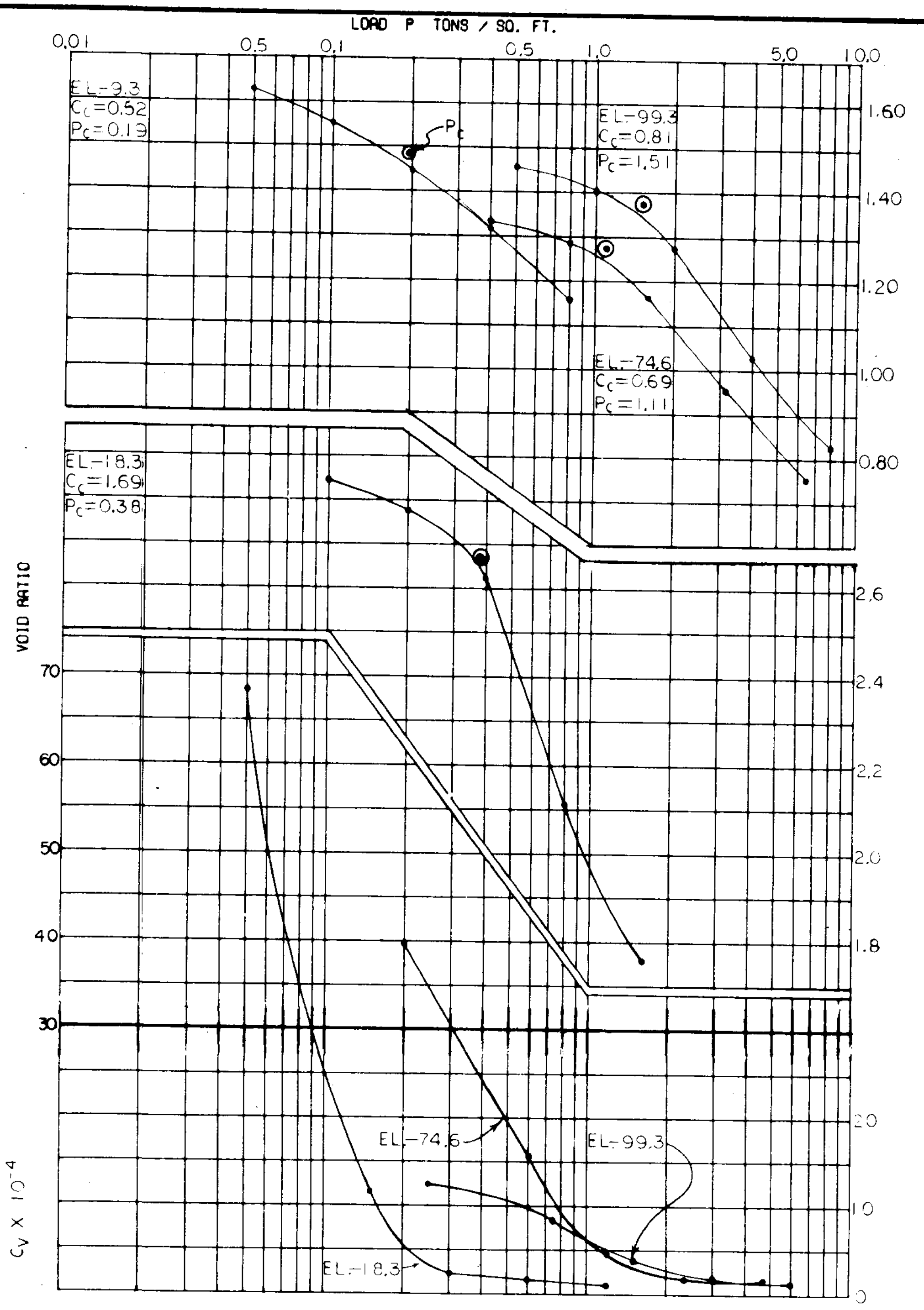




PLASTICITY CHART




SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 29-B2U | 1 | -17.6 | Q | 0 | 0.09 | CH |
| | 2 | -50.3 | | 0 | 0.29 | CH |
| | 3 | -73.9 | | 0 | 0.355 | CH |
| | 4 | -98.6 | | 0 | 0.45 | CH |
| | 5 | -21.5 | R | 13.5 | 0.100 | CH |
| | 6 | -19.2 | S | 21.8 | 0 | CH |
| | 7 | -29.5 | | 32.5 | 0 | SM |
| | 8 | -97.7 | | 23.7 | 0 | CH |




CONSOLIDATION DATA

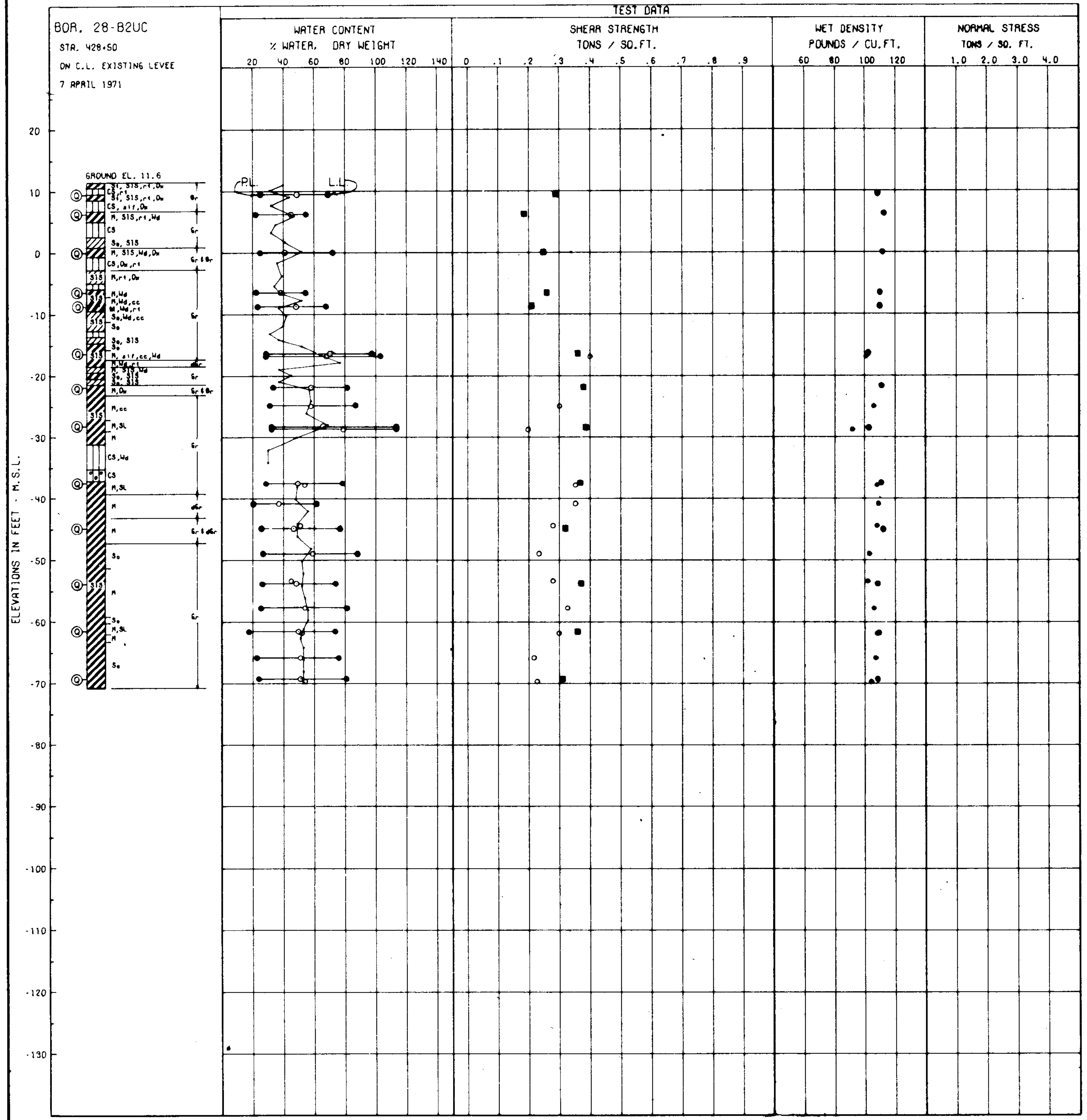
○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATE 5

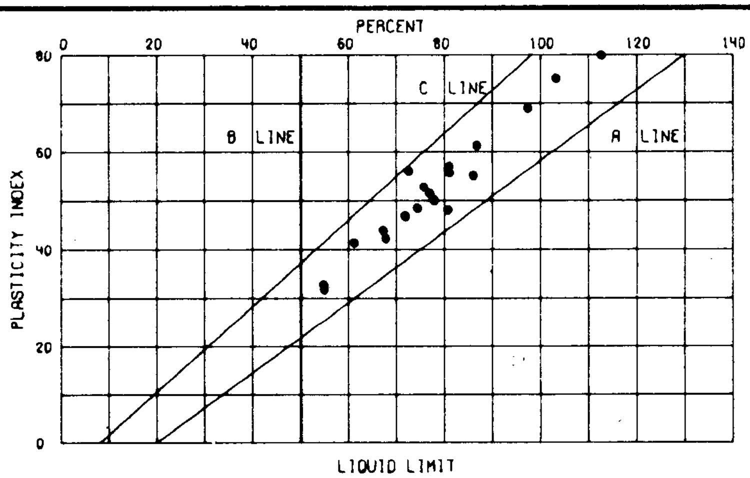
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

**UNDISTURBED BORING**
**29-B2U DATA**

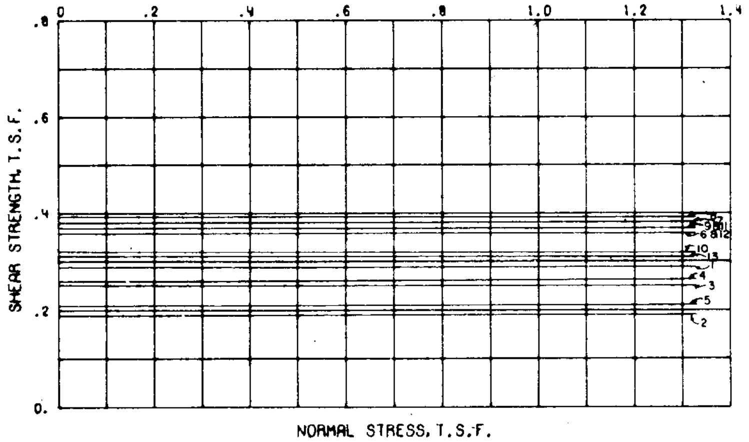
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953



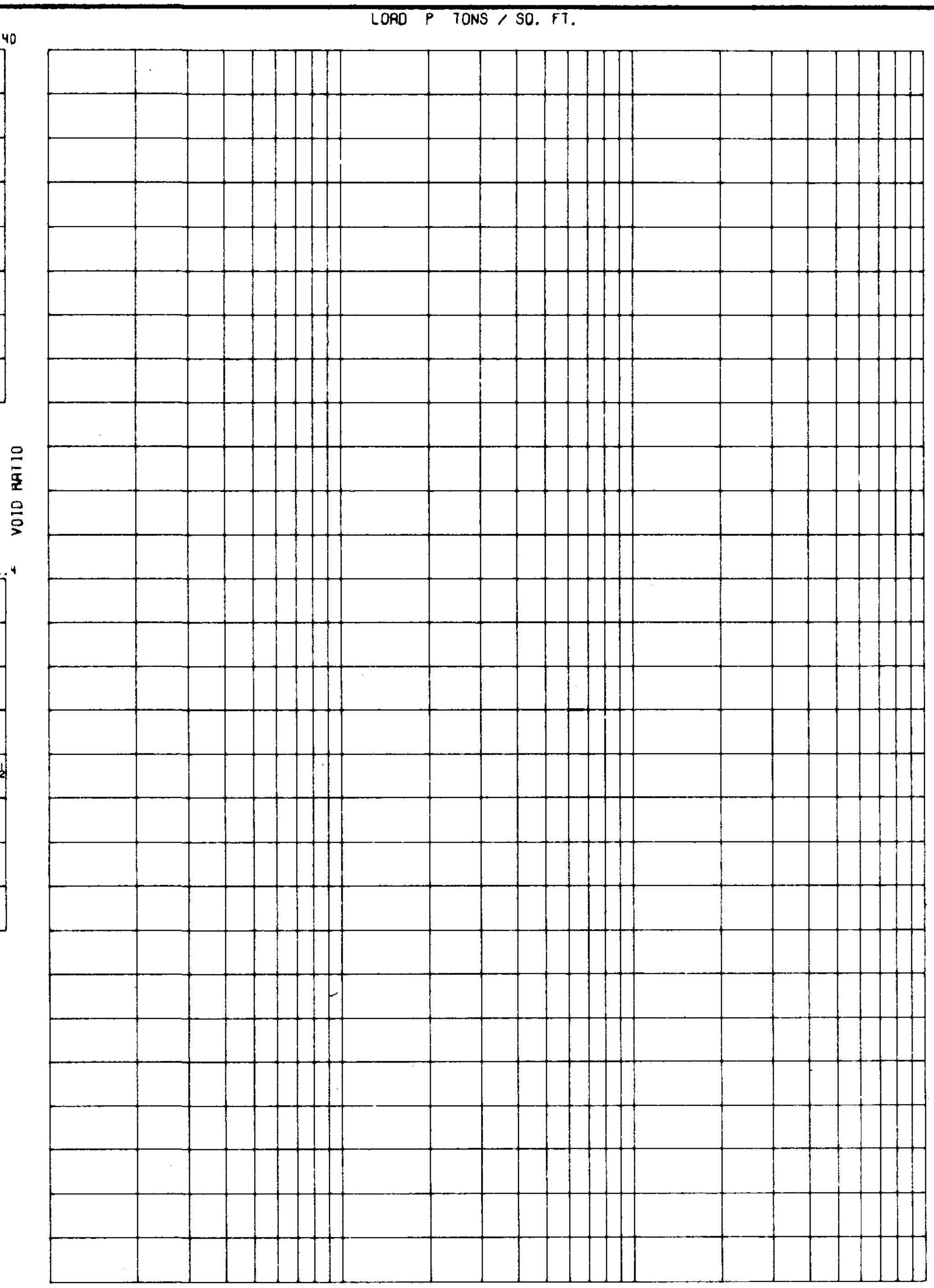




## PLASTICITY CHART




## SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 28-B2UC | 1 | +9.9 | Q | 0° | .287 | CH |
| | 2 | +6.2 | | 0° | .190 | CH |
| | 3 | 0.0 | | 0° | .245 | CH |
| | 4 | -6.2 | | 0° | .262 | CH |
| | 5 | -8.4 | | 0° | .213 | CH |
| | 6 | -16.3 | | 0° | .355 | CH |
| | 7 | -21.8 | | 0° | .383 | CH |
| | 8 | -28.2 | | 0° | .385 | CH |
| | 9 | -37.4 | | 0° | .367 | CH |
| | 10 | -44.9 | | 0° | .318 | CH |
| | 11 | -53.8 | | 0° | .368 | CH |
| | 12 | -61.3 | | 0° | .360 | CH |
| | 13 | -69.0 | | 0° | .307 | CH |




## 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

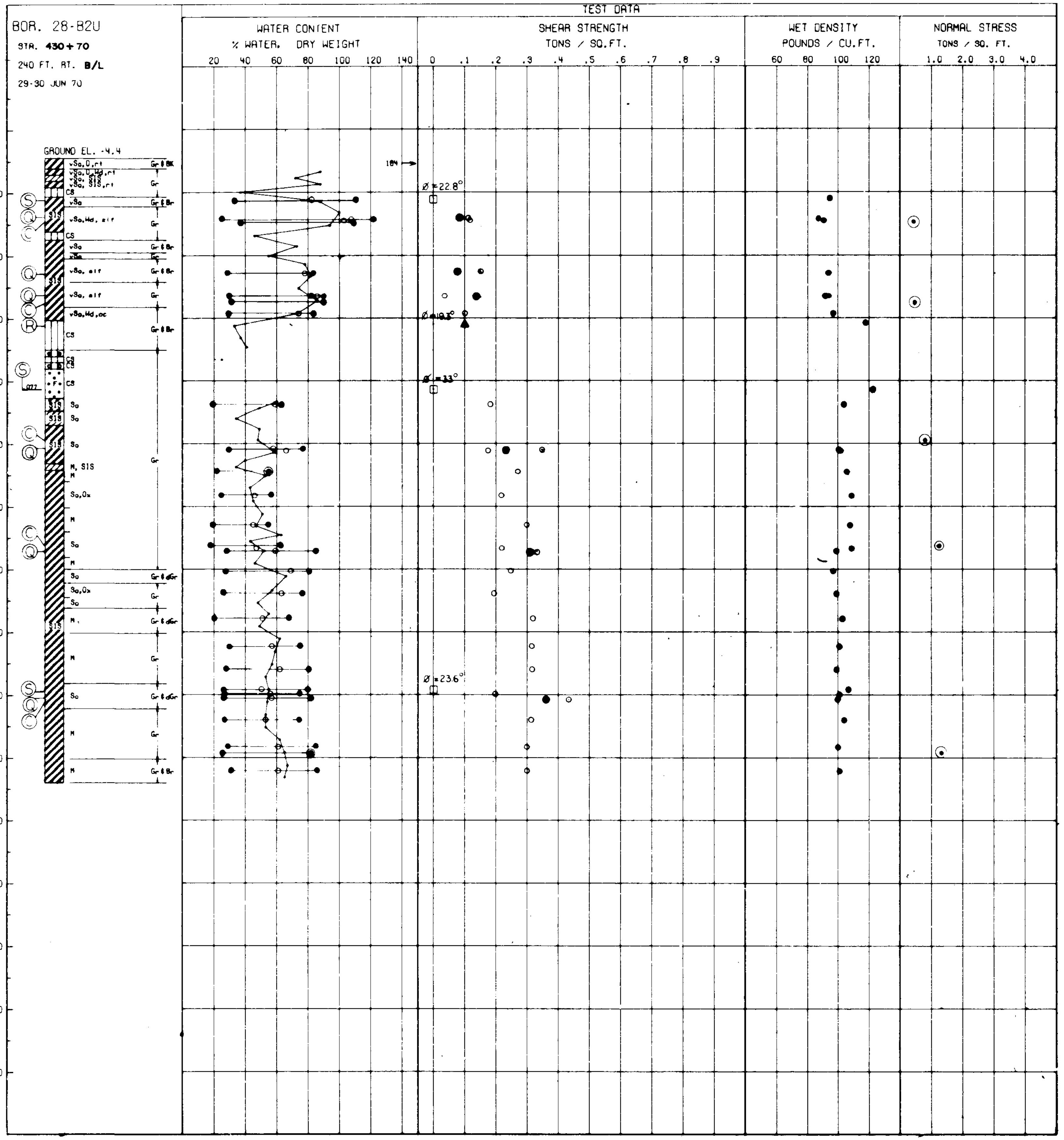
FOR LOCATION OF BORINGS SEE PLATE 6

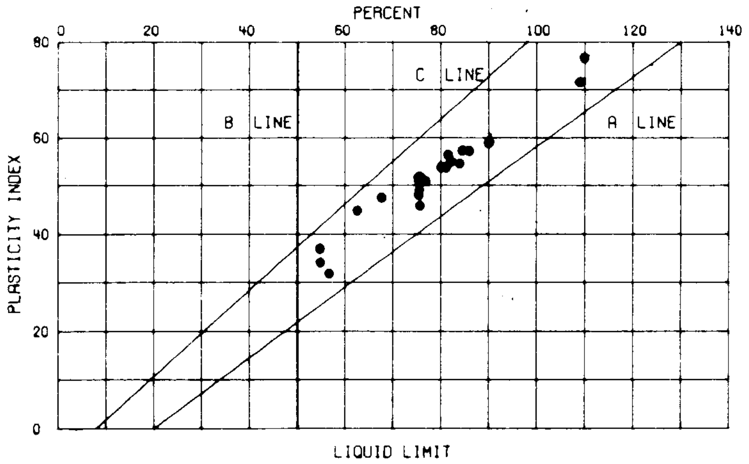
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# UNDISTURBED BORING 28-B2UC DATA

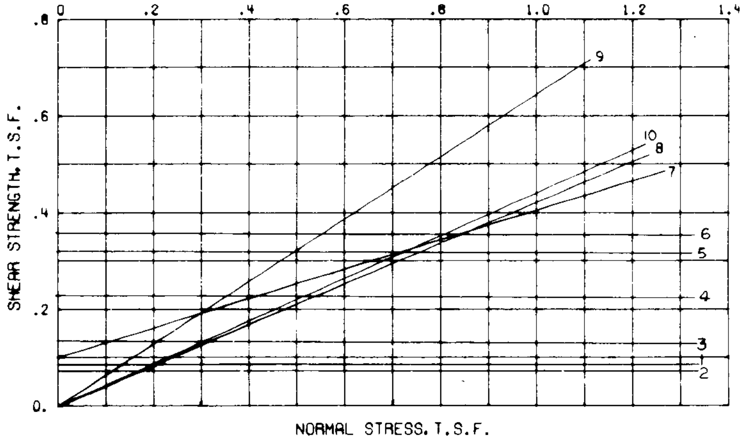
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1972 FILE NO. H-2-25953



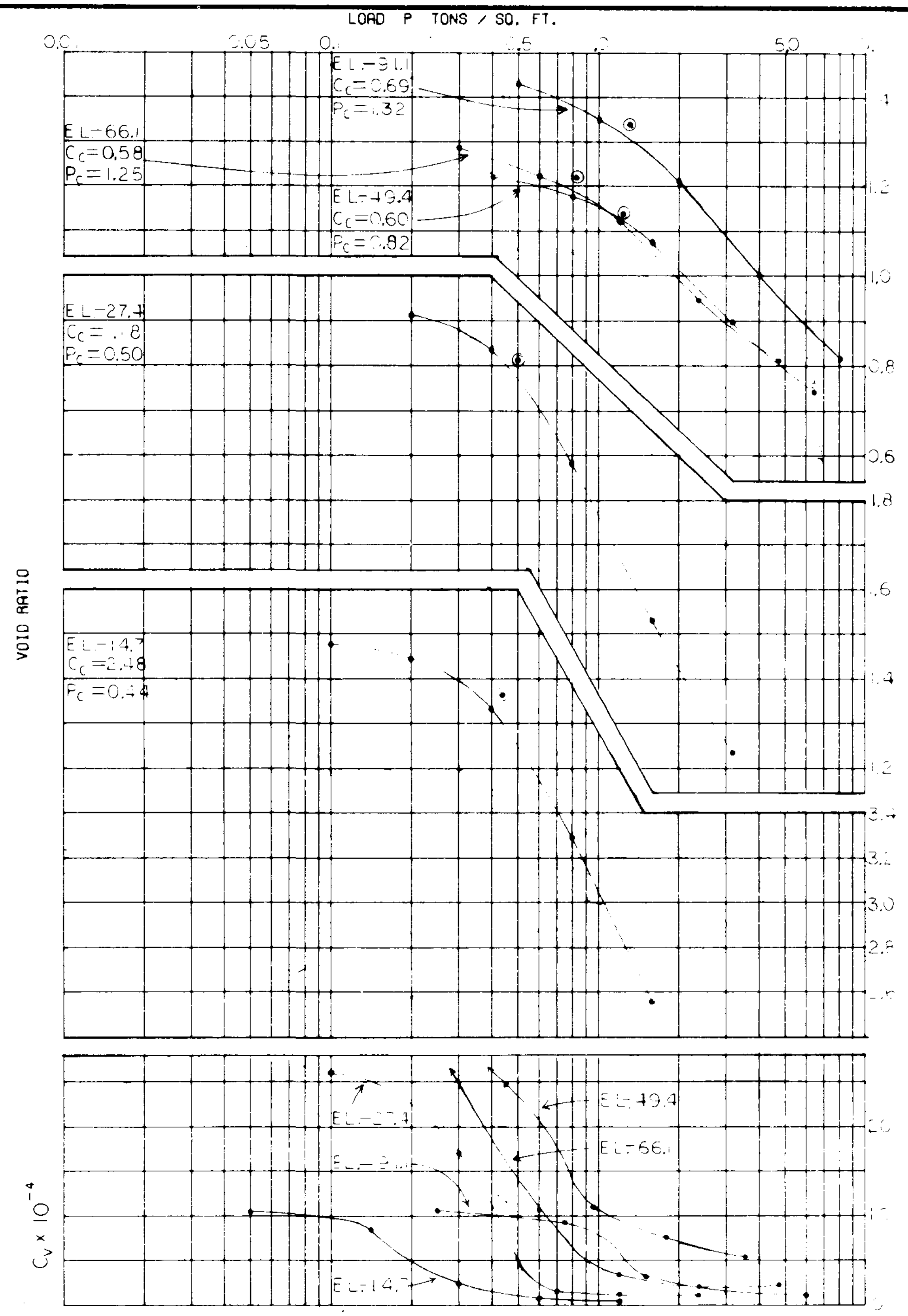




## PLASTICITY CHART




## SHEAR STRENGTH DATA

| BORING NO. | ENVELOPE NO. | ENVELOPE EL. | TYPE | STRENGTH Φ° | STRENGTH C - TSF | CLASS |
|---|---|---|---|---|---|---|
| 28-B2U | 1 | -13.6 | Q | 0 | .085 | CH |
| | 2 | -22.5 | | 0 | .075 | CH |
| | 3 | -26.6 | | 0 | .135 | CH |
| | 4 | -50.3 | | 0 | .230 | CH |
| | 5 | -67.0 | | 0 | .310 | CH |
| | 6 | -90.4 | | 0 | .360 | CH |
| | 7 | -31.1 | R | 17.0 | .100 | ML |
| | 8 | -11.2 | S | 22.8 | 0 | CH |
| | 9 | -41.4 | | 33.0 | 0 | SM |
| | 10 | -89.4 | | 23.6 | 0 | CH |




## 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 6.

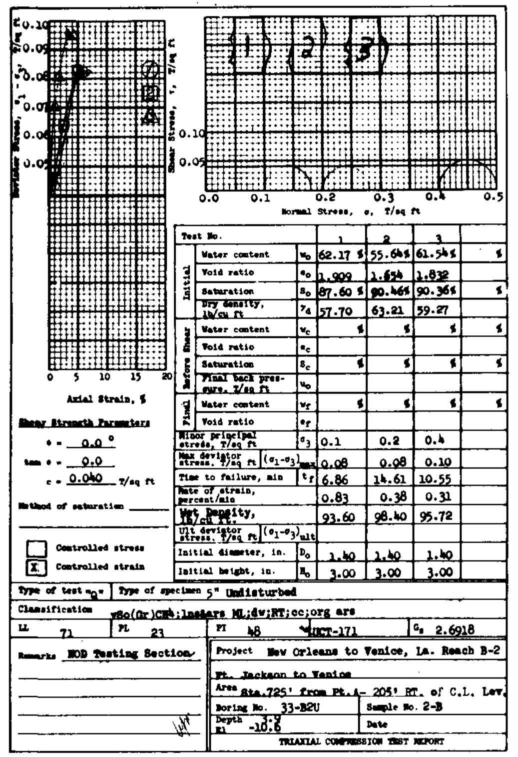
NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

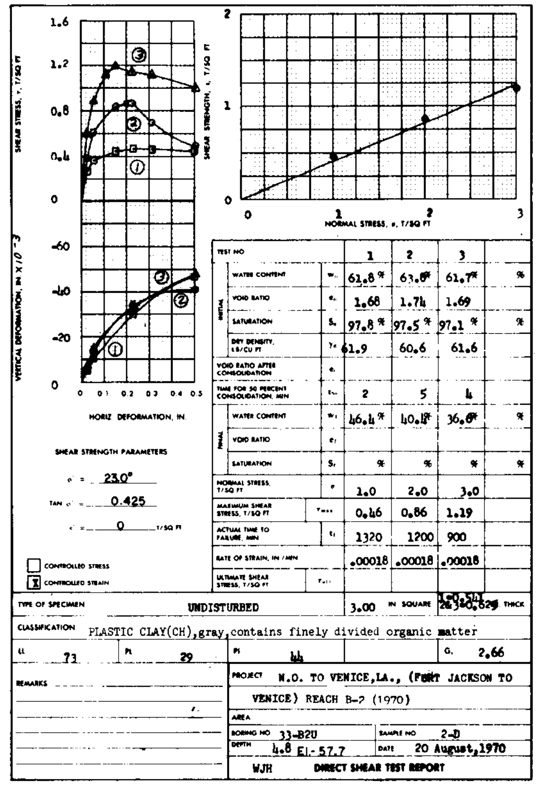
# UNDISTURBED BORING 28-B2U DATA

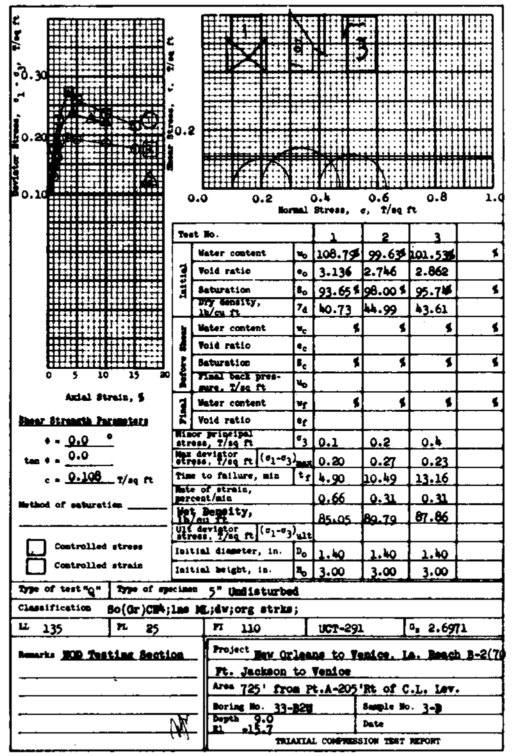
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

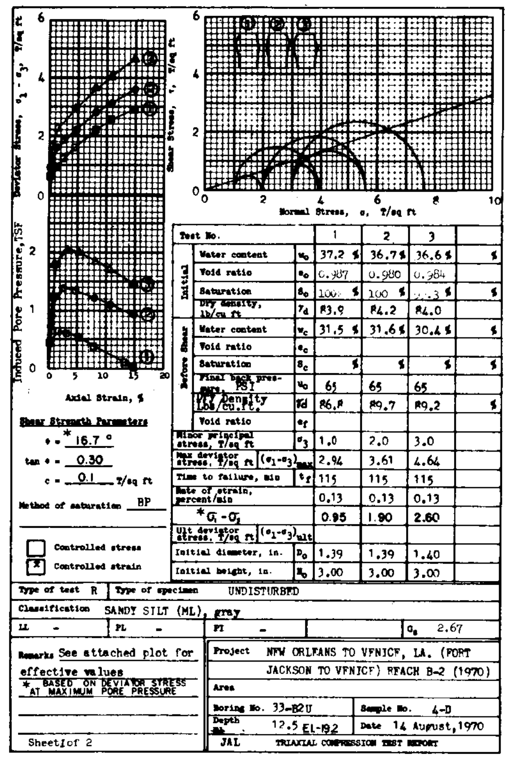
JULY 1972 FILE NO. H-2-25953

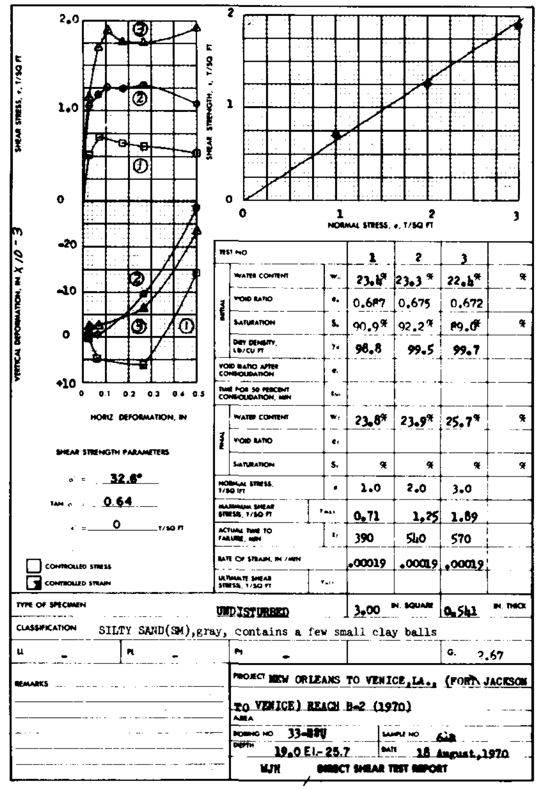
**PLATE 42**

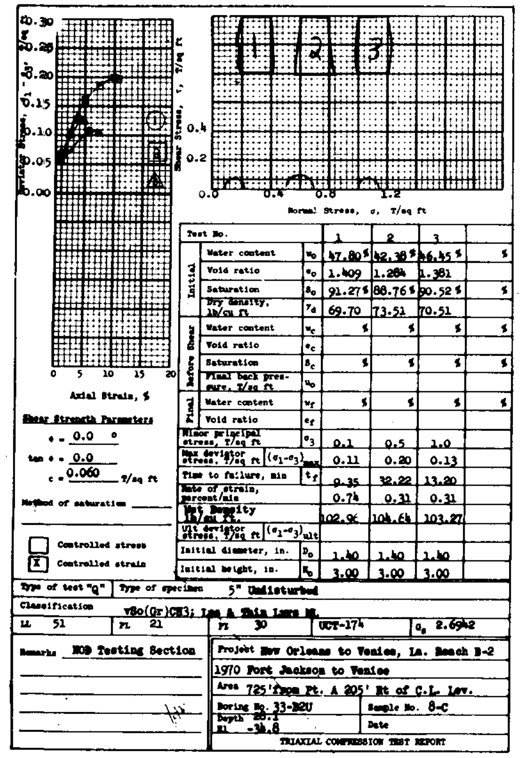


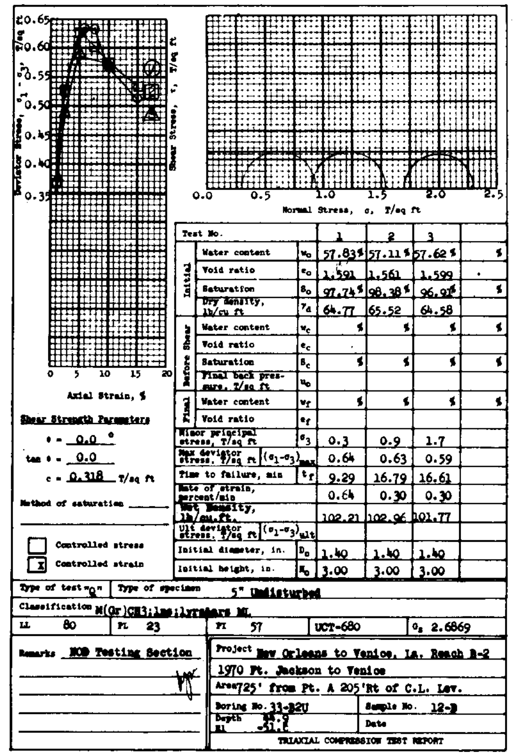


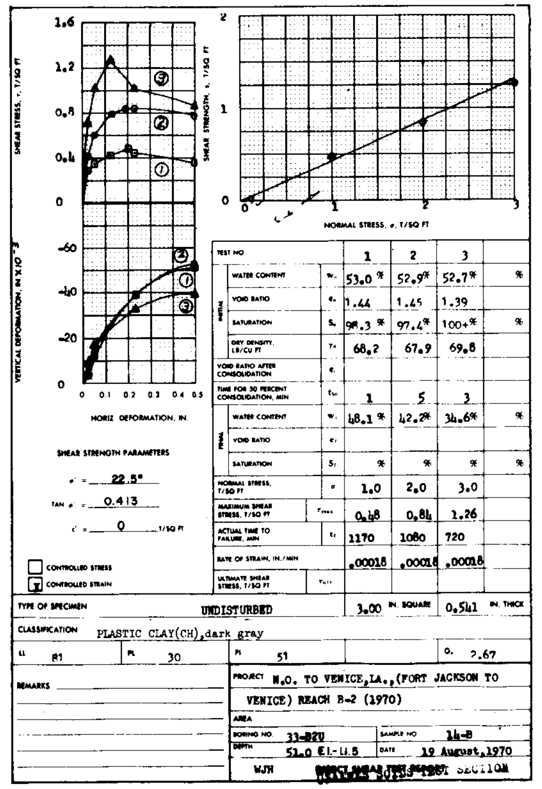


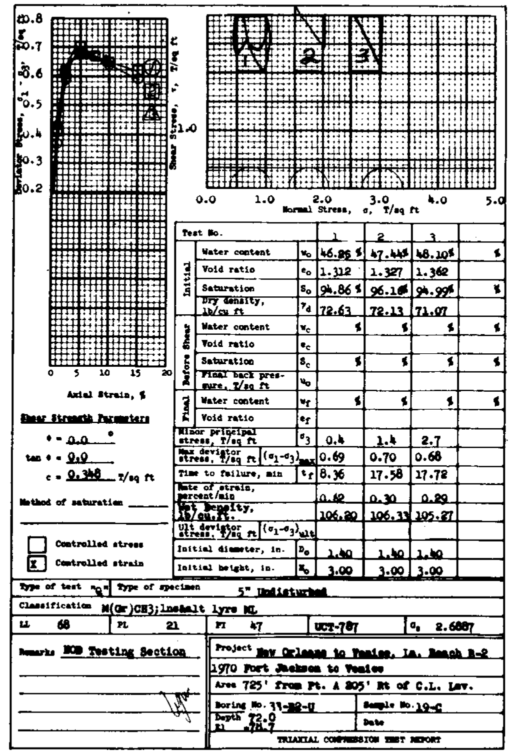


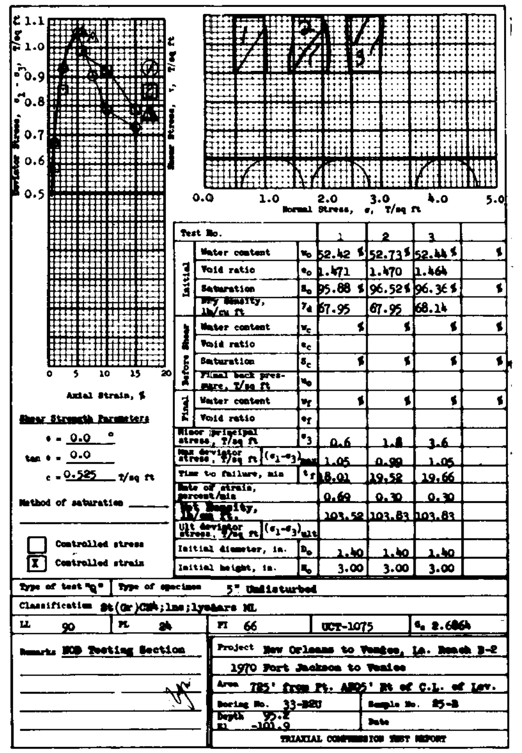












NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

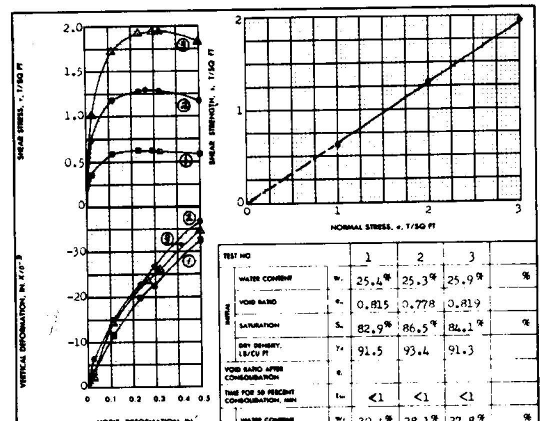
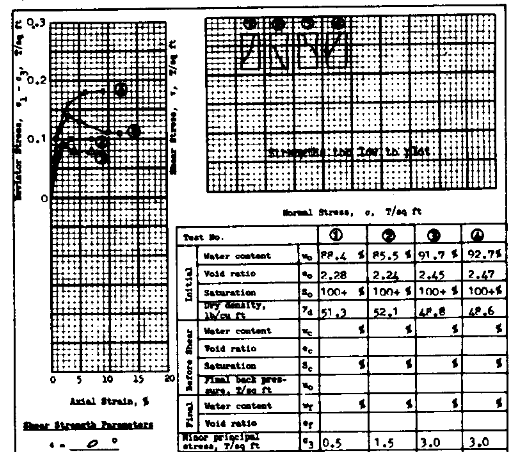
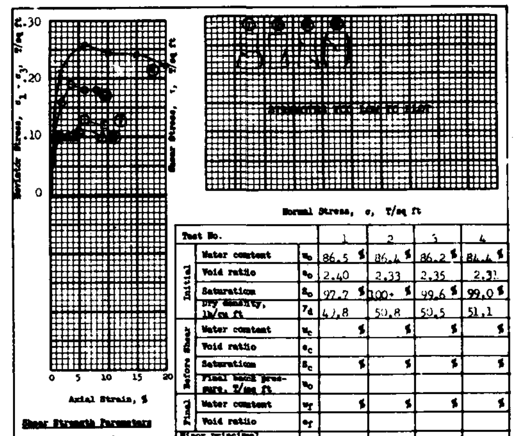
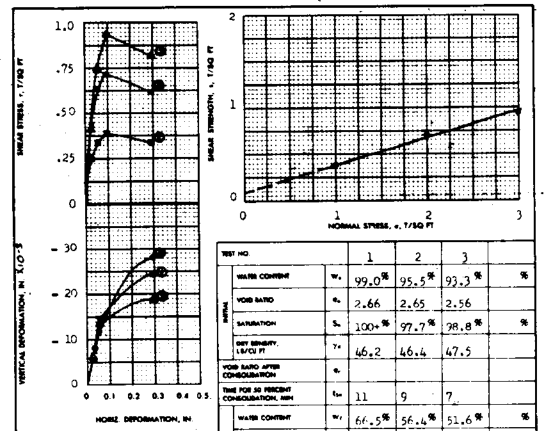
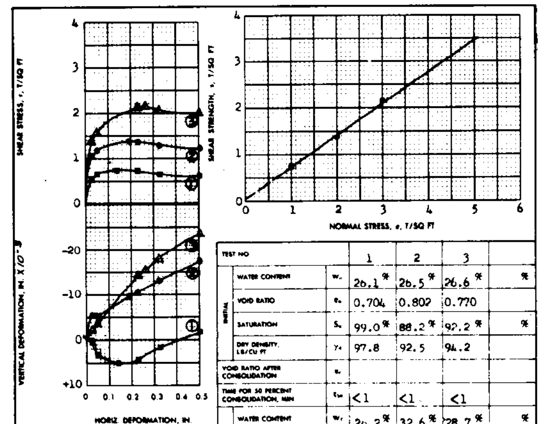
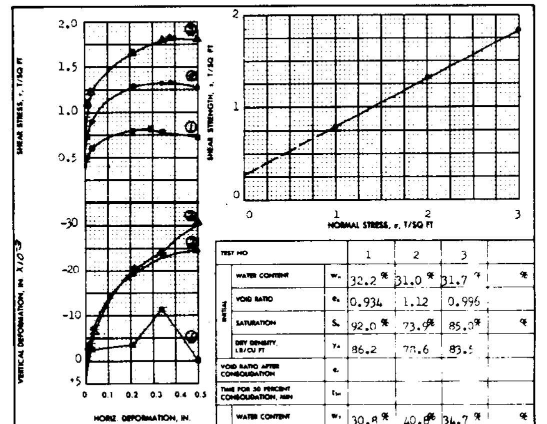
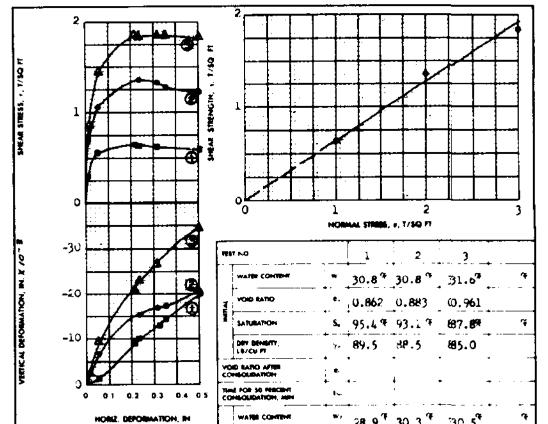
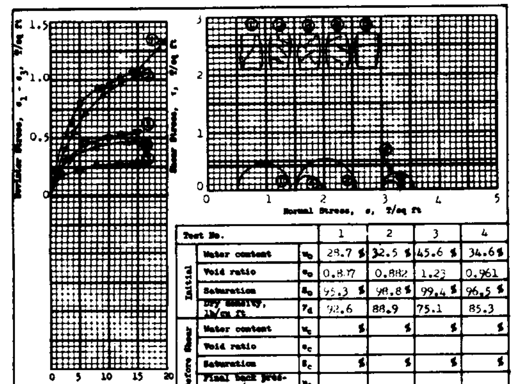
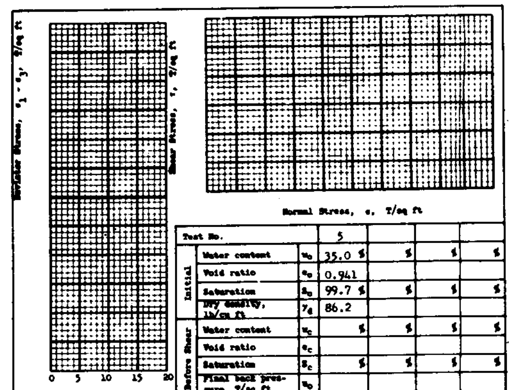
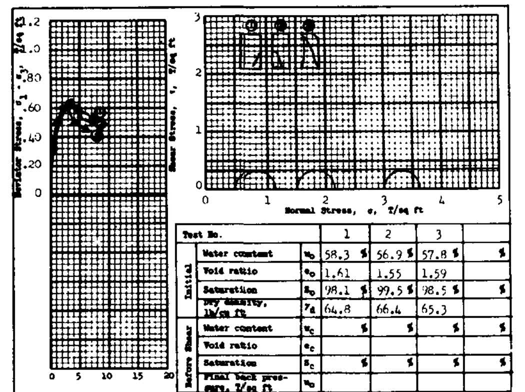
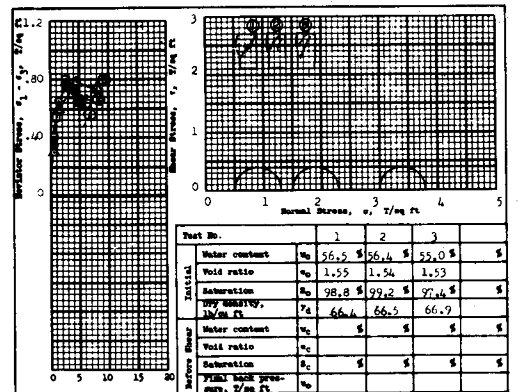
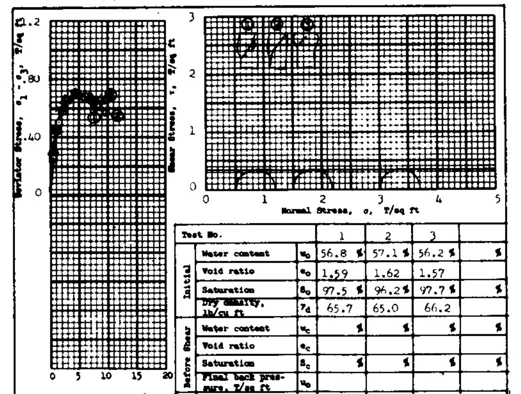
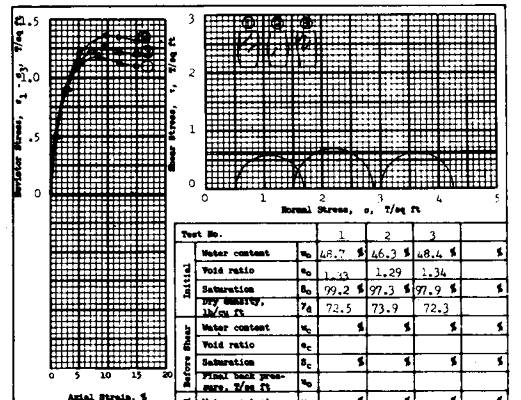
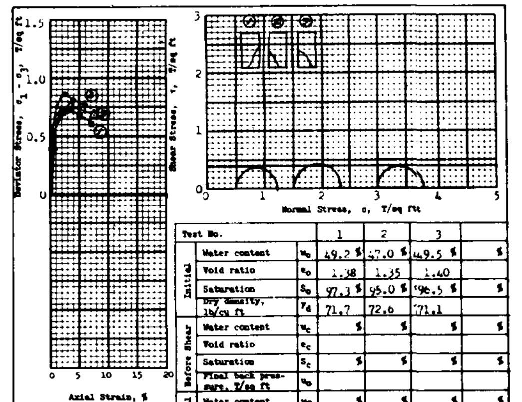
REACH B2 – FORT JACKSON TO VENICE

# DETAIL SHEAR STRENGTH DATA

# BORING 33-B2U

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

JULY 1972 FILE NO. H-2-25953

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 - FORT JACKSON TO VENICE

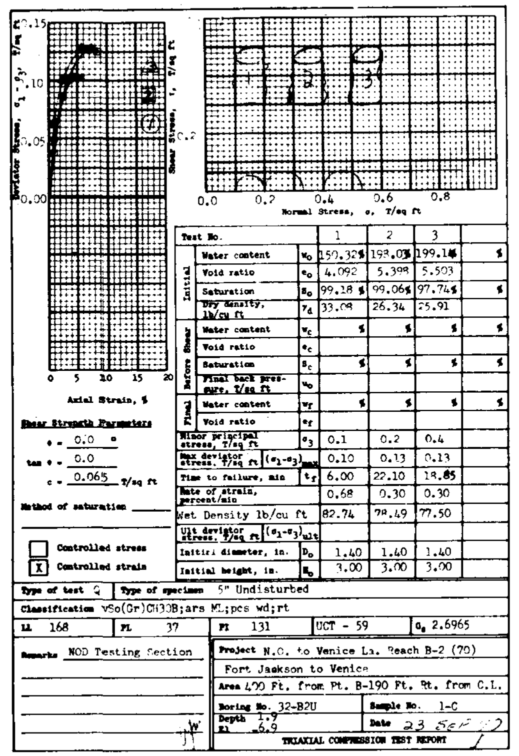
# DETAIL SHEAR STRENGTH DATA

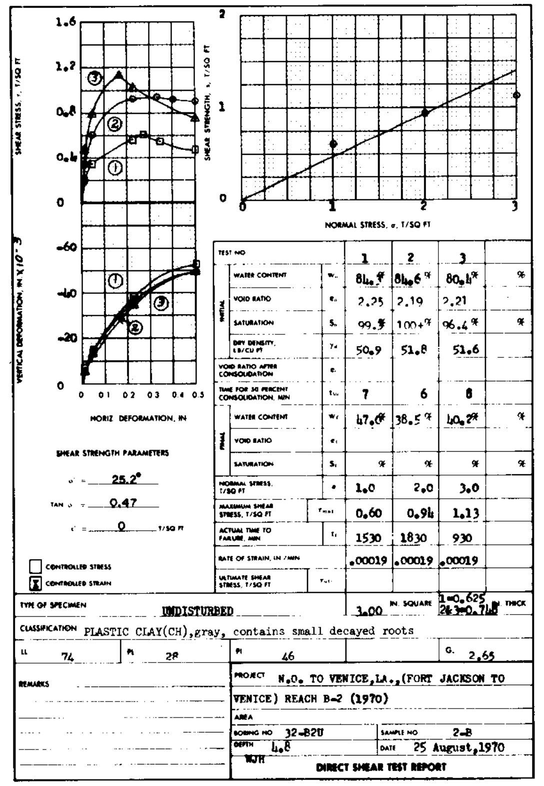
# BORING 6-DU

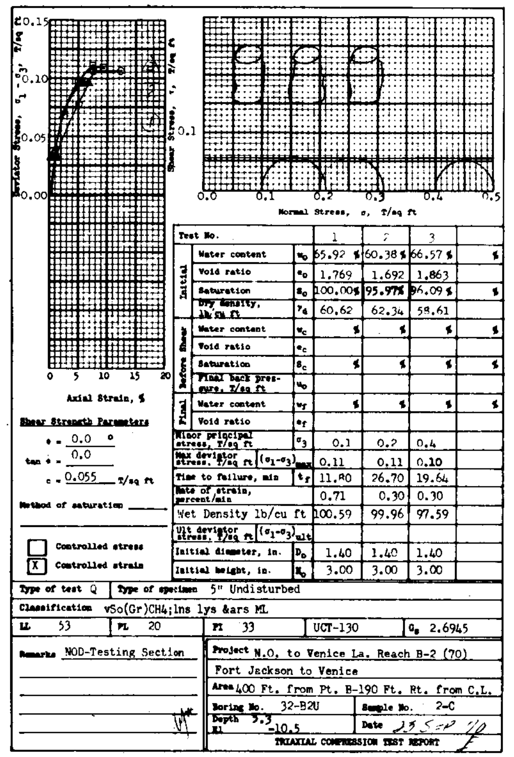
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

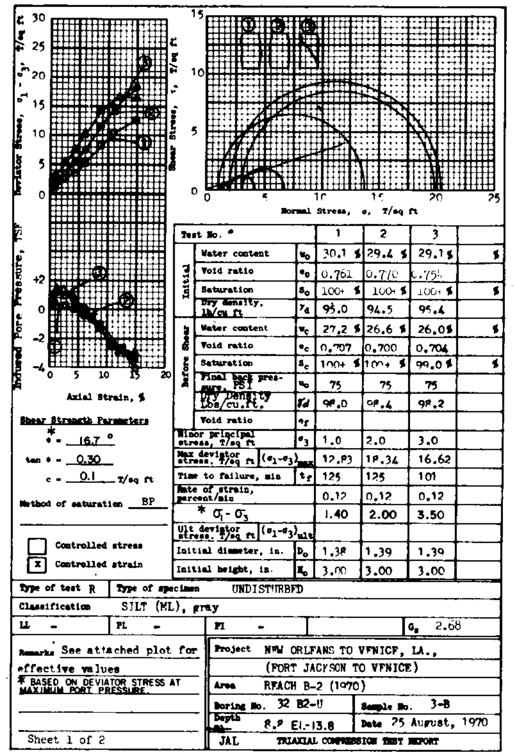
JULY 1972 FILE NO. H-2-25953

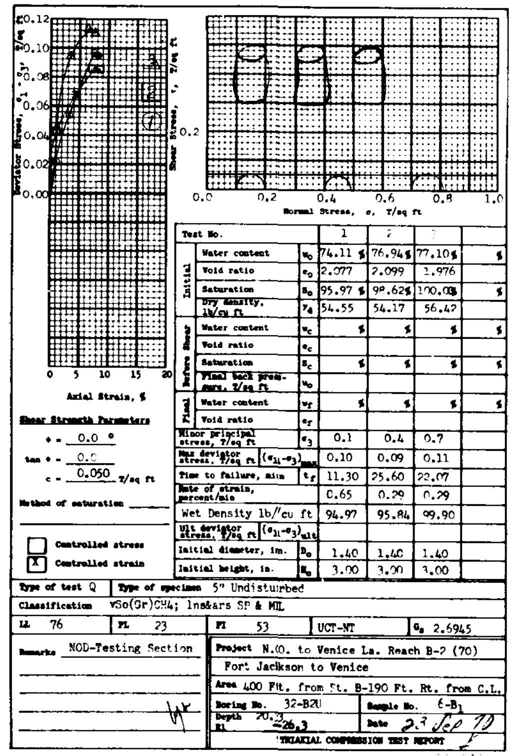
PLATE 44

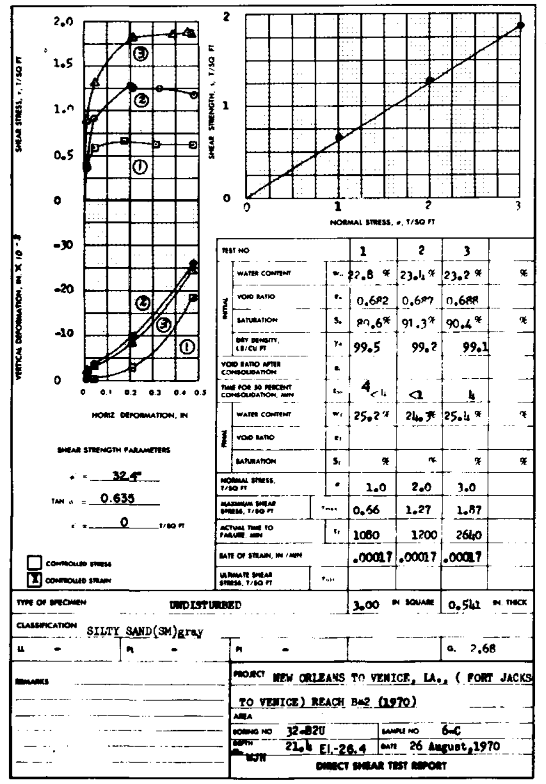


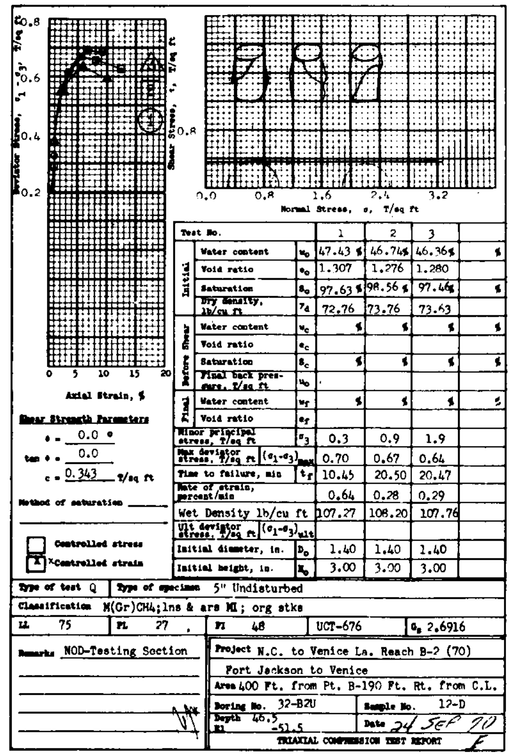



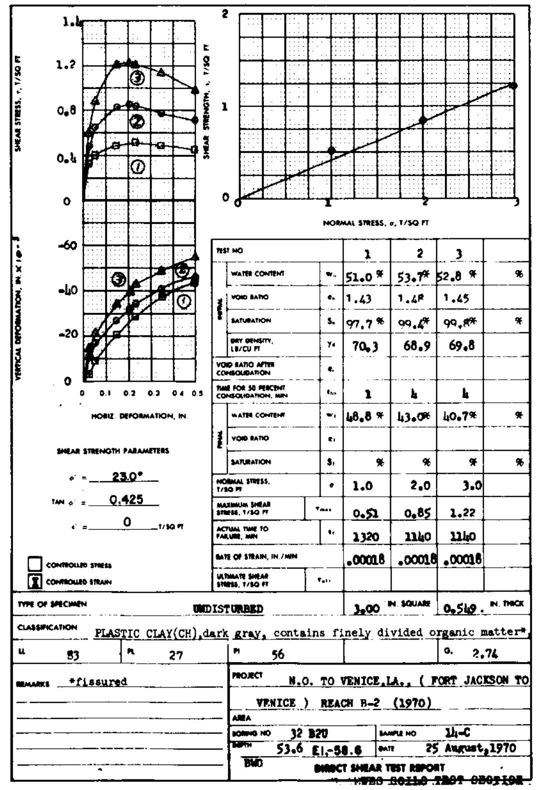



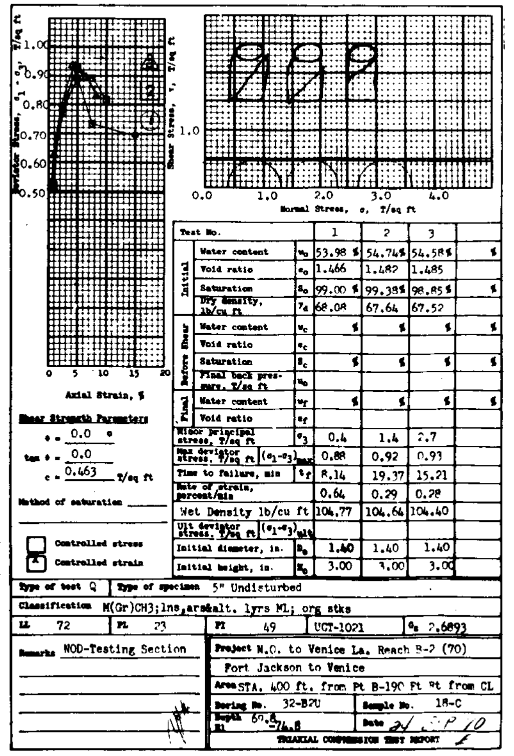



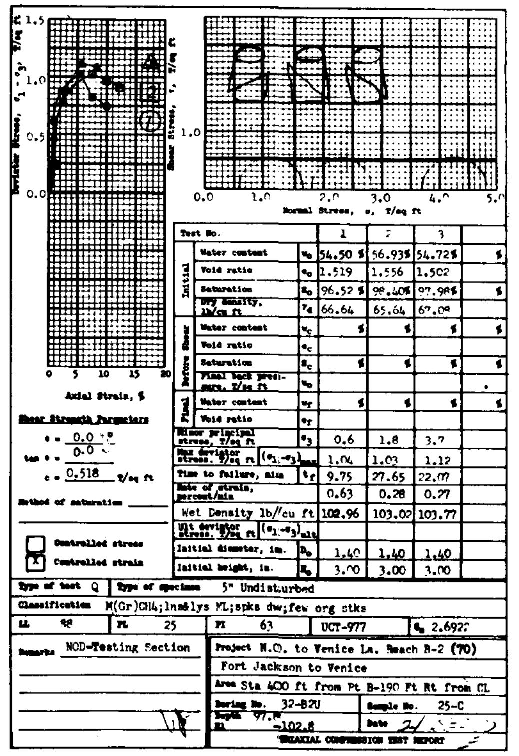




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

**REACH B2 - FORT JACKSON TO VENICE**

# DETAIL SHEAR STRENGTH DATA

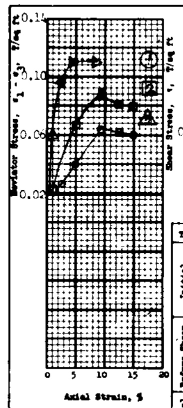
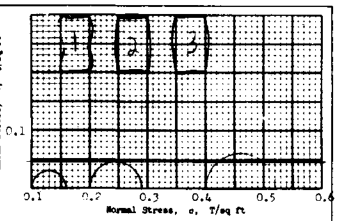
# BORING 32-B2U

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

JULY 1972 FILE NO. H-2-25953

**PLATE 45**

## Triaxial Compression Test Report — Boring 31-B2U, Sample 2-C

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 127.94% | 123.42% | 125.33% | % |
| Initial — Void ratio | $e_o$ | 3.625 | 3.463 | 3.573 | |
| Initial — Saturation | $S_o$ | 94.92% | 95.85% | 94.31% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 36.29 | 37.60 | 36.70 | |
| Before Shear — Water content | $w_c$ | % | % | % | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, T/sq ft | $u_o$ | | | | |
| Final — Water content | $w_f$ | % | % | % | % |
| Final — Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 0.1 | 0.2 | 0.4 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 0.06 | 0.09 | 0.12 | |
| Time to failure, min | $t_f$ | 13.96 | 13.97 | 12.99 | |
| Rate of strain, percent/min | | 0.64 | 0.28 | 0.30 | |
| Wet Density lb/cu ft | | 82.74 | 83.99 | 82.62 | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 0.0°; tan φ = 0.0; c = 0.045 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: 5" Undisturbed

Classification: VSo (Gr)CH4;lns & ars ML; org ars; rt

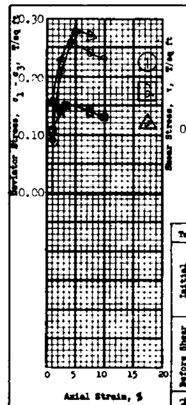
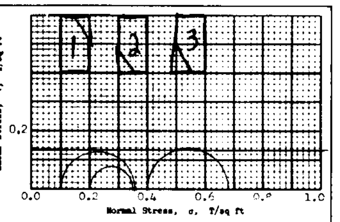
LL 100 — PL 33 — PI 67 — UCT - 59 — $G_s$ 2.6907

Remarks: NOD-Testing Section

Project: N.O. to Venice (70) Reach B-2, Fort Jackson to Venice
Area: Sta. 75 Ft from Pt C-195 Ft Rt C.L. Lev.
Boring No. 31-B2U — Sample No. 2-C
Depth 4.0, El -10.2 — Date 6 OCT 70

TRIAXIAL COMPRESSION TEST REPORT

## Triaxial Compression Test Report — Boring 31-B2U, Sample 5-C

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 67.14% | 63.68% | 64.82% | % |
| Initial — Void ratio | $e_o$ | 1.851 | 1.755 | 1.760 | |
| Initial — Saturation | $S_o$ | 97.03% | 97.97% | 99.44% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 59.09 | 61.16 | 61.05 | |
| Before Shear — Water content | $w_c$ | % | % | % | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, T/sq ft | $u_o$ | | | | |
| Final — Water content | $w_f$ | % | % | % | % |
| Final — Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 0.1 | 0.2 | 0.4 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 0.26 | 0.15 | 0.28 | |
| Time to failure, min | $t_f$ | 6.27 | 10.37 | 17.32 | |
| Rate of strain, percent/min | | 0.65 | 0.30 | 0.29 | |
| Wet Density lb/cu ft | | 98.78 | 100.09 | 100.65 | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 0.0°; tan φ = 0.0; c = 0.135 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: 5" Undisturbed

Classification: So(Gr&Br)CH3;lns & lys ML

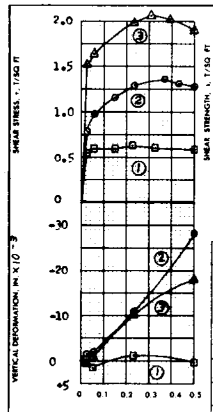
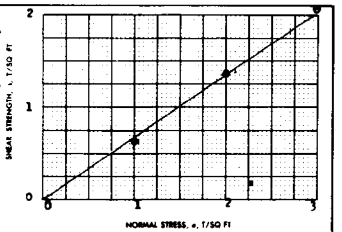
LL 68 — PL 24 — PI 44 — UCT - 262 — $G_s$ 2.6965

Remarks: NOD-Testing Section

Project: N.O. to Venice (70) Reach B-2, Fort Jackson to Venice
Area: Sta. 75 Ft from Pt C-195 Ft Rt C.L. Lev.
Boring No. 31-B2U — Sample No. 5-C
Depth 16.0, El -22.4 — Date 6 OCT 70

TRIAXIAL COMPRESSION TEST REPORT

## Direct Shear Test Report — Boring 31-B2U, Sample 6-C

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 26.3% | 25.6% | 28.9% | % |
| Initial — Void ratio | $e_o$ | 0.739 | 0.735 | 0.793 | |
| Initial — Saturation | $S_o$ | 94.7% | 92.6% | 96.9% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 95.5 | 95.7 | 92.6 | |
| Void ratio after consolidation | $e_c$ | | | | |
| Time for 50 percent consolidation, min | $t_{50}$ | | | | |
| Final — Water content | $w_f$ | 29.3% | 27.6% | 28.5% | % |
| Final — Void ratio | $e_f$ | | | | |
| Final — Saturation | $S_f$ | % | % | % | % |
| Normal stress, T/sq ft | σ | 1.0 | 2.0 | 3.0 | |
| Maximum shear stress, T/sq ft | $\tau_{max}$ | 0.62 | 1.36 | 2.06 | |
| Actual time to failure, min | $t_f$ | 1260 | 2010 | 1680 | |
| Rate of strain, in./min | | .00018 | .00018 | .00018 | |
| Ultimate shear stress, T/sq ft | $\tau_{ult}$ | | | | |

Shear Strength Parameters: φ = 34.2°; tan φ = 0.68; c = 0 T/sq ft

☐ Controlled stress
☒ Controlled strain

Type of specimen: UNDISTURBED — 3.00 in. square — 0.549 in. thick

Classification: SILTY SAND(SM),gray, contains a trace of finely divided organic matter

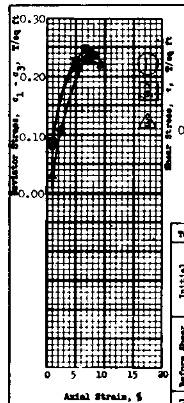
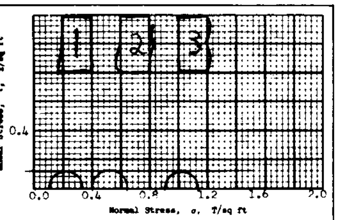
LL – — PL – — PI – — $G_s$ 2.66

Remarks:

Project: N.O. TO VENICE,LA.,(FORT JACKSON TO VENICE) REACH B-2 (1970)
Area:
Boring No. 31-B2U — Sample No. 6-C
Depth 20.0 El-26.4 — Date 26 August,1970
BMG

DIRECT SHEAR TEST REPORT

## Triaxial Compression Test Report — Boring 31-B2U, Sample 7-B

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 51.54% | 51.65% | 53.47% | % |
| Initial — Void ratio | $e_o$ | 1.467 | 1.444 | 1.499 | |
| Initial — Saturation | $S_o$ | 94.54% | 96.23% | 95.89% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 68.08 | 68.70 | 67.14 | |
| Before Shear — Water content | $w_c$ | % | % | % | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, T/sq ft | $u_o$ | | | | |
| Final — Water content | $w_f$ | % | % | % | % |
| Final — Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 0.1 | 0.4 | 0.9 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 0.24 | 0.24 | 0.23 | |
| Time to failure, min | $t_f$ | 11.35 | 9.94 | 23.59 | |
| Rate of strain, percent/min | | 0.64 | 0.65 | 0.28 | |
| Wet Density lb/cu ft | | 103.14 | 104.14 | 103.02 | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 0.0°; tan φ = 0.0; c = 0.120 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: 5" Undisturbed

Classification: So(Gr)CH2;lns & lys ML; spks dw

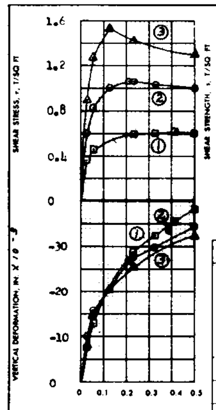
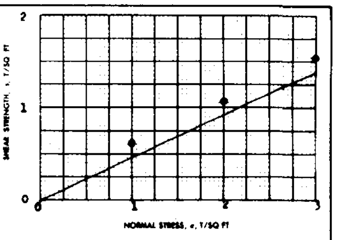
LL 51 — PL 21 — PI 30 — UCT - 313 — $G_s$ 2.6887

Remarks: NOD-Testing Section

Project: N.O. to Venice (70) Reach B-2, Fort Jackson to Venice
Area: Sta. 75 Ft from Pt C-195 Ft Rt C.L. Lev.
Boring No. 31-B2U — Sample No. 7-B
Depth 23.0, El -29.4 — Date 6 OCT 70

TRIAXIAL COMPRESSION TEST REPORT

## Direct Shear Test Report — Boring 31-B2U, Sample 7-C

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 43.8% | 46.0% | 43.7% | % |
| Initial — Void ratio | $e_o$ | 1.23 | 1.26 | 1.19 | |
| Initial — Saturation | $S_o$ | 96.1% | 98.6% | 99.2% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 75.6 | 74.4 | 77.0 | |
| Void ratio after consolidation | $e_c$ | | | | |
| Time for 50 percent consolidation, min | $t_{50}$ | <1 | 2 | <1 | |
| Final — Water content | $w_f$ | 35.0% | 34.0% | 29.3% | % |
| Final — Void ratio | $e_f$ | | | | |
| Final — Saturation | $S_f$ | % | % | % | % |
| Normal stress, T/sq ft | σ | 1.0 | 2.0 | 3.0 | |
| Maximum shear stress, T/sq ft | $\tau_{max}$ | 0.61 | 1.06 | 1.53 | |
| Actual time to failure, min | $t_f$ | 2280 | 1200 | 720 | |
| Rate of strain, in./min | | .00018 | .00018 | .00018 | |
| Ultimate shear stress, T/sq ft | $\tau_{ult}$ | | | | |

Shear Strength Parameters: φ = 25.0°; tan φ = 0.466; c = 0 T/sq ft

☐ Controlled stress
☒ Controlled strain

Type of specimen: UNDISTURBED — 3.00 in. square — 0.549 in. thick

Classification: LEAN CLAY(CL),gray, contains silt laminations

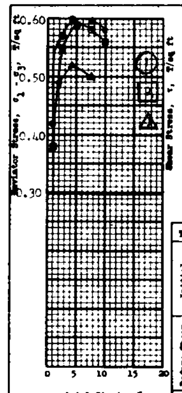
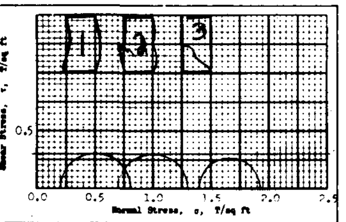
LL 47 — PL 18 — PI 29 — $G_s$ 2.70

Remarks:

Project: NEW ORLEANS TO VENICE,LA., (FORT JACKSON TO VENICE) REACH B-2 (1970)
Area:
Boring No. 31-B2U — Sample No. 7-C
Depth 24.0 El-30.4 — Date 27 August,1970
BMG

DIRECT SHEAR TEST REPORT

## Triaxial Compression Test Report — Boring 31-B2U, Sample 10-C

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 47.41% | 47.38% | 49.68% | % |
| Initial — Void ratio | $e_o$ | 1.280 | 1.311 | 1.371 | |
| Initial — Saturation | $S_o$ | 99.65% | 98.26% | 97.49% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 73.63 | 72.63 | 70.82 | |
| Before Shear — Water content | $w_c$ | % | % | % | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, T/sq ft | $u_o$ | | | | |
| Final — Water content | $w_f$ | % | % | % | % |
| Final — Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 0.2 | 0.7 | 1.4 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 0.60 | 0.59 | 0.52 | |
| Time to failure, min | $t_f$ | 6.69 | 17.94 | 15.74 | |
| Rate of strain, percent/min | | 0.64 | 0.28 | 0.28 | |
| Wet Density lb/cu ft | | 108.51 | 107.45 | 105.96 | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 0.0°; tan φ = 0.0; c = 0.300 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: 5" Undisturbed

Classification: M(Gr&dGr)CH3;lns ML; org stks; spks dw

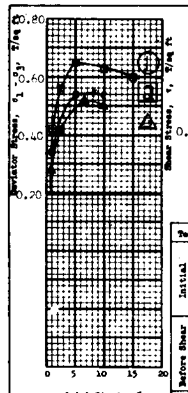
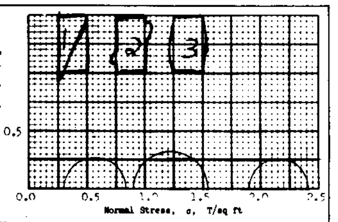
LL 63 — PL 25 — PI 38 — UCT - 544 — $G_s$ 2.6859

Remarks: NOD-Testing Section

Project: N.O. to Venice (70) Reach B-2, Fort Jackson to Venice
Area: Sta. 75 Ft from Pt C-195 Ft Rt C.L. Lev
Boring No. 31-B2U — Sample No. 10-C
Depth 36.0, El -42.4 — Date 6 OCT 70

TRIAXIAL COMPRESSION TEST REPORT

## Triaxial Compression Test Report — Boring 31-B2U, Sample 13-D

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 46.16% | 45.26% | 45.95% | % |
| Initial — Void ratio | $e_o$ | 1.280 | 1.247 | 1.286 | |
| Initial — Saturation | $S_o$ | 97.04% | 97.64% | 96.13% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 73.63 | 74.69 | 73.44 | |
| Before Shear — Water content | $w_c$ | % | % | % | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, T/sq ft | $u_o$ | | | | |
| Final — Water content | $w_f$ | % | % | % | % |
| Final — Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 0.3 | 0.9 | 1.9 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 0.54 | 0.65 | 0.52 | |
| Time to failure, min | $t_f$ | 13.24 | 19.25 | 23.79 | |
| Rate of strain, percent/min | | 0.63 | 0.28 | 0.29 | |
| Wet Density lb/cu ft | | 107.58 | 108.51 | 107.20 | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 0.0°; tan φ = 0.0; c = 0.260 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: 5" Undisturbed

Classification: M(Gr&dGr)CH4;lns & ars ML

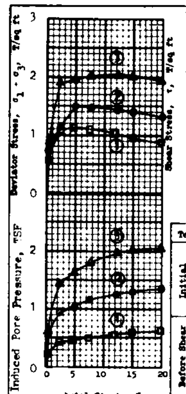
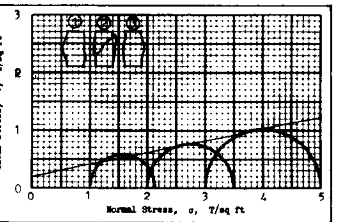
LL 60 — PL 22 — PI 38 — UCT - 785 — $G_s$ 2.6864

Remarks: NOD-Testing Section

Project: N.O. to Venice (70) Reach B-2, Fort Jackson to Venice
Area: Sta. 75 Ft from Pt C-195 Ft Rt C.L. Lev
Boring No. 31-B2U — Sample No. 13-D
Depth 49.0, El 55.4 — Date 6 OCT 70

TRIAXIAL COMPRESSION TEST REPORT

## Triaxial Compression Test Report — Boring 31 B2U, Sample 15-B

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 54.5% | 54.6% | 54.1% | % |
| Initial — Void ratio | $e_o$ | 1.50 | 1.50 | [illegible] | |
| Initial — Saturation | $S_o$ | [illegible]% | 100% | [illegible]% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 68.7 | 68.8 | 68.8 | |
| Before Shear — Water content | $w_c$ | 52.3% | 46.8% | 42.6% | % |
| Before Shear — Void ratio | $e_c$ | | | | |
| Before Shear — Saturation | $S_c$ | % | % | % | % |
| Before Shear — Final back pressure, PSI | $u_o$ | 65 | 65 | 65 | |
| Dry Density Lbs/cu.ft. | $\gamma_d$ | 71.3 | 75.3 | 78.7 | |
| | $e_f$ | | | | |
| Minor principal stress, T/sq ft | $\sigma_3$ | 1.0 | 2.0 | 3.0 | |
| Max deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{max}$ | 1.13 | 1.50 | 2.04 | |
| Time to failure, min | $t_f$ | 38 | 38 | 88 | |
| Rate of strain, percent/min | | 0.13 | 0.13 | 0.14 | |
| | | | | | |
| Ult deviator stress, T/sq ft | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | $D_o$ | 1.41 | 1.41 | 1.41 | |
| Initial height, in. | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters: φ = 11.3°; tan φ = 0.20; c = 0.2 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test: R — Type of specimen: UNDISTURBED

Classification: PLASTIC CLAY (CP), grey

LL 78 — PL 23 — PI 55 — $G_s$ 2.75

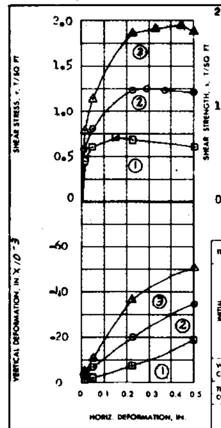
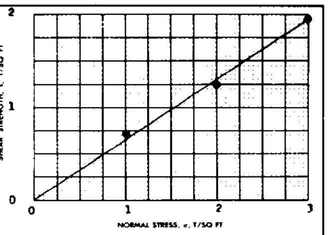
Remarks: See attached plot for effective values

Sheet 1 of 2

Project: NEW ORLEANS TO VENICE, LA. (FORT JACKSON TO VENICE)
Area: REACH B-2 (1970)
Boring No. 31 B2U — Sample No. 15-B
Depth 55.0 El-61.4 — Date 25 August,1970
JAL

TRIAXIAL COMPRESSION TEST REPORT

## Direct Shear Test Report — Boring 31-B2U, Sample 20-B

| Test No. | | 1 | 2 | 3 | |
|---|---|---|---|---|---|
| Initial — Water content | $w_o$ | 28.0% | 27.9% | 28.2% | % |
| Initial — Void ratio | $e_o$ | 0.798 | 0.808 | 0.804 | |
| Initial — Saturation | $S_o$ | 94.4% | 92.9% | 94.4% | % |
| Initial — Dry density, lb/cu ft | $\gamma_d$ | 93.4 | 92.9 | 93.1 | |
| Void ratio after consolidation | $e_c$ | | | | |
| Time for 50 percent consolidation, min | $t_{50}$ | | | | |
| Final — Water content | $w_f$ | 27.8% | 26.5% | 28.2% | % |
| Final — Void ratio | $e_f$ | | | | |
| Final — Saturation | $S_f$ | % | % | % | % |
| Normal stress, T/sq ft | σ | 1.0 | 2.0 | 3.0 | |
| Maximum shear stress, T/sq ft | $\tau_{max}$ | 0.72 | 1.25 | 1.95 | |
| Actual time to failure, min | $t_f$ | 870 | 1590 | 2400 | |
| Rate of strain, in./min | | .00019 | .00019 | .00019 | |
| Ultimate shear stress, T/sq ft | $\tau_{ult}$ | | | | |

Shear Strength Parameters: φ = 33.0°; tan φ = 0.65; c = 0 T/sq ft

☐ Controlled stress
☒ Controlled strain

Type of specimen: UNDISTURBED — 3.00 in. square — 0.541 in. thick

Classification: SANDY SILT(ML)gray, contains a trace of clay and finely divided *

LL – — PL – — PI – — $G_s$ 2.69

Remarks: *organic matter

Project: NEW ORLEANS TO VENICE,LA.,(FORT JACKSON TO VENICE) REACH B-2 (1970)
Area:
Boring No. 31-B2U — Sample No. 20-B
Depth 75.4 El-81.8 — Date 27 August,1970
WJH

DIRECT SHEAR TEST REPORT

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NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 - FORT JACKSON TO VENICE

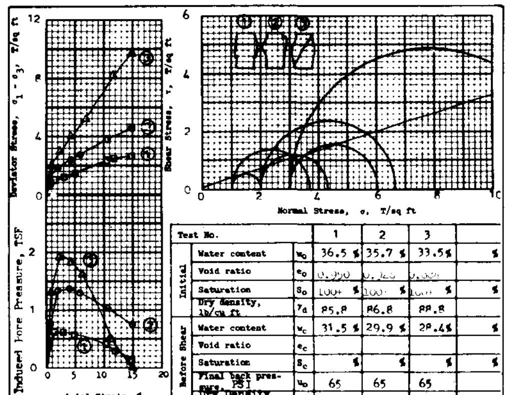
# DETAIL SHEAR STRENGTH DATA

# BORING 31-B2U

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

JULY 1972 — FILE NO. H-2-25953

PLATE 46



| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 36.5 % | 35.7 % | 33.5 % | % |
| Initial | Void ratio | $e_o$ | [illegible] | [illegible] | [illegible] | |
| Initial | Saturation | $S_o$ | 100+ % | [illegible] % | [illegible] % | % |
| Initial | Dry density, lb/cu ft | $\gamma_d$ | 85.8 | 86.8 | 88.8 | |
| Before Shear | Water content | $w_c$ | 31.5 % | 29.9 % | 28.4 % | % |
| Before Shear | Void ratio | $e_c$ | | | | |
| Before Shear | Saturation | $S_c$ | % | % | % | % |
| Before Shear | Final back pressure, PSI | $u_o$ | 65 | 65 | 65 | |
| Before Shear | Dry Density Lbs/cu.ft. | $\gamma_d$ | 93.3 | 97.9 | 96.5 | |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 1.0 | 2.0 | 3.0 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 2.70 | 4.64 | 9.71 | |
| Time to failure, min | | $t_f$ | 107 | 107 | 107 | |
| Rate of strain, percent/min | | | 0.14 | 0.14 | 0.14 | |
| * $\sigma_1 - \sigma_3$ | | | 1.0 | 2.3 | 30 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.39 | 1.39 | 1.39 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
- $\phi$ = 17.6 ° *
- tan $\phi$ = 0.317
- c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

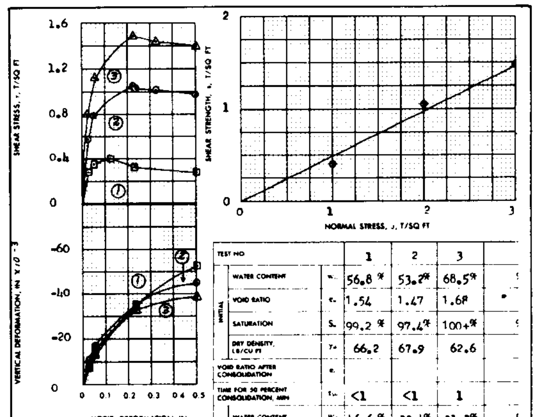
Type of test R — Type of specimen UNDISTURBED

Classification SILT (ML), gray — * BASED ON DEVIATOR STRESS AT MAXIMUM PORE PRESSURE.

LL – PL – PI – $G_s$ [illegible]

Remarks: See attached plot for effective values. Portion of Sample was allowed to drain before trimming. Sheet 1 of 2

Project NEW ORLEANS TO VENICE, LA. (FORT JACKSON TO VENICE) REACH B-2 (1970)
Area
Boring No. 30-B2U — Sample No. 3-B
Depth 6.6 El.-9.5 — Date 26 August, 1970
JAL — TRIAXIAL COMPRESSION TEST REPORT



| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 56.8 % | 53.2 % | 68.5 % | % |
| INITIAL | VOID RATIO | $e_o$ | 1.54 | 1.47 | 1.68 | |
| INITIAL | SATURATION | $S_o$ | 99.2 % | 97.4 % | 100+ % | % |
| INITIAL | DRY DENSITY, LB/CU FT | $\gamma_d$ | 66.2 | 67.9 | 62.6 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | <1 | <1 | 1 | |
| FINAL | WATER CONTENT | $w_f$ | 46.6 % | 33.4 % | 31.3 % | % |
| FINAL | VOID RATIO | $e_f$ | | | | |
| FINAL | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | $\sigma$ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.40 | 1.05 | 1.49 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 720 | 1260 | 1260 | |
| RATE OF STRAIN, IN/MIN | | | .00018 | .00018 | .00018 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
- $\phi'$ = 25.8°
- TAN $\phi'$ = 0.483
- $c'$ = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

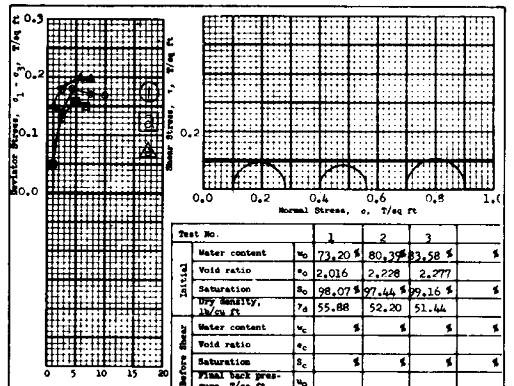
TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.549 IN. THICK

CLASSIFICATION PLASTIC CLAY(CH), gray

LL 86 — PL 31 — PI 55 — $G_s$ 2.69

REMARKS Initial water content of test specimen no. 3 appears erroneous

PROJECT NEW ORLEANS TO VENICE, LA., (FORT JACKSON TO VENICE) REACH B-2 (1970)
AREA
BORING NO 30-B2U — SAMPLE NO 3-D
DEPTH 8.5 El.-11.5 — DATE 31 August, 1970
BMG — DIRECT SHEAR TEST REPORT



| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 73.20 % | 80.39 % | 83.58 % | % |
| Initial | Void ratio | $e_o$ | 2.016 | 2.228 | 2.277 | |
| Initial | Saturation | $S_o$ | 98.07 % | 97.44 % | 99.16 % | % |
| Initial | Dry density, lb/cu ft | $\gamma_d$ | 55.88 | 52.20 | 51.44 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| Before Shear | Void ratio | $e_c$ | | | | |
| Before Shear | Saturation | $S_c$ | % | % | % | % |
| Before Shear | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| Final | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.1 | 0.4 | 0.7 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.18 | 0.16 | 0.20 | |
| Time to failure, min | | $t_f$ | 6.54 | 16.57 | 21.66 | |
| Rate of strain, percent/min | | | 0.63 | 0.29 | 0.27 | |
| Wet Density, lb/cu ft | | | 96.78 | 94.16 | 94.41 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.4 | 1.4 | 1.4 | |
| Initial height, in. | | $H_o$ | 3.0 | 3.0 | 3.0 | |

Shear Strength Parameters
- $\phi$ = 0.0 °
- tan $\phi$ = 0.0
- c = 0.095 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q — Type of specimen 5" Undisturbed

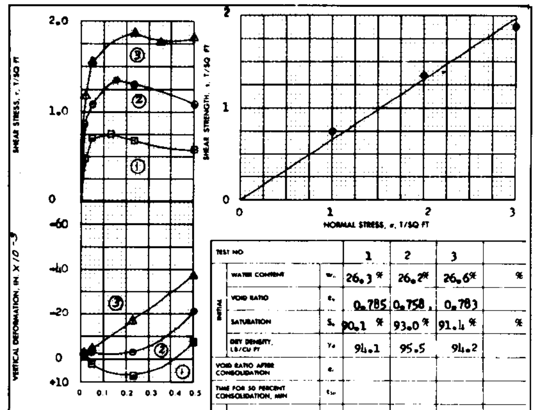
Classification vSo (Gr & dGr) CH4; lns lyrs & grs ML

LL 88 — PL 21 — PI 67 — UCT-141 — $G_s$ 2.6980

Remarks

Project New Orleans to Venice, La. Reach B-2, Fort Jackson to Venice
Area Sta. 65' from Pt. D, 265' Rt. C/L Levee
Boring No. 30-B2U — Sample No. 4-B
Depth El 11.0 -13.9 — Date 13 OCT 72
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 26.3 % | 26.2 % | 26.6 % | % |
| INITIAL | VOID RATIO | $e_o$ | 0.785 | 0.758 | 0.783 | |
| INITIAL | SATURATION | $S_o$ | 90.1 % | 93.0 % | 91.4 % | % |
| INITIAL | DRY DENSITY, LB/CU FT | $\gamma_d$ | 94.1 | 95.5 | 94.2 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | | | | |
| FINAL | WATER CONTENT | $w_f$ | 28.4 % | 26.7 % | 28.0 % | % |
| FINAL | VOID RATIO | $e_f$ | | | | |
| FINAL | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | $\sigma$ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.75 | 1.35 | 1.87 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 780 | 930 | 1320 | |
| RATE OF STRAIN, IN/MIN | | | .00019 | .00019 | .00019 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
- $\phi'$ = 33.5°
- TAN $\phi'$ = 0.662
- $c'$ = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

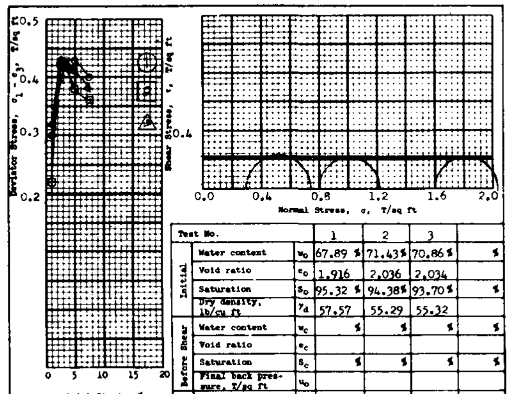
TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.541 IN. THICK

CLASSIFICATION SILTY SAND(SM), gray, contains finely divided organic matter

LL – PL – PI – $G_s$ 2.69

REMARKS

PROJECT NEW ORLEANS TO VENICE, LA., (FORT JACKSON TO VENICE) REACH B-2 (1970)
AREA
BORING NO 30-B2U — SAMPLE NO 6-C
DEPTH 19.1 El.-22.0 — DATE 31 August, 1970
WJH — DIRECT SHEAR TEST REPORT



| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 67.89 % | 71.43 % | 70.86 % | % |
| Initial | Void ratio | $e_o$ | 1.916 | 2.036 | 2.034 | |
| Initial | Saturation | $S_o$ | 95.32 % | 94.38 % | 93.70 % | % |
| Initial | Dry density, lb/cu ft | $\gamma_d$ | 57.57 | 55.29 | 55.32 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| Before Shear | Void ratio | $e_c$ | | | | |
| Before Shear | Saturation | $S_c$ | % | % | % | % |
| Before Shear | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| Final | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.3 | 0.8 | 1.6 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.43 | 0.42 | 0.43 | |
| Time to failure, min | | $t_f$ | 5.44 | 13.34 | 8.10 | |
| Rate of strain, percent/min | | | 0.62 | 0.27 | 0.31 | |
| Wet Density, lb/cu ft | | | 99.66 | 94.79 | 94.54 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.4 | 1.4 | 1.4 | |
| Initial height, in. | | $H_o$ | 3.0 | 3.0 | 3.0 | |

Shear Strength Parameters
- $\phi$ = 0.0 °
- tan $\phi$ = 0.0
- c = 0.220 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

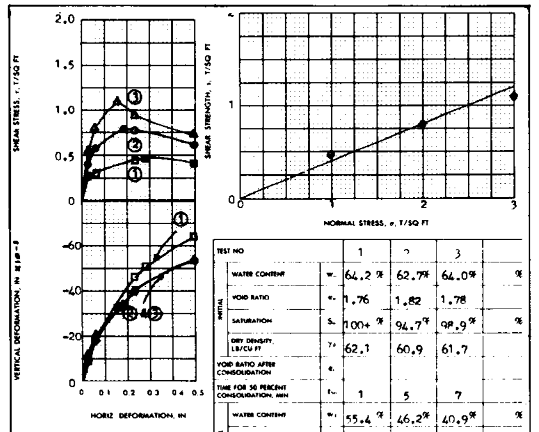
Type of test Q — Type of specimen 5" Undisturbed

Classification So (Gr) CH4; lns & thin lyrs ML

LL 85 — PL 27 — PI 58 — UCT-283 — $G_s$ 2.6878

Remarks

Project New Orleans to Venice, La. Reach B-2, Fort Jackson to Venice
Area Sta. 65' from Pt. D, 265' Rt C/L Levee
Boring No. 30-B2U — Sample No. 9-D2
Depth El 32.5 -35.4 — Date 13 OCT 72
TRIAXIAL COMPRESSION TEST REPORT



| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 64.2 % | 62.7 % | 64.0 % | % |
| INITIAL | VOID RATIO | $e_o$ | 1.76 | 1.82 | 1.78 | |
| INITIAL | SATURATION | $S_o$ | 100+ % | 94.7 % | 98.9 % | % |
| INITIAL | DRY DENSITY, LB/CU FT | $\gamma_d$ | 62.1 | 60.9 | 61.7 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | 1 | 5 | 7 | |
| FINAL | WATER CONTENT | $w_f$ | 55.4 % | 46.2 % | 40.9 % | % |
| FINAL | VOID RATIO | $e_f$ | | | | |
| FINAL | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | $\sigma$ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.47 | 0.80 | 1.10 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 1560 | 1020 | 900 | |
| RATE OF STRAIN, IN/MIN | | | .00018 | .00018 | .00018 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
- $\phi'$ = 21.8°
- TAN $\phi'$ = 0.40
- $c'$ = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

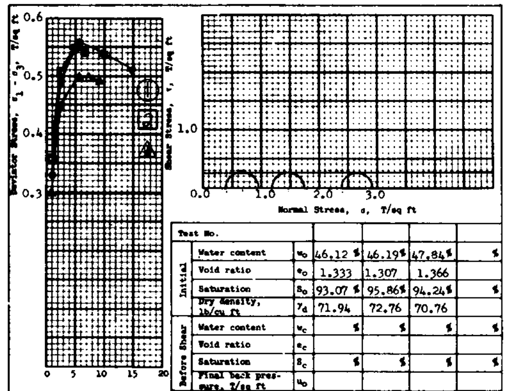
TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.549 IN. THICK

CLASSIFICATION PLASTIC CLAY(CH), gray, fissured

LL 91 — PL 25 — PI 66 — $G_s$ 2.75

REMARKS

PROJECT NEW ORLEANS TO VENICE, LA. (FORT JACKSON TO VENICE)
AREA REACH B-2 (1970)
BORING NO 30-B2U — SAMPLE NO 14-C
DEPTH 51.5 El.-54.4 — DATE 1 September, 1970
BMG — DIRECT SHEAR TEST REPORT



| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 46.12 % | 46.19 % | 47.84 % | % |
| Initial | Void ratio | $e_o$ | 1.333 | 1.307 | 1.366 | |
| Initial | Saturation | $S_o$ | 93.07 % | 95.86 % | 94.24 % | % |
| Initial | Dry density, lb/cu ft | $\gamma_d$ | 71.94 | 72.76 | 70.76 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| Before Shear | Void ratio | $e_c$ | | | | |
| Before Shear | Saturation | $S_c$ | % | % | % | % |
| Before Shear | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| Final | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.4 | 1.2 | 2.4 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.56 | 0.55 | 0.50 | |
| Time to failure, min | | $t_f$ | 9.54 | 18.88 | 20.54 | |
| Rate of strain, percent/min | | | 0.62 | 0.27 | 0.30 | |
| Wet Density, lb/cu ft | | | 105.14 | 106.64 | 104.89 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.4 | 1.4 | 1.4 | |
| Initial height, in. | | $H_o$ | 3.0 | 3.0 | 3.0 | |

Shear Strength Parameters
- $\phi$ = 0.0 °
- tan $\phi$ = 0.0
- c = 0.280 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

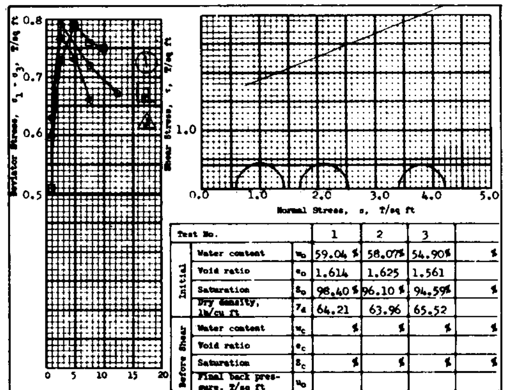
Type of test Q — Type of specimen 5" Undisturbed

Classification M (Gr) CH4; lns & lyrs ML

LL 65 — PL 22 — PI 43 — UCT-M.T. — $G_s$ 2.6873

Remarks

Project New Orleans to Venice, La. Reach B-2, Fort Jackson to Venice
Area Sta. 65' from Pt. D, 265' Rt C/L Levee
Boring No. 30-B2U — Sample No. 15-D
Depth El 56.5 -59.4 — Date 13 OCT 72
TRIAXIAL COMPRESSION TEST REPORT



| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 59.04 % | 58.07 % | 54.90 % | % |
| Initial | Void ratio | $e_o$ | 1.614 | 1.625 | 1.561 | |
| Initial | Saturation | $S_o$ | 98.40 % | 96.10 % | 94.59 % | % |
| Initial | Dry density, lb/cu ft | $\gamma_d$ | 64.21 | 63.96 | 65.52 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| Before Shear | Void ratio | $e_c$ | | | | |
| Before Shear | Saturation | $S_c$ | % | % | % | % |
| Before Shear | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| Final | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.6 | 1.7 | 3.4 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.79 | 0.79 | 0.77 | |
| Time to failure, min | | $t_f$ | 5.94 | 16.20 | 17.86 | |
| Rate of strain, percent/min | | | 0.63 | 0.31 | 0.24 | |
| Wet Density, lb/cu ft | | | 102.14 | 101.09 | 101.52 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.4 | 1.4 | 1.4 | |
| Initial height, in. | | $H_o$ | 3.0 | 3.0 | 3.0 | |

Shear Strength Parameters
- $\phi$ = 0.0 °
- tan $\phi$ = 0.0
- c = 0.400 T/sq ft

Method of saturation

☐ Controlled stress
☒ Controlled strain

Type of test Q — Type of specimen 5" Undisturbed

Classification M (Gr) CH4; lns ML

LL 86 — PL 26 — PI 60 — UCT-1148 — $G_s$ 2.6893

Remarks

Project New Orleans to Venice, La. Reach B-2, Fort Jackson to Venice
Area Sta. 65' from Pt. D, 265' Rt C/L Levee
Boring No. [illegible] — Sample No. [illegible]
Depth El 83.0 -85.9 — Date 13 OCT 72
TRIAXIAL COMPRESSION TEST REPORT

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

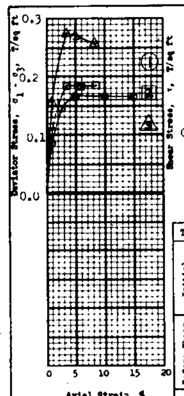
REACH B2 - FORT JACKSON TO VENICE

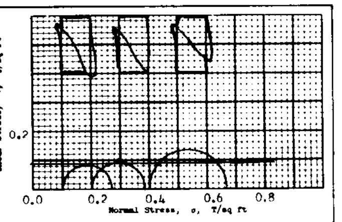
# DETAIL SHEAR STRENGTH DATA
# BORING 30-B2U

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

JULY 1972 — FILE NO. H-2-25953

PLATE 47



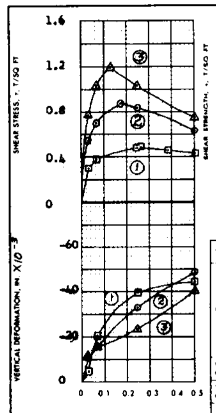



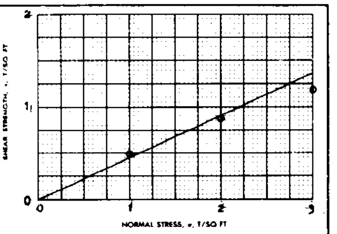

| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 85.86 % | 85.59% | 58.54% | % |
| | Void ratio | $e_o$ | 2.418 | 2.409 | 1.662 | |
| | Saturation | $S_o$ | 95.51 % | 95.56% | 94.72% | % |
| | Dry density, lb/cu ft | $\gamma_d$ | 49.11 | 49.23 | 63.04 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| | Void ratio | $e_c$ | | | | |
| | Saturation | $S_c$ | % | % | % | % |
| | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.1 | 0.2 | 0.4 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.17 | 0.19 | 0.27 | |
| Time to failure, min | | $t_f$ | 7.88 | 11.22 | 10.91 | |
| Rate of strain, percent/min | | | 0.63 | 0.29 | 0.30 | |
| Wet Density lb/cu. ft | | | 91.27 | 91.37 | 99.94 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.09 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed
Classification So(Gr&Br)CH4;lns,lyrs&ars ML: SIF
LL 76 | PL 24 | PI 52 | UCT - 311 | $G_s$ 2.6965
Remarks NOD-Testing Section
Project N.O. to Venice La. Reach B-2 (70)
Fort Jackson to Venice
Area Sta. 7075 Ft. from C.L. Pump Sta. 215 Ft. Rt. of C.L. Levee
Boring No. 29-B2U | Sample No. 4-B
Depth 13.3 El -17.6 | Date 15 OCT 70
TRIAXIAL COMPRESSION TEST REPORT



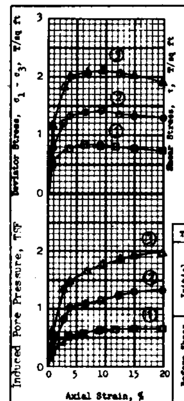



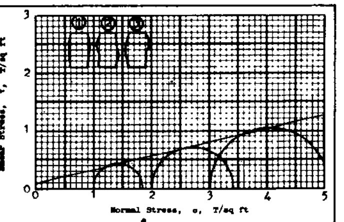

| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 76.2 % | 72.2 % | 75.1 % | % |
| | VOID RATIO | $e_o$ | 2.06 | 2.06 | 2.10 | |
| | SATURATION | $S_o$ | 95.3 % | 95.3 % | 97.3 % | % |
| | DRY DENSITY, LB/CU FT | $\gamma_d$ | 55.4 | 55.5 | 54.8 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | 4 | 4 | 4 | |
| FINAL | WATER CONTENT | $w_f$ | 47.9 % | 43.6 % | 42.8 % | % |
| | VOID RATIO | $e_f$ | | | | |
| | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | σ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.49 | 0.87 | 1.19 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 1440 | 930 | 690 | |
| RATE OF STRAIN, IN./MIN | | | .00019 | .00019 | .00019 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
φ' = 21.8°
TAN φ' = 0.40
c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.549 IN. THICK
CLASSIFICATION PLASTIC CLAY(CH),gray, fissured, contains shell fragments
LL 82 | PL 26 | PI 56 | $G_s$ 2.72
REMARKS
PROJECT NEW ORLEANS TO VENICE,LA.,(FORT JACKSON TO VENICE) REACH 2-B (1970)
AREA
BORING NO 29-B2U | SAMPLE NO 4-D
DEPTH 14.9 El.-19. | DATE 7 Oct.,1970
BMG DIRECT SHEAR TEST REPORT



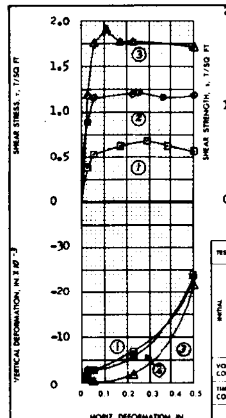



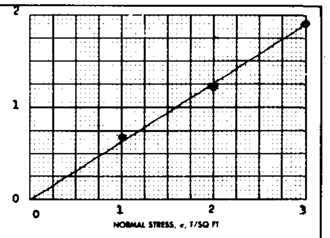

| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 68.7 % | 68.7 % | 66.8% | % |
| | Void ratio | $e_o$ | 1.92 | 1.91 | 1.85 | |
| | Saturation | $S_o$ | 99.5 % | 98.6 % | 98.9 % | % |
| | Dry density, lb/cu ft | $\gamma_d$ | 58.6 | 58.8 | 60.1 | |
| Before Shear | Water content | $w_c$ | 52.3 % | 45.3 % | 40.8% | % |
| | Void ratio | $e_c$ | 1.54 | 1.27 | 1.06 | |
| | Saturation | $S_c$ | 93.0*% | 97.7*% | 100+% | % |
| | Final back pressure, PSI | $u_o$ | 65 | 65 | 65 | |
| | Dry Density Lbs/cu.ft. | $\gamma_d$ | 67.3 | 75.3 | 82.8 | |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 1.0 | 2.0 | 3.0 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.84 | 1.41 | 2.10 | |
| Time to failure, min | | $t_f$ | 71 | 104 | 96 | |
| Rate of strain, percent/min | | | 0.09 | 0.09 | 0.10 | |
| | | | | | | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
φ = 13.5°
tan φ = 0.233
c = 0.10 T/sq ft
Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray
LL 78 | PL 20 | PI 58 | $G_s$ 2.74
Remarks See attached plot for effective values
* Pore pressure response indicated 100% saturation
Sheet 1 of 2
Project NEW ORLEANS TO VENICE, LA., (FORT JACKSON TO VENICE)
Area REACH B-2 (1970)
Boring No. 29- B2U | Sample No. 5-B
Depth 17.2 El.-21.5 | Date 26 August,1970
JAL TRIAXIAL COMPRESSION TEST REPORT



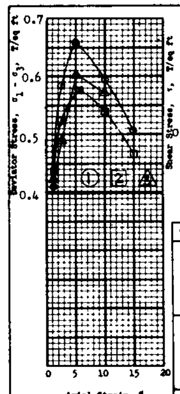



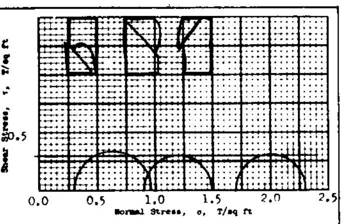

| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 26.5 % | 26.4 % | 26.1 % | % |
| | VOID RATIO | $e_o$ | 0.252 | 0.247 | 0.238 | |
| | SATURATION | $S_o$ | 100+ % | 100+ % | 100+ % | % |
| | DRY DENSITY, LB/CU FT | $\gamma_d$ | 134.1 | 134.7 | 135.6 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | | | | |
| FINAL | WATER CONTENT | $w_f$ | 28.6 % | 27.6 % | 27.0 % | % |
| | VOID RATIO | $e_f$ | | | | |
| | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | σ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.67 | 1.22 | 1.91 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 1680 | 1500 | 660 | |
| RATE OF STRAIN, IN./MIN | | | .00018 | .00018 | .00018 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
φ' = 32.5°
TAN φ' = 0.637
c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK
CLASSIFICATION SILTY SAND (SM), gray, contains a trace of clay and finely divided *
LL - | PL - | PI - | $G_s$ 2.69
REMARKS * organic matter
PROJECT NEW ORLEANS TO VENICE,LA.,(FORT JACKSON TO VENICE) REACH B-2 (1970)
AREA
BORING NO 29-B2U | SAMPLE NO 7-B
DEPTH 25.2 El-29.5 | DATE 2 Sept.,1970
WJH DIRECT SHEAR TEST REPORT
SOILS TEST SECTION



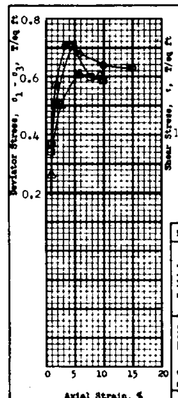



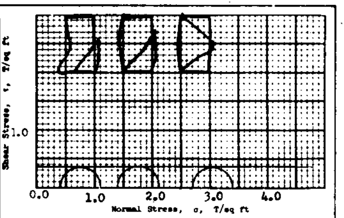

| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 62.42 % | 62.01 % | 62.40% | % |
| | Void ratio | $e_o$ | 1.758 | 1.755 | 1.764 | |
| | Saturation | $S_o$ | 95.53 % | 95.03% | 95.14% | % |
| | Dry density, lb/cu ft | $\gamma_d$ | 60.87 | 60.92 | 60.72 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| | Void ratio | $e_c$ | | | | |
| | Saturation | $S_c$ | % | % | % | % |
| | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.3 | 0.9 | 1.7 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.66 | 0.58 | 0.60 | |
| Time to failure, min | | $t_f$ | 8.29 | 22.20 | 17.67 | |
| Rate of strain, percent/min | | | 0.62 | 0.27 | 0.29 | |
| Wet Density lb/cu ft | | | 98.87 | 98.69 | 98.61 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.29 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed
Classification So(Gr)CH3;lns&few thin lyrs ML;spks dw; few org stks
LL 89 | PL 25 | PI 64 | UCT - 290 | $G_s$ 2.6965
Remarks NOD-Testing Section
Project N.O. to Venice La. Reach B-2 (70)
Fort Jackson to Venice
Area Sta. 7075 Ft. from C.L. Pump Sta. 215 Ft. Rt. of C.L. Levee
Boring No. 29-B2U | Sample No. 12-C
Depth 46.0 El -50.3 | Date 15 OCT 70
TRIAXIAL COMPRESSION TEST REPORT



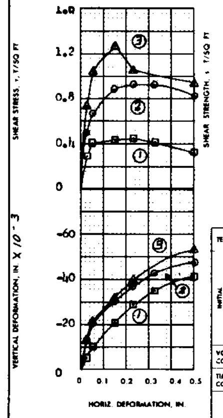



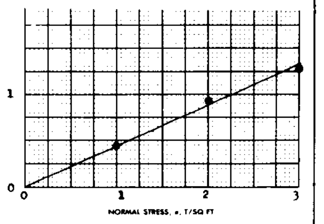

| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 54.46 % | 54.99% | 54.23% | % |
| | Void ratio | $e_o$ | 1.574 | 1.581 | 1.554 | |
| | Saturation | $S_o$ | 93.06 % | 93.58% | 93.89% | % |
| | Dry density, lb/cu ft | $\gamma_d$ | 65.21 | 64.62 | 65.73 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| | Void ratio | $e_c$ | | | | |
| | Saturation | $S_c$ | % | % | % | % |
| | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.4 | 1.4 | 2.7 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.71 | 0.71 | 0.61 | |
| Time to failure, min | | $t_f$ | 5.93 | 16.45 | 21.72 | |
| Rate of strain, percent/min | | | 0.67 | 0.27 | 0.27 | |
| Wet Density lb/cu ft | | | 100.72 | 100.81 | 101.37 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.355 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed
Classification M(Gr)CH3;;lns,lys ML;spks dw; few org stks
LL 79 | PL 24 | PI 55 | UCT - 902 | $G_s$ 2.6878
Remarks NOD-Testing Section
Project N.O. to Venice La. Reach B-2 (70)
Fort Jackson to Venice
Area Sta. 7075 Ft. from C.L. Pump Sta. 215 Ft. Rt. of C.L. Levee
Boring No. 29-B2U | Sample No. 18-B
Depth 69.5 El -73.9 | Date 15 OCT 70
TRIAXIAL COMPRESSION TEST REPORT



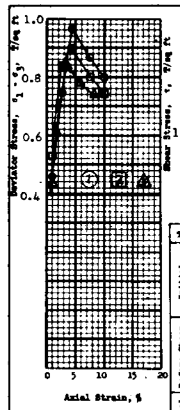



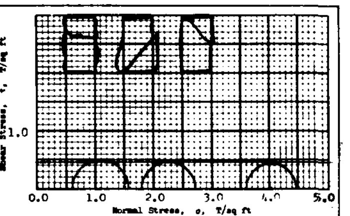

| TEST NO | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| INITIAL | WATER CONTENT | $w_o$ | 43.4 % | 42.3 % | 45.1 % | % |
| | VOID RATIO | $e_o$ | 1.27 | 1.23 | 1.28 | |
| | SATURATION | $S_o$ | 93.3 % | 93.9 % | 96.2 % | % |
| | DRY DENSITY, LB/CU FT | $\gamma_d$ | 74.9 | 76.3 | 74.8 | |
| VOID RATIO AFTER CONSOLIDATION | | $e_c$ | | | | |
| TIME FOR 50 PERCENT CONSOLIDATION, MIN | | $t_{50}$ | 1 | 2 | 2 | |
| FINAL | WATER CONTENT | $w_f$ | 51.4 % | 39.8 % | 36.5 % | % |
| | VOID RATIO | $e_f$ | | | | |
| | SATURATION | $S_f$ | % | % | % | % |
| NORMAL STRESS, T/SQ FT | | σ | 1.0 | 2.0 | 3.0 | |
| MAXIMUM SHEAR STRESS, T/SQ FT | | $\tau_{max}$ | 0.44 | 0.92 | 1.27 | |
| ACTUAL TIME TO FAILURE, MIN | | $t_f$ | 1320 | 1320 | 840 | |
| RATE OF STRAIN, IN./MIN | | | .00018 | .00018 | .00018 | |
| ULTIMATE SHEAR STRESS, T/SQ FT | | $\tau_{ult}$ | | | | |

SHEAR STRENGTH PARAMETERS
φ' = 23.7°
TAN φ' = 0.44
c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN | 3.00 IN. SQUARE | 0.549 IN. THICK
CLASSIFICATION PLASTIC CLAY(CH),gray, contains silt seams, fissured
LL 71 | PL 24 | PI 47 | $G_s$ 2.73
REMARKS Final water content for test specimen no. 1 appears erroneous
PROJECT NEW ORLEANS TO VENICE,LA.,(FORT JACKSON TO VENICE) REACH B-2 (1970)
AREA
BORING NO 29-B2U | SAMPLE NO 24-B
DEPTH 93.4 El.-97.7 | DATE 3 Sept.,1970
BMG DIRECT SHEAR TEST REPORT




| Test No. | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| Initial | Water content | $w_o$ | 48.44 % | 49.14% | 48.00% | % |
| | Void ratio | $e_o$ | 1.402 | 1.401 | 1.383 | |
| | Saturation | $S_o$ | 93.27 % | 94.73% | 93.68% | % |
| | Dry density, lb/cu ft | $\gamma_d$ | 70.14 | 70.19 | 70.69 | |
| Before Shear | Water content | $w_c$ | % | % | % | % |
| | Void ratio | $e_c$ | | | | |
| | Saturation | $S_c$ | % | % | % | % |
| | Final back pressure, T/sq ft | $u_o$ | | | | |
| Final | Water content | $w_f$ | % | % | % | % |
| | Void ratio | $e_f$ | | | | |
| Minor principal stress, T/sq ft | | $\sigma_3$ | 0.6 | 1.8 | 3.6 | |
| Max deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{max}$ | 0.97 | 0.90 | 0.84 | |
| Time to failure, min | | $t_f$ | 7.45 | 16.84 | 13.26 | |
| Rate of strain, percent/min | | | 0.61 | 0.28 | 0.28 | |
| Wet Density lb/cu ft | | | 104.11 | 104.68 | 104.12 | |
| Ult deviator stress, T/sq ft | | $(\sigma_1-\sigma_3)_{ult}$ | | | | |
| Initial diameter, in. | | $D_o$ | 1.40 | 1.40 | 1.40 | |
| Initial height, in. | | $H_o$ | 3.00 | 3.00 | 3.00 | |

Shear Strength Parameters
φ = 0.0 °
tan φ = 0.0
c = 0.45 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen 5" Undisturbed
Classification M(Gr)CH3;lns,lys&ars ML:spks dw; org stks
LL 77 | PL 22 | PI 55 | UCT - 967 | $G_s$ 2.6951
Remarks NOD-Testing Section
Project N.O. to Venice La. Reach B-2 (70)
Fort Jackson to Venice
Area Sta. 7075 Ft. from C.L. Pump Sta. 215 Ft. Rt. of C.L. Levee
Boring No. 29-B2U | Sample No. 24-C
Depth 94.3 El -98.6 | Date 15 OCT 70
TRIAXIAL COMPRESSION TEST REPORT

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 - FORT JACKSON TO VENICE

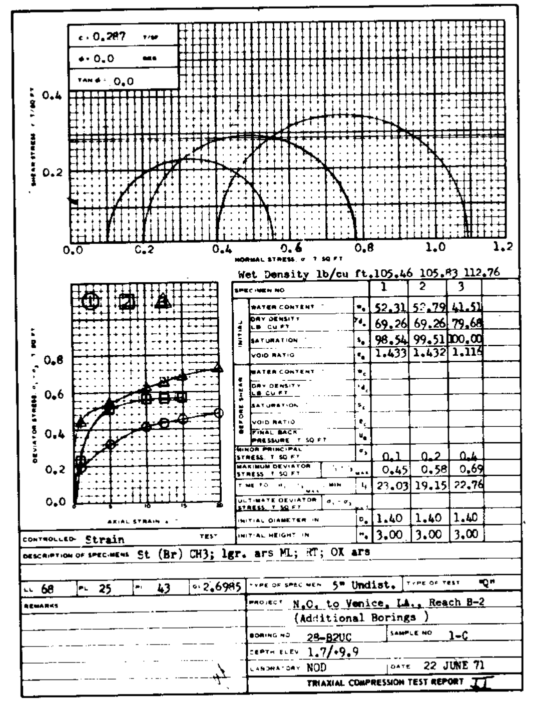
# DETAIL SHEAR STRENGTH DATA

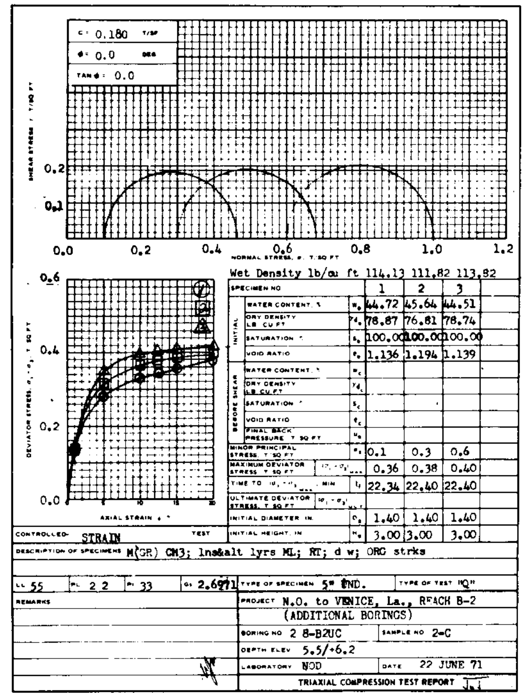
# BORING 29-B2U

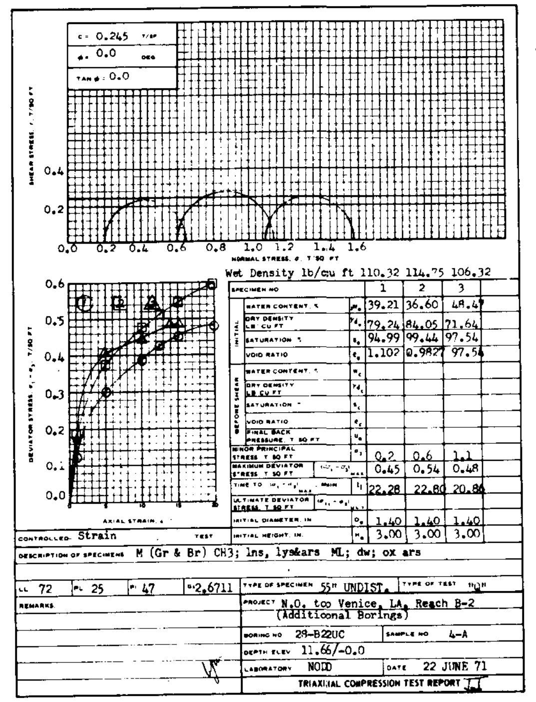
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

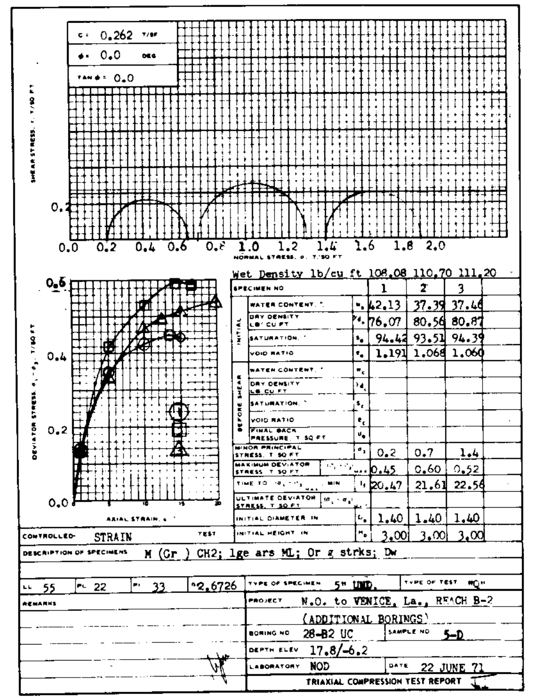
JULY 1972 | FILE NO. H-2-25953

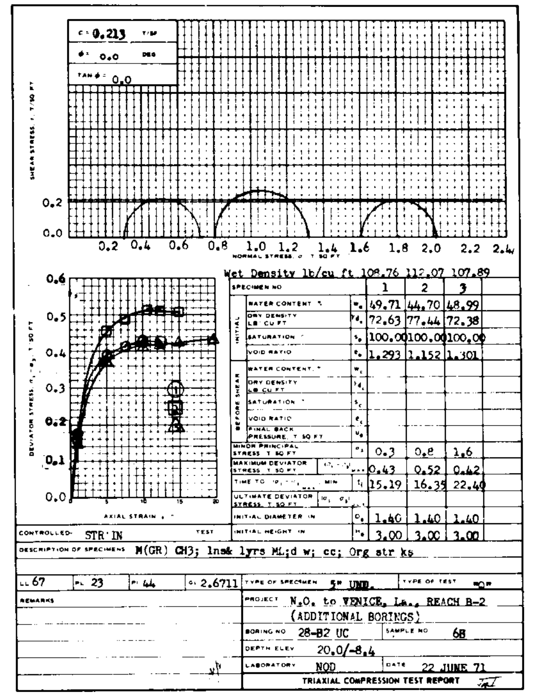
PLATE 48

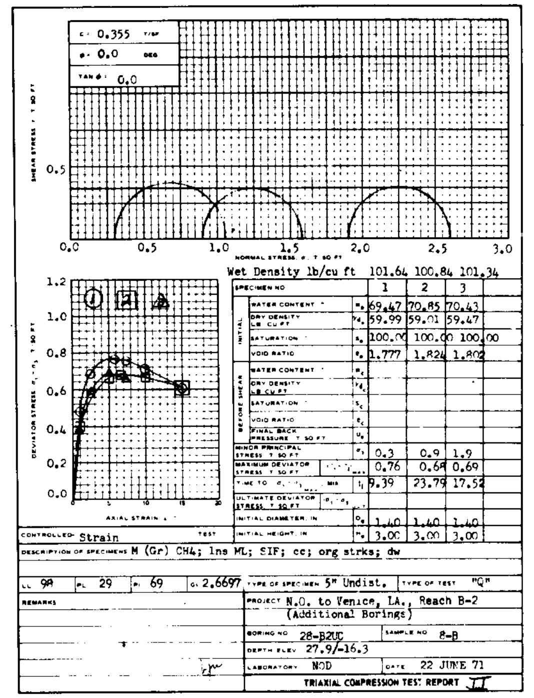


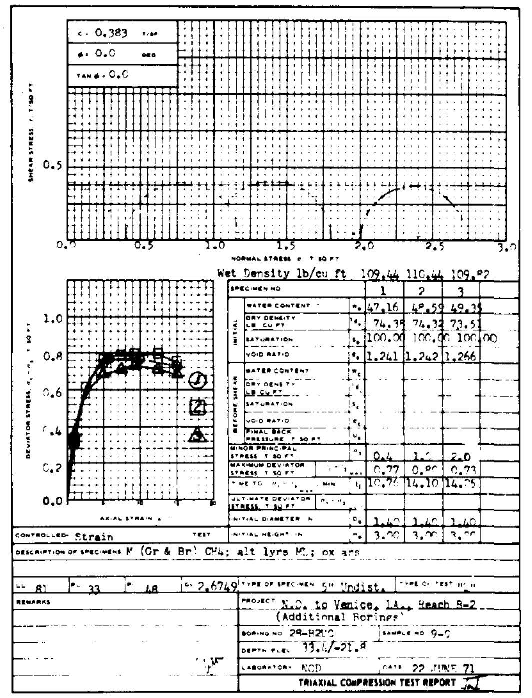


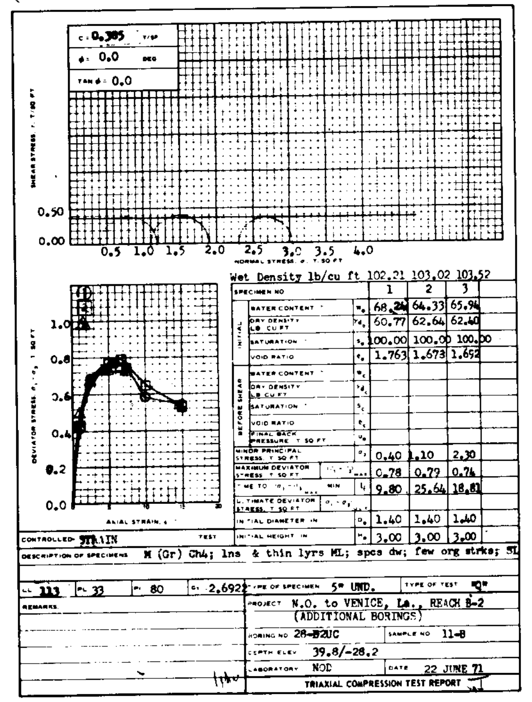


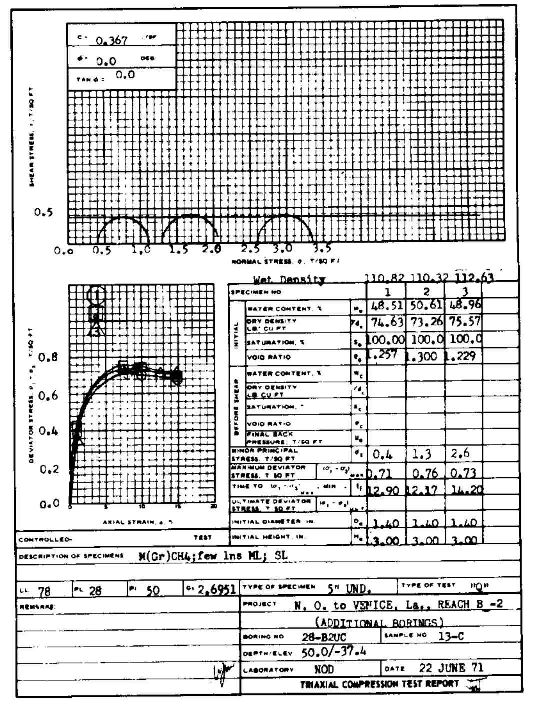


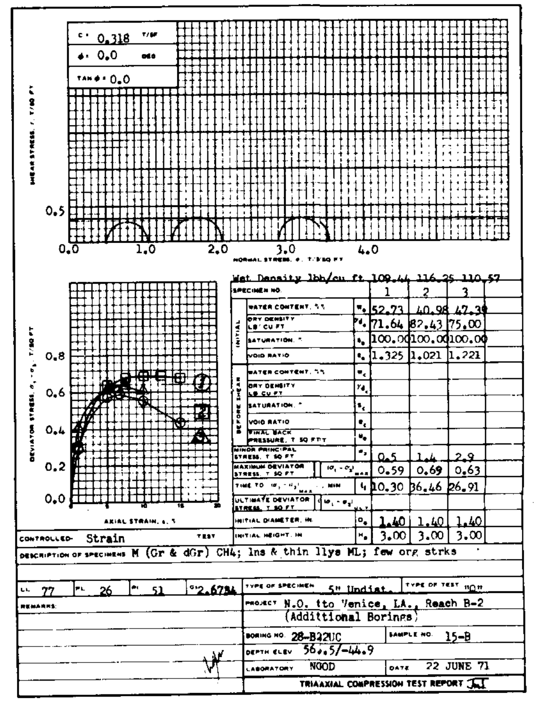


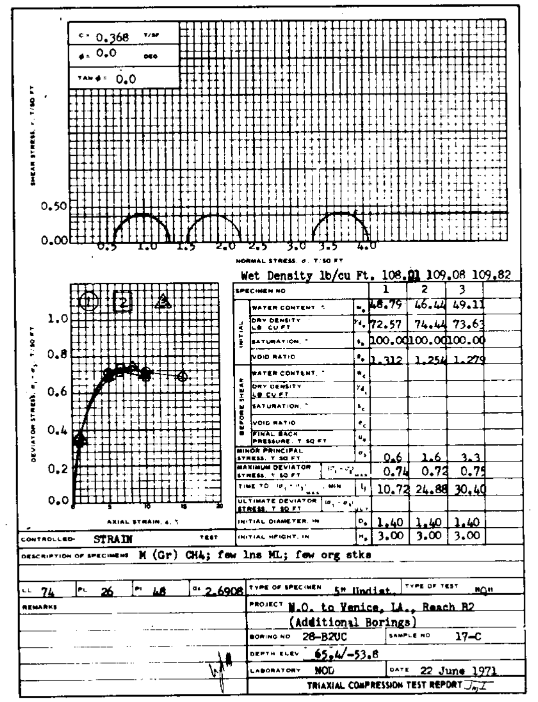


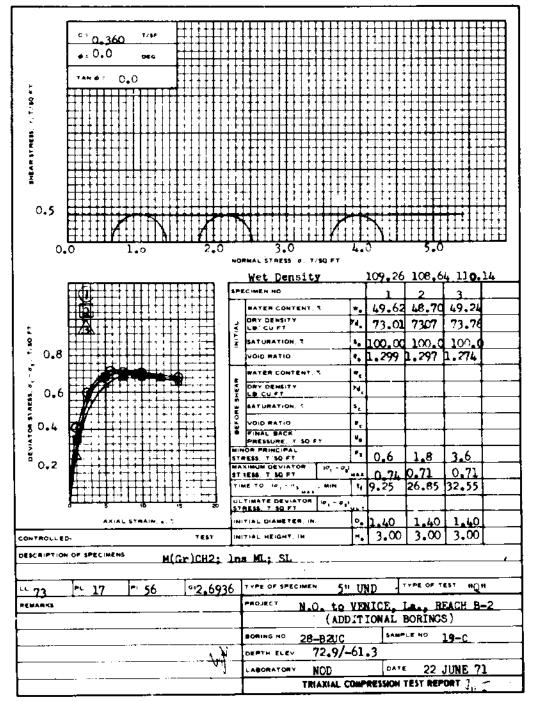


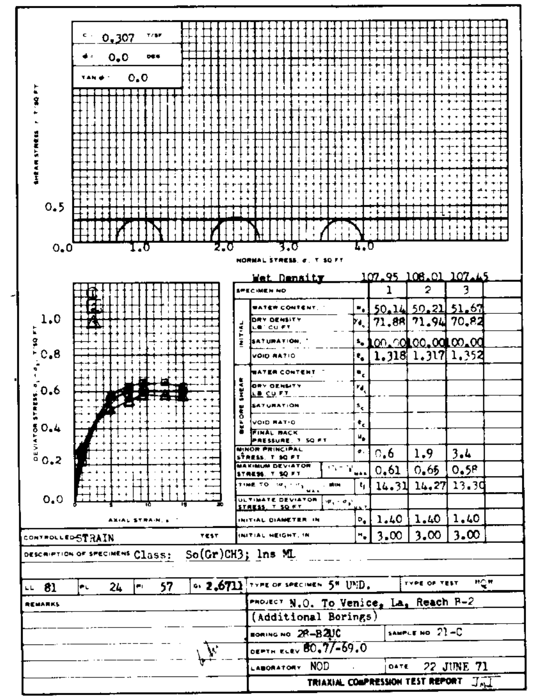












NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

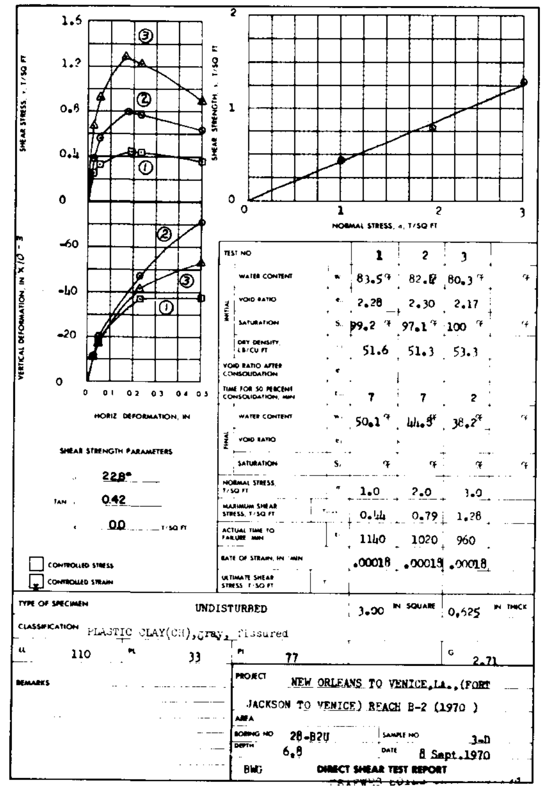
REACH B2 – FORT JACKSON TO VENICE

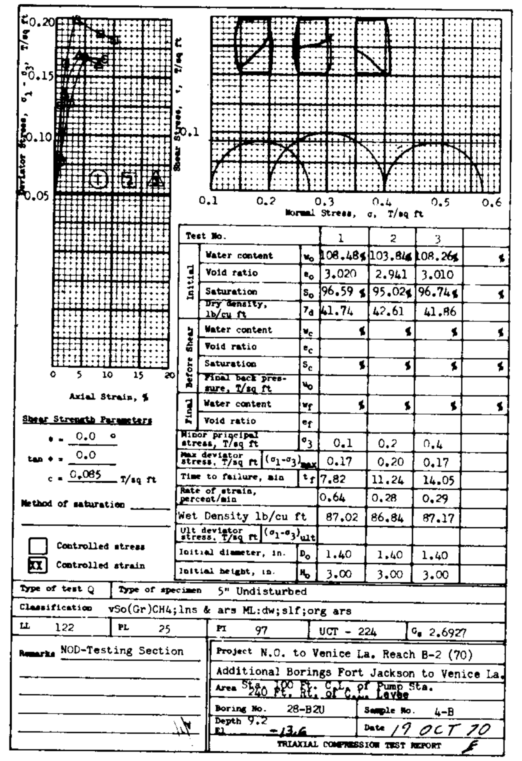
# DETAIL SHEAR STRENGTH DATA

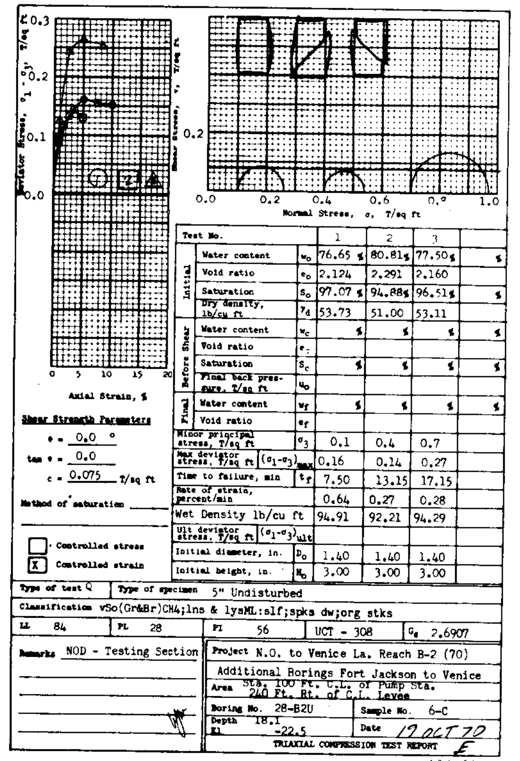
# BORING 28-B2UC

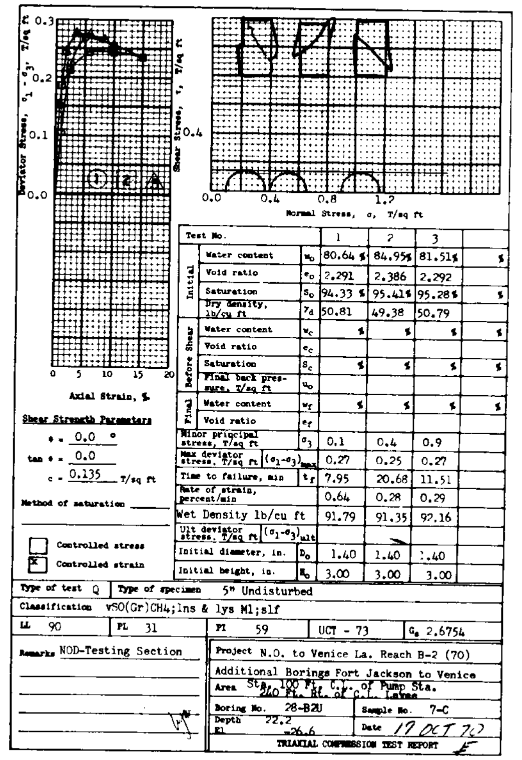
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

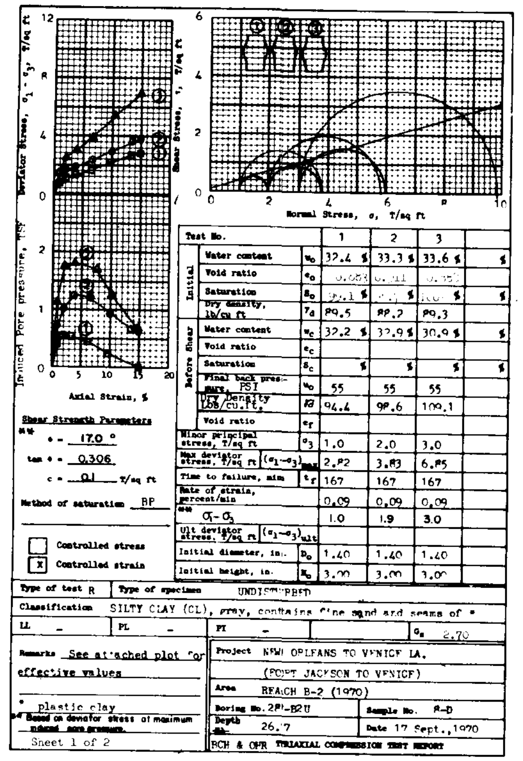
JULY 1972 FILE NO. H-2-25953

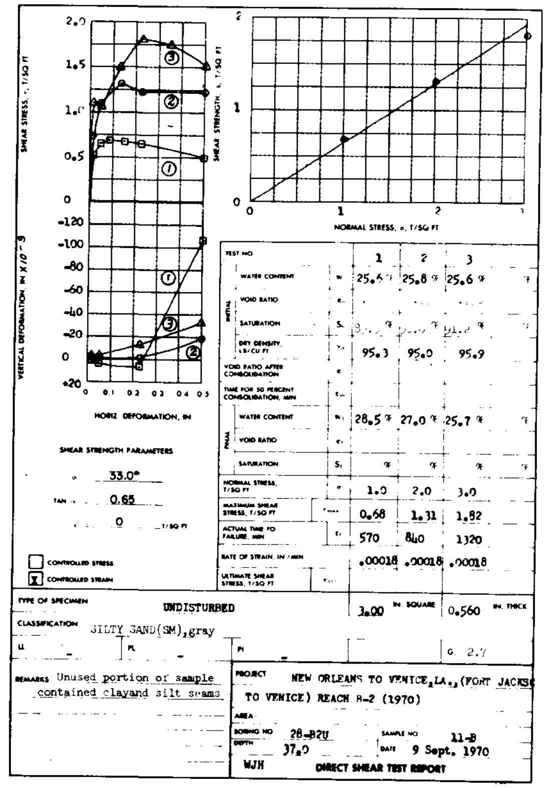


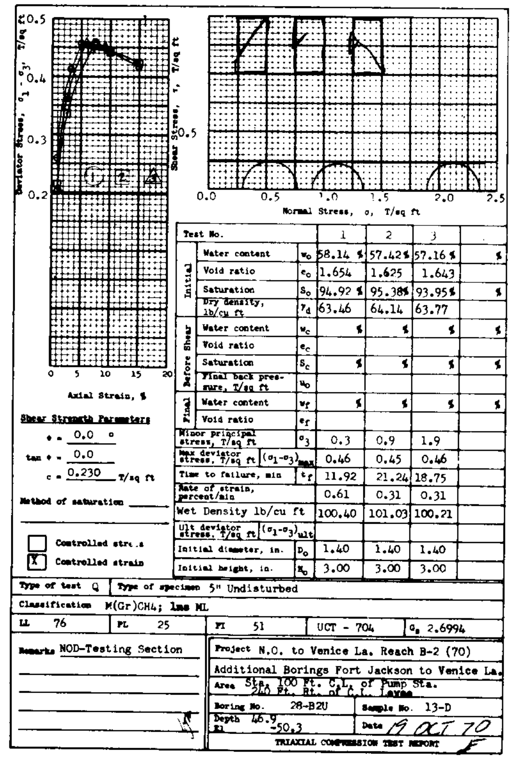



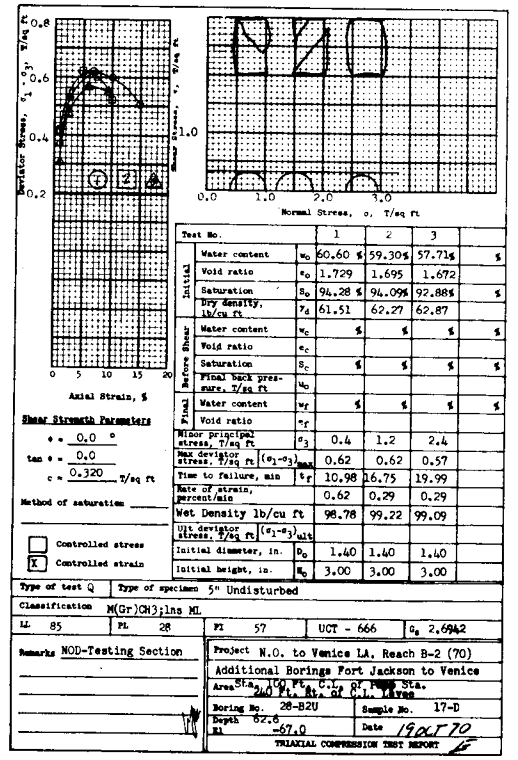



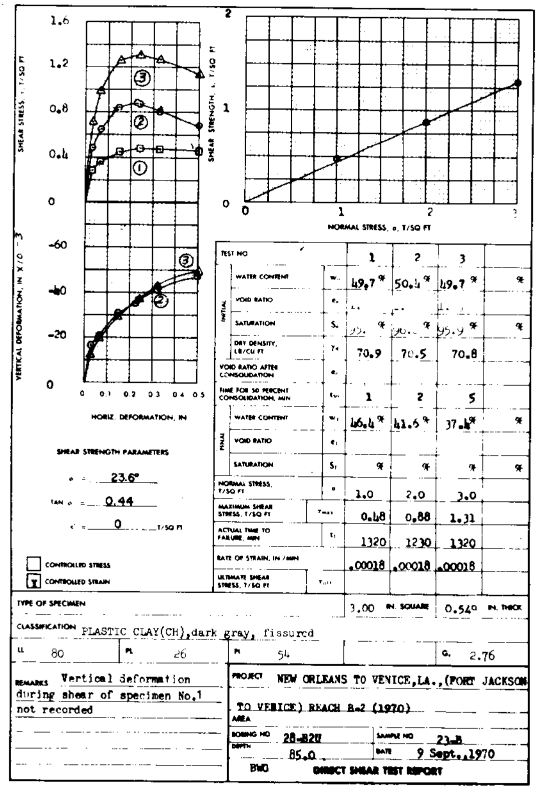



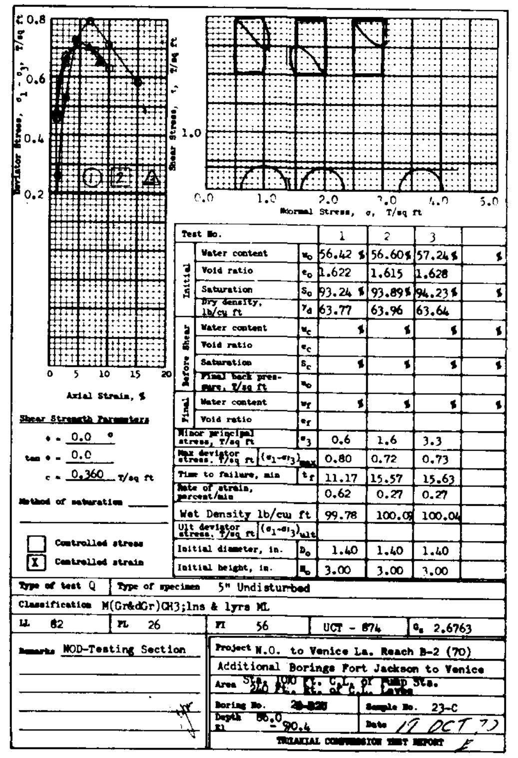




NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

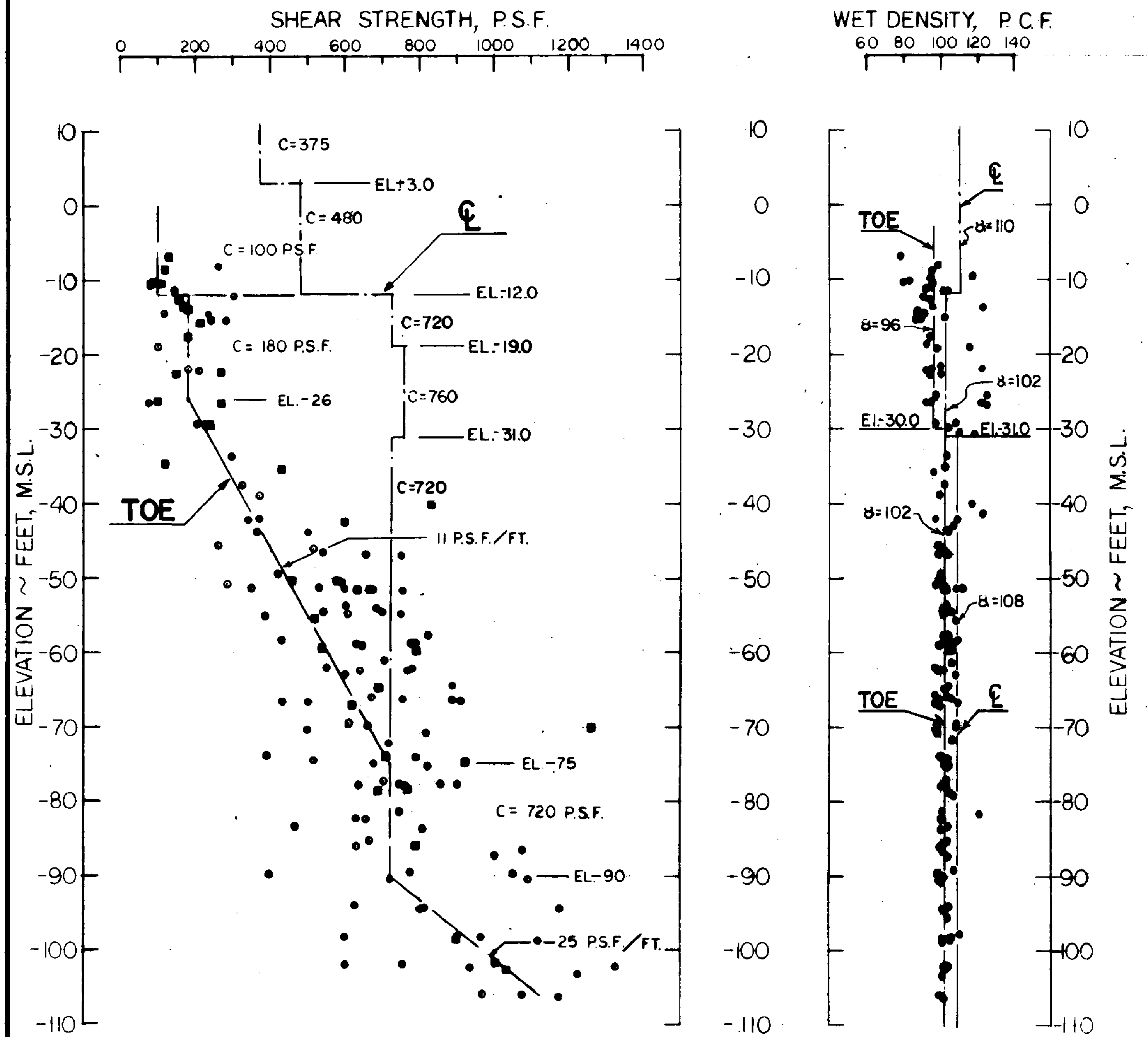
REACH B2 - FORT JACKSON TO VENICE

# DETAIL SHEAR STRENGTH DATA

# BORING 28-B2U

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

JULY 1972 FILE NO. H-2-25953




## NOTES

- o UC UNCONFINED COMPRESSION TEST
- ■ (Q) UNCONSOLIDATED UNDRAINED SHEAR TEST

TEST DATA TAKEN FROM BORINGS
28 B2U
29 B2U
30 B2U
31 B2U
32 B2U
33 B2U
6 DU

℄ STRENGTHS TAKEN FROM BORING 28 B2UC TEST DATA.

## GENERAL NOTES

FOR DETAIL SHEAR TEST DATA, SEE PLATES 33 THRU 50

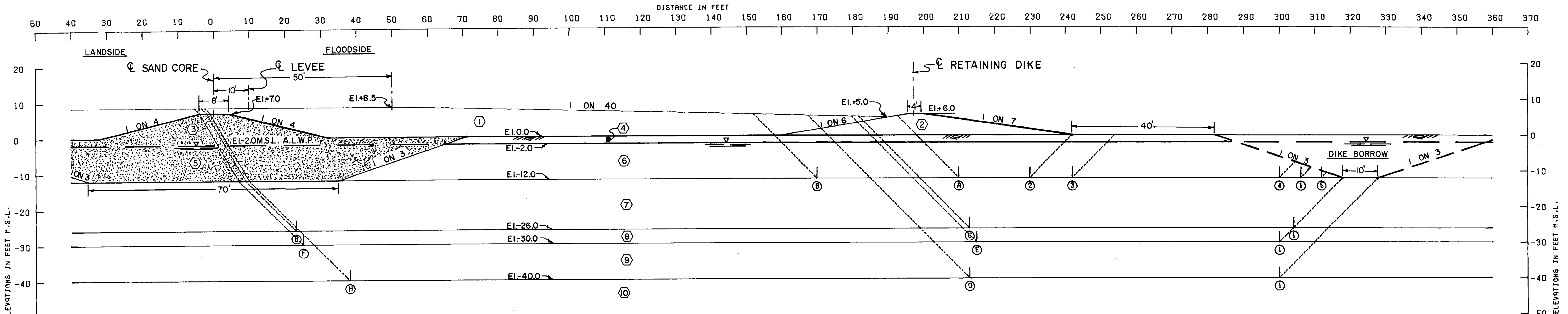
FOR UNDISTURBED BORING LOGS, SEE PLATES 33 THRU 42

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

**SHEAR STRENGTH AND WET DENSITY DATA PLOTS**

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

JULY 1972 FILE NO. H-2-25953




FIRST LIFT LEVEE SECTION
(STA.0+00 TO STA.45+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 6 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 7 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 8 | CH | 34.0 | 34.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 279.0 | 279.0 | 334.0 | 334.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 554.0 | 554.0 | 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 | -12.00 | 3051 | 9600 | 600 | 10353 | 203 | 13251 | 10150 | 1.31 |
| A | 2 | -12.00 | 3051 | 2000 | 2400 | 10353 | 4632 | 7451 | 5721 | 1.30 |
| A | 3 | -12.00 | 3051 | 3200 | 2400 | 10353 | 3810 | 8652 | 6544 | 1.32 |
| A | 4 | -12.00 | 3051 | 9000 | 900 | 10353 | 458 | 12951 | 9895 | 1.31 |
| A | 5 | -12.00 | 3051 | 10200 | 300 | 10353 | 51 | 13551 | 10302 | 1.32 |
| B | 1 | -12.00 | 2400 | 13600 | 600 | 12155 | 203 | 16600 | 11952 | 1.39 |
| C | 1 | -26.00 | 7903 | 16380 | 5040 | 26806 | 4440 | 29323 | 22366 | 1.31 |
| D | 1 | -26.00 | 19525 | 50580 | 5040 | 50165 | 4440 | 75145 | 45725 | 1.64 |
| E | 1 | -30.00 | 9485 | 19040 | 6656 | 32648 | 7341 | 35181 | 25308 | 1.39 |
| F | 1 | -30.00 | 21193 | 61500 | 6656 | 59560 | 7341 | 88449 | 52219 | 1.71 |
| G | 1 | -40.00 | 15199 | 29058 | 12576 | 51291 | 15459 | 56833 | 35832 | 1.59 |
| H | 1 | -40.00 | 27026 | 87508 | 12576 | 84202 | 15459 | 127110 | 68743 | 1.85 |

## NOTES

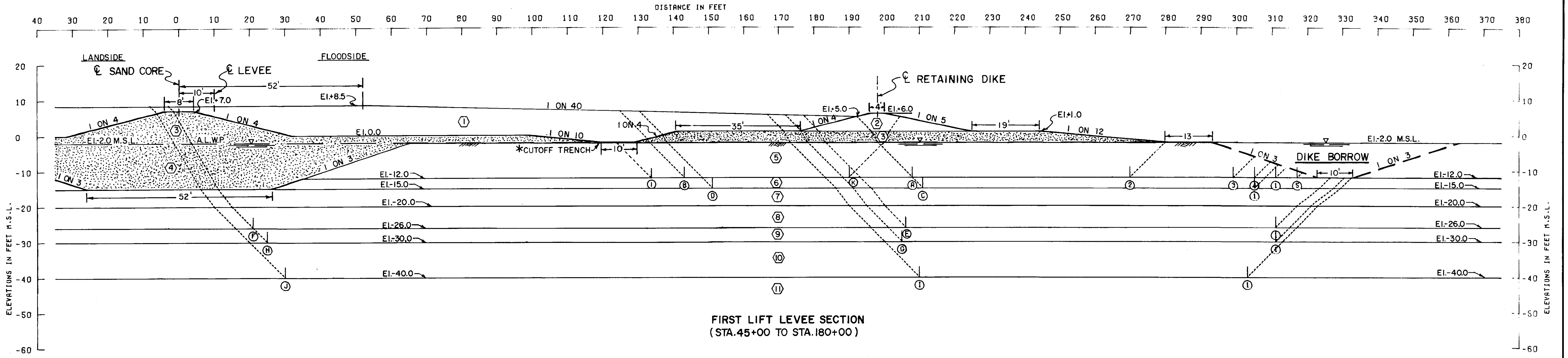
$\Phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA 0+00 TO STA. 45+00

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

JULY 1972 FILE NO. H-2-25953




## FIRST LIFT LEVEE SECTION
(STA.45+00 TO STA.180+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

* PROVIDE CUTOFF TRENCH WITH MINIMUM BOTTOM WIDTH OF 10' THROUGH SAND TO NATURAL GROUND.

| 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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 8 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 279.0 | 279.0 | 334.0 | 334.0 | 0.0 |
| 11 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 554.0 | 554.0 | 0.0 |

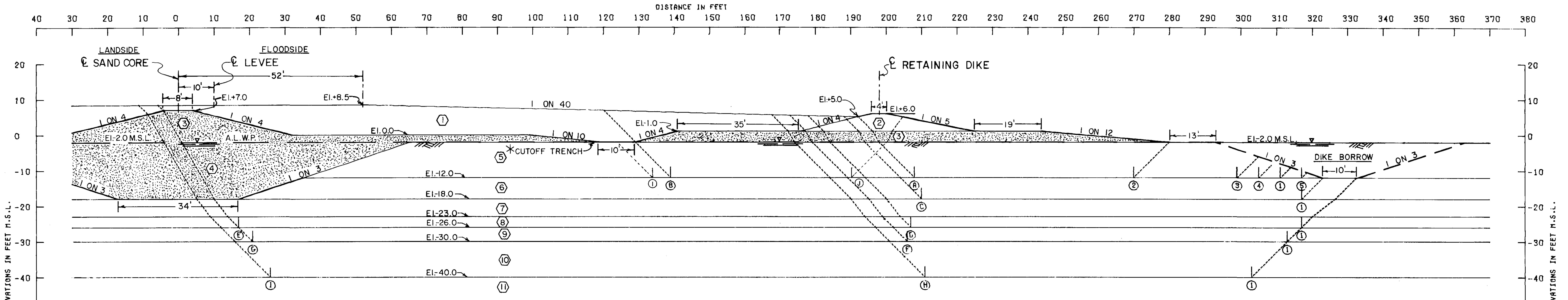
| ASSUMED FAILURE SURFACE NO. | ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| (A) (1) | -12.00 | 3656 | 10300 | 600 | 11441 | 203 | 14556 | 11237 | 1.30 |
| (A) (2) | -12.00 | 3656 | 6200 | 2000 | 11441 | 2209 | 11856 | 9232 | 1.28 |
| (A) (3) | -12.00 | 3656 | 9100 | 1200 | 11441 | 815 | 13956 | 10626 | 1.31 |
| (A) (4) | -12.00 | 3656 | 9700 | 900 | 11441 | 458 | 14256 | 10983 | 1.30 |
| (A) (5) | -12.00 | 3656 | 10900 | 300 | 11441 | 51 | 14856 | 11390 | 1.30 |
| (B) (1) | -12.00 | 2476 | 16800 | 600 | 14237 | 203 | 19876 | 14033 | 1.42 |
| (C) (1) | -15.00 | 4736 | 16920 | 1830 | 14461 | 1031 | 23486 | 13429 | 1.75 |
| (K) (1) | -12.00 | 3599 | 5700 | 2000 | 11411 | 1945 | 11299 | 9466 | 1.19 |
| (D) (1) | -15.00 | 4082 | 27720 | 1830 | 17985 | 1031 | 33632 | 16954 | 1.98 |
| (E) (1) | -26.00 | 10830 | 18900 | 6791 | 30899 | 4990 | 36521 | 25909 | 1.41 |
| (F) (1) | -26.00 | 26338 | 52200 | 6791 | 52123 | 4990 | 85329 | 47133 | 1.81 |
| (G) (1) | -30.00 | 12285 | 23744 | 8310 | 38204 | 7676 | 44341 | 30529 | 1.45 |
| (H) (1) | -30.00 | 27954 | 64064 | 8310 | 62063 | 7676 | 100328 | 54387 | 1.85 |
| (I) (1) | -40.00 | 17905 | 31062 | 13878 | 58403 | 18540 | 62845 | 39864 | 1.58 |
| (J) (1) | -40.00 | 33659 | 91182 | 13878 | 90150 | 18540 | 138719 | 71610 | 1.94 |

## NOTES

$\Phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- 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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO.4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA.45+00 TO STA.180+00
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972
FILE NO. H-2-25953




## FIRST LIFT LEVEE SECTION
(STA. 180+00 TO STA. 265+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

* PROVIDE CUTOFF TRENCH WITH MINIMUM BOTTOM WIDTH OF 10' THROUGH SAND TO NATURAL GROUND.

| 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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 8 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 279.0 | 279.0 | 334.0 | 334.0 | 0.0 |
| 11 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 554.0 | 554.0 | 0.0 |

| ASSUMED FAILURE NO. | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| A 1 | -12.00 | 3656 | 10300 | 600 | 11441 | 203 | 14556 | 11237 | 1.30 |
| A 2 | -12.00 | 3656 | 6200 | 2000 | 11441 | 2209 | 11856 | 9232 | 1.28 |
| A 3 | -12.00 | 3656 | 9100 | 1200 | 11441 | 815 | 13956 | 10626 | 1.31 |
| A 4 | -12.00 | 3656 | 9700 | 900 | 11441 | 458 | 14256 | 10983 | 1.30 |
| A 5 | -12.00 | 3656 | 10900 | 300 | 11441 | 51 | 14856 | 11390 | 1.30 |
| B 1 | -12.00 | 2000 | 17200 | 600 | 14208 | 203 | 19800 | 14004 | 1.41 |
| C 1 | -18.00 | 5605 | 19260 | 2160 | 18064 | 815 | 27026 | 17250 | 1.57 |
| D 1 | -26.00 | 10980 | 19800 | 7066 | 30419 | 4099 | 37846 | 26320 | 1.44 |
| E 1 | -26.00 | 29923 | 54000 | 7066 | 52922 | 4099 | 90988 | 48823 | 1.86 |
| F 1 | -30.00 | 12616 | 23968 | 8682 | 37809 | 7105 | 45266 | 30704 | 1.47 |
| G 1 | -30.00 | 31539 | 65408 | 8682 | 63193 | 7105 | 105628 | 56088 | 1.88 |
| H 1 | -40.00 | 18077 | 30728 | 14262 | 57837 | 18213 | 63067 | 39624 | 1.59 |
| I 1 | -40.00 | 37070 | 92518 | 14262 | 91853 | 18213 | 143850 | 73640 | 1.95 |
| J 1 | -12.00 | 3599 | 5700 | 2000 | 11411 | 1945 | 11299 | 9466 | 1.19 |

## NOTES

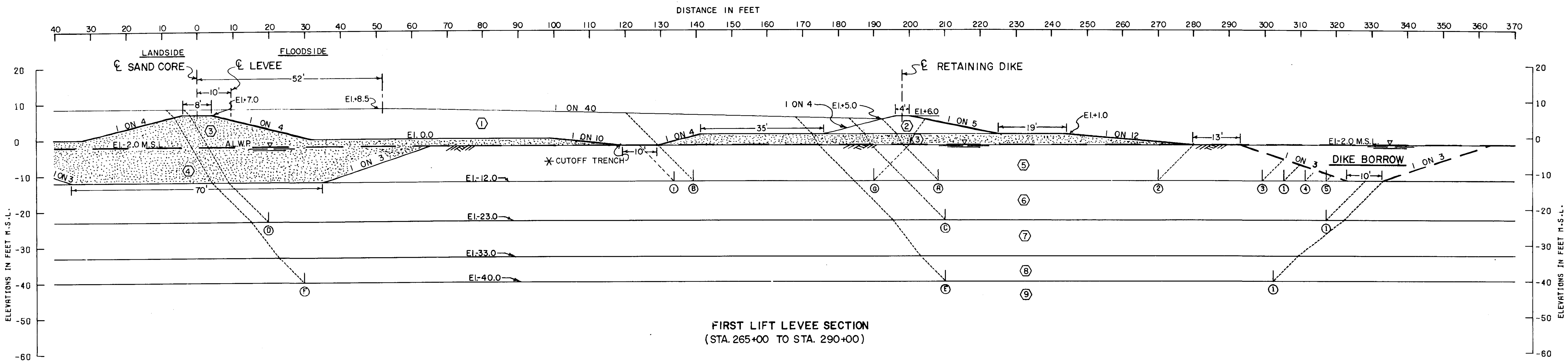
$\Phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA 180+00 TO STA. 265+00

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

JULY 1972 FILE NO. H-2-25953




## FIRST LIFT LEVEE SECTION
(STA. 265+00 TO STA. 290+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

✱ PROVIDE CUTOFF TRENCH WITH MINIMUM BOTTOM WITH OF 10' THROUGH SAND TO NATURAL GROUND.

| STRATUM NO. | SOIL TYPE | EFFECTIVE UNIT WT. P.C.F. | | C - UNIT COHESION - P.S.F. CENTER OF STRATUM | | BOTTOM OF STRATUM | | FRICTION ANGLE DEGREES |
|---|---|---|---|---|---|---|---|---|
| | | VERT. 1 | VERT. 2 | VERT. 1 | VERT. 2 | VERT. 1 | VERT. 2 | |
| 1 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 8 | CH | 40.0 | 40.0 | 296.0 | 296.0 | 334.0 | 334.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 554.0 | 554.0 | 0.0 |

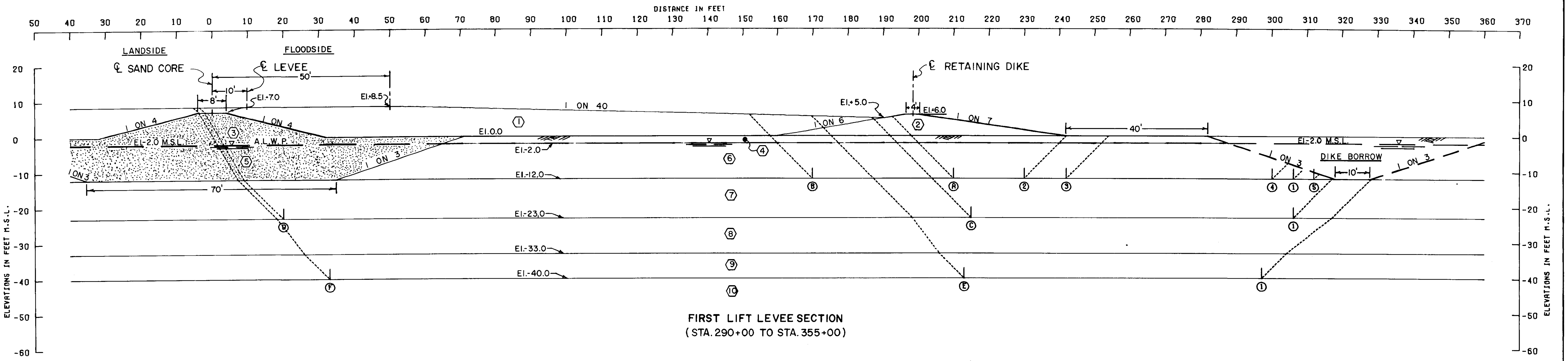
| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | -12.00 | 3656 | 9700 | 900 | 11441 | 458 | 14256 | 10983 | 1.30 |
| A | 2 | -12.00 | 3656 | 6200 | 2000 | 11441 | 2209 | 11856 | 9232 | 1.28 |
| A | 3 | -12.00 | 3656 | 9100 | 1200 | 11441 | 815 | 13956 | 10626 | 1.31 |
| A | 4 | -12.00 | 3656 | 10300 | 600 | 11441 | 203 | 14556 | 11237 | 1.30 |
| A | 5 | -12.00 | 3656 | 10900 | 300 | 11441 | 51 | 14856 | 11390 | 1.30 |
| B | 1 | -12.00 | 2000 | 16600 | 900 | 14208 | 458 | 19500 | 13750 | 1.42 |
| C | 1 | -23.00 | 7298 | 19260 | 3960 | 24860 | 2259 | 30518 | 22601 | 1.35 |
| D | 1 | -23.00 | 18445 | 53460 | 3960 | 43627 | 2259 | 75865 | 41368 | 1.83 |
| E | 1 | -40.00 | 21619 | 30728 | 18446 | 58081 | 18231 | 70792 | 39850 | 1.78 |
| F | 1 | -40.00 | 35588 | 90848 | 18446 | 87704 | 18231 | 144861 | 69473 | 2.09 |
| G | 1 | -12.00 | 3599 | 5700 | 2000 | 11411 | 1945 | 11299 | 9466 | 1.19 |

## NOTES

$\phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- 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

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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA 265+00 TO STA 290+00
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972
FILE NO. H-2-25953




FIRST LIFT LEVEE SECTION
(STA. 290+00 TO STA. 355+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 6 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 7 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 8 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 9 | CH | 40.0 | 40.0 | 296.0 | 296.0 | 334.0 | 334.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 554.0 | 554.0 | 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 | -12.00 | 3051 | 9600 | 600 | 10353 | 203 | 13251 | 10150 | 1.31 |
| A 2 | -12.00 | 3051 | 2000 | 2400 | 10353 | 4632 | 7451 | 5721 | 1.30 |
| A 3 | -12.00 | 3051 | 3200 | 2400 | 10353 | 3810 | 8652 | 6544 | 1.32 |
| A 4 | -12.00 | 3051 | 9000 | 900 | 10353 | 458 | 12951 | 9895 | 1.31 |
| A 5 | -12.00 | 3051 | 10200 | 300 | 10353 | 51 | 13551 | 10302 | 1.32 |
| B 1 | -12.00 | 2400 | 13600 | 600 | 12155 | 203 | 16600 | 11952 | 1.39 |
| C 1 | -23.00 | 6909 | 16380 | 4010 | 22425 | 2867 | 27299 | 19559 | 1.40 |
| D 1 | -23.00 | 18445 | 51480 | 4010 | 43627 | 2867 | 73935 | 40761 | 1.81 |
| E 1 | -40.00 | 20557 | 28056 | 18444 | 53520 | 18231 | 67057 | 35289 | 1.90 |
| F 1 | -40.00 | 35572 | 88176 | 18444 | 87211 | 18231 | 142191 | 68979 | 2.06 |

## 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

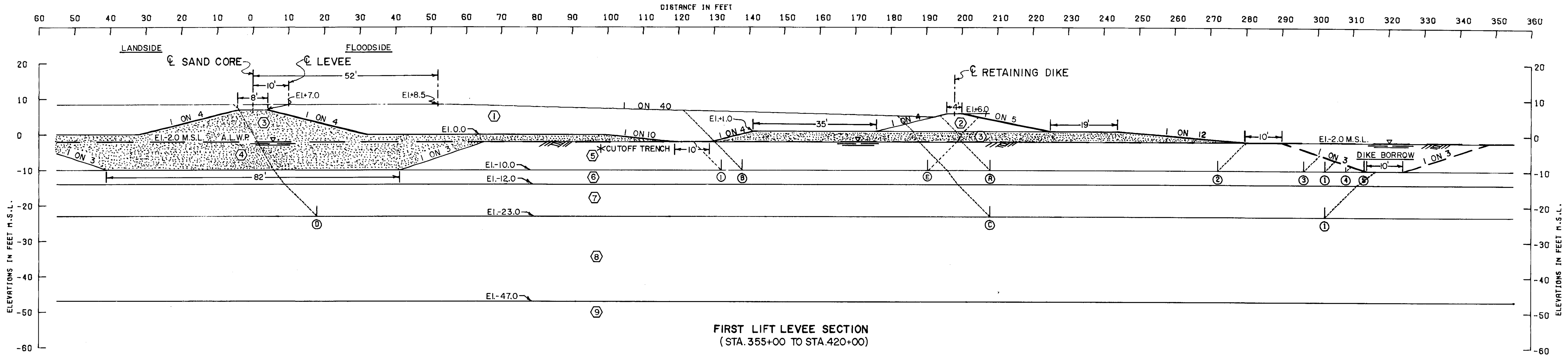
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. I - GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA. 290+00 TO STA. 355+00

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

JULY 1972 FILE NO. H-2-25953




# FIRST LIFT LEVEE SECTION
(STA. 355+00 TO STA. 420+00)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING, DATA PLATE 51

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

* PROVIDE CUTOFF TRENCH WITH MINMUM BOTTOM WIDTH OF 10' THROUGH SAND TO NATURAL GROUND.

| 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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 7 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 8 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 9 | CH | 40.0 | 40.0 | 483.0 | 483.0 | 554.0 | 554.0 | 0.0 |

| ASSUMED FAILURE SURFACE NO. | ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| Ⓐ ① | -10.00 | 3304 | 9400 | 600 | 9413 | 203 | 13304 | 9210 | 1.45 |
| Ⓐ ② | -10.00 | 3304 | 6400 | 1600 | 9413 | 1413 | 11304 | 8000 | 1.41 |
| Ⓐ ③ | -10.00 | 3304 | 8800 | 900 | 9413 | 458 | 13004 | 8955 | 1.45 |
| Ⓐ ④ | -10.00 | 3304 | 10000 | 300 | 9413 | 51 | 13604 | 9362 | 1.45 |
| Ⓐ ⑤ | -10.00 | 3304 | 10500 | 50 | 9413 | 1 | 13854 | 9412 | 1.47 |
| Ⓑ ① | -10.00 | 1724 | 16400 | 600 | 11826 | 203 | 18724 | 11622 | 1.61 |
| Ⓒ ① | -23.00 | 9287 | 16920 | 5659 | 26063 | 4599 | 31866 | 21464 | 1.49 |
| Ⓓ ① | -23.00 | 19631 | 51120 | 5659 | 44122 | 4599 | 76410 | 39524 | 1.93 |
| Ⓔ ① | -10.00 | 3242 | 5800 | 1600 | 9537 | 1333 | 10642 | 8204 | 1.30 |

## NOTES

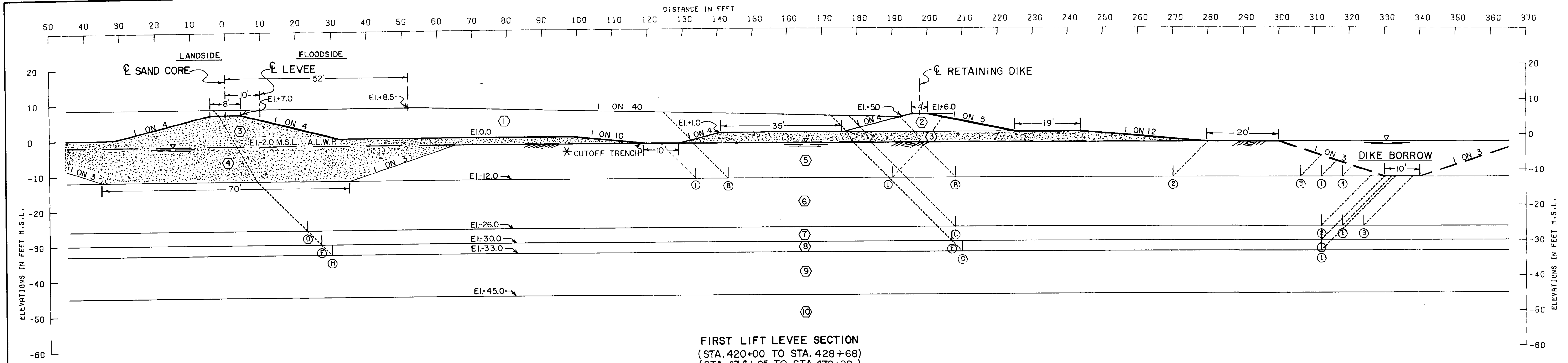
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
▽ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA 355+00 TO STA. 420+00

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

JULY 1972
FILE NO. H-2-25953




# FIRST LIFT LEVEE SECTION
(STA. 420+00 TO STA. 428+68)
(STA. 434+95 TO STA. 472+29)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

✱ PROVIDE CUTOFF TRENCH WITH MINIMUM BOTTOM WIDTH OF 10' THROUGH SAND TO NATURAL GROUND.

| 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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| 3 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | CH | 34.0 | 34.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 8 | CH | 40.0 | 40.0 | 241.0 | 241.0 | 257.0 | 257.0 | 0.0 |
| 9 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 10 | CH | 40.0 | 40.0 | 472.0 | 472.0 | 554.0 | 554.0 | 0.0 |

| ASSUMED FAILURE SURFACE 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 |
|---|---|---|---|---|---|---|---|---|---|
| A 1 | -12.00 | 3656 | 10400 | 900 | 11441 | 458 | 14956 | 10983 | 1.36 |
| A 2 | -12.00 | 3656 | 6200 | 2000 | 11441 | 2209 | 11856 | 9232 | 1.28 |
| A 3 | -12.00 | 3656 | 9800 | 1200 | 11441 | 815 | 14656 | 10626 | 1.38 |
| A 4 | -12.00 | 3656 | 11000 | 600 | 11441 | 203 | 15256 | 11237 | 1.36 |
| B 1 | -12.00 | 2476 | 16900 | 900 | 14237 | 458 | 20276 | 13778 | 1.47 |
| C 1 | -26.00 | 8333 | 19800 | 5040 | 29762 | 4145 | 33173 | 25617 | 1.30 |
| C 2 | -26.00 | 8333 | 18720 | 5240 | 29762 | 5097 | 32293 | 24665 | 1.31 |
| C 3 | -26.00 | 8333 | 20880 | 5040 | 29762 | 3534 | 34253 | 26229 | 1.31 |
| D 1 | -26.00 | 19525 | 53100 | 5040 | 50165 | 4145 | 77665 | 46020 | 1.69 |
| E 1 | -30.00 | 9904 | 23520 | 6656 | 36669 | 7341 | 40080 | 29329 | 1.37 |
| F 1 | -30.00 | 21141 | 63840 | 6656 | 59279 | 7341 | 91637 | 51939 | 1.76 |
| G 1 | -33.00 | 11350 | 26214 | 8102 | 41600 | 9356 | 45666 | 32244 | 1.42 |
| H 1 | -33.00 | 22587 | 72474 | 8102 | 66440 | 9356 | 103163 | 57084 | 1.81 |
| I 1 | -12.00 | 3599 | 5700 | 2000 | 11411 | 1945 | 11299 | 9466 | 1.19 |

## NOTES

- $\phi$ -- 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

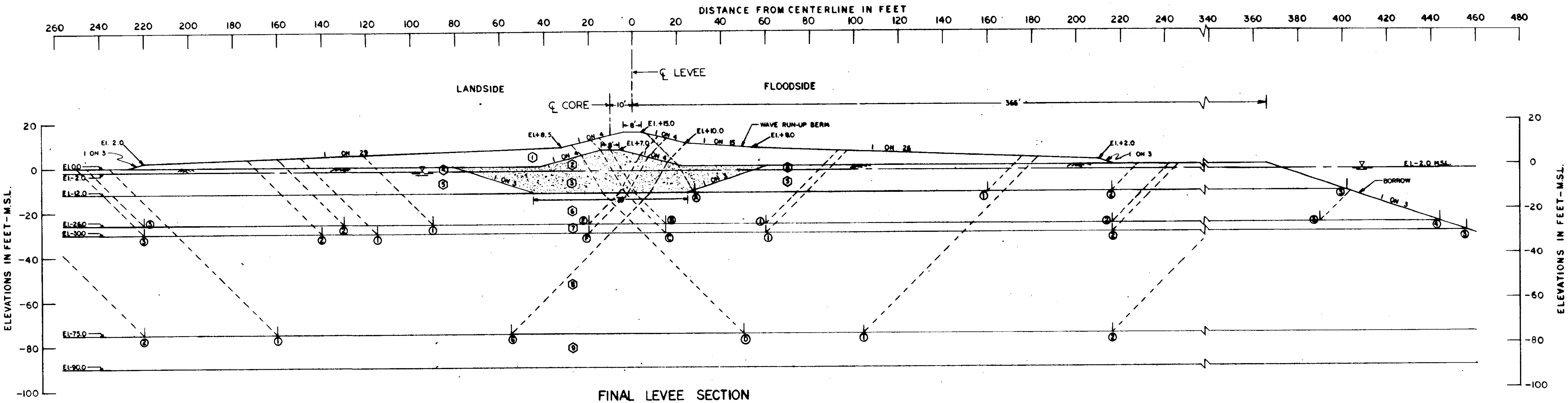
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FIRST LIFT LEVEE SECTION
STA. 420+00 TO STA. 428+68
STA. 434+95 TO STA. 472+29

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

JULY 1972 FILE NO. H-2-25953




## FINAL LEVEE SECTION
## STA. 0+00 TO STA. 45+00

### GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

| STRATUM NO. | SOIL TYPE | FRICTION ANGLE | UNIT WEIGHT | COHESION CTR. | COHESION BTM. |
|---|---|---|---|---|---|
| 1 | CH | 0 | 100 | 200 | 200 |
| 2 | SP | 30 | 122.5 | 0 | 0 |
| 3 | SP | 30 | 60 | 0 | 0 |
| 4 | CH | 0 | 96 | 100 | 100 |
| 5 | CH | 0 | 34 | 100 | 100 |
| 6 | CH | 0 | 34 | 180 | 180 |
| 7 | CH | 0 | 34 | 202 | 224 |
| 8 | CH | 0 | 40 | 472 | 720 |
| 9 | CH | 0 | 40 | 720 | 720 |

| FAILURE SURFACE NO. | | ELEV. | RESISTING FORCES Ra | Rb | Rp | DRIVING FORCES Da | Dp | SUMMATION R | D | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | -12.0 | 17014 | 13200 | 3733 | 25588 | 8817 | 33947 | 16771 | 2.024 |
| A | 2 | -12.0 | 17014 | 18800 | 2400 | 25588 | 3811 | 38214 | 21777 | 1.755 |
| A | 3 | -12.0 | 17014 | 37400 | 0 | 25588 | 0 | 54414 | 25588 | 2.127 |
| B | 1 | -26.0 | 29246 | 8100 | 10047 | 70634 | 35698 | 34393 | 34936 | 1.357 |
| B | 2 | -26.0 | 29246 | 36180 | 7440 | 70634 | 14589 | 72860 | 56045 | 1.300 |
| B | 3 | -26.0 | 29246 | 67500 | 4860 | 70634 | 4129 | 101606 | 66505 | 1.528 |
| B | 4 | -26.0 | 29246 | 77220 | 0 | 70634 | 0 | 106466 | 70634 | 1.507 |
| C | 1 | -30.0 | 29753 | 10080 | 11604 | 81042 | 42579 | 51437 | 38463 | 1.337 |
| C | 2 | -30.0 | 29753 | 45024 | 9056 | 81042 | 18893 | 83833 | 62149 | 1.349 |
| C | 3 | -30.0 | 29753 | 98784 | 0 | 81042 | 0 | 128537 | 81042 | 1.586 |
| D | 1 | -75.0 | 68207 | 38880 | 52766 | 227799 | 146118 | 159853 | 81681 | 1.957 |
| D | 2 | -75.0 | 68207 | 119520 | 51536 | 227799 | 110869 | 239263 | 116930 | 2.046 |
| E | 1 | -26.0 | 29331 | 12600 | 9604 | 71149 | 31818 | 51535 | 39331 | 1.310 |
| E | 2 | -26.0 | 29331 | 19800 | 9069 | 71149 | 27567 | 58200 | 43582 | 1.335 |
| E | 3 | -26.0 | 29331 | 36000 | 7440 | 71149 | 15189 | 72771 | 55960 | 1.300 |
| F | 1 | -30.0 | 29990 | 16800 | 11098 | 81811 | 37651 | 57889 | 44160 | 1.311 |
| F | 2 | -30.0 | 29990 | 26880 | 10498 | 81811 | 32306 | 67368 | 49505 | 1.361 |
| F | 3 | -30.0 | 29990 | 44800 | 9056 | 81811 | 19492 | 83846 | 62319 | 1.345 |
| G | 1 | -75.0 | 68487 | 39600 | 52777 | 229186 | 145166 | 160864 | 84020 | 1.915 |
| G | 2 | -75.0 | 68487 | 118800 | 51536 | 229186 | 111469 | 238823 | 117717 | 2.029 |

### 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

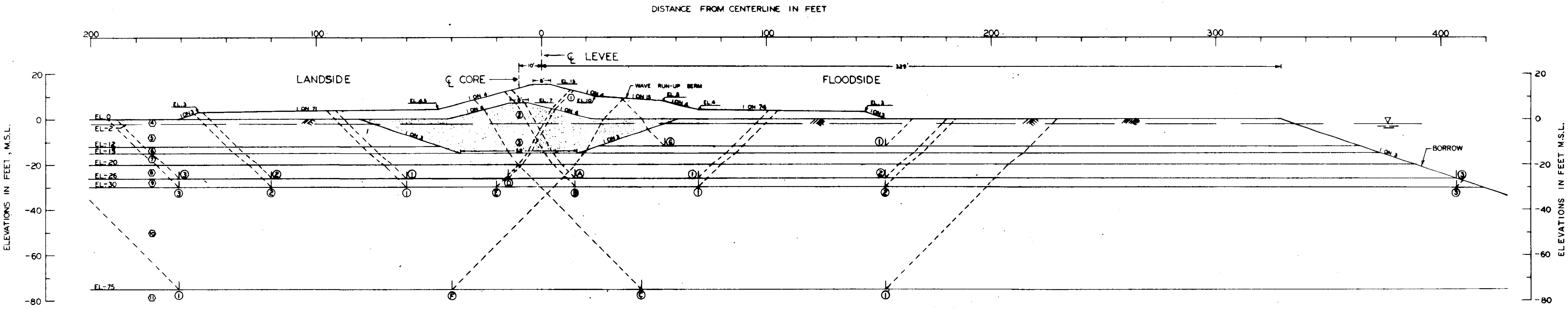
FACTOR OF SAFETY = $\frac{R_A + R_B + R_P}{D_A - D_P}$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## (Q) STABILITY ANALYSIS
## FINAL LEVEE SECTION
## STA. 0+00 TO STA. 45+00

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

JULY 1972 FILE NO. H-2-25953




## FINAL LEVEE SECTION
STA. 45+00 TO STA. 180+00

### GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

| STRATUM NO. | SOIL TYPE | FRICTION ANGLE | UNIT WEIGHT | COHESION CENTER | COHESION BOTTOM |
|---|---|---|---|---|---|
| 1 | CH | 0 | 100 | 200 | 200 |
| 2 | SP | 30 | 122.5 | 0 | 0 |
| 3 | SP | 30 | 60 | 0 | 0 |
| 4 | CH | 0 | 96 | 100 | 100 |
| 5 | CH | 0 | 34 | 100 | 100 |
| 6 | CH | 0 | 34 | 180 | 180 |
| 7 | ML | 15 | 55 | 200 | 200 |
| 8 | CH | 0 | 34 | 180 | 180 |
| 9 | CH | 0 | 34 | 202 | 224 |
| 10 | CH | 0 | 40 | 472 | 720 |
| 11 | CH | 0 | 40 | 720 | 720 |

| FAILURE SURFACE NO. | | FAILURE SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION R | D | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 1 | -26.0 | 38838 | 9900 | 13725 | 72991 | 26037 | 62463 | 46954 | 1.33 |
| A | 2 | -26.0 | 38838 | 24840 | 10940 | 72991 | 15481 | 74618 | 57510 | 1.30 |
| A | 3 | -26.0 | 38838 | 70380 | 90 | 72991 | 1 | 109308 | 72990 | 1.50 |
| B | 1 | -30.0 | 39950 | 12320 | 15301 | 84697 | 32191 | 67571 | 52500 | 1.29 |
| B | 2 | -30.0 | 39950 | 30912 | 12556 | 84697 | 20205 | 83418 | 64491 | 1.29 |
| B | 3 | -30.0 | 39950 | 90272 | 101 | 84697 | 1 | 130823 | 84696 | 1.54 |
| C | 1 | -75.0 | 76312 | 77760 | 55036 | 239328 | 116907 | 209108 | 122421 | 1.71 |
| D | 1 | -26.0 | 38220 | 8100 | 14300 | 73571 | 28682 | 60620 | 44889 | 1.35 |
| D | 2 | -26.0 | 38220 | 18900 | 13313 | 73571 | 24422 | 70433 | 49149 | 1.43 |
| D | 3 | -26.0 | 38220 | 26280 | 10940 | 73571 | 15485 | 75440 | 58086 | 1.30 |
| E | 1 | -30.0 | 40003 | 8960 | 15753 | 85043 | 35001 | 64716 | 50042 | 1.29 |
| E | 2 | -30.0 | 40003 | 22400 | 14696 | 85043 | 30306 | 77099 | 54737 | 1.41 |
| E | 3 | -30.0 | 40003 | 31584 | 12556 | 85043 | 20209 | 81699 | 64834 | 1.30 |
| F | 1 | -75.0 | 69791 | 87120 | 55036 | 237888 | 116910 | 211947 | 120978 | 1.75 |
| G | 1 | -12.0 | 8443 | 9800 | 2400 | 18656 | 3815 | 20643 | 14841 | 1.39 |

### NOTES

Ø = 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

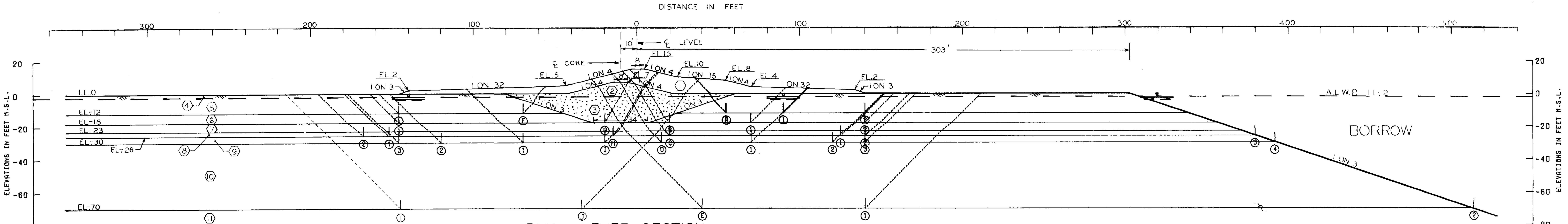
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## (Q) STABILITY ANALYSIS
FINAL LEVEE SECTION
STA. 45+00 TO STA. 180+00

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

JULY 1972 FILE NO. H-2-25953




# FINAL LEVEE SECTION
## STA. 180+00 TO STA. 265+00

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS, SEE BORING DATA PLATE 51

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

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| (A) | (1) | -12.00 | 8443 | 3500 | 3564 | 18658 | 8070 | 15507 | 10588 | 1.465 |
| (A) | (2) | -12.00 | 8443 | 8500 | 2400 | 18658 | 3810 | 19343 | 14848 | 1.303 |
| (B) | (1) | -18.00 | 27548 | 9000 | 5893 | 46272 | 14878 | 42442 | 31394 | 1.352 |
| (B) | (2) | -18.00 | 27548 | 21600 | 4560 | 46272 | 7613 | 53708 | 38659 | 1.389 |
| (C) | (1) | -26.00 | 39713 | 18900 | 12022 | 70324 | 17375 | 70635 | 52948 | 1.334 |
| (C) | (2) | -26.00 | 39713 | 21600 | 11296 | 70324 | 15165 | 72609 | 55159 | 1.316 |
| (C) | (3) | -26.00 | 39713 | 64800 | 90 | 70324 | 1 | 104603 | 70322 | 1.487 |
| (D) | (1) | -30.00 | 44838 | 12320 | 15367 | 85566 | 30872 | 72524 | 54694 | 1.326 |
| (D) | (2) | -30.00 | 44838 | 23520 | 13651 | 85566 | 23321 | 82009 | 62246 | 1.318 |
| (D) | (3) | -30.00 | 44838 | 28000 | 12912 | 85566 | 19936 | 85750 | 65630 | 1.307 |
| (D) | (4) | -30.00 | 44838 | 84448 | 101 | 85566 | 2 | 129387 | 85565 | 1.512 |
| (E) | (1) | -70.00 | 74072 | 66400 | 48432 | 222670 | 102851 | 188904 | 119820 | 1.577 |
| (E) | (2) | -70.00 | 74072 | 284156 | 10 | 222670 | 2 | 358238 | 222668 | 1.608 |

| STRATUM NO. | SOIL TYPE | EFFECTIVE UNIT WT. P.C.F. VERT. 1 | VERT. 2 | C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1 | VERT. 2 | BOTTOM OF STRATUM VERT. 1 | VERT. 2 | FRICTION ANGLE DEGREES |
|---|---|---|---|---|---|---|---|---|
| 1 | CH | 100.0 | 100.0 | 200.0 | 200.0 | 200.0 | 200.0 | 0.0 |
| 2 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 3 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 8 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 444.0 | 444.0 | 664.0 | 664.0 | 0.0 |
| 11 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| (F) | (1) | -12.00 | 5862 | 7600 | 2400 | 11291 | 3810 | 15862 | 7482 | 2.120 |
| (G) | (1) | -18.00 | 32943 | 22680 | 4560 | 47804 | 7613 | 60182 | 40191 | 1.497 |
| (H) | (1) | -26.00 | 43007 | 24660 | 11296 | 74270 | 15165 | 78963 | 59105 | 1.336 |
| (H) | (2) | -26.00 | 43007 | 27540 | 11296 | 74270 | 15165 | 81843 | 59105 | 1.385 |
| (I) | (1) | -30.00 | 44665 | 11200 | 15542 | 85990 | 32007 | 71407 | 53983 | 1.323 |
| (I) | (2) | -30.00 | 44665 | 22400 | 13717 | 85990 | 24811 | 80782 | 61179 | 1.320 |
| (I) | (3) | -30.00 | 44665 | 28224 | 12912 | 85990 | 19937 | 85801 | 66053 | 1.299 |
| (J) | (1) | -70.00 | 64238 | 73704 | 48432 | 223478 | 102854 | 186374 | 120624 | 1.545 |

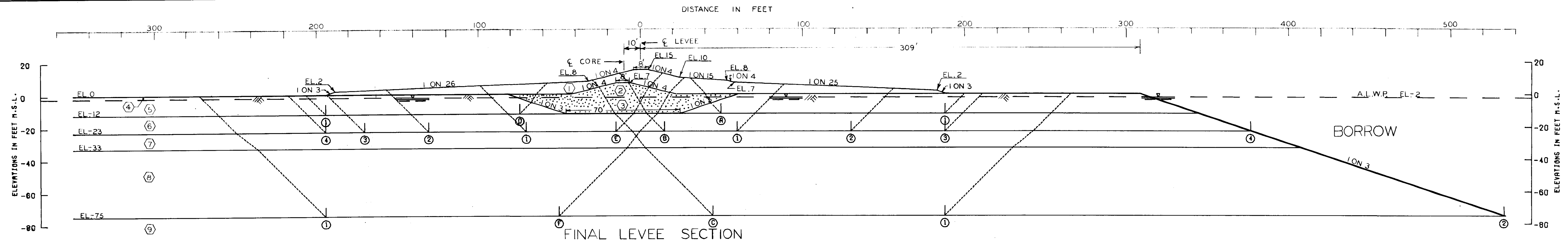
## NOTES

$\Phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- 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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1–GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FINAL LEVEE SECTION
STA. 180+00 TO STA. 265+00

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953




# FINAL LEVEE SECTION
# STA. 265+00 TO STA. 355+00

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

| ASSUMED FAILURE NO. | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| Ⓐ ① | -12.00 | 9497 | 13800 | 2400 | 19627 | 3826 | 25697 | 15801 | 1.626 |
| Ⓑ ① | -23.00 | 28631 | 8100 | 8668 | 62746 | 28307 | 45398 | 34438 | 1.318 |
| Ⓑ ② | -23.00 | 28631 | 20700 | 7591 | 62746 | 20626 | 56921 | 42120 | 1.351 |
| Ⓑ ③ | -23.00 | 28631 | 31140 | 6360 | 62746 | 11734 | 66131 | 51012 | 1.296 |
| Ⓑ ④ | -23.00 | 28631 | 65160 | 90 | 62746 | 1 | 93881 | 62744 | 1.496 |
| Ⓒ ① | -75.00 | 78904 | 102960 | 60896 | 239504 | 119968 | 242760 | 119536 | 2.031 |
| Ⓒ ② | -75.00 | 78904 | 351360 | 245 | 239504 | 2 | 430508 | 239502 | 1.798 |

| STRATUM NO. | SOIL TYPE | EFFECTIVE UNIT WT. P.C.F. VERT. 1 | VERT. 2 | C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1 | VERT. 2 | BOTTOM OF STRATUM VERT. 1 | VERT. 2 | FRICTION ANGLE DEGREES |
|---|---|---|---|---|---|---|---|---|
| 1 | CH | 100.0 | 100.0 | 200.0 | 200.0 | 200.0 | 200.0 | 0.0 |
| 2 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 3 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 8 | CH | 40.0 | 40.0 | 489.0 | 489.0 | 720.0 | 720.0 | 0.0 |
| 9 | CH | 40.0 | 40.0 | 720.0 | 720.0 | 720.0 | 720.0 | 0.0 |

| ASSUMED FAILURE NO. | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| Ⓓ ① | -12.00 | 7159 | 12000 | 2400 | 15094 | 3810 | 21559 | 11284 | 1.911 |
| Ⓔ ① | -23.00 | 27850 | 9900 | 8538 | 63268 | 27807 | 46288 | 35462 | 1.305 |
| Ⓔ ② | -23.00 | 27850 | 20700 | 7649 | 63268 | 20968 | 56199 | 42300 | 1.329 |
| Ⓔ ③ | -23.00 | 27850 | 27900 | 6460 | 63268 | 16526 | 62210 | 46742 | 1.331 |
| Ⓔ ④ | -23.00 | 27850 | 32220 | 6360 | 63268 | 11717 | 66430 | 51551 | 1.289 |
| Ⓕ ① | -75.00 | 79291 | 103680 | 60896 | 239032 | 119952 | 243867 | 119081 | 2.048 |

## NOTES

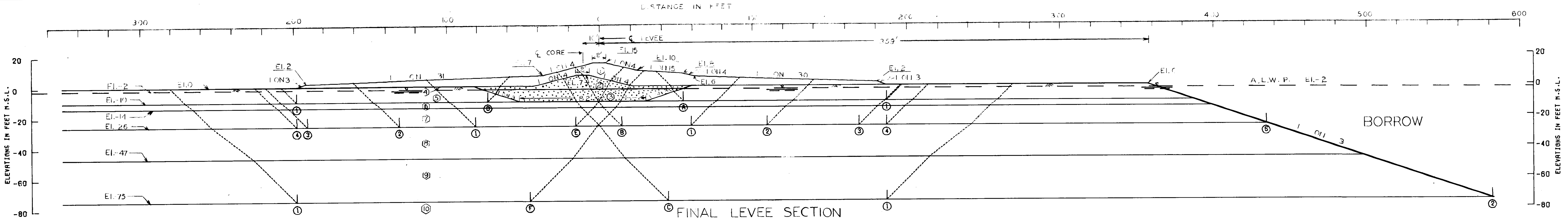
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1–GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2–FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FINAL LEVEE SECTION
STA. 265+00 TO STA. 355+00

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

JULY 1972 FILE NO. H-2-25953




# FINAL LEVEE SECTION
## STA. 355+00 TO STA. 420+00

### GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLAT 51

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

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| (A) | (1) | -10.00 | 7652 | 13300 | 2000 | 15602 | 2814 | 22952 | 12788 | 1.795 |
| (B) | (1) | -26.00 | 30598 | 8100 | 13564 | 71059 | 31695 | 52262 | 39364 | 1.328 |
| (B) | (2) | -26.00 | 30598 | 17100 | 12453 | 71059 | 26617 | 60151 | 44442 | 1.353 |
| (B) | (3) | -26.00 | 30598 | 27900 | 10324 | 71059 | 18866 | 68821 | 52193 | 1.319 |
| (B) | (4) | -26.00 | 30598 | 31140 | 10008 | 71059 | 15764 | 71746 | 55295 | 1.298 |
| (B) | (5) | -26.00 | 30598 | 75780 | 90 | 71059 | 1 | 106468 | 71058 | 1.498 |
| (C) | (1) | -75.00 | 92685 | 102960 | 77135 | 247886 | 129412 | 272781 | 118474 | 2.302 |
| (C) | (2) | -75.00 | 92686 | 387360 | 283 | 247886 | 2 | 480329 | 247884 | 1.938 |

| STRATUM NO. | SOIL TYPE | EFFECTIVE UNIT WT. P.C.F. VERT. 1 | VERT. 2 | C - UNIT COHESION - P.S.F. CENTER OF STRATUM VERT. 1 | VERT. 2 | BOTTOM OF STRATUM VERT. 1 | VERT. 2 | FRICTION ANGLE DEGREES |
|---|---|---|---|---|---|---|---|---|
| 1 | CH | 100.0 | 100.0 | 200.0 | 200.0 | 200.0 | 200.0 | 0.0 |
| 2 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 3 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 7 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 8 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 9 | CH | 40.0 | 40.0 | 566.0 | 566.0 | 720.0 | 720.0 | 0.0 |
| 10 | CH | 40.0 | 40.0 | 720.0 | 720.0 | 720.0 | 720.0 | 0.0 |

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| (D) | (1) | -10.00 | 5253 | 12500 | 2000 | 11569 | 2814 | 20752 | 8745 | 2.373 |
| (E) | (1) | -26.00 | 29441 | 11700 | 13258 | 71135 | 30209 | 54399 | 40926 | 1.329 |
| (E) | (2) | -26.00 | 29441 | 20700 | 12182 | 71135 | 25403 | 62324 | 45792 | 1.363 |
| (E) | (3) | -26.00 | 29441 | 31500 | 10008 | 71135 | 16564 | 70960 | 54571 | 1.300 |
| (E) | (4) | -26.00 | 29441 | 32760 | 10008 | 71135 | 15764 | 72210 | 55372 | 1.304 |
| (F) | (1) | -75.00 | 91823 | 109440 | 77134 | 246372 | 129412 | 278398 | 116960 | 2.380 |

### NOTES

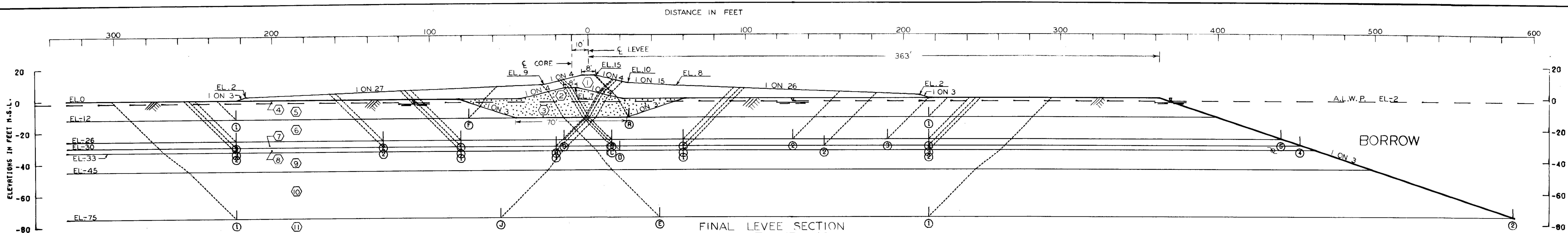
$\Phi$ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
$\nabla$ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS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

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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FINAL LEVEE SECTION
STA 355+00 TO STA. 420+00

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

JULY 1972 FILE NO. H-2-25953




FINAL LEVEE SECTION
STA. 420+00 TO STA. 428+68
STA. 434+95 TO STA. 472+29

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES | | | DRIVING FORCES | | SUMMATION OF FORCES | | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $R_A$ | $R_B$ | $R_P$ | $D_A$ | $-D_P$ | RESISTING | DRIVING | |
| Ⓐ | ① | -12.00 | 18175 | 19000 | 2400 | 26600 | 3810 | 39577 | 22790 | 1.737 |
| Ⓑ | ① | -26.00 | 29250 | 8100 | 10047 | 70640 | 35695 | 47397 | 34945 | 1.356 |
| Ⓑ | ② | -26.00 | 29250 | 20700 | 9010 | 70640 | 27286 | 58960 | 43354 | 1.360 |
| Ⓑ | ③ | -26.00 | 29250 | 31500 | 7440 | 70640 | 19956 | 68190 | 50685 | 1.345 |
| Ⓑ | ④ | -26.00 | 29250 | 36180 | 7440 | 70640 | 14588 | 72870 | 56053 | 1.300 |
| Ⓑ | ⑤ | -26.00 | 29250 | 76500 | 90 | 70640 | 1 | 105840 | 70639 | 1.498 |
| Ⓒ | ① | -30.00 | 29756 | 10080 | 11604 | 81049 | 42576 | 51440 | 38472 | 1.337 |
| Ⓒ | ② | -30.00 | 29756 | 30240 | 10271 | 81049 | 30561 | 70267 | 50488 | 1.392 |
| Ⓒ | ③ | -30.00 | 29756 | 45024 | 9059 | 81049 | 18891 | 83836 | 62158 | 1.349 |
| Ⓒ | ④ | -30.00 | 29756 | 97888 | 1011 | 81049 | 2 | 127745 | 81047 | 1.576 |
| Ⓓ | ① | -33.00 | 31825 | 10280 | 13003 | 89198 | 48082 | 55107 | 41115 | 1.340 |
| Ⓓ | ② | -33.00 | 31825 | 50372 | 10499 | 89198 | 22503 | 92696 | 66695 | 1.390 |
| Ⓔ | ① | -75.00 | 79636 | 123120 | 63382 | 236701 | 117345 | 266138 | 119356 | 2.230 |
| Ⓔ | ② | -75.00 | 79636 | 390240 | 277 | 236701 | 2 | 470153 | 236699 | 1.986 |

| 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 | CH | 100.0 | 100.0 | 200.0 | 200.0 | 200.0 | 200.0 | 0.0 |
| 2 | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 3 | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| 4 | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 5 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.0 |
| 6 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0.0 |
| 7 | CH | 34.0 | 34.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0.0 |
| 8 | CH | 40.0 | 40.0 | 240.5 | 240.5 | 257.0 | 257.0 | 0.0 |
| 9 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 10 | CH | 40.0 | 40.0 | 554.5 | 554.5 | 720.0 | 720.0 | 0.0 |
| 11 | CH | 40.0 | 40.0 | 720.0 | 720.0 | 720.0 | 720.0 | 0.0 |

| ASSUMED FAILURE NO. | | SURFACE ELEV. | RESISTING FORCES | | | DRIVING FORCES | | SUMMATION OF FORCES | | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $R_A$ | $R_B$ | $R_P$ | $D_A$ | $-D_P$ | RESISTING | DRIVING | |
| Ⓕ | ① | -12.00 | 7645 | 14800 | 2400 | 16715 | 3810 | 24845 | 12905 | 1.925 |
| Ⓖ | ① | -26.00 | 28064 | 11700 | 9797 | 70693 | 33531 | 49561 | 37163 | 1.334 |
| Ⓖ | ② | -26.00 | 28064 | 20700 | 9083 | 70693 | 27786 | 57847 | 42907 | 1.348 |
| Ⓖ | ③ | -26.00 | 28064 | 37440 | 7440 | 70693 | 14588 | 72944 | 58105 | 1.300 |
| Ⓗ | ① | -30.00 | 29993 | 13440 | 11356 | 81588 | 40163 | 54789 | 41425 | 1.323 |
| Ⓗ | ② | -30.00 | 29993 | 24640 | 10642 | 81588 | 33704 | 65275 | 47884 | 1.363 |
| Ⓗ | ③ | -30.00 | 29993 | 45472 | 9056 | 81588 | 18891 | 84521 | 62697 | 1.348 |
| Ⓘ | ① | -33.00 | 30423 | 15420 | 12756 | 89501 | 45483 | 58600 | 44018 | 1.331 |
| Ⓘ | ② | -33.00 | 30423 | 52171 | 10499 | 89501 | 22503 | 93094 | 66998 | 1.390 |
| Ⓙ | ① | -75.00 | 80997 | 120960 | 63382 | 236849 | 117345 | 265339 | 119505 | 2.220 |

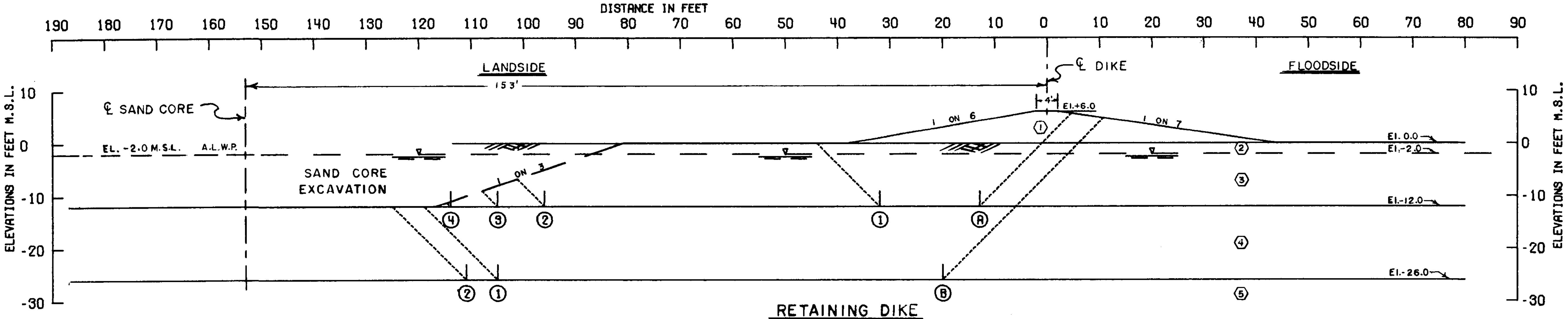
## NOTES

$\Phi$ -- 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

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

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
FINAL LEVEE SECTION
STA. 420+00 TO STA. 428+68
STA. 434+95 TO STA. 472+29

U.S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953




## RETAINING DIKE

STA. 0+00 TO STA. 45+00
STA 290+00 TO STA. 355+00

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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) | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0. |
| (2) | CH | 96.0 | 96.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0. |
| (3) | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0. |
| (4) | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0. |
| (5) | CH | 40.0 | 40.0 | 200.0 | 200.0 | 200.0 | 200.0 | 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) | -12.00 | 3075 | 1900 | 2400 | 10164 | 4049 | 7375 | 6115 | 1.206 |
| (A) (2) | -12.00 | 3075 | 8300 | 1050 | 10164 | 623 | 12425 | 9540 | 1.302 |
| (A) (3) | -12.00 | 3075 | 9200 | 600 | 10164 | 203 | 12875 | 9960 | 1.293 |
| (A) (4) | -12.00 | 3075 | 10100 | 150 | 10164 | 12 | 13325 | 10151 | 1.313 |
| (B) (1) | -26.00 | 8010 | 15300 | 5040 | 25857 | 4145 | 28350 | 21712 | 1.306 |
| (B) (2) | -26.00 | 8010 | 16380 | 5040 | 25857 | 3533 | 29430 | 22324 | 1.318 |

## NOTES

$\Phi$ -- 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

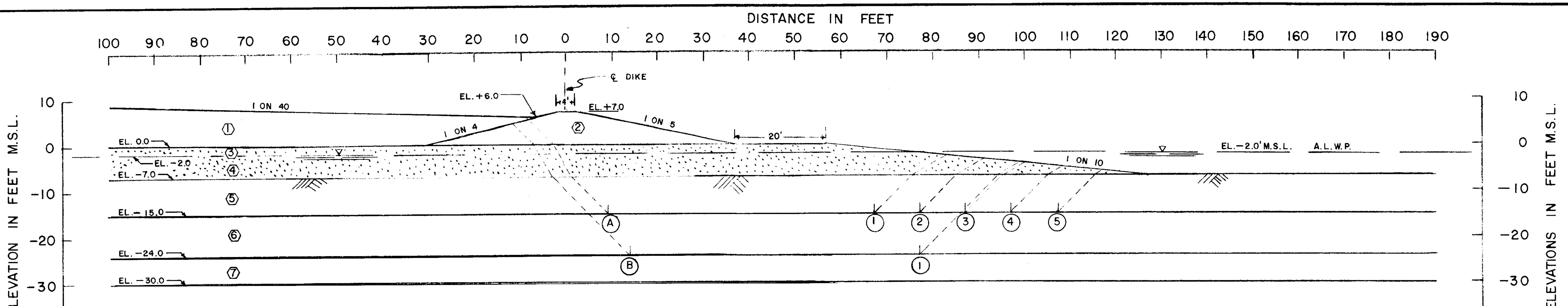
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

(Q) STABILITY ANALYSIS
RETAINING DIKE
STA. 0+00 TO STA. 45+00
STA. 290+00 TO STA. 355+00

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

JULY 1972 FILE NO. H-2-25953




## CROSS RETAINING DIKE*

STA. 0+00 (approx.)

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF UNDISTURBED BORINGS. SEE BORING DATA PLATE 88; NEW ORLEANS TO VENICE, LA. DESIGN MEMORANDUM NO. 1, GENERAL DESIGN, REACH B-1, TROPICAL BEND TO FORT JACKSON, REVISED 31 AUGUST 1971.

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

*SECTION ANALYZED IS APPROXIMATELY 60' LANDSIDE OF ℄ OF FIRST LIFT.

| 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 | HYD | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ② | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0.0 |
| ③ | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| ④ | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| ⑤ | CH | 36.0 | 36.0 | 120.0 | 120.0 | 120.0 | 120.0 | 0.0 |
| ⑥ | CH | 36.0 | 36.0 | 170.0 | 170.0 | 219.0 | 219.0 | 0.0 |
| ⑦ | CH | 36.0 | 36.0 | 252.0 | 252.0 | 285.0 | 285.0 | 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 | -15.0 | 6651 | 6960 | 3316 | 17287 | 4836 | 16927 | 12451 | 1.359 |
| A 2 | -15.0 | 6651 | 8160 | 2821 | 17287 | 3809 | 17632 | 13478 | 1.301 |
| A 3 | -15.0 | 6651 | 9360 | 2443 | 17287 | 3140 | 18454 | 14147 | 1.304 |
| A 4 | -15.0 | 6651 | 10560 | 2167 | 17287 | 2523 | 19378 | 14764 | 1.312 |
| A 5 | -15.0 | 6651 | 11760 | 1993 | 17287 | 1955 | 20404 | 15332 | 1.331 |
| B 1 | -24.0 | 9363 | 13797 | 5536 | 30176 | 9710 | 28696 | 20466 | 1.402 |

## NOTES

- Ø - - 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

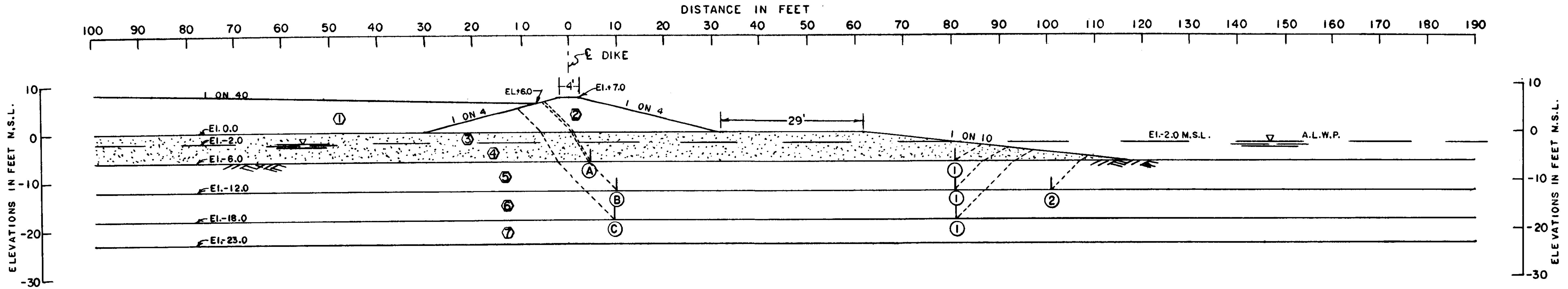
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

### (Q) STABILITY ANALYSIS
### CROSS RETAINING DIKE
### STA. 0+00 (APPROX)

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

JULY 1972 FILE NO. H-2-25953




## CROSS RETAINING DIKE*

STA. 245+00

### GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS, SEE BORING DATA PLATE 51.

*SECTION ANALYZED IS APPROXIMATELY 60' FLOODSIDE OF ℄ OF FIRST LIFT.

| STRATUM NO. | SOIL TYPE | EFFECTIVE UNIT WT. P.C.F | | C - UNIT COHESION - P.S.F | | | | FRICTION ANGLE |
|---|---|---|---|---|---|---|---|---|
| | | | | CENTER OF STRATUM | | BOTTOM OF STRATUM | | |
| | | VERT. 1 | VERT. 2 | VERT. 1 | VERT. 2 | VERT. 1 | VERT. 2 | DEGREES |
| ① | HYD. | 100.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 |
| ② | DIKE | 80.0 | 80.0 | 60.0 | 60.0 | 60.0 | 60.0 | 0 |
| ③ | SP | 122.5 | 122.5 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| ④ | SP | 60.0 | 60.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 |
| ⑤ | CH | 36.0 | 36.0 | 120.0 | 120.0 | 120.0 | 120.0 | 0 |
| ⑥ | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0 |
| ⑦ | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |

| 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 | -6.0 | 4039 | 7600 | 817 | 6789 | 409 | 12456 | 6389 | 1.95 |
| Ⓑ ① | -12.0 | 5256 | 7050 | 1790 | 13071 | 2238 | 14096 | 10833 | 1.30 |
| Ⓑ ② | -12.0 | 5256 | 9050 | 1300 | 13071 | 1273 | 15606 | 11798 | 1.32 |
| Ⓒ ① | -18.0 | 7190 | 12780 | 3760 | 20796 | 5094 | 23730 | 15702 | 1.51 |

### NOTES

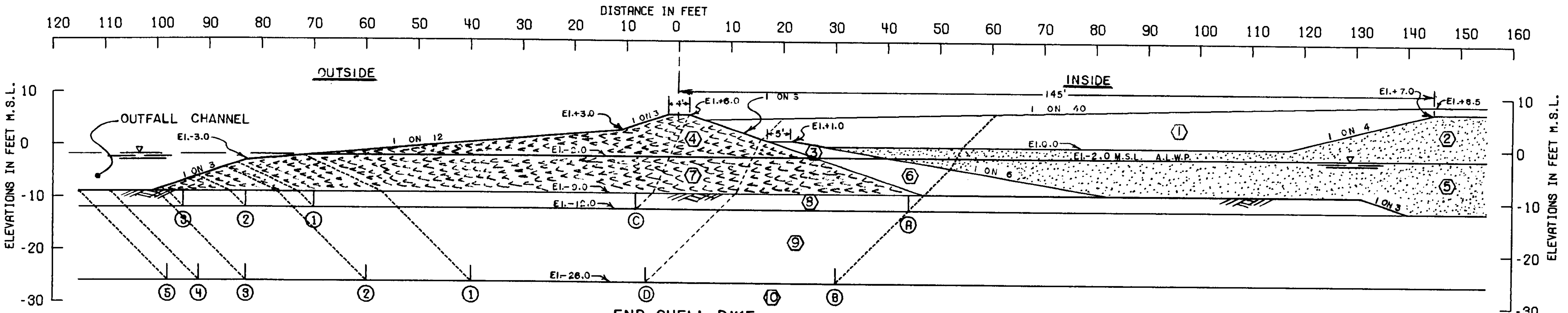
Ø = ANGLE OF INTERNAL FRICTION, DEGREES
C = UNIT COHESION, P.S.F.
∇ = STATIC WATER SURFACE
D = HORIZONTAL DRIVING FORCE IN POUNDS
R = HORIZONTAL RESISTING FORCE IN POUNDS
A = AS A SUBCRIPT, REFERS TO ACTIVE WEDGE
B = AS A SUBCRIPT, REFERS TO CENTRAL BLOCK
P = AS A SUBCRIPT, REFERS TO PASSIVE WEDGE

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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

**(Q) STABILITY ANALYSIS**
**CROSS RETAINING DIKE**
**STA. 245+00 (APPROX.)**

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953




## END SHELL DIKE

STA.430+13 & STA.433+50

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS, SEE BORING DATA PLATE 51

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 | SPOIL | 100.0 | 100.0 | 0. | 0. | 0. | 0. | 0. |
| 2 | SP | 122.5 | 122.5 | 0. | 0. | 0. | 0. | 30.0 |
| 3 | CLAY CUTOFF | 90.0 | 90.0 | 80.0 | 80.0 | 80.0 | 80.0 | 0. |
| 4 | SHELL | 92.0 | 92 0 | 0. | 0. | 0. | 0. | 40.0 |
| 5 | SP | 60.0 | 60.0 | 0. | 0. | 0. | 0. | 30.0 |
| 6 | CLAY CUTOFF | 28.0 | 28.0 | 80.0 | 80.0 | 80.0 | 80.0 | 0. |
| 7 | SHELL | 30.0 | 30.0 | 0. | 0. | 0. | 0. | 40.0 |
| 8 | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0. |
| 9 | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0. |
| 10 | CH | 40.0 | 40.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0. |

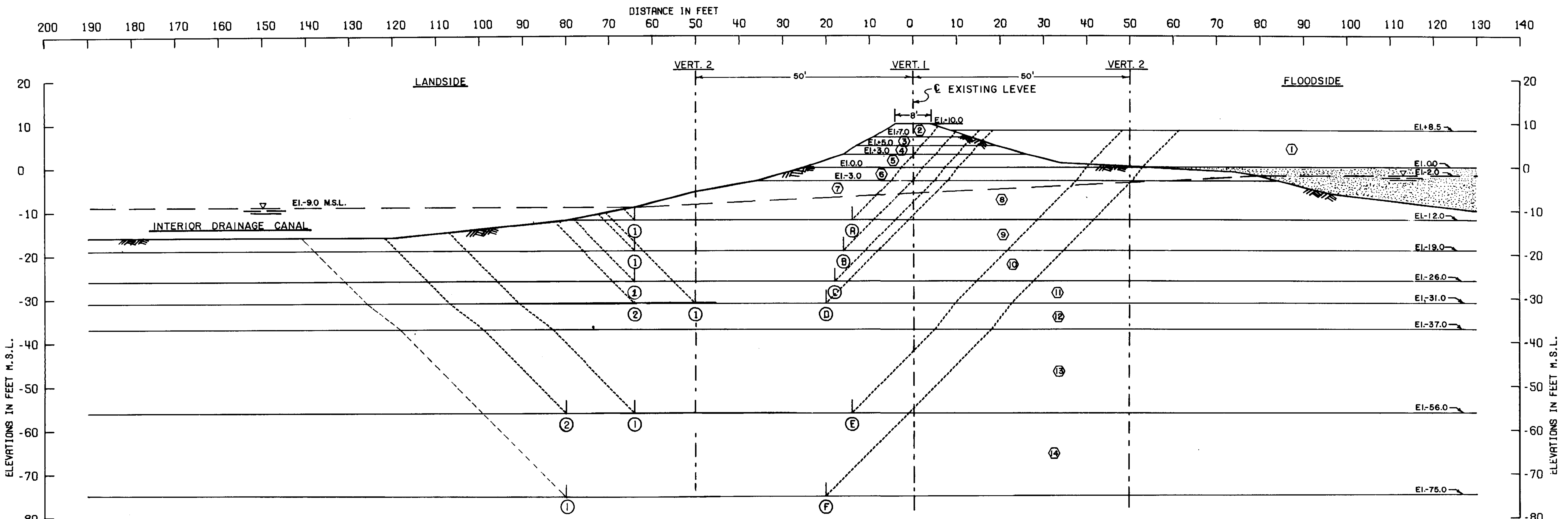
| ASSUMED FAILURE SURFACE | | RESISTING FORCES | | | DRIVING FORCES | | SUMMATION OF FORCES | | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| NO. | ELEV. | $R_A$ | $R_B$ | $R_P$ | $D_A$ | $-D_P$ | RESISTING | DRIVING | |
| A 1 | -12.00 | 3626 | 11400 | 2711 | 13870 | 1368 | 17737 | 12502 | 1.419 |
| A 2 | -12.00 | 3626 | 12700 | 1385 | 13870 | 865 | 17712 | 13004 | 1.362 |
| A 3 | -12.00 | 3626 | 13900 | 631 | 13870 | 296 | 18157 | 13574 | 1.338 |
| B 1 | -26.00 | 8666 | 12600 | 9541 | 32791 | 12496 | 30808 | 20294 | 1.518 |
| B 2 | -26.00 | 8666 | 16200 | 7426 | 32791 | 9395 | 32293 | 23396 | 1.380 |
| B 3 | -26.00 | 8666 | 20340 | 5643 | 32791 | 6525 | 34649 | 26265 | 1.319 |
| B 4 | -26.00 | 8666 | 21960 | 5640 | 32791 | 5315 | 36266 | 27476 | 1.320 |
| B 5 | -26.00 | 8666 | 23040 | 5640 | 32791 | 4955 | 37346 | 27836 | 1.342 |
| C 3 | -12.00 | 7284 | 8600 | 631 | 11118 | 296 | 16515 | 10822 | 1.526 |
| D 3 | -26.00 | 11393 | 13860 | 5643 | 28281 | 6525 | 30896 | 21756 | 1.420 |

## 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

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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
SHELL RETAINING DIKE
STA. 430+13 AND STA. 433+50
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1972 FILE NO. H-2-25953




# EXISTING BACK LEVEE

(STA. 0+00 TO STA. 428+68)
(STA. 434+95 TO STA. 472+29)

## 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 41 & 51

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 | HYD | 100.0 | 100.0 | 0. | 0. | 0. | 0. | 0. |
| 2 | ML | 117.0 | 117.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 3 | CH | 110.0 | 110.0 | 375.0 | 375.0 | 375.0 | 375.0 | 0. |
| 4 | ML | 117.0 | 117.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 5 | CH | 110.0 | 110.0 | 480.0 | 480.0 | 480.0 | 480.0 | 0. |
| 6 | ML | 117.0 | 117.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 7 | CH | 110.0 | 96.0 | 480.0 | 100.0 | 480.0 | 100.0 | 0. |
| 8 | CH | 48.0 | 34.0 | 480.0 | 100.0 | 480.0 | 100.0 | 0. |
| 9 | CH | 40.0 | 34.0 | 720.0 | 180.0 | 720.0 | 180.0 | 0. |
| 10 | CH | 40.0 | 34.0 | 760.0 | 180.0 | 760.0 | 180.0 | 0. |
| 11 | CH | 40.0 | 34.0 | 760.0 | 208.0 | 760.0 | 235.0 | 0. |
| 12 | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15.0 |
| 13 | CH | 46.0 | 40.0 | 720.0 | 406.0 | 720.0 | 511.0 | 0. |
| 14 | CH | 46.0 | 40.0 | 720.0 | 616.0 | 720.0 | 720.0 | 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) | -12.00 | 16345 | 9924 | 505 | 23096 | 128 | 26775 | 22968 | 1.166 |
| (B) (1) | -19.00 | 24634 | 14882 | 2804 | 36674 | 1430 | 42321 | 35244 | 1.201 |
| (C) (1) | -26.00 | 33319 | 14219 | 5103 | 51626 | 4134 | 52641 | 47491 | 1.108 |
| (D) (1) | -31.00 | 38993 | 11775 | 7467 | 62959 | 10104 | 58235 | 52854 | 1.102 |
| (D) (2) | -31.00 | 38993 | 15065 | 7021 | 62959 | 6935 | 61080 | 56023 | 1.090 |
| (E) (1) | -56.00 | 62417 | 28258 | 27999 | 142433 | 36244 | 118675 | 106118 | 1.118 |
| (E) (2) | -56.00 | 62417 | 36434 | 27307 | 142433 | 33662 | 126159 | 108770 | 1.160 |
| (F) (1) | -75.00 | 79748 | 43200 | 49745 | 213417 | 76793 | 172693 | 136624 | 1.264 |

## NOTES

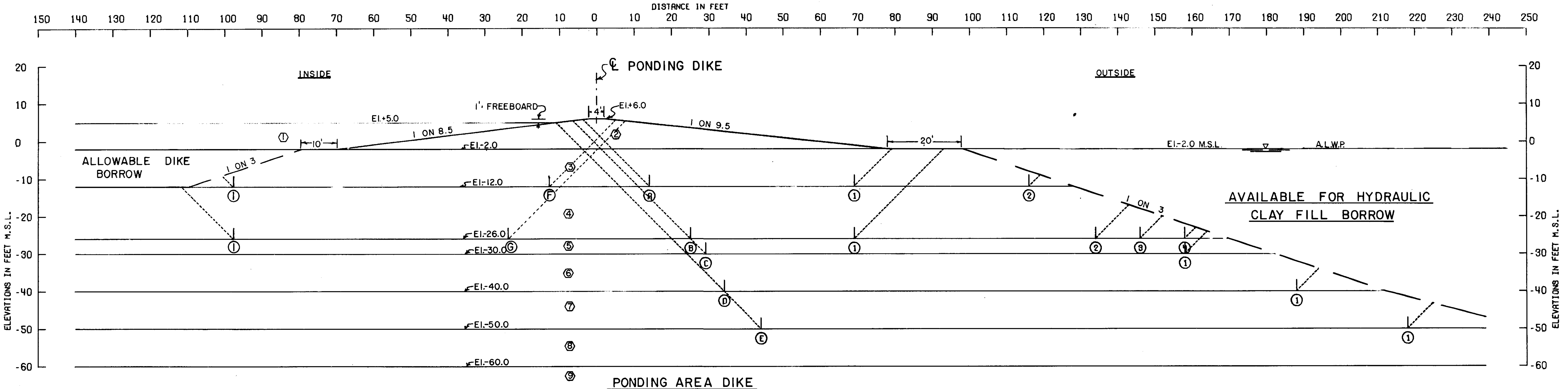
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. I-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

**(Q) STABILITY ANALYSIS**
**EXISTING BACK LEVEE**
**STA. 0+00 TO STA. 428+68**
**STA. 434+95 TO STA. 472+29**

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

JULY 1972 FILE NO. H-2-25953




## PONDING AREA DIKE

## GENERAL NOTES

CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS. SEE BORING DATA PLATE 51

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 | SPL | 90.0 | 90.0 | 0. | 0. | 0. | 0. | 0. |
| ② | DIKE | 80.0 | 80.0 | 45.0 | 45.0 | 45.0 | 45.0 | 0. |
| ③ | CH | 34.0 | 34.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0. |
| ④ | CH | 34.0 | 34.0 | 180.0 | 180.0 | 180.0 | 180.0 | 0. |
| ⑤ | CH | 34.0 | 34.0 | 202.0 | 202.0 | 224.0 | 224.0 | 0. |
| ⑥ | CH | 40.0 | 40.0 | 279.0 | 279.0 | 334.0 | 334.0 | 0. |
| ⑦ | CH | 40.0 | 40.0 | 389.0 | 389.0 | 444.0 | 444.0 | 0. |
| ⑧ | CH | 40.0 | 40.0 | 499.0 | 499.0 | 554.0 | 554.0 | 0. |
| ⑨ | CH | 40.0 | 40.0 | 1000.0 | 1000.0 | 1000.0 | 1000.0 | 0. |

| ASSUMED FAILURE SURFACE NO. | ELEV. | RESISTING FORCES $R_A$ | $R_B$ | $R_P$ | DRIVING FORCES $D_A$ | $-D_P$ | SUMMATION OF FORCES RESISTING | DRIVING | FACTOR OF SAFETY |
|---|---|---|---|---|---|---|---|---|---|
| Ⓐ ① | -12.00 | 2701 | 5500 | 2000 | 10040 | 2039 | 10201 | 8001 | 1.275 |
| Ⓐ ② | -12.00 | 2701 | 10200 | 600 | 10040 | 203 | 13501 | 9837 | 1.372 |
| Ⓑ ① | -26.00 | 7712 | 7920 | 7040 | 25385 | 10129 | 22672 | 15255 | 1.486 |
| Ⓑ ② | -26.00 | 7712 | 19620 | 3240 | 25385 | 1835 | 30572 | 23550 | 1.298 |
| Ⓑ ③ | -26.00 | 7712 | 21780 | 2160 | 25385 | 814 | 31652 | 24570 | 1.288 |
| Ⓑ ④ | -26.00 | 7712 | 23940 | 1080 | 25385 | 203 | 32732 | 25181 | 1.300 |
| Ⓒ ① | -30.00 | 9328 | 28896 | 2336 | 30639 | 814 | 40560 | 29824 | 1.360 |
| Ⓓ ① | -40.00 | 14861 | 51436 | 3348 | 47004 | 958 | 69645 | 46045 | 1.513 |
| Ⓔ ① | -50.00 | 22641 | 77256 | 5217 | 65810 | 1131 | 105114 | 64678 | 1.625 |
| Ⓕ ① | -12.00 | 2694 | 8500 | 600 | 10060 | 203 | 11794 | 9857 | 1.20 |
| Ⓖ ① | -26.00 | 7709 | 13320 | 5040 | 25303 | 4145 | 26069 | 21158 | 1.23 |

## 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

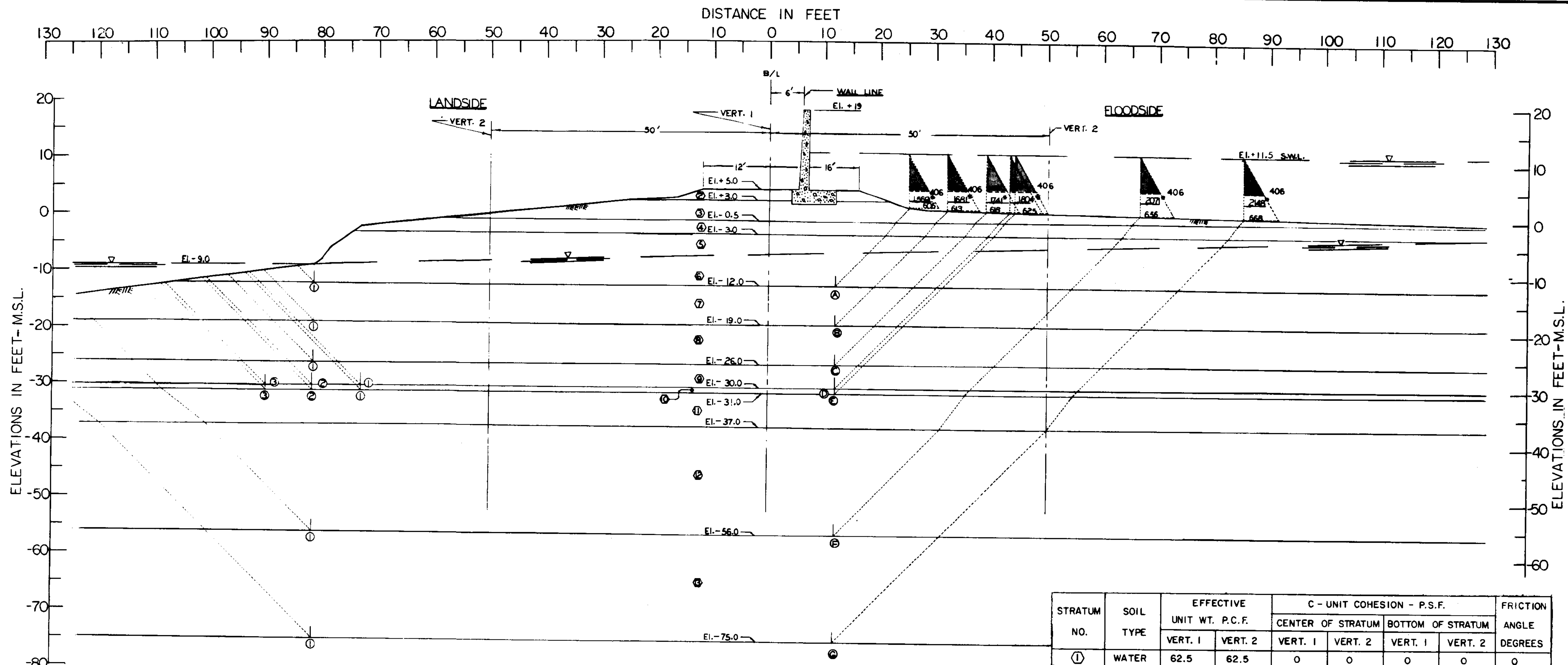
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2-FORT JACKSON TO VENICE
(Q) STABILITY ANALYSIS
PONDING AREA DIKE

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

JULY 1972 FILE NO. H-2-25953




VENICE PUMPING STATION

## 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 41 & 51.

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

SHADED PORTION OF PRESSURE DIAGRAM IS TAKEN BY THE T-WALL STRUCTURE.

| 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 | -12.0 | 8683 | 20826 | 528 | 20224 | 134 | 30037 | 20092 | 1.50 |
| Ⓑ ① | -19.0 | 14046 | 33138 | 2880 | 32716 | 1495 | 50064 | 31221 | 1.60 |
| Ⓒ ① | -26.0 | 18582 | 34346 | 5232 | 46706 | 4322 | 58160 | 42384 | 1.37 |
| Ⓓ ① | -30.0 | 20681 | 35227 | 6956 | 55344 | 10225 | 62864 | 45119 | 1.39 |
| Ⓓ ② | -30.0 | 20681 | 37131 | 6752 | 55344 | 6595 | 64564 | 48749 | 1.32 |
| Ⓓ ③ | -30.0 | 20681 | 39035 | 6511 | 55344 | 5892 | 66227 | 49452 | 1.34 |
| Ⓔ ① | -31.0 | 21136 | 35830 | 7392 | 57660 | 10974 | 64358 | 46686 | 1.38 |
| Ⓔ ② | -31.0 | 21136 | 37828 | 7188 | 57660 | 7242 | 66152 | 50418 | 1.31 |
| Ⓔ ③ | -31.0 | 21136 | 39825 | 6939 | 57660 | 6510 | 67900 | 51150 | 1.33 |
| Ⓕ ① | -56.0 | 39592 | 54090 | 28313 | 127685 | 37172 | 121995 | 90513 | 1.34 |
| Ⓖ ① | -75.0 | 60269 | 67320 | 51144 | 196758 | 75777 | 178733 | 120981 | 1.48 |

| 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 | WATER | 62.5 | 62.5 | 0 | 0 | 0 | 0 | 0 |
| ② | ML | 117.0 | 117.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15 |
| ③ | CH | 110.0 | 96.0 | 480.0 | 100.0 | 480.0 | 100.0 | 0 |
| ④ | ML | 117.0 | 117.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15 |
| ⑤ | CH | 110.0 | 96.0 | 480.0 | 100.0 | 480.0 | 100.0 | 0 |
| ⑥ | CH | 48.0 | 34.0 | 480.0 | 100.0 | 480.0 | 100.0 | 0 |
| ⑦ | CH | 40.0 | 34.0 | 720.0 | 180.0 | 720.0 | 180.0 | 0 |
| ⑧ | CH | 42.0 | 34.0 | 760.0 | 180.0 | 760.0 | 180.0 | 0 |
| ⑨ | CH | 42.0 | 34.0 | 760.0 | 202.0 | 760.0 | 224.0 | 0 |
| ⑩ | CH | 42.0 | 40.0 | 760.0 | 230.0 | 760.0 | 235.0 | 0 |
| ⑪ | ML | 55.0 | 55.0 | 200.0 | 200.0 | 200.0 | 200.0 | 15 |
| ⑫ | CH | 46.0 | 40.0 | 720.0 | 406.0 | 720.0 | 511.0 | 0 |
| ⑬ | CH | 46.0 | 40.0 | 720.0 | 616.0 | 720.0 | 720.0 | 0 |

## NOTES

Ø = 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.

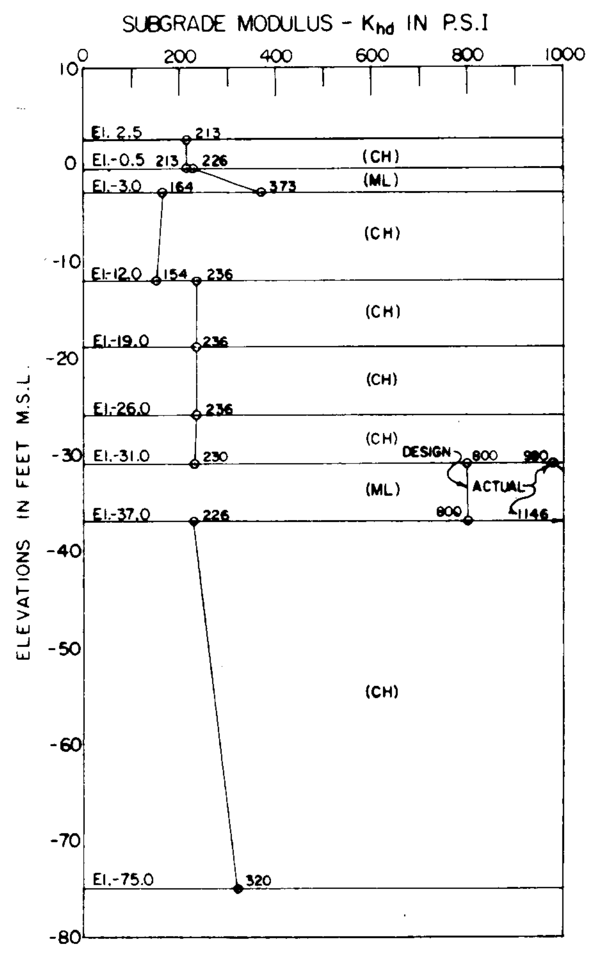
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

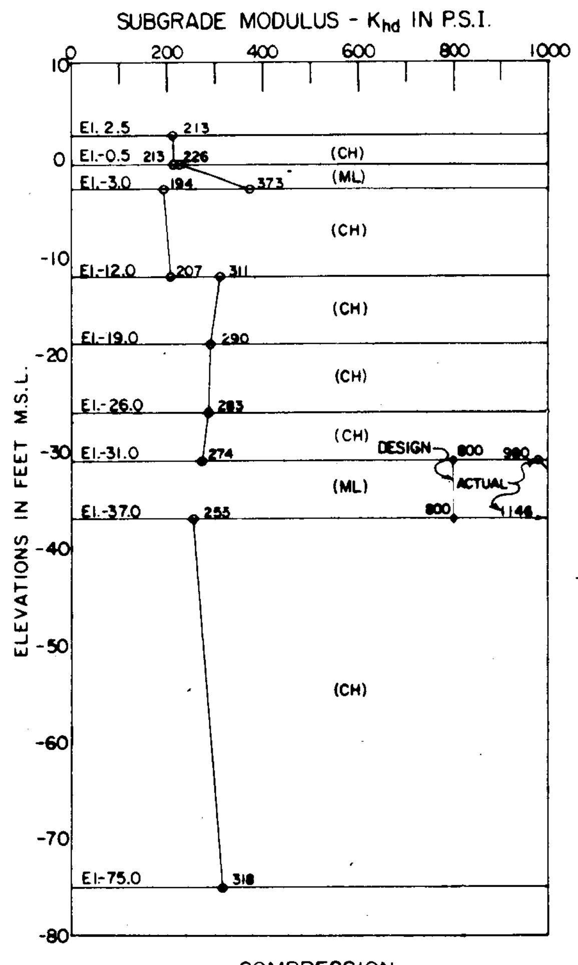
# (Q) STABILITY ANALYSIS
## VENICE PUMPING STATION

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

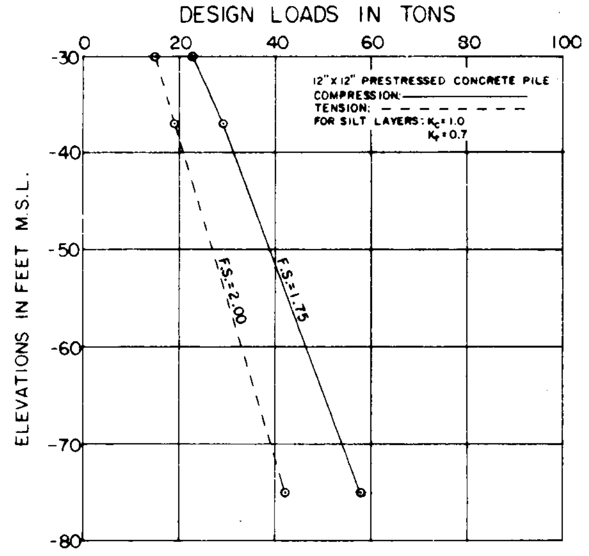
JULY 1972 FILE NO. H-2-25713



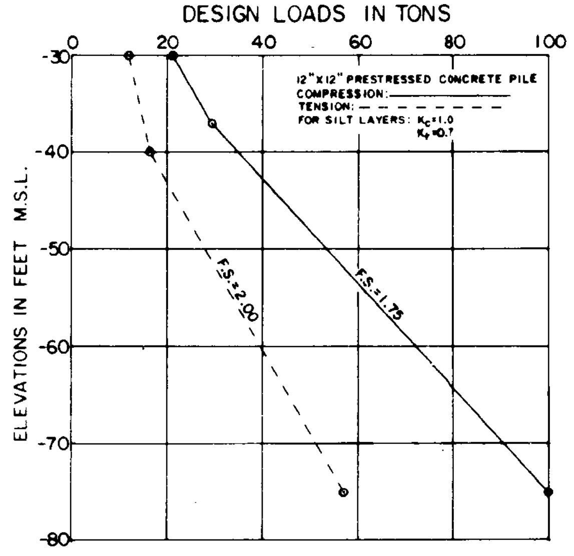

TENSION



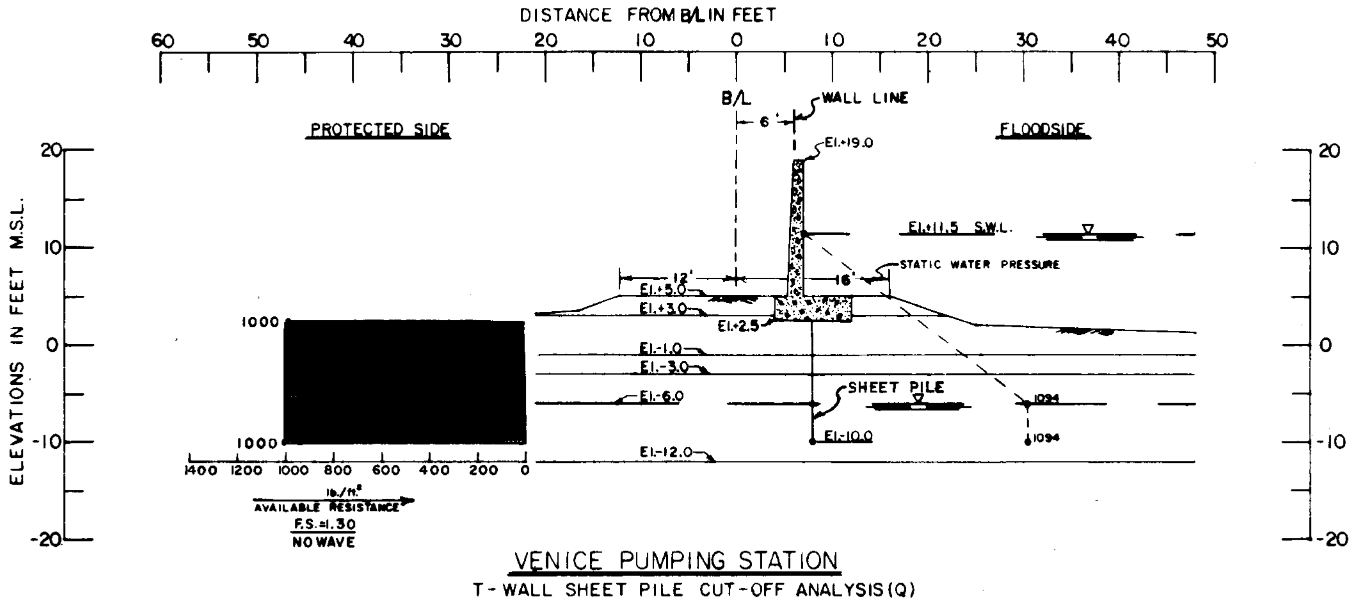

COMPRESSION




Q - CASE

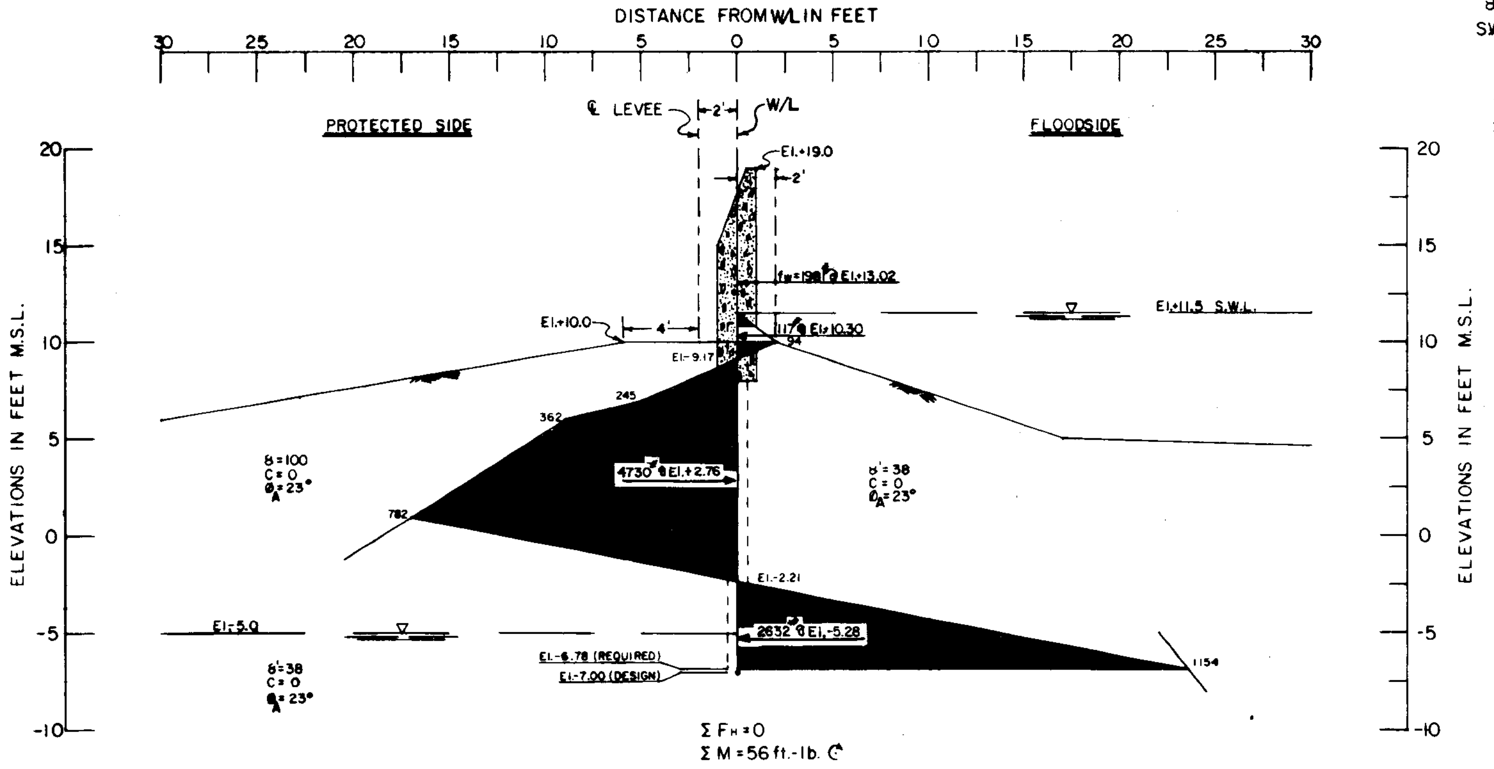



S - CASE




VENICE PUMPING STATION

T-WALL SHEET PILE CUT-OFF ANALYSIS (Q)




VENICE PUMPING STATION

SHEET PILE FLOODWALL (S) STABILITY

## GENERAL NOTES

SUBGRADE MODULUS AND PILE DESIGN LOADS:

- $N_h$ = CONSTANT OF HORIZONTAL SUBGRADE REACTION (p.s.i.)
- $\Delta do$ = THICKNESS OF STRATA
- d = PROJECTED PILE DIAMETER (in.)
- b = UNIT CONVERSION FACTOR = 12"
- Ko = 80qu (p.s.f.)
- C = COHESION
- Khd = 0.4 Ko d/b (FOR COHESIVE SOIL)
- 0.4 = REDUCTION FACTOR FOR CYCLIC LOADING
- Khd = 0.5 Nh$\Delta$do d/b (12) (FOR NONCOHESIVE SOIL)
- Kc = LATERAL EARTH PRESSURE COEFFICIENT (COMPRESSION)
- Kt = LATERAL EARTH PRESSURE COEFFICIENT (TENSION)
- K = CONJUGATE STRESS RATIO

SHEET PILE FLOODWALL (S) STABILITY:

- $\phi_A$ = AVAILABLE ANGLE OF INTERNAL FRICTION IN DEGREES
- $\phi_D$ = DEVELOPED ANGLE OF INTERNAL FRICTION = $TAN^{-1}(\frac{TAN \phi_A}{F.S.})$
- $C_A$ = UNIT COHESION AVAILABLE
- $C_D$ = UNIT COHESION DEVELOPED = $C_A \div$ F.S.
- S = CONSOLIDATED - DRAINED SHEAR STRENGTH OF SOIL, FOR UNDISTURBED SHEAR TEST DATA SEE PLATES
- $\Sigma F_H$ = SUMMATION OF HORIZONTAL FORCES
- $\Sigma M$ = SUMMATION OF MOMENTS ABOUT THE SHEETPILE TIP
- $\gamma, \gamma'$ = UNIT WEIGHTS - P.C.F.
- S.W.L. = STILL WATER LEVEL
- $f_W$ = WAVE FORCE EFFECTIVE TO TOP OF IMPERVIOUS CLAY LAYER.

THE (S)-SHEAR STRENGTH CASE GOVERNED FOR DESIGN.
STABILITY ANALYSIS BY METHOD OF PLANES WITH SURFACES $45 \pm \phi_D/2$ & F.S.=1.25 APPLIED TO THE SHEAR STRENGTH OF THE SOIL.

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

**REACH B2 - FORT JACKSON TO VENICE**
**VENICE PUMPING STATION**
**BEARING PILE DESIGN, SUBGRADE MODULUS, SHEET PILE CUTOFF ANALYSIS (Q) AND CANTILEVER SHEET PILE FLOODWALL (S) STABILITY**

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

JULY 1972 FILE NO. H-2-25953

# UNIFIED SOIL CLASSIFICATION

| MAJOR DIVISION | | TYPE | LETTER SYMBOL | 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 | | | SI | | SHELLS |
| NO SAMPLE | | | | | |

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

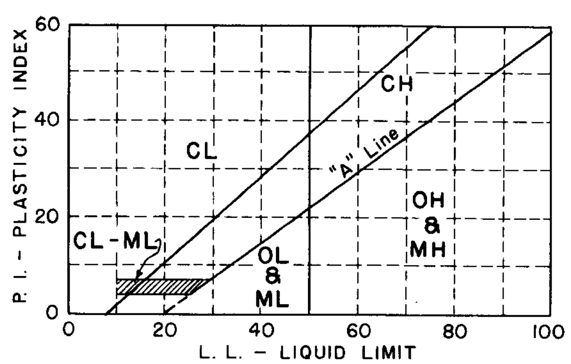
# DESCRIPTIVE SYMBOLS

## 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

Ⓒ Denotes location of consolidation test **

Ⓢ Denotes location of consolidated-drained direct shear test **

Ⓡ Denotes location of consolidated-undrained triaxial compression test **

Ⓠ Denotes location of unconsolidated-undrained triaxial compression test **

Ⓣ 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 ($1\frac{3}{8}$" 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 size $D_{10}$.

**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.

## GENERAL 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 represent 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 |
|---|---|---|---|
| 3 | 5-3-71 | ADDED UPPER LIMIT LINE (P.I.=0.9 (LL-8)) ON PLASTICITY CHART | LMVED-G LETTER D'T'D 29 APRIL 1971 |
| 2 | 6-8-64 | SYMBOL FW, NOTE REVISED | ORAL FROM L.M.V.G.G. 5 JUNE 1964 |
| 1 | 9-17-63 | 1ST. PAR. OF GENERAL NOTES REVISED | L. M. V. D. MULTIPLE LETTER, DATED 5 SEPT., 1963 |

# SOIL BORING LEGEND

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-2-21800

# NEW ORLEANS TO VENICE, LOUISIANA
# DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
# SUPPLEMENT NO. 4
# REACH B2 - FORT JACKSON TO VENICE

## APPENDIX A
## HYDROLOGY AND HYDRAULIC ANALYSIS

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

APPENDIX A
HYDROLOGY AND HYDRAULIC ANALYSIS

TABLE OF CONTENTS

## TABLE OF CONTENTS (cont'd)

### TABLES



### PLATES

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

## GLOSSARY

ASTRONOMICAL TIDE - See PREDICTED NORMAL TIDE

ATMOSPHERIC PRESSURE ANOMALY - The difference between atmospheric pressure at any point within the hurricane and normal pressure at the periphery of the hurricane.

BUILDUP - The increase, in feet, over that from other causes, of water surface elevation in a body of water resulting from:

a. Convergence in depth or width
b. Construction of a barrier
c. Ponding

CENTRAL PRESSURE INDEX - A parameter of hurricane intensity which reflects the minimum atmospheric pressure within the eye of a particular hurricane.

FETCH - The continuous area of water over which the wind blows in essentially a constant direction. Often used with FETCH LENGTH.

FETCH LENGTH - The horizontal distance over which the wind from a fixed direction may have unobstructed contact with the water surface.

HURRICANE - A cyclonic storm, usually of tropical origin, containing winds of 75 miles per hour or more.

a. DESIGN HURRICANE - That hurricane selected by the reporting office as a basis for design of the proposed plan of improvement.

b. STANDARD PROJECT HURRICANE - A hypothetical hurricane intended to represent the most severe combination of meteorological conditions that are reasonably characteristic of the region involved, excluding extremely rare combinations.

c. PROBABLE MAXIMUM HURRICANE - A hypothetical hurricane that might result from the most severe combination of meteorological conditions that are considered reasonably possible in the region involved. This hurricane is substantially more severe than the standard project hurricane and is seldom, if ever, used as the controlling consideration in design.

GLOSSARY (cont'd)

d. MODERATE HURRICANE - A hurricane that may be expected from a combination of meteorological conditions that are frequently experienced in the region.

e. TRANSPOSED HURRICANE - A storm transferred from actually observed location to another location for the purpose of study, with appropriate changes in storm characteristics.

HURRICANE TRACK - The line connecting successive locations of central pressure of the hurricane.

HURRICANE SPEED - The rate of forward movement of the hurricane eye in knots or miles per hour.

HURRICANE SURGE - The mass of water causing an increase in elevation of the water surface above normal tide at the time of a hurricane.

HURRICANE SURGE HEIGHT - The elevation of the stillwater level at a given point resulting from predicted normal tide and from hurricane surge action. It may be the result of one or more of the following components:

a. Predicted normal tide
b. Pressure setup
c. Setup due to winds over the continental shelf
d. Buildup

In inland lakes, hurricane surge height is the average lake level and does not include local wind setup.

HURRICANE TIDE - The elevation of the stillwater level at a given point during a hurricane. In inland lakes it is the sum of hurricane surge height and additional local wind setup.

ISOVEL - Line connecting points of simultaneous equal wind velocities and in this appendix represents a 5-minute average, 30 feet above ground level.

KNOT - A velocity equal to 1 nautical mile (6,080 feet) per hour, or about 1.15 statute miles per hour.

LANDFALL - The arrival of a hurricane center at the coastline.

OVERTOPPING - The amount of water passing over the top of a structure as a result of wave runup or surge action.

PONDING - The storage, behind a water-retaining structure, of water from interior runoff or from overtopping of a structure.

## GLOSSARY (cont'd)

PREDICTED NORMAL TIDE - The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting upon the rotating earth.

PRESSURE SETUP - A rise in the surface of a large body of water caused by a measurable reduction in local atmospheric pressure at sea level.

RANGE - An imaginary line representing the centerline of a narrow fetch over which the hurricane surge height is computed.

RUNUP - The vertical elevation above stillwater level to which water rises on the face of a structure as a result of wave action.

SETUP - The vertical rise in the stillwater level, above that which would occur without wind action, caused by wind stresses on the surface of the water.

SIGNIFICANT WAVE - A statistical term denoting waves having the average height and period of the highest one-third waves of a given wave train.

STILLWATER LEVEL - The elevation of the water surface if all wave action were to cease.

STORM SURGE - Same as HURRICANE SURGE, except that it may be caused by storms not of hurricane characteristics as well as by hurricanes.

SURGE REFERENCE LINE - The locus of points where the maximum surge height would be observed along fetches normal to the general coast.

WAVE HEIGHT - The vertical distance between the crest and the preceding trough. (Referenced to significant waves in this report.)

WAVE SETUP - The superelevation of the water surface above the hurricane surge height due to wave action alone.

WAVE TRAIN - A series of waves from the same direction.

WIND SETUP - Same as SETUP

WIND TIDE LEVEL - Same as STILLWATER LEVEL

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# APPENDIX A
# HYDROLOGY AND HYDRAULIC ANALYSIS

## SECTION I - CLIMATOLOGY AND HYDROLOGY

1. Climatology.

a. Climate. The climate of the project area is related to a subtropical latitude in proximity to the Gulf of Mexico. The climate may be characterized as marine, especially in summer when southerly winds prevail and produce conditions favorable for the generation of convective thundershowers. In the colder seasons the area is subjected to frontal movements which produce squalls and sudden temperature drops. Fogs on the Mississippi River are prevalent during the winter and spring when the temperature of the river is generally colder than the air temperature. Normally, the river flood season occurs from December to early June, and the hurricane season occurs during the period June to October. Climatological data for this area are contained in monthly and annual publications by the U. S. Department of Commerce, Weather Bureau (now the National Oceanic and Atmospheric Administration, National Weather Service), titled "Climatological Data for Louisiana," and "Local Climatological Data, New Orleans, Louisiana." The temperature and precipitation data are available for several National Weather Service stations. The data for New Orleans, with 98 years of record, and Burrwood, with 56 years of record, were used to compute normals and averages of temperature and precipitation for the project area.

b. Temperature. The average annual temperature in the project area is 70° Fahrenheit, with monthly means ranging from 57° in January to 83° in July and August. The maximum temperature of 102° was recorded at Belle Chasse on 7 August 1935, at New Orleans on 30 June 1954 and earlier dates, and at Port Sulphur on 31 August 1951. Minimum temperatures of 6° were recorded at Diamond on 12 February 1899 and 7° at New Orleans on 13 February 1899. Normal temperatures by months, determined by averaging Weather Service normals for Burrwood and New Orleans, are as follows:

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 56.8 | 58.2 | 62.2 | 68.8 | 76.0 | 81.7 | 83.1 | 83.2 | 80.4 | 73.5 | 63.6 | 58.4 |

c. Precipitation. Rainfall is generally heavy during two fairly well defined periods. Summer showers occur from about mid-June to mid-September and winter rains from mid-December to mid-March. Precipitation is greatest in the warm months due to summer thundershowers, and February has a greater average than the other winter months. The average annual rainfall is 60.8 inches. At New Orleans, a maximum annual rainfall accumulation of 85.73 inches was recorded in 1875 and a minimum of 31.04 inches was recorded in 1899. Normal monthly rainfall ranges from 7.3 inches in July to 3.3 inches in October. Monthly normals based on averaging records for Burrwood and New Orleans are as follows:

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.25 | 4.50 | 5.22 | 4.71 | 4.60 | 4.87 | 7.31 | 6.93 | 6.83 | 3.31 | 3.94 | 4.34 |

The maximum monthly rainfall is 29.0 inches, recorded at Belle Chasse in October 1937. Several stations have experienced periods in which no rainfall was recorded in a calendar month. Snow occurs infrequently in the area. New Orleans had an 8.2-inch snowfall on 14-15 February 1895. The last appreciable snowfall in the project area occurred on 12 February 1958 when stations reported snowfalls ranging from 1.3 to 4.0 inches.

2. Hydrology.

a. Tides. The tide along the coast is diurnal and has a mean range of approximately 1 foot under normal conditions. During periods of low flow of the Mississippi River, tidal effects are observed in the river as far as 200 miles upstream from the Gulf of Mexico. Water surface elevations are observed regularly at four locations along the Mississippi River within and in the general vicinity of the project limits. These elevations reflect headwater flows and tidal fluctuations. Stage recording gages are located and have been observed at West Pointe a la Hache from 1926 to date; Empire, 1960 to date; and Venice, 1944 to date. Staff gage records are available at Port Sulphur for period 1934 to date. In addition, daily river stages were obtained at Fort Jackson during the period 1891 - 1960. Crest stage recorders are maintained at two points--one at Davant on the landside of the Mississippi River east levee and the other at Magnolia on the landside of the west levee. These recorders show the maximum tides reached during tropical storms. River water surface elevations are available in "Stages and Discharges of the Mississippi River and its Outlets and Tributaries," published annually by the Mississippi River Commission, and in "Stages and Discharges of the Mississippi River and Tributaries and Other Streams and Waterways in the New Orleans District," published biennially by the U. S. Army Engineer District, New Orleans.

b. River floods of record. Headwater flooding of the natural banks of the Mississippi River occurs almost annually, but the area flooded is small and confined by the river levees. The higher stages usually occur during the period from February to May. The 1950 high water which produced stages of 10.7 and 7.5 feet m.s.l.[1] at Pointe a la Hache and Fort Jackson, respectively, is the maximum flood of record in the project area. The coincidence of a hurricane occurring with a major river flood is considered to be possible but highly improbable.

c. Storm tides. Many severe storms have been experienced in and near the project area. Flooding to various depths occurred in these areas during the storms of 1856, 1860, 1886, 1887, 1893, 1901, 1906, 1909, 1915, 1916, 1917, 1926, 1940, 1947, 1948, 1956, 1961, 1964, 1965, and 1969. Hurricane Betsy, in September 1965, produced tides of 14.8 feet at Bohemia; 14.4 feet at West Pointe a la Hache; 12.6 feet at Ostrica Lock; 9.7 feet at Empire; 7.9 feet at Venice; and 7.6 feet at Lake Grande Ecaille. Hurricane Camille, occurring in August 1969, passed east of the project area and inundated the protected area on the west side of the Mississippi River from Port Sulphur to Venice and caused almost total destruction to facilities located south of the latitude of Port Sulphur. Some of the flood stages caused by Hurricane Camille at and near the project area were: Ostrica lock, 15.1 feet; Mississippi River mile 48.7 AHP (Above Head of Passes), 10.9 feet; Mississippi River mile 35.5 AHP, 10.6 feet; Bohemia back levee, 10.1 feet; Buras, 12.6 feet; Fort Jackson, 12.7 feet; National Weather Service station near Boothville, 13.8 feet; and Venice, 8.2 feet. Since the path of Hurricane Camille passed closer to the project area, damage exceeded that experienced from Hurricane Betsy.

## SECTION II - TIDAL HYDRAULIC DESIGN

### 3. Description and verification of procedures.

a. Hurricane memorandums. The Hydrometeorological Branch (HMB), National Weather Service, cooperated in the development of hurricane criteria for historical and potential hurricanes in the project area. Memorandums prepared by the HMB provided isovel patterns, hurricane tracks, pressure profiles, rainfall estimates, frequency data, and various other parameters required for the hydraulic computations. A reevaluation of historical meteorologic and hydrologic data was the basis for memorandums

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[1]Mean sea level, the datum to which all elevations in this appendix are referenced unless otherwise indicated.

relative to historical hurricanes. Those relative to potential hurricanes were developed through the use of generalized estimates of hurricane parameters based on the latest research and theory. Memorandums applicable to the project area are listed in the bibliography of this appendix.

b. <u>Historical storms used for verification</u>. Three observed storms, with known parameters and effects, were used to establish and verify procedures and relationships for determining hurricane surge heights. These three storms occurred in September of 1915, 1947, and 1956. Isovel patterns for the hurricanes of September 1915(1)[2], September 1947(2), and September 1956(3) are shown on plates A-1, A-2, and A-3, respectively. Isovel patterns are also shown for the two recent devastating hurricanes, Betsy(4) and Camille(5), on plates A-4 and A-5, respectively.

(1) The hurricane of 29 September 1915 had a CPI (central pressure index) of 27.87 inches, an average forward speed of 10 knots, and a maximum windspeed of 99 m.p.h. at a radius of 27 nautical miles. This hurricane approached the mainland from the south. A surge height of 12 feet was experienced at Pointe a la Hache, and Buras had a surge height of 7.9 feet.

(2) The 19 September 1947 hurricane had a CPI of 28.57 inches, an average forward speed of 16 knots, and a maximum windspeed of 100 m.p.h. at a radius of 33 nautical miles. The direction of approach of this hurricane was approximately from the southeast. Surge heights of 11.2 feet at Shell Beach, 8.2 feet at Bohemia, and 11.5 feet at Ostrica lock were experienced during this hurricane.

(3) Hurricane Flossy, 23 September 1956, had a CPI of 28.76 inches, an average forward speed of 10 knots, and a maximum windspeed of 80 m.p.h. at a radius of 30 nautical miles. Flossy approached the mainland from the southwest. Surge heights of 12.1 feet and 8 feet occurred at Ostrica lock and Grand Isle, respectively.

(4) The hurricane of 9 September 1965, Betsy, had a CPI of 27.79 inches, an average forward speed of about 17 knots, and a maximum windspeed of 122 m.p.h. at a radius of 30 nautical miles. The storm approached land from a southeasterly direction. Maximum surge heights which occurred in and near the project area are listed in paragraph 2c of this appendix.

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[2]Superscript numbers in parentheses indicate references in the bibliography of this appendix.

(5) Hurricane Camille, 17 August 1969, had a CPI of 26.61 inches, an average forward speed of 13 knots, and a maximum windspeed of 146 m.p.h. at a radius of 15 nautical miles. See paragraph 2c of this appendix for maximum surge heights experienced in and near the project area.

c. Synthetic storms. Computed hurricane surge heights, resulting from synthetic storms, are necessary for frequency and design computations. Parameters for certain synthetic storms and methods for derivation of others were furnished by the National Weather Service. The SPH (Standard Project Hurricane) for the Louisiana coast was used as the base hurricane since other hurricanes could be derived from it. The PMH (Probable Maximum Hurricane) and Mod H (Moderate Hurricane) were derived from the SPH and differ from it only in wind velocities and CPI's.

(1) The SPH used in the "Interim Survey Report, Mississippi River Delta at and below New Orleans, Louisiana," was derived by the National Weather Service from a study of 48 hurricanes that occurred in the region over a period of 69 years. Based on subsequent studies of recent hurricanes, the Weather Service revised the original SPH wind field patterns[6][7]. However, the other characteristics of the SPH did not require change. The hurricane track and isovels at the critical hour for the design hurricane critical to Reach B2 - Fort Jackson to Venice are shown on plate A-6.

(a) The SPH has a frequency of once in 100 years for the Louisiana coastal region. The CPI that corresponds to this frequency is 27.5 inches[8]. CPI probabilities are based on the following relationship[8]:

$$P = \frac{100\ (M-0.5)}{Y}$$

where P = percent of occurrence per year
M = number of the event (rank)
Y = number of years of record

(b) The radius of maximum winds is an index of hurricane size. The average radius of 12 hurricanes occurring in the vicinity of the project area is 36 nautical miles. From relationships of CPI and radius of maximum winds of gulf coast hurricanes[8], a radius of 30 nautical miles is considered representative for an SPH having a CPI of 27.5 inches.

(c) An average forward speed of 11 knots was used for hurricanes critical to the project area. The average forward speeds of hurricanes experienced in the Gulf of Mexico have ranged from 5 to 30 miles per hour.

(d) Maximum theoretical gradient wind(8) is expressed as follows:

$$V_{gx} = 73 \sqrt{P_n - P_o} - R\,(0.575\,f)$$

where $V_{gx}$ = maximum gradient windspeed in miles per hour
$P_n$ = asymptotic pressure in inches
$P_o$ = central pressure in inches
$R$ = radius of maximum winds in nautical miles
$f$ = Coriolis parameter in units of hour $^{-1}$

The estimated windspeed[3] $(V_x)$(9) in the region of the highest speeds is obtained as follows:

$$V_x = 0.885\,V_{gx} + 0.5T$$

where T is equal to the forward speed of translation in miles per hour. From these relationships, a windspeed of approximately 100 m.p.h. was obtained for the SPH.

(2) Synthetic storms with various frequencies and corresponding CPI's are derived from the SPH. The CPI for any frequency except the PMH is obtained from the graph shown on plate A-7. For the PMH, the National Weather Service recommends a CPI of 26.9 inches(10)(11)(12). The computation of $V_{gx}$ for all synthetic and historical storms is identical to that for the SPH. However, for the PMH, $P_n$ is increased to 31.22 inches(12). Similarly, the computation of $V_x$ for any storm is identical to that for the SPH. Various isovels are adjusted from the SPH pattern using the ratio $V_x$ of any hurricane to $V_x$ of the SPH. Characteristics of some Zone B, large radius, synthetic storms with moderate speeds of translation, along with five historical storms, are listed in table A-1. The track for a hurricane most critical to the project area (Design Hurricane) and the paths of some large historical storms are shown on plate A-8.

[3]Windspeeds represent a 5-minute average, 30 feet above ground level.

TABLE A-1
HURRICANE CHARACTERISTICS

| Hurricane[1] | CPI | Radius to max. winds | Forward speed | $V_x$ |
|---|---|---|---|---|
| | inches | nautical miles | knots | m.p.h. |
| Sep 1915 | 27.87 | 29 | 10 | 99 |
| Sep 1947 | 28.57 | 33 | 16 | 100 |
| Sep 1956 | 28.76 | 30 | 10 | 80 |
| Sep 1965 | 27.79 | 32 | 17 | 122 |
| Aug 1969 | 26.61 | 15 | 13 | 146(@ 25° Lat.) |
| PMH | 26.9 | 30 | 11 | 143(@ 30° Lat.) |
| SPH | 27.5 | 30 | 11 | 100 |
| Mod H | 28.3 | 30 | 11 | 83 |

[1]Tracks are shown on plate A-8.

d. Surges.

(1) Maximum hurricane surge heights along the gulf shore were determined by use of a general wind tide formula that is based on the steady state conception of water superelevation(13)(14)(15). The computations were made for ranges extending from the shore to the continental shelf. In order to reach agreement between computed maximum surge heights and observed high-water marks, it was necessary to introduce a calibration coefficient or surge adjustment factor (Z) into the general equation which, in its modified form, is:

$$S = 1.165 \times 10^{-3} \frac{V^2 F}{D} NZ \cos \theta$$

where S = wind setup in feet
V = windspeed in statute miles per hour
F = fetch length in statute miles
D = average depth of fetch in feet
N = planform factor, generally equal to unity
Z = surge adjustment factor
θ = angle between direction of wind and the fetch

(2) Water surface elevations along a range were determined by incremental summation of wind setup above the water elevation at the gulf end of the range. The initial elevation at the beginning of each range was determined from the predicted normal tide and the setup due to atmospheric pressure anomaly. Typical tidal cycles for the project area are shown on plate A-9. An adjustment was made at the shoreward end of the range

to compensate for the difference in pressure setup between the ends of the range. This procedure for the determination of surge height at the coastline was developed for an area along the Mississippi gulf coast where reliable data were available at several locations for more than one severe hurricane. The procedure was then used for the entire Louisiana coastal region. Due to dissimilar shoreline configurations, different surge adjustment factors were required at each location, but identical factors were used at a particular location for all storms. The value of the factor is apparently a function of the distance between the shoreline and deep water and varies inversely with this distance. Computed maximum elevations and observed high-water elevations for the 1915 and 1947 hurricanes at the locations that were used in the development of the procedure are shown in table A-2.

TABLE A-2
HURRICANE SURGE HEIGHTS

| Location | Surge Adjustment factor(Z) | 1915 Observed | 1915 Computed | 1947 Observed | 1947 Computed |
|---|---|---|---|---|---|
| Bay St.Louis,Miss. | 0.46 | 11.8 | 11.8 | 15.2 | 15.1 |
| Gulfport, Miss. | 0.60 | 10.2[1] | 9.9 | 14.1 | 14.3 |
| Biloxi, Miss. | 0.65 | 10.1[1] | 9.8 | 12.2[1] | 12.6 |

[1]Average of several high-water marks.

(3) The incremental step computation was used to check maximum hurricane surge heights experienced at several locations within the project area. Verification of these surge heights and the surge adjustment factors used in the computations are shown in table A-3.

TABLE A-3
VERIFICATION OF HURRICANE SURGE HEIGHTS

| Location | Surge adjustment factor(Z) | Sep 1915 Observed (feet m.s.l.) | Sep 1915 Computed (feet m.s.l.) | Sep 1956 Observed (feet m.s.l.) | Sep 1956 Computed (feet m.s.l.) |
|---|---|---|---|---|---|
| Phoenix | 0.52 | - | - | 8.5 | 7.8 |
| Pointe a la Hache | 0.52 | 12.0 | 12.4 | 10.3 | 10.2 |
| Ostrica Lock | 0.64 | - | - | 12.1 | 12.2 |
| Buras | 0.80 | 7.9 | 8.7 | - | - |
| Grand Isle | 0.80 | 9.0 | 8.8 | 3.9 | 4.1 |

(4) Surge heights were computed for Hurricane Betsy, September 1965, at locations within the project area where reliable observed surge heights were available. Using the same

Z factors as shown in table A-3, the computed surge heights averaged about 2.9 feet higher than the observed surge heights. This apparently was caused by the higher forward speed of Betsy. A fast-moving hurricane does not allow enough time for the surge heights to approach the steady state of water superelevation[13][14][15]. However, it was determined that Z factors derived from slow-moving hurricanes should be used for design purposes because this type hurricane is more nearly representative of hurricanes in the project area and the resulting design elevations are conservative (high).

(5) For each surge computation, the average windspeed was determined from isovel charts supplied by the National Weather Service[6] and average depth values were derived from standard hydrographic charts prepared by the U. S. Coast and Geodetic Survey (now the National Oceanic and Atmospheric Administration, National Ocean Survey).

(6) For the purpose of surge routing procedures, the coastline is defined as the locus of points where the maximum surge heights would be observed along fetches normal to the general coast. This synthetic coastline has been designated the SRL (surge reference line) and is shown on plate A-10.

e. Wave runup.

(1) Wave runup on a protective structure depends on characteristics of the structure (i.e., shape and surface roughness), the wave characteristics, and the depth of water at the structure. The vertical height to which water from a breaking wave will run up on a given protective structure determines the top elevation to which the structure must be built to prevent wave overtopping.

(2) Computations were made to determine wave runup for the protective structures along the project alinement. The configurations of the protective structures are shown on plate A-11.

(3) In order to compute wave runup on a protective structure, the significant wave height ($H_s$) and wave period (T) in the vicinity of the structure must be known. These parameters were determined according to Bretschneider[16] and as described in paragraph 1.25 of bibliographic reference (13). The windspeed and depth used in determining $H_s$ and T were average values over a 5-mile fetch. Data used to determine wave characteristics in the vicinity of the protective structures are shown in table A-4.

TABLE A-4
DATA USED TO DETERMINE WAVE CHARACTERISTICS
DESIGN HURRICANE

| Pertinent factors | | Fort Jackson to Venice |
|---|---|---|
| F | = Length of fetch, miles | 5 |
| U | = Windspeed, m.p.h. | 78 |
| s.w.l. | = Stillwater elevation, feet | 11.5 |
| d | = Average depth of fetch, feet | 7.2 |
| $d_t$ | = Depth at toe of structure, feet | 8.7 |

(4) Wave runup was calculated by use of model study data developed by Saville(17)(18)(19)(20) which relate relative runup ($R/H_0'$), wave steepness ($H_0'/T^2$), and relative depth ($d/H_0'$). The average depth of the 5-mile fetch is shown in table A-4 and the significant wave height ($H_s$) and wave period (T) can be determined from the data in table A-4. The equivalent deepwater wave height ($H_0'$) can be determined from table D-1 of bibliographic reference (13) which relates $d/L_0$ to $H/H_0'$. The deepwater wave length ($L_0$) is determined from the equation:

$$L_0 = 5.12\ T^2$$

When determining runup from the significant wave, H in the term $H/H_0'$ is equal to $H_s$. Wave characteristics used in computing runup from the significant wave are shown in table A-5.

TABLE A-5
WAVE CHARACTERISTICS
DESIGN HURRICANE

| Characteristics | | Fort Jackson to Venice |
|---|---|---|
| $H_s$ | = Significant wave height, feet | 3.3 |
| T | = Wave period, seconds | 4.4 |
| $L_0$ | = Deepwater wave length, feet | 99.1 |
| $d/L_0$ | = Relative depth | 0.0721 |
| $H_s/H_0'$ | = Shoaling coefficient | 0.9674 |
| $H_0'$ | = Deepwater wave height, feet | 3.41 |
| $H_0'/T^2$ | = Wave steepness | 0.176 |

(5) With the terms $d/H_o'$ and $H_o'/T^2$ known, runup on a protective structure can be computed if the slope of the structure is known. The levee configuration used in these computations has a stabilizing berm on the flood side. This berm breaks the continuity of the levee slope and Saville's[20] method of determining wave runup on composite slopes was used (see plate A-12). In using this method, the actual composite slope is replaced by a hypothetical single constant slope. This hypothetical slope is computed by estimating a value of wave runup and then determining the slope of a line from the point where the wave breaks to the estimated point of runup. The breaking depth is determined from the equation:

$$d_b = \frac{0.67\ H_o'}{(H_o'/T^2)^{1/3}}$$

Using the slope of this line, which is the hypothetical slope, a value of runup is determined. If the value of runup determined is different from the estimated runup, the process is then repeated using the new value of runup to obtain a new hypothetical slope which, in turn, determines a new value of runup. This process is repeated until the estimated value of runup agrees with the computed value of runup.

(6) Protective structures exposed to wave runup will be constructed to an elevation that is sufficient to prevent all overflow from the significant wave and waves smaller than the significant wave accompanying the design hurricane. Waves larger than the significant wave may overtop the protective structures, but such overtopping will not endanger the security of the structure or cause excessive interior flooding. During the time of maximum hurricane surge height, the berm on the flood side of the levee becomes submerged and waves of lesser height than the significant wave, but of the same period, break farther up the levee slope. Sometimes runup from these smaller waves reach an elevation higher than that from the significant wave; therefore, runup resulting from these smaller waves must also be computed. The equivalent deepwater wave heights for the smaller waves breaking on the berm were computed by use of the equation:

$$H_o' = \frac{1.84}{T}(d_b)^{3/2}$$

Runup was computed for the significant wave and for smaller waves breaking on the berm and the required levee height was determined by adding the highest computed runup value to the maximum stillwater elevation. The design runup value and proposed elevation of the protective structures are shown in table A-6.

TABLE A-6
DESIGN WAVE RUNUP AND DESIGN ELEVATIONS
FOR PROTECTIVE STRUCTURES
DESIGN HURRICANE
FORT JACKSON TO VENICE

| Type of structure | Avg. depth | Surge height | Design runup | Design elevations for protective structures |
|---|---|---|---|---|
| | ft. | ft. m.s.l. | ft. | ft. m.s.l. |
| Levee | 7.2 | 11.5 | 3.5 | 15.0 |
| Floodwall | 7.2 | 11.5 | 7.5 | 19.0 |

f. Residual flooding. The protective structure was designed to prevent wave overtopping from the significant or any lesser wave that would be experienced during an occurrence of the design hurricane. However, 14 percent of the waves in a spectrum are higher than the significant wave and the maximum wave height to be expected is about 1.87 times the significant wave height. Thus, the protective structure described herein will be overtopped by those waves of the spectrum which exceed the significant wave. Studies indicate that no significant flooding will result from such overtopping.

4. Frequency estimates.

a. Procedure.

(1) Prior to 1900, information of record deals primarily with loss of life and damage in the more densely populated areas, with practically no reference to water surface elevations caused by hurricanes. Only since 1900 has detailed information been available on flooding in coastal Louisiana and adjacent areas. Subsequent to the widely destructive September 1915 hurricane, Charles W. Oakey, Senior Drainage Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, made a thorough survey of the coastal areas between Biloxi, Mississippi, and Palacios, Texas. The 1915 investigation is the only known area-wide study containing reliable stages until the investigation of Hurricane Flossy (September 1956) was completed. The data indicate that all localities along the Louisiana coast are about equally prone to hurricane attack.

(2) Lack of historical data relative to elevation of hurricane surges prohibits the establishment of dependable observed stage-frequency relationships for Reach B2, Fort Jackson to Venice. Therefore, a procedure was developed to establish synthetic stage-frequency relationships. Grand Isle, located approximately 34 miles west of Reach B2, is the only location

on the west side of the Mississippi River near the project area where a sufficient number of observed hurricane surge elevations are available to compute a dependable observed stage-frequency curve for comparison with the results of the synthetic method of computing frequencies. Probabilities for the historical data shown on plate A-13 were calculated by means of the formula:

$$P = \frac{100\ (M - 0.5)}{Y}$$

(3) The first requirement in the development of synthetic frequency relationships was to select representative critical hurricane tracks for the particular locale in question. Tracks B and D were selected as critical tracks for Reach B2 and Grand Isle, respectively. These tracks are shown on plate A-8. In the process of formulating synthetic frequency relationships, it was necessary to correlate the following hurricane parameters: central pressure indices, tracks of approach, wind velocities, radii to maximum winds, and forward speeds of translation.

(4) Surge heights were developed for at least three storms of different CPI values for each track. Each hurricane selected for the representative tracks was assumed to have the same radius of maximum winds, the same forward speed of translation, and the same adjustment for any land effects. Conversion of wind fields for hurricanes of different CPI's requisite to computing surge heights is covered in paragraph 3c of this appendix. Surge heights for storms with other CPI values were obtained graphically by plotting the above data and reading from the resulting curve.

(5) Hurricane characteristics of area-representative storms were developed in cooperation with the National Weather Service. The Weather Service has made a generalized study of hurricane frequencies for a 400-mile zone along the central coast, Zone B, from Cameron, La., to Pensacola, Fla., and has presented the results in a memorandum[8]. Frequencies for hurricane central pressure indices that were presented in the report, as shown on plate A-7, reflect the probability of hurricane recurrence from any direction in the midgulf coastal area. In order to establish frequencies for the locations under study, it was assumed that a hurricane whose track is perpendicular to the coast will ordinarily cause high tides and inundation for a distance of about 50 miles along the coast. Thus, the number of occurrences in the 50-mile subzone would be 12.5 percent of the number of occurrences in the 400-mile zone, provided that all hurricanes traveled in a direction normal to the coast. However, the usual hurricane track is oblique to the shoreline as shown in table 2 of the memorandum[8]. The average projection along the coast of this 50-mile swath for the azimuths of 48 Zone B hurricanes is 80 miles. Since this is 1.6 times the width of the normal

50-mile strip affected by a hurricane, the probability of occurrence of any hurricane in the 50-mile subzone would be 1.6 times the 12.5 percent, or 20 percent of the probability for the entire midgulf Zone B. Thus, 20 percent of the Zone B frequencies shown on plate A-7[8] were used to represent the CPI frequencies in the 50-mile subzone that is critical for each study locality.

(6) The azimuths of hurricane tracks observed in the vicinity of landfall were divided into quadrants corresponding to the four cardinal points. In Zone B, 29 tracks were from the south, 15 from the east, 3 from the west, and 1 from the north. This indicates that approximately two-thirds of all experienced hurricanes have come from a southerly direction whereas about one-third have come from the east. The average azimuth of tracks from the south is 180° and tracks from the east had an average azimuth of 117°.

(7) In order to insure the maximum accuracy in the computation of hurricane stage-frequencies, levees of the Mississippi River and azimuths of the critical hurricane tracks are considered the principal determinants for this analysis. Stage-frequencies for Grand Isle and the Fort Jackson to Venice area were computed for presentation in this appendix and are used to reflect probabilities for Reach B2.

(8) The location and physical features of Grand Isle are conducive to critical stages for a hurricane approaching from any direction. Therefore, the full 20 percent of the probabilities for midgulf Zone B, Col. (3) of table A-7, was used for computing synthetic frequencies for Grand Isle. Column (4) of table A-7 illustrates the result of this computation.

TABLE A-7
STAGE-FREQUENCY
GRAND ISLE

| | | Synthetic Frequency[1] | | Indicated Frequency |
|---|---|---|---|---|
| CPI | Surge height | Zone B (400 miles) | Grand Isle (50-mile subzone) | Grand Isle (50-mile subzone) |
| in. | ft. m.s.l. | occ/100 years | occ/100 years | occ/100 years |
| (1) | (2) | (3) | (4) | (5) |
| 27.5 | 9.9 | 1 | 0.2 | 0.54 |
| 27.7 | 9.5 | 2 | 0.4 | 0.85 |
| 28.3 | 7.9 | 10 | 2.0 | 2.80 |
| 29.1 | 5.1 | 40 | 8.0 | 9.50 |

[1]Frequency = $\frac{100}{\text{Return period in years}}$

Col. (4) = 20 percent of Col. (3)

Col. (5) is indicated stage-frequencies obtained from Grand Isle shifted frequency curve

(9) The synthetic frequency curve for Grand Isle was shifted to the experienced frequency plot, maintaining as nearly as possible its general shape. Plate A-13 is a graphical presentation of the shift. The indicated frequencies shown in column (5) for the corresponding surge heights shown in column (2) of table A-7 were taken from the shifted curve. This curve was adopted as the stage-frequency relationship for Grand Isle.

(10) Despite the proximity of Reach B2 and Grand Isle, computations of stage-frequencies for those locations differ slightly. Whereas hurricanes approaching from any direction generate critical stages for Grand Isle, only hurricanes approaching from between an azimuth of 160° and due west would generate critical stages for the back levee along Reach B2. Consequently, 27 of the 48 Zone B tracks or 56 percent were used in computations for developing synthetic frequency curves for Reach B2. This means that the most critical surge height along Reach B2 for a Zone B hurricane of given frequency occurs only 56 percent as often as the most critical surge height at Grand Isle for the same hurricane. Therefore, the final stage-frequency curve for Fort Jackson to Venice was developed by plotting the computed stages for several different Zone B hurricanes at 56 percent of the corresponding probabilities indicated by the shifted Grand Isle curve. Computations used to develop the frequency curve for Reach B2 are shown in table A-8.

TABLE A-8
SYNTHETIC STAGE-FREQUENCY
FORT JACKSON TO VENICE

| CPI | Surge height | Zone B (400 miles) | Reach B2 50-mile subzone | Adopted Freq. Grand Isle | Adopted Freq. Reach B2 |
|---|---|---|---|---|---|
| in. | ft.m.s.l. | occ/100 yrs. | occ/100 yrs. | occ/100 yrs. | occ/100 yrs. |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 27.5 | 13.0 | 1 | 0.2 | 0.54 | 0.30 |
| 27.7 | 12.5 | 2 | 0.4 | 0.85 | 0.48 |
| 28.3 | 10.6 | 10 | 2.0 | 2.80 | 1.57 |
| 29.1 | 6.6 | 40 | 8.0 | 9.50 | 5.32 |

Col. (4) = 20 percent of col. (3)
Col. (5) = Probabilities for identical CPI's adjusted to indicated probabilities of Grand Isle experienced frequency curve, plate A-12
Col. (6) = 56 percent of col. (5)

b. Relationships. Based on the procedures described above, stage-frequency relationships were established for the Fort Jackson-Venice area. The stage-frequency curves are shown on plate A-14.

5. Design hurricane.

a. Selection of the design hurricane. A hurricane that would produce the 100-year stage was selected as the design hurricane. A design hurricane of lesser intensity which would indicate a lower levee grade and an increased frequency would expose the protected areas to hazards to life and property that would be disastrous in the event a hurricane with the intensity and destructive capability of the design hurricane.

b. Characteristics. The design hurricane for the project area has a CPI of 28.00 inches and a maximum overwater windspeed of 91 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 11 knots.

c. Predicted normal tide. The range of predicted normal tides in the project area is 1 foot and the mean tide varies from 0.4 to 1.0 foot m.s.l. The difference, therefore, in hurricane surge heights for an occurrence of the design hurricane at high or low tides is only a few tenths of a foot. In determining the elevations of design surge heights, it was assumed that mean predicted normal tide occurs at the initial period of surges.

d. Design hurricane surge heights. The hurricane surge height is the maximum stillwater surface elevation experienced at a given location during the passage of a hurricane. The design hurricane surge height for the project area is 11.5 feet m.s.l. (see table A-6).

SECTION III - INTERIOR DRAINAGE

6. Interior drainage. Local interests have provided drainage in the project area, and construction of the Reach B2 hurricane protective levee in accordance with the plan presented herein will not affect the capability of the existing interior drainage system. The major portion of runoff caused by direct rainfall is drained by gravity through existing canals and evacuated from the project area by the Venice pumping station, except for a small area of about 520 acres at the western end of the project which is drained by gravity and finally evacuated by the Grand Liard pumping station located in the project area of the Reach B1 feature of the New Orleans to Venice project. The discharge pipes of the Venice pumping station will require minor modification to accommodate construction of floodwall at the site of the pumping station. In addition to serving the primary purposes of providing flotation access for excavation of the sand core trench and borrow area for construction of ponding dikes, the flotation channel to the Venice pumping station site will also serve as an outfall to allow drainage flow into open water.

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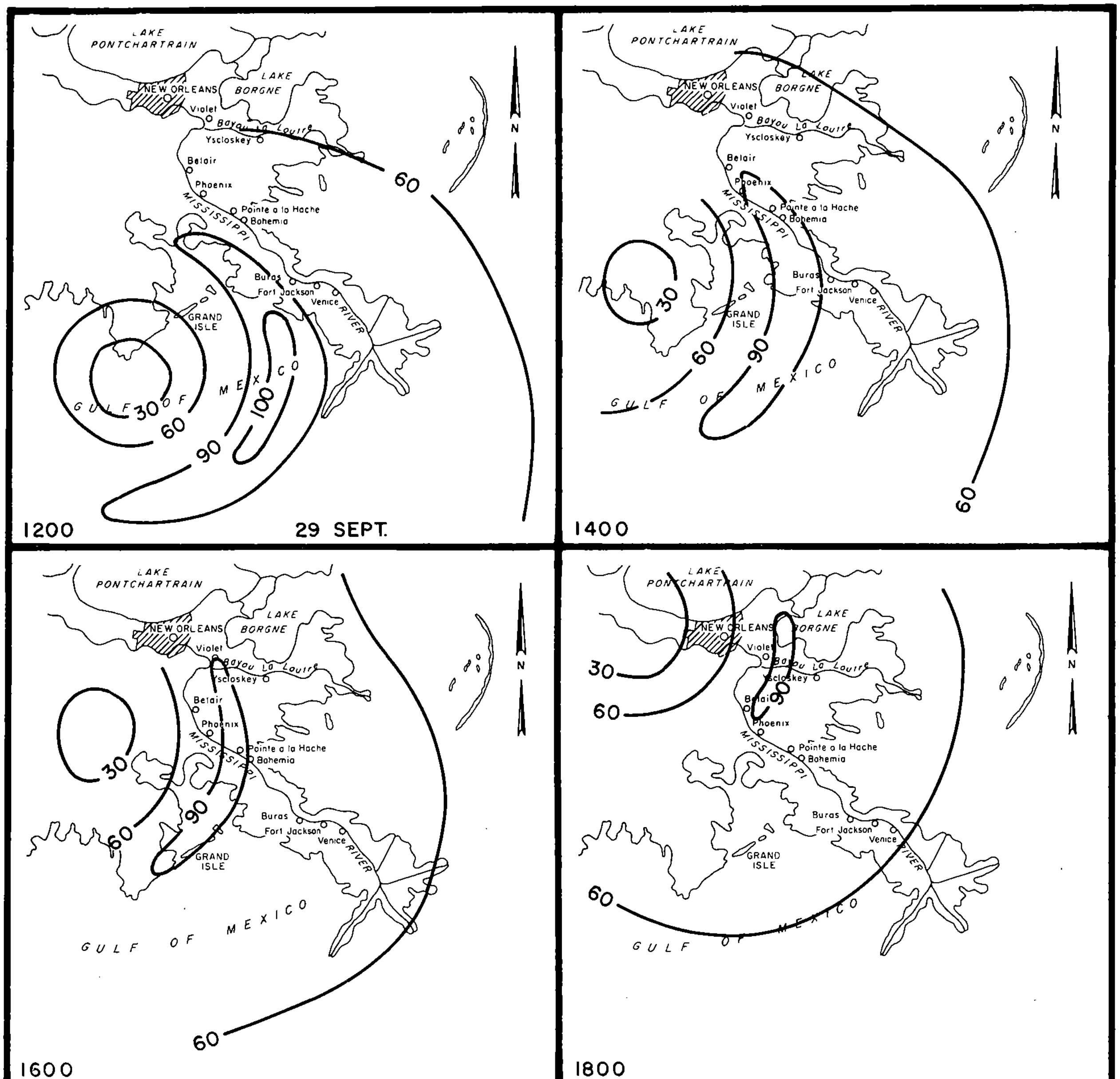
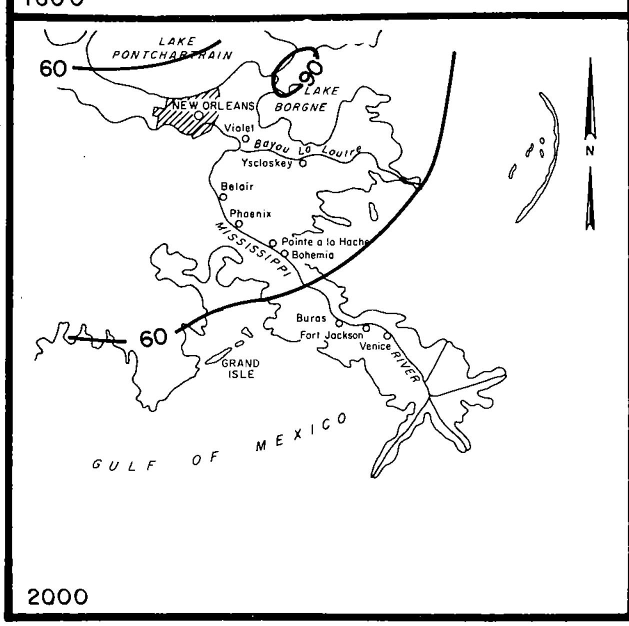



LEGEND

70 Average Wind Velocity in M.P.H.

SCALE IN MILES

25 0 25 50

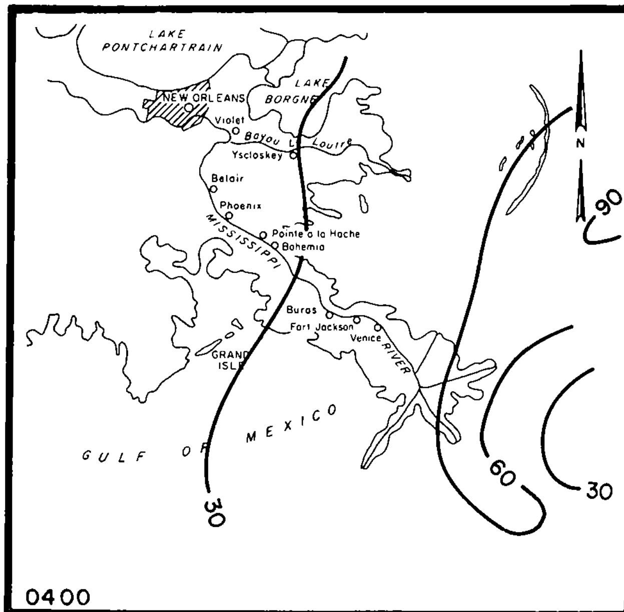
NEW ORLEANS TO VENICE, LOUISIANA

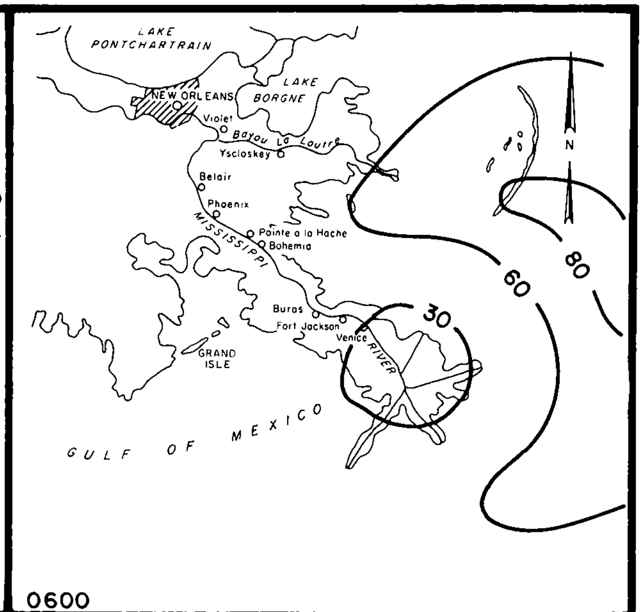
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

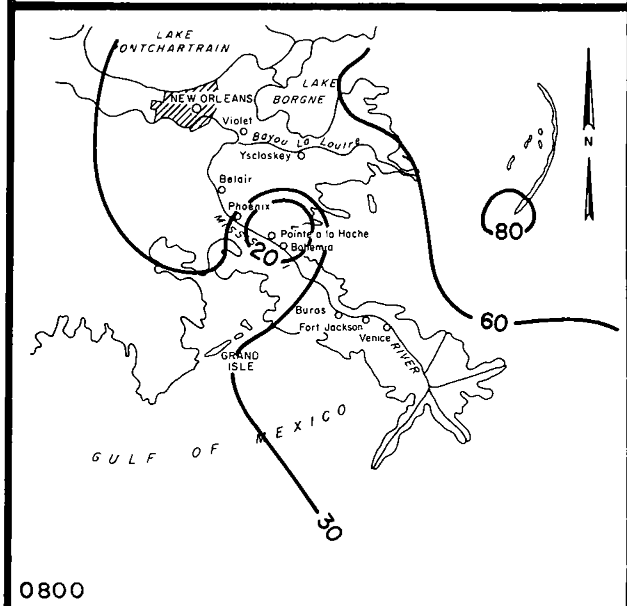
# ISOVEL PATTERNS
# HURRICANE OF 28 SEPT. - 1 OCT. 1915

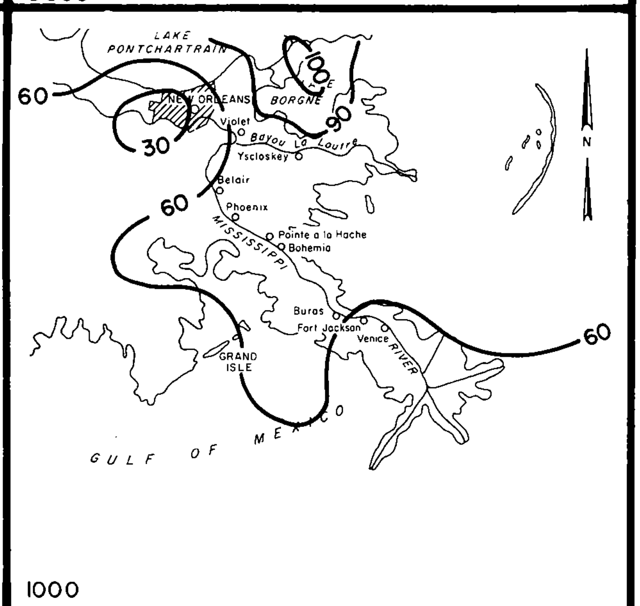
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

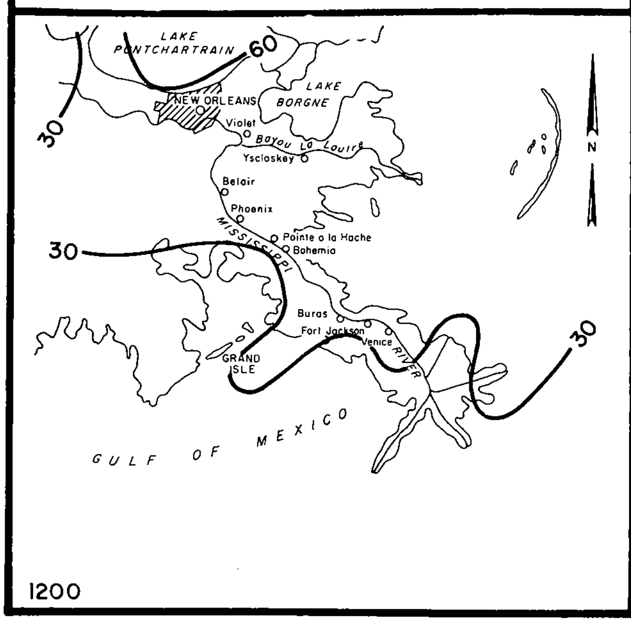
JUNE 1972 FILE NO. H-2-25953




LEGEND

70 — Average Wind Velocity in M.P.H.

SCALE IN MILES

25 0 25 50

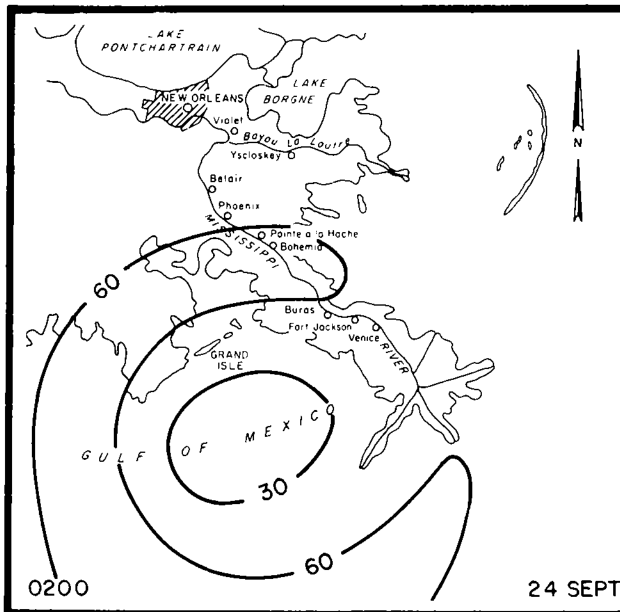
NEW ORLEANS TO VENICE, LOUISIANA

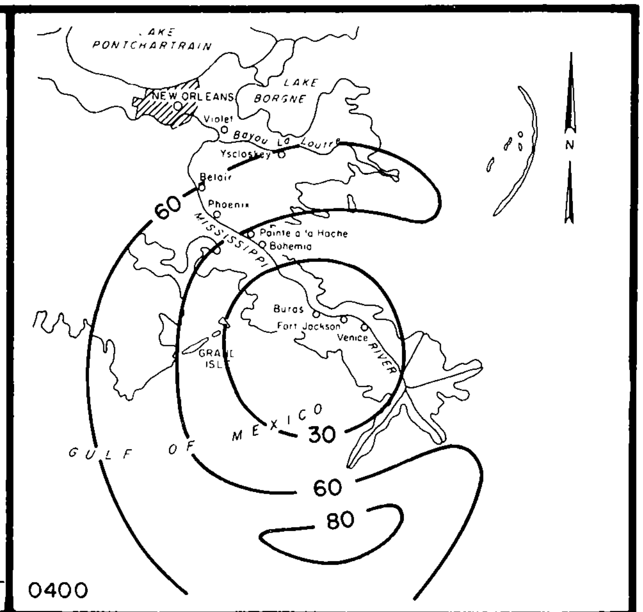
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO 4
REACH B2 - FORT JACKSON TO VENICE

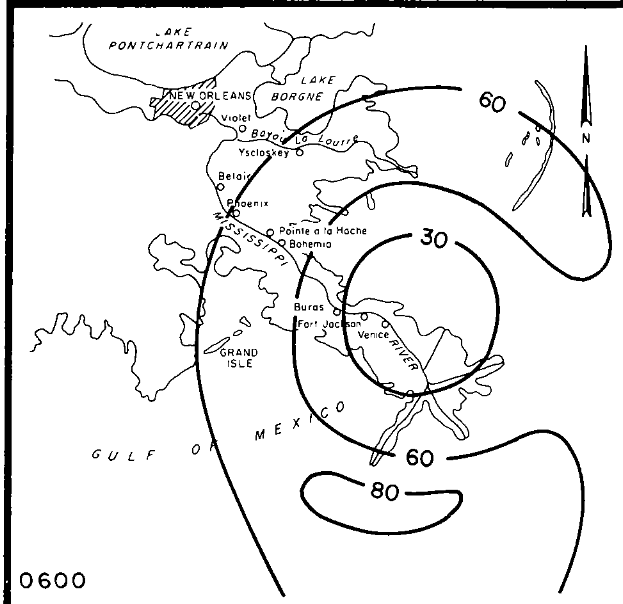
# ISOVEL PATTERNS
# HURRICANE OF 19 SEPT. 1947

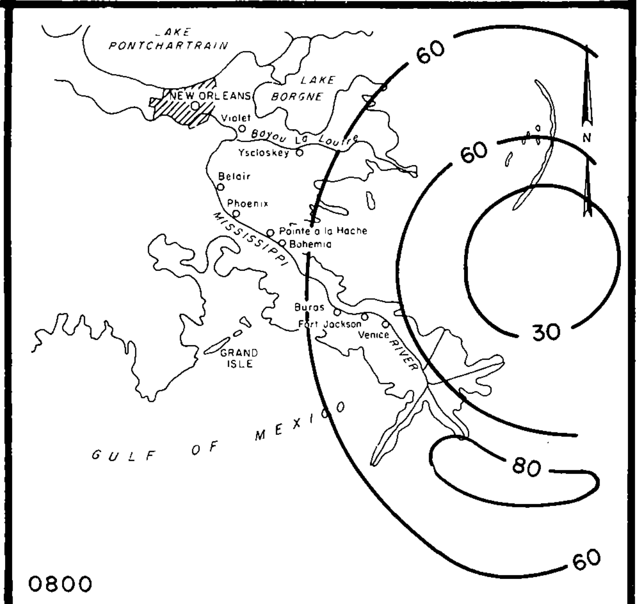
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

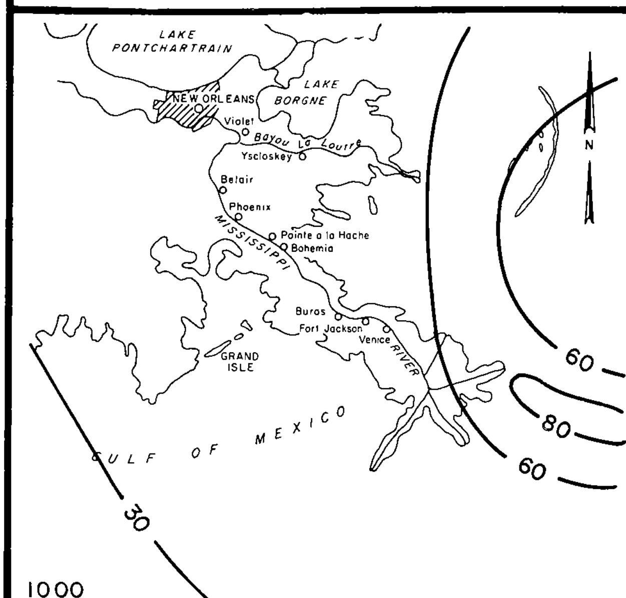
JUNE 1972 FILE NO. H-2-25953




LEGEND

70 — Average Wind Velocity in M.P.H.

SCALE IN MILES

25 0 25 50

NEW ORLEANS TO VENICE, LOUISIANA

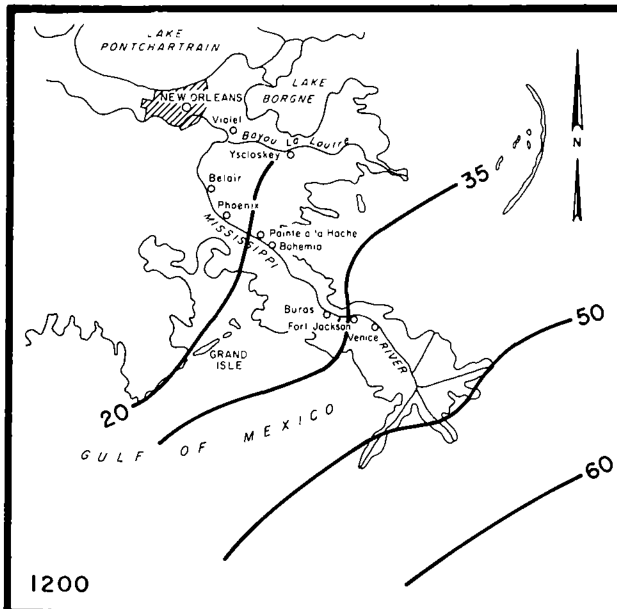
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

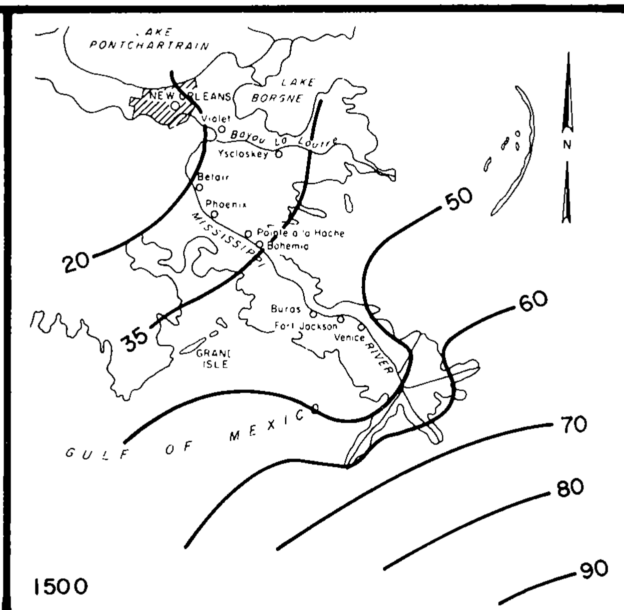
# ISOVEL PATTERNS
# HURRICANE FLOSSY
# 23-24 SEPT. 1956

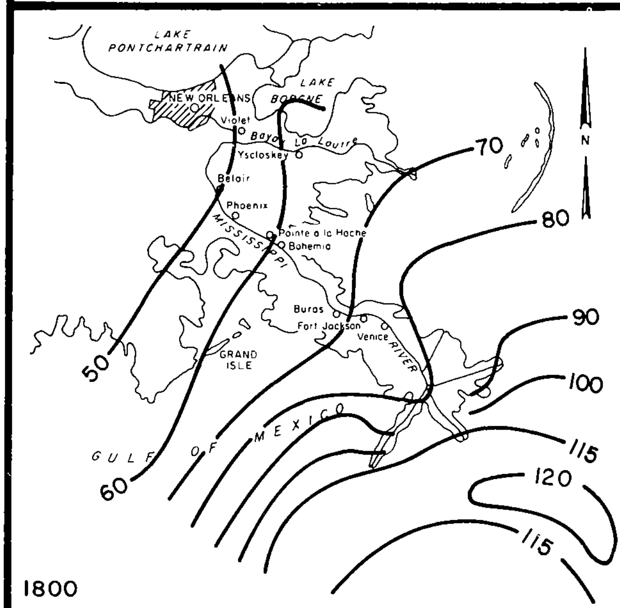
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

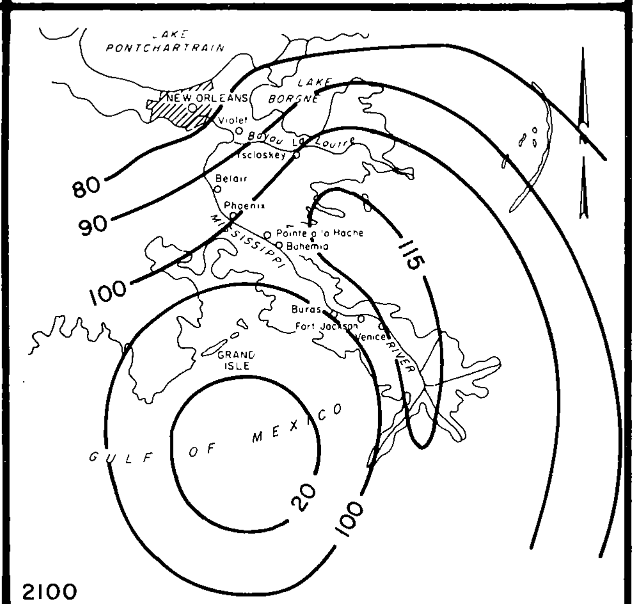
JUNE 1972 FILE NO. H-2-25953

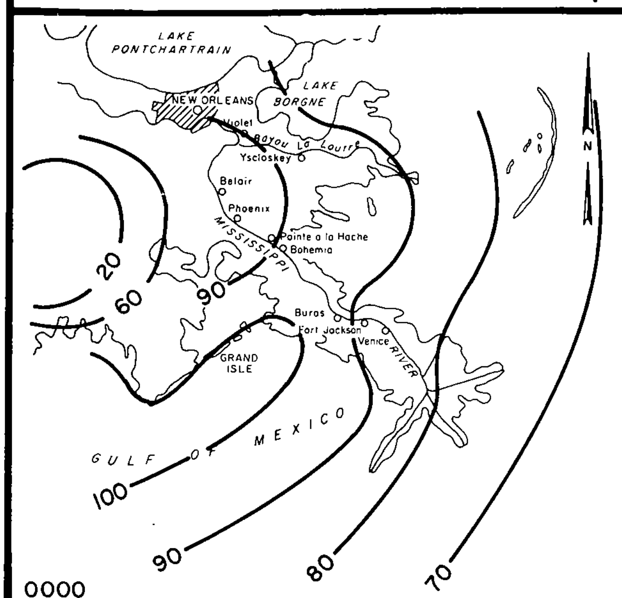
PLATE A-3




LEGEND

70 — Average Wind Velocity in M.P.H.

SCALE IN MILES

25 0 25 50

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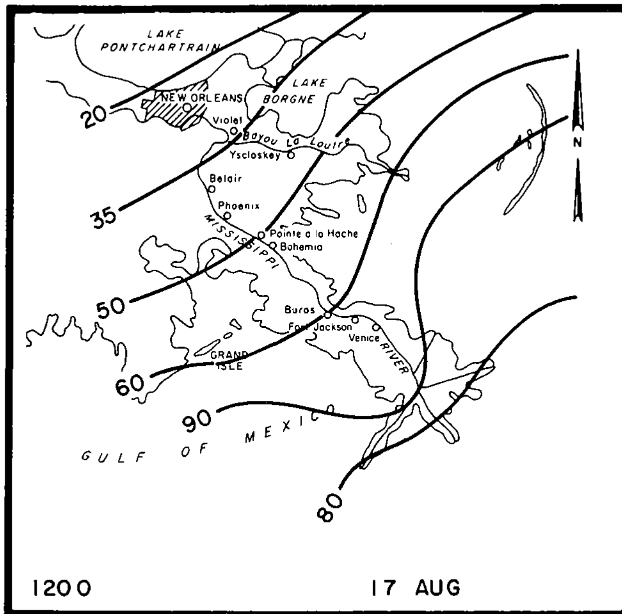
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

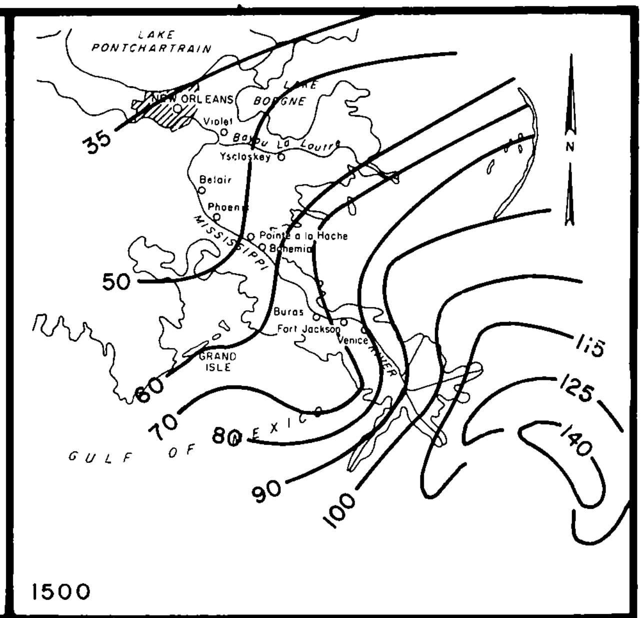
# ISOVEL PATTERNS HURRICANE BETSY 9-10 SEPT. 1965

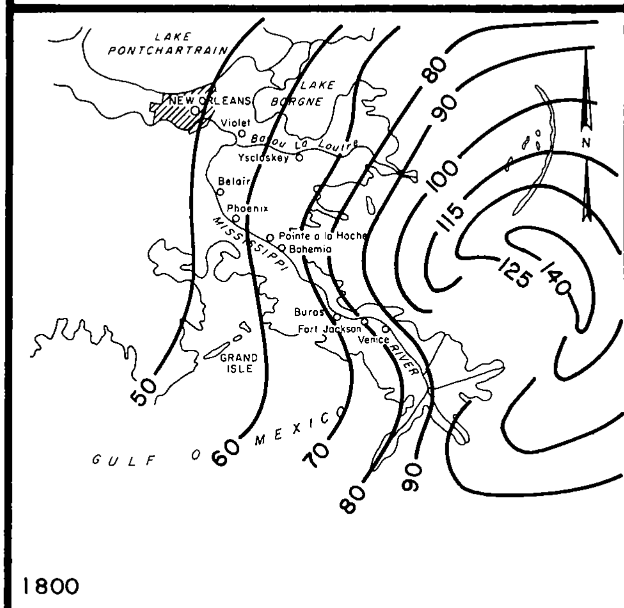
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

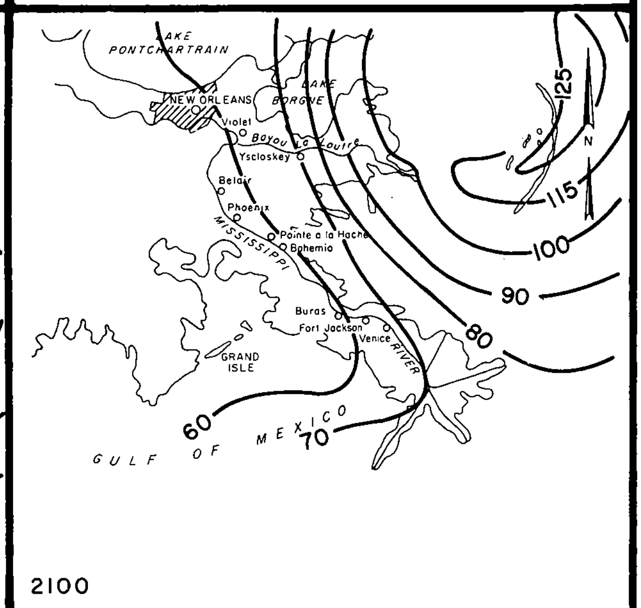
JUNE 1972 FILE NO. H-2-25953

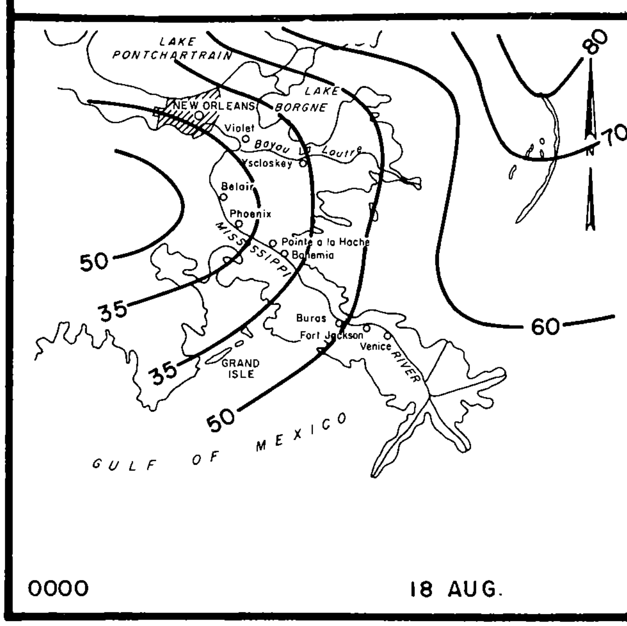
PLATE A-4




LEGEND

70 — Average Wind Velocity in M.P.H.

SCALE IN MILES

25 0 25 50

NEW ORLEANS TO VENICE, LOUISIANA

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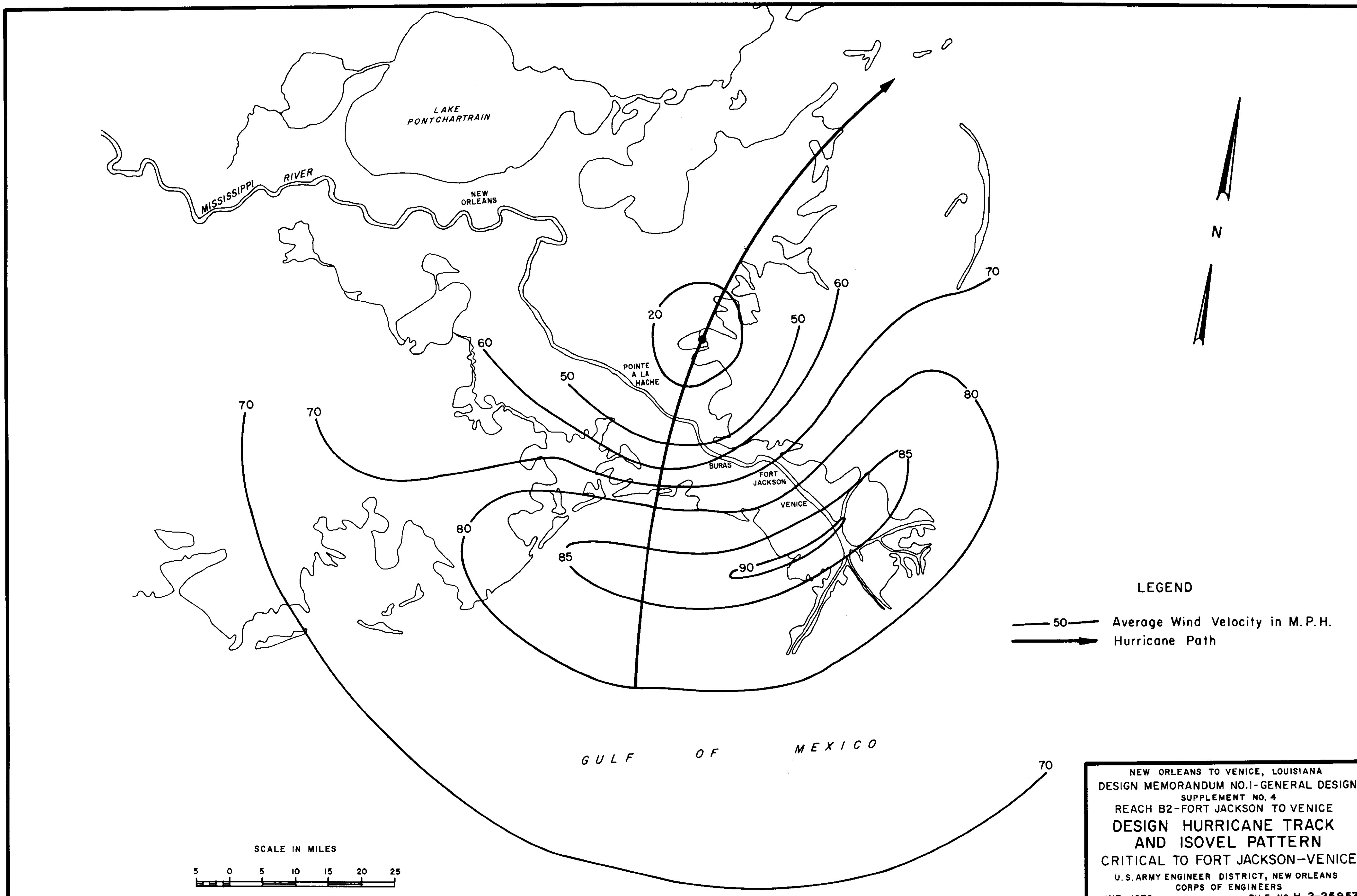
# ISOVEL PATTERNS
# HURRICANE CAMILLE
# 17-18 AUG. 1969

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

JUNE 1972 FILE NO. H-2-25953

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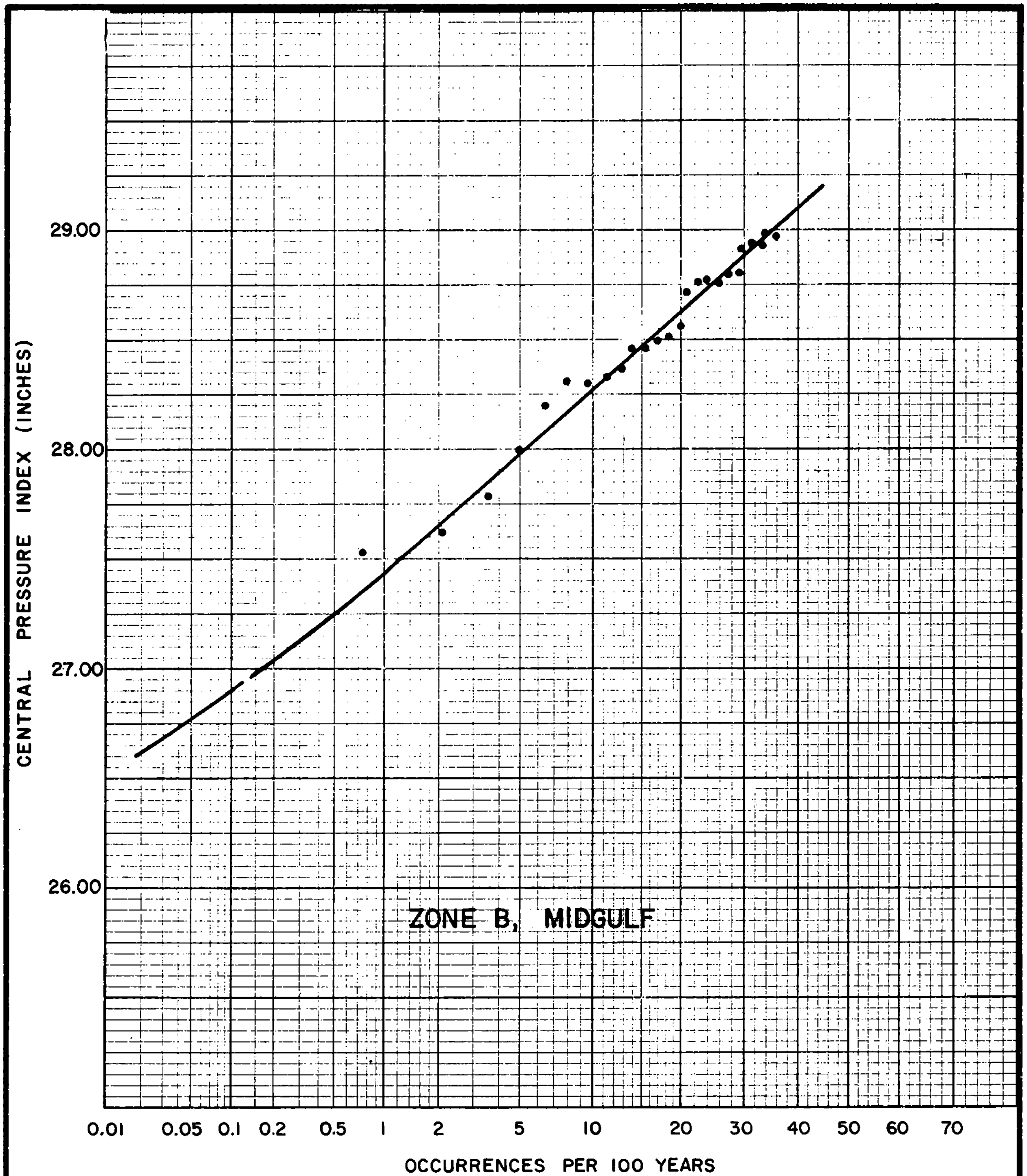
DESIGN MEMORANDUM NO.1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

**DESIGN HURRICANE TRACK AND ISOVEL PATTERN**

CRITICAL TO FORT JACKSON-VENICE

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

JUNE 1972 FILE NO. H-2-25953

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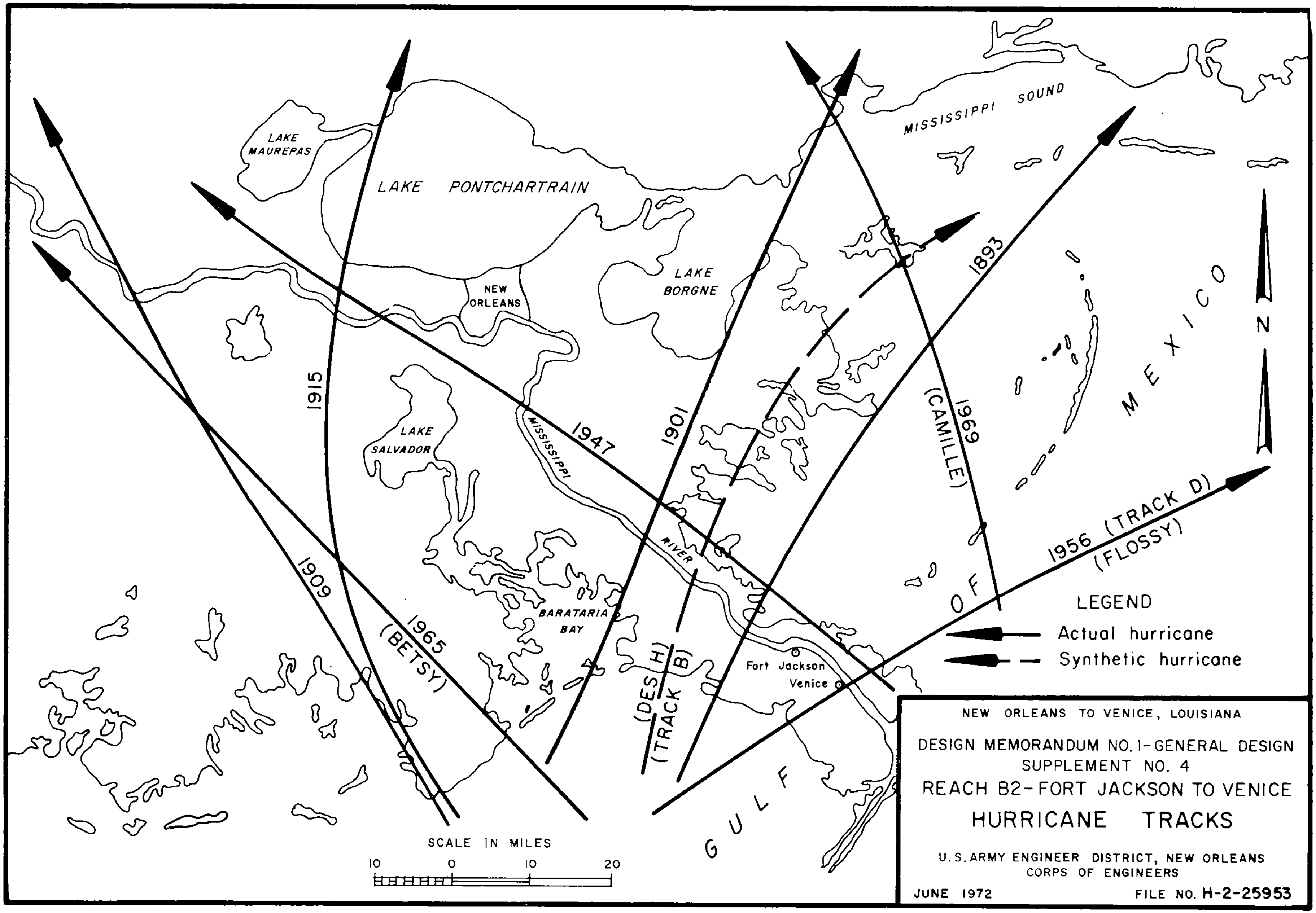
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

**FREQUENCY OF HURRICANE CENTRAL PRESSURES ZONE B, MIDGULF**

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

JUNE 1972 FILE NO. H-2-25953




NEW ORLEANS TO VENICE, LOUISIANA

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REACH B2-FORT JACKSON TO VENICE

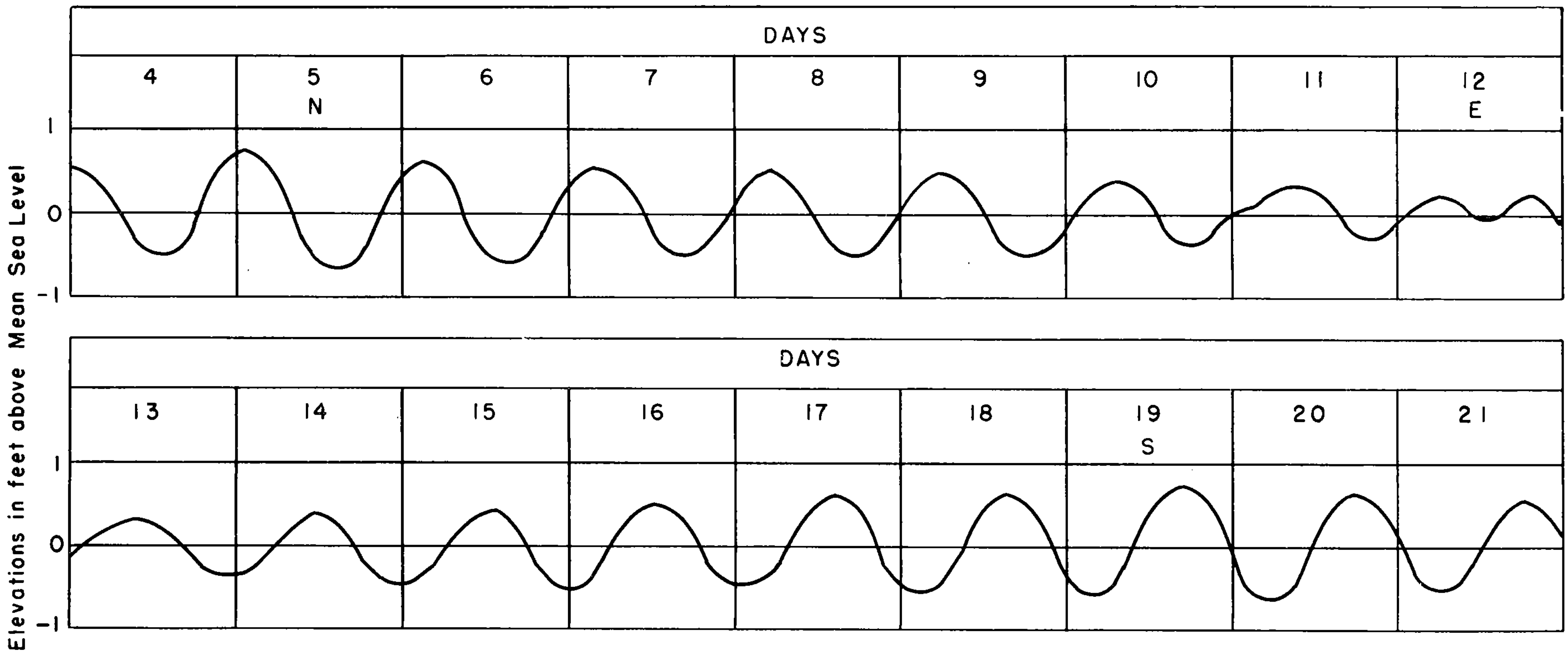
## HURRICANE TRACKS

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

JUNE 1972 FILE NO. H-2-25953



PLATE A-8




LEGEND

E, moon on the equator

N, S, moon farthest north or south of the equator

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 - FORT JACKSON TO VENICE

**TYPICAL TIDAL CYCLES**

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

JUNE 1972 FILE NO. H-2-25953


PLATE A-9

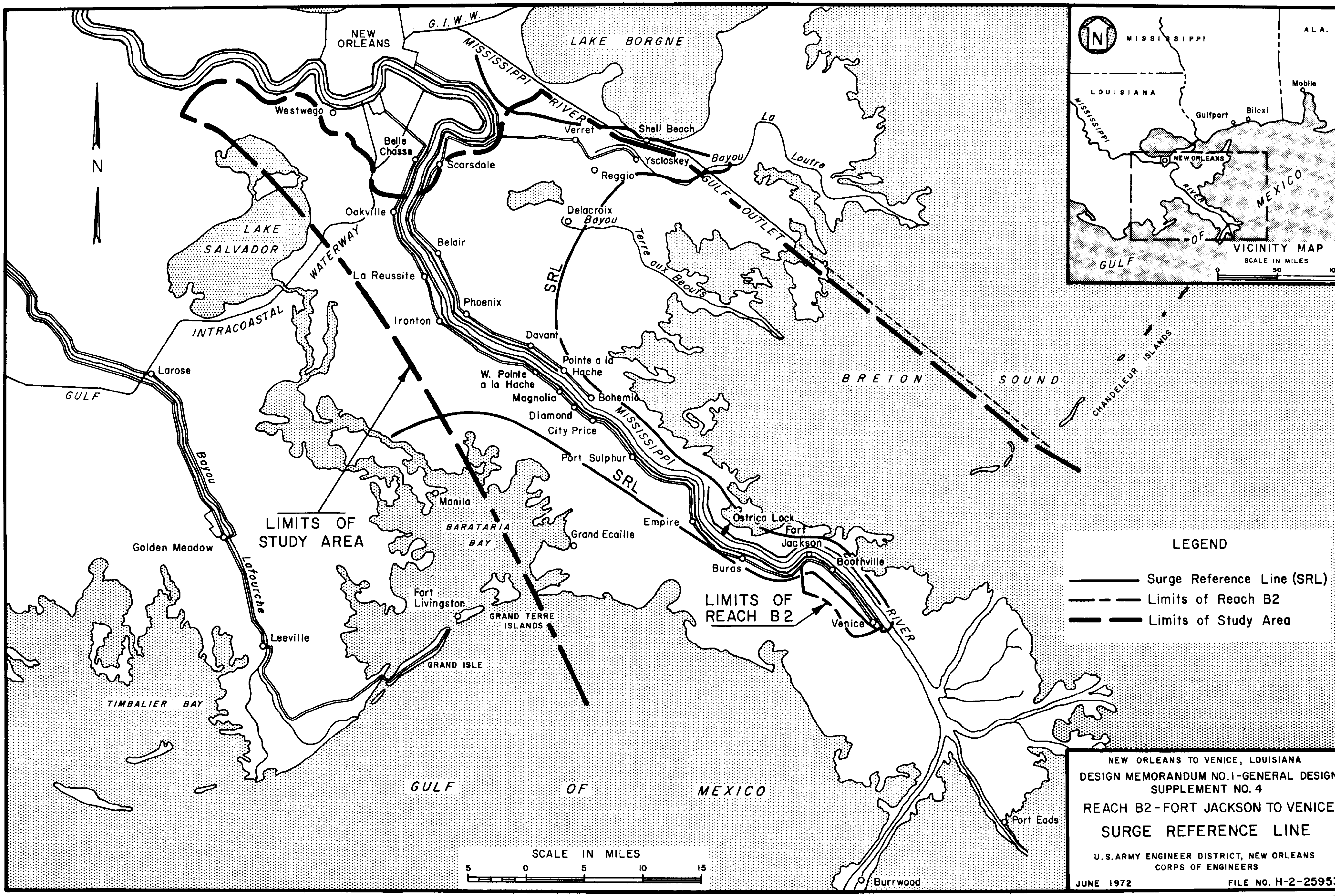
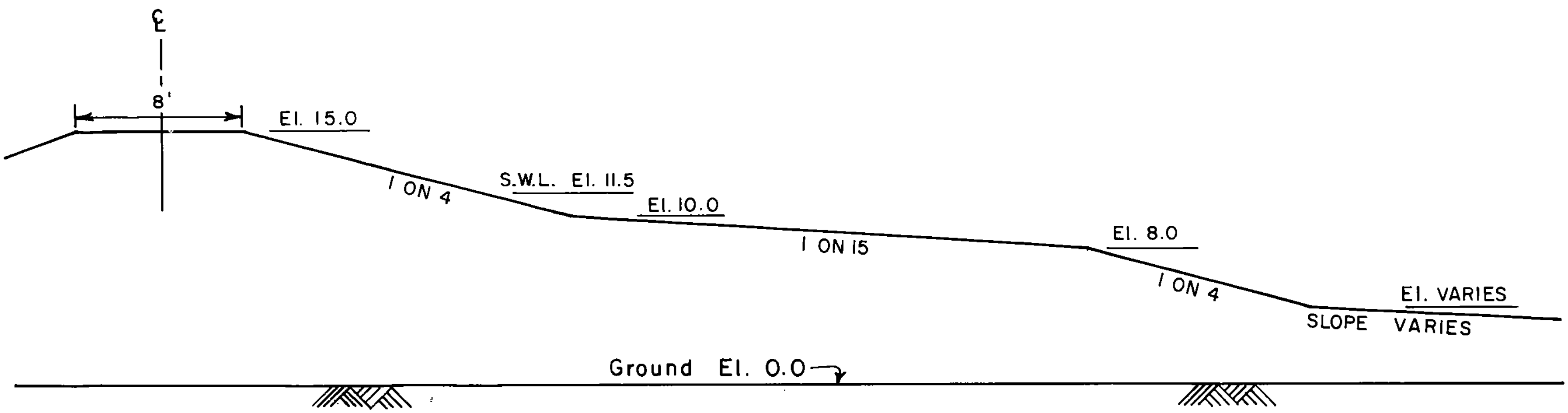
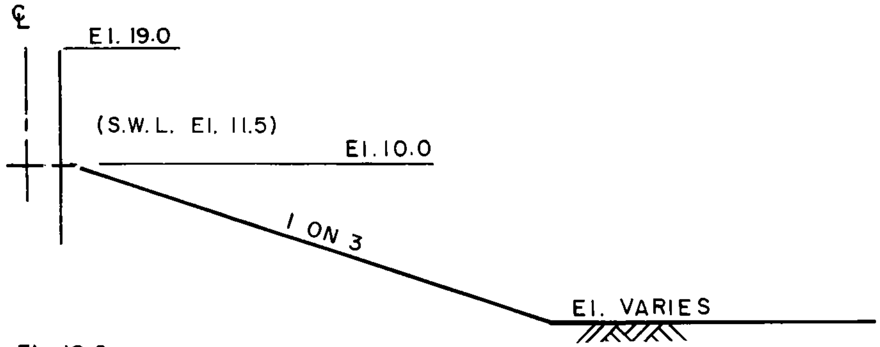

NEW ORLEANS
G.I.W.W.
LAKE BORGNE
MISSISSIPPI RIVER
Westwego
Belle Chasse
Scarsdale
Verret
Shell Beach
Ycloskey
Reggio
La Loutre
Bayou
GULF OUTLET
Oakville
Delacroix
Bayou
Terre aux Beoufs
LAKE SALVADOR
WATERWAY
INTRACOASTAL
GULF
Belair
La Reussite
Phoenix
Ironton
SRL
Davant
Pointe a la Hache
W. Pointe a la Hache
Magnolia
Bohemia
Diamond
City Price
MISSISSIPPI
BRETON SOUND
CHANDELEUR ISLANDS
Larose
Port Sulphur
SRL
Bayou
Lafourche
Manila
LIMITS OF STUDY AREA
BARATARIA BAY
Grand Ecaille
Empire
Ostrica Lock
Fort Jackson
Boothville
Buras
Golden Meadow
Fort Livingston
GRAND TERRE ISLANDS
LIMITS OF REACH B2
Venice
RIVER
Leeville
GRAND ISLE
TIMBALIER BAY
GULF OF MEXICO
Port Eads
Burrwood
SCALE IN MILES
5 0 5 10 15
N
MISSISSIPPI
ALA.
LOUISIANA
Mobile
MISSISSIPPI
Gulfport
Biloxi
NEW ORLEANS
RIVER
MEXICO
GULF OF
VICINITY MAP
SCALE IN MILES
0 50 100
LEGEND
Surge Reference Line (SRL)
Limits of Reach B2
Limits of Study Area
NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. I-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
SURGE REFERENCE LINE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JUNE 1972
FILE NO. H-2-25953

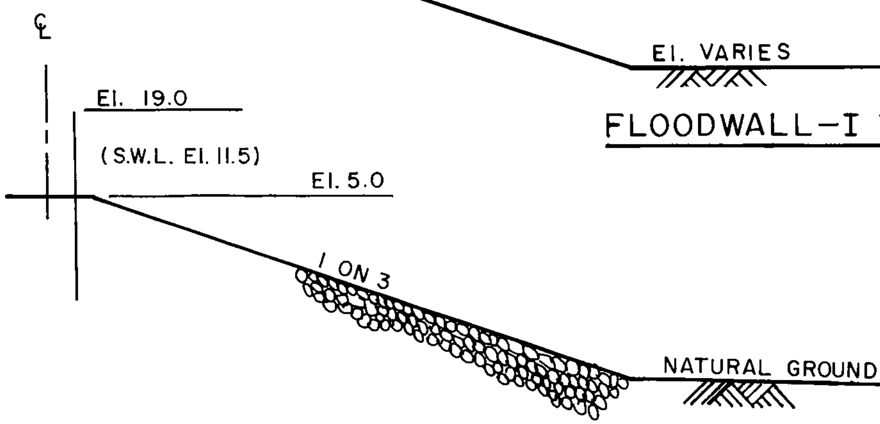
PLATE A-10




LEVEE




FLOODWALL–I TYPE




FLOODWALL–T TYPE

NOTES:
Elevations are in feet and refer to M.S.L.
Sections not to scale.

NEW ORLEANS TO VENICE, LOUISIANA

DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2-FORT JACKSON TO VENICE

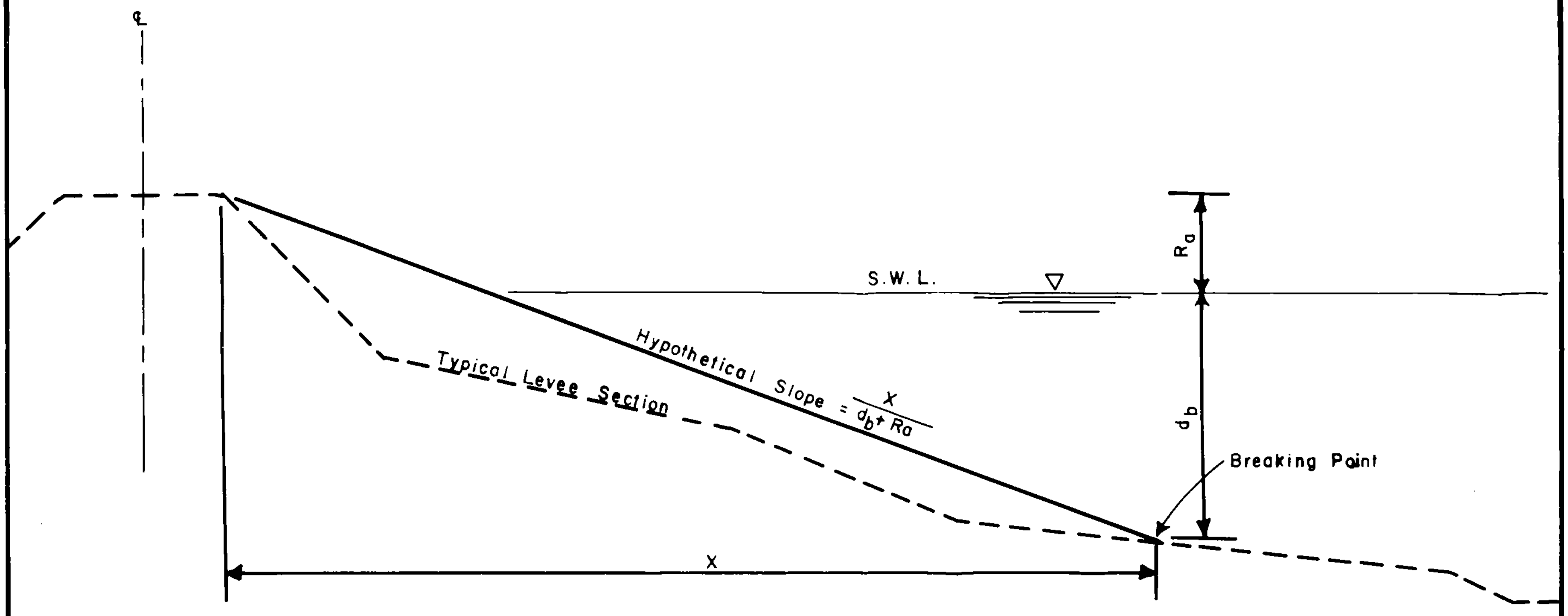
TYPICAL LEVEE SECTIONS

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

JUNE 1972 FILE NO. H-2-25953



PLATE A-11

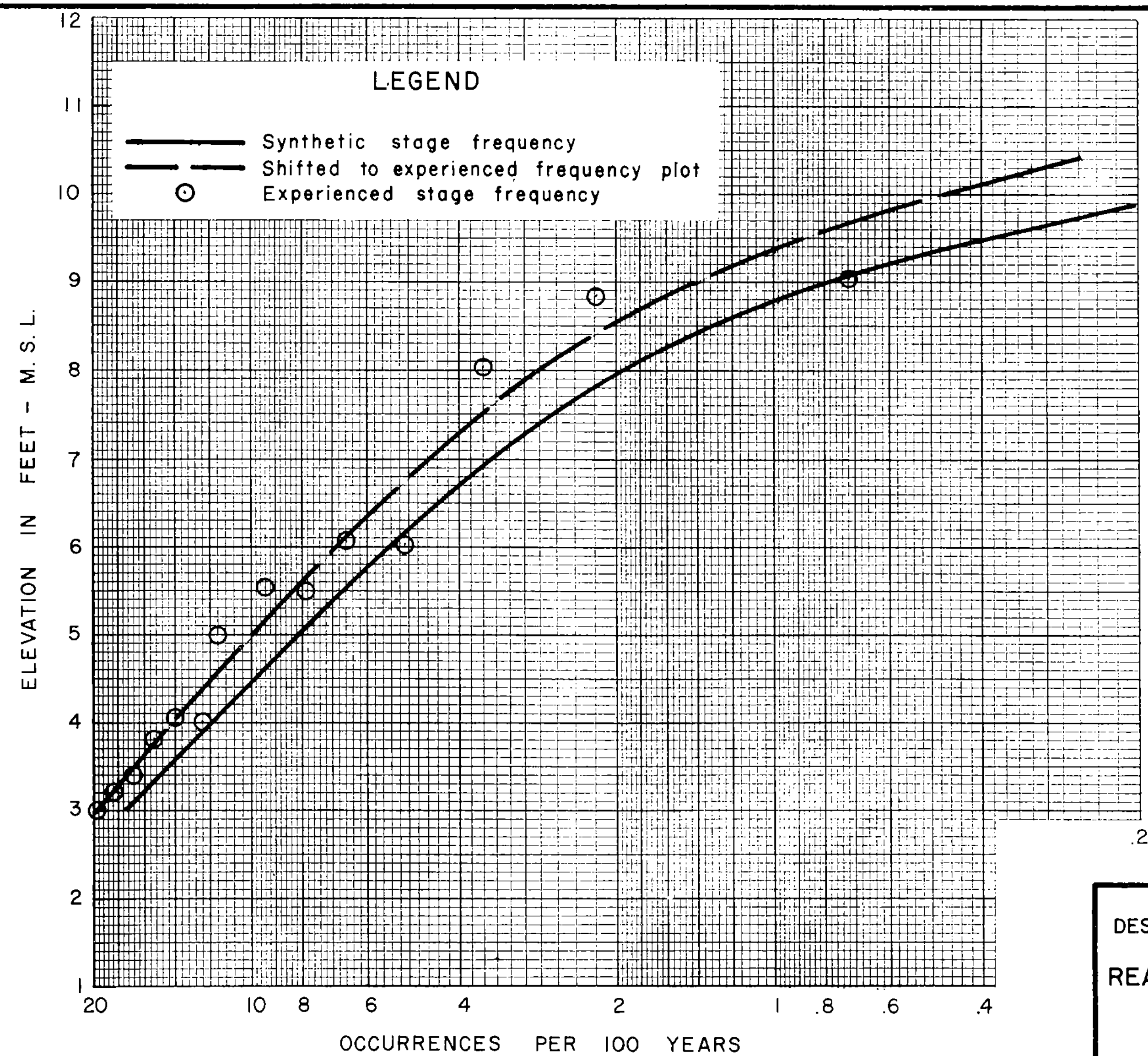



LEGEND

$R_a$ = assumed runup
$d_b$ = breaking depth of wave
X = horizontal distance from breaking point to elevation of runup
S.W.L. = stillwater level

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE
DETERMINATION OF
HYPOTHETICAL SLOPE
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS
JUNE 1972 FILE NO. H-2-25953

PLATE A-12




## FREQUENCY ANALYSIS

| M | YEARS | WIND TIDE LEVEL ( FT.) | P |
|---|---|---|---|
| 1 | *1915 | 9.0 | 0.72 |
| 2 | 1965 | 8.8 | 2.17 |
| 3 | 1956 | 8.0 | 3.62 |
| 4 | 1919 | 6.0 | 5.08 |
| 5 | **1915 | 6.0 | 6.54 |
| 6 | 1964 | 5.5 | 7.94 |
| 7 | 1909 | 5.5 | 9.43 |
| 8 | 1901 | 5.0 | 10.90 |
| 9 | 1947 | 4.0 | 12.4 |
| 10 | 1926 | 4.0 | 13.7 |
| 11 | 1940 | 3.8 | 15.2 |
| 12 | 1941 | 3.4 | 16.7 |
| 13 | 1954 | 3.2 | 18.2 |
| 14 | 1969 | 3.0 | 19.5 |

* September 1915
** August 1915

$$P = \frac{100(M-0.5)}{Y}$$

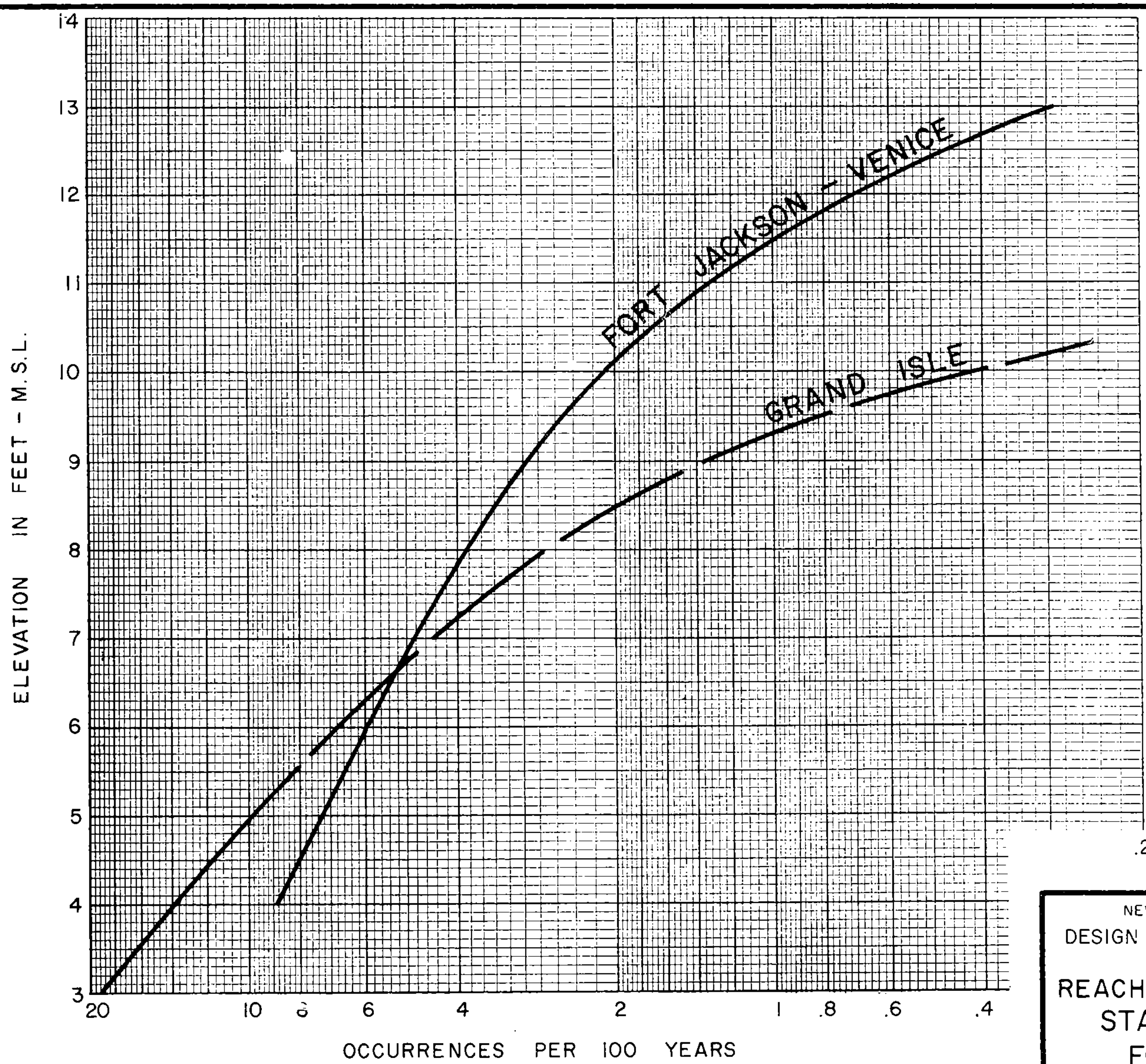
P = Probability
M = Number of the event (rank)
Y = Number of years of record (69)

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2-FORT JACKSON TO VENICE

STAGE - FREQUENCY
GRAND ISLE, LA.

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JUNE 1972 FILE NO. H-2-25953


PLATE A-13




NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN
SUPPLEMENT NO. 4

**REACH B2-FORT JACKSON TO VENICE**
**STAGE-FREQUENCY CURVE**
**FORT JACKSON-VENICE**

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

JUNE 1972 FILE NO. H-2-25953

PLATE A-14

# NEW ORLEANS TO VENICE, LOUISIANA
# DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
# SUPPLEMENT NO. 4
# REACH B2 - FORT JACKSON TO VENICE

## APPENDIX B
## STRUCTURAL DESIGN CALCULATIONS

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 1 of 4 | COMPUTED BY H.C.A. | DATE 9/10/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY DAM | DATE 9/21/71 |

# WAVE LOADING (From TR-4) T-WALL & I-WALL

SWL = El. 11.5 Average Bottom = El. -1.0

Average water depth fronting the structures = 12.5'

Design for max. 1% wave $H_1' = 1.67 H_0' = 5.70'$

$T = 4.4$ sec. $d_b = 0.667 (H'T)^{2/3} = 5.72'$

At seven breaker heights from the walls (40'±) the water depth will be greater than $d_b$ except where I-walls tie into the main levee. Therefore assume 1% non-breaking wave is possible at walls.

Breaking wave will not act on a total structure (See WES Research Report H-68-2)

Critical loading is from non-breaking or broken wave. Both must be checked for each wall.

## NON-BREAKING WAVE

$H = 5.7$ $d = 12.5'$ $L_0 = 99.1'$

$\frac{2\pi d}{L_0} = 0.7925$

$\sinh \frac{2\pi d}{L_0} = 0.8781$

$\cosh \frac{2\pi d}{L_0} = 1.3308$

$\coth \frac{2\pi d}{L_0} = 1.5155$

$h_0 = \frac{\pi H^2}{L_0} \coth \frac{2\pi d}{L_0} = 1.6'$

$P_1 = \frac{wH}{\cosh \frac{2\pi d}{L_0}} = 267.7$ psf

## BROKEN WAVE

$H = 5.7$ $d_b = 5.72$

$h_c = 0.7H = 4.0'$

$P_m = \frac{w d_b}{2} = 178.8$ psf

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 2 of 4 | COMPUTED BY H.C.A. | DATE 9/10/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY Dam | DATE 9/21/71 |

## NON-BREAKING WAVE

Top of pres. diagram = $SWL + H + h_o$ = El. 16.8

## BROKEN WAVE

Top of pres. diagram = $SWL + h_c$ = 15.5

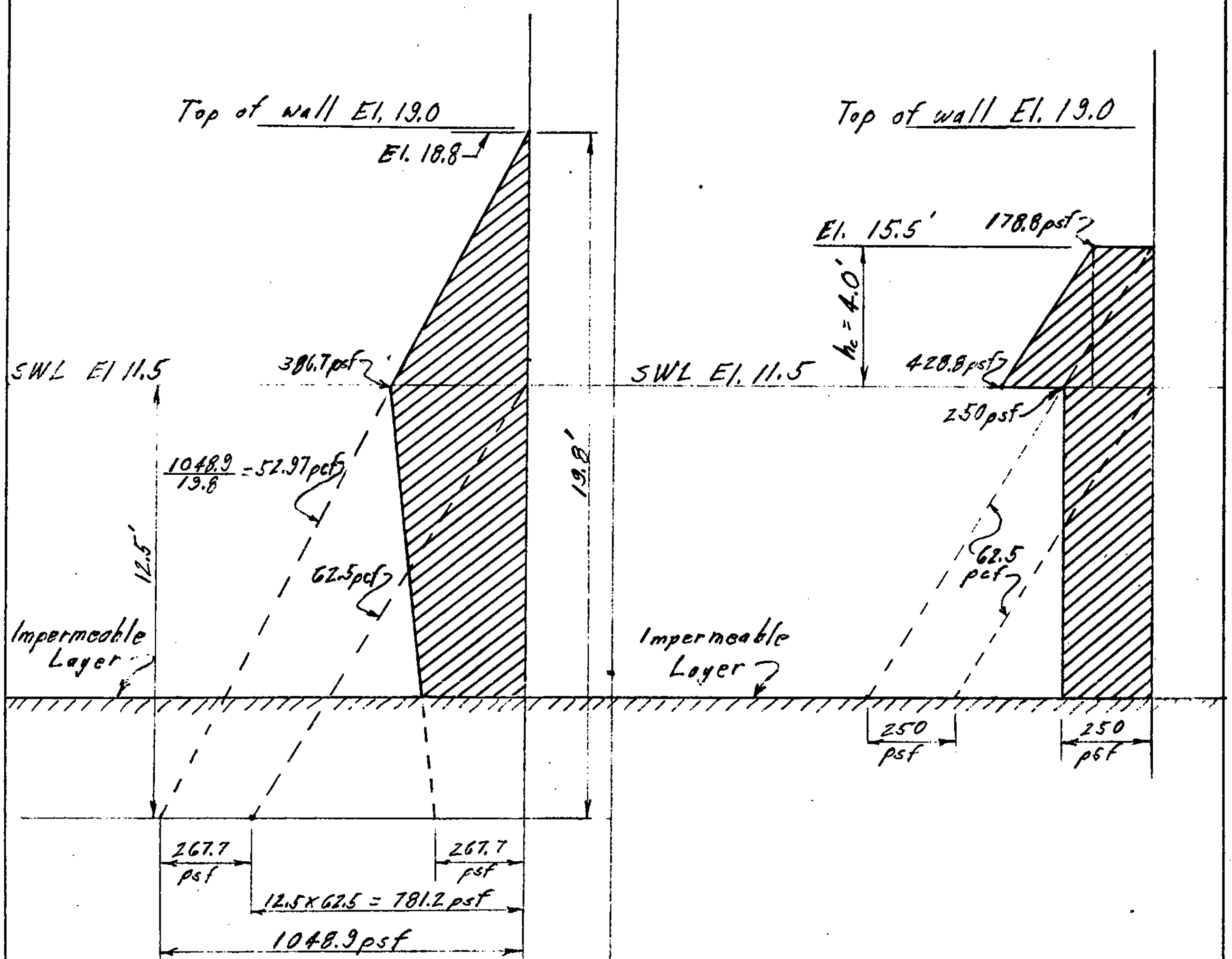
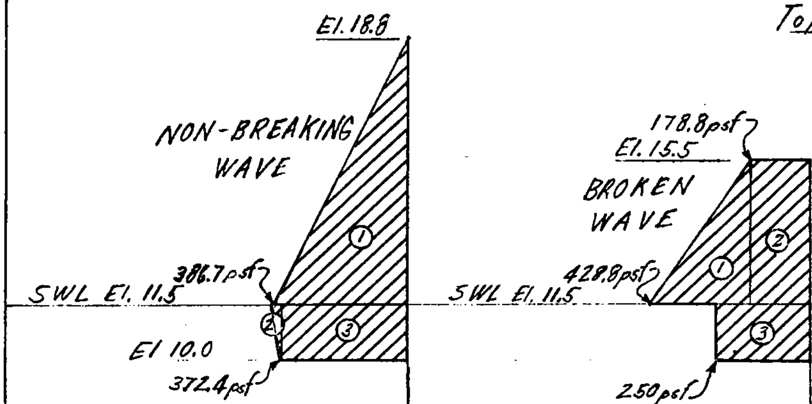
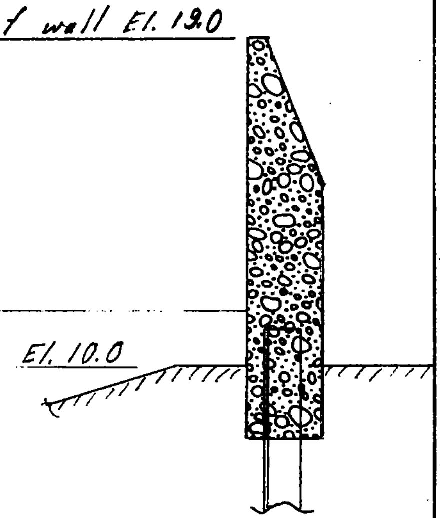





FIGURE B-2

# I-WALL WAVE LOADING




**Non-breaking wave**

| Diag No. | Force # | $\bar{y}$ ft | El. 10.0 Moment #ft |
|---|---|---|---|
| ① | 1411.5 | 3.93 | 5547.0 |
| ② | 10.7 | 1.00 | 10.7 |
| ③ | 558.6 | 0.75 | 419.0 |
| Tot. | 1980.8 | 3.02 | 5976.7 |

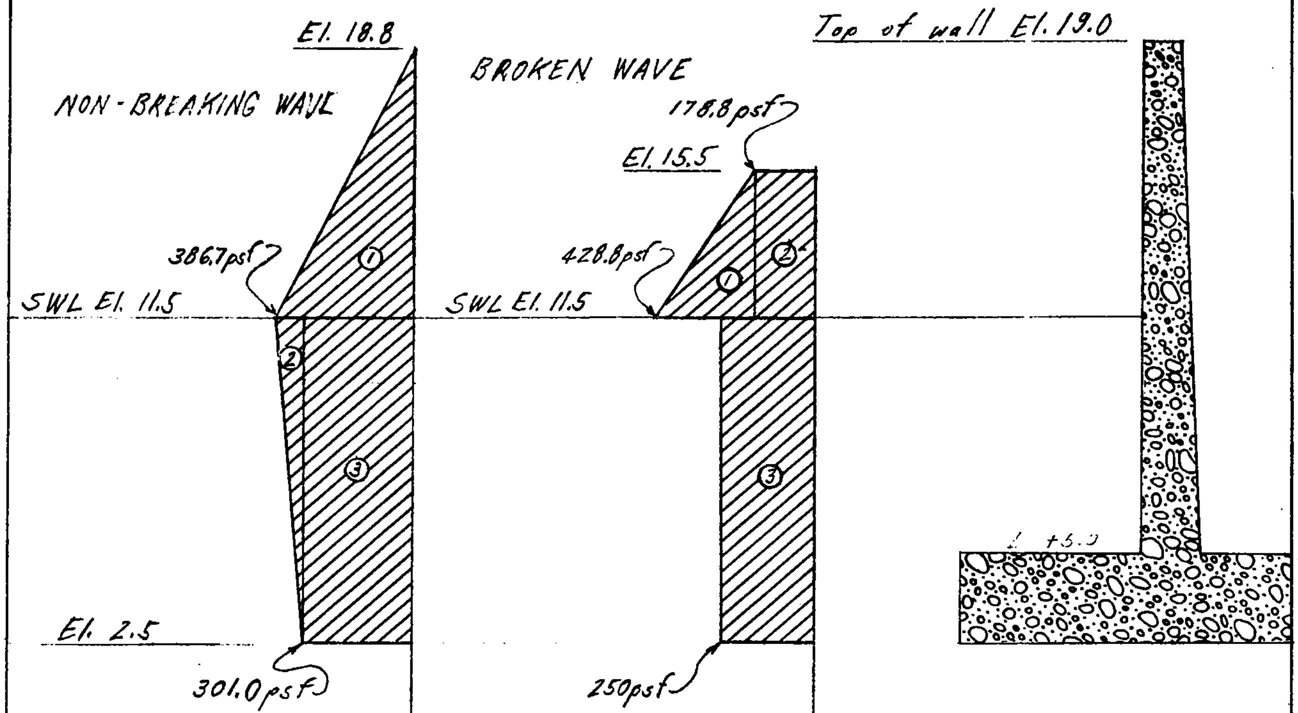
**Broken wave**

| Diag No | Force # | $\bar{y}$ ft | El 10.0 Moment #ft |
|---|---|---|---|
| ① | 500.0 | 2.83 | 1415.0 |
| ② | 715.2 | 3.50 | 2503.2 |
| ③ | 375.0 | 0.75 | 281.2 |
| Tot. | 1590.2 | 2.64 | 4199.4 |

NON-BREAKING WAVE GIVES CRITICAL LOADING

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 4 of 4 | COMPUTED BY H.C.A | DATE 9/11/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY WaM | DATE 9/21/71 |

# T-WALL WAVE LOADING



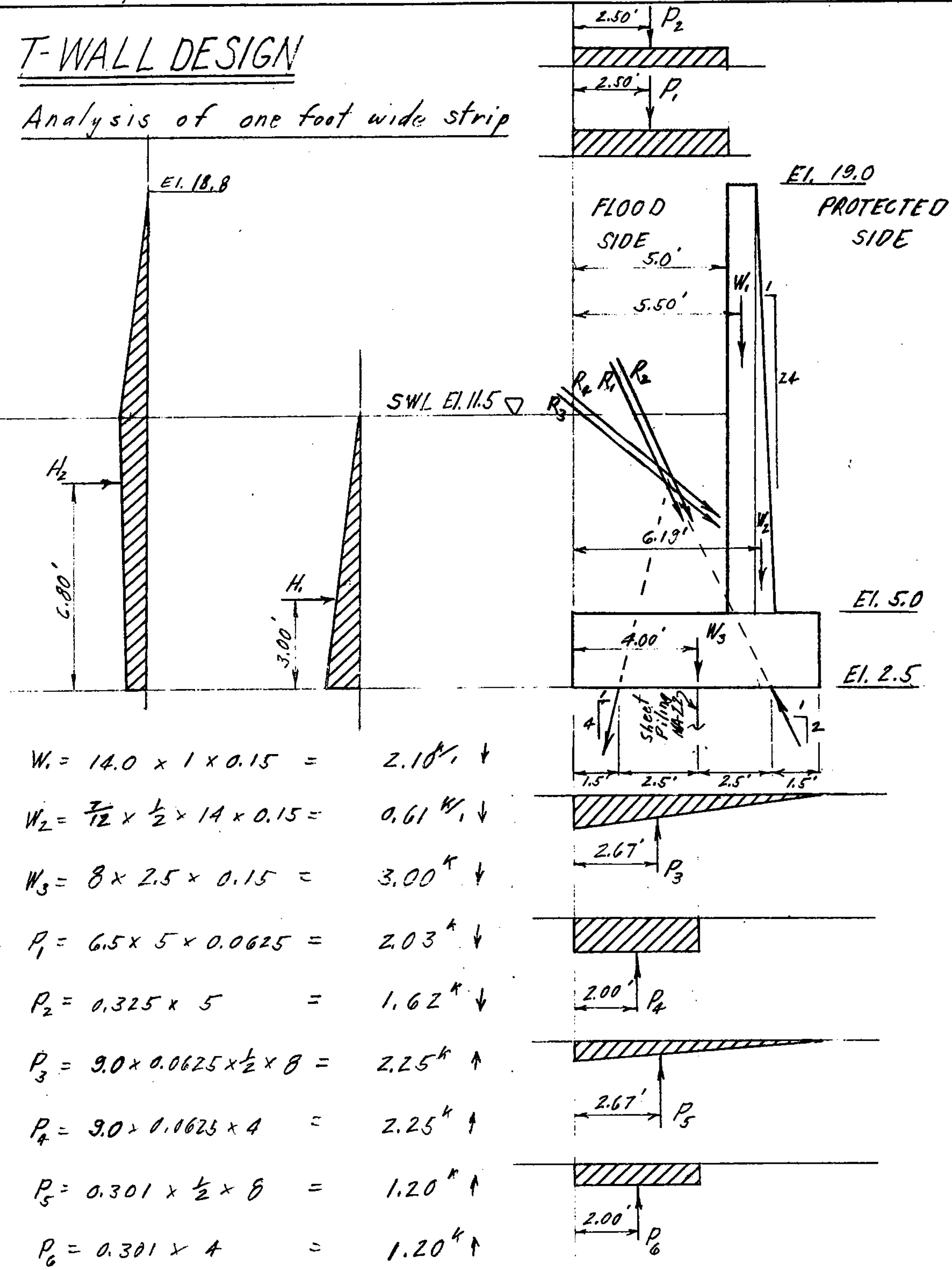

| Diag. No | Force # | $\bar{y}$ ft | El. 2.5 Moment # ft | Diag. No | Force # | $\bar{y}$ ft | El. 2.5 Moment # ft |
|---|---|---|---|---|---|---|---|
| ① | 1411.5 | 11.43 | 16,133.4 | ① | 500.0 | 10.33 | 5165.0 |
| ② | 385.6 | 6.00 | 2313.6 | ② | 715.2 | 11.00 | 7867.2 |
| ③ | 2709.0 | 4.50 | 12,190.5 | ③ | 2250.0 | 4.50 | 10,125.0 |
| Tot | 4506.1 | 6.80 | 30,637.5 | Tot | 3465.2 | 6.68 | 23,157.2 |

NON-BREAKING WAVE GIVES CRITICAL LOADING

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 1 of 6 | COMPUTED BY H.C.A. | DATE 9/27/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY F.E.H. | DATE 10/19/71 |

# T-WALL DESIGN

Analysis of one foot wide strip




$W_1 = 14.0 \times 1 \times 0.15 = 2.10^{K/1} \downarrow$

$W_2 = \frac{7}{12} \times \frac{1}{2} \times 14 \times 0.15 = 0.61^{K/1} \downarrow$

$W_3 = 8 \times 2.5 \times 0.15 = 3.00^K \downarrow$

$P_1 = 6.5 \times 5 \times 0.0625 = 2.03^K \downarrow$

$P_2 = 0.325 \times 5 = 1.62^K \downarrow$

$P_3 = 9.0 \times 0.0625 \times \frac{1}{2} \times 8 = 2.25^K \uparrow$

$P_4 = 9.0 \times 0.0625 \times 4 = 2.25^K \uparrow$

$P_5 = 0.301 \times \frac{1}{2} \times 8 = 1.20^K \uparrow$

$P_6 = 0.301 \times 4 = 1.20^K \uparrow$

$H_1 = 9 \times 0.0625 \times \frac{1}{2} \times 9 = 2.53^K \rightarrow$

$H_2$ = (See Wave Computations) = $4.51^K \rightarrow$

| PROJECT | N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 2 of 6 | COMPUTED BY H.C.A | DATE 9/28/71 |
|---|---|---|---|---|
| SUBJECT | REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY F.E.H. | DATE 10/19/71 |

| LOAD DESIGNATION | STATIC WATER LOAD ONLY | | | | | | STATIC WATER PLUS WAVE LOAD<br>Note: Loads reduced to 3/4 actual in lieu of increasing allowable loads by 33%. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PERMEABLE SHEET PILING | | | IMPERMEABLE SHEET PILING | | | PERMEABLE SHEET PILING | | | IMPERMEABLE SHEET PILING | | |
| | CASE 1 | | | CASE 2 | | | CASE 3 | | | CASE 4 | | |
| | FORCE | $\bar{d}$ | MOM. | FORCE | $\bar{d}$ | MOM | FORCE | $\bar{d}$ | MOM. | FORCE | $\bar{d}$ | MOM. |
| VERT. | | | | | | | | | | | | |
| $W_1$ | 2.10 | 5.50 | 11.55 | 2.10 | 5.50 | 11.55 | 1.58 | 5.50 | 8.66 | 1.58 | 5.50 | 8.66 |
| $W_2$ | 0.61 | 6.19 | 3.78 | 0.61 | 6.19 | 3.78 | 0.46 | 6.19 | 2.83 | 0.46 | 6.19 | 2.83 |
| $W_3$ | 3.00 | 4.00 | 12.00 | 3.00 | 4.00 | 12.00 | 2.25 | 4.00 | 9.00 | 2.25 | 4.00 | 9.00 |
| $P_1$ | 2.03 | 2.50 | 5.08 | 2.03 | 2.50 | 5.08 | 1.52 | 2.50 | 3.81 | 1.52 | 2.50 | 3.81 |
| $P_2$ | — | — | — | — | — | — | 1.22 | 2.50 | 3.05 | 1.22 | 2.50 | 3.05 |
| $P_3$ | -2.25 | 2.67 | -6.01 | — | — | — | -1.69 | 2.67 | -4.51 | — | — | — |
| $P_4$ | — | — | — | -2.25 | 2.00 | -4.50 | — | — | — | -1.69 | 2.00 | -3.38 |
| $P_5$ | — | — | — | — | — | — | -0.90 | 2.67 | -2.40 | — | — | — |
| $P_6$ | — | — | — | — | — | — | — | — | — | -0.90 | 2.00 | -1.80 |
| TOTAL VERT. | 5.49 | 4.81 | 26.40 | 5.49 | 5.08 | 27.91 | 4.44 | 4.60 | 20.44 | 4.44 | 4.99 | 22.17 |
| HORIZ. | | | | | | | | | | | | |
| $H_1$ | 2.53 | 3.00 | 7.59 | 2.53 | 3.00 | 7.59 | 1.90 | 3.00 | 5.70 | 1.90 | 3.00 | 5.70 |
| $H_2$ | — | — | — | — | — | — | 3.38 | 6.80 | 22.98 | 3.38 | 6.80 | 22.98 |
| TOTAL HORIZ | 2.53 | 3.00 | 7.59 | 2.53 | 3.00 | 7.59 | 5.28 | 5.43 | 28.68 | 5.28 | 5.43 | 28.68 |
| $\bar{x}$ RESULT. $\bar{y}$ | 6.04 | 6.19<br>13.44 | 33.99 | 6.04 | 6.47<br>14.03 | 35.50 | 6.90 | 11.06<br>9.30 | 49.12 | 6.90 | 11.45<br>9.63 | 50.85 |



FIGURE B-6

Resultant loads on one foot wide strip for each case are shown on page 2 and are plotted on the figure on page 1. Arranging pile groups so that their axes intersect near all the case load resultants will minimize transverse pile loads and therefore minimize deflections of the wall (See the figure on page 1). Using 12" x 12" prestressed concrete piles, 60 feet long at the batters shown in the figure on page 1 will yield theoretical allowable loads as follows:

| PILE GROUP | BATTER | TIP ELEVATION | ALLOWALABLE LOAD |
|---|---|---|---|
| FLOOD SIDE | 1 on 4 | -55.0 | 60^k Tension |
| PROTECTED SIDE | 1 on 2 | -50.4 | 78^k Compression |

Analysis of a one foot wide wall strip with one flood side pile and one protected side pile at the above batters by the Hrennikoff method gives the following pile loads:

| CASE NO | FLOOD SIDE | | PROTECTED SIDE | |
|---|---|---|---|---|
| | AXIAL | TRANSVERSE | AXIAL | TRANSVERSE |
| 1 | 0.34^k | -0.03^k | 5.76^k | -0.01^K |
| 2 | 0.06^k | 0.07^k | 6.05^K | 0.10^K |
| 3 (¾ Actual) | -4.18^k | -0.02^K | 9.49^K | 0^K |
| 4 (¾ Actual) | -4.51^k | 0.09^k | 9.82^K | 0.13^K |

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 4 of 6 | COMPUTED BY H.C.A. | DATE 10/5/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY F.E.H. | DATE 10/19/71 |

Maximum desirable pile spacing is 10' on centers.

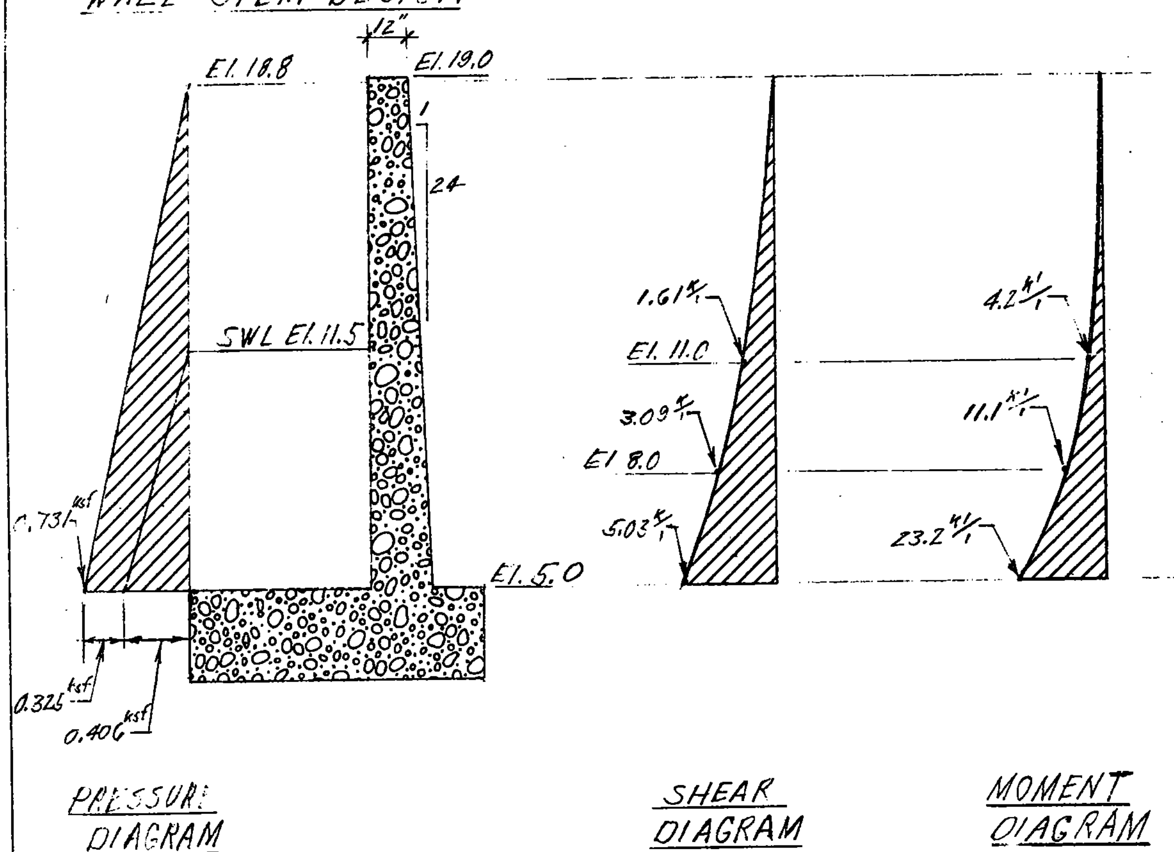
Theoretical flood side spacing $= \frac{60^k}{4.51^k/_1} = 13.3'$

At 10' o.c. flood side pile will be working at 75% of the theoretical allowable tension load.

Protected side spacing $= \frac{78^k}{9.82^k/_1} = 7.94'$ say 8'

Design spacing: 10' O.C. flood side
8' O.C. protected side

WALL STEM DESIGN




LMV FORM 1 AUG 68 107a

COMPUTATION SHEET

FIGURE B-8

WALL STEM DESIGN (CON'T)

El. 5.0 $M = \frac{3}{4} \times 23.2^{k'} = 17.4^{k'}$ $V = \frac{3}{4} \times 5.03^{k} = 3.77^{k}$

$\text{min } d = \sqrt{\frac{17.4 \times 12}{.152 \times 12}} = 10.7''$ $\text{min } d = \frac{3.77}{12 \times 0.06} = 5.2''$

$\text{actual } d = 12 + \frac{14 \times 12}{24} - 2.5 - 0.7 - .5 = 15.3''$

$A_s = \frac{17.4}{1.44 \times 15.3} = 0.79 \text{ in}^2$ w/ #8 @ 12" $p = 0.0043$ OK

USE #8 @ 12" Floodside Face 27" Embdmt

Min $A_s = 0.0025\, bd = 0.46 \text{ in}^2$

#6 @ 12" $p = 0.0024$ OK

USE #6 @ 12" Protected side Face

USE #6 @ 12" Horizontal Each Face

El. 8.0 $M = \frac{3}{4} \times 11.1^{k'} = 8.3^{k'}$ $V = \frac{3}{4} \times 3.09 = 2.32^{k}$

$\text{min. } d = \sqrt{\frac{8.3}{.152}} = 7.4''$ $\text{min } d = \frac{2.32}{12 \times 0.06} = 3.2''$

$\text{actual } d = 12 + \frac{11 \times 12}{24} - 2.5 - 0.7 - 0.5 = 13.8''$

$A_s = \frac{8.3}{1.44 \times 13.8} = 0.42 \text{ in}^2$

USE #6 @ 12" Floodside Face above El. 8.0

$L = 23.25 \frac{M}{d}$

Lap splice = 14" + 13.8" = 27.8"

Stop #8 @ El. 8.0 and lap #6 30" below El 8.0

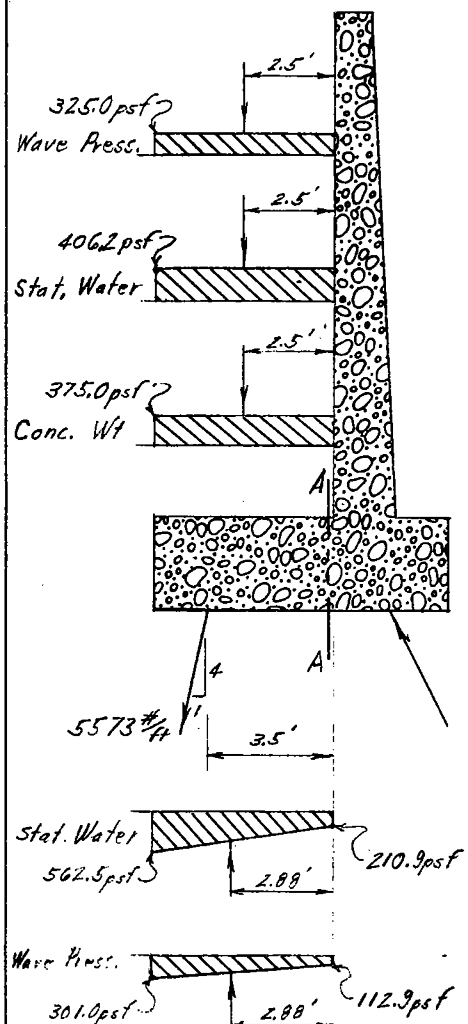
Steel wt. 5.3' #8 = 14.2#
43.5' #6 = 65.3#
79.5#

$Vol. = \frac{12+13}{24} \times 14 \times \frac{1}{27} = 0.67$ C.Y.

120 #/C.Y.

| PROJECT N.O. TO VENICE GENERAL DESIGN SUPPLEMENT | Page 6 of 6 | COMPUTED BY H.C.A. | DATE 10/14/71 |
|---|---|---|---|
| SUBJECT REACH B-2, FORT JACKSON TO VENICE, VENICE PUMPING STA. | | CHECKED BY F.E.H. | DATE 10/19/71 |

BASE SLAB DESIGN    Case 3 is critical




Neglect transverse pile load.

At section A-A ($\frac{3}{4}$ actual values)

$M = 18.2^{K'}/'$    $V = 6.0^{K}/'$

$min.\ d = \sqrt{\frac{18.2 \times 12}{.152 \times 12}} = 11.0''$    $min.\ d = \frac{6.0}{12 \times 0.06} = 8.4''$

actual $d = 30 - 2.5 - 0.7 - 0.5 = 26.3''$

$A_s = \frac{18.2}{1.44 \times 26.3} = 0.48\ in^2$    $min\ A_s = 0.79\ in^2$

w/ #8 @ 12''    $p = 0.0025$   ok

USE #8 @ 12'' Top Face Transverse

Bottom face actual $d = 30 - 2.5 - 0.7 - 0.5 = 26.3''$

min $A_s = 0.0025\ bd = 0.79\ \square''$

USE #8 @ 12'' Bottom Face Transverse

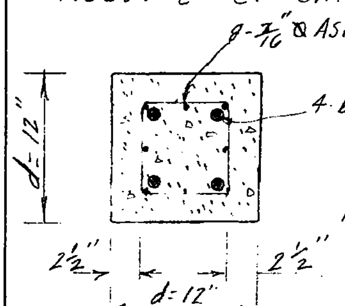
USE #8 @ 12'' Top & Bottom Face Longit.

120 #/CY

Peripheral shear around piles is OK with max. 10' spacing

Check pile slab anchorage with max. 10' pile spacing.

Assume excentricity of applied load = 0.1 d

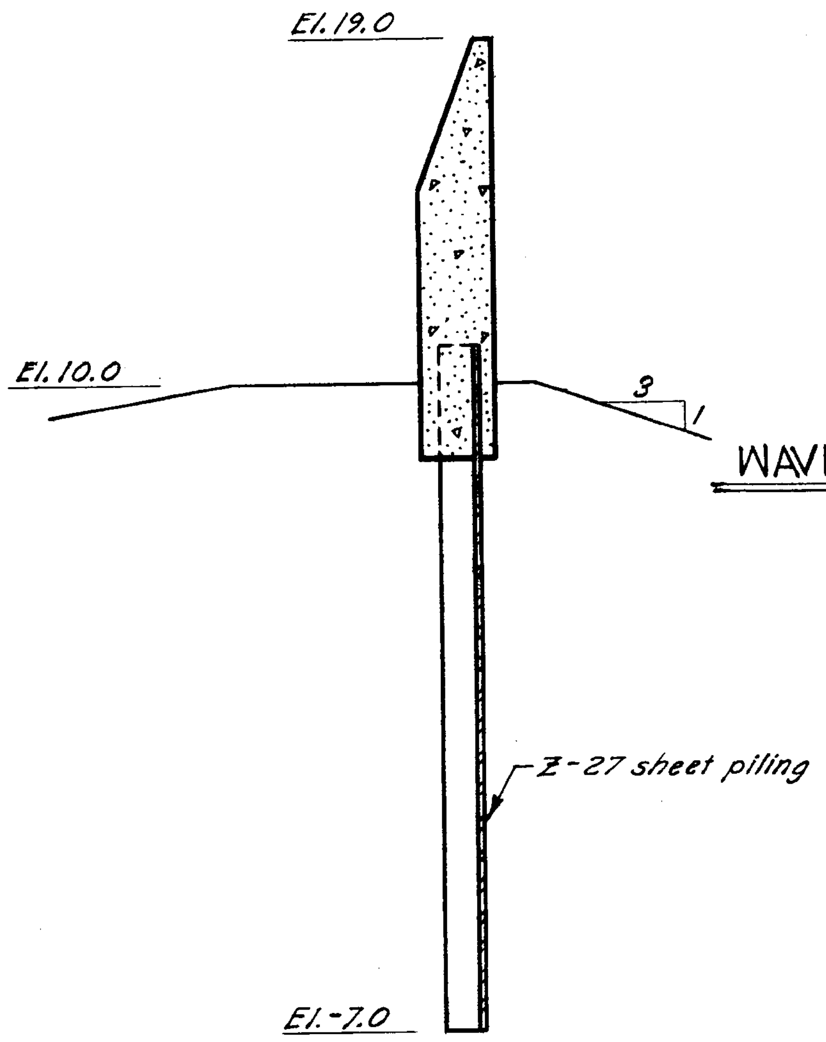



At 10' spacing:   $P = 10 \times 4.51 = 45.1^{K}$   $M = 45.1 \times 0.1 = 4.51^{K'}$

assume $d - d' = 12 - 2 \times 2.5 - 2 \times .5 - 2 \times .25 = 5.5''$

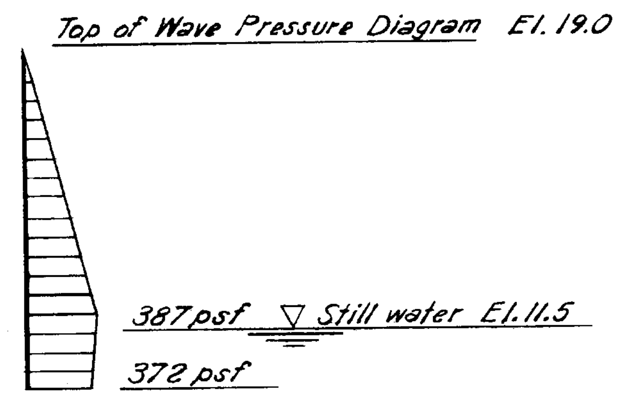
Req'd $A_s$ one bar $= \frac{45.1}{4 \times 20} + \frac{4.51 \times 12}{5.5 \times 2 \times 20} \doteq 0.81\ in^2$

USE 4 #8  w/ Standard Hooks    $A_s = 0.79\ in^2$ each   say OK

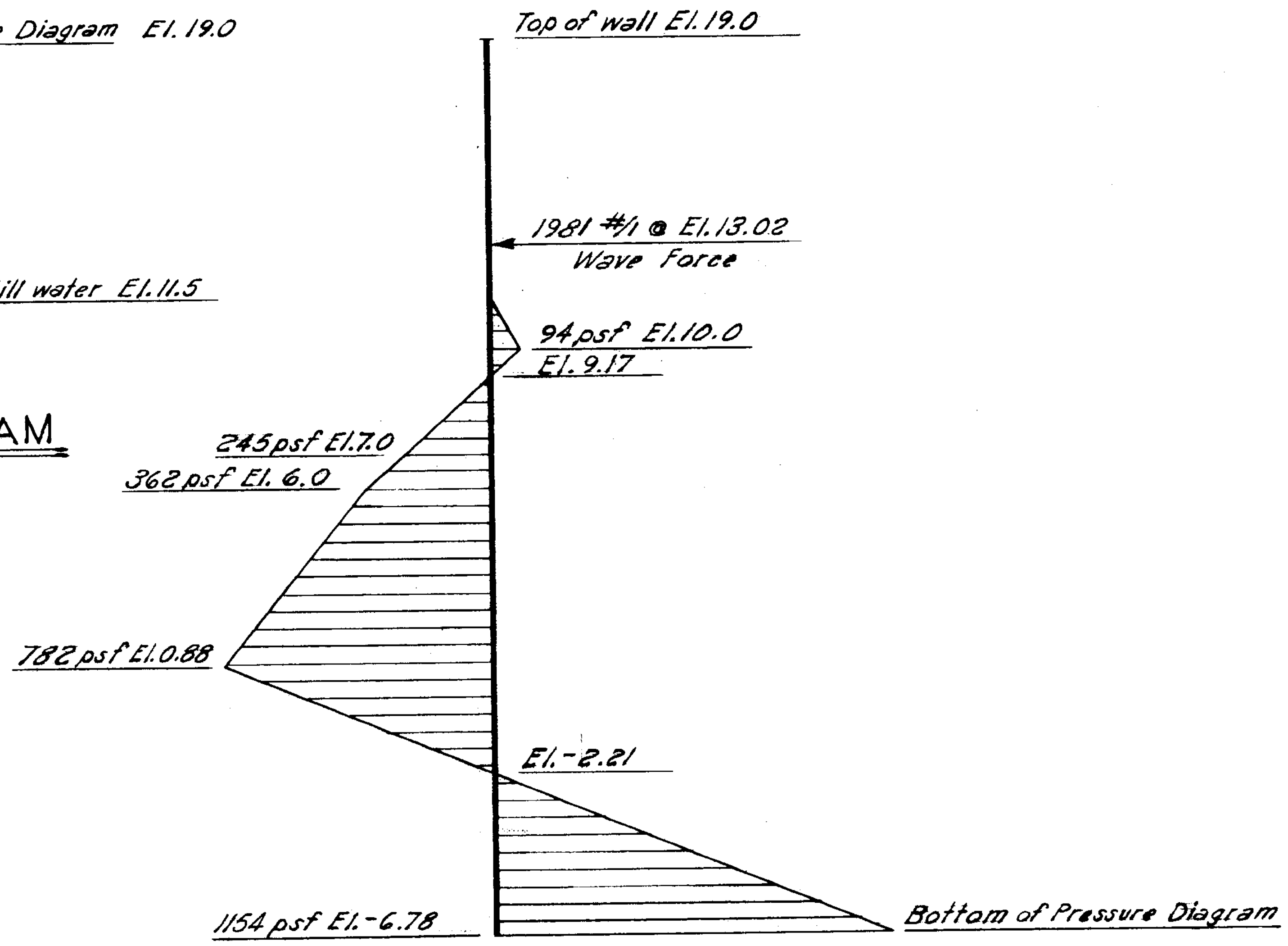



TYPICAL SECTION

Scales: 1" = 5'
1" = 1000 psf

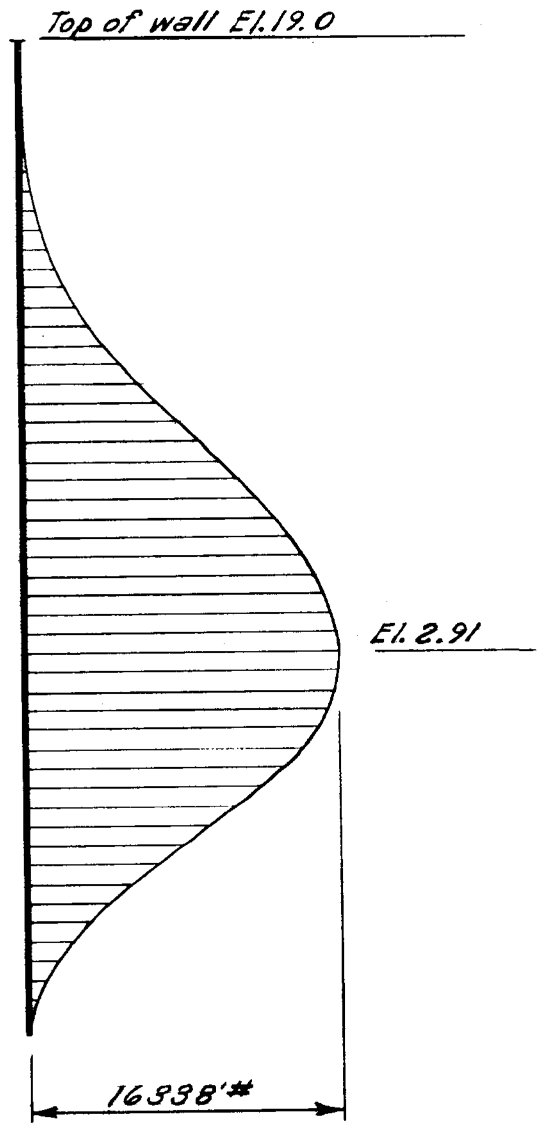



WAVE PRESSURE DIAGRAM




NET PRESSURE DIAGRAM (F.S.=1.25 S-CASE)

Scales: 1" = 5'
1" = 1000 psf




MOMENT DIAGRAM (F.S.=1.25)

Max. deflection at top of wall = 0.83"

Scales: 1" = 5'
1" = 10,000'#

NEW ORLEANS TO VENICE, LA.
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN
SUPPLEMENT NO. 4

REACH B2 — FORT JACKSON TO VENICE

**I-WALL DESIGN ANALYSIS**
**VENICE PUMPING STATION**

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

JUNE 1972 FILE NO. H-2-25953

FIGURE B-11

NEW ORLEANS TO VENICE, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
SUPPLEMENT NO. 4
REACH B2 - FORT JACKSON TO VENICE

# APPENDIX C
# CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

LOUISIANA WILD LIFE AND FISHERIES COMMISSION
WILD LIFE AND FISHERIES BUILDING
400 ROYAL STREET
NEW ORLEANS, LOUISIANA 70130

October 7, 1971

Colonel Richard L. Hunt
District Engineer
US Army Corps of Engineers
P. O. Box 60267
New Orleans, LA 70160

Dear Colonel Hunt:

This is in reply to your letter of October 1, 1971, requesting that we review the authorized "New Orleans to Venice, Louisiana Hurricane Protection Project".

We have at your suggestion reviewed the previous correspondence detailing our interest, recommendations, and considerations regarding the various fish and wildlife resources and values associated with the project area. Because there have been no appreciable modifications or changes in the plan for reaches A, B, and C. We feel our original letter reports would be sufficient in establishing our interest and recommendations regarding the proposed work.

However, because of the absence of sufficient discharges of waters from the Mississippi River into the marshes on either side possibly at some later date some consideration could be given to establishing fresh water introduction features in the levee system of the hurricane protection project. With reduced flood peaks by upstream works and the improvement and extention of the Mississippi River levees, fresh water flows into the marshes have been drastically reduced. This has resulted in increased salinities in the prime oyster producing areas east and west of the river below New Orleans. The increased salinities have reduced the amount of area which now can produce oysters on a reoccuring or annual basis. In order to maintain the oyster industry as we know it today, provisions for the introduction of fresh water into these areas should be included where ever possible and made a part of existing projects in this area. This would improve the quality of the environment and help maintain or reestablish valuable natural renewable resources. In the event additional planning is possible and other features could be considered, we would appreciate a review of the above request in order to take every opportunity to maintain or improve existing environmental conditions in this valuable marsh land area.

We appreciate the opportunity to offer comments relative to fish and wildlife aspects of this project. Should you have any questions concerning our interest in this area or should the project as presently proposed be altered or modified in any way, we request the opportunity to review these changes and submit additional comments concerning wildlife interest.

Sincerely yours,

Clark M. Hoffpauer
Director
Louisiana Wild Life & Fisheries
Commission

MWS/cgl

cc Oyster Division
Robert E. Murry

United States Department of the Interior
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

November 8, 1971

District Engineer
U.S. Army, Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of October 1, 1971, requesting our review of the New Orleans to Venice, Louisiana, hurricane protection project.

Based on the information contained in your letter that no appreciable modifications are being contemplated for Reaches A, B-2, and C of the authorized New Orleans to Venice, Louisiana project, our previous reports with respect to these reaches will suffice in establishing the fish and wildlife implications of the hurricane protection plan.

However, with respect to Reach A we would recommend that consideration be given to establishing the necessary features for the freshwater introduction control structure No. 3 which is a part of the authorized plan for Freshwater Introduction Into the Sub-Delta Marshes Below New Orleans, Louisiana. Incorporation of this structure which is to be located in the vicinity of Homeplace, Louisiana, with Reach A of the hurricane protection plan would provide for the timely implementation of one of the four freshwater introduction structures needed to rectify, in part, the adverse conditions to fish and wildlife resources brought about by the existing levees along the Mississippi River below New Orleans.

The opportunity to provide these additional comments with respect to the fish and wildlife aspects of the proposed project is appreciated. Should questions arise concerning our recommendations, or should project plans be further modified, we will be happy to assist in any manner possible in the interest of fish and wildlife conservation.

Sincerely yours,

C. Edward Carlson

C. Edward Carlson
Regional Director

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1971

**ENVIRONMENTAL PROTECTION AGENCY**
REGION VI
1600 Patterson, Suite 1100
Dallas, Texas 75201

November 26, 1971

Colonel Richard L. Hunt
District Engineer
Departments of the Army
New Orleans District, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Colonel Hunt:

We have reviewed the maps showing the New Orleans to Venice, Louisiana Hurricane Protection Levees. The project consists of the enlargement of existing levees and extensive construction of new levees.

The enlargement and construction of new levees will involve the excavation of large quantities of sand from the Mississippi River and clay fill from adjacent marsh areas.

Obviously, the project potentially could have significant adverse effects on the environment even if construction methods are of the highest quality.

We would like to know more about the construction methods and methods that will be used to protect environmental values during and after construction of the project.

Perhaps your office plans to prepare an Environmental Statement on this project and/or associated projects. An Environmental Statement that would include this project would permit our agency to evaluate more fully the potential adverse effects on environmental values within our area of responsibility.

We appreciate the opportunity to give you our preliminary views on this project.

Sincerely,

Mac A. Weaver

Mac A. Weaver, P. E.
Air and Water Programs Division

STATE OF LOUISIANA
STREAM CONTROL COMMISSION
P. O. DRAWER FC
UNIVERSITY STATION
BATON ROUGE, LOUISIANA 70803

January 19, 1972

Colonel Richard L. Hunt, C.E.
District Engineer
Department of the Army
Corps of Engineers, New Orleans District
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter dated October 15, 1971, requesting our comments on the New Orleans to Venice, Louisiana, Hurricane Protection Project.

We reiterate our previous position:

1. Spoil bank control to prevent water pollution from turbid conditions is recommended.

Areas adjacent to reaches A and B2 are oyster growing areas; therefore, siltation of these water bottoms could be most harmful.

2. State and federal water pollution control and health laws, rules, and regulations should be complied with by the contractor.

Very truly yours,

Robert A. Lafleur
Robert A. Lafleur
Executive Secretary

fbr

**LOUISIANA AIR CONTROL COMMISSION**

Louisiana State Office Building
P.O. Box 60630
NEW ORLEANS 70160

October 28, 1971

Department of the Army
New Orleans District
Corps of Engineers
P. O. Box 60267
New Orleans, La. 70160

Attention: Colonel Richard L. Hunt, CE
District Engineer

Gentlemen:

Thank you for your letter of October 15, 1971 in regard to various authorized projects including the "New Orleans to Venice, Louisiana" hurricane protection project.

We have no further comment except that in the period since 1967 greater emphasis is being placed on air pollution control.

There is no information as to whether or not there will be combustible materials from the work involved. If there will be such materials, we believe that any contract could provide for compliance with the Louisiana Air Control Commission's standards and regulations.

At the direction of Andrew Hedmeg, M.D., M.P.H.

Very truly yours,

John E. Trygg

John E. Trygg
Technical Secretary

JET:ls