JEFFERSON PARISH
ST. CHARLES PARISH
RETURN LEVEE

LAKE PONTCHARTRAIN, LA. AND VICINITY

LAKE PONTCHARTRAIN
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

US Army Corps of Engineers
New Orleans District

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

JULY 1987

SERIAL NO. 17

CELMV-ED-TD (CELMN-ED-SP/14 Jul 87) 5th End Mr. Bardwell/jm/5925
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/ St. Charles Return Levee

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39180-0080
28 MAR '88

FOR: Commander, New Orleans District, ATTN: CELMN-ED-SP

Satisfactory.

FOR THE COMMANDER:

7 Encls
nc

FRED H. BAYLEY III
Chief, Engineering Division

CF w/ 12 cys 4th End:
CEEC-EB

CELMV-ED-TD (CELMN-ED-SP/14 Jul 87) 3d End Mr. Bardwell/brs/5925
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39180-0080

22 JAN 88

FOR: Commander, New Orleans District, ATTN: CELMN-ED-SP

The resolution of the 1st End comments is satisfactory except as follows.

a. Para 1d and 1e, Comparison of Cost.

(1) We do not concur in the need to relocate the forced sewer main due to stability reasons for the I-wall/el.+5 and I-wall/el+3 plans. Therefore, the relocation cost should be deleted from the cost analysis.

(2) We understand that the required sheet pile tip elevation of -62 shown on encl 3, 5 for the elevation+3 levee/I-wall scheme, sta. 74+00 - 121+00, was based on an analysis with water to the top of the wall (elevation + 13.5). This case is considered overly conservative and is much more critical than the SWL plus waveload which is normally used to analyze hurricane protection I-walls. Guidance regarding future designs of this nature is forthcoming.

b. The following are additional comments on the subject DM.

(1) Para 40b(4) and Plates 54 and 55. The design load(s) in the piles together with the selected pile lengths should be included in this paragraph and/or shown on the plates. Design load(s) and selected length data should also be furnished for pile designs in future similar design memoranda.

(2) Table 6. The waterproof finish proposed for the concrete surface of the I-wall and T-wall (protected side) is not necessary and should be deleted from the detailed cost. Reference para 9-5, Protective Coating, EM 1110-1-2009, Architectural Concrete, Sep 87.

(3) Para 70. The following paragraph should be substituted for the Economic Justification, para 70.

The current economic analysis for the entire Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project is contained in the Reevaluation Study entitled "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project," dated December 1983. Based on October 1981 price levels, and the project interest rate of 3 1/8 percent, the benefit-cost ratio for the project as a whole was 4.2 to 1. The project is currently under construction and a remaining benefit-remaining cost ratio is appropriate. The current remaining benefit to remaining cost ratio at the project interest rate is 9.9 to 1 and at the current Federal discount rate is 5.0 to 1. The Reevaluation Study also broke out separable project areas (SPA) for incremental justification. The New Orleans Lakefront reach is a part of the New Orleans-Jefferson SPA. The computed benefit-cost ratio for the New Orleans-Jefferson area was 5.0 to 1 in the 1984 Reevaluation Study. Updating this SPA for price levels and interest rates produces a remaining benefit to remaining cost ratio of 6.0 to 1 at the project interest rate and 1.6 to 1 at the current Federal interest rate.

c. Para A-7e. Freeboard is defined in the Shore Protection Manual as "the additional height of a structure above the design water level to prevent overflow." This vertical distance is primarily a judgement determination and should encompass all possible unaccountable errors in hydraulic determination. Once a freeboard has been established for a project then it should be applicable to all segments of the project, with the exception of those areas where sound sensitivity analysis dictates otherwise. There has to be continuity in our judgemental decisions. For the Lake Pontchartrain Hurricane Protection in areas where there are no waves, freeboard above the design water level has been either 1 or 2 ft for walls and 2 ft plus an additional amount for long term settlement in the case of earthen structures. The long term settlement value should be the computed amount, but in no circumstances less than 1 ft. The fact that those walls were designed for different frequency events is not, itself, sufficient justification to increase the freeboard to 3 ft, nor is it justifiable to design this wall to a higher freeboard because it protects an urban area. Unless sensitivity analysis dictates otherwise, 2 ft of freeboard will be used for walls with no waves and 2 ft plus long term settlement for earthen structures.

d. Para 2. The request for concurrent review of the plans and specifications for the Airport to West Esplanade Avenue Floodwall contract is approved.

FOR THE COMMANDER:

4 Encls
nc

FRED H. BAYLEY III
Chief, Engineering Division

CF w/12 cys 2d End:
CEEC-EB

CELMN-ED-SP(CELMN-ED-SP/14 Jul 87) 4th End Mr. Stutts/saj/2614
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee.

DA, New Orleans District, Corps of Engineers, P. O. Box 60267, New Orleans, LA 70160-0267 24 Feb 88

FOR: Commander, Lower Mississippi Valley Division
ATTN: CELMV-ED-TD

1. The proposed disposition of comments presented in the 3rd End of this chain of correspondence is presented in the subsequent paragraphs (paragraph numbers are referenced by like paragraph of the 3rd End).

a. Para 1d and 1e, Comparison of Cost.

(1) Concur, the cost for relocating the forced sewer mains will be deleted.

(2) Concur, future I-wall designs will follow the criteria furnished in your CEMRC-ED-GS letter dated 23 December 1987 and any subsequent future guidance that may be forthcoming.

b. Responses to paragraph b.(1) through b.(3) are as follow:

(1) Para 40b(4) and Plates 54 and 55. Concur, the design load(s) in the piles together with the selected pile lengths are shown on enclosure 5. In future design memoranda the requested data will be shown on the appropriate plates.

(2) Table 6. Concur, the cost for the waterproof finish has been deleted from Table 6. However, it should be noted that during the preparation of plans and specifications for the Airport to West Esplanade Floodwall, a "Fractured Fin Finish" was specified for the protected side of the wall. The finish is being provided for aesthetic reasons, since the wall is in a highly visible residential area. The cost for this finish is less than 1% of the total construction cost for the floodwall.

(3) Para 70. Concur, the paragraph furnished in para b.(3) of the 3rd End is substituted for para 70 of the subject design memorandum.

c. Para A-7e. In response to paragraph c. of the 3rd End, we offer the following:

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

(1) Reference the meeting of 26 Jan 88 in NOD with Messrs Tuttle and Cook of CELMV and Soileau of H&H Br attending. During this meeting the vulnerability of the return levee to waves generated by hurricanes on tracks other than the design hurricane path and the continuing deterioration of the wooded marsh on the floodside of the levee was discussed.

(2) At the St. Charles return levee the standard project hurricane, which produces the design stage, generates waves which travel parallel to the return levee during the critical hour. These waves do not "runup" on the wall in the traditional technical definition but slosh up and down on the walls as they travel to the south. Runup does occur on the wall during other hours of the storm when windtide levels are lower, but not to the height of the wave crest plus water level at the critical hour. Enclosure 6 illustrates the wind shift patterns, which cause the wave runup phenomenon, during passage of the design storm. In addition, other hurricanes on other tracks can produce windtide levels almost as high as the design storm with wind directions which can cause waves to strike directly on the wall. To further explain the assumptions and factors which influenced our selection of 3 feet of freeboard, we have enclosed revised pages A-26 and A-27 appendix A of the subject design memorandum, (see enclosure 7).

FREDERIC M. CHATRY
Chief, Engineering Division

7 Encls
2-4. nc
added 3 encls
5-7. as

JEFF/ST. CHARLES PARISH GDM
PILE DATA

LOCATION W/L Station	PILE TIP ELEVATIONS			PILE LOADS			PILE LENGTHS		
	PROTECTED SIDE	MIDDLE ROW	FLOOD SIDE	PROTECTED SIDE	MIDDLE ROW	FLOOD SIDE	PROTECTED SIDE	MIDDLE ROW	FLOOD SIDE
0+00 to 65+20 12" sq. Piles	-69.0		S-Case -53.0 Q-Case -52.0	+56.4		-31.6 Kips	78' @ 6' O.C.		60'@ 9' O.C.
65+20 to 131+20 14" sq. Piles	-67.0		Q-Case -57.0	+48.4 Kips		-28.1 Kips	77" @ 5' O.C.		65' @ 7' -6" O.C.
131+20 to 173+04 14" sq. Piles	-69.0		Q-Case -61.0	+51.7 Kips		-32.4 Kips	79' @ 5' O.C.		70' @ 7' -6" O.C.
173+04 to 180+69.7 14" sq. Piles	-76.0 Q-Case	-67.0 Q-Case	-71.0 Q-Case	+65.3 Kips	+49K -25.3K	+21K -49.3K	81' @ 4' O.C. 1H ON 3V	72' @ 8' O.C. 1H ON 3V	75' @ 4' O.C. 1H ON 4V

ENCL 5

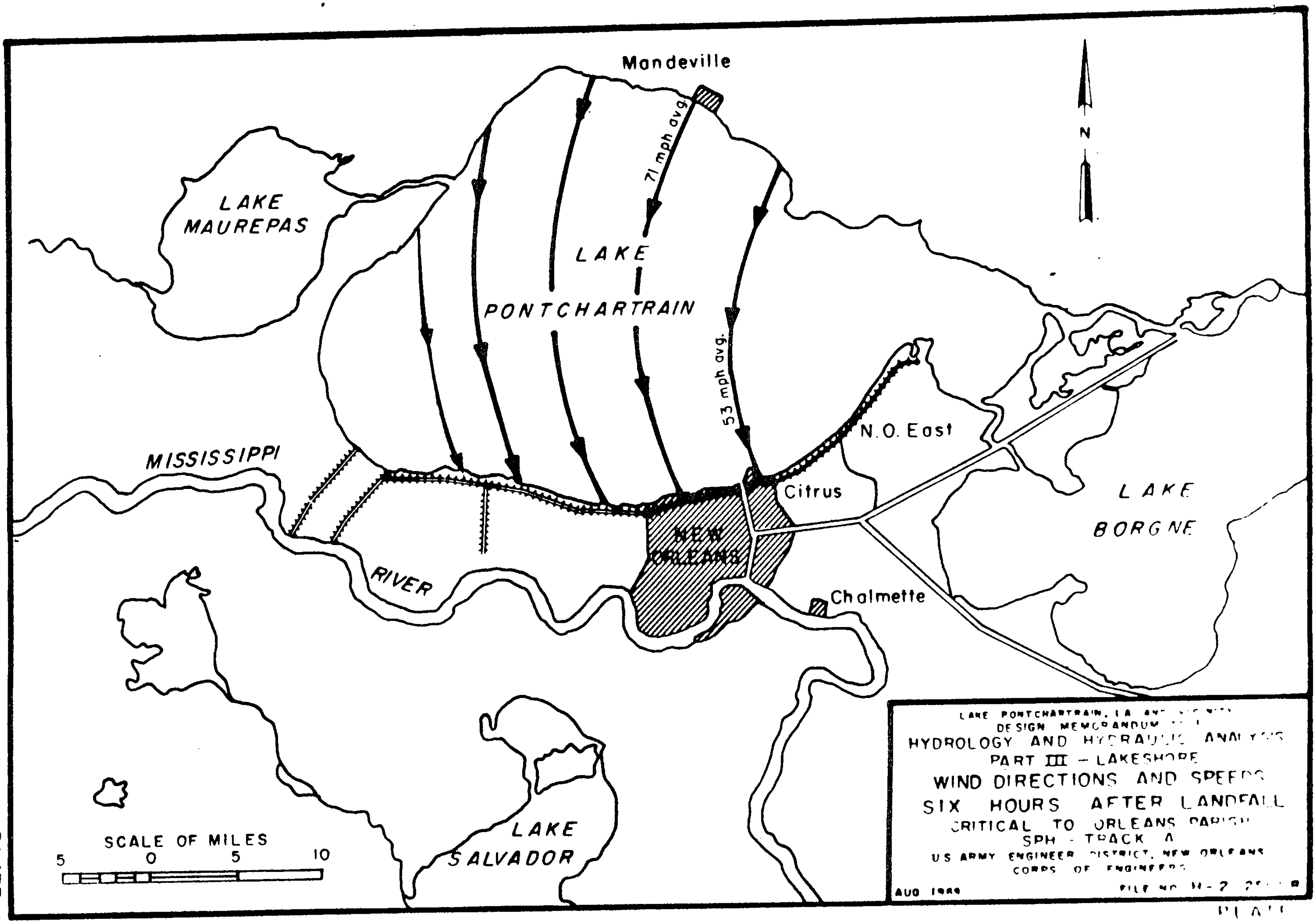


PLATE I

Encl 6

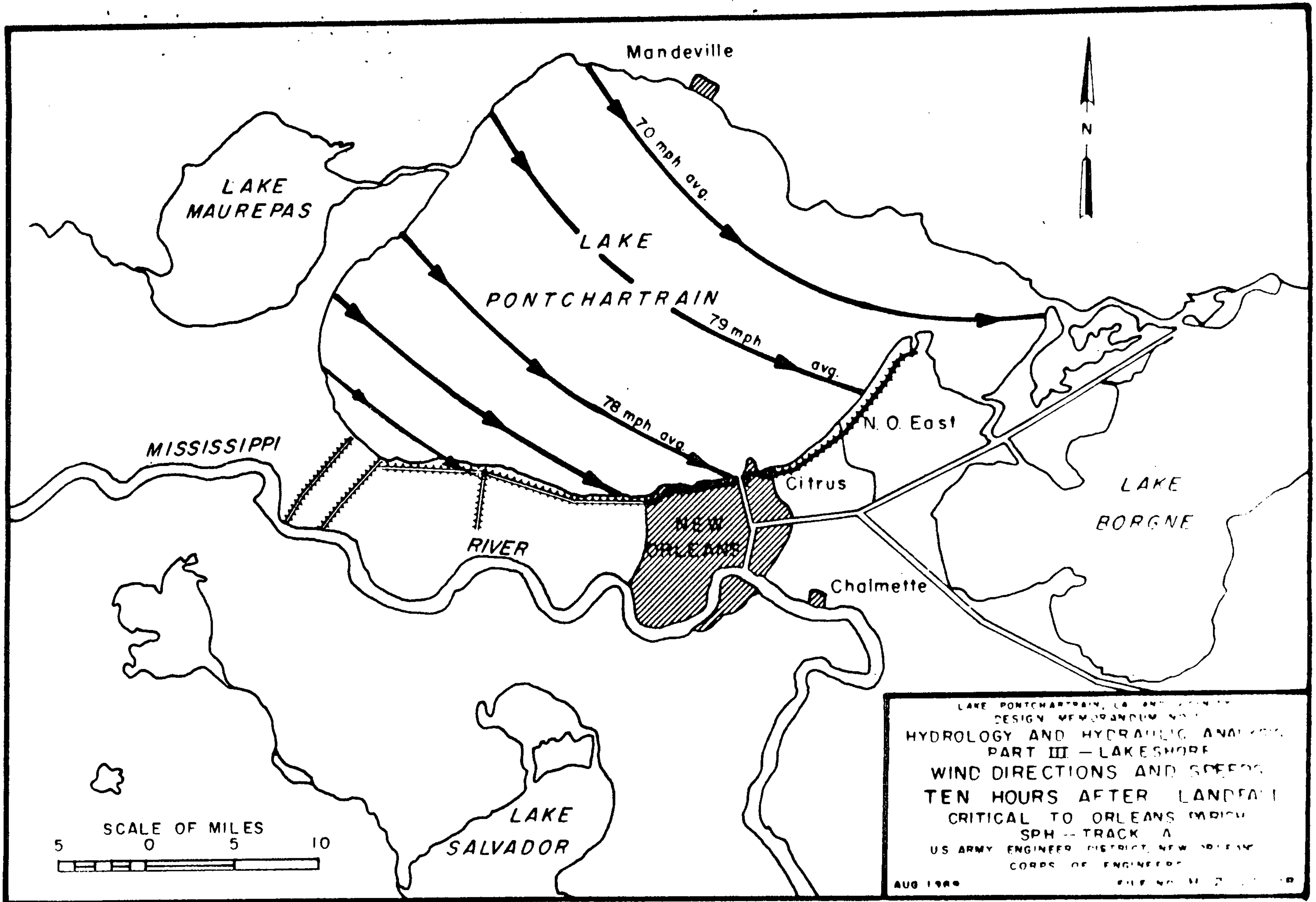


PLATE 3

Encl 62

lower levee grade and an increased frequency would expose the protected areas to hazards to life and property that would be disastrous in event of the occurrence of a hurricane of the intensity and destructive capability of the standard project hurricane.

b. Characteristics. The characteristics of the Des H for the proposed plan of protection are identical to the standard project hurricane described in detail in paragraph A-5. However, due to transposition of the regional SPH to the smaller study area the design hurricane would have a probability of recurrence of only once in about 300 years in the study area. The path of the Des H's was located to produce maximum hurricane tides along the entire length of the proposed structure. The Des H is a theoretical hurricane but ones of similar intensity have been experienced in the area. Table A-13 is a summary of the Des H characteristics.

TABLE A-13
DESIGN HURRICANE CHARACTERISTICS

Location	CPI (inches)	Max. winds (m.p.h)	Radius of max. winds (miles)	Forward speed (knots)	Direction of approach	Track (plate A-6)
Lake Pontchartrain South Shore	27.6	100	30	6	South	A

c. Normal predicted tides. The average tidal range in Lake Pontchartrain is 0.5 foot. Lake Pontchartrain has an average elevation of about 1.0 foot. In determining the elevation of design surges and wind tide levels, the mean normal predicted tide was assumed to occur at the critical period.

d. Design tide. The hurricane wind-tide is the maximum stillwater surface elevation experienced at a given location during the passage of a hurricane. It reflects the combined effects of the hurricane surge and wind tide. Design hurricane tides were computed for conditions reflecting the proposed protective works. The resulting elevations, which are identical to those for an SPH, are the same for existing or project conditions. Refer to para A-5.f.(1) and Plate A-15 for wind-tide, wind direction, and isovel patterns at the critical hour.

TABLE A-14
DATA USED TO DETERMINE WAVE CHARACTERISTICS
DESIGN HURRICANE

F	Length of fetch, miles	5
U	windspeed, mph	82
SWL	Stillwater elevation, feet	11.5
d	Average depth of fetch, feet	24.6

Encl

e. Levee heights. During the critical hour, when maximum wind-tide levels are against the protective levee, the winds are nearly parallel to the alinement of the levee. These winds generate waves that travel along the levee parallel to its alinement and no wave runup will occur. The passage of the crest and trough of the waves causes the water level to rise and fall on the levee or wall. We calculate that the top of the wave during the critical hour will not be more than 3 feet above the still water level. After the critical hour, the winds begin to blow more nearly perpendicular to the levee alinement. For those winds, waves can be generated which will strike the levee at a highly oblique angle and cause wave runup. The height of this wave runup will not exceed the design grade determined for the critical hour. The height of protection required decreases southward from the lakefront since the height of the wind-tide drops off with distance because of friction over the marsh. At the lakefront, the return-levee height matches the lakefront levee height. The design elevation varies with distance south from the lakefront as shown in Table A-15

TABLE A-15

DESIGN HURRICANE
WINDTIDE LEVELS AND
DESIGN ELEVATIONS OF PROTECTIVE STRUCTURES

Location W/L Stations	Windtide level ft. n.g.v.d.	Elev. of protective levees ft. n.g.v.d.
181+35.5 to 173+04.7	11.5	Varies*
173+04.7 to 130+70	11.5	14.5
130+70 to 65+20.4	11.0	14.0
65+20.4 to 0	10.5	13.5

* Transition reach whose height and cross section depends upon the design section along the Jefferson Parish Lakefront.

72

CELMN-ED-SP (CELMN-ED-SP/14 Jul 87) 2d End   Mr. Stutts/ds/2614
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A -- General Design, Jefferson Parish/St. Charles Parish Return Levee

DA, New Orleans District, Corps of Engineers, P.O. Box 60267, New Orleans, LA 70160-0267   24 Nov 87

TO: Commander, Lower Mississippi Valley Division, ATTN: CELMV-ED-TD

1. The proposed disposition of comments presented in the 1st endorsement of this chain of correspondence is presented in the subsequent paragraphs (paragraph numbers are referenced by like paragraph of the 1st end).

a. Para 40b(7) and Plate 12. Concur. The recommended foreshore protection between stations 173+04.7 and 178+74.7 W/L will be changed during plans & specifications to reflect either grouted riprap, larger riprap, or a concrete blanket. The least costly of these options will be recommended.

b. Para 44 and Plate 15 and Table 6.

(1) Do not concur. The existing access road will not be affected by the floodwall construction within the reach shown on plate 15. The access road falls outside the limits shown on the plate.

(2) A revised Table 6 is enclosed as enclosure 2.

c. Para 70. Concur. The price levels contained in the reevaluation study were October 1981 price levels rather than October 1983 price levels.

d. Plates 18 and 19. Concur. We have reexamined the I-wall in levee alternative to determine the most cost effective I-wall plan. The minimum degraded levee elevation that could be made to satisfy both foundation and structural stability requirements was determined for the levee reach addressed in this GDM. For the purpose of developing a cost estimate, where existing structures preclude construction of a protected side stability berm, the proposed method of protection would be T-wall construction. In these areas, the costs for acquisition of lands and relocations would obviously be cost prohibitive. In addition to the I-wall alternative with minimum levee height, several other I-wall in levee plans having higher crest elevations were checked to determine if the cost for landside berm and real estate would outweigh any reduction in sheet pile cost. The following tabulation gives a comparison of estimated costs for the most cost-effective I-wall in levee plan along with the corresponding estimated cost for the optimum T-wall, GDM plan.

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A -- General Design, Jefferson Parish/St. Charles Parish Return Levee

COMPARISON OF COST I-WALL VS. T-WALL
REACH STA. 74+00 B/L to Sta. 121+00 B/L

Alt.	Flood Wall Cost	Real Estate Cost	Relocation Cost	Total
T-Wall/Levee @ El.+3 NGVD	$ 5,915,000	-	-	$ 5,915,000
I-Wall/Levee @ El.+3 NGVD	$10,720,000*	No Est.	No Est.	$10,720,000
I-Wall/Levee @ El. +5 NGVD	$ 4,383,000	$1,774,000	$2,340,000**	$ 8,497,000

* Includes $7,960,000 for PZ-40 sheet piling
**Relocation Cost includes 3-forced sewer mains (16", 24", and 48" dia.), Main underground trunk line telephone, shell concrete asphalt Rds 1-6", water lines

REACH STA. 198+00 B/L to Sta. 247+20 B/L

Alt.	Flood Wall Cost	Real Estate Cost	Relocation Cost	Total
T-Wall/Levee @ El. +3 NGVD	$7,735,000	-	-	$ 7,735,000
I-Wall/Levee @ El. +5 NGVD	$5,180,000	$2,602,000	-	$ 7,782,000
I-Wall/Levee @ El. +6	$4,297,000	$3,291,000	-	$ 7,588,000

SUBREACH STA. 198+00 B/L to Sta. 213+50 B/L

Alt.	Flood Wall Cost	Real Estate Cost	Relocation Cost	Total
T-Wall/Levee @ El. +3 NGVD	$2,224,000	-	-	$ 2,224,000
I-Wall/Levee @ El. +5 NGVD	$1,432,000	$ 26,000	-	$ 1,458,000
I-Wall/Levee @ El. +6 NGVD	$1,233,000	$ 36,000	-	$ 1,269,000

Based on the forgoing, it is recommended that only the subreach from station 198+00 B/L to station 213+50 B/L be protected by I-wall construction. The comparison of cost for the two types of walls between station 198+00 B/L and station 247+20 B/L shows that both plans would cost approximately the same, with the T-wall being about 2 percent greater in cost than the I-wall in levee with crown elevation of +6 NGVD. We feel that the difference in costs falls well within the allowable error of estimate. The adjacent protected side lands with this reach constitute prime real estate which is slated for medium to high-cost residential development. Many of the properties impacted by the I-wall plan would preclude any construction on the remaining part of the property not taken by the project. Not only would this be an extremely unpopular plan with the land owners but also would adversely affect the future tax base for the Parish and City of Kenner, LA.

e. Plate 44. Do not concur. See response d. above. Cost for the I-wall in levee for this reach is greater than the GDM, T-wall plan. Enclosure 3 shows the sections for an I-wall between B/L sta. 74+00 and sta. 140+00 constructed along the same alignment of the T-Wall with the levee degraded to elevation +3 NGVD.

f. Plates 44-53. We have checked the stability of the existing levee/I-wall with GDM shear strength and the maximum past flood elevation of 6.5 feet NGVD and determined that the minimum F.S. was approximately 1.15.

g. Plate 46. Do not concur. Field observations indicate that the existing levee toe is currently susceptible to erosion. With the anticipated increase in deforestation, sea level rise, subsidence, and boat traffic in the canal, this situation can be expected to worsen. Therefore, we recommend that the riprap blanket be placed as shown in the GDM to insure the integrity of the fill adjacent to the floodwall base slab.

2. Also enclosed (Encl 4) please find revised pages 38 through 41. The revisions to these pages are necessary because of changes to the cost estimate arising from adoption of an I-Wall for the levee reach between sta. 198+00 B/L and sta. 213+50

CELMN-ED-SP (CELMN-ED-SP/14 Jul 87) 2d End
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A -- General Design, Jefferson Parish/St. Charles Parish Return Levee

B/L. Tables 6, 7, 8, 9, and 10 have been revised accordingly. Please note that the contract for the pile test - Airport to Lakefront previously shown on Table 8, has been deleted and added to the construction contracts. In order to maintain the award date shown in revised Table 8, we are recommending that a local and Division review of plans and specifications for the first contract be accomplished concurrently and that review time be limited to 30 days. We expect to submit plans and specifications for the Airport to West Esplanade Avenue Floodwall contract in early February 1988. Your approval of this procedure is requested.

FOR THE COMMANDER:

FREDERIC M. CHATRY
Chief, Engineering Division

4 Encls
Added 3 encls
2-3-4
as

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:
CELMN-ED-SP

14 July 1987

MEMORANDUM FOR: Commander, Lower Mississippi Valley Division, ATTN: CELMVED-TD

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

1. The subject design memorandum is submitted for review and approval, and has been prepared generally in accordance with the provisions of ER 1110-2-1150, dated 15 November 1984.

2. A summary of the current status of the Clean Water Act, endangered species, EIS, and cultural resources investigations is as follows:

a. Since there is no deposition of dredged or fill material into water of the U.S. with the subject work, no Section 404(b)(1) Evaluation or Water Quality Certificate is necessary.

b. Based on studies and investigations at this stage of design, the proposed action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species.

c. A final EIS for the barrier plan for the subject project was filed with CEQ on 17 January 1975. A final supplement to this EIS was filed with EPA on 7 December 1984. This supplement addressed the impacts associated with raising the height of the subject levee with hydraulic fill on the existing levee. The proposed floodwall work detailed in this GDM has fewer environmental damages than those described in the EIS Supplement, thus, no new environmental document will be prepared.

d. A cultural resources survey of the subject levee item was conducted in 1982, by New World Research, Inc., under contract to the New Orleans District, U.S. Army Corps of Engineers. No significant cultural resources were located in the project impact zone. The survey report was coordinated with the Louisiana SHPO and he concurred with the survey findings. No further cultural resources investigation is necessary.

3. In accordance with LMVED-TS letter dated 5 February 1981, this report has been reviewed by the District Security Officer. There were no review comments to be incorporated in the report.

CELMN-ED-SP
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

4. This report is being submitted as scheduled. The current program calls for construction award in October 1987; therefore, a prompt review and approval of this General Design Memorandum is required.

5. Approval of the report as a basis for preparation of plans and specifications is recommended.

LLOYD K. BROWN
Colonel, CE
Commanding

Encl (16 cys) fwd sep

CELMV-ED-TD (CELMN-ED-SP/14 Jul 87) 1st End Mr. Bardwell/bj/5925
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39180-0080

26 AUG 87

FOR: Commander, New Orleans District, ATTN: CELMN-ED-SP

The subject design memorandum is approved subject to the resolution of the following comments:

a. Para 40b(7) and Plate 12. It is noted that a 24-in. gabion blanket is recommended for foreshore protection between Stas 173+04.7 to 178+74.7 W/L. We question the use of this type of protection in a saltwater environment and also in an area of frequent waves. A wave attack on a gabion field will move the small stones that are within the baskets which will result in the wearing away of any type of corrosion protection on the wire. The Old River gabion field has experienced blanket wire deterioration due to stone wear during overbank structure operation. Once the corrosion protection is removed, rapid basket deterioration will occur. Therefore, an alternative (grouted riprap, larger riprap, or a concrete blanket) should be used in lieu of the gabions.

b. Para 44 and Plate 15 and Table 6.

(1) The existing and restored shell access road should be shown on the typical cross section, Plate 15.

(2) The cost for the restoration of the access road should be shown on Table 6.

c. Para 70. The reevaluation study referenced in this paragraph was dated Jul 84 and the price levels used in this reevaluation study were 1981 rather than 1983.

d. Plates 18 and 19. The proposed I-wall alternative design shown on these plates consists of degrading the existing levee, filling the adjacent canal with uncompacted fill, relocating the canal, and constructing a levee/I-wall on the uncompacted fill. This alternative is obviously prohibitively expensive, and in addition, construction would be difficult. The most desirable and economical I-wall design would be to degrade the existing levee to the maximum extent possible, construct an I-wall near the existing sheetpile alignment, and add protected side stability berms as necessary. We understand that this design alternative was not pursued since protected side rights-of-way constraints precluded berm construction. In order to determine the least costly alternative you should perform the structural and stability analyses for the I-wall constructed on the existing levee crown with a protected side berm. The cost for this alternative, including rights-of-way, should be compared with the proposed T-wall design on a reach by reach basis.

CELMV-ED-TD (CELMN-ED-SP/14 Jul 87) 1st End 26 AUG '87
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

e. Plate 44. Based on this analysis, it appears that an I-wall, constructed along the same alignment or slightly to the floodside of the T-wall with the levee degraded to el +3, could be constructed without a protected side stability berm. If this is the case, an I-wall should be constructed between base line Stas 74+00 and 140+00.

f. Plates 44-53. If not previously accomplished, the shear strengths shown on these plates should be examined to ensure that the use of these strengths does not result in factors of safety less than one using existing ground profiles and maximum past flood levels.

g. Para 46. Considering the relatively short fetch across the parish line canal and the heavily wooded swamp west of the canal, the need for the 5-ft band of 24-in. thick riprap should be reconsidered. In our opinion a 5-ft strip of solid turf in place of the riprap and the returfed floodside work area will adequately protect the structure from Stas 0+00 W/L to 156+72.90 W/L.

FOR THE COMMANDER:

for William K. Hill
FRED H. BAYLEY III
Chief, Engineering Division

Encl wd

CF w encl: 2
CEEC-EB (1 cys)

ESTIMATE OF COST

65. General. Based on October 1987 price levels, the estimated first cost for construction of the Jefferson/St. Charles return levee high level plan is $26,900,000. Of this cost, $22,000,000 is required for the Levees and Floodwall feature, $2,600,000 for Engineering and Design, and 2,200,000 for Supervision and Administration and $36,000 for lands and damages. The detailed estimate of first cost is shown in Table 6.

TABLE 6
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A

ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price $	Estimated Amount $
	LANDS AND DAMAGES				
A.	FLOODWALL - WEST ESPLANADE TO LAKEFRONT (STA. 95+00 W/L to STA. 181+35.5 W/L)				
01	Lands and Damages				
	Perpetual Levee Rights-of-Way Potential Residential	.25	ACRE	$100,000	25,000
	Improvements				0
	Severance Damage				0
	SUBTOTAL				$25,000
	Contingencies, 25% (R)				6,000
	Acquisition Cost (Estimated 2 tracts)				
	Non-Federal 2 @ $1,400 per tract				3,000
	Federal				2,000
	PL-91-646				0
	TOTAL, LANDS AND DAMAGES				$36,000

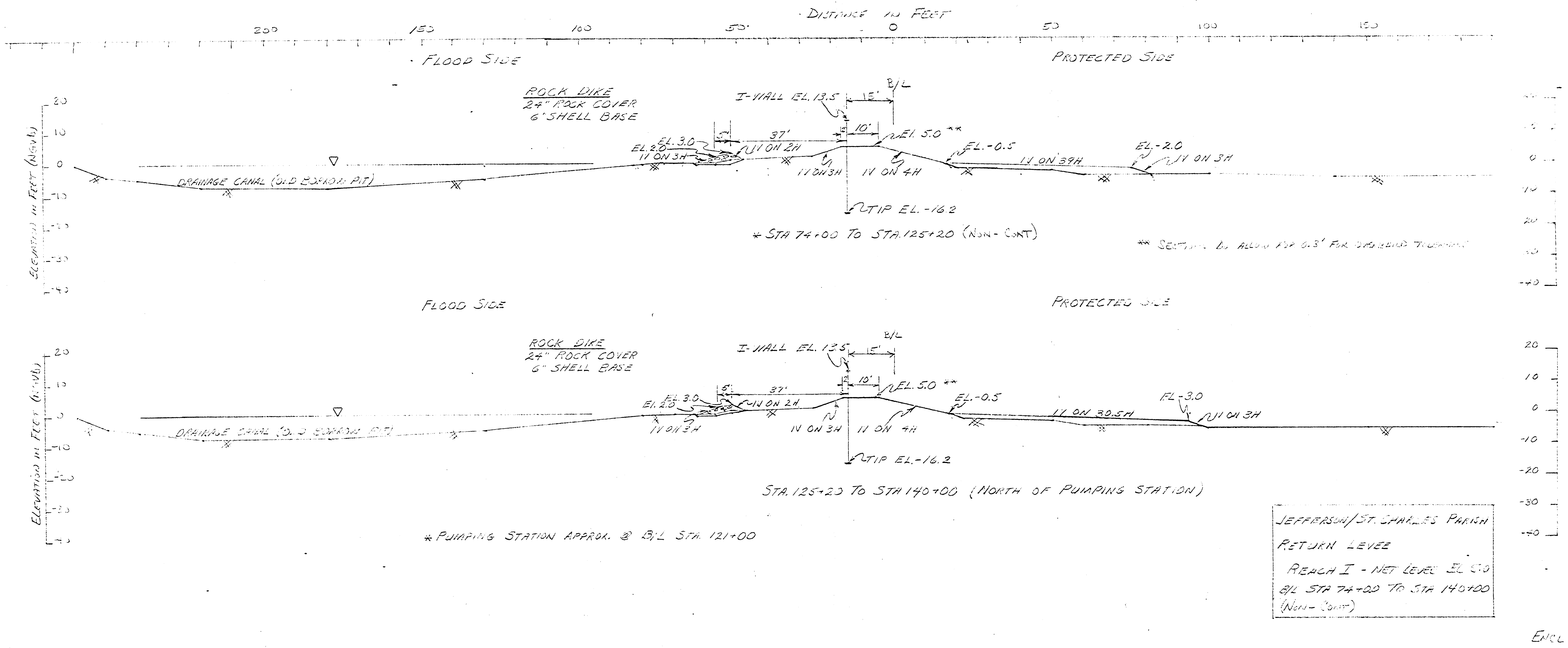
Encl. 2

TABLE 6 (Continued)
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A
ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
	CONSTRUCTION				
B.	FLOODWALL - AIRPORT TO WEST ESPLANADE (STA. 0+00 W/L TO STA. 95+00 W/L)				
11	Levees and Floodwalls				
	Mobilization & Demobilization	1	JOB	50,000.00	50,000
	Clearing & Grubbing	19	ACRE	1,000.00	19,000
	Fertilizing & Seeding	17	ACRE	400.00	6,800
	Temporary Earth Dike	1,800	C.Y.	2.00	3,600
	Levee Fill (Semi-Compacted)	3,000	C.Y.	1.60	4,800
	Levee Excavation (Haul to Lakefront Levee-Reach A)	49,200	C.Y.	4.00	196,800
	Filter Fabric	6,160	S.Y.	2.00	12,320
	Shell (Uncompacted)	1,510	C.Y.	25.00	37,750
	Riprap	4,100	TONS	20.00	82,000
	Shell Access Road	10,500	C.Y.	20.00	210,000
	Structural Excavation	10,830	C.Y.	6.00	64,980
	Structural Backfill	4,100	C.Y.	8.50	34,850
	Frodingham B1 Sections -Driving Existing Sht Pile	63,300	S.F.	2.25	142,425
	Frodingham B1 Sections -Pulling & Redriving Existing	47,700	S.F.	4.25	202,725
	Frodingham B1 Sections -Driving Existing @ I-10	1,800	S.F.	7.00	12,600
	-Splicing @ I-10, 2 Per Pile	113	EA	500.00	56,500
	Frodingham B1 Fabricated Corners	80	S.F.	50.00	4,000
	PZ-22 Steel Sheet Piling	24,500	S.F.	11.50	281,750
	Compression Pile Test	2	EA	18,000.00	36,000
	Additional Compression Pile Test	2	EA	14,000.00	28,000
	Tension Pile Test	2	EA	19,000.00	38,000
	Additional Tension Pile Test	2	EA	14,000.00	28,000
	12" X 12" Prestrsd Conc Piling	132,270	L.F.	18.00	2,380,860
	14" X 14" Prestrsd Conc Piling	74,000	L.F.	22.00	1,628,000
	Conc in Stab Slab	240	C.Y.	70.00	16,800
	Conc in T-Wall Base	6,850	C.Y.	200.00	1,370,000
	Conc in T-Wall Stem	4,700	C.Y.	350.00	1,645,000
	Conc in I-Walls	145	C.Y.	350.00	50,750
	Waterstops, 3-Bulb Type	4,900	L.F.	10.00	49,000
	Waterproof Finish (Prot side)	103,100	S.F.	1.00	103,100
	Planting of Shrubbery	1,585	Plant	15.00	23,775
	SUBTOTAL				$ 8,820,185
	CONTINGENCIES (20%±)				$ 1,763,815
	TOTAL, CONSTRUCTION (R)				$10,584,000
30	Engineering and Design (12%±)				$ 1,270,000
31	Supervision and Administration (10%±)				$ 1,058,000
	TOTAL COST				$12,912,000

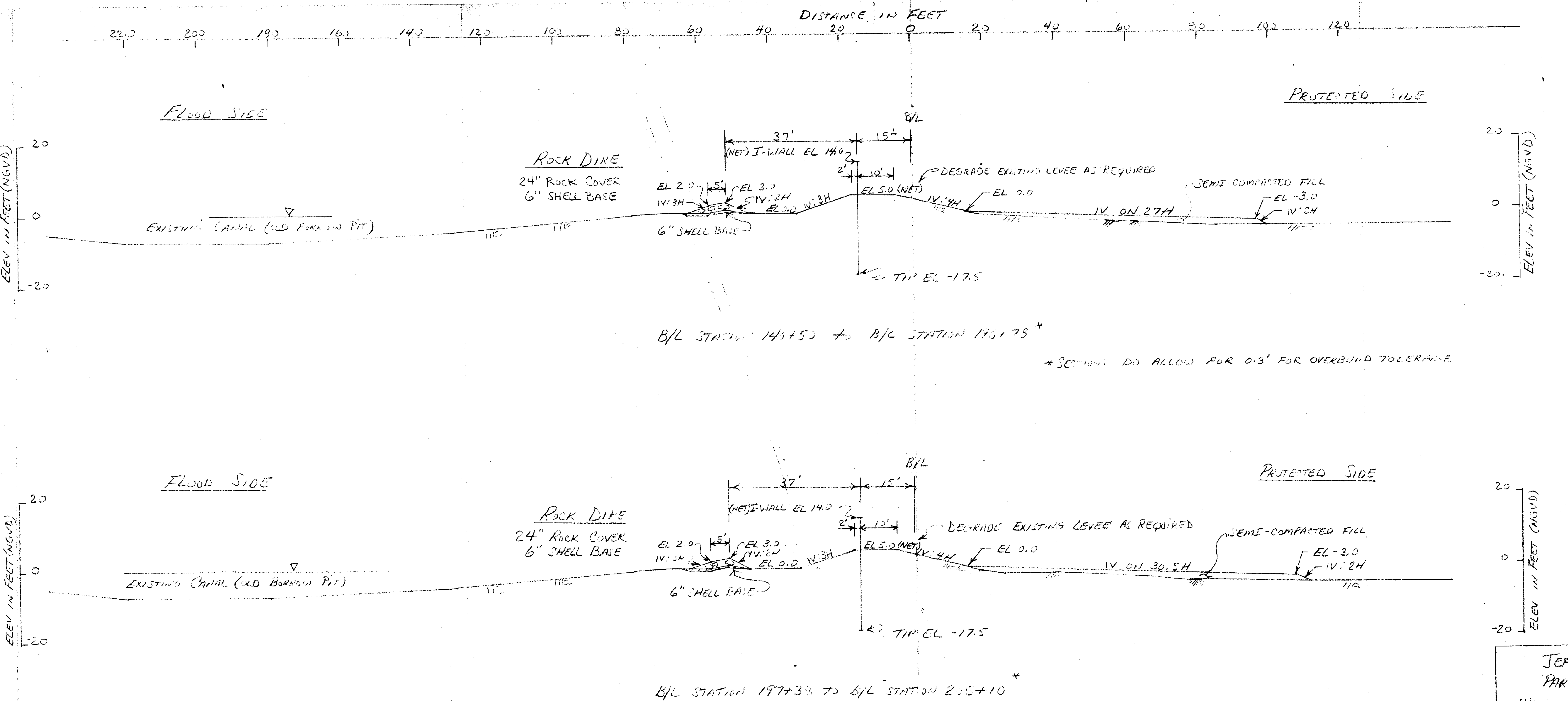
TABLE 6 (CONTINUED)
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A
ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
	CONSTRUCTION				
C.	FLOODWALL - WEST ESPLANADE TO LAKEFRONT (STA. 95+00 W/L TO STA. 181+35.5 W/L)				
11	Levees and Floodwalls				
	Mobilization & Demobilization	1	JOB	50,000.00	50,000
	Clearing & Grubbing	21	ACRE	1,000.00	21,000
	Fertilizing & Seeding	19	ACRE	400.00	7,600
	Temporary Earth Dike	5,300	C.Y.	2.00	10,600
	Levee Fill (Semi-Compacted)	16,000	C.Y.	1.60	25,600
	Levee Excavation (Haul to Lakefront Levee-Reach A)	36,500	C.Y.	4.00	146,000
	Filter Fabric	9,245	S.Y.	2.00	18,490
	Shell (Uncompacted)	965	C.Y.	25.00	24,125
	Riprap	6,600	TONS	20.00	132,000
	Shell Access Road	9,600	C.Y.	20.00	192,000
	Structural Excavation	5,010	C.Y.	6.00	30,060
	Structural Backfill	2,440	C.Y.	8.50	20,740
	Frodingham B1 Sections				
	-Pulling Existing Piling	22,400	S.F.	2.00	44,800
	-Pulling & Redriving Existing	113,300	S.F.	4.25	481,525
	Frodingham B1 Fabricated Corners	110	S.F.	50.00	5,500
	PZ-22 Steel Sheet Piling	41,430	S.F.	11.50	476,445
	Steel Sheet Piling PZ-27	17,580	L.F.	12.50	219,750
	Compression Pile Test	1	EA	18,000.00	18,000
	Additional Compression Pile Test	1	EA	14,000.00	14,000
	Tension Pile Test	1	EA	19,000.00	19,000
	Additional Tension Pile Test	1	EA	14,000.00	14,000
	14" X 14" Prestrsd Conc Piling	200,420	L.F.	22.00	4,409,240
	Conc in Stab Slab	1,365	C.Y.	70.00	95,550
	Conc in T-Wall Base	5,535	C.Y.	200.00	1,107,000
	Conc in T-Wall Stem	4,135	C.Y.	350.00	1,447,250
	Conc in I-Walls	946	C.Y.	350.00	331,100
	Waterstops, 3-Bulb Type	4,695	L.F.	10.00	46,950
	Waterproof Finish (Prot side)	107,950	S.F.	1.00	107,950
	Planting of Shrubbery	1,415	Plant	15.00	21,225
	SUBTOTAL				$ 9,537,500
	CONTINGENCIES (20%±)				$ 1,907,500
	TOTAL, CONSTRUCTION (R)				$11,445,000
30	Engineering and Design (12%±)				$ 1,373,000
31	Supervision and Administration (10%±)				$ 1,145,000
	TOTAL COST				$13,963,000



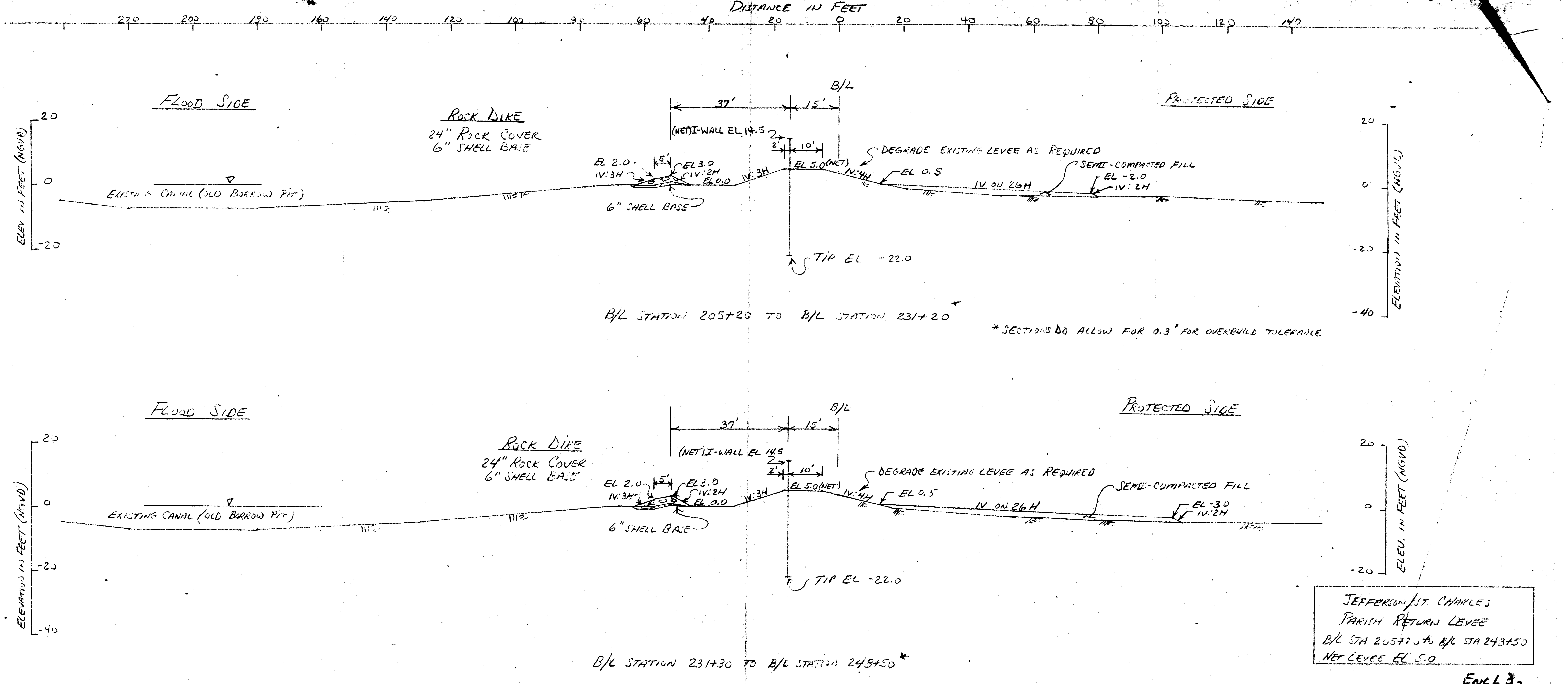
DISTANCE IN FEET
FLOOD SIDE
PROTECTED SIDE
ROCK DIKE
24" ROCK COVER
6" SHELL BASE
I-WALL EL. 13.5
15'
B/L
10'
37'
EL. 3.0
EL. 2.0
1V ON 3H
1V ON 2H
EL. 5.0 **
EL. -0.5
1V ON 39H
EL. -2.0
1V ON 3H
1V ON 3H
1V ON 4H
DRAINAGE CANAL (OLD BORROW PIT)
TIP EL. -16.2
* STA 74+00 TO STA. 125+20 (NON-CONT)
ELEVATION IN FEET (NGVD)
FLOOD SIDE
PROTECTED SIDE
ROCK DIKE
24" ROCK COVER
6" SHELL BASE
I-WALL EL. 13.5
15'
B/L
10'
37'
EL. 3.0
EL. 2.0
1V ON 2H
EL. 5.0 **
EL. -0.5
1V ON 30.5H
EL. -3.0
1V ON 3H
1V ON 3H
1V ON 3H
1V ON 4H
DRAINAGE CANAL (OLD BORROW PIT)
TIP EL. -16.2
STA. 125+20 TO STA 140+00 (NORTH OF PUMPING STATION)
ELEVATION IN FEET (NGVD)
ELEVATION NGVD
* PUMPING STATION APPROX. @ B/L STA. 121+00
JEFFERSON/ST. CHARLES PARISH
RETURN LEVEE
REACH I - NET LEVEE EL 5.0
B/L STA 74+00 TO STA 140+00
(NON-CONT)

ENCL 3,



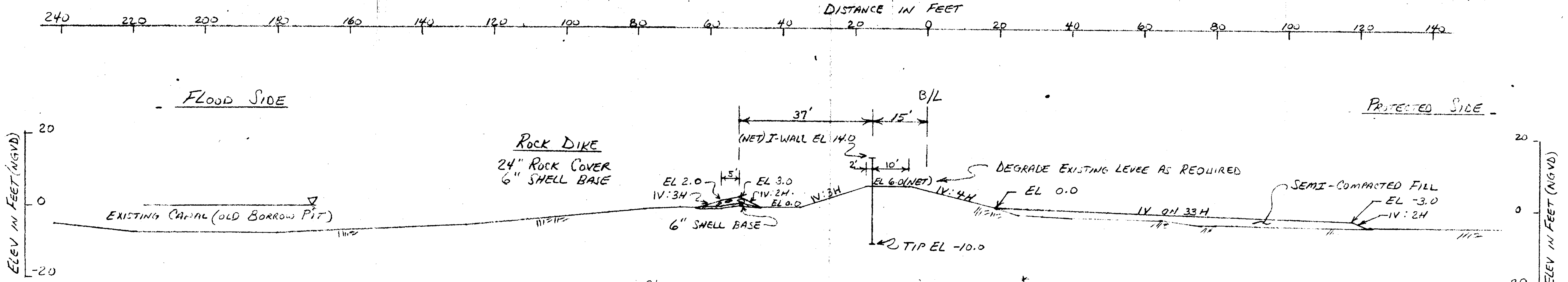
JEFFERSON/ST. CHARLES PARISH RETURN LEVEE
B/L STA. 141+50 to B/L STA. 205+10
NET LEVEE EL 5.0 30 SEPT 97

Encl 3[2]



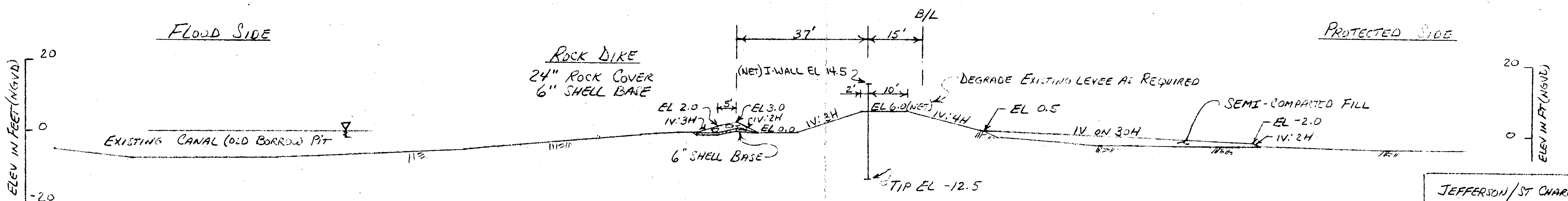
JEFFERSON/ST CHARLES
PARISH RETURN LEVEE
B/L STA 205+20 to B/L STA 248+50
NET LEVEE EL 5.0

ENCL 3



B/L STATION 197+38 to B/L STATION 205+10*

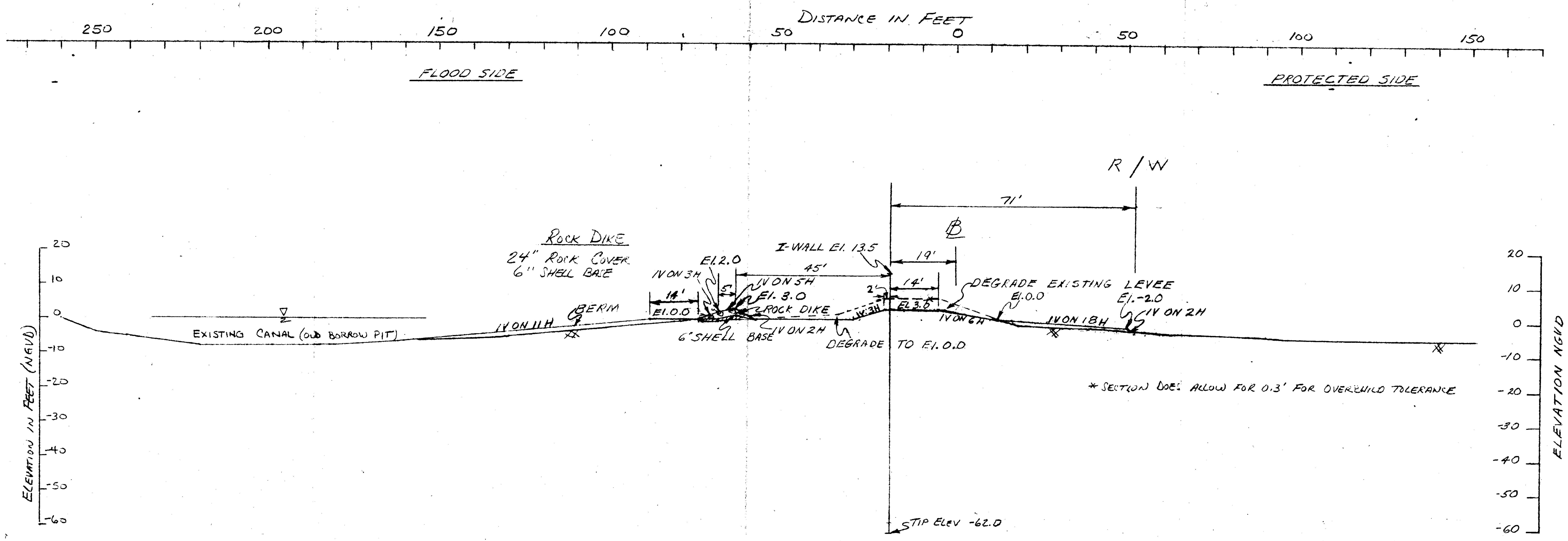
*SECTIONS DO ALLOW FOR 0.3' FOR OVERBUILD TOLERANCE



B/L STATION 205+20 to B/L STATION 231+20*

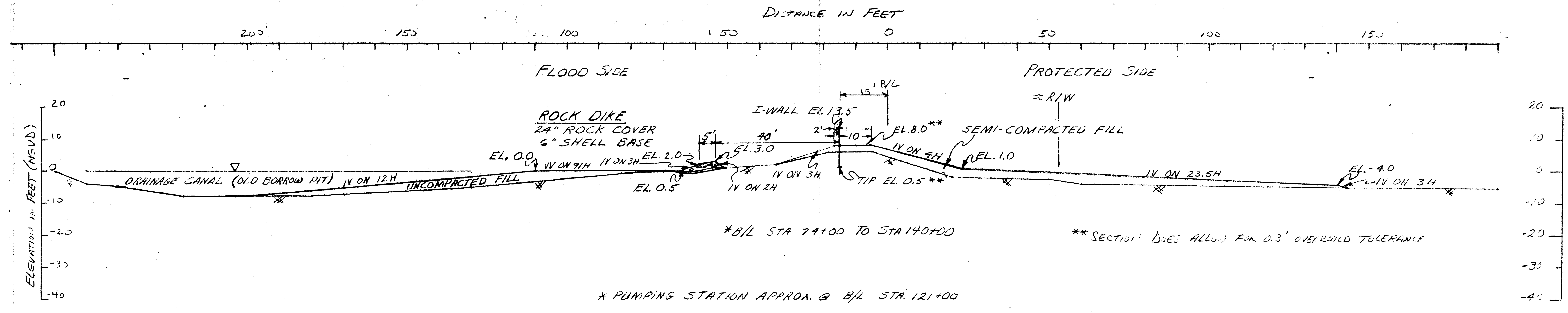
JEFFERSON/ST CHARLES PARISH
RETURN LEVEE - I WALL
NET LEVEE EL 6.0
B/L STA 197+38 to STA 231+20

ENCL 34



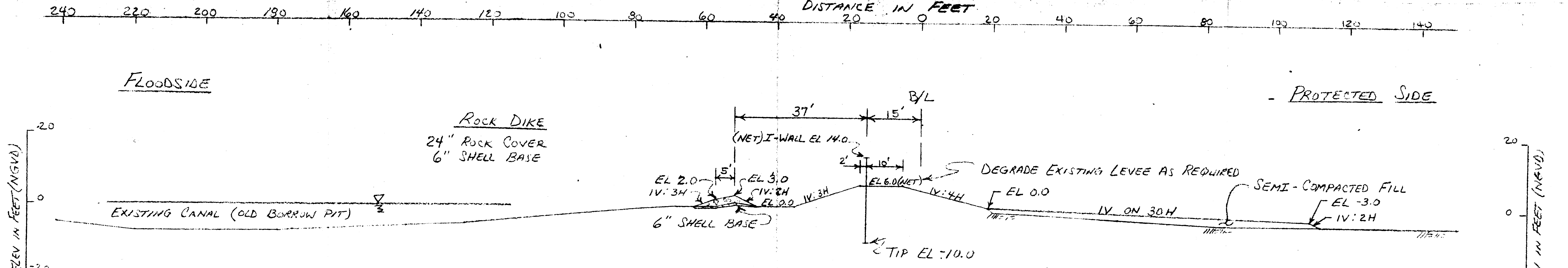
JEFFERSON / ST. CHARLES
PARISH - RETURN LEVEE
NET LEVEE EL 3.0
B/L STA. 74+00 to STA 140+00
(NON-CONT) SEPT 87

ENCL 3s



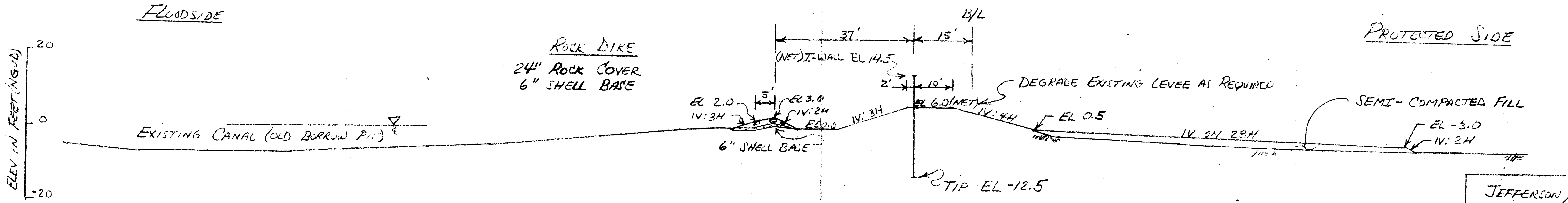
JEFFERSON/ST CHARLES PARISH
RETURN LEVEE
REACH I - NET LEVEE EL 8.0
B/L STA. 74+00 TO STA 140+00

ENCL 36



B/L STATION 140+50 TO B/L STATION 196+78*

*SECTIONS DO ALLOW FOR 0.2' FOR OVERBUILD TOLERANCE



B/L STATION 231+30 TO B/L STATION 248+50*

JEFFERSON / ST CHARLES PARISH
RETURN LEVEE - I WALL
NET LEVEE EL 6.0
B/L STA 140+50 TO STA 196+78
& B/L STA 231+30 TO STA 248+50
9 OCT 87

ENCL 3₇

66. Comparison of Estimates. The current estimate of $26,836,000 for the high level plan Jefferson/St. Charles Return Levee represents a decrease of $713,000 when compared to the cost contained in the current PB-3 effective 1 October 1987. The PB-3 estimate is based on survey scope estimates contained in the "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project, Reevaluation Study", dated July 1984. Estimates contained in the reevaluation report were published at October 1983 levels. These estimates were indexed to October 1987 levels for the current PB-3. The decrease in cost shown in Table 7 is explained in the following subparagraphs:

Table 7
COMPARISON OF ESTIMATES
(Remaining Costs)
High Level Reevaluation Study
New Orleans, La.

	Feature	PB-3 (eff Oct 87)	GDM (Oct 87 Prices)	Difference GDM and PB-3
11	LEVEES & FLOODWALLS	$22,549,000	$22,000,000	-$549,000
30	ENGINEERING & DESIGN	2,700,000	2,600,000	-$100,000
31	SUPERVISION & ADMINISTRATION	2,300,000	2,200,000	-$100,000
	SUBTOTAL	$27,549,000	$26,800,000	-$749,000
01	LANDS & DAMAGES	-	36,000	+$ 36,000
02	RELOCATIONS	-	-	-
	TOTAL PROJECT COST	$27,549,000	$ 26,836,000	-$713,000

a. Levee and Floodwall. The net decrease in the levee and floodwall account of $549,000 is due to several factors. As stated above, the PB-3 estimate is based on a survey scope estimate contained in the "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project, Reevaluation Study". This report recommends an I-wall in the levee alternative as the "tentatively selected" plan. The length of floodwall covered by the Reevaluation Study is approximately 4,100 feet longer than the floodwall reach covered in this memorandum. Therefore, it is not possible at this time to make a detailed comparison between the PB-3 estimate and the plan contained herein; however, an approximate estimate can be obtained by prorating the levee cost on a cost/ft basis. Using this procedure, a more realistic comparison in cost is obtained. The prorated increase in cost is approximately $4.1 million. The plan detailed in this memorandum is a T-Wall in levee plan which is the most cost effective plan that provides Standard Project Hurricane protection. A discussion of alternative plans investigated during the preparation of this Design Memorandum is contained in paragraph 47.

Encl 4

b. Engineering and Design. Table 7 shows a difference of $100,000 in E&D cost between the PB-3 estimate and the cost for Engineering and Design for work detailed in this memorandum. As explained in subparagraph a. above, since the two estimates are not based on the same physical coverage, the decrease in cost for the E&D account is also misleading. An approximate estimate for the real increase in E&D cost can also be made using the same prorating procedure as used for the Levees & Floodwalls account. The prorated increase in E&D is estimated to be approximately $500,000. The $2.6 million cost for E&D results from recomputing the E&D cost based on analysis of work required rather than by using a fixed percentage of construction cost.

c. Supervision and Administration. As with the E&D comparison made in subparagraph b. above, an approximate comparison of cost can only be made by comparing the cost on the same physical work basis. The prorated increase in S&A, obtained in a similar manner as in subparagraphs a. and b. above, is estimated to be approximately $400,000. An increase in S&A should be expected with a change from a relatively simple I-wall construction plan to more complex T-Wall type construction.

d. Lands and Damages. An increase of $36,000 for lands and damages estimated cost is due to the recommendation that an I-wall in levee be built between sta. 199+20 B/L and sta. 203+01.1 B/L. Additional rights-of-way are required to construct a required protected side stability berm. The PB-3 (Reevaluation Study) plan of protection calls for a flood side shift in the alignment of the proposed floodwall in levee. No additional protected side rights-of-way were anticipated under the PB-3 plan.

67. Schedule for Design and Construction. The sequence of contracts and schedules are as follows:

TABLE 8
SCHEDULE FOR DESIGN AND CONSTRUCTION

Contracts	Plans & Specs		Construction			Estimated Construction Cost 1/
	Start	Complete	Adver.	Award	Complete	$
Airport to West Esplanade Ave Floodwall	Oct 87	Mar 88	Apr 88	May 88	Jul 90	11,536,000
West Esplanade Ave to Lakefront Floodwall	Jun 88	Oct 88	Apr 89	May 89	Nov 91	12,476,000

1/ This cost includes contingencies, Federal and Non-Federal construction costs, and Federal and Non-Federal supervision and inspection (S & I) costs (S & I costs constitute 90% of the supervision and administration costs).

68. Funds Required by Fiscal Year. To maintain the schedule for design and construction of the levees and floodwalls for the Jefferson Parish Return Levee, Federal funds will be required by fiscal years as follows:

TABLE 9

FEDERAL FUNDING BY FISCAL YEAR[1]/

Funds Required	FY 87	$ 600,000
Funds Required	FY 88	2,300,000
Funds Required	FY 89	8,700,000
Funds Required	FY 90	9,300,000
Funds Required	FY 91	3,600,000
Funds Required	FY 92	600,000
TOTAL		25,100,000

1/ Federal funding schedule takes into account surplus credits that local interest has accrued for work at the four lakefront pumping stations.

OPERATION AND MAINTENANCE

69. General. The Jefferson/St. Charles return levee will be maintained and operated at the expense of local interests as a feature of local cooperation for the project. The estimate of the annual operation and maintenance costs for the levee and floodwall features which are detailed in this GDM are as follows:

a. Levee Maintenance (46 acres)	$ 5,000	per year
b. Floodwall Maintenance (3.43 miles)	10,000	per year
Total	$15,000	per year

ECONOMICS

70. Economic Justification. The current economic analysis for the entire Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project is contained in the Reevaluation Study entitled "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project", dated December 1983. Based on October 1983 price levels, and at the project interest rate of 3 1/8 percent, the benefit-cost ratio for the project as a whole is 4.2 to 1. The Reevaluation Study also breaks out separable project areas (SPA) for incremental justification. The New Orleans Lakefront reach is a part of the New Orleans-Jefferson SPA. The computed benefit-cost ratio for the New Orleans-Jefferson area is 5.0 to 1.

FEDERAL AND NON-FEDERAL COST BREAKDOWN

71. Federal and Non-Federal Cost Breakdown. The breakdown of Federal and non-Federal costs for the high level plan construction work described in this GDM are shown in Table 10 below:

Table 10
FEDERAL AND NON-FEDERAL COST BREAKDOWN
OCT 87 PRICE LEVELS

Item	Federal	Non-Federal	Total
Levees & Floodwalls	$18,813,000	$8,062,000 1/	$26,875,000
Lands & Damages	$ 2,000	34,000 2/	$ 36,000
Relocations	———	2/	———
TOTAL	$18,815,000	$8,096,000	$26,911,000

1/ Includes Sunk cost estimated to be $343,000 for constructing the fronting protection for the Parish Line Canal Pumping Station, a creditable item of work accomplished by local interests.

2/ The additional rights-of-way required are limited to .25 Acres between sta. 199+20 B/L and sta. 203+01.1 B/L. All other rights-of-way were in existence at the time of the authorization for the Lake Pontchartrain project. No relocations are required to construct the floodwall reach detailed in this GDM.

RECOMMENDATIONS

72. Recommendations. The plan of improvement for the high level plan presented herein consists of 3.43 miles of floodwall construction along the Jefferson/St. Charles Parish return levee. This plan is considered to be the most economical means of providing high level plan, SPH - project protection and is recommended for approval as a basis for preparing plans and specifications for this project reach.

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:
CELMN-ED-SP

14 July 1987

MEMORANDUM FOR: Commander, Lower Mississippi Valley Division, ATTN: CELMVED-TD

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

1. The subject design memorandum is submitted for review and approval, and has been prepared generally in accordance with the provisions of ER 1110-2-1150, dated 15 November 1984.

2. A summary of the current status of the Clean Water Act, endangered species, EIS, and cultural resources investigations is as follows:

a. Since there is no deposition of dredged or fill material into water of the U.S. with the subject work, no Section 404(b)(1) Evaluation or Water Quality Certificate is necessary.

b. Based on studies and investigations at this stage of design, the proposed action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species.

c. A final EIS for the barrier plan for the subject project was filed with CEQ on 17 January 1975. A final supplement to this EIS was filed with EPA on 7 December 1984. This supplement addressed the impacts associated with raising the height of the subject levee with hydraulic fill on the existing levee. The proposed floodwall work detailed in this GDM has fewer environmental damages than those described in the EIS Supplement, thus, no new environmental document will be prepared.

d. A cultural resources survey of the subject levee item was conducted in 1982, by New World Research, Inc., under contract to the New Orleans District, U.S. Army Corps of Engineers. No significant cultural resources were located in the project impact zone. The survey report was coordinated with the Louisiana SHPO and he concurred with the survey findings. No further cultural resources investigation is necessary.

3. In accordance with LMVED-TS letter dated 5 February 1981, this report has been reviewed by the District Security Officer. There were no review comments to be incorporated in the report.

CELMN-ED-SP
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, High Level Plan, Design Memorandum No. 17A - General Design, Jefferson Parish/St. Charles Parish Return Levee

4. This report is being submitted as scheduled. The current program calls for construction award in October 1987; therefore, a prompt review and approval of this General Design Memorandum is required.

5. Approval of the report as a basis for preparation of plans and specifications is recommended.

LLOYD K. BROWN
Colonel, CE
Commanding

Encl (16 cys) fwd sep

LEGEND

EXISTING IMPROVEMENTS

- LEVEE
- SEAWALL

AUTHORIZED IMPROVEMENTS

- NEW LEVEE
- ENLARGEMENT OF EXISTING LEVEE
- FLOODWALL IN EXISTING LEVEE
- SEAWALL STRENGTHENING
- DRAINAGE STRUCTURE
- STRUCTURE-NAVIGABLE
- PUMPING STATION
- PROJECT GRADES
- LEVEE STATION
- PARISH LINE
- STATE LINE
- LOCATION OF WORK COVERED IN THIS DOCUMENT

SCALE OF MILES
1 0 1 2 3 4 5

LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION

AUTHORIZED PLAN OF PROTECTION

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

FILE NO. H-4-29540

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A - GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH RETURN LEVEE

STATUS OF DESIGN MEMORANDUMS

Design Memo No.	Title	Status
1	Hydrology and Hydraulic Analysis	
	Part I - Chalmette	Approved 27 Oct 66
	Part II - Barrier	Approved 18 Oct 67
	Part III - Lakeshore	Approved 6 Mar 69
	Part IV - Chalmette Extension	Approved 1 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Advance Supplement, Inner Harbor Navigation Canal Levees	Approved 31 May 67
2	Lake Pontchartrain Barrier Plan, GDM, Citrus Back Levee	Approved 29 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 1, Lake Pontchartrain Barrier, Rigolets Control Structure, Closure Dam, and Adjoining Levees	Approved 10 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 2, Lake Pontchartrain Barrier, Rigolets Lock and Adjoining Levees	Approved 19 Sep 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 3, Lake Pontchartrain Barrier, Chef Menteur Pass Complex	Approved 19 Sep 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 4, New Orleans East Back Levees	Approved 18 Aug 71

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5, Orleans Parish Lakefront Levees - West of IHNC	1/
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5A, Citrus Lakefront Levees - IHNC to Paris Road	Approved 12 Jul 76
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5B, New Orleans East Lakefront Levees - Paris Road to South Point	Approved 5 Dec 72
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5C, Orleans Parish Outfall Canals, West of the IHNC	1/
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5D, Orleans Parish Lakefront Levees, Orleans Marina	Approved 24 May 78
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 6, St. Charles Parish Lakefront Levees	Approved 4 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 7, St. Tammany Parish, Mandeville Seawall	1/
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 8, IHNC Remaining Levees	Approved 6 Jun 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 9, New Orleans East Levee from South Point to GIWW	Approved 1 May 73

1/ This Design Memorandum is no longer applicable due to the recommended change from a Barrier Plan of protection to a High Level Plan of protection. A High Level Plan Design Memorandum will be prepared for this project feature.

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 10, Jefferson Parish Lakefront Levees	1/
3	Chalmette Area Plan, GDM	Approved 31 Jan 67
3	Chalmette Area Plan, GDM, Supplement No. 1, Chalmette Extension	Approved 31 Jan 67
4	Lake Pontchartrain Barrier Plan, and Chalmette Area Plan, GDM, Florida Avenue Complex, IHNC	Approved 31 Oct 80
5	Chalmette Area Plan, DDM, Bayous Bienvenue and Dupre Control Structures	Approved 29 Oct 68
6	Lake Pontchartrain Barrier Plan, DDM, Rigolets Control Structure and Closure	2/
7	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Control Structure and Closure	2/
8	Lake Pontchartrain Barrier Plan, DDM, Rigolets Lock	Approved 20 Dec 73
9	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Navigation Structure	2/
10	Lake Pontchartrain Barrier Plan, Corrosion Protection	Approved 21 May 69
12	Sources of Construction Materials	Approved 30 Aug 66

1/ This Design Memorandum is no longer applicable due to the recommended change from a Barrier Plan of protection to a High Level Plan of protection. A High Level Plan Design Memorandum will be prepared for this project feature.

2/ Due to the recommendation for a change from the Barrier Plan of protection to a High Level plan of protection, this Detailed Design Memorandum is no longer applicable.

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
1	Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River - Gulf Outlet, Louisiana, GDM, Seabrook Lock	Approved 4 Nov 70
2	Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River - Gulf Outlet, Louisiana, DDM, Seabrook Lock	Approved 17 Apr 81
Report	Lake Pontchartrain Barrier Plan, Seabrook Lock Breakwater	3/
12	Lake Pontchartrain and Vicinity, Louisiana, Sources of Construction Materials (Revised)	Approved 23 Oct 79
13	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Parish Lakefront Levee West of IHNC	Approved Feb 85
13	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Parish Lakefront Levee West of IHNC - Supplement No. 1 - Orleans Marina Floodwall	unscheduled
14	Lake Pontchartrain, La. & Vicinity High Level Plan, Citrus Lakefront Levee IHNC to Paris Road	Approved 11 Oct 84
14	Lake Pontchartrain, La. & Vicinity, High Level Plan, Citrus Lakefront Levee IHNC to Paris Road - Supplement No. 1 - New Orleans Lakefront Airport and Lincoln Beach	unscheduled

3/ Since the Seabrook Lock is a part of the Barrier Plan of protection and it has been recommended to construct a High Level Plan, the need for Seabrook Lock under the High Level Plan is not required. However, construction of Seabrook Lock under the Mississippi River-Gulf Outlet project remains an unresolved issue at this time.

STATUS OF DESIGN MEMORANDUMS (cont'd)

Design Memo No.	Title	Status
15	Lake Pontchartrain, La. & Vicinity, High Level Plan, New Orleans East Lakefront Levee, Paris Road to South Point	Approved 19 Jun 85
16	Lake Pontchartrain, La. & Vicinity, High Level Plan, New Orleans East Levee, South Point to GIWW	Scheduled Sep 87
17	Lake Pontchartrain, La. & Vicinity, High Level Plan, Jefferson Parish Lakefront Levee	Scheduled Aug 87
17A	Lake Pontchartrain, La. & Vicinity, High Level Plan, Jefferson - St. Charles Return Levee	Submitted Jul 87
18	Lake Pontchartrain, La. & Vicinity, High Level Plan, St. Charles Parish Levee (North of Airline Highway Alignment)	Scheduled Jun 88
19	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Avenue Outfall Canal	Scheduled Aug 87
19A	Lake Pontchartrain, La. & Vicinity, High Level Plan, London Avenue Outfall Canal	Scheduled Apr 88
20	Lake Pontchartrain, La. & Vicinity, High Level Plan, 17th Street Outfall Canal	Scheduled Nov 87
21	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Parish Outfall Canal, Detailed Design Memorandum (London Avenue Canal)	Scheduled Sep 89
22	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Parish Outfall Canal, Detailed Design Memorandum (Orleans Avenue Canal)	Scheduled Jan 89
23	Lake Pontchartrain, La. & Vicinity, High Level Plan, Orleans Parish Outfall Canal, Detailed Design Memorandum (17th Street Canal)	Unscheduled

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A - GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH RETURN LEVEE

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LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A-GENERAL DESIGN
JEFFERSON/ST. CHARLES RETURN LEVEE

PERTINENT DATA

Location of Project		Southeastern Louisiana in Jefferson Parish, from the south shore of Lake Pontchartrain to the proposed New Orleans International Airport runway extension into St. Charles Parish.
Purpose of Project		To protect developed areas in the western portion of Jefferson Parish from tidal surges (emanating from St. Charles Parish and Lake Pontchartrain) generated by standard project hurricanes.
Datum Plane		National Geodetic Vertical Datum (NGVD)[1]
Climatologic Data		
Temperature	Monthly means	
	Maximum	82.1 Degrees Fahrenheit
	Minimum	52.4 Degrees Fahrenheit
	Annual Normal	68.2 Degrees Fahrenheit
Annual Precipitation		
	Maximum	83.54 Inches
	Minimum	39.0 Inches
	Annual Normal	59.74 Inches
Hydraulic Design Criteria - Tidal		
Design Hurricane		
Central Pressure Index (CPI)		27.6 Inches of Mercury
Maximum 5-Minute Average Wind Speed		100 M.P.H.
Radius of Maximum Winds		30 Nautical Miles
Average Forward Speed		6 Knots
Stillwater Level		11.5 Feet

[1] Elevations herein are in feet referred to National Geodetic Vertical Datum of 1929 (NGVD) unless otherwise noted.

PERTINENT DATA (cont'd.)

Levees	
Method of Construction	Degrading and Reshaping of Existing Levee
Levee Length (approximate)	3.5 Miles
Crown Elevation	3.0 Feet
Floodwalls	
Top Elevation (T-wall)	13.0 to 13.5 to 14.0 to 14.5 to 20.0 Feet
Top Elevation (I-wall)	11.5 to 13.5 feet
Estimated first cost	
Federal	$19,320,000
Non-Federal	$ 8,280,000
Total	$27,600,000
Economics	
Benefit-to-cost ratio (project)	4.2 to 1
Benefit-to-cost ratio (New Orleans-Jefferson separable project area)	5.0 to 1

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A - GENERAL DESIGN
JEFFERSON/ST. CHARLES
RETURN LEVEE

PROJECT AUTHORIZATION

1. Authority.

a. Public Law. Public Law 298, 89th Congress, 1st Session, approved 27 October 1965, authorized the "Lake Pontchartrain, Louisiana, and Vicinity, Hurricane Protection Project," substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 231, 89th Congress, 1st Session, except that the recommendations of the Secretary of the Army in that document shall apply with respect to the Seabrook Lock feature of the project.

b. House Document. The report of the Chief of Engineers dated 4 March 1964 printed in House Document No. 231, 89th Congress, 1st Session, submitted for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers and the concurring report of the Mississippi River Commission for those areas under its jurisdiction. The report of the Board of Engineers for Rivers and Harbors stated: "For protection from hurricane flood levels, the reporting officers find that the most suitable plan would consist of a barrier extending generally along U.S. Highway 90 from the easternmost levee to high ground east of the Rigolets, together with floodgates and a navigation lock in the Rigolets, and flood and navigation gates in Chef Menteur Pass; construction of a new lakeside levee in St. Charles Parish extending from the Bonnet Carre Spillway guide levee to and along the Jefferson Parish line; extension upward of the existing riprap slope protection along the Jefferson Parish levee; enlargement of the levee landward of the seawall along the 4.1 mile lakefront, and construction of a concrete-capped sheetpile wall along the levee west of the Inner Harbor Canal in New Orleans."

c. BERH Recommendation. The report of the Chief of Engineers stated: "The Board (of Engineers of Rivers and Harbors) recommends authorization for construction essentially as planned by the reporting officers ....I concur in the recommendation of the Board of Engineers for Rivers and Harbors."

2. Purpose and Scope. This memorandum presents the essential data, assumptions, criteria, and computations for developing the plan design and cost estimate for constructing the "High Level Plan" (i.e., no barriers in the Chef Menteur and Rigolets Passes) Jefferson/St. Charles Parish Return Levee for the Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection project. The recommended design contained in this DM reflects the least costly method of modifying the existing levee so that a high

level of protection can be achieved. The return levee reach south of the northern edge of the New Orleans International Airport is not addressed in this Design Memorandum. For the airport area, there are current efforts by the airport authority to extend the east-west runway approximately 1,500 feet. The New Orleans District Office has been reviewing, through the permit process, the designs for the proposed new levee which will go around the runway extension. The new levee in this area will be addressed by a supplement to this GDM. The levee reach south of the southern boundary of the airport will also be addressed in the same supplement since this levee reach is dependent upon the St. Charles Parish Levee alignment. The St. Charles Parish, North of Airline Hwy. Levee, GDM No. 18 is scheduled for submission in June 1988.

3. Local Cooperation.

a. Flood Control Act of 1965 (Public Law 89-298). The conditions of local cooperation pertinent to this Design Memorandum and as specified in the report of the Board of Engineers for Rivers and Harbors and concurred by the report of the Chief of Engineers are as follows: "....That the barrier plan for protection from hurricane floods of the shores of Lake Pontchartrain ... be authorized for construction, ... provided that prior to construction of each separable independent feature local interest furnish assurances satisfactory to the Secretary of the Army that they will, without cost to the United States:

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

"(2) Accomplish all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures, and other facilities made necessary by the construction works;

"(3) Hold and save the United States free from damages due to the construction works;

"(4) Bear 30 percent of the first cost, to consist of the fair market value of the items listed in subparagraphs (1) and (2) above and a cash contribution presently estimated at $14,384,000 for the barrier plan... to be paid either in a lump sum prior to initiation of construction or in installments at least annually in proportion to the Federal appropriation 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;

"(5) For the barrier plan, provide an additional cash contribution equivalent to the estimated capitalized value of operation and maintenance of the Rigolets navigation lock and channel to be undertaken by the United States, presently estimated at $4,092,000, said amount to be paid either in a lump sum prior to initiation of construction of the barrier or in installments at least annually in proportion to the Federal appropriation for construction of the barrier;

"(6) Provide all interior drainage and pumping plants required for reclamation and development of the protected areas;

"(7) Maintain and operate all features of the works in accordance with regulations prescribed by the Secretary of the Army, including levees, floodgates, approach channels, drainage structures, drainage ditches or canals, floodwalls, seawalls, and stoplog structures, but excluding the Rigolets navigation lock and channel and the modified dual purpose Seabrook lock; and

"(8) Acquire adequate easements or other interest in land to prevent encroachment on existing ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly, provided that construction of any of the separable independent features of the plan may be undertaken independently of the others, whenever funds for that purpose are available and the prescribed local cooperation has been provided..."

b. Water Resources Development Act of 1974 (Public Law 93-251). The local interest payment procedures outlined in the original conditions of local cooperation were modified in 1974 as follows: "The hurricane-flood protection project on Lake Pontchartrain, Louisiana, authorized by Section 204 of the Flood Control Act of 1965 (Public Law 89-298) is hereby modified to provide that non-Federal public bodies may agree to pay the unpaid balance of the cash payment due, with interest, in yearly installments. The yearly installments will be initiated when the Secretary determines that the project is complete, but in no case shall the initial installment be delayed more than ten years after the initiation of project construction. Each installment shall not be less than one twenty-fifth of the remaining unpaid balance plus interest on such balance, and the total of such installments shall be sufficient to achieve full payment, including interest, within twenty-five years of initiation of project construction."

4. Project Document Investigations. Studies and investigations made in connection with the report on which authorization is based (House Document No. 231, 89th Congress, 1st Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in the history and records of hurricanes; damage and characteristics of hurricanes; extensive tidal hydraulics investigations involving both office and model studies relating to the ecological impact of the project on Lakes Pontchartrain and Borgne; an economic survey; and survey scope design and cost studies. A public hearing was held in New Orleans on 13 March 1956 to determine the views of local interests.

5. Investigations Made Subsequent to Project Authorization. In December 1977, a Federal court injunction was issued stopping construction of portions of the authorized project. The injunction was issued on the basis that the 1975 final Environmental Impact Statement (EIS) for the Lake Pontchartrain project was inadequate. The court directed, among other things, that the EIS be rectified to include adequate development and analysis of alternatives to the then ongoing proposed action. The results of these studies are contained in a three volume report entitled "Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project, Reevaluation Study," dated July 1984. The reevaluation report recommended a "tentatively selected" high level plan of protection. This recommendation necessitated the preparation of this report and the engineering and environmental studies discussed herein. Surveys and studies accomplished in preparing this GDM include the following:

a. Alternative plan studies to develop alternative methods of construction required to optimize the proposed plan of protection;

b. Aerial and hydrographic surveys;

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

d. Detailed design studies for alternative plans (including stability analyses);

e. Tidal hydraulic studies required for establishing design grades for protective works based on the latest revised hurricane parameters furnished subsequent to project authorization by the National Weather Service;

f. Real Estate requirements;

g. Detailed cost estimates for the proposed plan of protection as well as alternative plans and necessary utility relocations;

h. Environmental effects and evaluations;

i. A comprehensive public meeting for the "tentatively selected" high level plan held on 12 April 1984.

6. Planned Future Investigations. Upon satisfactory approval of this GDM, additional detailed Engineering Designs and Specifications will be prepared to support construction of this project feature. Some additional soils investigations or field surveys are anticipated at this time to support these designs. Planned future investigations for features not covered in this Design Memorandum will include that portion of the hurricane protection return levee south of the New Orleans International Airport. There are presently underway planning and design efforts to extend the east-west runway which is currently located wholly in Jefferson Parish. The proposed lengthening will be into the St. Charles Parish

wetlands area west of the airport. The New Orleans Aviation Board working through their consultants are coordinating this effort through the proper channels to insure that Local, State, and Federal laws are complied with. The designs for this work are also being coordinated with the New Orleans District, U. S. Army Corps of Engineers, to insure that the proposed new levee meets applicable Corps criteria. The airport extension levee along with the tie-in segment of the return levee that will join the St. Charles Parish, North of Airline Highway levee is to be addressed in an unscheduled supplement to this GDM. The North of Airline Highway levee in St. Charles Parish, GDM No. 18 is scheduled for submission in June 1988.

7. Local Cooperation Requirements. The conditions of local cooperation as specified in the authorizing laws are quoted in paragraph 3. These conditions are applicable to the "Barrier Plan." A post authorization report for a "High Level Plan" recommended that assurances be amended. A complete list of local assurance items (as amended) are set forth as follows:

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

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

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

d. Bear 30 percent of the first cost, to consist of the fair market value of the items listed in subparagraphs (a) and (b) above and a cash contribution as presently estimated below, to be paid either in a lump sum prior to initiation of construction or in installments at least annually in proportion to the Federal appropriation 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:

COST TO JEFFERSON LEVEE DISTRICT

($1,000,000's)

	FIRST COST[1/]	LOCAL SHARE
Jefferson	142.1	42.6

1/ Cost to complete after October 1979; October 1981 price levels.

e. Delete the following item in full because it pertains only to the barrier plan:

Provide an additional cash contribution equivalent to 30.4% of the estimated capitalized value of maintenance and operation of the Rigolets navigation lock and channel to be undertaken by the United States, the cash consideration is estimated at $2,805,900, the final determination to be made after construction is complete, said amount to be paid either in a lump sum prior to initiation of construction of the barrier or in installments at least annually in proportion to the Federal appropriation for construction of the barrier; and

f. Provide all interior drainage and pumping plants required for reclamation and development of the protected areas; and

g. Maintain and operate all features of the project in accordance with regulations prescribed by the Secretary of the Army, including levees, floodgates and approach channels, drainage structures, drainage ditches or canals, floodwalls, and stoplog structures (the remainder of this item is deleted); and

h. Acquire adequate easements or other interest in land to prevent encroachment on existing ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly; and

i. Comply with the applicable provisions of the "Uniform Relocation Assistance and Real Property Acquistion Policies Act of 1970," Public Law 91-646; and

j. Assume the responsibility to pay its share of the non-Federal project costs (the remainder of this item is deleted); and

k. As a minimum, adhere to the payment schedule of the deferred payment plan, the apportionment of costs to be made as actual costs values and schedules are determined. The first payment under the deferred payment plan was due on 1 October 1976, with subsequent payments being due on 1 October of each succeeding year, up to and including 1 October 1990. Interest is charged on the unpaid balance during this period at the rate of 3.225 percent per annum. Cash contributions required subsequent to 30 September 1991 shall be computed in accordance with the basic 30 percent requirement stipulated in Section 204 of the Flood Control Act of 1965, Public Law 89-298 and House Document 231, 89th Congress; and

l. Recognizes that subsections (b), (c), and (e) of Section 221 of the "Flood Control Act of 1970," Public Law 91-611 shall apply to paragraph (k) above; and

m. Comply with Section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, that no person shall be excluded from participation in, denied the benefits of, or subjected to discrimination in connection with the project on the grounds of race, creed, or national origin.

8. Status of Local Cooperation. The following subparagraphs capsulize the history of assurances for local cooperation on the Lake Pontchartrain project.

a. Assurances from the Board of Levee Commissioners of the Orleans Levee District for the Barrier Plan portion of the project were originally accepted on 10 October 1966. Because of the rising non-Federal cost of participation and the widespread benefits to be derived by surrounding parishes, the Orleans Levee District requested assistance in carrying out the assurances. Accordingly, the Governor of the State of Louisiana by Executive Order Number 80, dated 5 March 1971, designated the Louisiana Department of Public Works as the local coordinating agency. Through this procedure the Orleans Levee District, the Pontchartrain Levee District, and the St. Tammany Parish Police Jury were designated the assurers of local cooperation for the portions of the subject project within their respective jurisdictions. The designation was under the authority of Section 81, Title 38, Louisiana Revised Statutes of 1950.

b. Assurances from the Pontchartrain Levee District were accepted on 7 October 1971. Due to the reluctance of the St. Tammany Parish Police Jury to furnish required assurances of local cooperation for that portion of the project within St. Tammany Parish, the Governor of the State of Louisiana executed assurances on behalf of the St. Tammany Parish Police Jury on 8 May 1972 under authority of Section 81, Title 38, Louisiana Revised Statutes of 1950.

c. Recognizing the increasing burden of providing required matching local funds, Representative F. Edward Hebert sponsored Congressional legislation to defer required local payments over an extended period of time. This legislation was enacted in March 1974 as Section 92 of the Water Resources Development Act of 1974. This Act modified the authorizing law by providing that non-Federal public bodies may agree to pay the unpaid balance of their required cash payment due, with interest, in annual installments in accordance with a specified formula.

d. For the "Barrier Plan" we have received the necessary agreements, legal opinions, and resolutions from the Orleans Levee District, jointly from the Lake Borgne Basin Levee District and the St. Bernard Parish Police Jury, and from the Pontchartrain Levee District approving the deferred payment plan and incorporating the requirements of Public Law 91-646 ("Uniform Relocation and Real Property Acquisition Policies Act of 1970") and items (b) (c) and (e) of Section 221 of the "Flood Control Act of 1970," Public Law 91-611. We have also received the required agreements, legal opinions, and assurances from the Louisiana Department of Transportation, Office of Public Works and the Governor of Louisiana stating that the Office of Public Works is now the local sponsor on behalf of the St. Tammany Parish Police Jury and that the Office of Public Works will lend financial assistance, when required, to the Pontchartrain Levee District.

e. On 13 July 1978 the Louisiana Legislature, in Act 716 of 1978, La. R.S. 38:1471, effectuated a conveyance to the Jefferson Levee District of all lands presently held by the Pontchartrain Levee District that lie on the east side of the Mississippi River in the parish of Jefferson. This transfer became effective 1 January 1979. On 9 January 1979, the Pontchartrain and Jefferson Levee District agreed between themselves, upon the specifics of the division between them, including but not limited to, division of indebtedness for obligations for the Pontchartrain Levee District for which the Jefferson Levee District assumed a pro rata share.

f. With the change to a high level plan of protection and approval of the revised EIS (Feb 1985), a supplemental agreement was requested from the Board of Levee Commissioners of the East Jefferson Levee District. The supplemental agreement was signed on 16 January 1987. By letter dated 6 February 1987, the Chief of Real Estate Division, New Orleans District requested a copy of the Levee District's latest financial statement and a letter indicating that the East Jefferson Levee District intends to meet its financial obligation for the project by asking the voters of Jefferson Parish to support a millage increase to finance the hurricane protection work.

9. Views of Local Interests. The East Jefferson Levee District is the agency responsible for providing local interest assurances for this feature of the project. The plan presented herein was coordinated in detail with the East Jefferson Levee District engineering staff and bears the approval of that agency.

LOCATION OF PROJECT AND TRIBUTARY AREA

10. Project Location. The Jefferson/St. Charles return levee, a feature of the Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection project, as shown on Plate 1, is located in southeastern Louisiana in Jefferson Parish. The levee/floodwall is oriented in a north-south direction and separates the highly developed areas in Jefferson Parish from the wetland marsh area located in St. Charles Parish. The northern end of the levee/floodwall ties into the Jefferson lakefront levee. The southern limit of the levee/floodwall will join the flood protection levee which is to be built around the proposed airport runway extension into St. Charles Parish.

11. Tributary Area. The tributary area of Lake Pontchartrain varies in character from flat tidal marsh at or near sea level to upland areas of significant relief with natural ground elevations as high as 250 feet above National Geodetic Vertical Datum (NGVD)[1/]. Runoff from within the project area drains into either Lake Borgne or Lake Pontchartrain, generally by pumping from within the protected areas on the south shore of Lake Pontchartrain, although some developed areas located on alluvial ridges in St. Charles and St. Bernard Parish are drained by gravity. In addition to runoff from the project area, Lake Pontchartrain receives the

1/ Elevations throughout this GDM are in feet referred to National Geodetic Vertical Datum unless otherwise noted.

runoff of 4,700 square miles located to the north and west of the lake. During major floods on the Mississippi River and its tributaries, flood flows may be diverted from the Mississippi River to Lake Pontchartrain through the Bonnet Carre Spillway, a controlled overbank floodway constructed under the Flood Control, Mississippi River and Tributaries project.

PROJECT PLAN

12. General. The project, as shown on the flyleaf map, consists of two separate and distinct major features - the Chalmette Area Plan and the Lake Pontchartrain High Level Plan. This memorandum is concerned only with a segment of the latter, the Jefferson/St. Charles return levee. The overall Lake Pontchartrain High Level Plan is described in "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project" Reevaluation Study dated July 1984.

13. Jefferson/St. Charles Return Levee. The floodwall in levee described in this memorandum is located in the extreme western edge of Jefferson Parish on the east bank of the Mississippi River. The existing return levee is approximately 4.9 miles in length; its northern end ties-in to the Jefferson Parish lakefront levee at Lake Pontchartrain and its southern end terminates just north of Airline Hwy, (U.S. Hwy. 61).

The area located on the eastern side of the return levee is a highly developed residential and commercial area of about 30,820 acres in which resides approximately one-half million people. Immediately adjacent to the west or floodside of the return levee is the Parish Line Canal which is contiguous to the St. Charles Parish wetlands. The St. Charles Parish wetlands are a vast wetland area of about 28,000 acres. This wetland is bounded on the south by Airline Hwy, on the west by the Bonnet Carre Spillway east guide levee and on the north by Lake Pontchartrain.

The existing return levee was constructed under the Flood Control Act of 24 July 1946, House Document 691, 79th Congress, 1st Session, Public Law 526, 79th Congress and modified the Flood Control Act of 17 May 1950, Senate Document 139, 81st Congress, 2nd Session which incorporated the project into the "Flood Control, Mississippi River and Tributary Project." The levee work under this 1950 authority was officially completed in May 1965. Levee grades were constructed to elevations varying from 7.0 ft. n.g.v.d at Airline Hwy to 10.0 feet n.g.v.d at the lakefront.

In the late 1960's, in order to provide a higher degree of interim protection in Jefferson Parish prior to construction of the proposed barriers, local interest raised the existing return levee by driving steel sheetpiling into the crown of the levee. This provided an additional 3 to 5 feet of height to the levee. It should be noted that under the authorized barrier plan, no work was planned for the return levee since the 1950 levee heights were considered adequate with the closure structures in place.

The plan detailed in this report consists of 17,844.7 feet of T-Wall and 290.8 feet of I-wall. There are two short reaches of I-wall; one reach of 225 feet is located at the I-10 crossing (stations 29+50.0 W/L to 31+75.0 W/L) and another short reach of 65.8 feet where the return levee ties-in to the lakefront levee (stations 180+69.7 W/L to sta. 181+35.5 W/L). The existing levee will require degrading to elevation 3.0 n.g.v.d. The plan layout for the proposed work is shown on Plates 2 through 7. The profile of the wall is shown on Plates 8 through 10 and typical cross-sections are shown on Plates 11 and 12.

14. Departures From Project Document Plan. The project document plan (Barrier Plan) did not call for any work along the return levee in Jefferson Parish. The Barrier Plan as authorized called for constructing a lakefront levee in St. Charles Parish thereby eliminating the hurricane protection need for the return levee. The barrier plan lakefront levee would have tied-in to the Jefferson Parish lakefront levee on the east and to the northern end of the east guide levee of the Bonnet Carre Spillway. The Reevaluation Study, Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project, July 1984, recommended a north of Airline Hwy levee alignment in St. Charles Parish, thus requiring the return levee as a vital link in the chain of protection. The reevaluation report also recommended a floodwall in the existing return levee as the means of providing high level hurricane protection. The plan contained in this GDM is considered a minor refinement to the Reevaluation Study Plan. The degree of degrading necessary to insure a stable design section is greater than contemplated in the Reevaluation Report. However, the material from the degraded levee will be stockpiled and used in constructing the lakefront levee.

HYDROLOGY AND HYDRAULICS

15. Hydrology and Hydraulics.

a. General. The Hydrology and Hydraulics Analysis Design Memorandum for the Lake Pontchartrain Barrier Plan was presented in a series of three separate reports entitled "Design Memorandum No. 1" and subtitled "Part 1 - Chalmette, Part II - Barrier, and Part III - Lakeshore." Part 1 - Chalmette was approved on 27 October 1966; Part II - Barrier was approved on 18 October 1967; and Part III - Lakeshore was approved on 6 March 1969. These documents present detailed descriptions and analyses of the tidal hydraulic methods and procedures used in the tidal hydraulic design of the features of the Plan and include the essential data, assumptions, and criteria used and results of studies which provide the bases for determining surges, routing, wind tides, runup, overtopping, and frequencies. The criteria applicable to this levee feature and the hydraulic design of the drainage facilities in this levee reach are presented in Appendix A of this memorandum.

b. Surface Drainage. The proposed floodwall and levee construction recommended herein will not significantly affect existing surface drainage patterns. No modifications to existing area storm and sanitary sewer utilities are required.

GENERAL GEOLOGY

16. Scope. The geology presented herein is based on regional and local surface and subsurface information. It is intended to present a general project overview of the pertinent geologic data and interpretation.

17. Physiography and Topography. The project site is located within the Central Gulf Coastal Plain region on the flanks of the Mississippi River Deltaic Plain and that portion of Northern Jefferson Parish Protection Levee that parallels St. Charles Parish from the Airport to Lake Pontchartrain. Pronounced physiographic features of the area are lakes, shorelines, canals, an abandoned Mississippi River delta, the Mississippi River, beach ridges, marshes, and swamps. Elevations in the vicinity vary from -15.0 feet NGVD in Lake Pontchartrain to +20.0 feet NGVD along the crown of the mainline Mississippi River levees.

18. Surface Investigation. Aerial photographs, topographic maps, and geologic maps were used in conjunction with published literature to define the geologic setting of the project area.

19. Subsurface Investigation. Twelve 1-7/8 inch I.D. general type borings and fourteen 5-inch undisturbed borings were taken by Corps of Engineers personnel for this project. In addition, one A-E contract general type boring (Bor. 4) was included for additional geologic analysis. This boring is included on profile B-B and is appropriately noted. Individual boring depths vary from 75.5 to 117.3 feet and generally encountered artificial fill, Holocene soils, and the Pleistocene horizon. The boring data, used in conjunction with other available data, was the primary source for site-specific geologic foundation interpretations (refer to Table 1 for boring summary).

20. Geophysical Investigation. No geophysical methods were used at the project site. Present refractive methods would not have delineated the various Holocene environments.

TABLE 1
BORING SUMMARY
JEFFERSON PARISH WEST RETURN LEVEE HURRICANE PROTECTION (1986)

UNDISTURBED BORINGS

Boring No.	Date Completed	Station on Baseline	Offset* (Footage From B/L)	Ground Surface El.	Depth Sampled (Footage)	Overburden Thickness (Holocene)	Top of Pleistocene (El.)	Pleistocene Penetration (Footage)	Boring No.
1-U	03-18-85	72+17	5 F.S.	7.15	108.6	72.4	-65.25	43.35	1-U
3-U	03-13-85	98+95	8 F.S.	7.41	117.3	93.6	-86.19	23.7	3-U
4-U	03-18-85	97+53	73 P.S.	-2.41	81.5	>81.5	<-83.91	N.A.	4-U
5-U	05-31-85	115+30	90 F.S.	-4.90	77.5	>77.5	<-82.4	N.A.	5-U
6-U	03-06-85	115+27	11 F.S.	-7.15	96.0	>96.0	<-103.15	N.A.	6-U
7-U	02-26-85	145+85	9 F.S.	7.85	99.5	80.5	-72.65	19.0	7-U
8-U	03-04-85	145+85	41 P.S.	-1.80	79.7	73.7	-75.5	6.0	8-U
8-UA	06-10-85	158+94	8 F.S.	11.50	111.5	79.7	-72.71	31.8	8-UA
9-U	05-30-85	188+96	128 F.S.	-4.90	75.5	55.7	-60.6	19.8	9-U
10-U	02-26-85	193+95	10 F.S.	8.28	106.8	75.3	-67.02	31.5	10-U
11-U	03-20-85	221+20	10 F.S.	8.02	104.1	68.0	-59.98	36.1	11-U
12-U	02-16-85	221+20	40 P.S.	-0.34	81.6	56.8	-57.14	24.8	12-U
13-U	05-23-85	249+00	136 F.S.	-5.90	75.5	47.8	-53.7	27.7	13-U
14-U	02-08-85	247+90	11 F.S.	7.22	109.6	58.5	-51.28	51.1	14-U

*F.S. - FLOOD SIDE
*P.S. - PROTECTED SIDE

GENERAL TYPE BORINGS

Boring No.	Date Completed	Station on Baseline	Offset* (Footage From B/L)	Ground Surface El.	Depth Sampled (Footage)	Overburden Thickness (Holocene)	Top of Pleistocene (El.)	Pleistocene Penetration (Footage)	Boring No.
1-G	04-30-85	57+62	17 F.S.	8.00	108.5	75.0	-67.0	33.5	1-G
2-G	05-03-85	78+93	2 F.S.	6.59	108.5	72.5	-65.91	36.0	2-G
3-G	05-07-85	88+96	5 F.S.	6.95	108.0	74.0	-67.05	34.0	3-G
4-G	05-09-85	118+93	5 F.S.	6.02	108.0	>108.0	<-101.98	N.A.	4-G
5-GA	05-31-85	128+92	11 F.S.	7.47	109.0	79.0	-71.53	30.0	5-G
5-G	05-12-85	138+95	10 F.S.	8.00	108.5	84.5	-76.5	24.0	5-GA
6-G	05-29-85	148+93	9 F.S.	6.84	111.0	84.0	-77.16	27.0	6-G
7-G	06-09-86	178+44	5 F.S.	7.17	108.0	74.0	-66.83	34.0	7-G
8-G	01-29-86	199+05	8 F.S.	6.80	108.0	86.5	-79.7	21.5	8-G
9-G	01-22-86	209+05	8 F.S.	5.60	105.5	84.0	-78.4	21.5	9-G
10-G	02-04-86	229+05	7 F.S.	8.20	95.5	84.0	-75.8	11.5	10-G
11-G	02-13-86	239+05	7 F.S.	7.00	106.5	79.0	-72.0	27.5	11-G
Bor. 4**	07-16-81	171+97	10 F.S.	7.00	87.0	73.0	-66.0	14.0	Bor. 4

*F.S. - FLOOD SIDE
*P.S. - PROTECTED SIDE
**A-E CONTRACT

21. Geologic Structure. The project site is located within the Gulf Coastal Plain Province. The province extends east to west from Georgia to Texas and north to south from southern Illinois to the Gulf of Mexico continental shelf. The central portion of the province and area of project location is the Mississippi Embayment. The embayment is structurally oriented in a north-south direction with its axis passing locally through a point east of Houma, Louisiana.

The development of the embayment, an approximate 60 million year process, is continuous with the influx of additional sediment. Tertiary and quaternary sediment thicknesses presently exceed 40,000 feet near the gulf coastline. This tremendous accumulation of sediments has caused a downwarping of the underlying basement rock resulting in the deformation and faulting of that sediment. Such massive accumulations are also associated with higher than normal Quaternary sediment consolidations and stresses that also produces both regional and local faults and structural deformations such as folds. Salt domes, diapiric formations of deeply seated Triassic-Jurassic evaporitic deposits, have also produced a locally faulted and massively deformed subsurface. These surficial extrusions or near surficial intrusions usually result in large, easily mined halite and gypsum deposits. Diapiric movement appears to be pre-Quaternary in age.

22. Faulting. A series of subsurface normal faults trending NE to SW and NW to SE are common in the area, but lack surface expression in the immediate project area. Most of these faults, classic down to the basin normal faults, are associated with the structural deformation of the sedimentary deposits, resulting from differential settlement of the subsiding sediments. Local faulting is somewhat responsible for the north shoreline orientation of Lake Pontchartrain. As previously stated, diapiric salt movement has caused local, generally radial type normal faulting.

23. General Historical Geology and Geomorphology. The Holocene geologic history of the project area is directly related to the developing Mississippi River. The Mississippi River was formed during the Nebraskan stage, the first glacial advance of the Pleistocene Epoch. Sea level at that time was approximately 450 feet below present level due to the massive continental accumulations of ice. Subsequent to this first glacial period, three other major cycles of continental glacial advancement and recession occurred. These advances (waxing glaciation) and retreats (waning glaciation) have respectively resulted in periods of Mississippi River degradation (erosion or stream entrenchment) and aggradation (sediment deposition or channel filling).

During the last glacial cycle (Wisconsin), the lower Mississippi Embayment experienced a major Mississippi River entrenchment and stratigraphic incision of older Pleistocene and Tertiary deposits. The axis of this ancestral trench runs southeast to northwest between Baton

Rouge and Lafayette and southward through a point near Houma, Louisiana. This orientation and location approximates the present central portion of the alluvial valley. During this period, the various tributaries of the Mississippi River also experienced entrenchment.

As glacial meltwaters returned to the oceanic basins, sea level rose and eventually stream gradients decreased. Decreased Mississippi River gradients and associated energy losses resulted in a massive coarse-grained alluviation of the entrenched valley. A braided river system resulted from these factors. Continued deposition of coarse-grained material within the valley directly above the incised and formerly exposed Pleistocene surface resulted in a massive coarse-grain blanket that is now referred to as the Holocene substratum.

As stream gradients stabilized, grain size and sediment load decreased to such an extent that a single meandering channel, forerunner of the modern Mississippi, formed and the braiding characteristic ceased. A top stratum comprised of the finer grain size sediment and representing the various deltaic and fluvial environments developed within the Mississippi River floodplain.

Lateral and southern deltaic progradation resulted from a meandering Mississippi River. As a result of continued meandering, channel shifts, and massive deposition, a series of seven delta lobes were built gulfward. The seven major courses and associated delta lobes are presently identifiable in the region. The oldest course that can be detected is the Sale' - Cypremort (Maringouin), which is located along the present western boundary of the Mississippi River Deltaic Plain. The Sale' - Cypremort was active approximately 5,500 to 4,400 years before present. Concurrent with the abandonment of that course, the Mississippi River shifted eastward and occupied the Cocodrie course. It was during this period, approximately 4,600-3,500 years before present, that the first Holocene sediments of any significance were introduced into the study area. However, when the Mississippi River again shifted, this time to the west to occupy the Teche course (3,800 to 2,700 years before present), most of the residual Cocodrie Delta began to subside and was eventually destroyed by advancing gulf waters. Continuing to seek a shorter route to the gulf because of decreased channel gradient, the Mississippi River again shifted eastward to occupy the St. Bernard course. It was during this period, 2,800 to 1,700 years before present, that maximum Holocene deposition occurred in the study area; Lake Pontchartrain was encapsulated in its present form, and major physiographic features of the New Orleans area were developed. The Mississippi River, shifting briefly to the west once again, occupied the Lafourche Course from 1,900 to 1,300 years before present, and then finally shifted eastward to occupy the Plaquemine course (1,200 to 450 years before present) and the Balize or Modern course (450 years to the present); refer to Figure 1, Deltaic Plain of the Mississippi River.

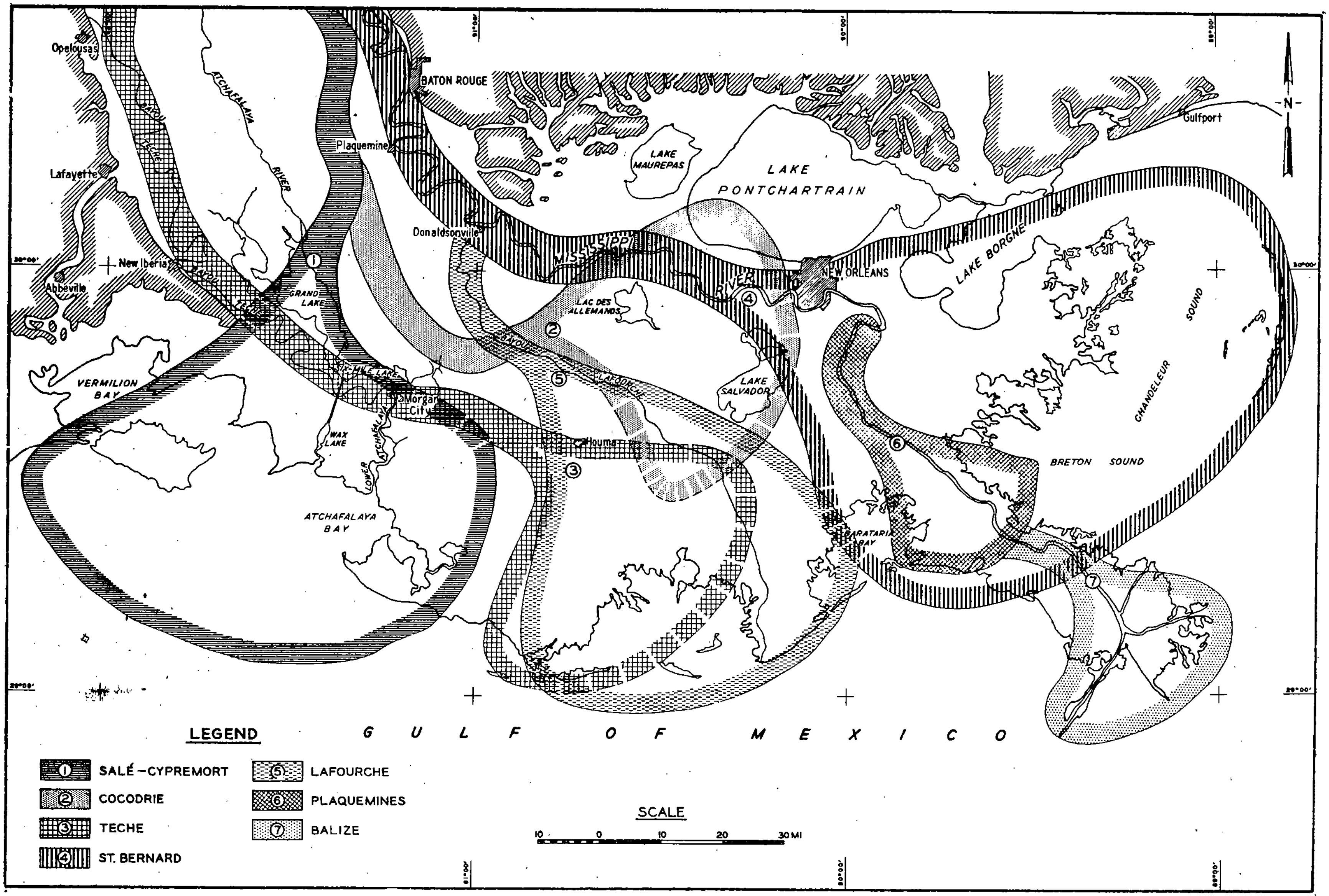


Fig. 1. Mississippi River deltas

At present, the Mississippi River is discharging most sediments near or at the edge of the continental shelf and into deep gulfwaters where dissipation occurs over a relatively large geographical area. Construction of flood protection levees and major flood control projects restrains the river from migrating laterally (thus, preventing the replenishment of much needed sediment in southeastern Louisiana).

When course abandonment occurs, deltaic accretion and sedimentation ceases. These processes are then replaced by the effects of subsidence and coastal erosion. This destructive phase is characterized by a series of environmental changes that includes landform deformation and shoreline retreat.

24. Regional Subsidence and Land Loss. The project area lies in a region of active subsidence. Regional subsidence rates vary from less than 0.5 feet to greater than 5.0 feet per century. Estimate project site rates vary from 0.33 to 0.49 feet per century (McFarlan, 1961 and Frazier, 1967). Rates of 5.00 or more feet per century are found in the active delta to the south. The high subsidence and land loss rates result from five major processes. They are:

a. Tectonic

(1) Sea level rise

(2) Basement sinking

(3) Faulting

b. Consolidation or sediment compaction

c. Human influences

(1) Water and hydrocarbon withdrawal

(2) Commercial activities

(3) Construction

d. Vegetative modifications

e. Erosion

Subsidence within the deltaic plain is a natural process and can be expected to continue. The effects may be mitigated by controlled sediment replenishment within marsh environments and areas of prior marsh existence by such methods as breached levees, strategically placed drainage structures, and pumping stations.

Local conditions indicate serious shoreline retreat and land loss within the Pontchartrain Basin. Saucier (1963) estimated shoreline retreat at 2 feet per year along Lake Maurepas and 5.4 feet per year along Lake Pontchartrain. Gagliano's basin calculations (1981) indicate land losses of 50 to 100 acres per year.

25. Earthquake History. The region is located in a stable area of low seismicity. The Mississippi River Deltaic Plain is encompassed by "Zone 1" on the Seismic Zone Map of the United States (Figure 2). This indicates that earthquake activity is a relatively rare event and usually less severe than average. Resulting damage to structures or levees in the immediate area should be minimal.

The only events that are known to have produced motion in the region were a series of New Madrid, Missouri, earthquakes dated 1811 to 1812. These earthquakes were felt in the New Orleans area. However, no direct report or geologic evidence suggests that the zone of damage extended to the study site. A few minor quakes have occurred in south Louisiana and southwest Texas which may have transmitted vibrations to the area. Calculated ground accelerations show that the greatest ground motions would likely occur from a major earthquake in the New Madrid Zone of the northern Mississippi Embayment. However, none of the calculated motions would exceed 0.05 g.

26. Groundwater. The shallow aquifers of the New Orleans area consist of discontinuous near-surface sands, such as former and present Mississippi River accretionary and distributary-channel deposits. These sands, because of quality and quantity constraints, are of little importance as aquifers. Where present, they are capable of supplying only small quantities of water (less than 50 gal/min).

Four deep freshwater aquifers in close proximity to the project area are: the Gramercy (historically referred to as the 200-foot sand), Norco (400-foot sand), Gonzales-New Orleans (700-foot sand), and the "1,200-foot" sand. The Gonzales-New Orleans aquifer, as determined by the Louisiana Geological Survey, is a good source of potable water within the New Orleans area and is presently being used in various cooling systems within the New Orleans metropolitan area. Stratigraphically equivalent sands upriver from New Orleans are without similar nomenclature and are historically referred to simply as older deltaic or pre-Holocene deposits. The project effect on the water quality or volume per local aquifer will be minimal.

27. Mineral Resources. Several hydrocarbon reservoirs are located in the region and adjacent to the project. However, the only producing reservoir within the project limits underlies the project from station 128+50 to station 172+50 and extends west to east from St. Charles Parish to Kenner. The reservoir, East Goodhope 9150 RB sand, is at approximate elevation -9100 feet with closure development on the downthrown side of a down-to-the-south fault. Production, initiated in 1970, is slowly declining and appears to be approaching depletion. All producing wells and pipeline facilities are located in St. Charles Parish and outside the limits of the project. Due to reservoir depth, additional subsidence is

not anticipated nor will the project be adversely affected by hydrocarbon withdrawal.

Any future levee construction will not preclude future oil and gas production or exploration, since directional drilling methods can be utilized.

Shell dredging within the confines of Lake Pontchartrain would not be affected unless borrow material is produced within the confines of the lake. Constraints on shell dredging may be enacted to prevent any activity near the borrow site. Measures may then become necessary to mitigate possible loss of resource at this site.

No other major mineral resources are presently being developed in the area.

SITE GEOLOGY

28. Site Location and Description. The project is confined to that portion of the Jefferson Parish levee that runs parallel to the St. Charles Parish boundary and north from New Orleans International Airport to Lake Pontchartrain. This represents approximately 3.5 miles of levee. The project alignment is nearly normal to the regional geologic strike and traverses Holocene surficial deltaic and subsurface deltaic, lacustrine, and marine deposits. A review of geologic profiles A-A' and B-B' (Plates 22 and 23) further details site geologic structure. Subsurface elevations at the top of Pleistocene average -65 feet, but vary from -45 to approximately -105 feet.

Historically, the site stratigraphic sequence indicates a period of aerially exposed Pleistocene prior to an early Holocene marine transgression. Gulf water transgression and the ensuing Pontchartrain Embayment are evidenced by the development of a locally extensive basal marine sequence comprised of bay-sound and nearshore gulf estuarine type soils. The clayey bay-sound deposit averages 15 feet in thickness and provides material east of the project for the development of the Pine Island beach trend. Estimated ages of the beach and bay-sound deposits are respectively 5,000 and 7,000 years.

Isolation of the embayment by the eastward prograding Cocodrie Delta (4,600 to 3,500 years before present) is possibly represented by a thin sequence of prodelta clays from station 90+00 to 150+00. This marked the end of marine conditions and the subsequent development of the lacustrine (lake) environment that exists today at the northern end of the project.

The later prograding St. Bernard delta, 2,800-1,700 years ago, represented the last major period of active deltaic sedimentation within the basin. This period is presented by a wedge-shaped sequence of deltaic type clayey soils that averages 20 feet in thickness and extends from the Mississippi River to the northern terminus of the project.

The Lake Pontchartrain shoreline retreat, resulting from the St. Bernard course abandonment and associated decreased sedimentation, is evident throughout the area and may explain the presence of marsh type deposits 3,000 feet offshore of the project.

A surficial marsh veneer, 5 to 15 feet thick throughout the project, represents the last stage of sedimentation in the area. Marsh type sediments are a result of annual Mississippi River overbank flooding and subsequent deposition of clay and silt size particles landward of the natural levees. A review of borings in the vicinity of the artificial levee indicates that the additional overburden acts as a surcharge, in some instances consolidating the underlying marsh deposits to less than half its original thickness. Along the centerline of the artificial levee, the additional loading of soil has, to a lesser extent, similarly affected the underlying lacustrine, deltaic, and bay-sound deposits.

Borings near the south shore of Lake Pontchartrain reveal a slightly elevated Pleistocene surface and a stratigraphic thinning. This may be indicative of one or a combination of the following: southern stratigraphic dip, deltaic loading, lower subsidence rates, and/or possible normal faulting. Lake Pontchartrain bay-sound deposits are thinner (15 to 20 feet thick) than the onshore equivalent and offshore Pine Island beach development east of the project is minimal to non-existent.

29. Detailed Holocene Environmental Descriptions.

a. Nearshore gulf/estuarine deposits are generally found at the borders of open ocean and seaward of barrier beaches. Thickness appears to increase with distance from shore. Estuarine-type deposits are usually a result of infilling of minor entrenched valleys during transgressive marine phases. Generally, they are coarse grain deposits and well suited for founding projects.

b. Bay-sound deposits are fine to coarse grain sediments bottoming bays and sounds. Average thicknesses are 25 feet in the project area. Reworking of the bottom portion by burrowing marine organisms produces a mottled appearance and inclusions of materials that are distinct from the surrounding sediment. Colors are typically light grey to grey.

c. Prodelta deposits are offshore homogeneous fat clays that precede aerial deltaic development. Thickness is generally related to Pleistocene depth and distributary activity. Cohesive strengths are generally greater than overlying deltaic deposits.

d. The term undifferentiated deltaic deposits refers to those areas of intense and varied deltaic activity. Undifferentiated deltaic deposits generally encompasses intradelta, interdistributary, and prodelta soils. Generally, each individual deltaic environment is not discernible unless further testing is performed.

e. Lacustrine deposits are generally fine grained, thinly stratified, and average 20 feet in thickness. These characteristics are indicative of periodic deposition within a quiescent environment. Organic remains are more prominent in the upper 5 to 10 feet. The bottom one-third is characterized by relatively massive clays and an absence of organics.

f. The marsh deposits are highly compressible organic soils that typically cover 95 percent of the area. They grade vertically downward from peat to organic clays and silts. Generally, soil moistures exceed 100 percent, color varies from light grey to black, and consistencies vary from very soft to medium.

30. Detailed Pleistocene Soil Descriptions. The Pleistocene soils are a result of both deltaic and marine deposition. They represent both the regressive and transgressive phases and associated environments of an earlier Mississippi River deltaic system. The soils are, therefore, similar to the overlying Holocene. However, due to dessication, Pleistocene deposits are distinguished by a decrease in moisture contents, a stiffening of consistencies, a decrease in sampling penetration rates, an increase in oxidized sediments, and calcareous concretions.

31. Foundation Conditions. Representative geologic site conditions are displayed on profiles A-A' and B-B' (Plates 22 and 23). The stratigraphy is basically tabular throughout except for minor entrenchments and undulations created by artificial sediment loads and differential settling. Potential for additional differential settlement, structural uplift, or need of construction dewatering and its effect on foundation conditions must be addressed.

A review of Profile B-B' (Plate 23) details the geologic interpretations at the intersection of the return levee of northwest Jefferson Parish and the lakefront levee.

32. Future Investigations. Subsurface field investigations have been completed, and only occasional future investigations are anticipated if it becomes necessary to verify anomalous subsurface conditions.

33. Conclusion. Current geologic information indicates sensitive foundation conditions with regard to future construction. Further addition of fill, may result in increased settlement rates, due to lacustrine and marsh soil compaction. Differential settlement may result in areas where organic contents are extremely high and relatively thick. Should future construction in the immediate project vicinity require dewatering local settlement may occur due to oxidation of organics and consolidation of sediment.

FOUNDATIONS INVESTIGATION AND DESIGN

34. General. This section covers the soils and foundation investigation and the design for the recommended hurricane protection works along the

Jefferson-St. Charles Parish Line. T-wall is the recommended alternative except beneath Interstate 10 where a levee/I-wall will be used. The project originates at the airport extension at approximate B/L station 74+00 and terminates at the Jefferson Lakefront levee. Design for the airport extension and the tie-in to the St. Charles Parish hurricane protection will be accomplished as a supplement to this DM.

The Jefferson-St. Charles Parish hurricane protection was divided into two soil reaches, but 6 design reaches were used based on stillwater elevation, existing protection side ground elevations, and type of flood protection such as T-wall or levee/I-wall. Design reaches are listed in Table 2 below.

TABLE 2
DESIGN REACHES

Soil/Design Reach	Levee Design Reach B/L Sta. to B/L Sta.	Design Water Elevation
I-A	74+00 to 139+40 (Noncontinuous)	10.5
I-B	103+50 to 105+75 (I-wall)	10.5
II-A	140+50 to 196+78	11.0
II-B	197+38 to 205+10	11.1
II-C	205+20 to 231+20	11.5
II-D	231+30 to 253+80	11.5

Two other alternatives were investigated for this report and are as follows:

a. I-wall/levee. This alternative requires the existing Parish Line Canal to be filled and relocated, and the I-wall/levee shifted 105 to 225 feet floodside of the project B/L.

b. Geotextile Reinforcement Earthen Levee. This alternative also requires the existing Parish Line Canal to be filled and relocated. The reinforcement levee between B/L stations 74+00 and 139+40 would straddle the existing levee, and the reinforcement levee between B/L stations 140+00 and 253+00 would be shifted 40 to 65 feet floodside of the project B/L.

35. Field Investigations. A total of 12 general type and 14 undisturbed soil borings were taken and tested by the Corps of Engineers along the alignment of the existing levee/I-wall. The approximate locations of these soil borings are shown on Plates 2 through 7. The 11 general type soil borings, 1-G through 11-G and 5-GA extend to an approximate elevation of -100 NGVD and the 14 undisturbed soil borings 1-U through 14-U extend to an elevation between -80 and -100 NGVD. Plates 24 through 26 show logs of all soil borings taken along the alignment centerline and Plate 27 shows logs of borings taken along the floodside and protected side levee toes. Plates 28 through 31 show plates of the undisturbed soil borings with the applicable soil data.

36. Laboratory Tests. Visual classifications were made on all samples obtained from the soil borings. Water content determinations were made on all cohesive soil samples. Consolidation (C) tests, Unconfined Compression (UCT), Unconsolidated-Undrained Triaxial (Q), Consolidated-Undrained Triaxial (R), and Consolidated-Drained Direct (S) shear tests were performed on samples from the undisturbed borings that were representative of the soil encountered. Liquid and plastic limits were determined for all samples on which consolidation and shear tests were performed. Results of laboratory tests are shown on soil boring log Plates 28 through 41, and on the detailed laboratory test data sheet included in this report (see Appendix B).

37. Foundation and Soil Conditions. A general soil profile delineating the subsurface conditions along the project alignment are shown on the soil and geologic profile plates 22 and 23. A detailed description of the foundation conditions can be found in the Site Geology section. Design shear strengths and stratifications are shown on plates 42 and 43.

38. Design Problems. The limited protected side right-of-way, low soil shear strength, low protected side ground elevation (between El-3.0 to El-5.0), and existing flood side borrow pit all combine to produce major design problems in the following areas of interest:

a. Types of protective works

b. Stability

c. Floodwall type

d. Bearing pile lengths and subgrade reaction data for the structure.

e. Protection beneath existing Interstate 10 highway bridge.

39. Types of Protective Works. The recommended Jefferson-St. Charles Parish line Hurricane Protection predominantly consists of a pile supported T-wall between B/L station 74+00 and B/L station 253+78.5 B/L and between B/L station 0+00 and Lakefront B/L station 0+86.2 (noncontinuous). A levee/I-wall section is proposed beneath the Interstate 10 bridge between B/L stations 103+50 and 105+75 B/L and also between Lakefront B/L station 0+86.2 and Lakefront B/L station 1+50.0.

a. Station 74+00 B/L to Station 140+00 B/L.

(1) Between stations 74+00 B/L and 103+50 B/L and between stations 105+75 B/L and 140+00 B/L, the existing levee will be degraded to elevation of 3.0, the existing sheet pile will be driven to a tip elevation of -18.75 and a T-wall will be constructed approximately 14 feet west of the project B/L. The existing sheet pile is approximately 13 feet west of the project B/L (see Plates 44 and 45 for analyzed T-wall section).

(2) Between stations 103+50 B/L and 105+75 B/L, the existing levee will be degraded to an elevation of 6.0 and the existing sheet pile will be driven to a tip elevation of -16.0. A 2-foot section of new sheet piling will be spliced to the existing sheet piling and the I-wall will be capped with a concrete wall (see Plates 46, 47, and 48 for analyzed I-wall section).

b. Station 140+00 B/L to Station 231+20 B/L. In this reach, a T-wall will be constructed 36 feet left of the project B/L and the existing levee will be degraded as required (see Plates 49 through 51 and Plate 53 for analyzed T-wall section). The 20-foot long sheet pile in the existing levee will be pulled and reused as a cut-off wall beneath the project T-wall.

c. Station 231+30 B/L to Station 252+74.5 B/L. In this reach, a T-wall will be constructed 51 feet left of the project B/L and the existing levee degraded as required (see Plates 52 and 53 for analyzed T-wall section). The 20-foot long sheet pile in the existing levee will be pulled and reused as a cut-off wall beneath the project T-wall.

40. Design Analyses.

a. Cantilever I-wall.

(1) I-Wall Stability. The required penetration for the stability of the sheet pile wall was determined by the method of planes analysis for both the short term (Q) and long term (S) cases. The wall was analyzed for the short term (Q) case, using the "Q" soil design parameters (as shown on Plate 42) and the long term (S) case, using the "S" shear strengths of C=0 and 0 =23° for clay strata. A factor of safety of 1.5 was applied to the design shear strengths as follows: 0 developed=arctan (tan 0 available/factor-of-safety) and cohesion value/factor-of-safety. Using the resulting shear strengths, net lateral soil and water pressure diagrams were developed for movement toward each side of the sheet pile. With these pressure distributions, the summation of horizontal forces was equated to zero for various tip penetrations, and the overturning moments about the tip of the sheets were determined. The required depth of penetration to satisfy the stability criteria was determined where the summation of the moments were equal to zero. The "S" case governed the required penetration. The "S" case analysis is presented on Plate 46.

(2) Shear Stability. The stability of the levee with the I-wall was determined by the method of planes using the design "Q" shear strengths with appropriate hydraulic loading shown on the stability plates (Plates 47 and 48) and were designed for a minimum factor of safety of 1.3.

(3) Seepage Cut-Off. The sheet pile penetration required to satisfy Lane's weighted creep ratio (LWCR) of 3.0 for soft clays was determined for the I-wall section. The deeper penetration of the two analyses (cantilever I-wall or creep ratio) was selected as the

recommended tip elevation of the sheet pile floodwall except where the soil boring data indicated that a slightly deeper penetration would be preferable. The I-wall stability penetration elevation of -16.0 governed the required penetration.

(4) Settlements. Since the existing sheet pile wall was installed approximately in 1968 and the existing levee (built in the 1950's) will be degraded to elevation 6.0, no further settlement of the I-wall is anticipated.

b. Inverted T-Wall.

(1) Shear Stability. The stability of the levee with the T-wall was determined by the method of planes using the design "Q" shear strengths with appropriate hydraulic loading shown on the stability plates (Plates 44 and 45 and Plates 49 through 53) and were designed for a minimum factor-of-safety of 1.3.

(2) Deep Seated Stability Analysis. A conventional stability analysis utilizing a 1.30 factor-of-safety incorporated into the soil parameters was performed for various potential failure surfaces beneath the T-wall sections. The results of these analyses are shown on shear stability plates 44 and 49 through 52. The summation of horizontal driving and resisting forces is negative for all failure surfaces, indicating that no additional load need be carried by the structure.

(3) Seepage Cut-Off. A steel sheet pile cut-off will be used beneath the T-walls to provide protection against hazardous seepage during a hurricane. The sheet pile penetration required to satisfy Lane's weighted creep ratio (LWCR) of 3.0 for soft clays was determined for the T-wall sections. The required penetration for seepage cut-off is elevation -12.0. A sample calculation can be found on Plate 53. The steel sheet pile construction tip elevation is elevation -18.75, since the existing 20-foot long steel sheet piling in the existing levee will be used.

(4) Bearing Pile Foundations. Ultimate compression and tension pile capacities versus tip elevations were developed for 12 and 14 inch square prestressed concrete piles. Overburden stress in the soft clay material was limited to approximately 1,000 psf in the "S" case. In determining the normal pressure on the pile surface for the "Q" case and "S" case, lateral earth pressure coefficients of 1.0 and 0.7 were used in compression and tension, respectively. The results of pile design load versus tip elevations analyses are shown on Plates 54 and 55. The estimated tip elevations are based on the factors-of-safety presented in Table 3 below:

TABLE 3
RECOMMENDED FACTORS-OF-SAFETY
FOR PILE CAPACITY CURVES

	With Pile Load Test	W/O Pile Load Test
Q-Case	2.0	3.0
S-Case	2.0 (Dead load only)	3.0 (Dead load only)
	1.0 (Total load)	1.5 (Total load)

It is anticipated that during construction, test piles will be driven and load tested in the project area. The results of the pile load tests will be used to determine the length of the service piles.

(5) Soil Moduli. Bearing pile subgrade moduli curves for estimating lateral restraint of the soil beneath the T-walls are shown on Plates 54 and 55. The equations used in the development of the soil moduli curves are as stated in the notation on these plates.

(6) Settlement. Settlement of the T-wall is considered to be negligible, since the major loads are caused by hurricane-induced stage of insufficient duration for consolidation to occur.

(7) Erosion Protection. Due to the short duration of the hurricane flood stages, no erosion protection is considered necessary along most of the T-wall alignment. However, foreshore protection will be constructed on the flood side of the T-wall in areas where damages could occur from waves generated by other than hurricane winds. The foreshore protection will consist of 24 inches of riprap or gabions on a 6-inch thick shell bedding.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

41. Levees. The proposed improvement consists of degrading and reshaping the existing levee on the east bank of the Parish Line Canal located between Jefferson Parish and St. Charles Parish. The top of the reshaped levee will be at El. 3.0 and a floodwall will be constructed on the levee for providing flood protection to the required elevations. The detailed alignment and profile of the proposed levee and floodwall are shown on Plates 2 through 10. Typical levee and floodwall design sections are presented on Plates 11 and 12.

42. Floodwalls. I-type and T-type floodwalls, constructed on an earthen levee embankment will replace the existing deficient levee and steel sheet piling flood protection as follows:

a. From sta. 0+00 W/L to sta. 65+20.40 W/L. The floodwall follows the alignment of the existing steel sheet pile flood protection. The elevation of the top of the floodwall varies. The detailed alignment and profile of the floodwall and features contiguous thereto are shown on Plates 2 through 4, 8, 9, 10 and 15 through 17. The typical design sections are shown on Plates 11 and 12 and the typical I-wall and T-wall sections on Plate 13.

b. From sta. 65+20.40 W/L to sta. 178+74.70 W/L. The floodwall will be located on the west side of the existing steel sheet pile flood protection. The elevation of the top of the floodwall varies. The detailed alignment and profile of the floodwall are shown on Plates 4 through 7, 9, and 10. The typical design sections are shown on Plates 11 through 13.

c. From sta. 178+74.70 W/L to sta. 181+35.50 W/L. The floodwall will follow the alignment of the existing lakefront levee to provide a transition from the Parish Line Canal flood protection to the lakefront flood protection. The top of the floodwall will be at El. 20.0 feet NGVD. The detailed alignment and profile of the floodwall are shown on Plates 7 and 10. The typical design sections are shown on Plate 13.

43. Drainage Facilities. The floodwall alignment from sta. 47+09.20 W/L to sta. 47+51.20 W/L crosses the discharge tubes from the Parish Line Drainage Canal Pumping Station in Jefferson Parish. The hurricane protection floodwall in the vicinity of the pumping station was completed as a part of the Parish Line Canal Drainage Pumping Station by local authorities. The proposed floodwall described in this document will tie into the existing floodwall at the pumping station. The portion of the existing floodwall at the pumping station will be incorporated into the project. The profile and details of the existing floodwall at the Parish Line Canal Drainage Pumping Station are shown on Plates 16 and 17.

METHOD OF CONSTRUCTION

44. I-Wall and T-Wall Construction. Construction of the pile supported inverted T-wall type floodwall from sta. 0+00.0 W/L to sta. 65+20.40 W/L (not continuous) will be accomplished by degrading and reshaping the existing levee, driving the existing sheet piling to the required depth and then constructing the T-wall as shown on Plate 11.

The floodwall in the vicinity of the Interstate 10 highway (sta. 29+50.0 W/L to sta. 31+75.00 W/L) will consist of a cantilevered I-wall. The existing steel sheet piling under the Interstate 10 overpass will be driven in segments to the required tip elevation, the existing levee will be reshaped and the steel sheet piling will be capped with concrete (see Plates 13 through 15 for details). From sta. 65+20.40 W/L to sta. 181+35.50 W/L, the construction procedure for the T-wall as described above will be followed except that the existing sheet piling will be pulled and redriven on the new alignment, as shown on Plates 4 through 7 and 11. In addition, between sta. 65+20.40 W/L and sta. 178+74.70 W/L, a temporary earthen dike will be constructed on the flood side of the floodwall to allow constructing floodwall in the dry.

Following construction, the existing shell surfaced road currently used for inspection and maintenance will be restored on the new protected side levee berm.

45. Special Construction Requirements. Since the existing levee will be degraded to elevation +3 after removal of the sheet piling, the driving and/or pulling of the existing sheet piling will be restricted to 300 feet in advance of concrete placement to avoid loss of flood protection in the event of impending hurricanes or high lake stages. In addition, provisions will be made in the construction contract to have equipment and materials on hand to close the gap in an emergency.

46. Erosion Control. The floodside levee will be lined with riprap to prevent erosion. For details, see Plates 11, 12, and 15.

OTHER PLANS CONSIDERED

47. Alternate Plan "I-Wall on Levee." During the evaluation of the required flood protection in this area, an alternate plan providing an I-wall on levee was considered (see Plates 18 and 19). This plan would require filling the existing Parish Line Canal and a new canal would have to be excavated in the wetlands of St. Charles Parish to maintain drainage from the Parish Line Pumping Station and for providing water access to the natural gas production wells in the area. This plan would be constructed in four lifts and would cost $44,800,000. This cost is higher than the recommended plan. In addition, the potential negative environmental impact on the wetlands rendered this alternative unacceptable. Because of the higher cost, long construction time, and adverse environmental impact on the wetlands area, the I-wall on levee alternative was not recommended.

48. Alternate Plan "High-Strength Geofabric Reinforced Earthen Levee." A second alternate plan providing an earthen levee reinforced with high-strength geofabric was considered (see Plates 20 and 21). This plan would also require filling the existing Parish Line Canal and excavating a new canal in the wetlands of St. Charles Parish. The earthen levee would be constructed in three lifts and would cost $36,300,000. This cost is also higher than the recommended plan. As with the I-wall on levee alternative described in paragraph 47 above, due to the potential negative environmental impact on the wetlands, the higher cost, and long construction time, the geofabric reinforced earthen levee alternative was not recommended.

ACCESS ROADS

49. Access Roads. Vehicular access to the project site is available via Veterans Memorial Hwy, Interstate 10 Hwy, and West Esplanade Ave. Water access to the project is also available via the Parish Line Canal from Lake Pontchartrain.

STRUCTURAL DESIGN

50. Criteria for structural design. The structural designs presented herein comply with standard engineering practice and criteria set forth in Engineering Manuals and Engineering Technical Letters for civil works

construction published by the Office, Chief of Engineers, subject to modifications indicated by engineering judgment and experience to meet local conditions.1/

51. Basic data. Basic data relevant to the design of the protective works are shown in the following table:

TABLE 4
RELEVANT STRUCTURAL DESIGN DATA

a. Water Elevations	Elevations (feet NGVD)
Wind tide level (Lake Pontchartrain)	11.5
Wind tide level (Parish Line Canal)	9.51 to 11.5
Landside of Floodwall	0.0 to -5.0

b. Floodwall Gross Grade (stationing refers to W/L)	Elevations (feet NGVD)
T-Wall (0+00.0 to 0+55.00)	13.0 to 13.50
T-Wall (0+55.0 to 29+50.00)	13.50
I-Wall (29+50.0 to 29+60.00)	13.50 to 11.5
I-Wall (29+60.0 to 31+65.00)*	11.50
I-Wall (31+65.0 to 31+75.00)	11.50 to 13.5
T-Wall (31+75.00 to 46+73.20)	13.50
T-Wall (46+73.20 to 47+09.20)	13.50 to 14.0
T-Wall (47+09.20 to 47+51.20)**	14.0
T-Wall (47+51.20 to 47+87.20)	14.0 to 13.50
T-Wall (47+87.20 to 65+20.40)	13.50
T-Wall (65+20.40 to 66+02.90)	13.50 to 14.0
T-Wall (66+02.90 to 130+70.00)	14.00
T-Wall (130+70.0 to 131+20.00)	14.0 to 14.50
T-Wall (131+20.00 to 173+04.70)	14.50
T-Wall (173+04.70 to 178+54.70)	14.50 to 20.0
T-Wall (178+54.70 to 180+69.70)	20.00
I-Wall (180+69.70 to 181+35.50)***	20.50

c. Unit Weights	Lb. Per Cu. Ft.
Water	64.0
Concrete	150

1/ The floodwall design is similar to the design presented in the Lake Pontchartrain, La. and Vicinity, High Level Plan, Orleans Parish Lakefront Levee, West of IHNC, Design Memorandum No. 13-General Design, approved Feb 1985.

TABLE 4 (continued)

c. Unit Weights	Lb. Per Cu. Ft.
Steel	490
Earth	See Plates 44 thru 53

d. Design Loads	
Earth Pressures (lateral)	See Plate 46
Wind Loads	50 p.s.f.
Water Loads	See Plates 44 thru 53

* The floodwall between sta. 29+60.0 W/L and sta. 31+65.0 W/L crosses under the existing elevated Interstate 10 highway. The present bottom of structure grade of Interstate 10 highway and the bottom of structure grade of future highway widening will require that the floodwall be constructed to a top elevation of 11.50 feet NGVD. This will provide a freeboard of 1.64 feet with respect to wind tide level of El. 9.86 feet NGVD at this location.

**T-wall from sta. 47+09.20 W/L to sta. 47+51.20 W/L was built to El. 14.00 feet NGVD by local authorities. This work is now being incorporated into the future hurricane protection project.

***The I-wall will be constructed to a top elevation of 20.5 ft. n.g.v.d. to allow for 0.5 feet of settlement.

52. Design Methods.

Reinforced Concrete. The design of reinforced concrete structures is in accordance with the requirements of the strength design method of the current ACI Building Code, as modified by the guidelines of "Strength Design Criteria for Reinforced Concrete Hydraulic Structures," ETL 1110-2-265 dated 15 September 1981. The basic minimum 28-day compressive strength concrete will be 3,000 psi, except for prestressed concrete piling where the minimum will be 5,000 psi. For convenient reference, pertinent stresses are tabulated below:

TABLE 5
PERTINENT STRESSES FOR REINFORCED CONCRETE DESIGN

Reinforced Concrete	
f'c	3,000 psi
fy (grade 40 steel)	40,000 psi
Maximum flexural reinforcement	0.25 x balance ratio
Minimum flexural reinforcement	200/fy
f'c (for prestressed concrete piles)	5,000 psi
fu (prestressing strands, Gr. 250)	250,000 psi

53. Location and Alignment. The flood protection will consist of I-walls and T-walls as described in paragraph 44 above. Generally, the new flood protection follows the east bank of the existing Parish Line Canal between Jefferson Parish and St. Charles Parish. The location is shown on Plate 1. At the south end, the floodwall will tie into the future flood protection to be constructed with the proposed airport expansion by local authorities (the details of the proposed flood protection around the airport expansion will be addressed in supplement No. 1 to this document). At the lake end (north end) the floodwall will tie into the proposed flood protection for the Jefferson Parish Lakefront (the details of the proposed flood protection will be addressed in the Lake Pontchartrain, La. and Vicinity, Hurricane Protection Project HLP, Jefferson Parish Lakefront Levee, GDM #17). The detailed location and alignment of the proposed floodwalls are shown on Plates 2 through 7. The detailed profile of the floodwall and features contiguous thereto are shown on Plates 8 through 17.

54. I-Type Floodwall.

a. General. The I-wall between stations 29+50.0 W/L and 31+75.0 W/L will incorporate the existing steel sheet piling driven into the existing levee embankment underneath the elevated Interstate 10 highway. The I-wall between stations 180+69.70 W/L and 181+35.5 W/L will utilize new steel sheet piling driven in the levee for transition into the lakefront levee in Jefferson Parish. The upper portion of the sheet piling will be capped with concrete. The concrete portion of the floodwall will extend from 2 feet below the finished levee crown to the required flood protection elevation (see Plates 8 and 10, and Plates 13 through 15 for details).

b. Loading Case. Since the Parish Line Canal is located in a protected area, the I-wall between stations 29+50.0 W/L and 31+75.0 W/L was designed for a F.S. = 1.5 with static water at the top of the floodwall (stillwater elevation (swl) plus freeboard) and no dynamic wave force. The I-wall between stations 180+69.70 W/L and 181+35.50 W/L was designed for a F.S. = 1.25 with static water to El. 11.5 and a dynamic wave pressure applied above the stillwater level.

c. Joints. Expansion joints in the I-wall will be spaced approximately 30 feet apart, adjusted to fall at sheet pile interlocks. To compensate for expansion, contraction, or displacement, three-bulb waterstops and premolded expansion joint fillers will be provided. Where the I-wall joins the T-wall, the anticipated deflection of the I-wall loading will produce a lateral separation between the I-type and T-type walls. To compensate for this displacement, a special seal located in a notch in the I-wall has been designed to prevent water from flowing through this joint (see Plates 13 and 14 for details).

55. T-Type Floodwall.

a. General. T-wall will be constructed between wall line stations indicated in Table 4. The T-wall will consist of a reinforced concrete stem on a monolith concrete base of varying width supported on precast prestressed concrete piles. The base of the T-wall will be constructed on a four-inch thick concrete stabilization slab. A continuous steel sheet pile seepage cut-off wall will be provided beneath the base slab for seepage cut-off purposes (see Plates 11 through 13 for details).

b. Loading Cases. Design load cases are listed as follows: from station 0+00 W/L to station 173+04.70 W/L, the T-wall was designed for load cases I through V. From station 173+04.70 W/L to sta. 180+69.70 W/L, T-wall was designed for load cases III through VII. Load cases I through VII are as follows:

Case I — Static water pressure, no wind, impervious pile cutoff, no dynamic wave force.

Case II — Static water pressure, no wind, pervious pile cutoff, no dynamic wave force.

Case III — No water, no wind.

Case IV — No water, wind from protected side (75% force used).

Case V — No water, wind from flood side (75% force used).

Case VI — Stillwater pressure to El. 11.5, dynamic wave force, impervious sheet pile cutoff (75% force used).

Case VII — Stillwater pressure to El. 11.5, dynamic wave force, pervious sheet pile cutoff (75% force used).

c. Joints. Expansion joints in the T-wall will be spaced not more than sixty feet apart. The joints will be adjusted to fall at sheet pile interlocks. To compensate for expansion, contraction, or displacement, three-bulb waterstops and premolded expansion joint fillers will be provided.

56. Cathodic Protection and Corrosion Control.

a. Cathodic protection for steel sheet piling. All steel sheet piling will be bonded together to obtain electrical continuity and no corrosion protection measures will be provided. Cathodic protection can be installed in the future if the need arises. The sheet piles will be bonded together with a No. 6 reinforcing bar welded to the top of each pile. Flexible jumpers insulated with cross-linked polyethelene will be welded or brazed to adjacent sheet piles at the monolith joints 3 inches below the bottom of the concrete.

b. Corrosion control. All exposed ferrous metal components will be either galvanized or stainless steel to provide for corrosion control.

REAL ESTATE REQUIREMENTS

57. General. All rights-of-way and construction easements required for construction of this levee/floodwall covered in this Design Memorandum were acquired by the Pontchartrain Levee District and right-of-entry for construction was furnished without cost to the United States under the 1950 authority. (See para. 8.b., page 7.) These rights-of-way are now under the jurisdiction of the East Jefferson Levee District. There will be no acquisition by the United States. The existing rights-of-way claimed by the East Jefferson Levee District are shown on Plates 2 through 7. No new rights-of-way are required to construct the works covered in this Design Memorandum. Local interests would be required to assume the cost of relocation assistance to persons and businesses displaced by such acquisition pursuant to the requirements of Public Law 91-646. However, Public Law 91-646 will not be a factor for the works covered in the DM. On the east side of the proposed floodwall a 50-ft. construction easement paralleling the wall will serve to construct and maintain the floodwall. The existing west side right-of-way will allow construction access by barge from Lake Pontchartrain.

SOURCES OF CONSTRUCTION MATERIALS

58. Sources of construction materials. "Lake Pontchartrain Hurricane Protection, Sources of Construction Materials," DM # 12, contains a listing of the sources of sand, gravel, shell, and rock available in the region to construct the works described in the memorandum.

RELOCATIONS

59. General. Under the authorizing law, local interests are responsible for the accomplishment of "...all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures and other facilities made necessary by the construction work, ...". For the reach of return levee covered in this memorandum, there are no relocations required.

COORDINATION WITH OTHER AGENCIES

60. General. As previously mentioned, the State of Louisiana, Department of Public Works, was appointed project coordinator for the State by the Governor of Louisiana. This agency has functioned to coordinate the needs, desires, and interests of state agencies and the Corps of Engineers. The East Jefferson Levee District will provide the local cooperation for this feature of the hurricane protection project. The project plan presented herein is acceptable to both of the above agencies. The entire Lake Pontchartrain hurricane protection project, including this project feature, has been discussed at numerous public and private meetings since its authorization. Such meetings have been held before regional, state, local, community, social, and educational organizations and have served generally to inform the public of the proposed works, to explain project functions, and to solicit the public

viewpont. The latest public meeting was held in New Orleans on 12 April 1984. The project has also been described and discussed by the press and by communications media, as well as organizational and individual correspondence. This public meeting was held as part of the continuing coordination required for input to the Draft Supplemental Environmental Impact Statement (DSEIS) of the Lake Pontchartrain project as a whole.

ENVIRONMENTAL ASSESSMENT

61. Affected Environment. The study area includes the existing return levee and adjacent canal and residences from Lake Pontchartrain to the runway extension for the New Orleans International Airport. The land use in this area is primarily residential with some light industrial. The vegetation is lawn grasses or scrub shrub and is not preferred wildlife habitat. However, these habitats are used to some degree by song birds, rabbits, raccoons, and other small animals. No endangered species or their habitat exist in the area of direct impacts. However, two active eagle's nests "Moisant Nos. 23 and 23A have been identified in the adjacent La Branche wetlands. This canal system provides habitat for various freshwater and brackish water fishes as well as a moderate crab population.

The water quality in this canal is not suitable for contact recreation. The lower quality water is associated with the contaminants contributed to the canal through storm drainage.

Under existing conditions, interlocking panels of sheet piling approximately seven feet in height are exposed above the levee crest. This nearly continuous wall of sheet piling forms a pedestrian barrier and somewhat restricts sport fishermen and crabbers, however, due to the project's location in a dense urban area, sportsmen access the water and marsh over the wall via step ladders. People gain access to the wall at street ends. Cars park along these streets and sportsmen walk to the return levee primarily at these points. Others whose back yards are adjacent to the return levee also access the marsh side with step ladders.

62. Environmental Effects

a. Biological - Impacts associated with the levee construction would involve the temporary loss of grasses and vegetative cover through degrading of the existing levee. Therefore, some temporary displacement of small animals is expected until the area becomes vegetated. The only endangered species are the eagle's nests identified in paragraph 61. These nests are sufficiently remote to the proposed work as to have no impacts.

In conjunction with construction there will be increases in localized turbidity levels which could cause displacement of fishery resources until ambient conditions are established. The most affected of the fishery resources would be the less mobile benthic communities and crab populations. This increased turbidity may temporarily cause reductions in plankton populations as a result of clumping and flocculation. These temporary losses in primary productivity should not have long-term effects on the aquatic resources. However, impacts during construction related to increases in noise, airborne dust, and disruption of existing vistas in residential areas would also be encountered. We estimate that approximately 67 houses would be exposed to highly annoying noise levels (89-105 decibels) for a period up to 15 days. Approximately 280 houses would be subjected to annoying decibel levels (77-89) for periods up to 53 days.

Due to the small amount of wildlife habitat affected and the duration of impacts, the long-term adverse impacts on wildlife in the area are not expected to be substantial. Some temporary disturbance of residential areas may occur due to the use of heavy machinery.

b. Recreation. Impacts associated with construction of a 10-ft. high concrete T-wall are not considered to be substantial since the existing steel sheet pile wall is already 7 or 8 ft. in height. Public recreational access to the Parish Line Canal is currently limited to only one ramp which is located at Vintage Dr. (See Plate 6). However, access by the most ardent fishermen is achieved at other locations by use of step ladders. With an increase in wall height of an additional 2 to 3 feet, access by step ladder will become a marginal and unsafe means of gaining access to the canal. Visual and aesthetic impacts of the wall will be minimized by use of earth-tone colors of water proofing paints on the protected side surface of the floodwall. The visual and aesthetics of the T-wall will represent improvement when compared to the present aesthetics of an exposed rusting steel sheet pile wall. To further reduce the visual impacts of the T-wall, it is recommended that shrubs be planted so that they will partially screen or buffer the view from the neighborhood toward the wall. Several varieties such as Ligustrum, Red Top Photenia, Pampas Grass, Pyracantha and/or Oleander should be used.

These positive attributes provided via vegetative plantings would lessen negative visual and aesthetic qualities that a wall alone would impose on the environment.

63. Status of Cultural Resources Investigation. A cultural resources survey of the subject levee item was conducted in 1982, by New World Research, Inc., under contract to the New Orleans District, U. S. Army Corps of Engineers. No significant cultural resources were located in the project impact zone. The survey report was coordinated with the Louisiana SHPO and he concurred with the survey findings. No further cultural resources investigation is necessary.

64. Environmental Impact Statement. The final Environmental Impact Statement (EIS) for the entire Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project, was filed with the President's Council on Environmental Quality on 17 January 1975. A draft supplement to this EIS was filed with the Environmental Protection Agency (EPA) in December of 1983. The Draft Supplement assessed the impacts associated with increased levee height for a high level plan of protection for the Jefferson-St. Charles project reach. The final Supplement to this EIS was filed with EPA on 7 December 1984; formal approval (Record of Decision) was obtained on 7 February 1985. While the Jefferson-St. Charles return levee was addressed in the final supplement, the method of construction, T-wall, detailed in this GDM was not covered. The proposed work detailed in this GDM will be accomplished within the existing rights-of-way. These

rights-of-way were previously covered by the FEIS. In fact, the environmental damages under the T-wall plan are reduced from those previously anticipated in the FEIS. In the preparation of this GDM, the U. S. Fish and Wildlife Service Endangered Species Office in Jackson, Mississippi was consulted for any changes in endangered species within the area of direct impact.

ESTIMATE OF COST

65. General. Based on October 1967 price levels, the estimated first cost for construction of the Jefferson/St. Charles return levee high level plan is $27,600,000. Of this cost, $22,600,000 is required for the Levees and Floodwall feature, $2,700,000 for Engineering and Design, and 2,300,000 for Supervision and Administration. The detailed estimate of first cost is shown in Table 6.

TABLE 6
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A

ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price $	Estimated Amount $
	CONSTRUCTION				
A.	PILE TEST - AIRPORT TO LAKEFRONT				
11	Levees and Floodwalls				
	Mobilization & Demobilization	1	JOB	Lump Sum	40,000
	Temporary Retaining Earthen Dikes	1	JOB	Lump Sum	3,500
	Compression Pile Test				
	Compression Test	3	EA	18,000.00	54,000
	Additional Compression Test	3	EA	14,000.00	42,000
	Tension Pile Test				
	Tension Test	3	EA	19,000.00	57,000
	Additional Tension Test	3	EA	14,000.00	42,000
	SUBTOTAL				238,500
	Contingencies(10%±)				23,500
	TOTAL, CONSTRUCTION				262,000
30	Engineering and Design (12%±)				31,000
31	Supervision and Administration (10%±)				26,000
	TOTAL				319,000

TABLE 6 (CONTINUED)
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A

ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price $	Estimated Amount $
	CONSTRUCTION				
B.	FLOODWALL - AIRPORT TO WEST ESPLANADE (STA. 0+00 W/L TO STA. 95+00 W/L)				
11	Levees and Floodwalls				
	Mobilization & Demobilization	1	JOB	50,000.00	50,000
	Clearing & Grubbing	19	ACRE	1,000.00	19,000
	Fertilizing & Seeding	17	ACRE	400.00	6,800
	Temporary Earth Dike	1,800	C.Y.	2.00	3,600
	Levee Fill (Semi-Compacted)	3,000	C.Y.	1.60	4,800
	Levee Excavation (Haul to Lakefront Levee-Reach A)	49,200	C.Y.	4.00	196,800
	Filter Fabric	6,160	S.Y.	2.00	12,320
	Shell (Uncompacted)	1,510	C.Y.	25.00	37,750
	Riprap	4,100	TONS	20.00	82,000
	Structural Excavation	10,830	C.Y.	6.00	64,980
	Structural Backfill	4,100	C.Y.	8.50	34,850
	Frodingham B1 Sections -Driving Existing SHT Pile	63,300	S.F.	2.25	142,425
	Frodingham B1 Sections -Pulling & Redriving Existing	47,700	S.F.	4.25	202,725
	Frodingham B1 Sections -Driving Existing @I-10	1,800	S.F.	7.00	12,600
	-Splicing @ I-10, 2 Per Pile	113	EA	500.00	56,500
	Frodingham B1 Fabricated Corners	80	S.F.	50.00	4,000
	PZ-22 Steel Sheet Piling	24,500	S.F.	11.50	281,750
	12" X 12" Prestrsd Conc Piling	132,270	L.F.	18.00	2,380,860
	14" X 14" Prestrsd Conc Piling	74,000	L.F.	22.00	1,628,000
	Conc in Stab Slab	240	C.Y.	70.00	16,800
	Conc in T-Wall Base	6,850	C.Y.	200.00	1,370,000
	Conc in T-Wall Stem	4,700	C.Y.	350.00	1,645,000
	Conc in I-Walls	145	C.Y.	350.00	50,750
	Waterstops, 3-Bulb Type	4,900	L.F.	10.00	49,000
	Waterproof Finish (Prot side)	103,100	S.F.	1.00	103,100
	Planting of Shrubbery	1,585	Plant	15.00	23,775
	SUBTOTAL				$ 8,480,485
	CONTINGENCIES (20%±)				$ 1,667,515
	TOTAL, CONSTRUCTION (R)				$10,148,000
30	Engineering and Design (12%±)				$ 1,218,000
31	Supervision and Administration (10%±)				$ 1,015,000
	TOTAL COST				$12,381,000

TABLE 6 (CONTINUED)
LAKE PONTCHARTRAIN HIGH LEVEL PLAN
JEFFERSON/ST. CHARLES RETURN LEVEE, DM 17A

ESTIMATE OF FIRST COST
October 1987 Price Levels

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price $	Estimated Amount $
	CONSTRUCTION				
C.	FLOODWALL - WEST ESPLANADE TO LAKEFRONT (STA. 95+00 W/L TO STA. 181+35.5 W/L)				
11	Levees and Floodwalls				
	Mobilization & Demobilization	1	JOB	50,000.00	50,000
	Clearing & Grubbing	19	ACRE	1,000.00	19,000
	Fertilizing & Seeding	17	ACRE	400.00	6,800
	Temporary Earth Dike	5,300	C.Y.	2.00	10,600
	Levee Fill (Semi-Compacted)	10,700	C.Y.	1.60	17,120
	Levee Excavation (Haul to Lakefront Levee-Reach A)	50,300	C.Y.	4.00	201,200
	Filter Fabric	8,870	S.Y.	2.00	17,740
	Shell (Uncompacted)	860	C.Y.	25.00	21,500
	Riprap	4,610	TONS	20.00	25,750
	Gabions	1,440	C.Y.	100.00	144,000
	Structural Excavation	5,140	C.Y.	6.00	30,840
	Structural Backfill	2,370	C.Y.	8.50	20,145
	Frodingham B1 Sections -Pulling & Redriving Existing	135,700	S.F.	4.25	576,725
	Frodingham B1 Fabricated Corners	110	S.F.	50.00	5,500
	PZ-22 Steel Sheet Piling	36,830	S.F.	11.50	423,545
	Steel Sheet Piling PZ-27	1,980	L.F.	12.50	24,750
	14" X 14" Prestrsd Conc Piling	236,200	L.F.	22.00	5,196,400
	Conc in Stab Slab	1,500	C.Y.	70.00	105,000
	Conc in T-Wall Base	6,570	C.Y.	200.00	1,314,000
	Conc in T-Wall Stem	4,860	C.Y.	350.00	1,701,000
	Conc in I-Walls	35	C.Y.	350.00	12,250
	Waterstops, 3-Bulb Type	4,980	L.F.	10.00	49,800
	Waterproof Finish (Prot side)	107,100	S.F.	1.00	107,000
	Planting of Shrubbery	1,415	Plant	15.00	21,225
	SUBTOTAL				$10,172,590
	CONTINGENCIES (20%±)				$ 2,009,410
	TOTAL, CONSTRUCTION (R)				$12,182,000
30	Engineering and Design (12%±)				$ 1,462,000
31	Supervision and Administration (10%±)				$ 1,218,000
	TOTAL COST				$14,862,000

66. Comparison of Estimates. The current estimate of $27,600,000 for the high level plan Jefferson/St. Charles Return Levee represents an increase of $51,000 when compared to the cost contained in the current PB-3 effective 1 October 1987. The PB-3 estimate is based on survey scope estimates contained in the "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project, Reevaluation Study", dated July 1984. Estimates contained in the reevaluation report were published at October 1983 levels. These estimates were indexed to October 1987 levels for the current PB-3. The increase in cost shown in Table 7 is explained in the following subparagraphs:

Table 7
COMPARISON OF ESTIMATES
(Remaining Costs)
High Level Reevaluation Study
New Orleans, La.

	Feature	PB-3 (eff Oct 87)	GDM (Oct 87 Prices)	Difference GDM and PB-3
11	LEVEES & FLOODWALLS	$22,549,000	$22,600,000	+$ 51,000
30	ENGINEERING & DESIGN	2,700,000	2,700,000	-
31	SUPERVISION & ADMINISTRATION	2,300,000	2,300,000	-
	SUBTOTAL	27,549,000	27,600,000	+ 51,000
01	LANDS & DAMAGES	-	-	-
02	RELOCATIONS	-	-	-
	TOTAL PROJECT COST	$27,549,000	$ 27,600,000	+$ 51,000

a. Levee and Floodwall. The net increase in the levee and floodwall account of $51,000 is due to several factors. As stated above, the PB-3 estimate is based on a survey scope estimate contained in the "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project, Reevaluation Study". This report recommends an I-wall in the levee alternative as the "tentatively selected" plan. The length of floodwall covered by the Reevaluation Study is approximately 4,100 feet longer than the floodwall reach covered in this memorandum. Therefore, the apparent relative small increase in cost of only $51,000 for the Levees & Floodwalls account is misleading since the two estimates are not based on the same physical coverage. It is not possible at this time to make a detailed comparison between the PB-3 estimate and the plan contained herein; however, an approximate estimate can be obtained by prorating the levee cost on a cost/ft basis. Using this procedure, a more realistic increase in cost is obtained. The prorated increase in cost is approximately $4.2 million. The plan detailed in this memorandum is a T-Wall in levee plan which is the most cost effective plan that provides Standard Project Hurricane protection. A discussion of alternative plans investigated during the preparation of this Design Memorandum is contained in paragraph 47.

b. Engineering and Design. Table 7 shows no change in E&D cost between the PB-3 estimate and the cost for Engineering and Design for work detailed in this memorandum. As explained in subparagraph a. above, since the two estimates are not based on the same physical coverage, the no change in cost for the E&D account is also misleading. An approximate estimate for the real increase in E&D cost can also be made using the same prorating procedure as used for the Levees & Floodwalls account. The prorated increase in E&D is estimated to be approximately $500,000. The $2.7 million cost for E&D results from recomputing the E&D cost based on analysis of work required rather than by using a fixed percentage of construction cost.

c. Supervision and Administration. As with the E&D comparision made in subparagraph b. above, an approximate comparison of cost can only be made by comparing the cost on the same physical work basis. The prorated increase in S&A, obtained in a similar manner as in subparagraphs a. and b. above, is estimated to be approximately $500,000. An increase in S&A should be expected with a change from a relatively simple I-wall construction plan to more complex T-Wall type construction.

67. Schedule for Design and Construction. The sequence of contracts and schedules are as follows:

TABLE 8
SCHEDULE FOR DESIGN AND CONSTRUCTION

Contracts	Plans & Specs		Construction			Estimated Construction Cost[1/]
	Start	Complete	Adver.	Award	Complete	$
Pile Test - Airport to Lakefront	Jun 87	Jul 87	Sep 87	Oct 87	Feb 88	285,000
Airport to West Esplanade Ave Floodwall	Jul 87	Oct 87	Apr 88	May 88	May 90	11,062,000
West Esplanade Ave to Lakefront Floodwall	Jun 88	Oct 88	Apr 89	May 89	Nov 91	13,278,000

1/ This cost includes contingencies, Federal and Non-Federal construction costs, and Federal and Non-Federal supervision and inspection (S & I) costs (S & I costs constitute 90% of the supervision and administration costs).

68. Funds Required by Fiscal Year. To maintain the schedule for design and construction of the levees and floodwalls for the Jefferson Parish Return Levee, Federal funds will be required by fiscal years as follows:

TABLE 9
FEDERAL FUNDING BY FISCAL YEAR[1]/

Funds Required	FY 87	$ 600,000
Funds Required	FY 88	2,800,000
Funds Required	FY 89	8,700,000
Funds Required	FY 90	9,600,000
Funds Required	FY 91	3,600,000
Funds Required	FY 92	600,000
TOTAL		25,900,000

1/ Federal funding schedule takes into account surplus credits that local interest has accrued for work at the four lakefront pumping stations.

OPERATION AND MAINTENANCE

69. General. The Jefferson/St. Charles return levee will be maintained and operated at the expense of local interests as a feature of local cooperation for the project. The estimate of the annual operation and maintenance costs for the levee and floodwall features which are detailed in this GDM are as follows:

a. Levee Maintenance (44 acres)		$ 4,800 per year
b. Floodwall Maintenance (3.43 miles)		10,000 per year
	Total	$14,800 per year

ECONOMICS

70. Economic Justification. The current economic analysis for the entire Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project is contained in the Reevaluation Study entitled "Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project", dated December 1983. Based on October 1983 price levels, and at the project interest rate of 3 1/8 percent, the benefit-cost ratio for the project as a whole is 4.2 to 1. The Reevaluation Study also breaks out separable project areas (SPA) for incremental justification. The New Orleans Lakefront reach is a part of the New Orleans-Jefferson SPA. The computed benefit-cost ratio for the New Orleans-Jefferson area is 5.0 to 1.

FEDERAL AND NON-FEDERAL COST BREAKDOWN

71. Federal and Non-Federal Cost Breakdown. The breakdown of Federal and non-Federal costs for the high level plan construction work described in this GDM are shown in Table 10 below:

Table 10
FEDERAL AND NON-FEDERAL COST BREAKDOWN
OCT 87 PRICE LEVELS

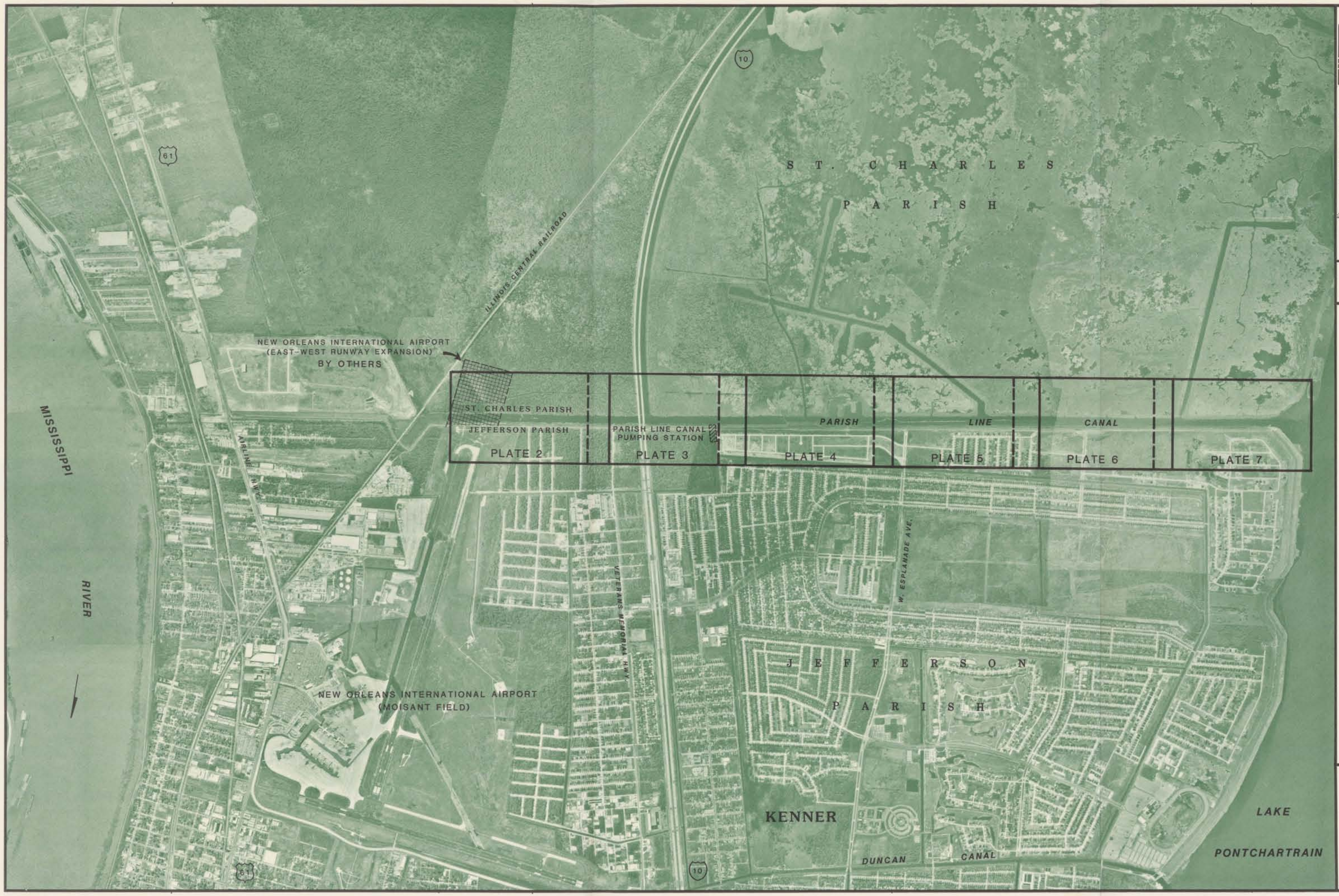
Item	Federal	Non-Federal	Total
Levees & Floodwalls	$19,320,000	$8,280,000 1/	$27,600,000
Lands & Damages	___	2/	___
Relocations	___	2/	___
TOTAL	$19,320,000	$8,280,000	$27,600,000

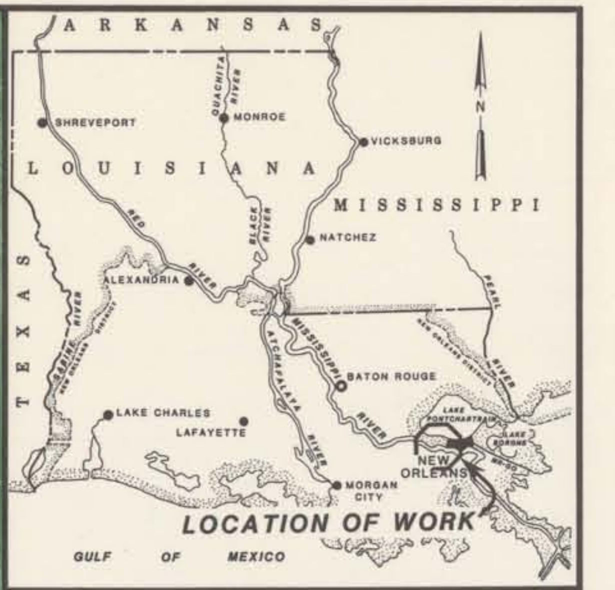
1/ Includes Sunk cost estimated to be $343,000 for constructing the fronting protection for the Parish Line Canal Pumping Station, a creditable item of work accomplished by local interests.

2/ There are no additional rights-of-way required to construct the floodwall reach described in this memorandum. All rights-of-way were in existence at the time of the authorization for the Lake Pontchartrain project. No relocations are required to construct the floodwall reach detailed in this GDM.

RECOMMENDATIONS

72. Recommendations. The plan of improvement for the high level plan presented herein consists of 3.43 miles of floodwall construction along the Jefferson/St. Charles Parish return levee. This plan is considered to be the most economical means of providing high level plan, SPH - project protection and is recommended for approval as a basis for preparing plans and specifications for this project reach.





VICINITY MAP

SCALE OF MILES

40 0 40 80 120 160 200

INDEX MAP

SCALE IN FEET

1200 0 1200 2400 3600

LAKE PONTCHARTRAIN LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO.17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

INDEX AND VICINITY MAP

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

DATE JULY 1987 FILE NO. H-2-30197

PLATE 1


NEW ORLEANS
INTERNATIONAL AIRPORT
(EAST - WEST RUNWAY EXPANSION BY OTHERS)
ST. CHARLES PARISH
NEW FLOOD PROTECTION
(TO BE CONSTRUCTED WITH AIRPORT EXPANSION) DETAILS TO BE ADDRESSED IN SUPPLEMENT I TO THIS GDM.
LIMIT OF WORK
STA. 0+00.00 W/L =
STA. 74+00.00 B/L
12' OFFSET
EXISTING R/W TO BE RESCINDED
R/W
PARISH LINE CANAL
BASE LINE
STA.75+58.01 B/L
STA. 11+60.00 W/L
WALL LINE
253'±
254'±
FLOOD SIDE
1-U
2-G
3-G
AZ. 180° 27' 11"
AZ. 180° 40' 59"
AZ. 180° 43' 08"
AZ. 180° 40' 41"
57'±
55'±
45'±
STA.72+50.00 B/L
PROTECTED SIDE
JEFFERSON PARISH
LEGEND
2-G GENERAL TYPE BORING
5-U UNDISTURBED BORING
PLAN
SCALE: 1" = 100'
100 0 100 200 300 400 500 FT.
NOTE: UNCONTROLLED MOSAIC PREPARED FROM AERIAL PHOTOS FLOWN DECEMBER 1985.
NEW ORLEANS
INTERNATIONAL AIRPORT
Computer Aided Design Drafting
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH RETURN LEVEE
PLAN
STA. 0+00.00 W/L TO STA. 23+00.00 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987
FILE NO. H-4-30197

ST. CHARLES PARISH
N
FUTURE INTERSTATE 10 WIDENING (BY OTHERS)
INTERSTATE 10 (EAST BOUND)
INTERSTATE 10 (WEST BOUND)
R/W
PARISH LINE CANAL
WALL LINE
FLOOD SIDE
STA. 25+60.00 W/L
258'±
STA. 30+08.00 W/L
STA. 35+20.00 W/L
255'±
250'±
STA. 46+73.20 W/L
STA. 47+09.20 W/L
STA. 47+51.20 W/L
STA. 47+87.20 W/L
AZ. 180° 29' 20"
STA. 49+20.40 W/L
245'±
AZ. 180° 40' 41"
AZ. 180° 20' 07"
AZ. 180° 13' 08"
AZ. 180° 29' 20"
AZ. 183° 47' 58"
AZ. 180° 25' 55"
AZ. 180° 43' 08"
AZ. 180° 23' 12"
AZ. 173° 41' 04"
AZ. 183° 47' 58"
3-U
5-U
6-U
4-G
4-U
52'±
STA. 104+07.63 B/L
BASE LINE
100'±
140'±
110'±
STA. 101+97.59 B/L
STA. 114+97.69 B/L
STA. 123+98.19 B/L
STA. 124+98.19 B/L
PROTECTED SIDE
JEFFERSON PARISH
FUTURE INTERSTATE 10 WIDENING (BY OTHERS)
PARISH LINE CANAL PUMPING STATION (BY OTHERS)
LEGEND
2-G GENERAL TYPE BORING
5-U UNDISTURBED BORING
PLAN
SCALE: 1" = 100'
100 0 100 200 300 400 500 FT.
NOTE: UNCONTROLLED MOSAIC PREPARED FROM AERIAL PHOTOS FLOWN DECEMBER 1985.
Computer Aided Design Drafting
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH RETURN LEVEE
PLAN
STA. 17+00.00 W/L TO STA. 54+00.00 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987
FILE NO. H-2-30197


ST. CHARLES PARISH
N
R/W
PARISH LINE CANAL
FLOOD SIDE
WALL LINE
BASE LINE
STA. 57+70.40 W/L
STA. 65+20.40 W/L
STA. 66+02.90 W/L
STA. 82+97.90 W/L
AZ. 166° 43' 42"
AZ. 180° 25' 55"
AZ. 180° 23' 12"
AZ. 180° 48' 10"
AZ. 180° 43' 52"
AZ. 180° 45' 52"
AZ. 180° 31' 03"
240'±
245'±
250'±
255'±
105'±
135'±
50'±
51'±
5-GA
5-G
6-G
7-U
8-U
8-UA
STA. 123+98.19 B/L
STA. 124+98.19 B/L
STA. 130+67.89 B/L
STA. 132+02.89 B/L
STA. 138+99.29 B/L
STA. 156+95.04 B/L
STA. 159+00.04 B/L
PROTECTED SIDE
JEFFERSON PARISH
LEGEND
2-G GENERAL TYPE BORING
5-U UNDISTURBED BORING
PLAN
SCALE: 1" = 100'
100 0 100 200 300 400 500 FT.
NOTE: UNCONTROLLED MOSAIC PREPARED FROM AERIAL PHOTOS FLOWN DECEMBER 1985.
Computer Aided Design Drafting
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE
PLAN
STA. 49+00.00 W/L TO STA. 87+00.00 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987
FILE NO. H-2-30197

PLATE 4

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

PLAN

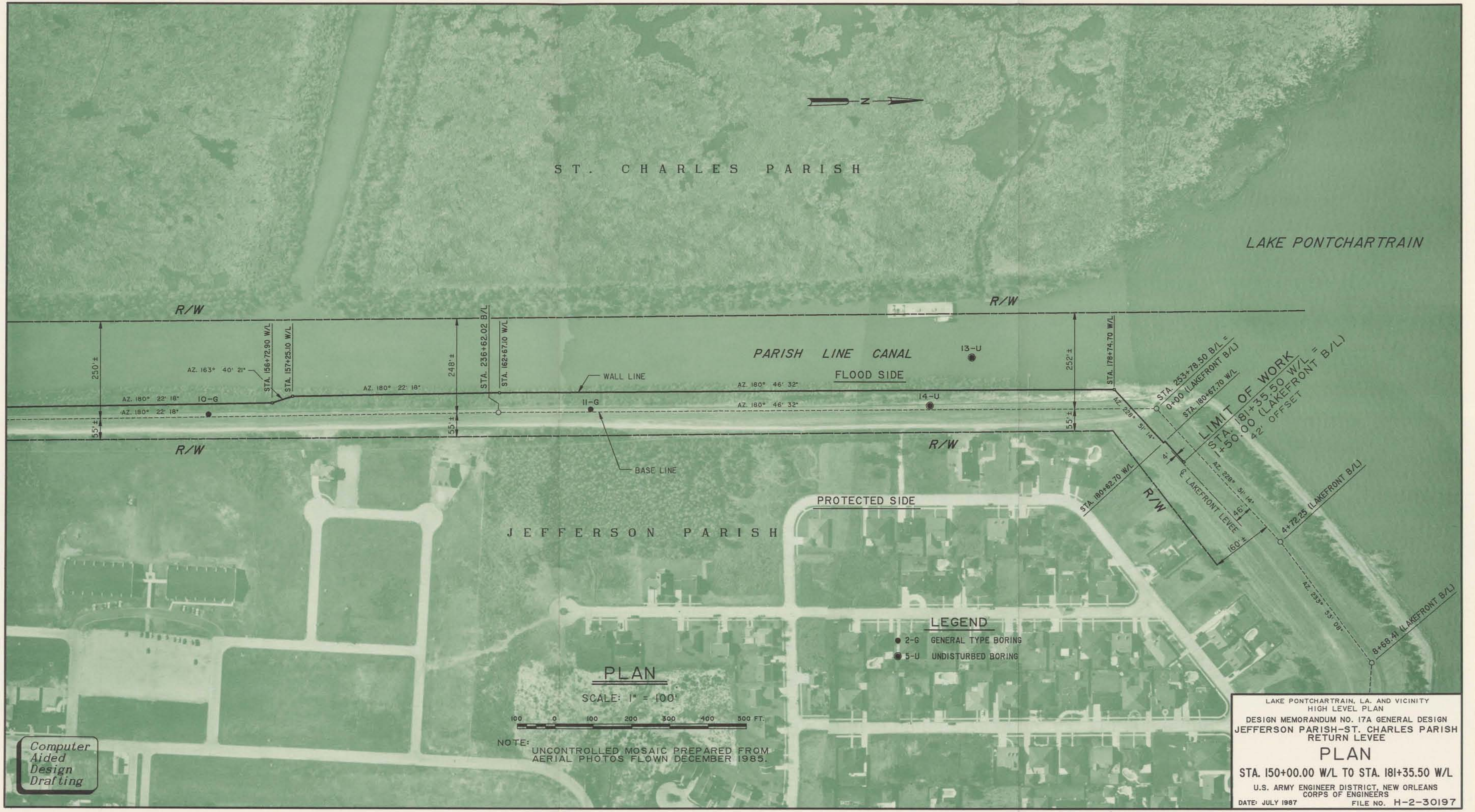
STA. 84+00.00 W/L TO STA. 121+00.00 W/L

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

DATE: JULY 1987 FILE NO. H-2-30197


ST. CHARLES PARISH
N
R/W
R/W
265'±
265'±
STA. 135+99.50 W/L
PARISH LINE CANAL
260'±
WALL LINE
WALL LINE
FLOOD SIDE
10-U
8-G
AZ. 180° 32' 20"
9-G
AZ. 180° 22' 18"
11-U
10-G
AZ. 180° 32' 20"
AZ. 180° 22' 18"
50'±
12-U
100'±
200'±
130'±
BASE LINE
R/W
R/W
R/W
R/W
R/W
R/W
STA. 196+06.50 B/L
STA. 203+01.10 B/L
STA. 208+51.10 B/L
STA. 209+96.60 B/L
STA. 213+51.60 B/L
STA. 214+51.60 B/L
PROTECTED SIDE
JEFFERSON PARISH
VINTAGE DR.
LEGEND
2-G GENERAL TYPE BORING
5-U UNDISTURBED BORING
PLAN
SCALE: 1 = 100'
100 0 100 200 300 400 500 FT.
NOTE: UNCONTROLLED MOSAIC PREPARED FROM AERIAL PHOTOS FLOWN DECEMBER 1985.
Computer Aided Design Drafting
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE
PLAN
STA. 118+00.00 W/L TO STA. 155+00.00 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987
FILE NO. H-2-30197

PLATE 6

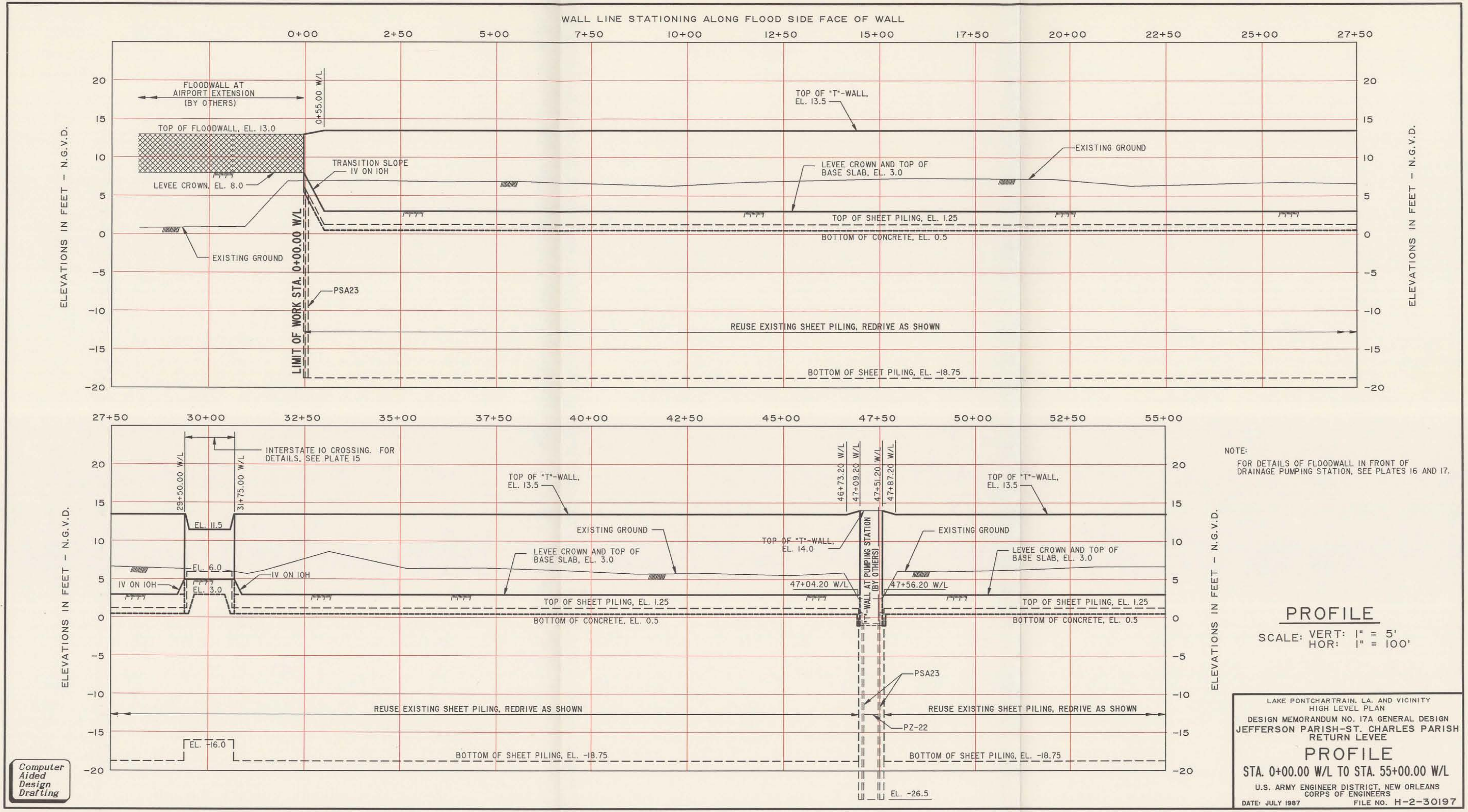


LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH–ST. CHARLES PARISH RETURN LEVEE

PLAN

STA. 150+00.00 W/L TO STA. 181+35.50 W/L

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197



NOTE:
FOR DETAILS OF FLOODWALL IN FRONT OF DRAINAGE PUMPING STATION, SEE PLATES 16 AND 17.

PROFILE

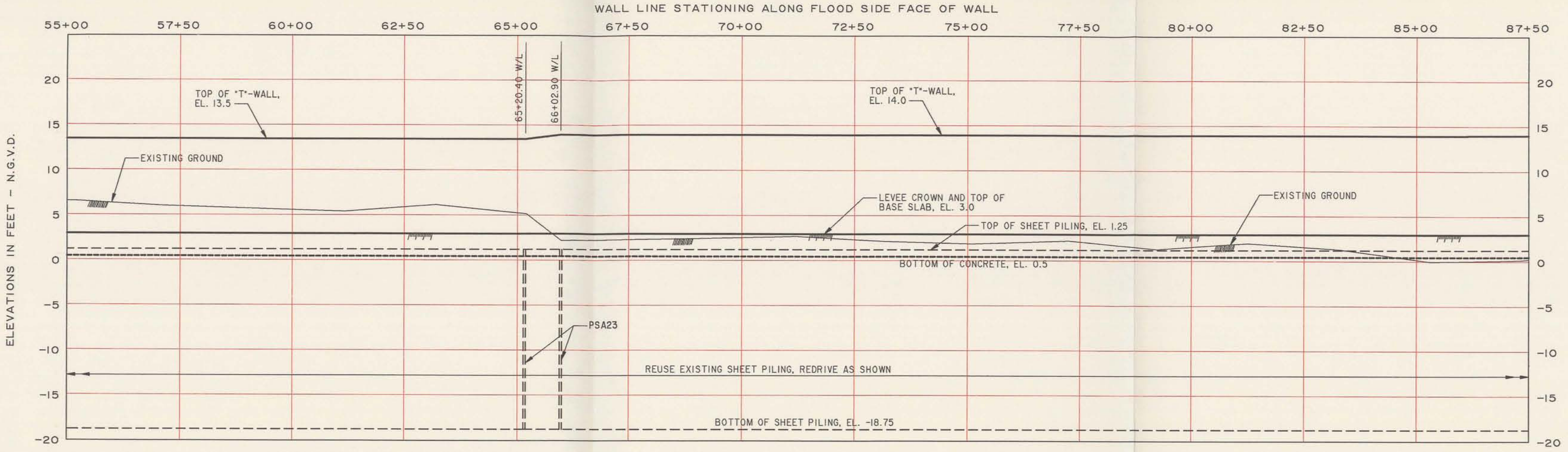
SCALE: VERT: 1" = 5'
HOR: 1" = 100'

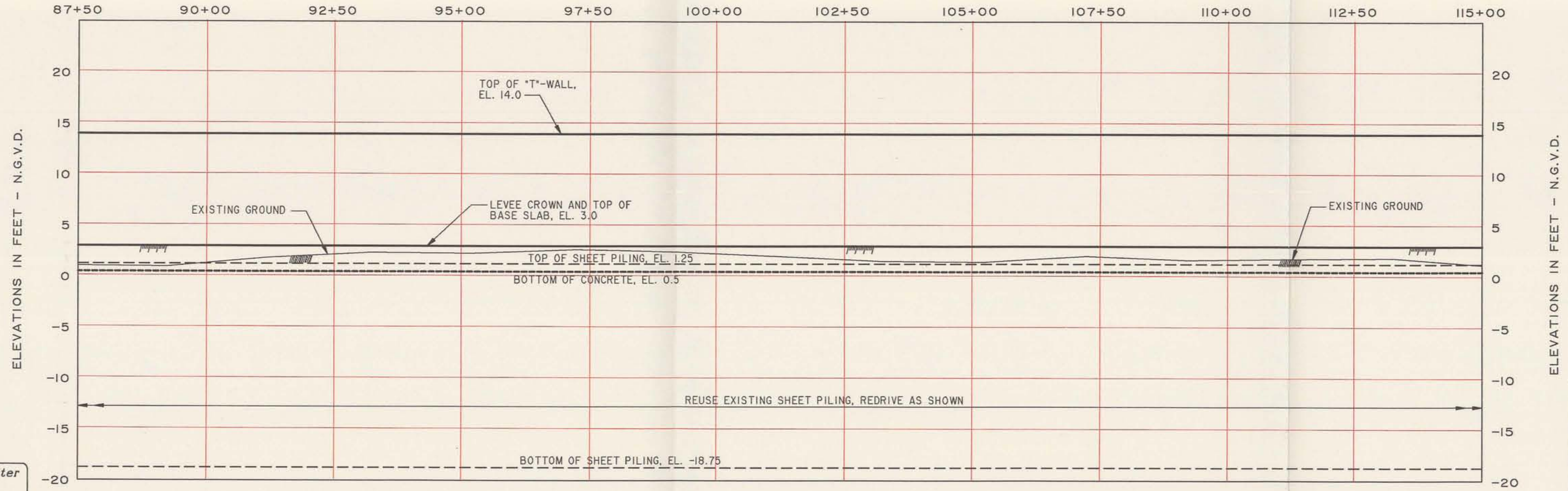
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH RETURN LEVEE

PROFILE

STA. 0+00.00 W/L TO STA. 55+00.00 W/L

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197





PROFILE

SCALE: VERT: 1" = 5'
HOR: 1" = 100'

Computer Aided Design Drafting

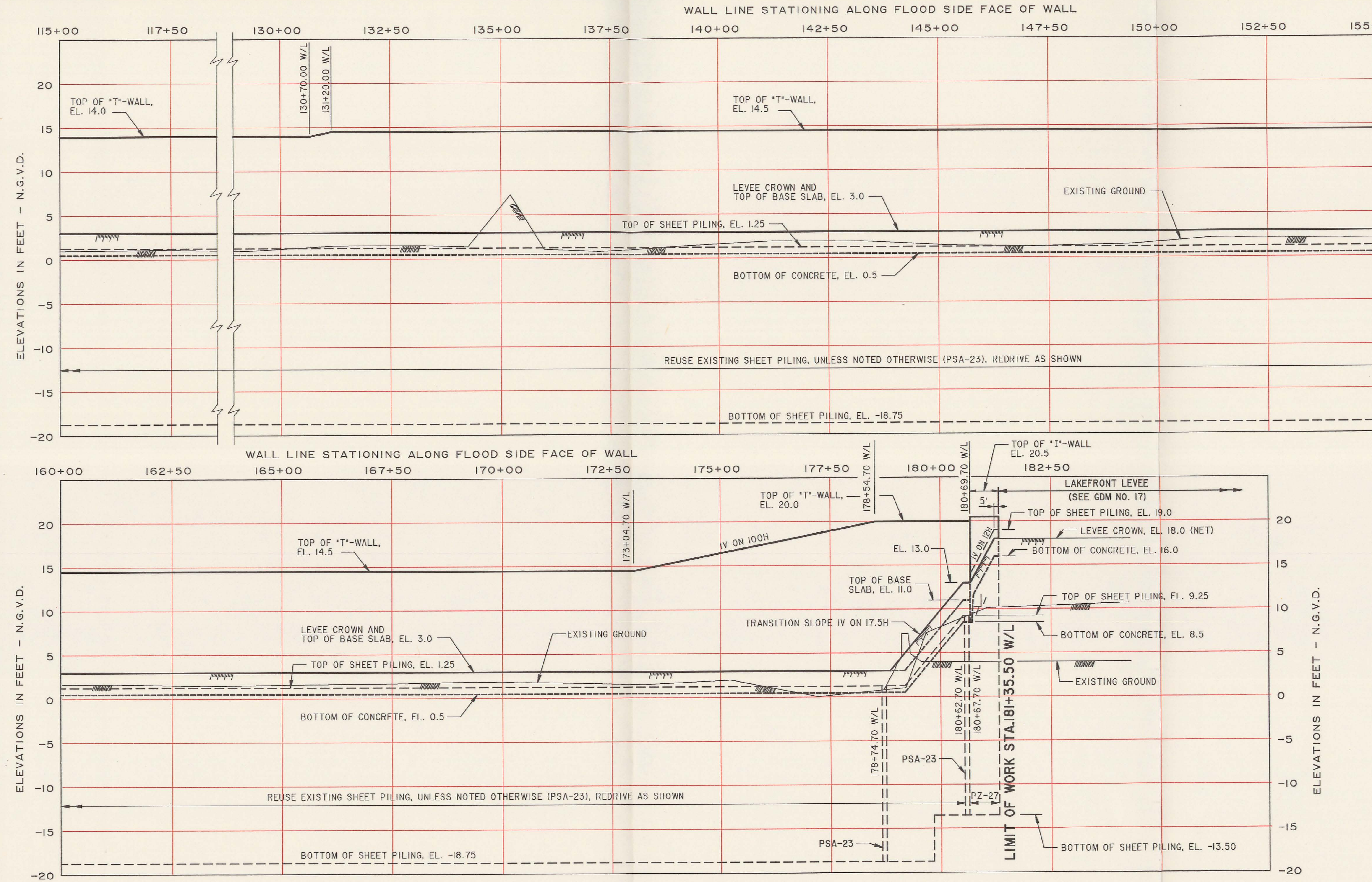
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

PROFILE

STA. 55+00.00 W/L TO STA. 115+00.00 W/L

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

DATE: JULY 1987 FILE NO. H-2-30197



PROFILE

SCALE: VERT. 1" = 5'
HORIZ. 1" = 100'

Computer Aided Design Drafting

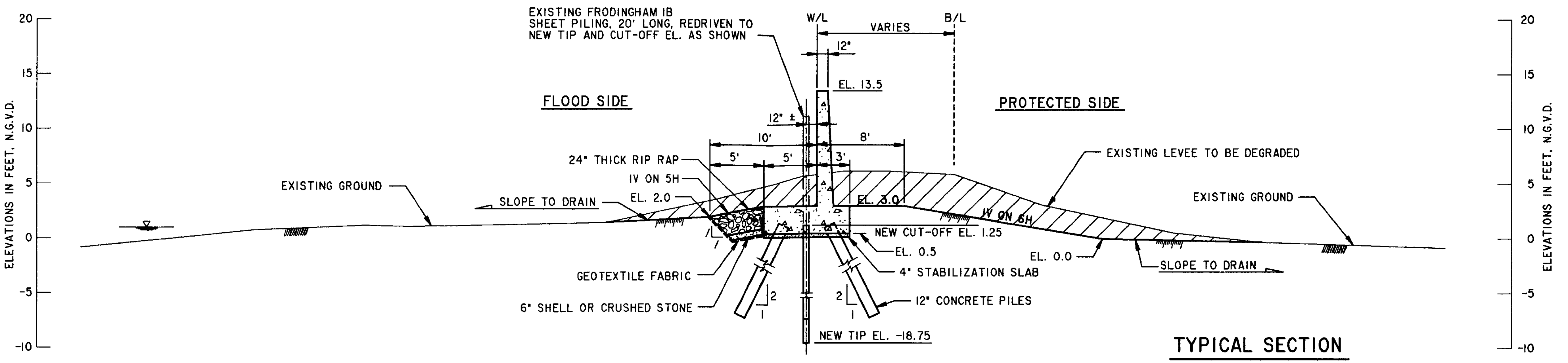
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

PROFILE

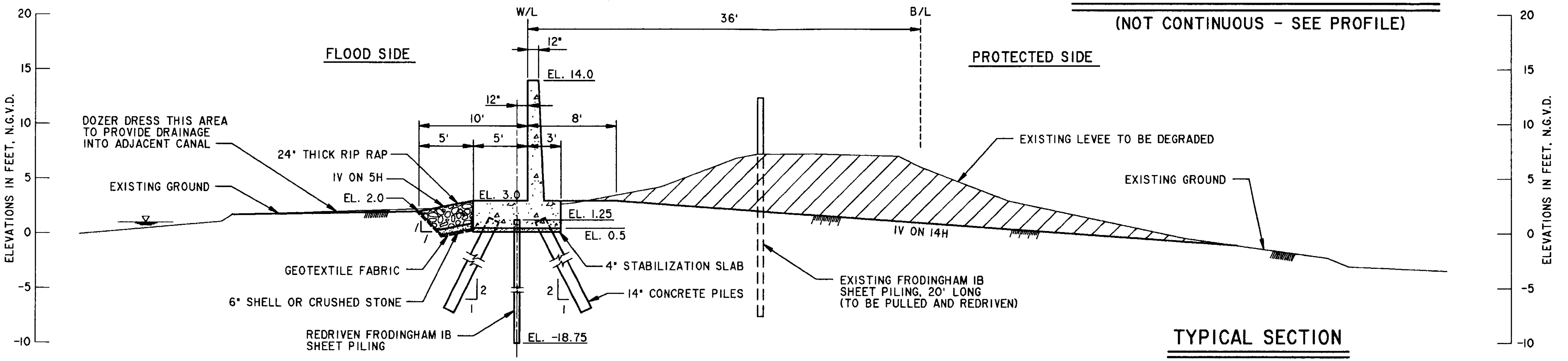
STA. 115+00.00 W/L TO STA. 181+35.50 W/L

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

DATE: JULY 1987 FILE NO. H-2-30197

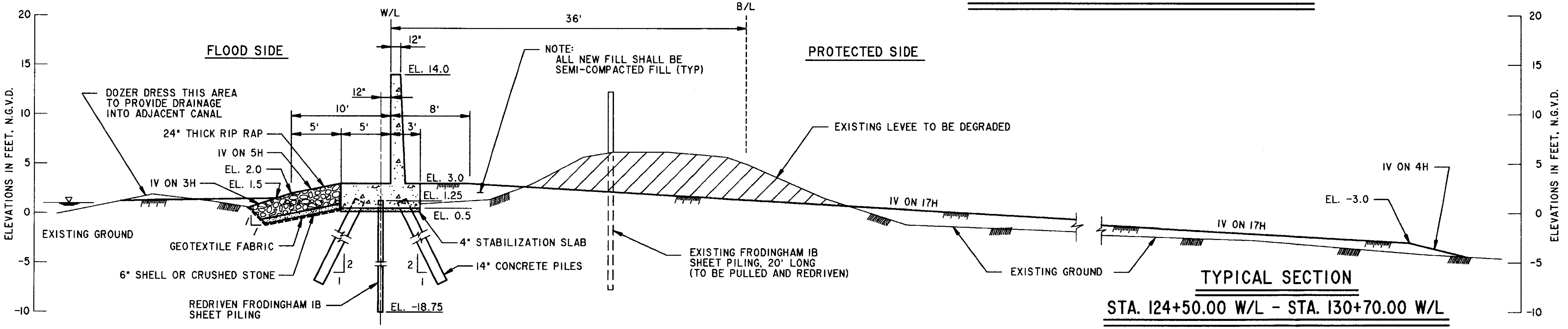


TYPICAL SECTION
STA. 0+00.00 W/L - STA. 65+20.40 W/L
(NOT CONTINUOUS - SEE PROFILE)



TYPICAL SECTION
STA. 66+02.90 W/L - STA. 124+50.00 W/L

NOTE:
SEE PROFILE FOR TRANSITION DETAILS BETWEEN THE TYPICAL SECTIONS SHOWN.



TYPICAL SECTION
STA. 124+50.00 W/L - STA. 130+70.00 W/L

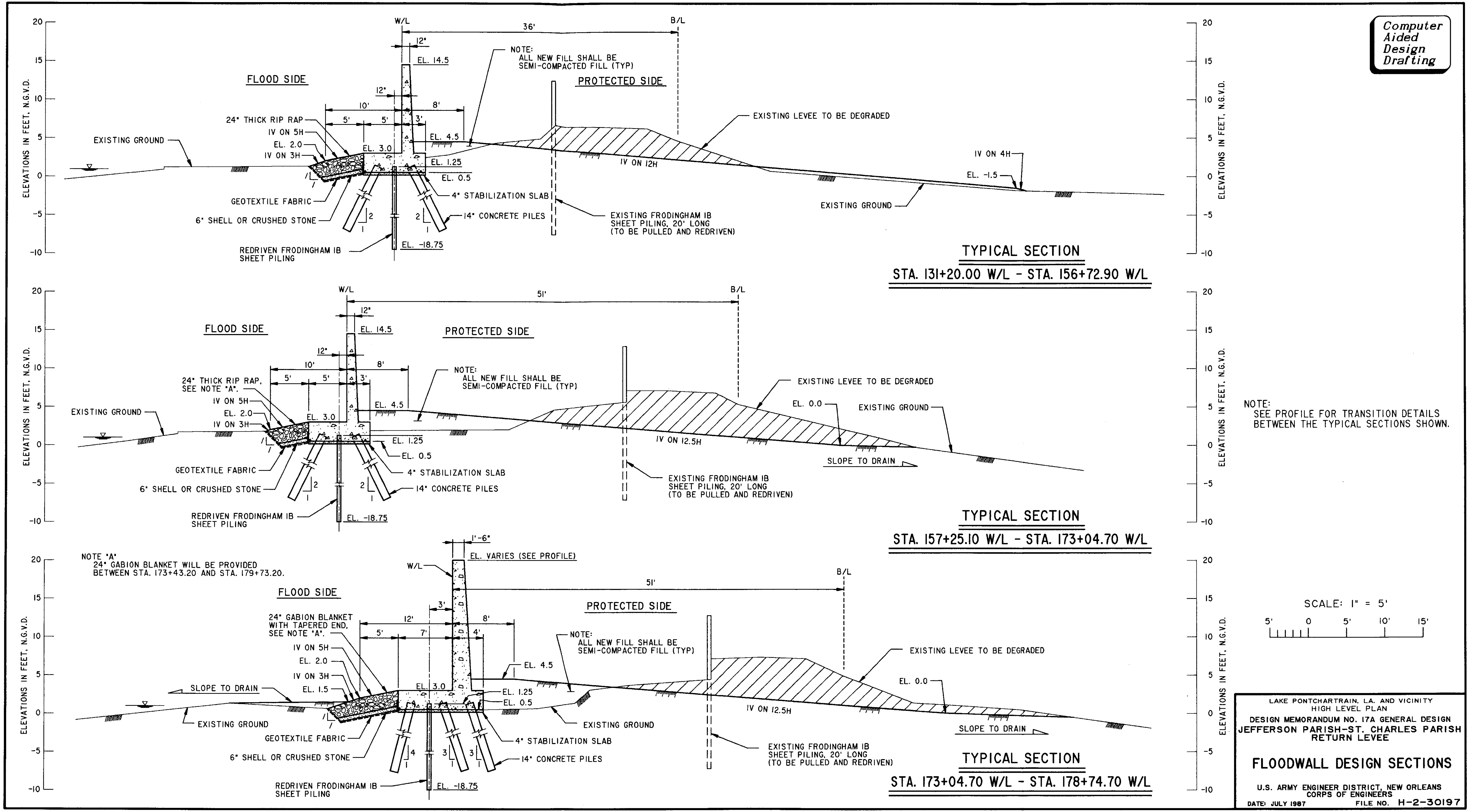
SCALE: 1" = 5'
5' 0 5' 10' 15'

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH RETURN LEVEE

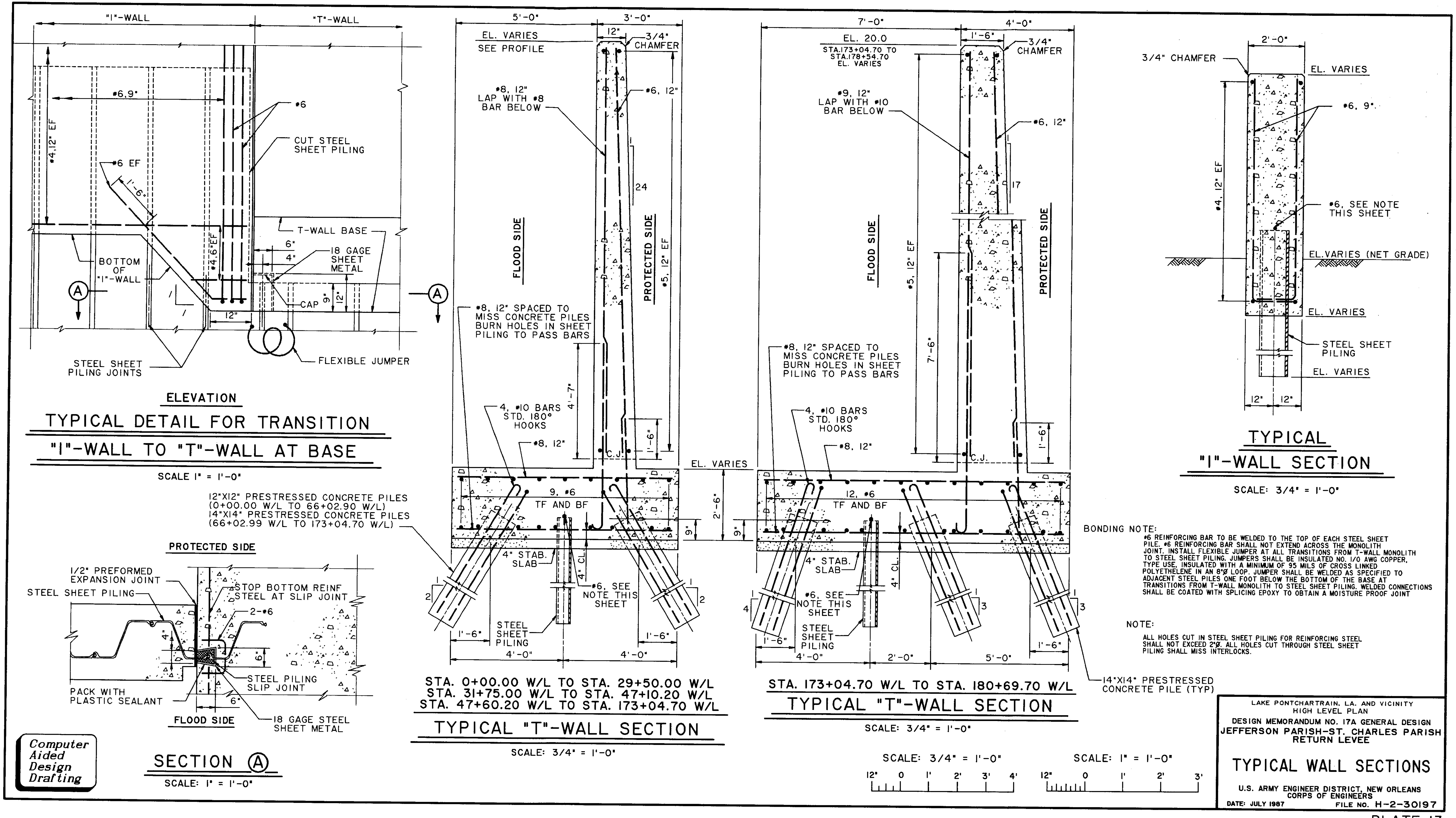
FLOODWALL DESIGN SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197

PLATE 11



Computer Aided Design Drafting
ELEVATIONS IN FEET, N.G.V.D.
W/L
B/L
36'
12"
EL. 14.5
NOTE: ALL NEW FILL SHALL BE SEMI-COMPACTED FILL (TYP)
FLOOD SIDE
PROTECTED SIDE
10'
8'
5'
3'
24" THICK RIP RAP
IV ON 5H
EL. 2.0
IV ON 3H
EL. 3.0
EL. 4.5
EL. 1.25
EL. 0.5
EXISTING GROUND
EXISTING LEVEE TO BE DEGRADED
IV ON 12H
IV ON 4H
EL. -1.5
GEOTEXTILE FABRIC
6" SHELL OR CRUSHED STONE
4" STABILIZATION SLAB
14" CONCRETE PILES
EXISTING FRODINGHAM IB SHEET PILING, 20' LONG (TO BE PULLED AND REDRIVEN)
REDRIVEN FRODINGHAM IB SHEET PILING
EL. -18.75
TYPICAL SECTION
STA. 131+20.00 W/L - STA. 156+72.90 W/L
51'
24" THICK RIP RAP, SEE NOTE "A".
EL. 0.0
IV ON 12.5H
SLOPE TO DRAIN
TYPICAL SECTION
STA. 157+25.10 W/L - STA. 173+04.70 W/L
NOTE: SEE PROFILE FOR TRANSITION DETAILS BETWEEN THE TYPICAL SECTIONS SHOWN.
NOTE "A" 24" GABION BLANKET WILL BE PROVIDED BETWEEN STA. 173+43.20 AND STA. 179+73.20.
1'-6"
EL. VARIES (SEE PROFILE)
24" GABION BLANKET WITH TAPERED END, SEE NOTE "A".
12'
7'
4'
EL. 1.5
TYPICAL SECTION
STA. 173+04.70 W/L - STA. 178+74.70 W/L
SCALE: 1" = 5'
5' 0 5' 10' 15'
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH RETURN LEVEE
FLOODWALL DESIGN SECTIONS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987
FILE NO. H-2-30197



BONDING NOTE:

#6 REINFORCING BAR TO BE WELDED TO THE TOP OF EACH STEEL SHEET PILE. #6 REINFORCING BAR SHALL NOT EXTEND ACROSS THE MONOLITH JOINT. INSTALL FLEXIBLE JUMPER AT ALL TRANSITIONS FROM T-WALL MONOLITH TO STEEL SHEET PILING. JUMPERS SHALL BE INSULATED NO. 1/0 AWG COPPER, TYPE USE, INSULATED WITH A MINIMUM OF 95 MILS OF CROSS LINKED POLYETHELENE IN AN 8"Ø LOOP. JUMPER SHALL BE WELDED AS SPECIFIED TO ADJACENT STEEL PILES ONE FOOT BELOW THE BOTTOM OF THE BASE AT TRANSITIONS FROM T-WALL MONOLITH TO STEEL SHEET PILING. WELDED CONNECTIONS SHALL BE COATED WITH SPLICING EPOXY TO OBTAIN A MOISTURE PROOF JOINT

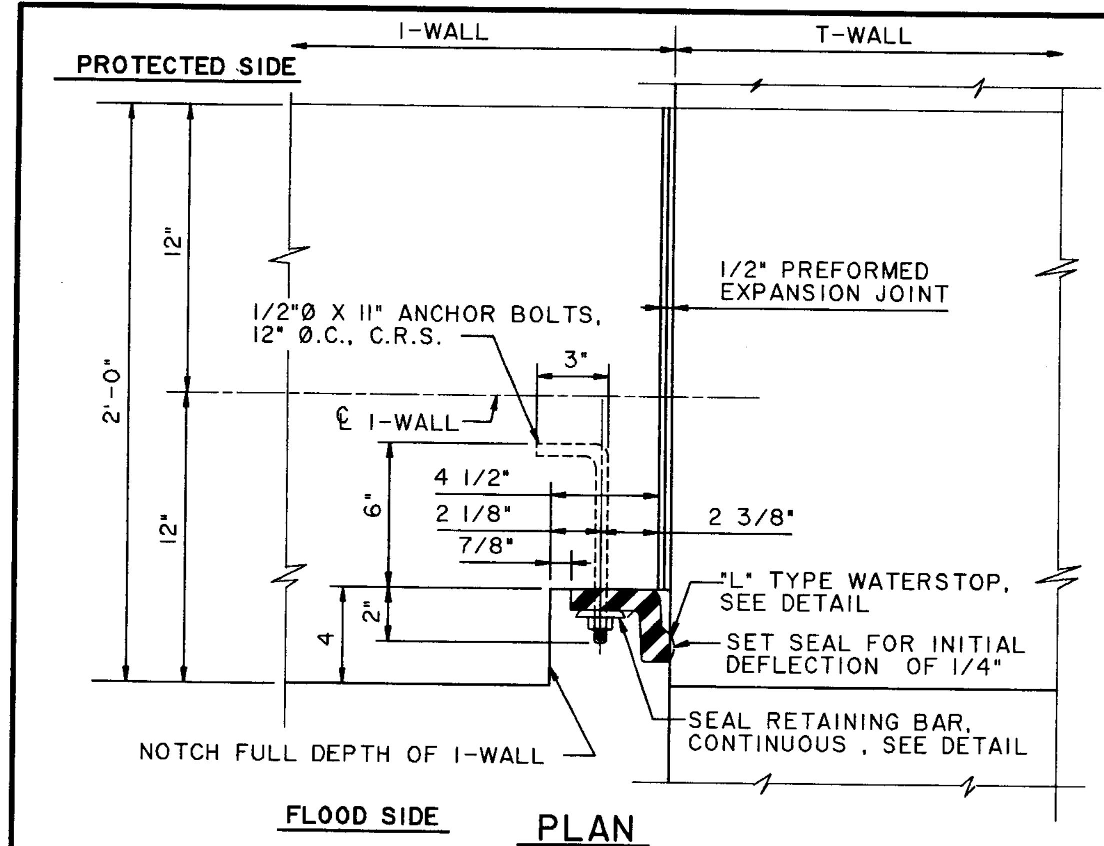
NOTE:

ALL HOLES CUT IN STEEL SHEET PILING FOR REINFORCING STEEL SHALL NOT EXCEED 2"Ø. ALL HOLES CUT THROUGH STEEL SHEET PILING SHALL MISS INTERLOCKS.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

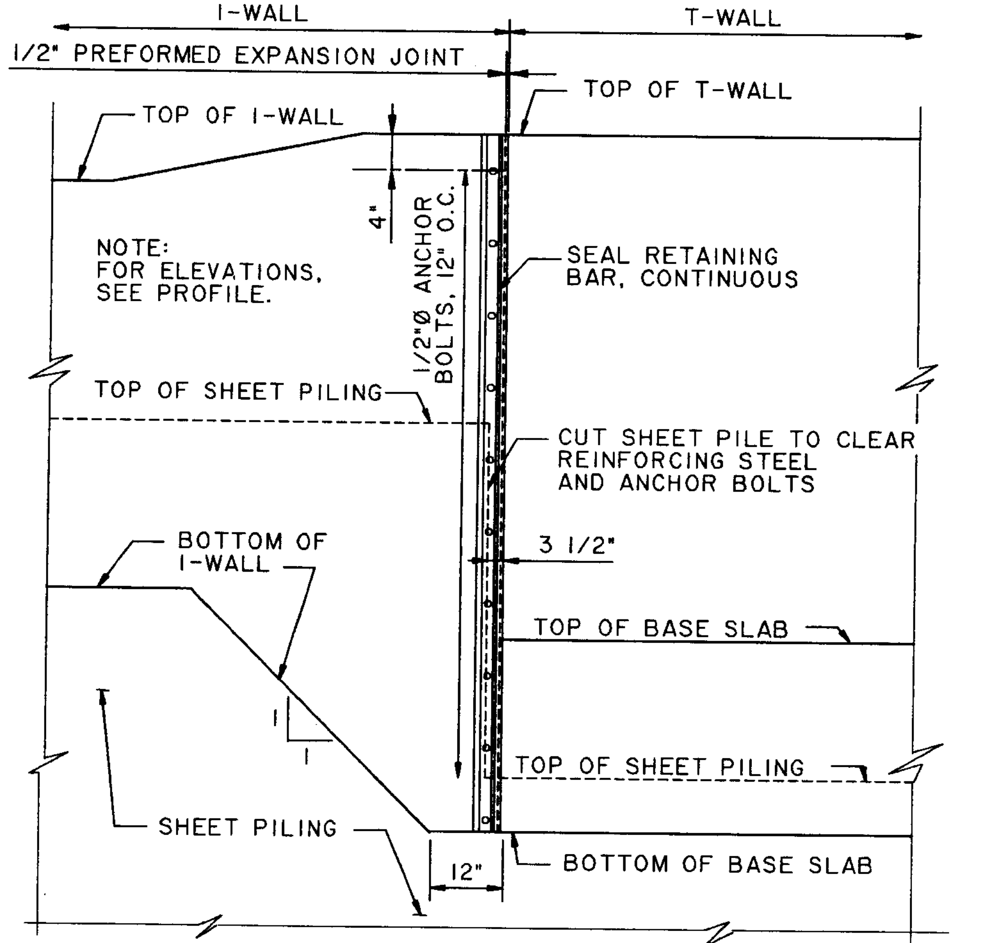
TYPICAL WALL SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197



PLAN

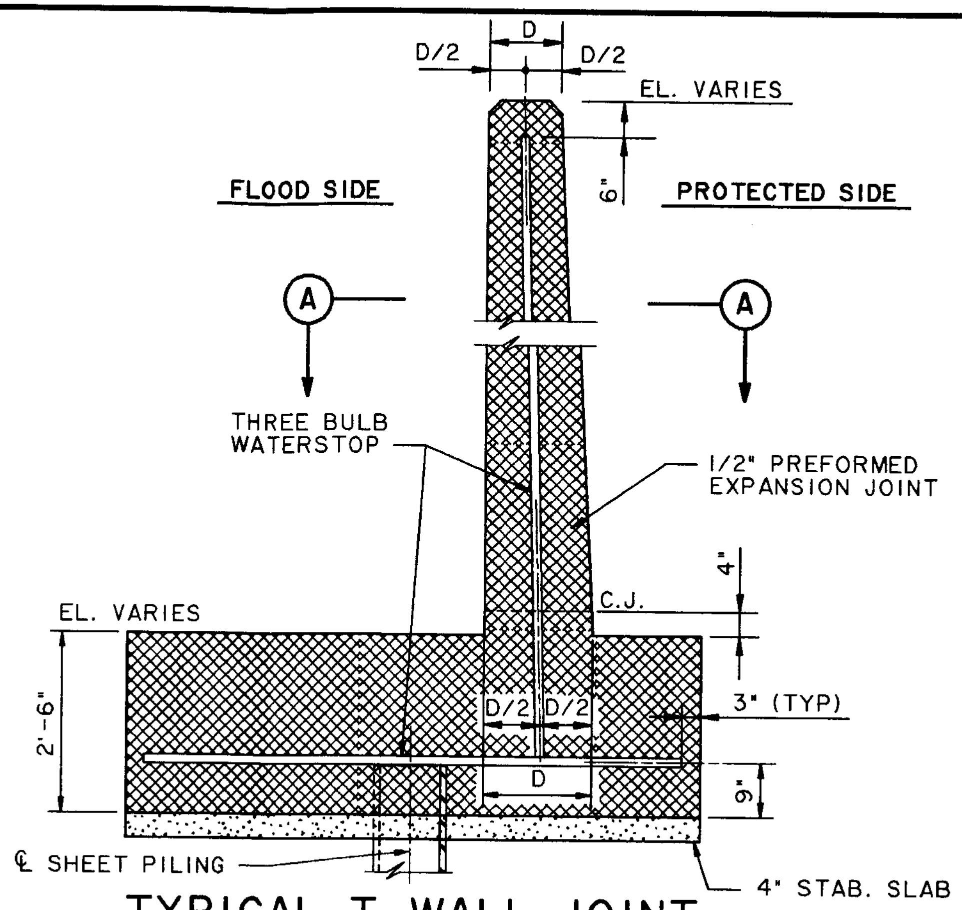
SCALE: 3" = 1'-0"



FLOOD SIDE ELEVATION

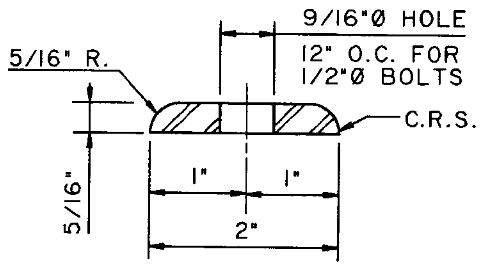
TYPICAL JOINT BETWEEN I-WALL AND T-WALL

SCALE: 3/4" = 1'-0"



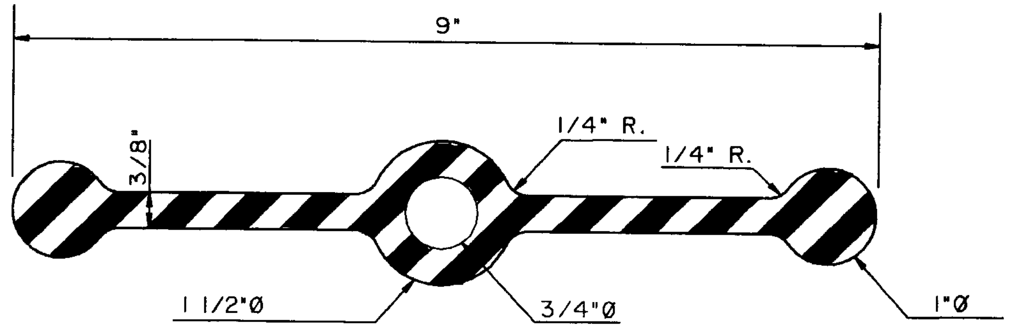
TYPICAL T-WALL JOINT

SCALE: 3/4" = 1'-0"



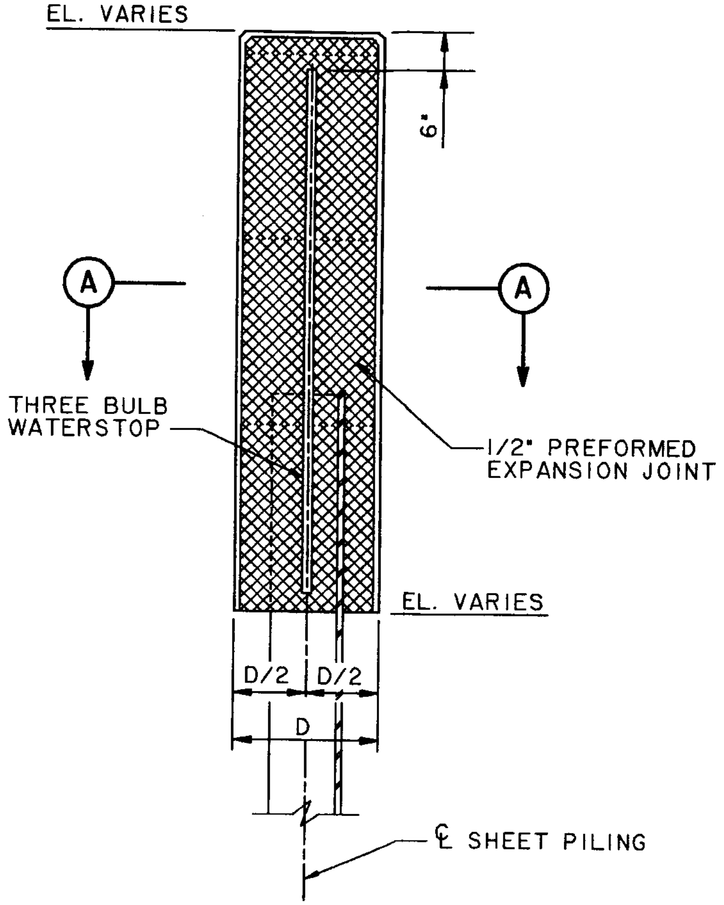
SEAL RETAINING BAR

SCALE: 12" = 1'-0"



THREE BULB WATERSTOP

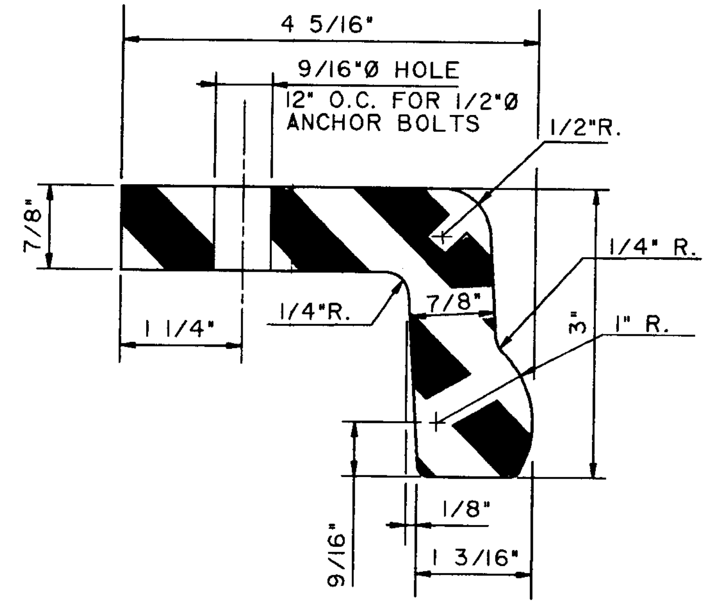
SCALE: 12" = 1'-0"



TYPICAL I-WALL JOINT

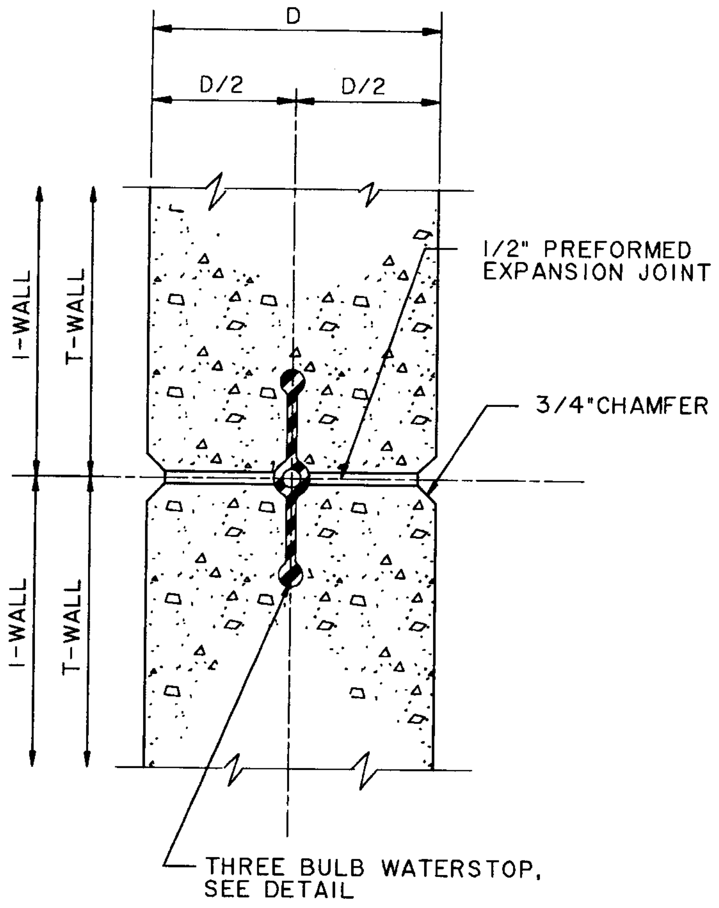
SCALE: 3/4" = 1'-0"

NOTE:
I-WALL MONOLITHS SHALL BE 30'±
UNLESS OTHERWISE INDICATED ON THE PROFILE
EACH MONOLITH SHALL END AT CENTER OF
NEAREST SHEET PILE INTERLOCK.



"L"-TYPE WATERSTOP

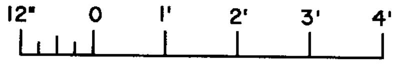
SCALE: 12" = 1'-0"



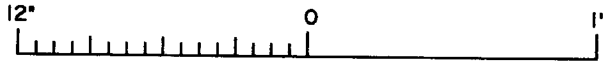
SECTION Ⓐ

SCALE: 3" - 1'-0"

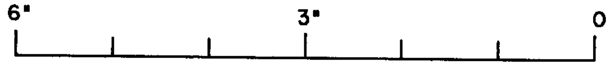
SCALE: 3/4" = 1'-0"



SCALE: 3" = 1'-0"



SCALE: 12" = 1'-0"



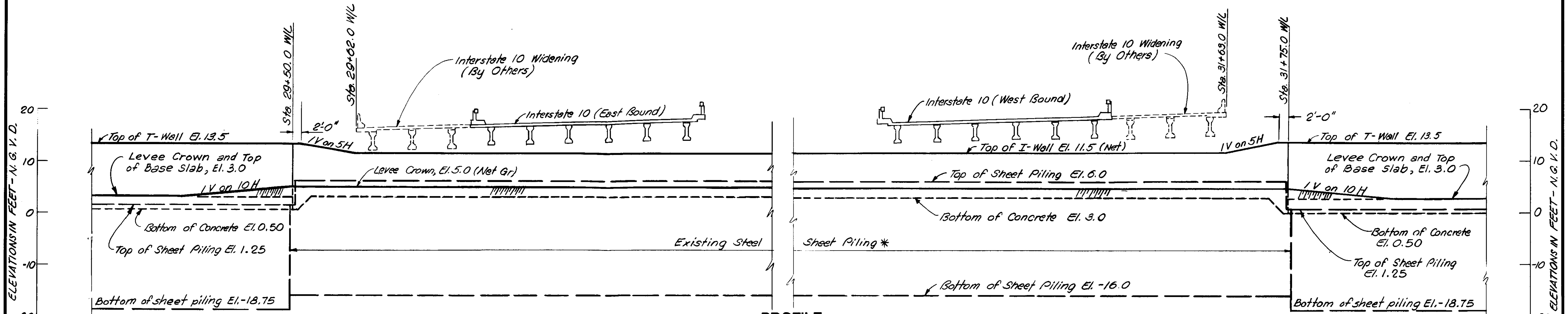
Computer Aided Design Drafting

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

TYPICAL WALL JOINTS

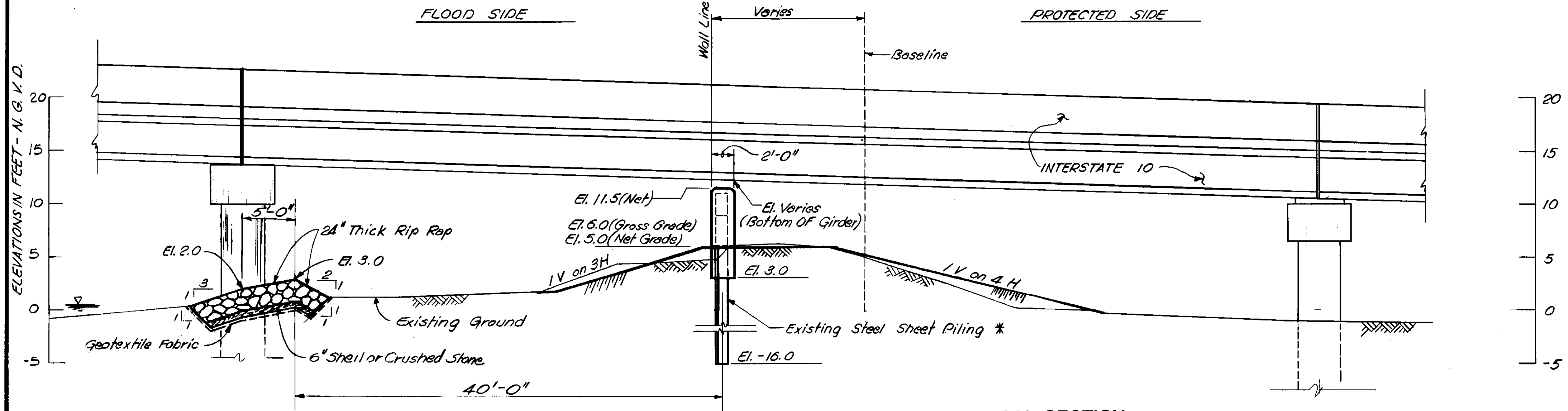
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: JULY 1987 FILE NO. H-2-30197



PROFILE

SCALE: 1/8"-1'-0"



TYPICAL SECTION

STA. 29+50.00 W/L TO STA. 31+75.00 W/L

SCALE: 1"-5'

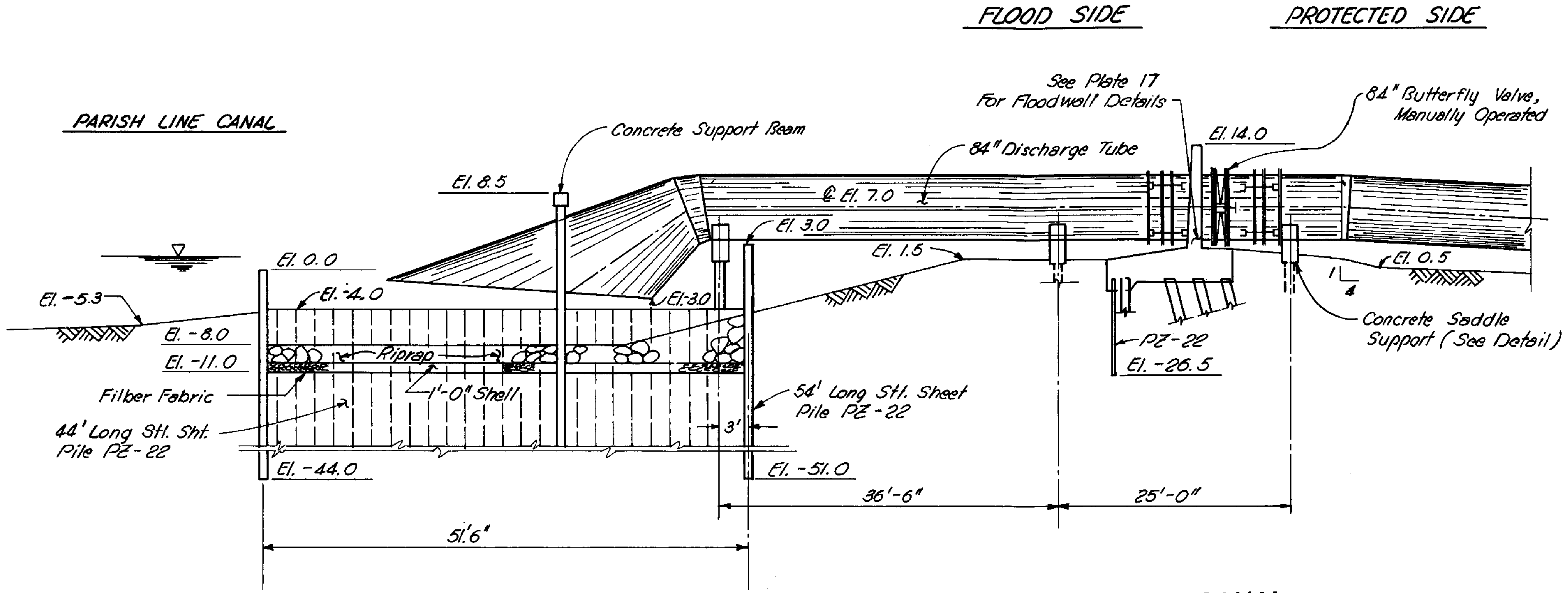
* The Existing 20' Long Steel Sheet Piling Will Be Cut And Driven In Segments To Tip El. -16.0. A 2 Ft. Segment Of New Sheet Piling Will Be Spliced To The Top Of The Existing Piling.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17 A GENERAL DESIGN
JEFFERSON PARISH - ST.CHARLES PARISH
RETURN LEVEE

DETAILS I-WALL UNDER INTERSTATE 10 CROSSING

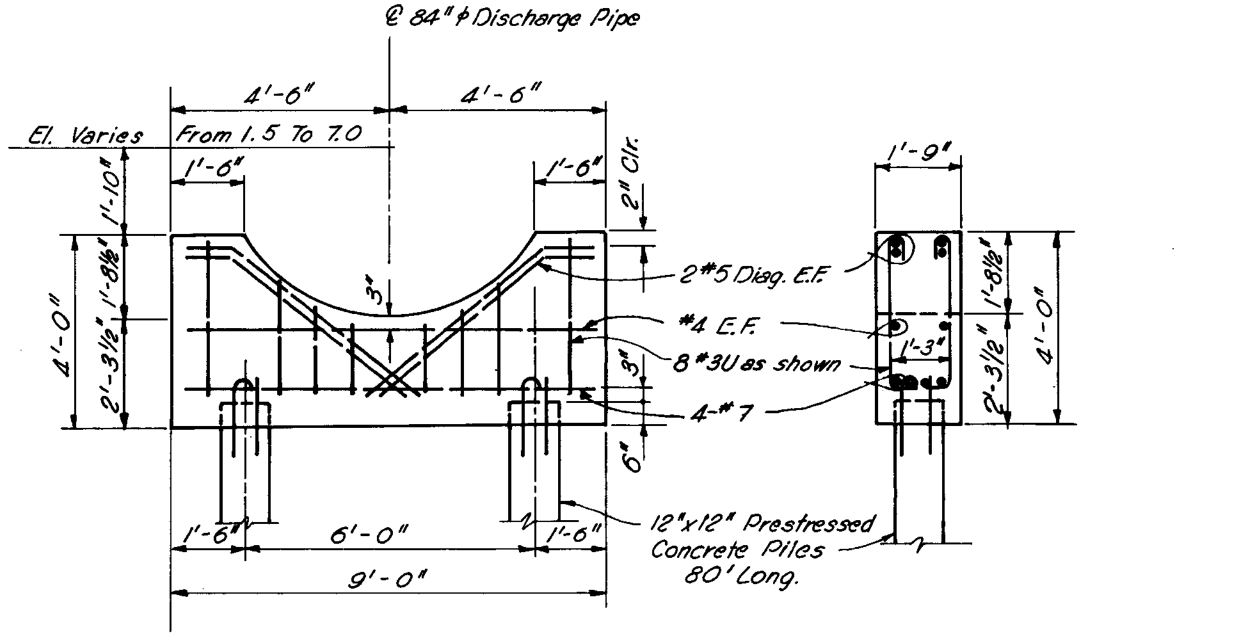
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE JULY 1987 FILE NO. H-2-30197



PROFILE OF DISCHARGE TUBE AT PARISH LINE CANAL PUMPING STATION- PUMP NOS. 1, 2, 3,

SCALE: 1/8"-1'-0"



SADDLE DETAIL

SCALE: 1/2"-1'-0"

SECTION THRU SADDLE

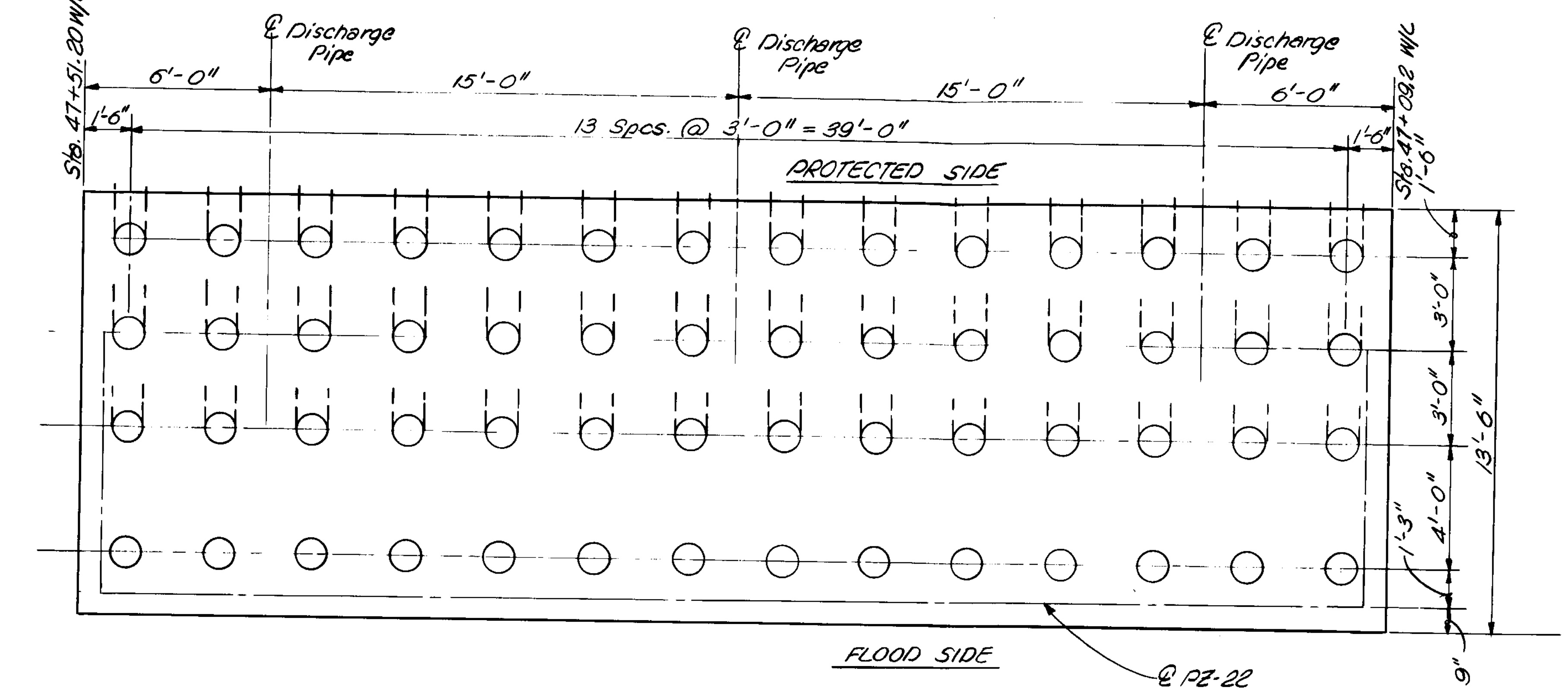
SCALE: 1/2"-1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17 A GENERAL DESIGN
JEFFERSON PARISH - ST.CHARLES PARISH
RETURN LEVEE

DISCHARGE TUBES FOR PARISH LINE CANAL PUMPING STATION

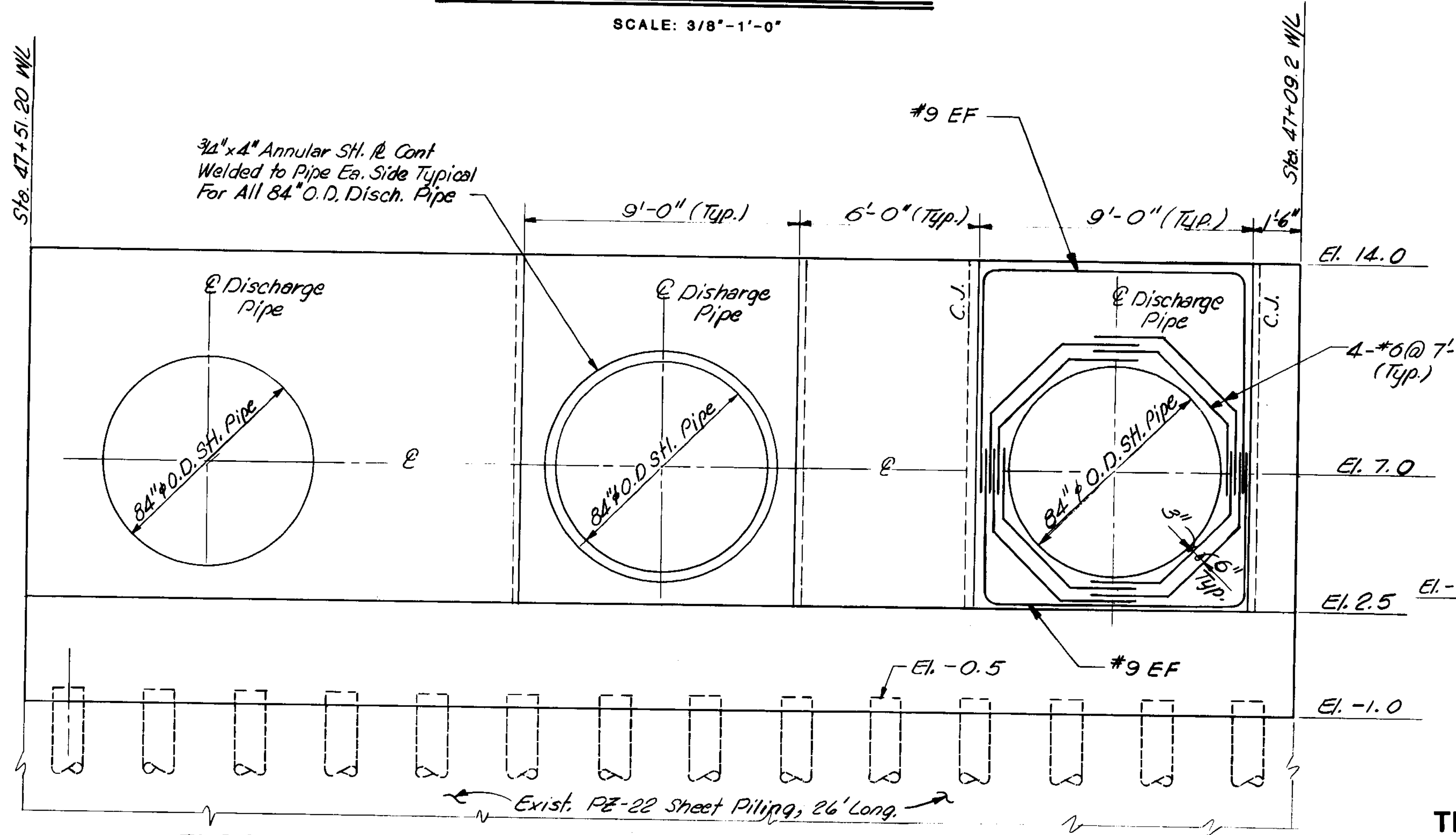
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE JULY 1987 FILE NO. H-2-30197



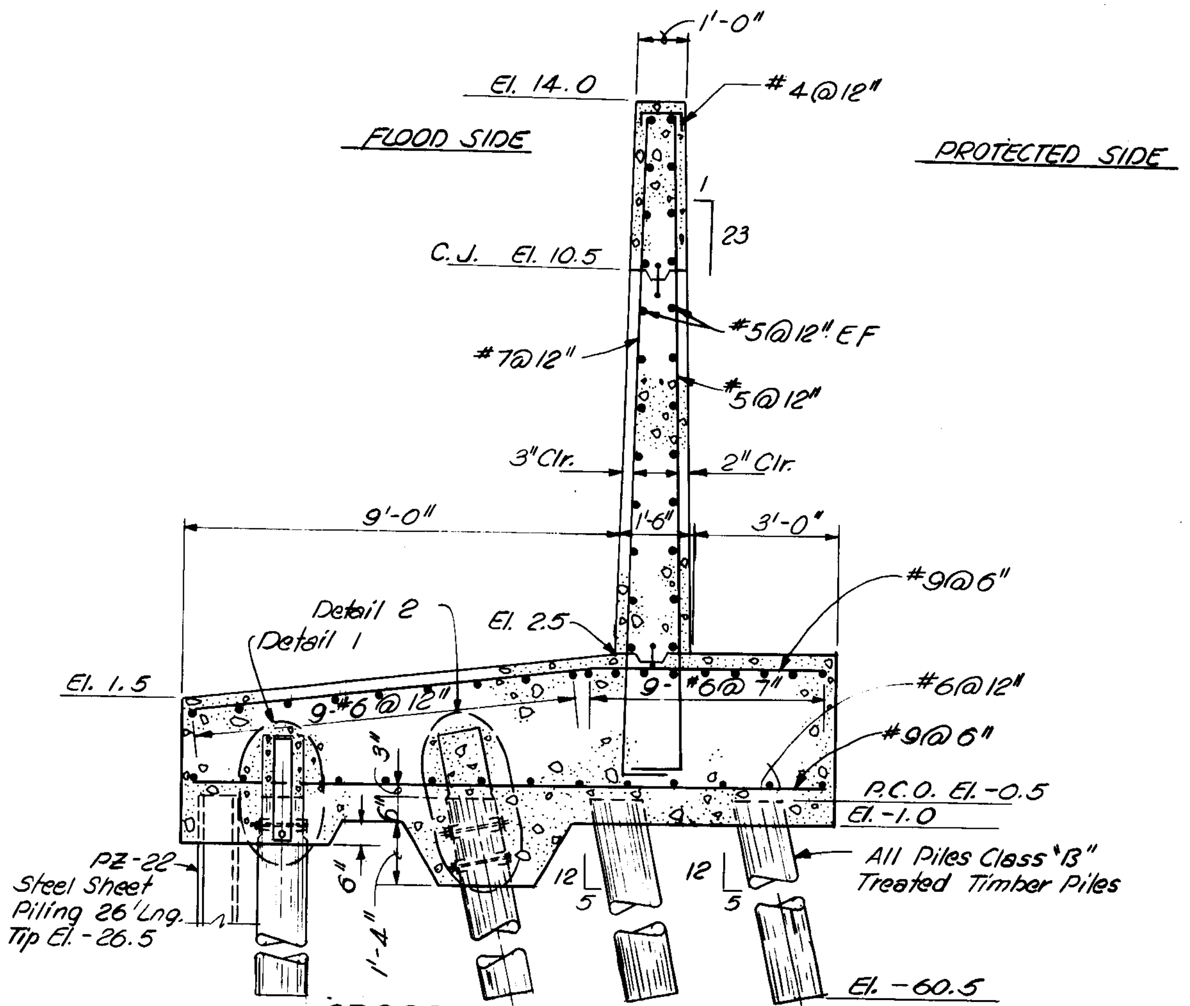
FOUNDATION AND PILE LAYOUT

SCALE: 3/8"-1'-0"



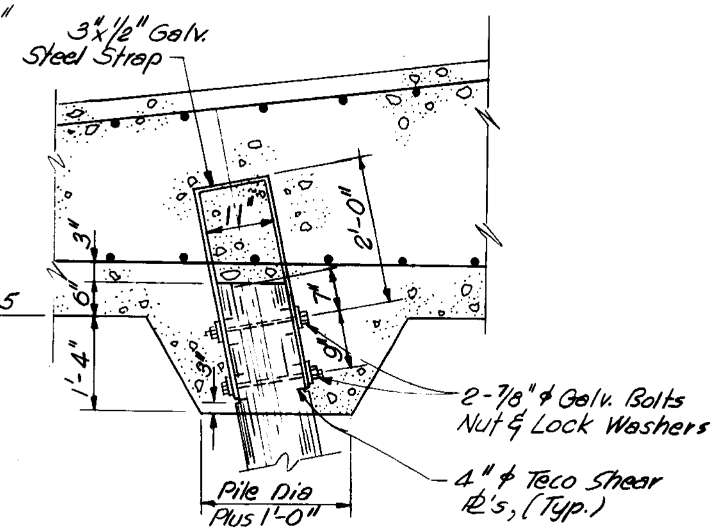
FLOODSIDE ELEVATION OF FLOODWALL AT PUMPING STATION

SCALE: 3/8"-1'-0"



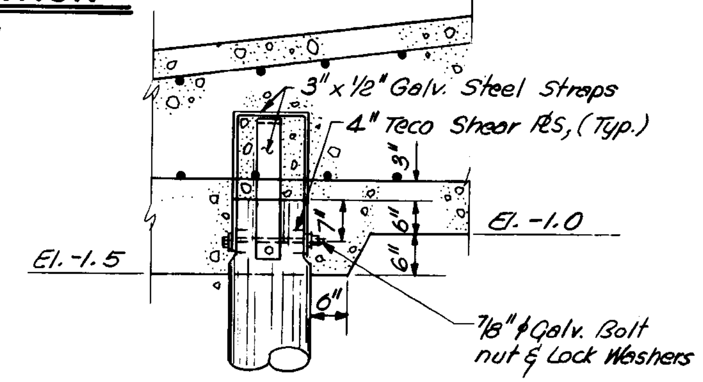
CROSS SECTION OF FLOODWALL AT PUMPING STATION

SCALE: 1/2"-1'-0"



TENSION PILE CONNECTION DETAIL 2

SCALE: 3/4"-1'-0"



TENSION PILE CONNECTION DETAIL 1

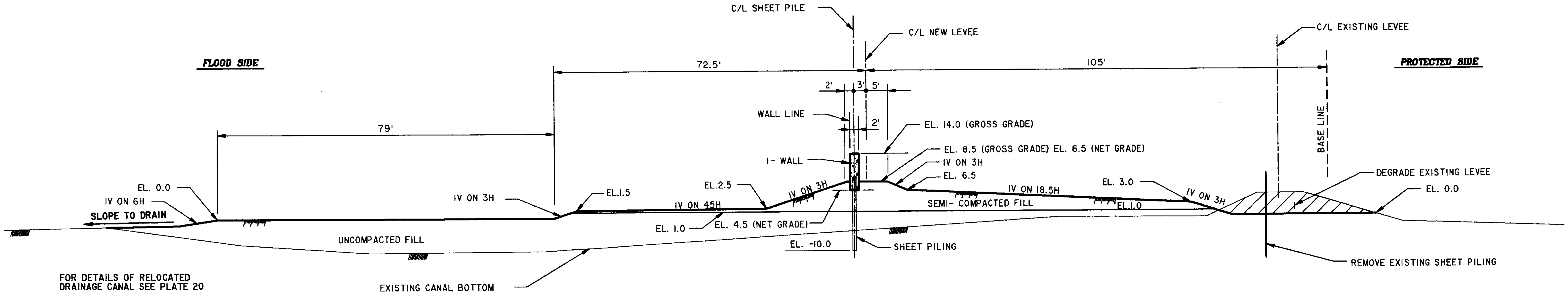
SCALE: 3/4"-1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17 A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

DETAILS EXISTING FLOODWALL AT PARISH LINE PUMPING STATION

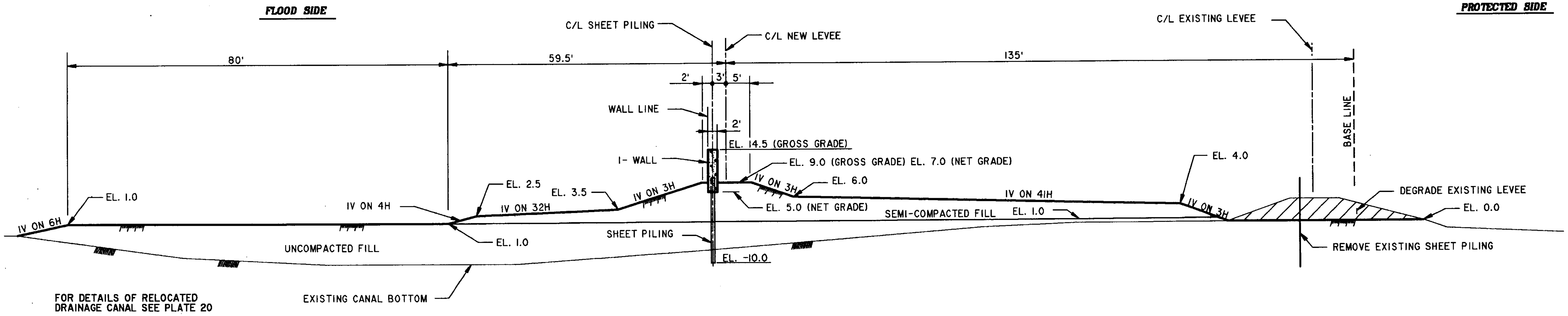
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE JULY 1987 FILE NO. H-2-30197



STA. 74+00.00 B/L - STA. 139+40.00 B/L

SCALE 1" = 10'



STA. 140+00.00 B/L - STA. 196+78.00 B/L

SCALE: 1" = 10'

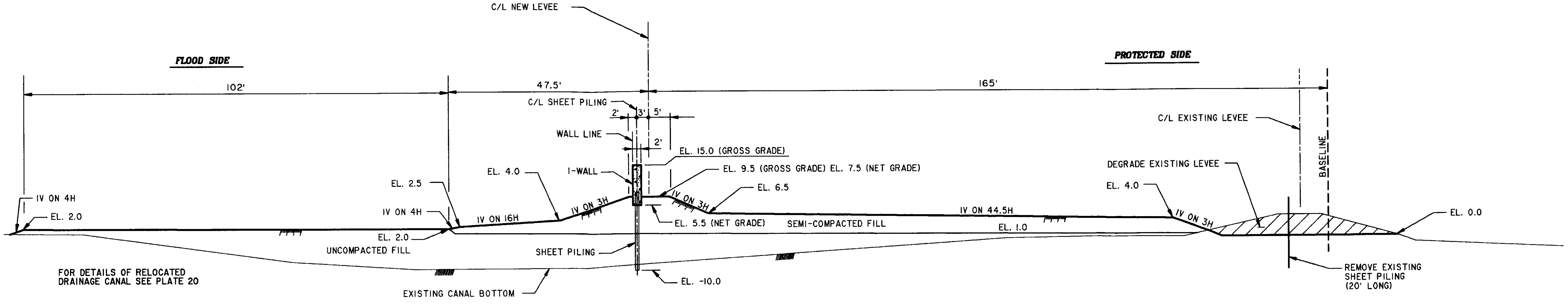
SCALE: 1" = 10'
10' 0 10' 20' 30'

Computer Aided Design Drafting

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

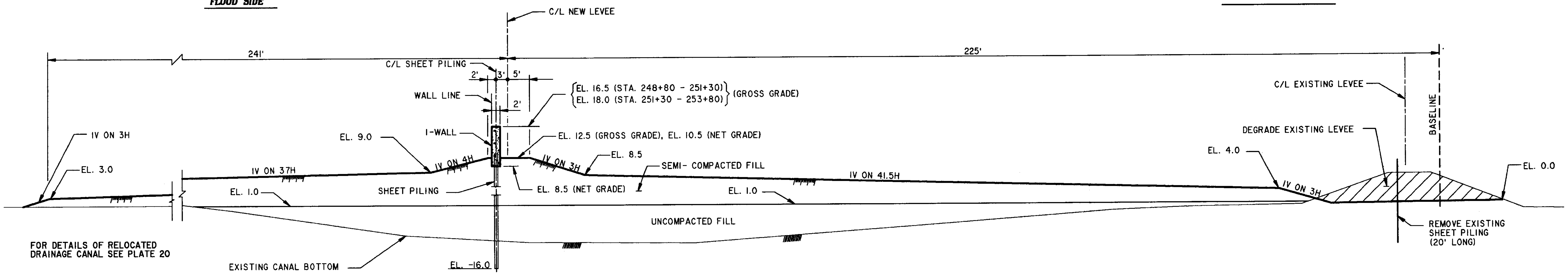
ALTERNATE PLAN
I-WALL ON LEVEE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197



STA. 197+38.00 B/L - STA. 248+20.00 B/L

SCALE: 1" = 10'



STA. 248+80.00 B/L - STA. 253+80.00 B/L

SCALE: 1" = 10'

SCALE: 1" = 10'

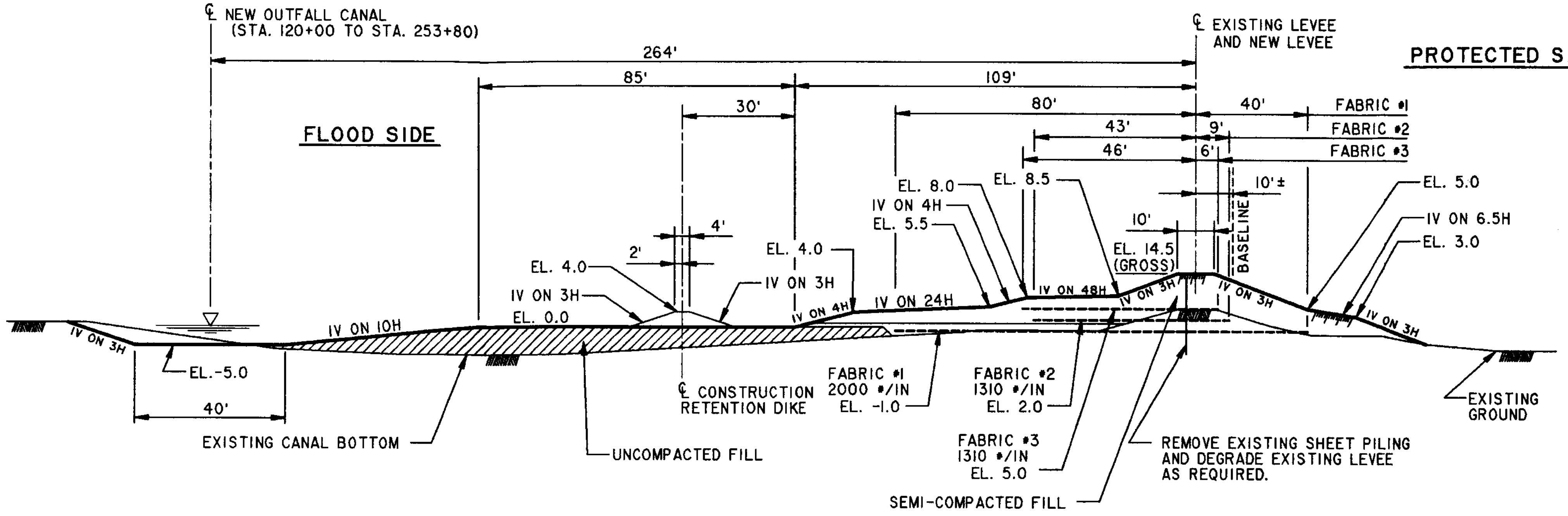
10' 0 10' 20' 30'

Computer Aided Design Drafting

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

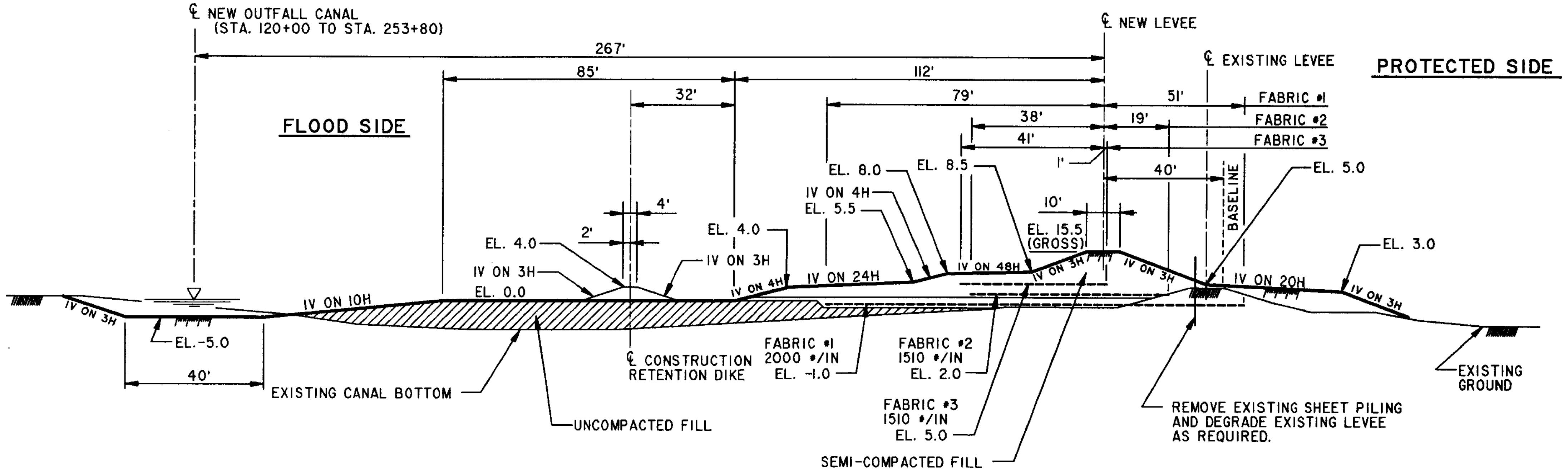
ALTERNATE PLAN
I-WALL ON LEVEE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197



STA. 74+00 B/L TO STA. 139+00 B/L

SCALE: 1" = 20'



STA. 140+00 B/L TO STA. 248+00 B/L

SCALE: 1" = 20'

Computer Aided Design Drafting

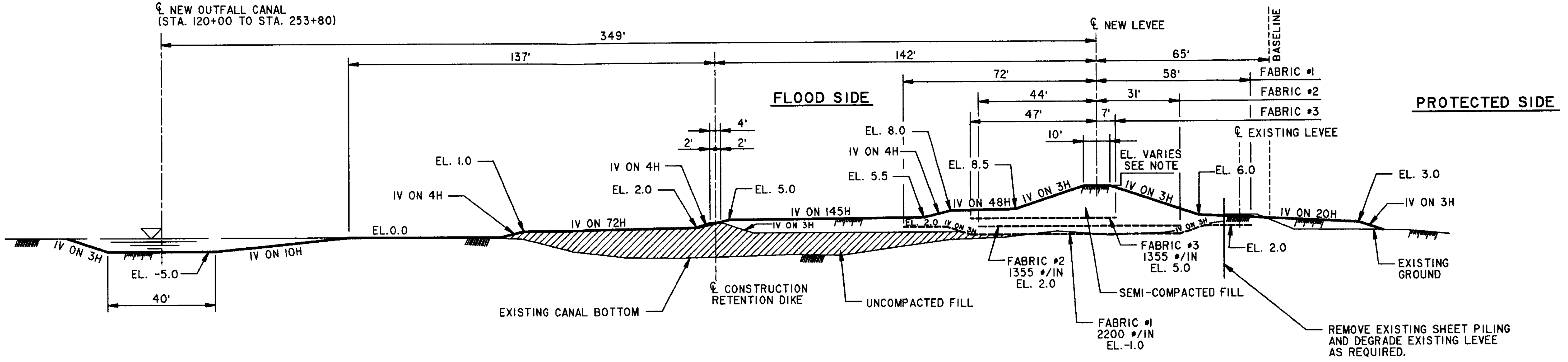
SCALE: 1" = 20'

20' 0 20' 40' 60' 80' 100'

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

ALTERNATE PLAN
REINFORCED LEVEE SECTION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197



NOTE:

STA. 248+00 B/L TO STA. 252+30 B/L, LEVEE CROWN EL. 17.0 (NET)
STA. 252+30 B/L TO STA. 253+80 B/L, LEVEE CROWN EL. 18.0 (NET)

STA. 248+80 B/L TO STA. 253+00 B/L

SCALE: 1" = 20'

Computer Aided Design Drafting

SCALE: 1" = 20'

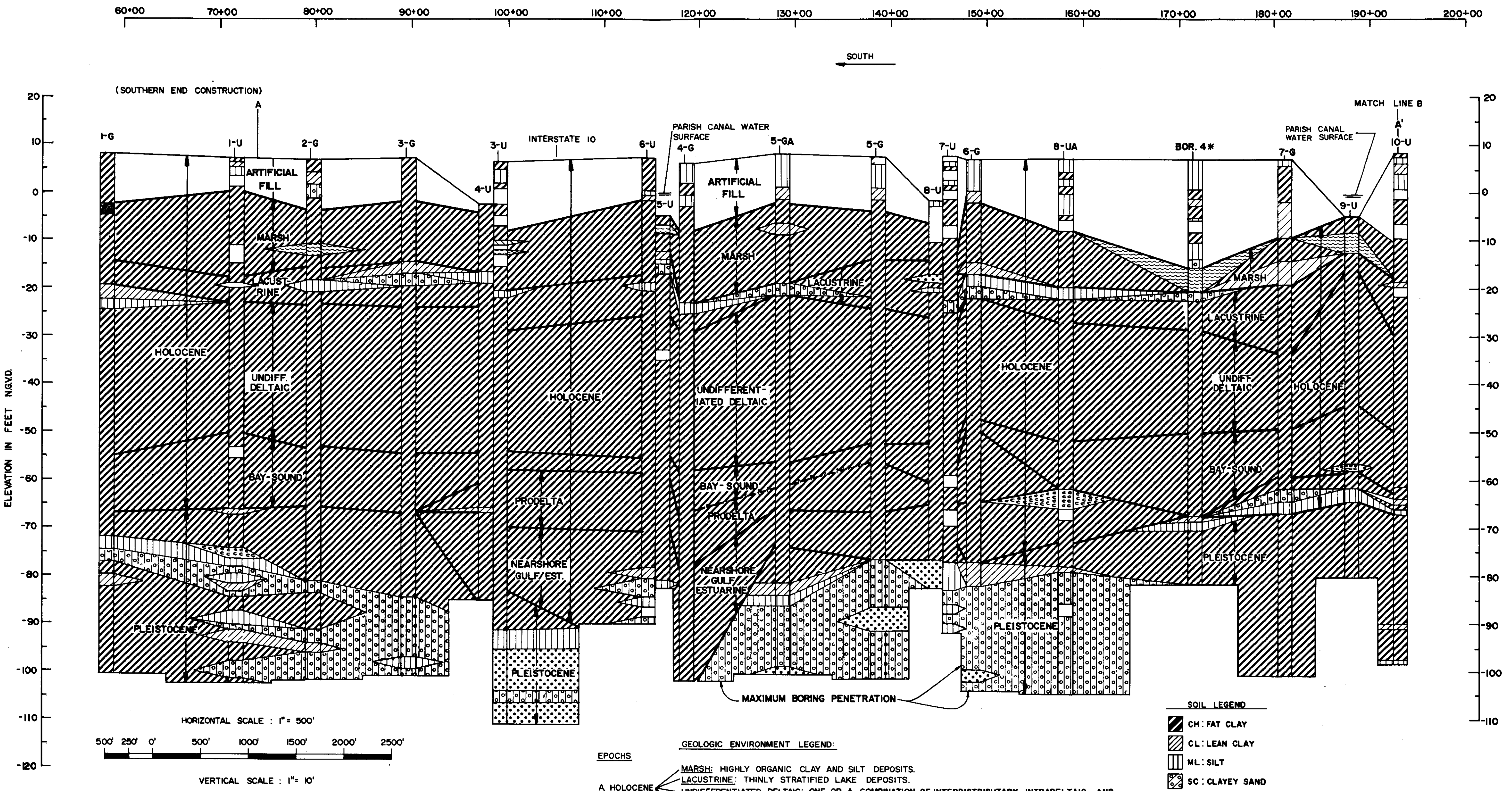
20' 0 20' 40' 60' 80' 100'

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

ALTERNATE PLAN
REINFORCED LEVEE SECTION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JULY 1987 FILE NO. H-2-30197

SOIL PROFILE LEVEE BORINGS-JEFFERSON PARISH RETURN LEVEE



EPOCHS

GEOLOGIC ENVIRONMENT LEGEND:

A. HOLOCENE
- MARSH: HIGHLY ORGANIC CLAY AND SILT DEPOSITS.
- LACUSTRINE: THINLY STRATIFIED LAKE DEPOSITS.
- UNDIFFERENTIATED DELTAIC: ONE OR A COMBINATION OF INTERDISTRIBUTARY, INTRADELTAIC, AND PRODELTAIC ENVIRONMENTS. PREDOMINATELY FAT CLAY.
- BAY-SOUND: MARINE DEPOSITS BOTTOMING BAYS AND SOUNDS.
- PRODELTA: FORWARD MOST DELTAIC ENVIRONMENT. MOSTLY FAT CLAY
- NEARSHORE GULF/ESTUARINE: MARINE ENVIRONMENTS BORDERING OPEN OCEAN AND FILLING MINOR VALLEYS ENTRENCHED INTO UNDERLYING PLEISTOCENE.

B. PLEISTOCENE — ANCIENT FORMER MISSISSIPPI RIVER DELTAIC AND MARINE DEPOSITS. OLDEST DEPOSITS ENCOUNTERED.

BORING NOMENCLATURE (SAMPLING METHOD)

G - GENERAL TYPE - DISTURBED SOILS. RETRIEVED
U - UNDISTURBED SOIL SAMPLES.
* - EUSTIS ENGINEERING BORING - SOIL SYMBOLS MODIFIED TO ACCOMMODATE UNIFIED SOIL CLASSIFICATION.

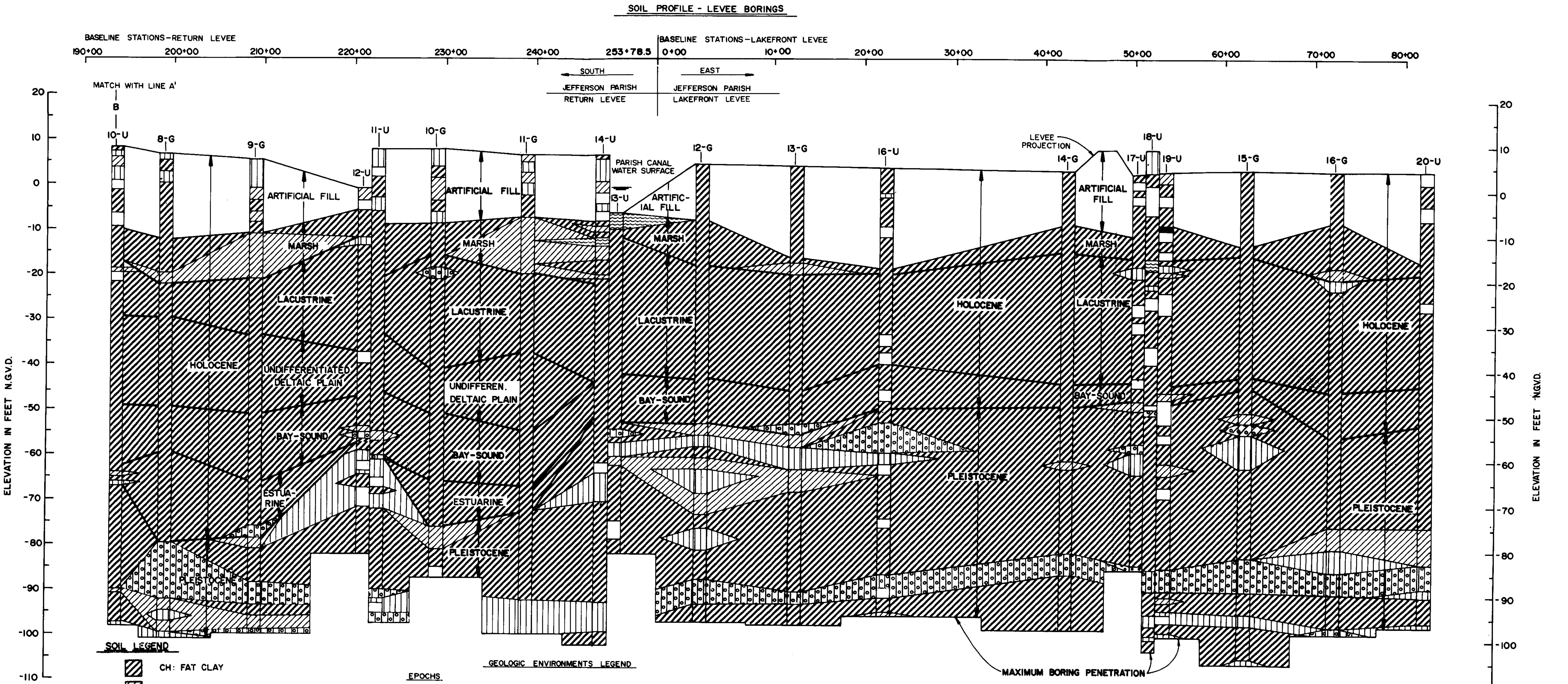
SOIL LEGEND

- CH : FAT CLAY
- CL : LEAN CLAY
- ML : SILT
- SC : CLAYEY SAND
- SM : SILTY SAND
- SP : SAND, POORLY GRADED
- GP : GRAVEL, POORLY GRADED
- WD : WOOD
- PT : PEAT
- SL : SHELLS
- NO SAMPLE

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

SOIL AND GEOLOGIC PROFILE ALONG PROJECT ALIGNMENT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



SOIL LEGEND

- CH: FAT CLAY
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- PT: PEAT
- SL: SHELLS
- NO SAMPLE

GEOLOGIC ENVIRONMENTS LEGEND

EPOCHS

A. HOLOCENE
- MARSH : HIGHLY ORGANIC SILT AND CLAY DEPOSIT
- LACUSTRINE : THINLY STRATIFIED FINE GRAINED LAKE DEPOSITS
- BAY - SOUND : MARINE DEPOSITS, BOTTOMING BAYS AND SOUNDS
- UNDIFFERENTIATED DELTAIC PLAIN : ONE OR A COMBINATION OF INTERDISTRIBUTARY, INTRADELTAIC, AND PRODELTAIC ENVIRONMENTS PREDOMINATELY FAT CLAY
- ESTUARINE : NEARSHORE GULF ENVIRONMENT FILLING MINOR VALLEYS ENTRENCHED INTO PLEISTOCENE

B. PLEISTOCENE — ANCIENT FORMER MISSISSIPPI RIVER DELTAIC & NEARSHORE DEPOSITS. OLDEST DEPOSITS ENCOUNTERED

BORING NOMENCLATURE (SAMPLING METHOD)

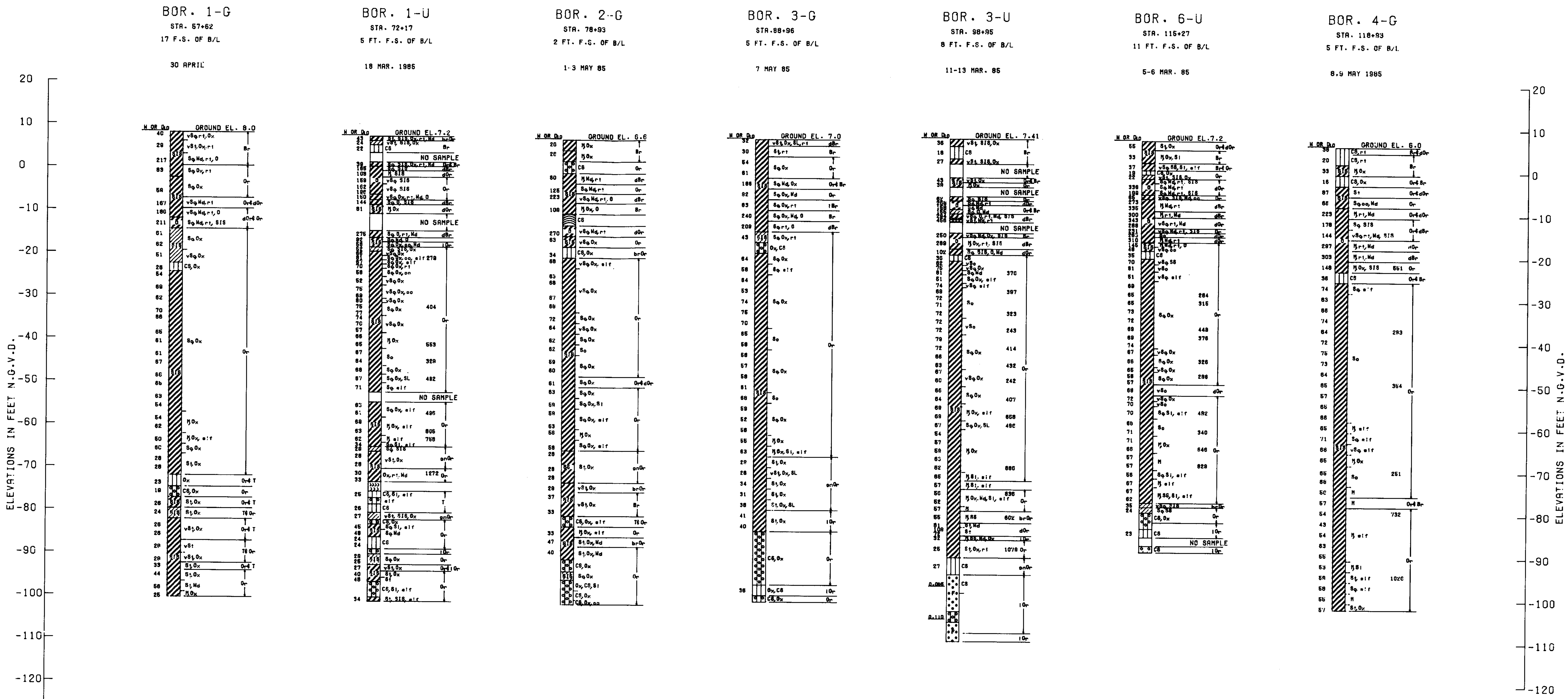
G - GENERAL TYPE - DISTURBED SOILS RETRIEVED
U - UNDISTURBED SOIL SAMPLES

HORIZONTAL SCALE : 1" = 500'

500' 250' 0' 500' 1000' 1500' 2000 2500'

VERTICAL SCALE : 1" = 10'

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
SOIL AND GEOLOGIC PROFILE ALONG PROJECT ALIGNMENT
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



NOTE: GENERAL TYPE BORING WERE TAKEN WITH 1-7/8 IN I.D. x 29 INCH SAMPLER. UNDISTURBED BORINGS INDICATED BY THE LETTER "U" WERE TAKEN WITH 5 IN I.D. x 4 FOOT PISTON TYPE SAMPLER.
FOR BORING LOCATIONS SEE PLATES 2 & 3.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

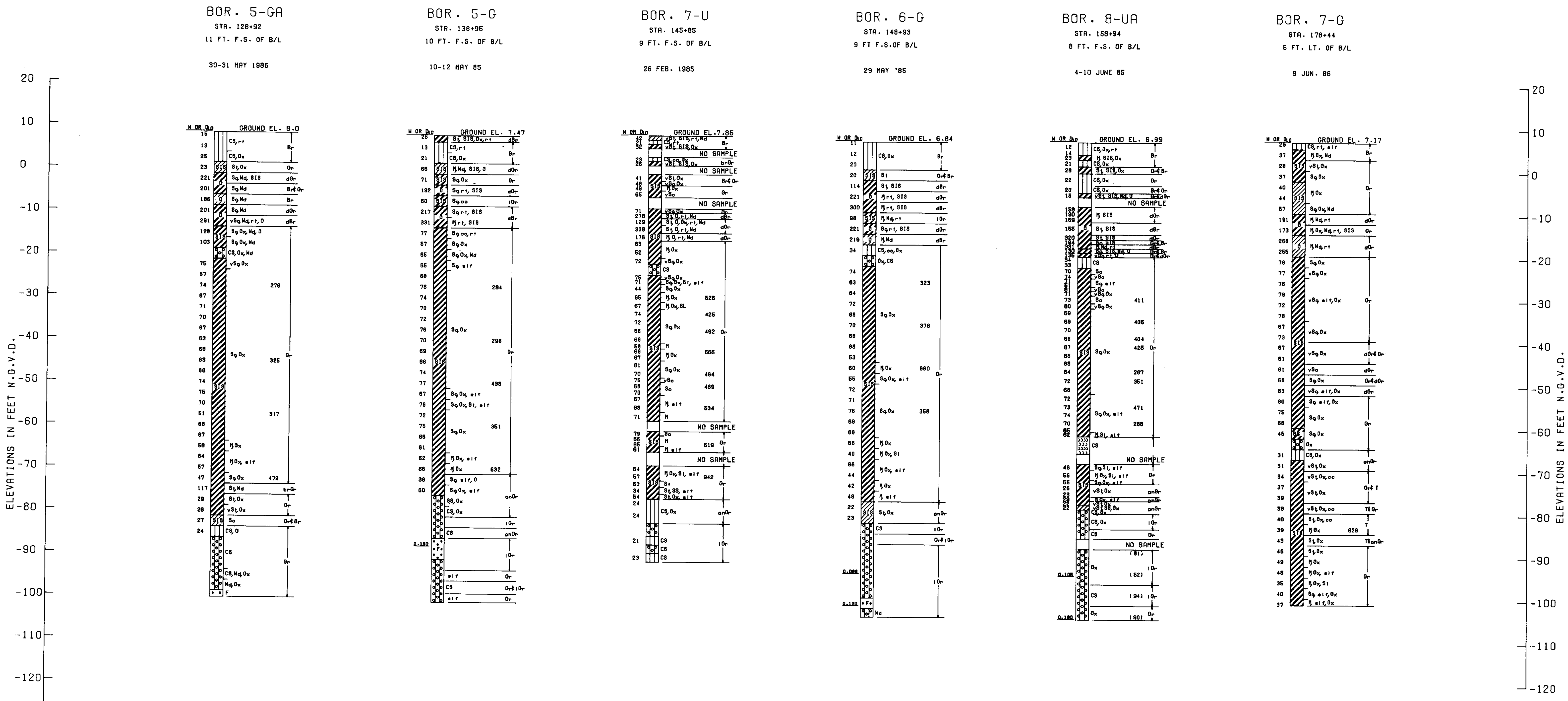
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

GENERAL AND UNDISTURBED SOIL BORINGS ALONG LEVEE C/L

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

JULY 1987 FILE NO. H-2-30197



NOTE: GENERAL TYPE BORING WERE TAKEN WITH 1-7/8 IN. I.D. x 29 INCH SAMPLER UNDISTUBED BORINGS INDICATED BY THE LETTER "U" WERE TAKEN WITH 5 IN. I.D. x 4 FOOT PISTON TYPE SAMPLER
FOR BORING LOCATIONS SEE PLATES 4 & 5

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

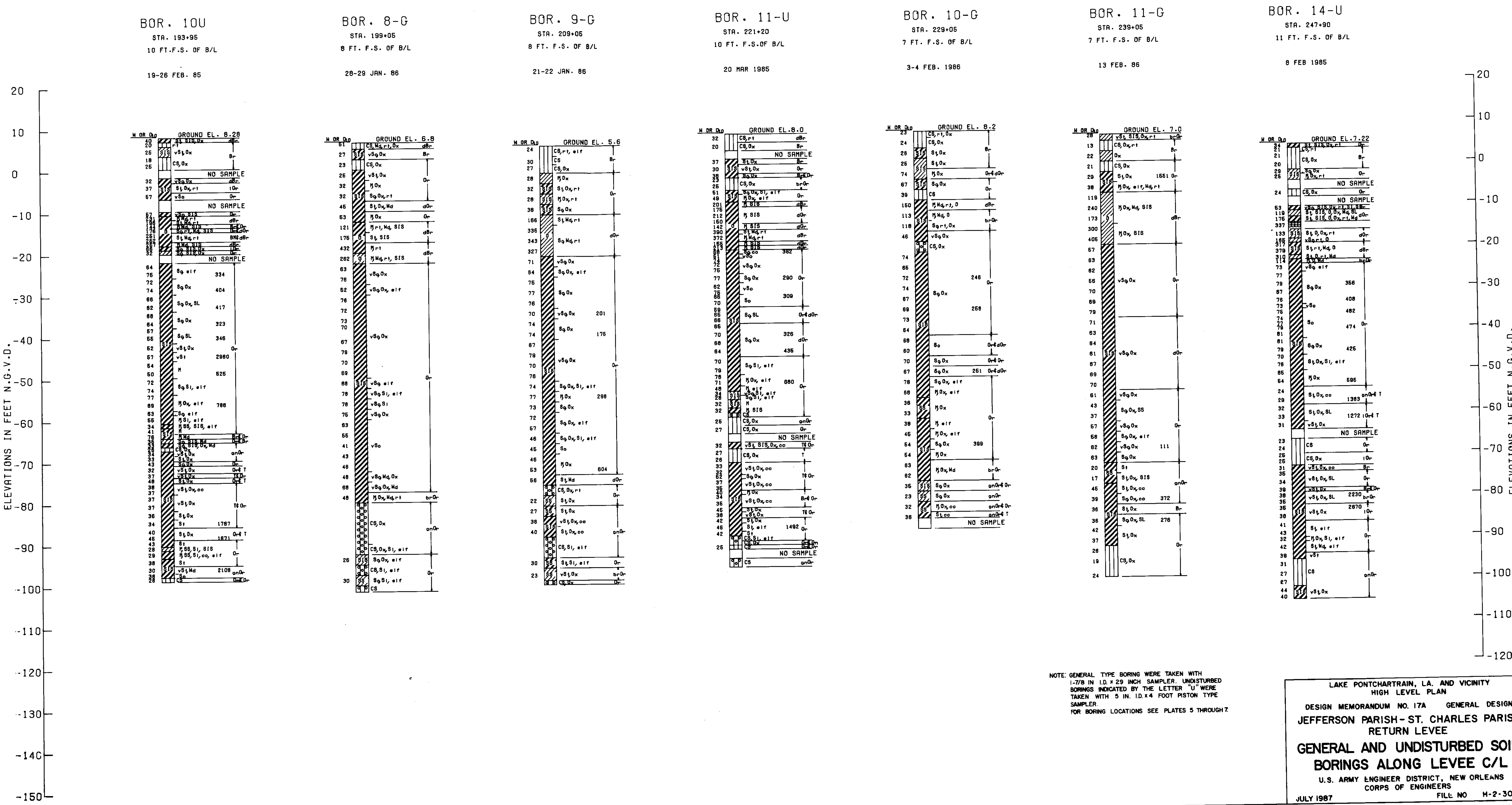
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

GENERAL AND UNDISTURBED SOIL BORINGS ALONG LEVEE C/L

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

JULY 1987 FILE NO. H-2-30197

PLATE 25



NOTE: GENERAL TYPE BORING WERE TAKEN WITH 1-7/8 IN. I.D. x 29 INCH SAMPLER. UNDISTURBED BORINGS INDICATED BY THE LETTER "U" WERE TAKEN WITH 5 IN. I.D. x 4 FOOT PISTON TYPE SAMPLER.
FOR BORING LOCATIONS SEE PLATES 5 THROUGH 7.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

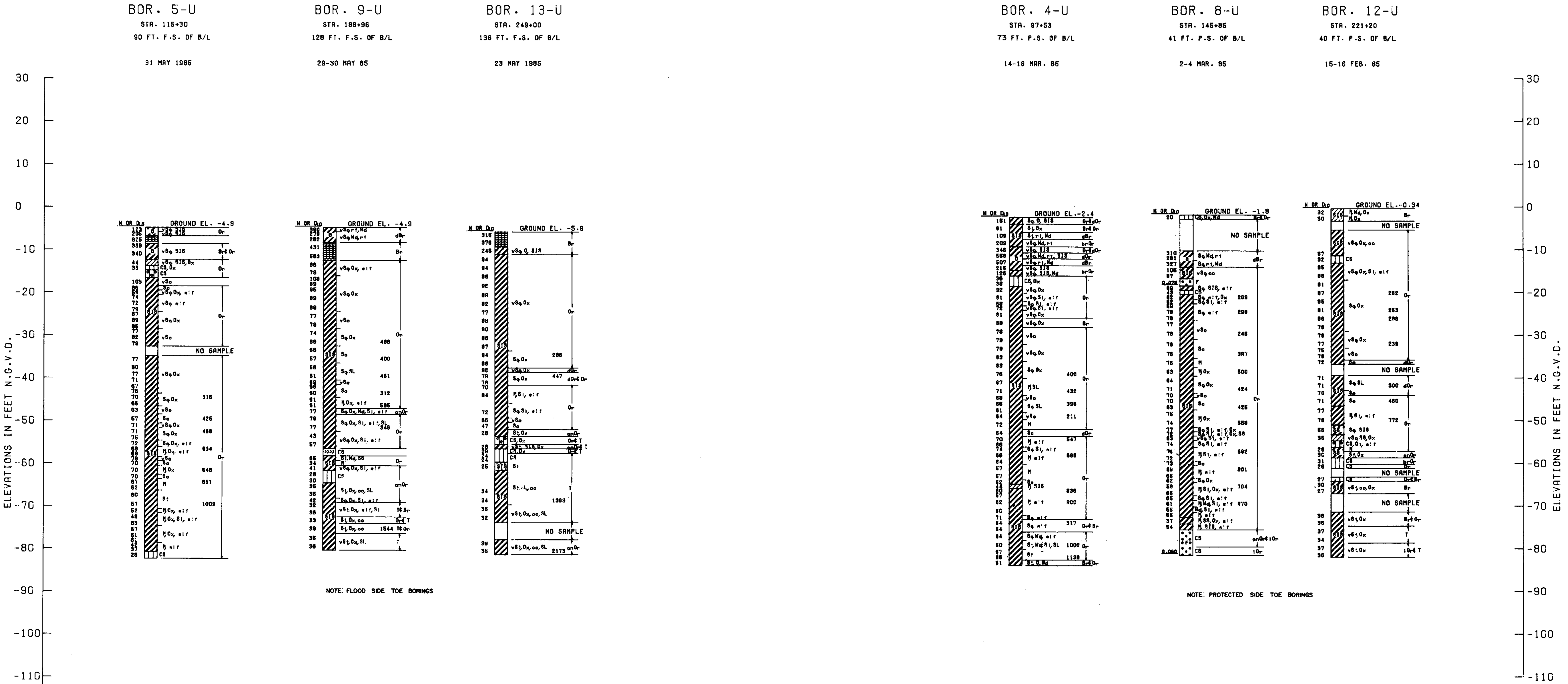
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

GENERAL AND UNDISTURBED SOIL BORINGS ALONG LEVEE C/L

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

JULY 1987 FILE NO. H-2-30197



NOTE: GENERAL TYPE BORING WERE TAKEN WITH 1-7/8 IN. I.D. X 29 INCH SAMPLER. UNDISTURBED BORINGS INDICATED BY THE LETTER "U" WERE TAKEN WITH 5 IN. I.D. X 4 FOOT PISTON TYPE SAMPLER.
FOR BORING LOCATIONS SEE PLATES 3 THROUGH 7

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

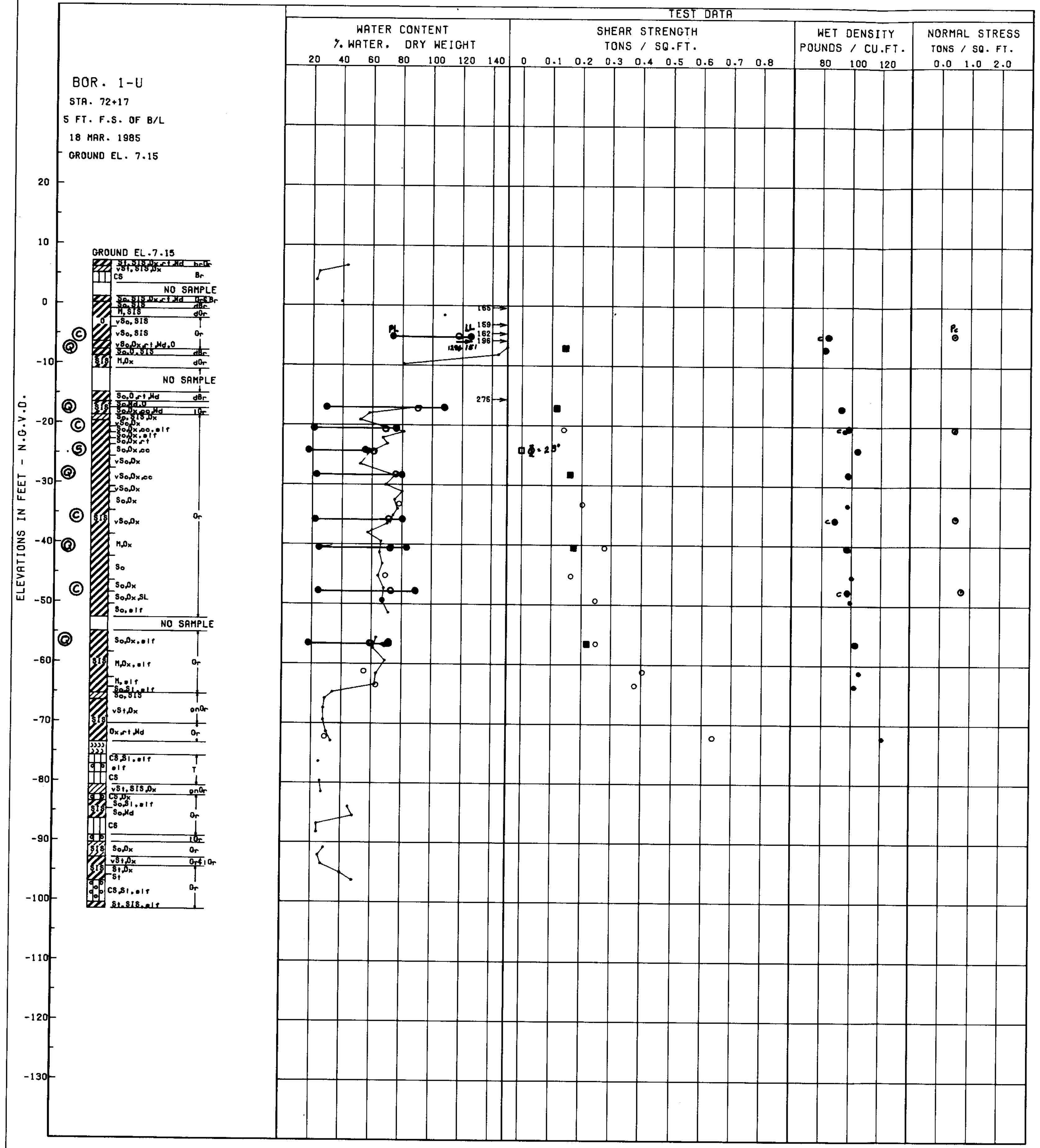
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

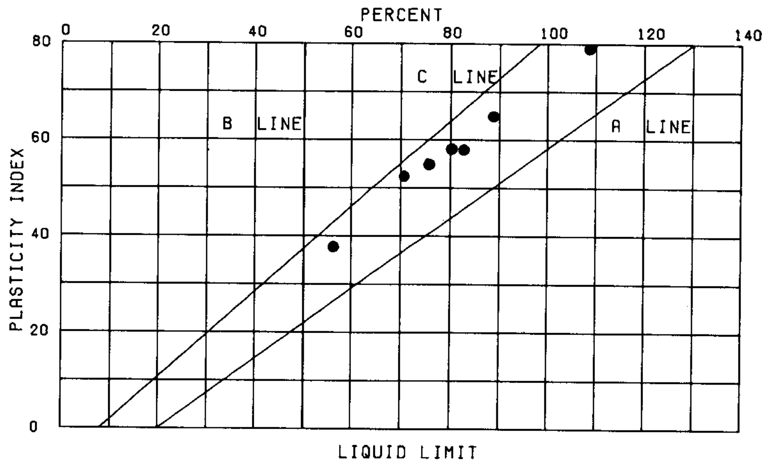
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED TOE BORINGS FLOOD & PROTECTED SIDE OF EXISTING LEVEE

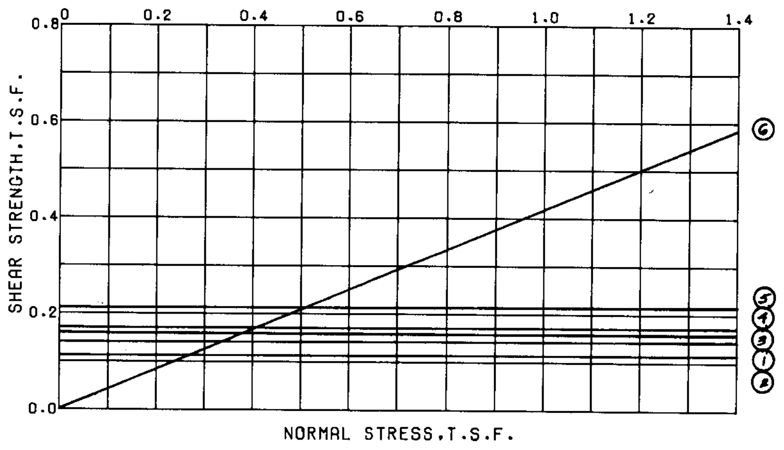
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



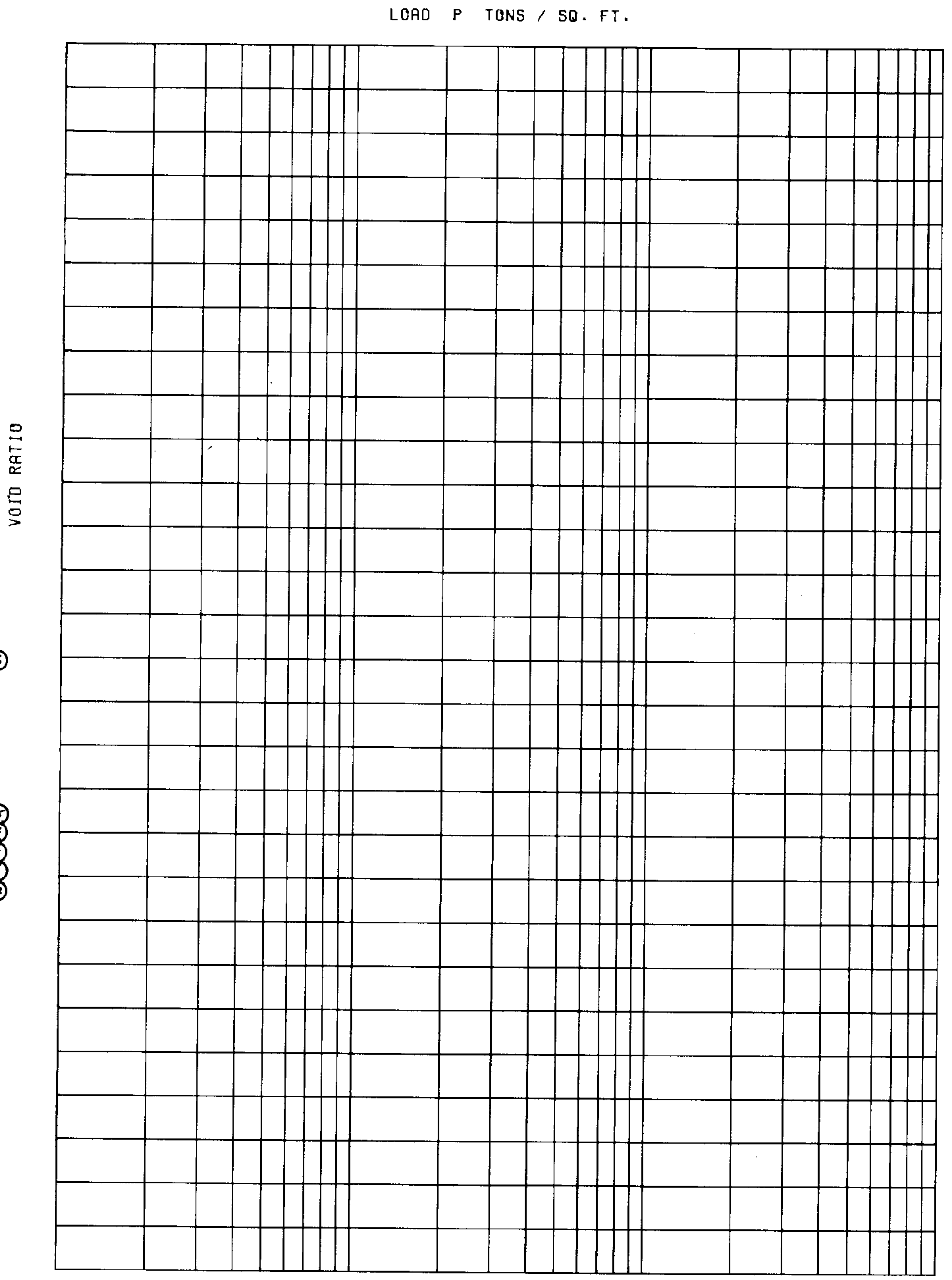


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-7.50	Q	0°	0.142	CH
2.	-17.25	Q	0°	0.118	CH
3.	-28.65	Q	0°	0.160	CH
4.	-40.15	Q	0°	0.172	CH
5.	-56.15	Q	0°	0.213	CH
6.	-24.35	S	23°	0.000	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 BORING SEE PLATE 2.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PL

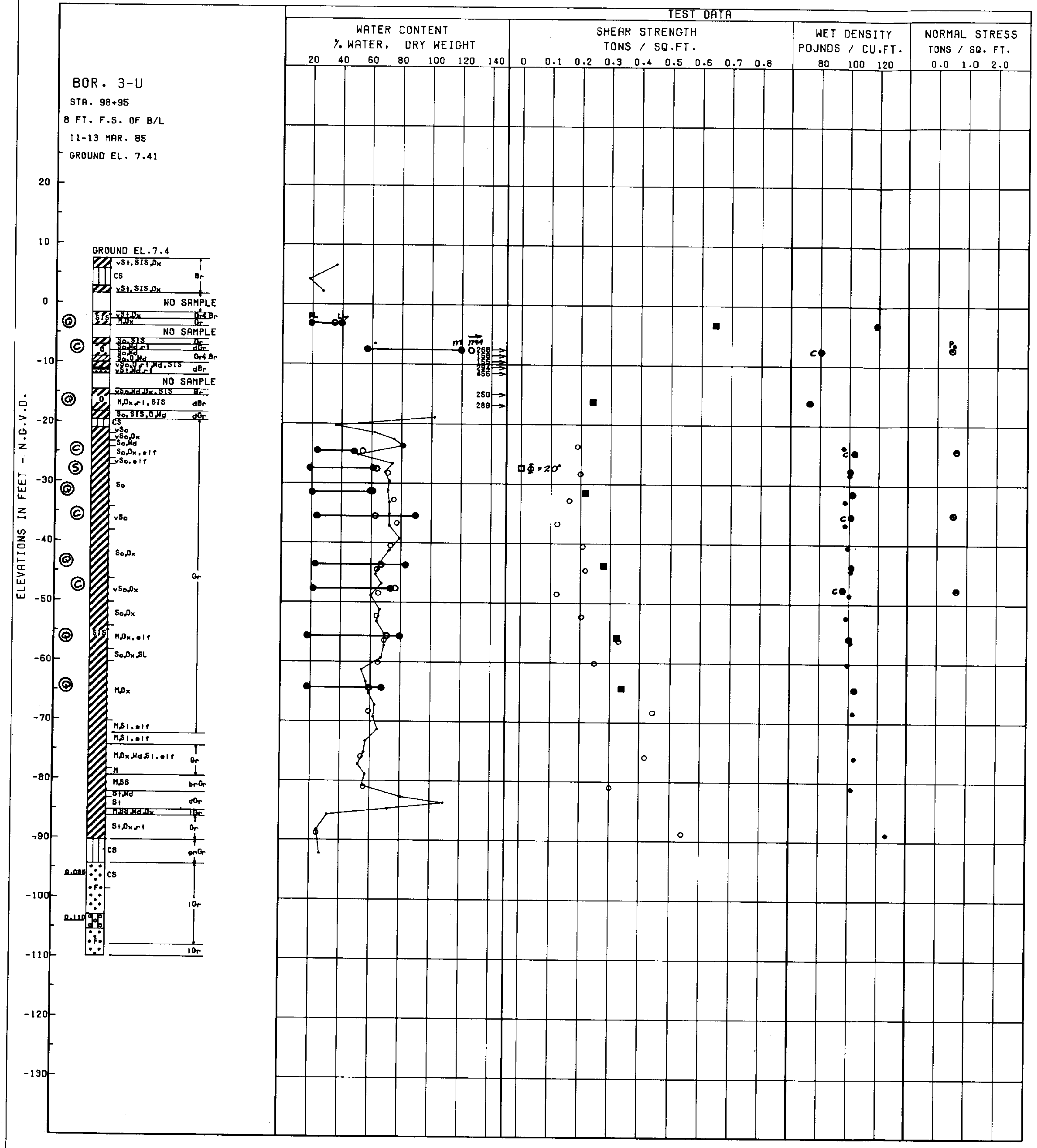
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

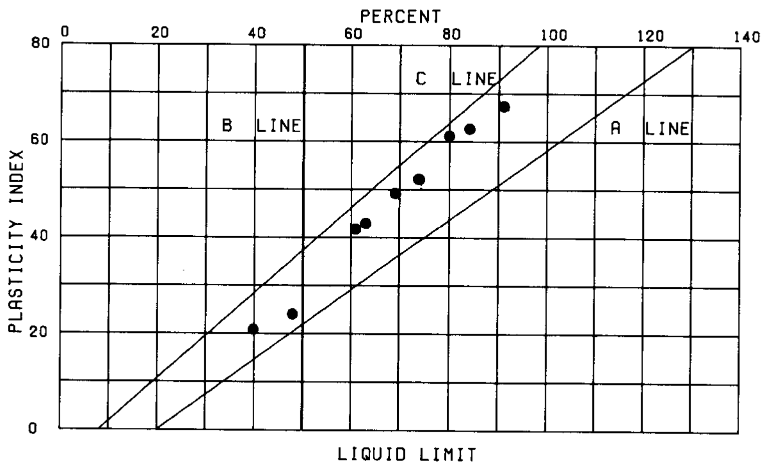
JEFFERSON PARISH - ST. CHARLES PARISH RETURN LEVEE

UNDISTURBED BORING I-U

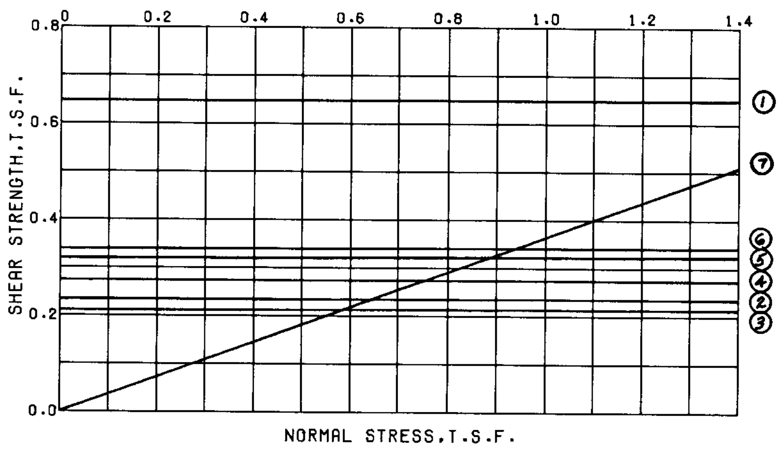
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



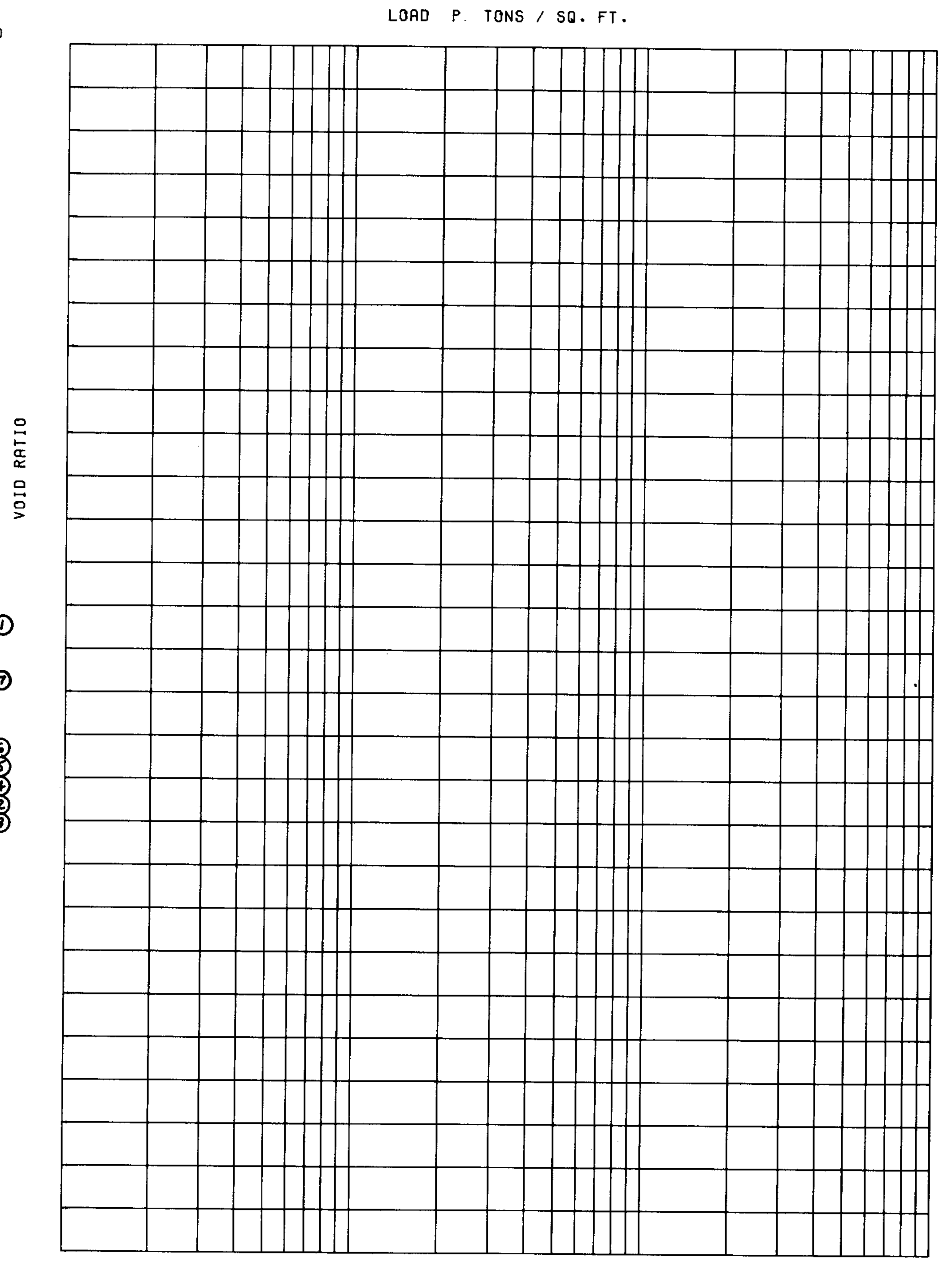


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-3.09	Q	0°	0.648	CL
2.	-16.19	Q	0°	0.237	CH
3.	-31.39	Q	0°	0.218	CH
4.	-43.59	Q	0°	0.277	CH
5.	-55.59	Q	0°	0.327	CH
6.	-64.09	Q	0°	0.342	CH
7.	-27.39	S	20°	0.000	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 BORING SEE PLATE 3.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

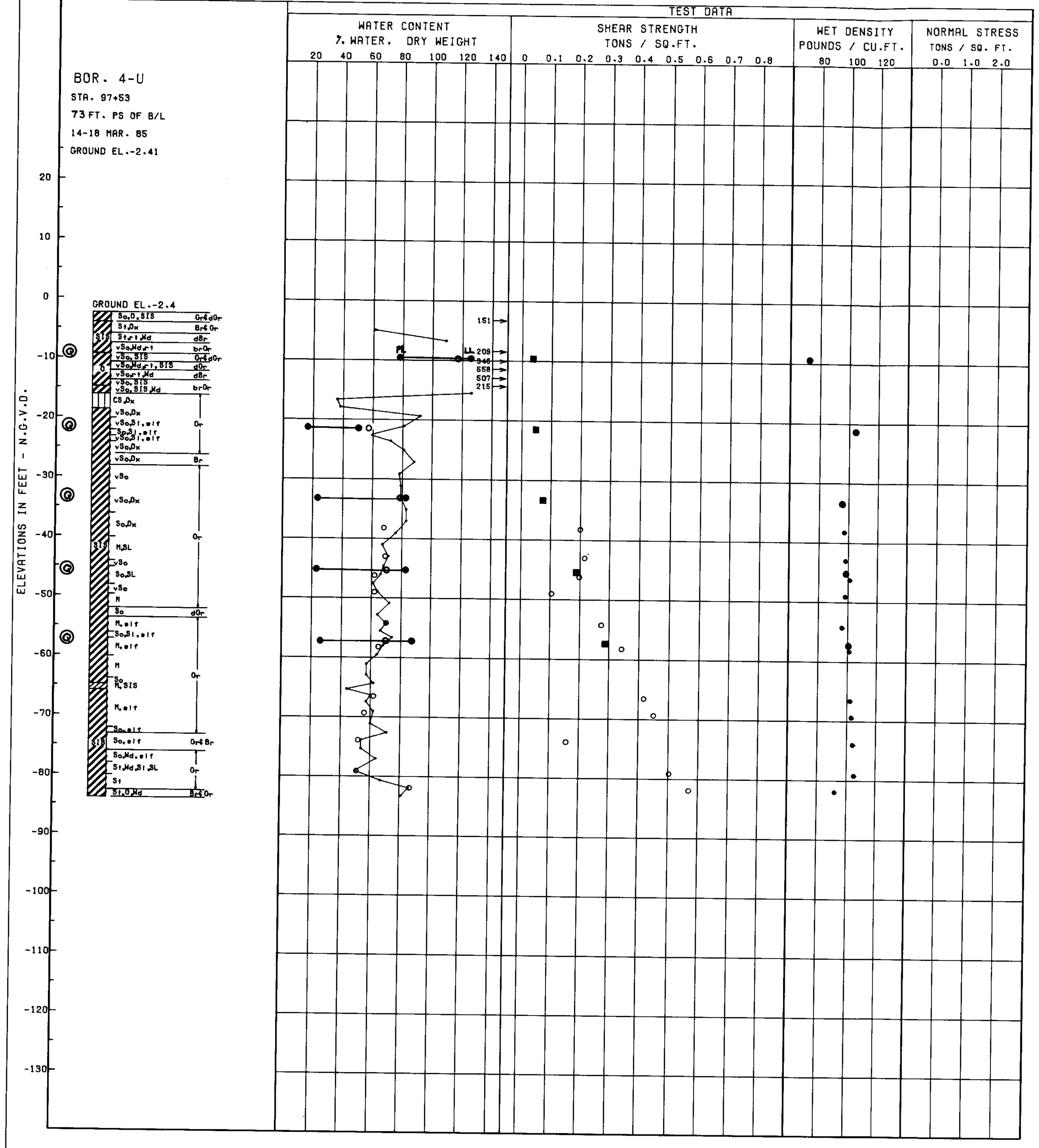
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

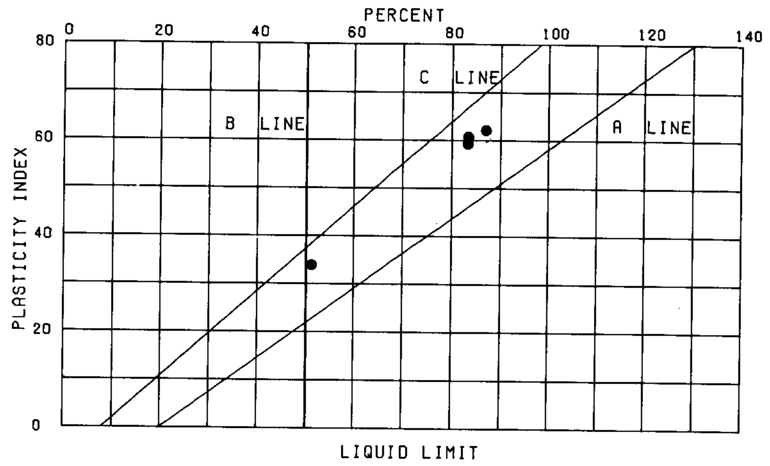
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 3-U

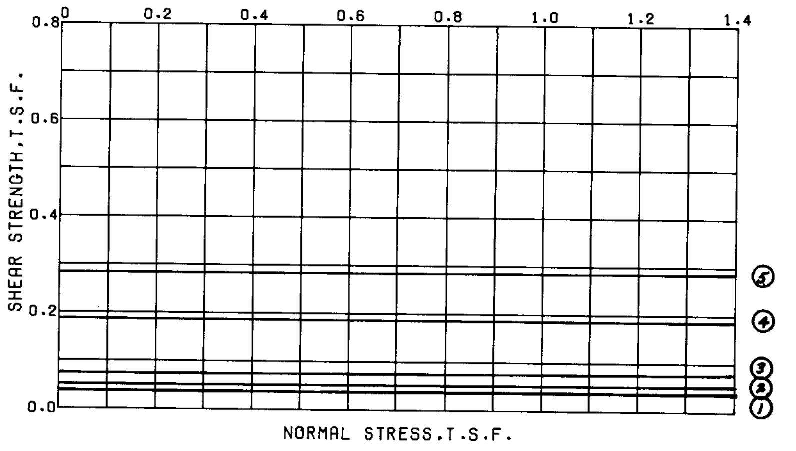
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



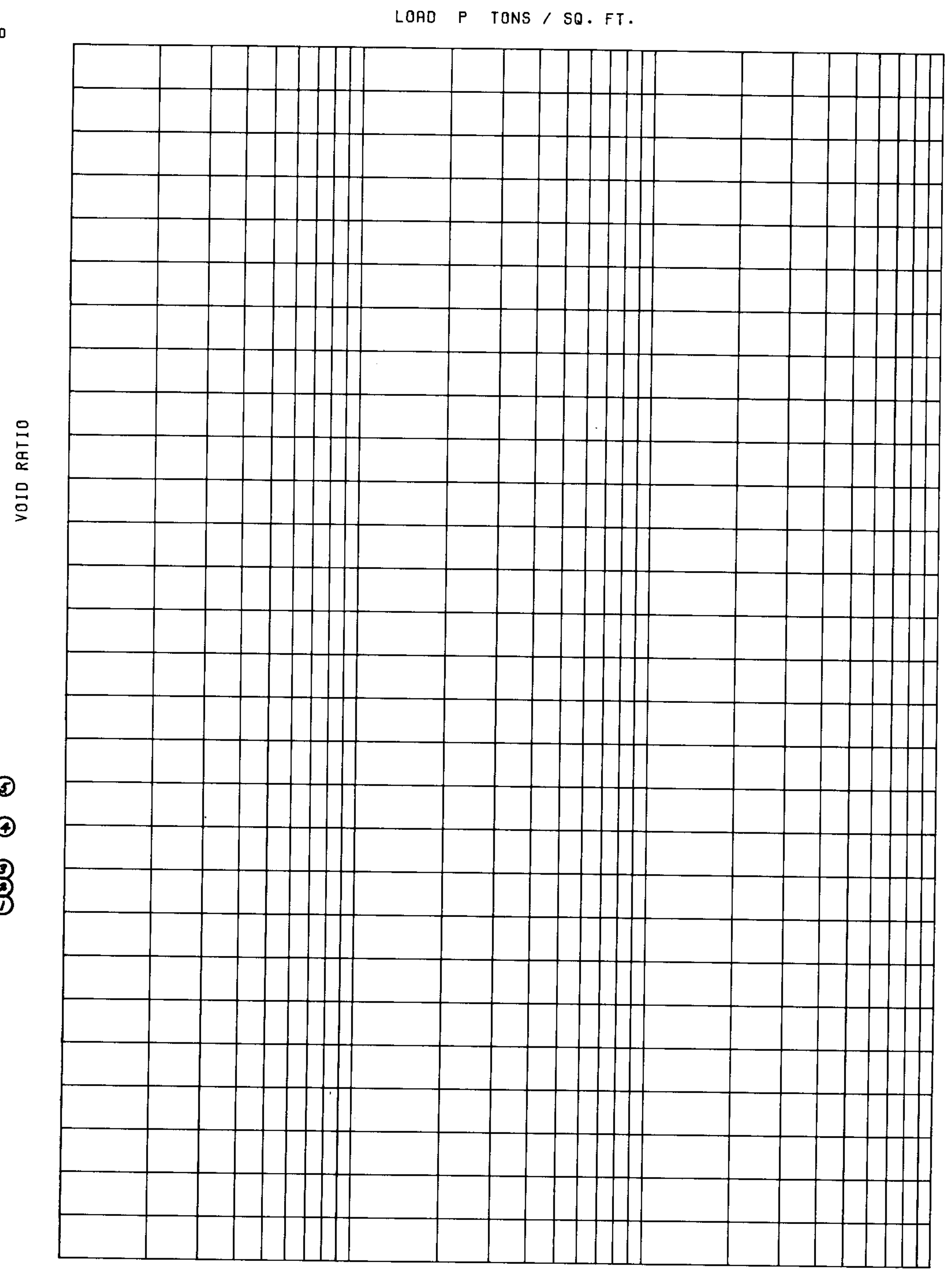


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-9.91	Q	0°	0.040	CH
2.	-21.41	Q	0°	0.052	CH
3.	-33.41	Q	0°	0.078	CH
4.	-45.41	Q	0°	0.190	CH
5.	-57.41	Q	0°	0.288	CH



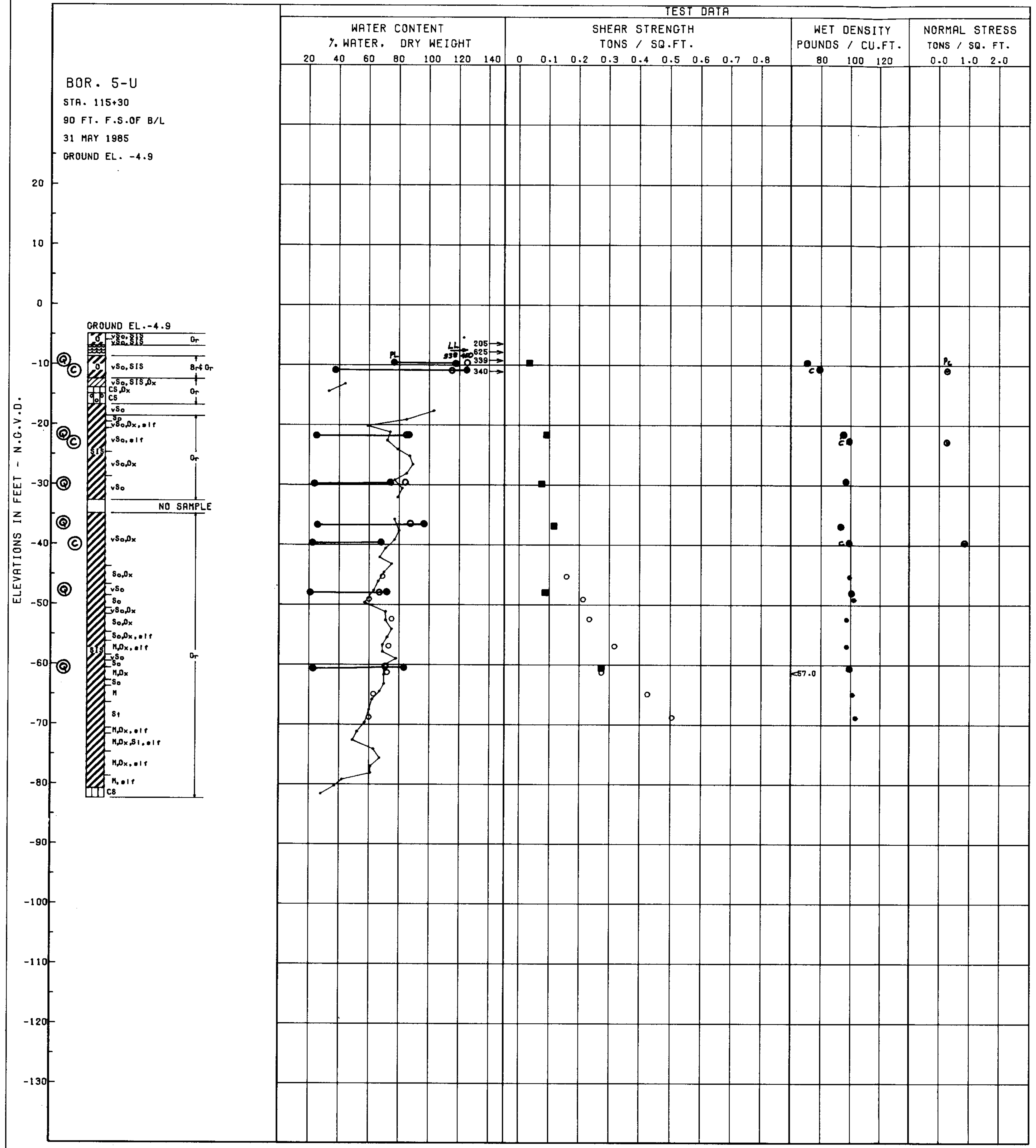
CONSOLIDATION DATA

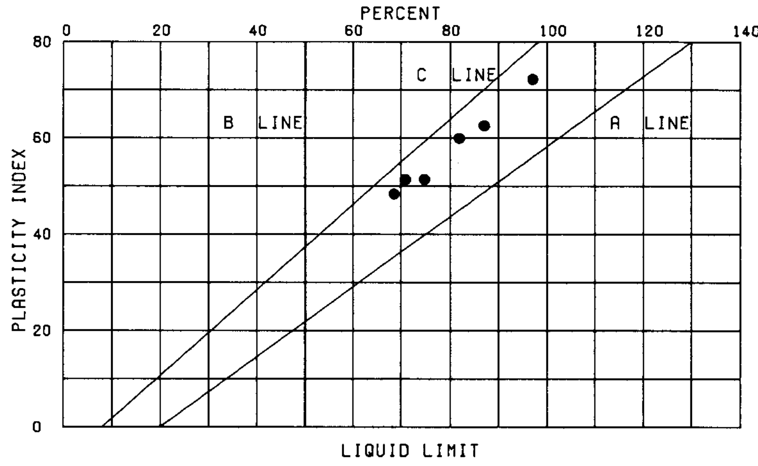
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 3

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

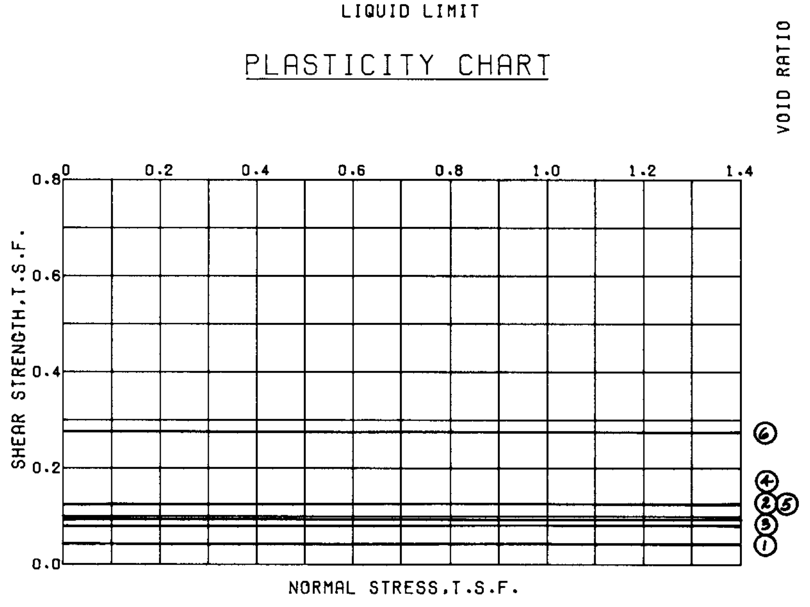
UNDISTURBED BORING 4-U

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



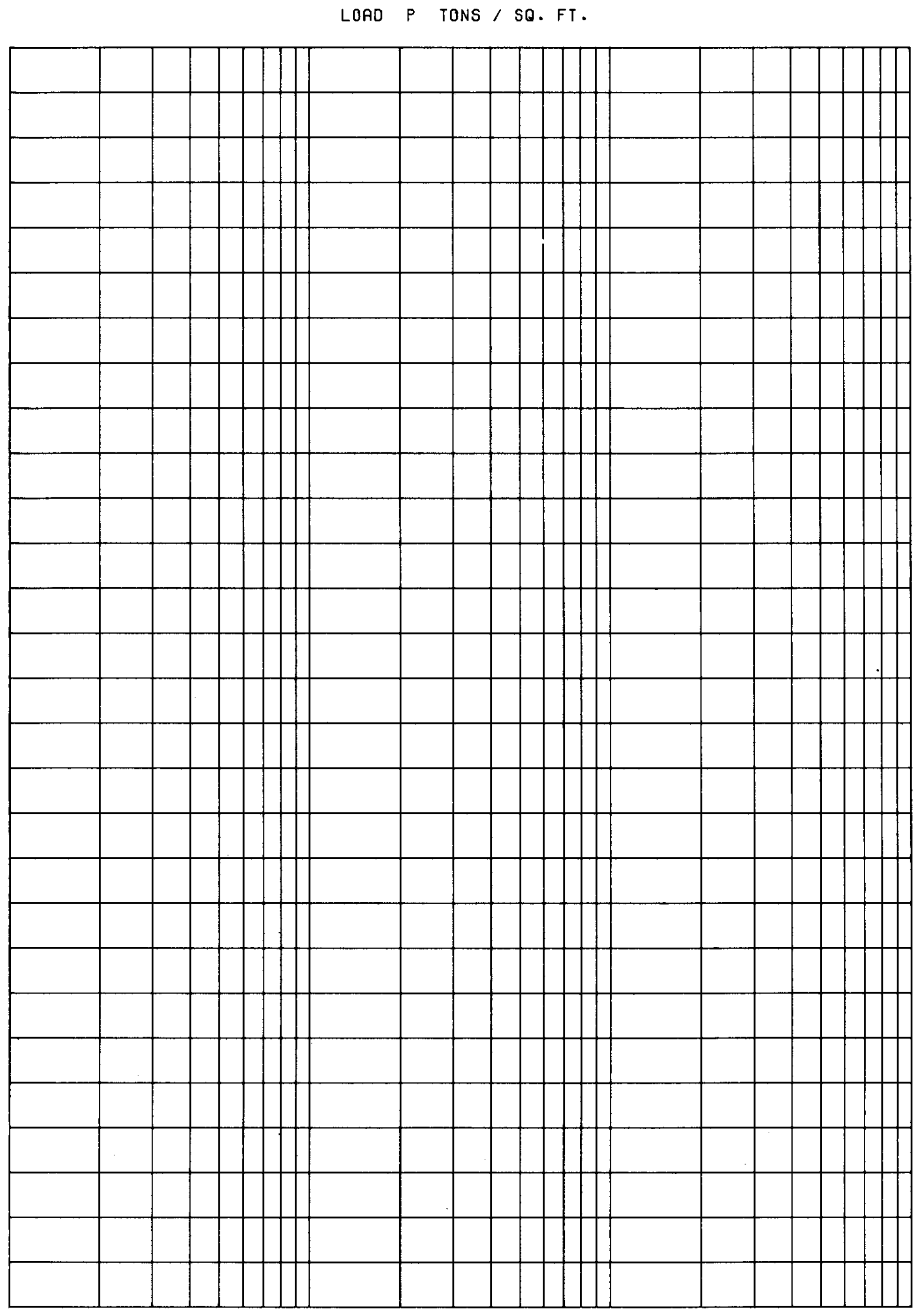


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1	-9.9	Q	0°	0.038	OH
2	-21.9	Q	0°	0.093	CH
3	-29.9	Q	0°	0.078	CH
4	-36.9	Q	0°	0.120	CH
5	-47.9	Q	0°	0.095	CH
6	-60.3	Q	0°	0.272	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 BORING SEE PLATE 3.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

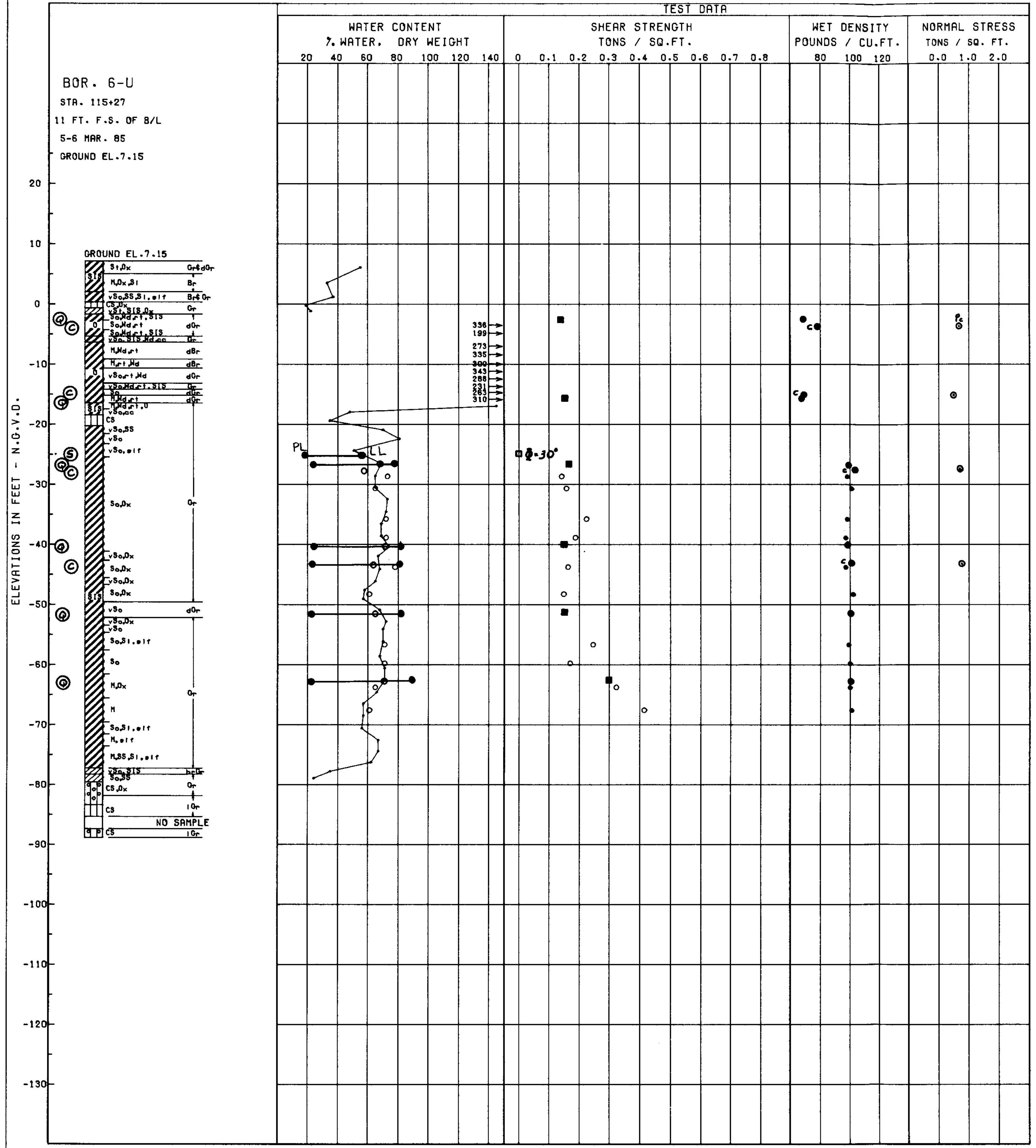
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

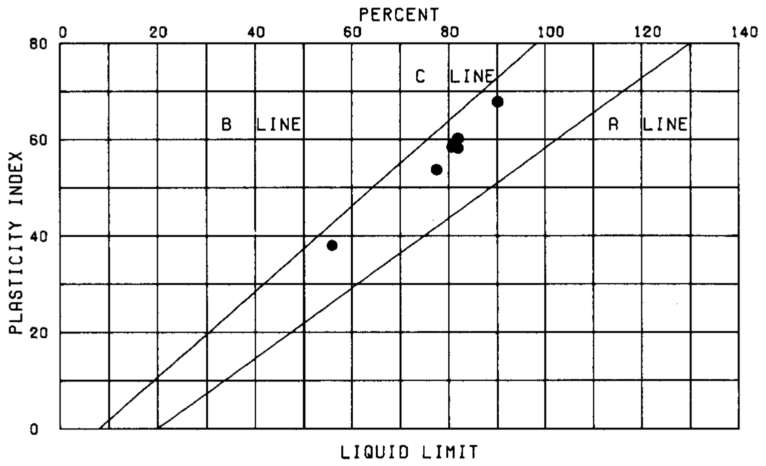
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 5-U

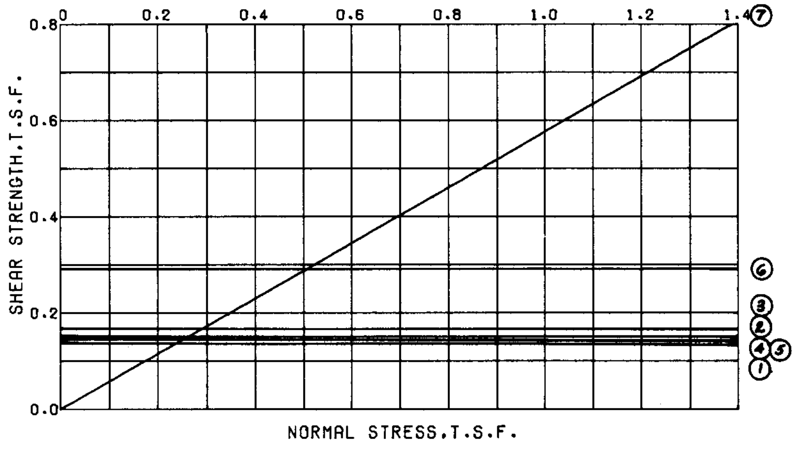
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



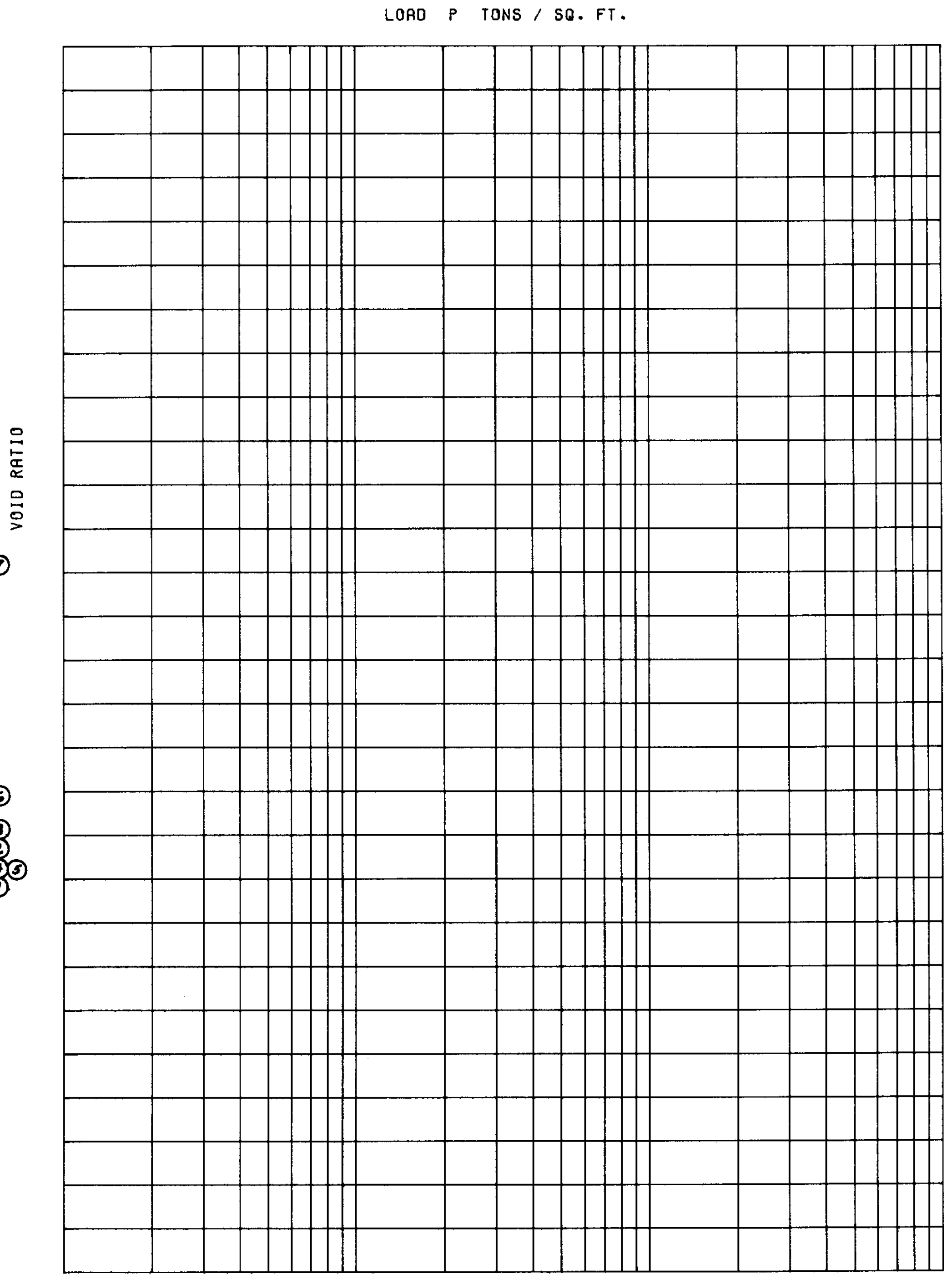


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-2.85	Q	0°	0.136	PT
2.	-15.85	Q	0°	0.150	PT
3.	-26.85	Q	0°	0.163	CH
4.	-40.25	Q	0°	0.145	CH
5.	-51.45	Q	0°	0.147	CH
6.	-62.85	Q	0°	0.294	CH
7.	-23.55	S	30°	0.000	CH



CONSOLIDATION DATA

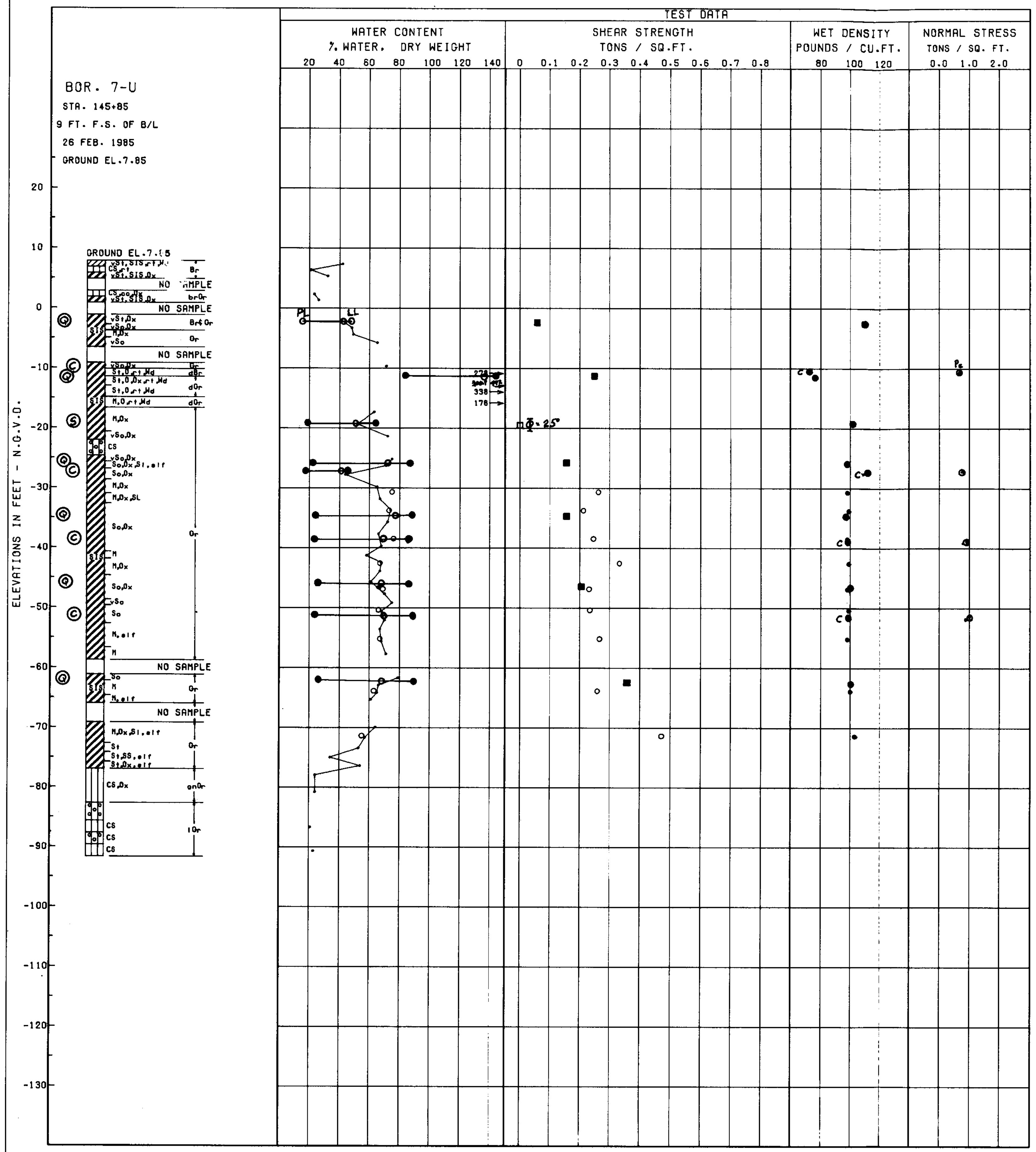
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER
STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 3.

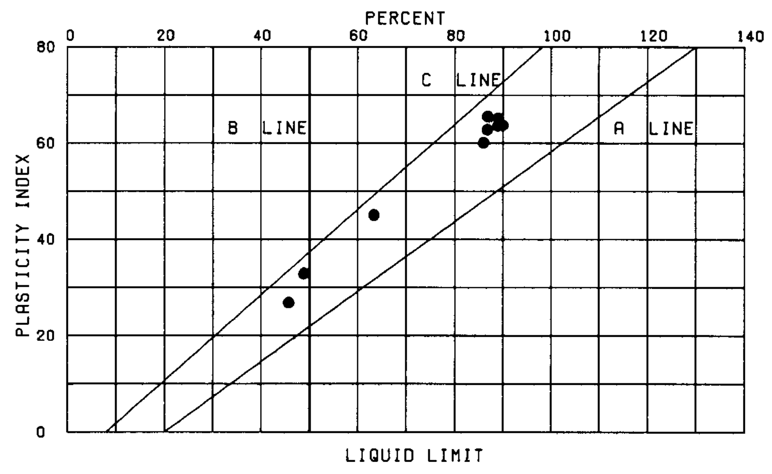
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 6-U

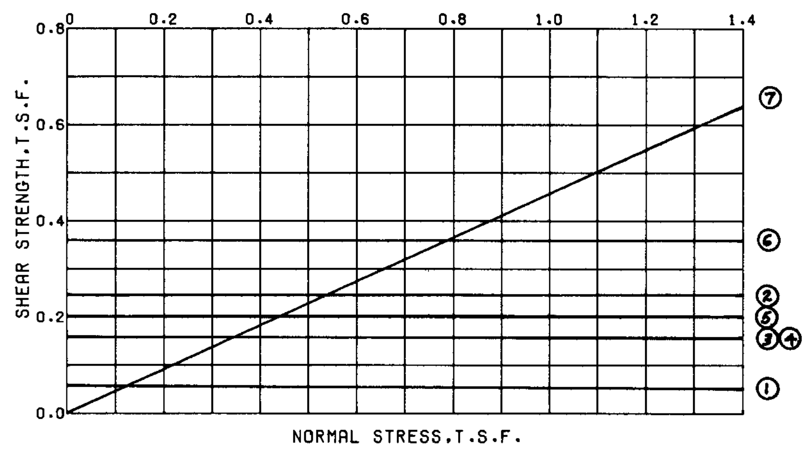
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197

PLATE 32



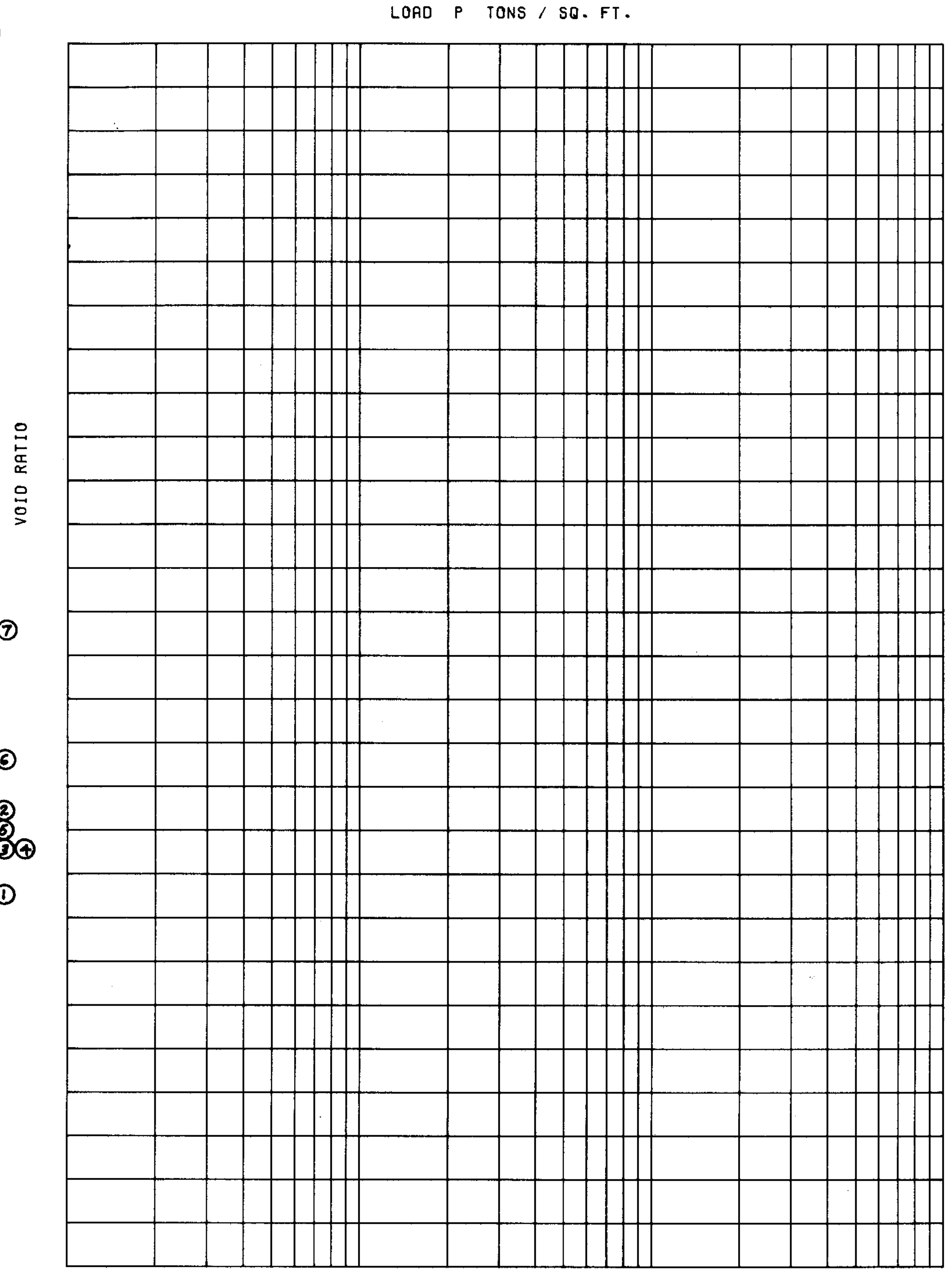


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-2.15	Q	0°	0.053	CL
2.	-11.15	Q	0°	0.245	CH
3.	-25.95	Q	0°	0.157	OH
4.	-34.75	Q	0°	0.157	CH
5.	-46.15	Q	0°	0.203	CH
6	-62.20	Q	0°	0.360	CH
7.	-19.50	S	25°	0.000	CH



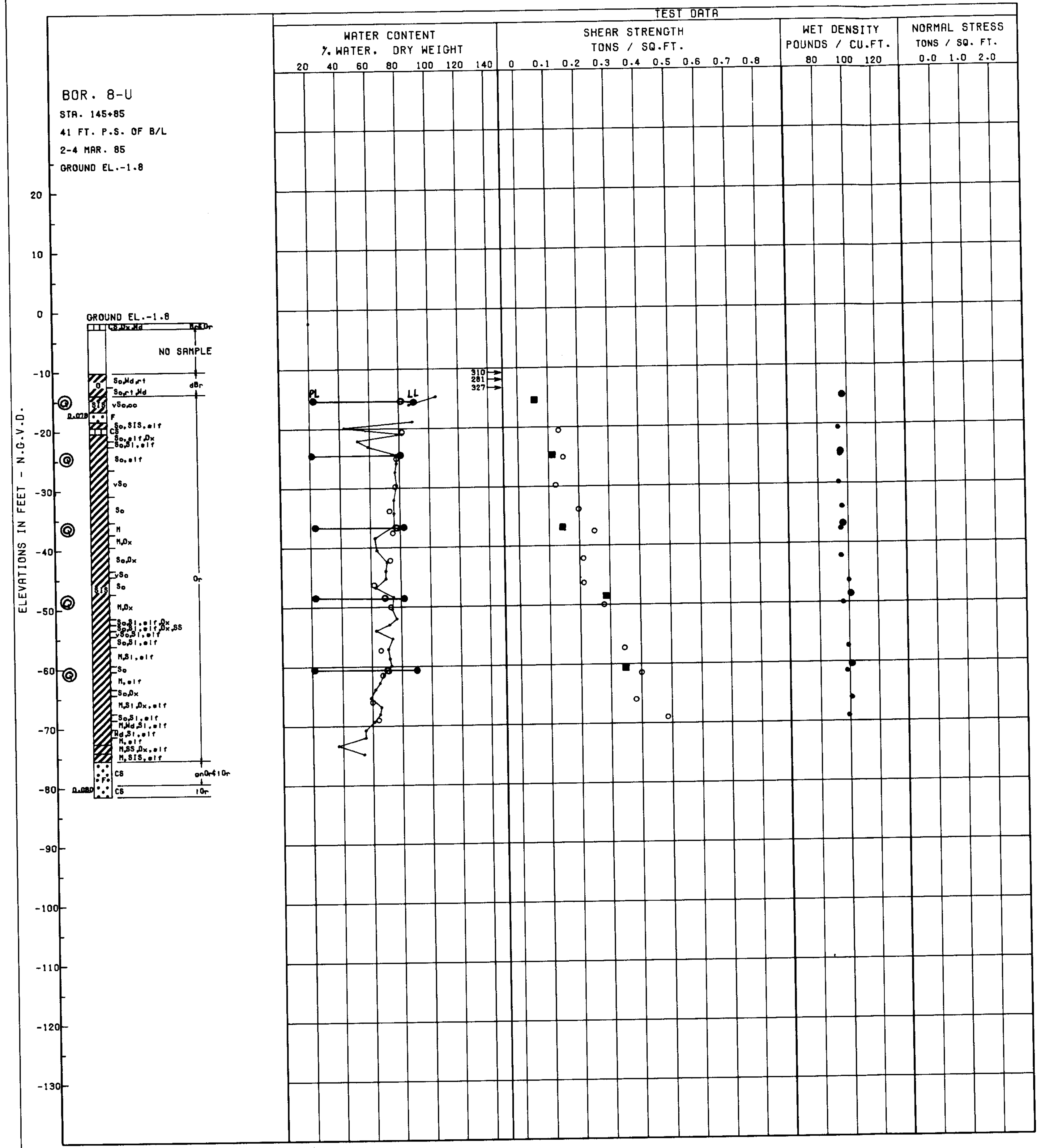
CONSOLIDATION DATA

○ - (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 BORING SEE PLATE 4.

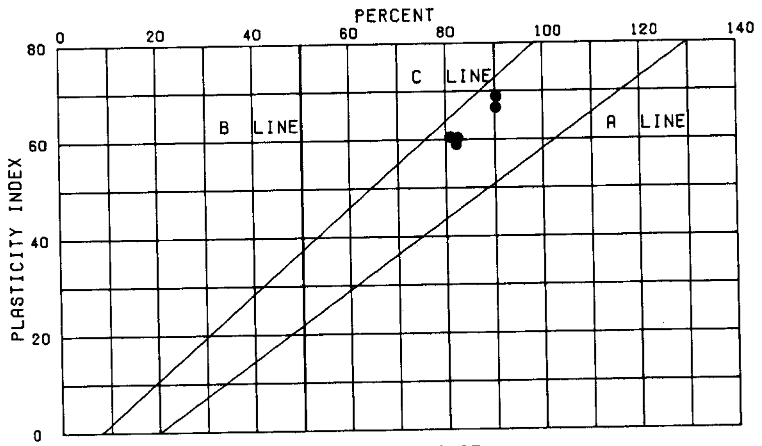
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 7-U

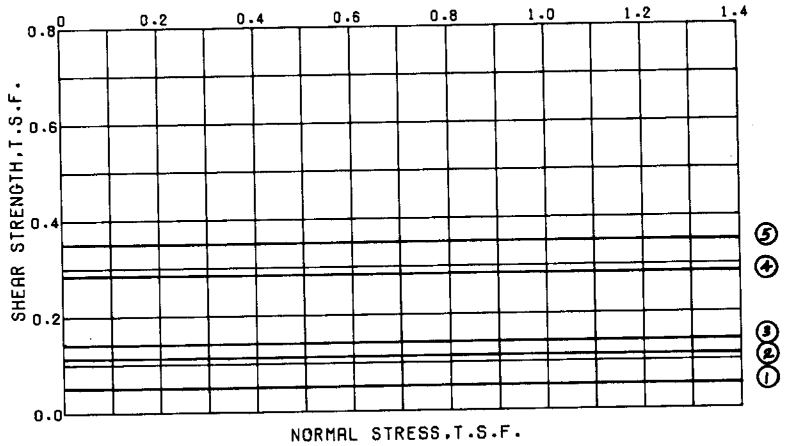
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



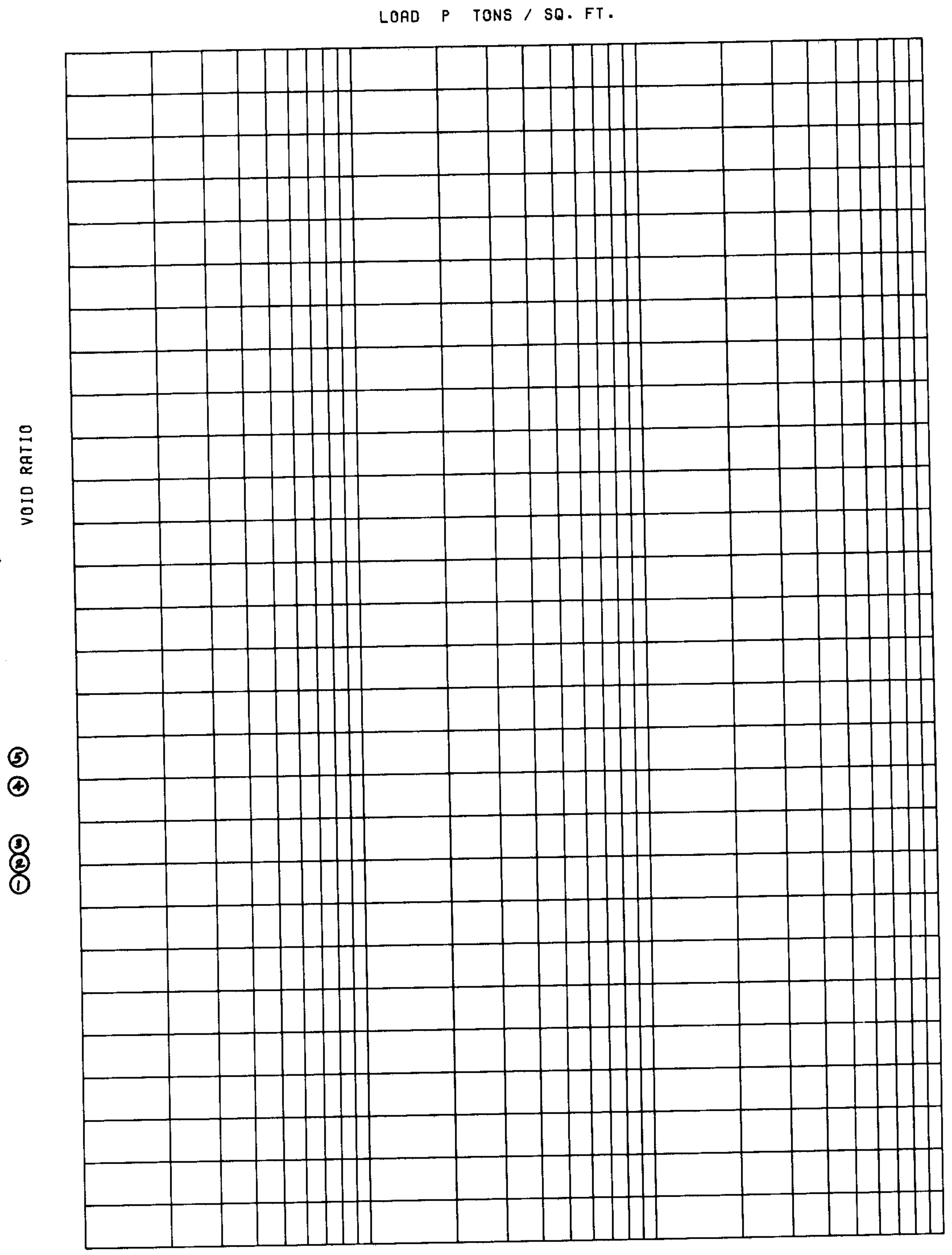
PLASTICITY CHART



SHEAR STRENGTH DATA



ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-15.6	Q	0°	0.052	CH
2.	-24.6	Q	0°	0.115	CH
3.	-36.7	Q	0°	0.147	CH
4.	-45.8	Q	0°	0.290	CH
5.	-60.6	Q	0°	0.350	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 BORING SEE PLATE 4.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

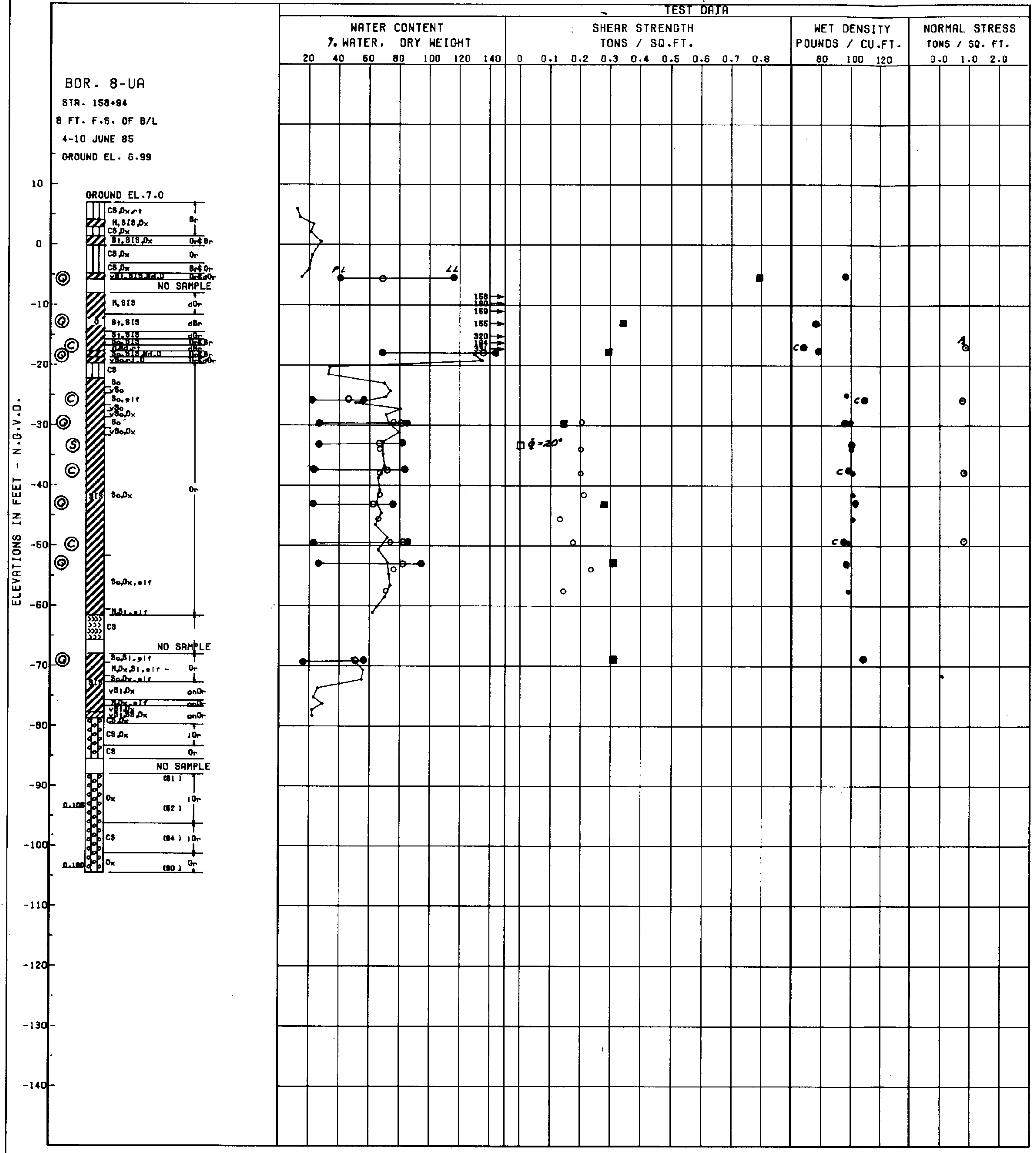
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

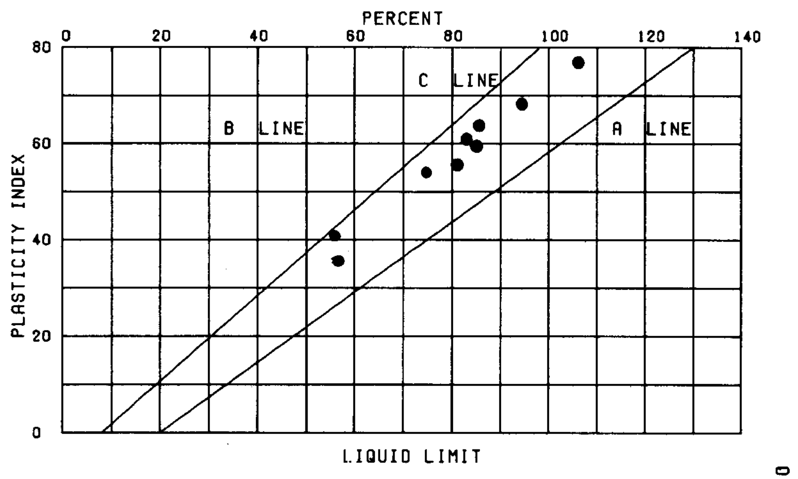
UNDISTURBED BORING 8-U

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

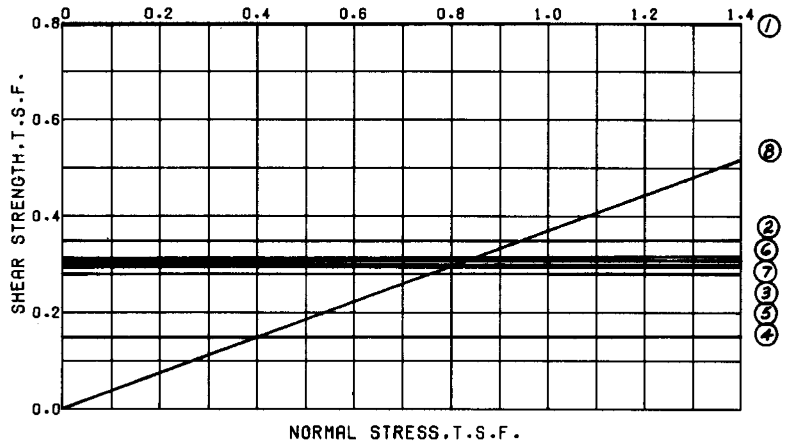
JULY 1987 FILE NO. H-2-30197

PLATE 34



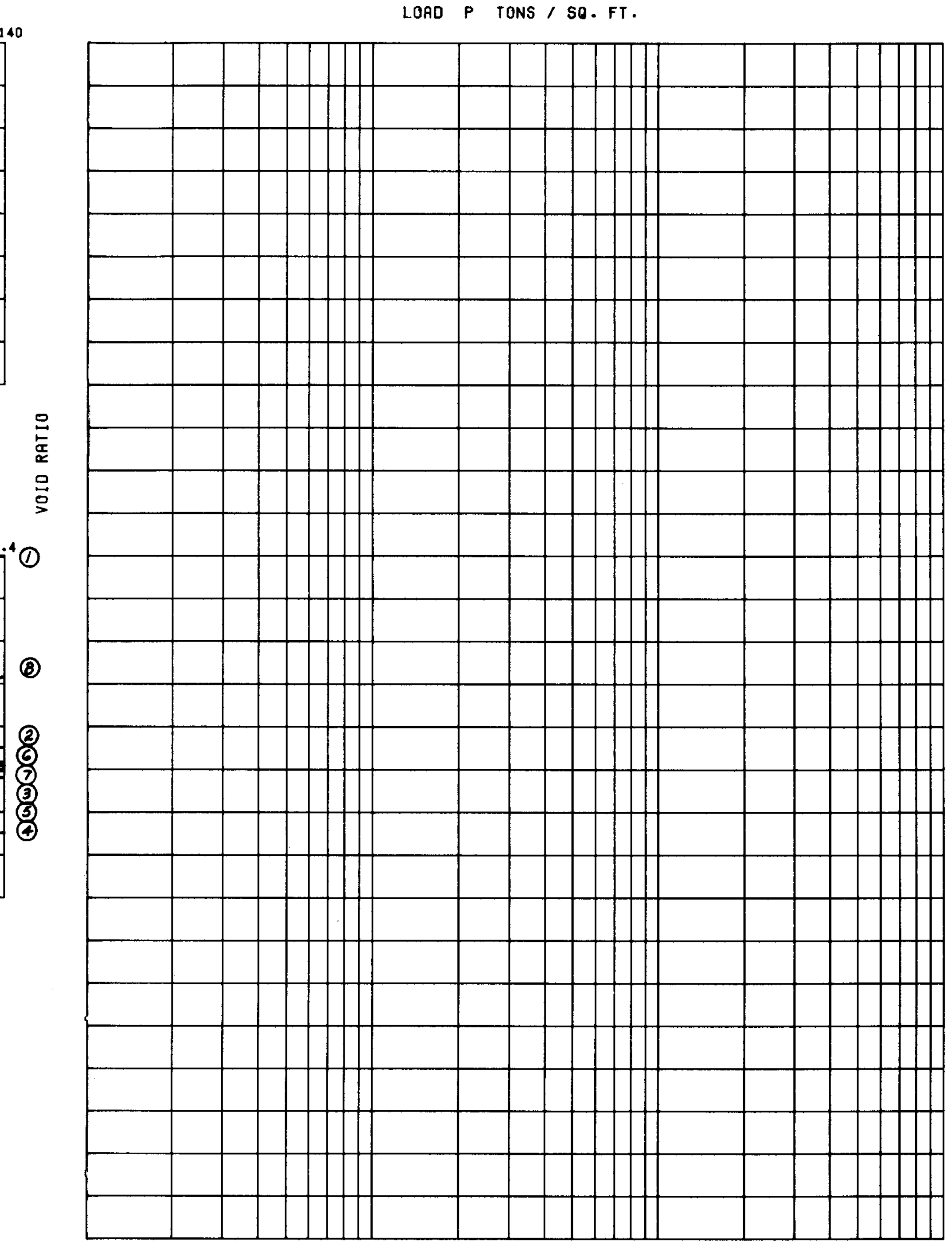


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-5.2	Q	0°	0.798	CH
2.	-13.0	Q	0°	0.348	OH
3.	-17.8	Q	0°	0.292	CH
4.	-29.9	Q	0°	0.147	CH
5.	-43.0	Q	0°	0.280	CH
6.	-53.0	Q	0°	0.308	CH
7.	-69.0	Q	0°	0.303	CH
8.	-33.0	S	20°	0.000	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 BORING SEE PLATES 4 & 5.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

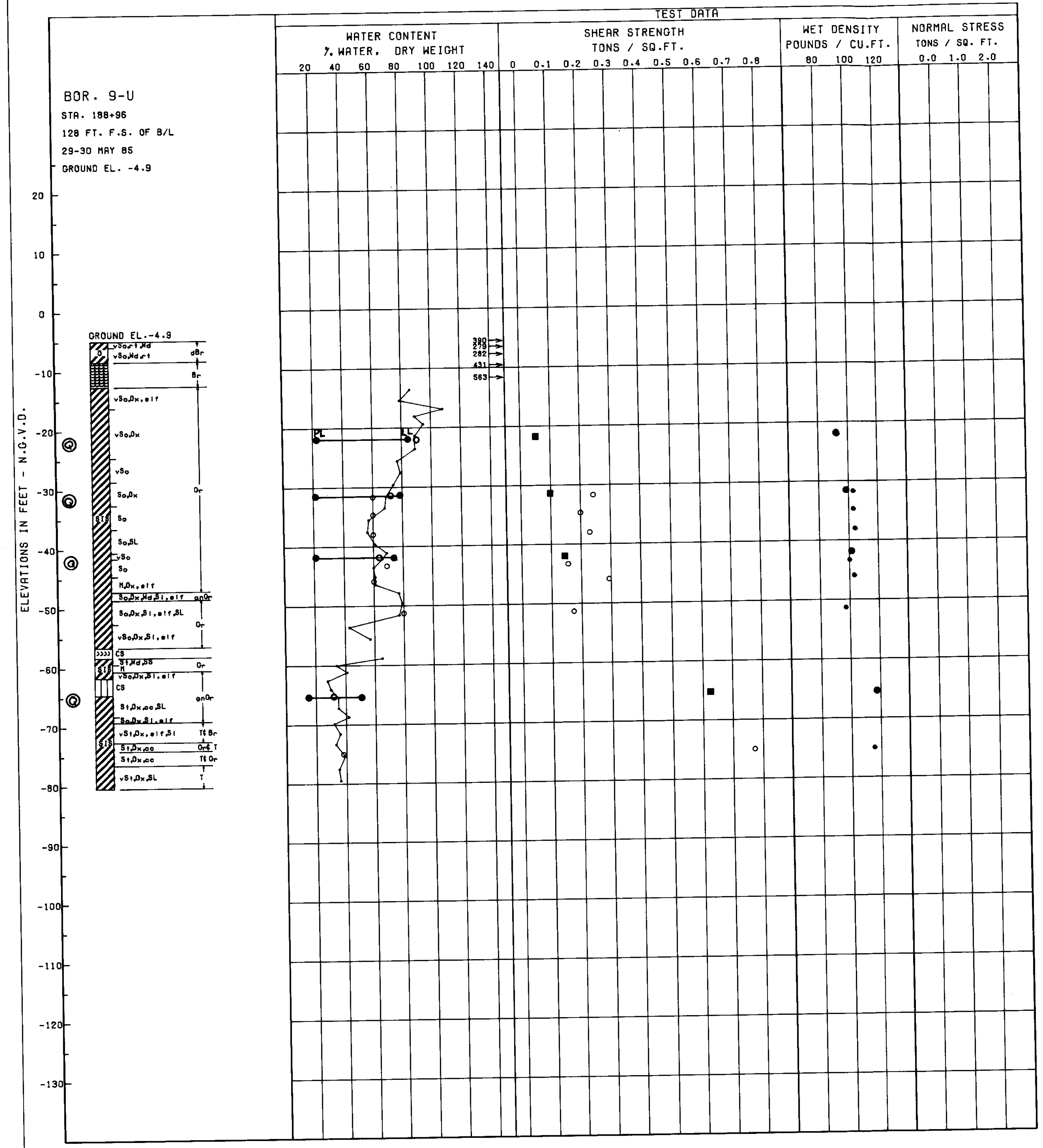
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

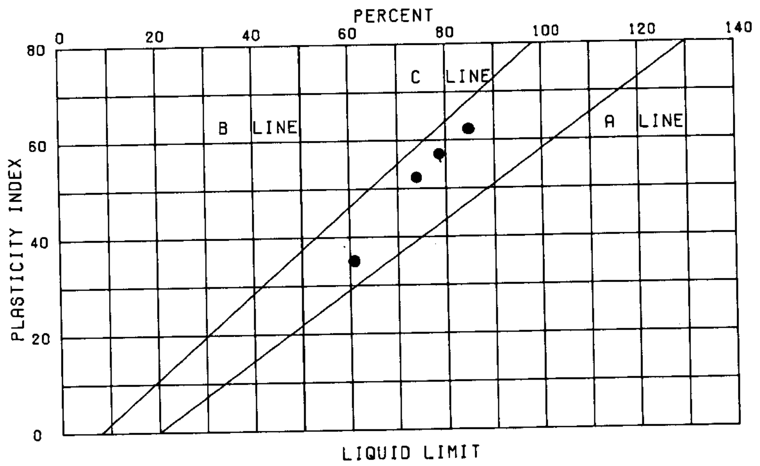
JEFFERSON PARISH - ST. CHARLES PARISH RETURN LEVEE

UNDISTURBED BORING 8-UA

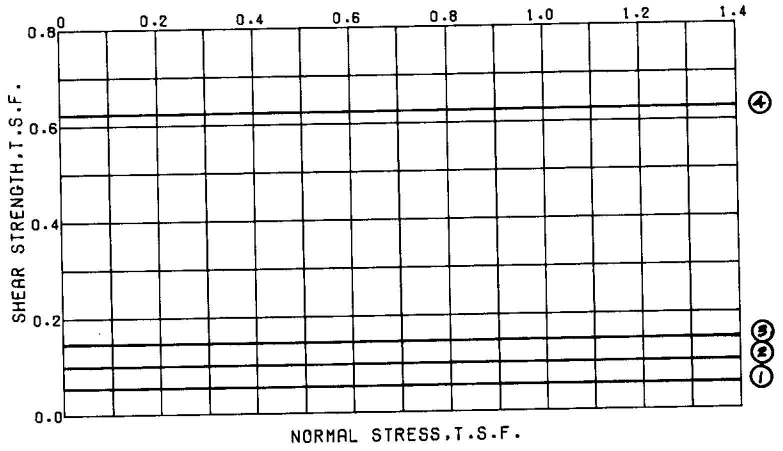
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



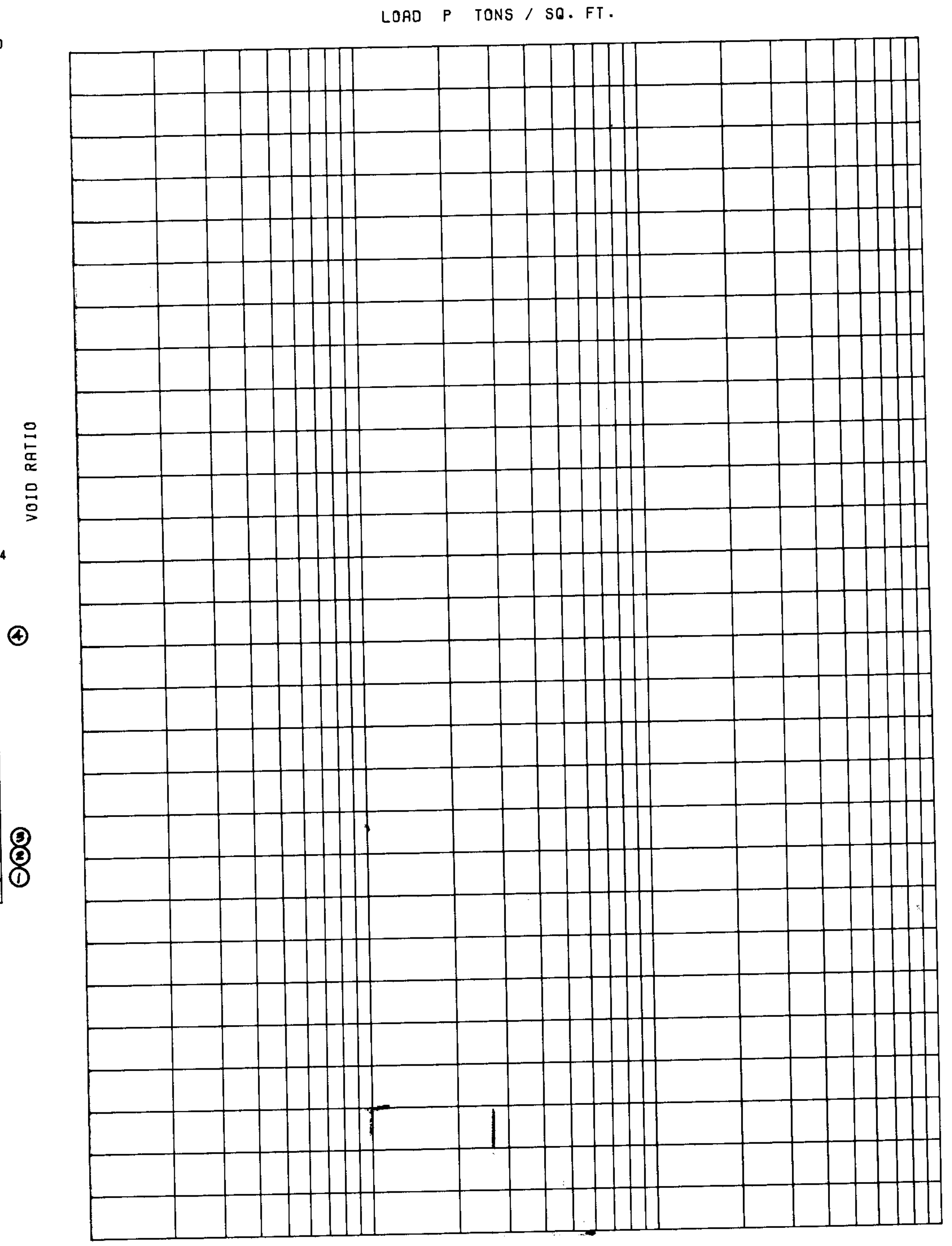


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
1	-21.9	Q	0°	0.053	CH
2	-31.3	Q	0°	0.100	CH
3	-41.9	Q	0°	0.149	CH
4	-65.9	Q	0°	0.628	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 BORING SEE PLATE 5.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

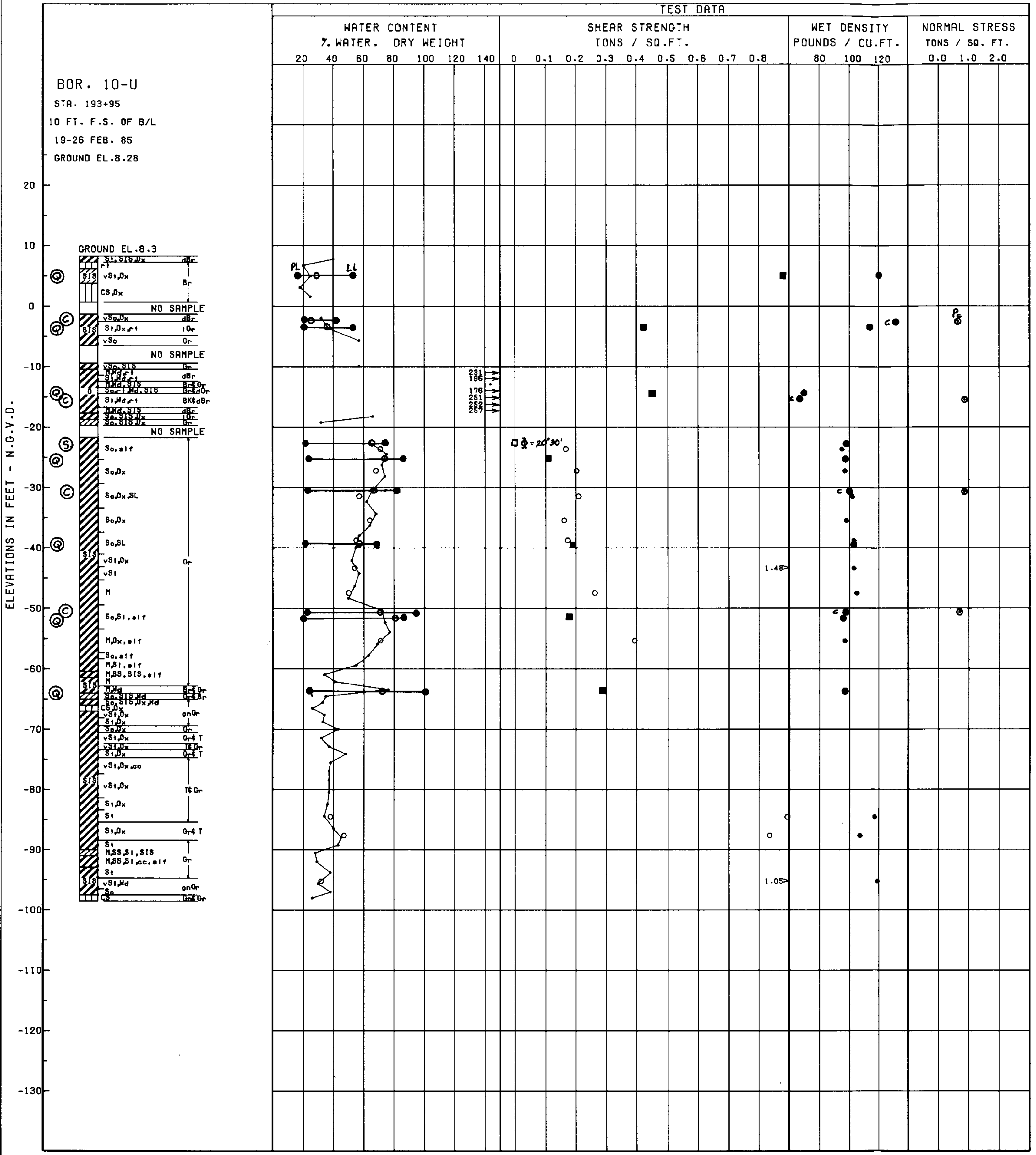
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

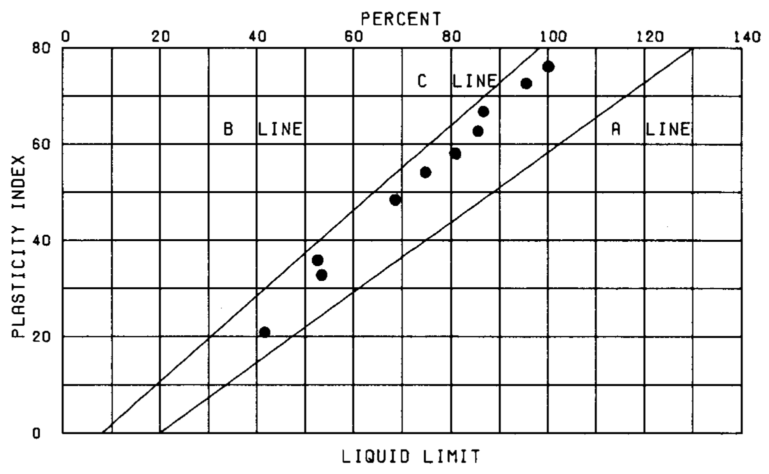
UNDISTURBED BORING 9-U

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

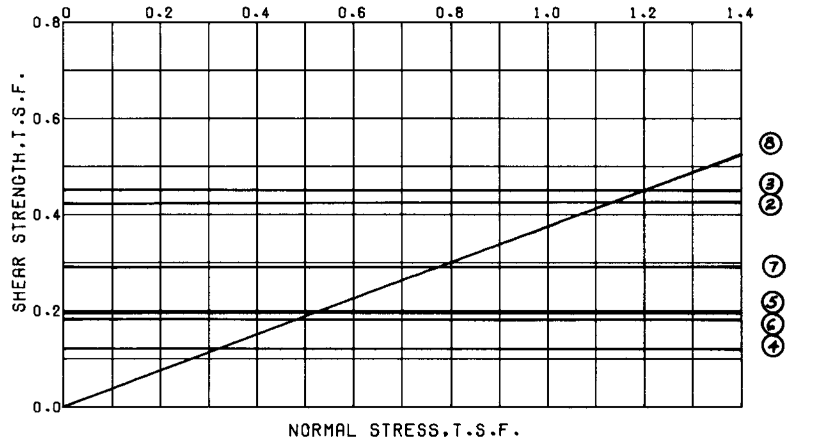
JULY 1987 FILE NO. H-2-30197

PLATE 36



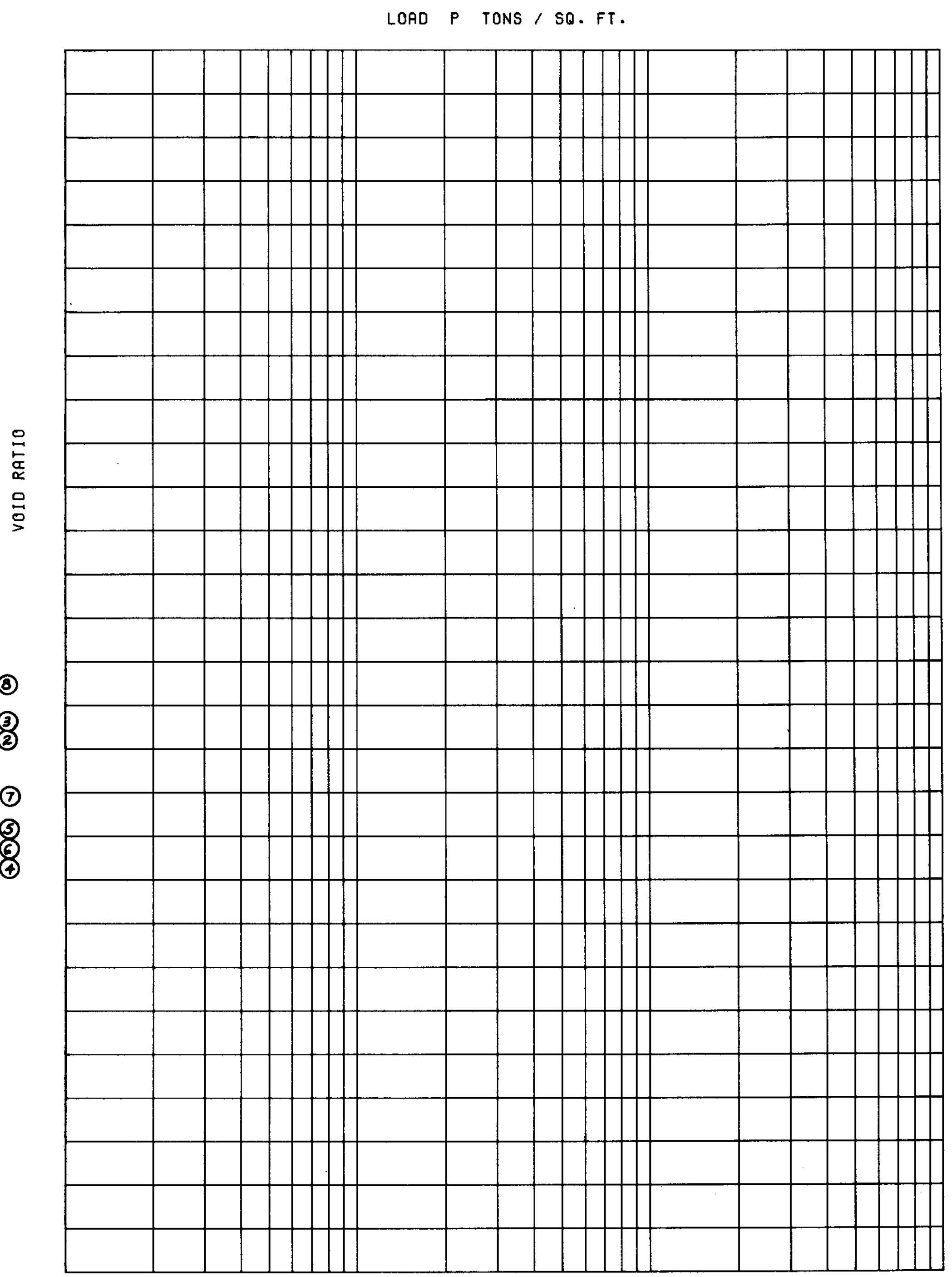


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
1.	5.00	Q	0°	0.880	CH
2.	-3.22	Q	0°	0.425	CH
3.	-14.30	Q	0°	0.452	PT
4.	-26.32	Q	0°	0.117	CH
5.	-39.60	Q	0°	0.198	CH
6.	-51.52	Q	0°	0.183	CH
7.	-63.42	Q	0°	0.290	CH
8.	-22.72	S	20°30'	0.000	CH



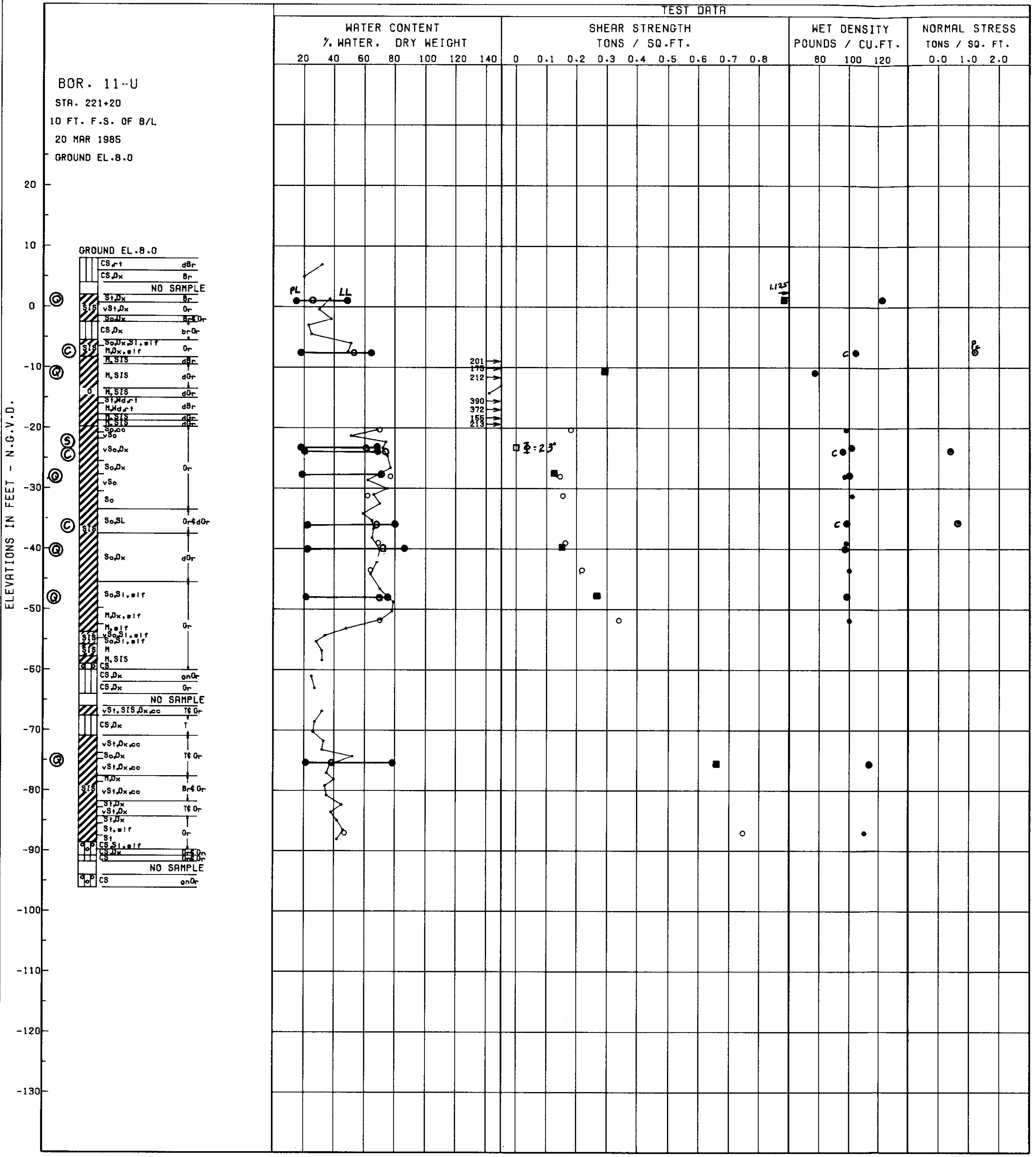
CONSOLIDATION DATA

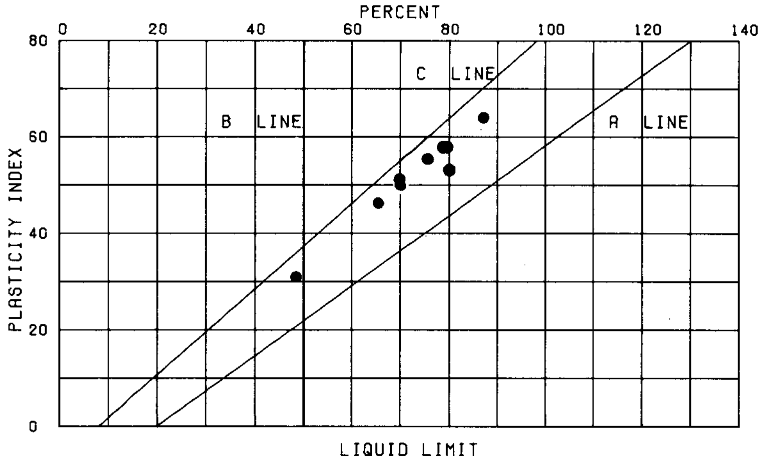
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
◫ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATES 5&6.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

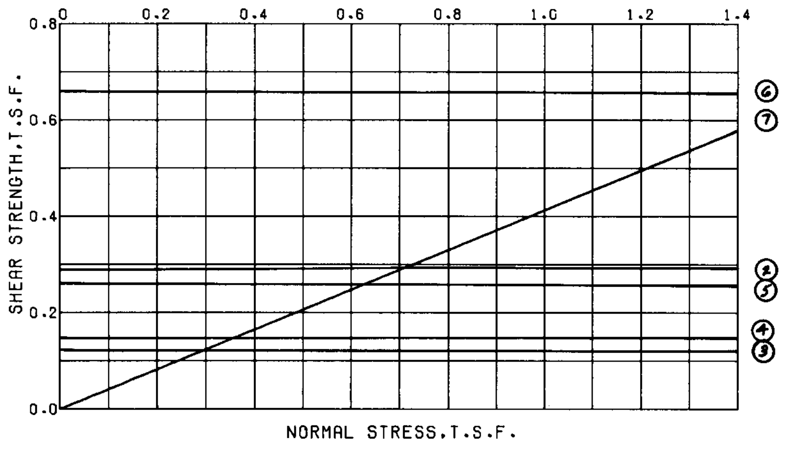
UNDISTURBED BORING 10-U

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



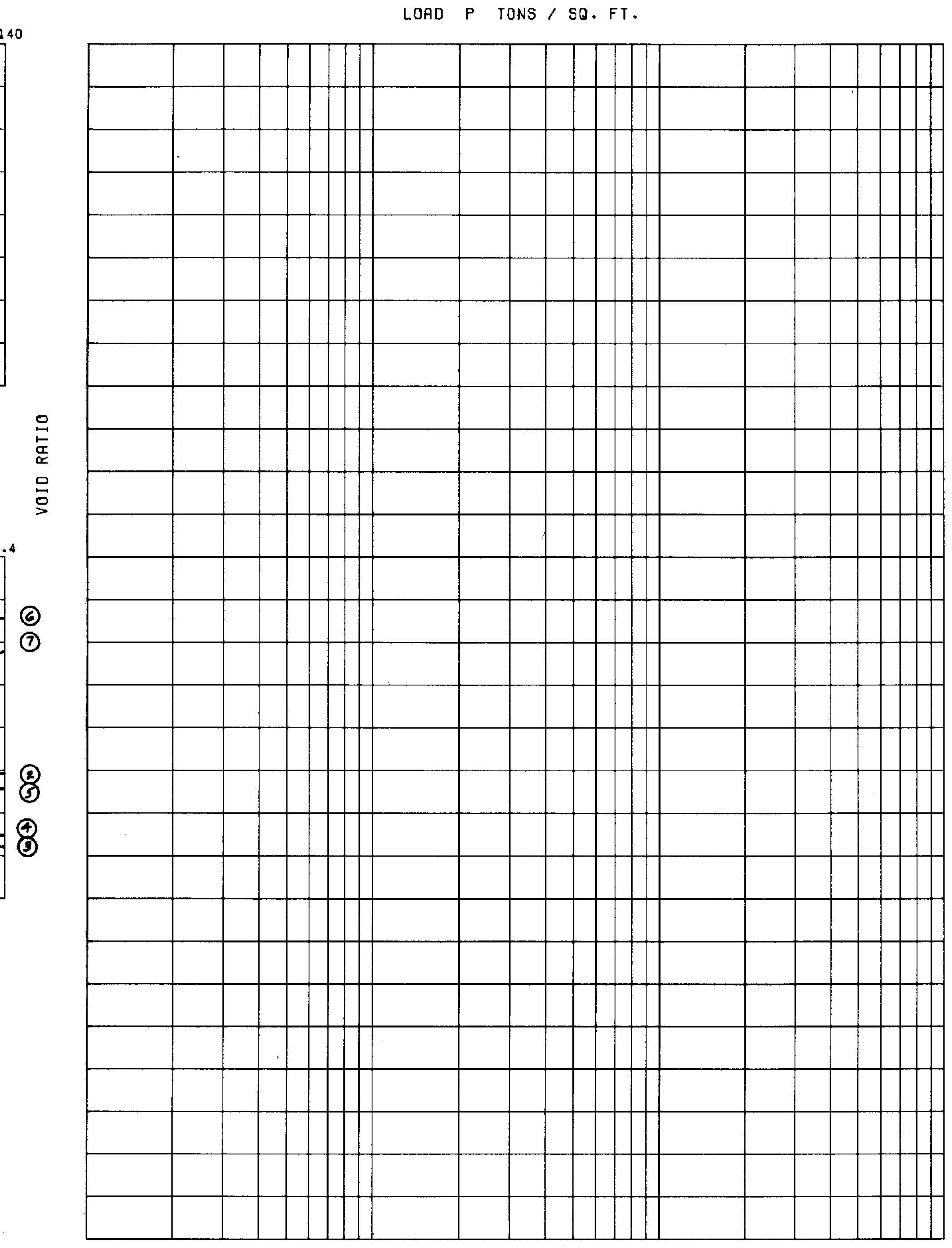


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	0.10	Q	0°	1.125	CL
2	-11.00	Q	0°	0.294	CH
3.	-27.90	Q	0°	0.125	CH
4.	-40.00	Q	0°	0.150	CH
5.	-48.00	Q	0°	0.266	CH
6.	-75.40	Q	0°	0.661	CH
7.	-23.50	S	23°	0.000	CH



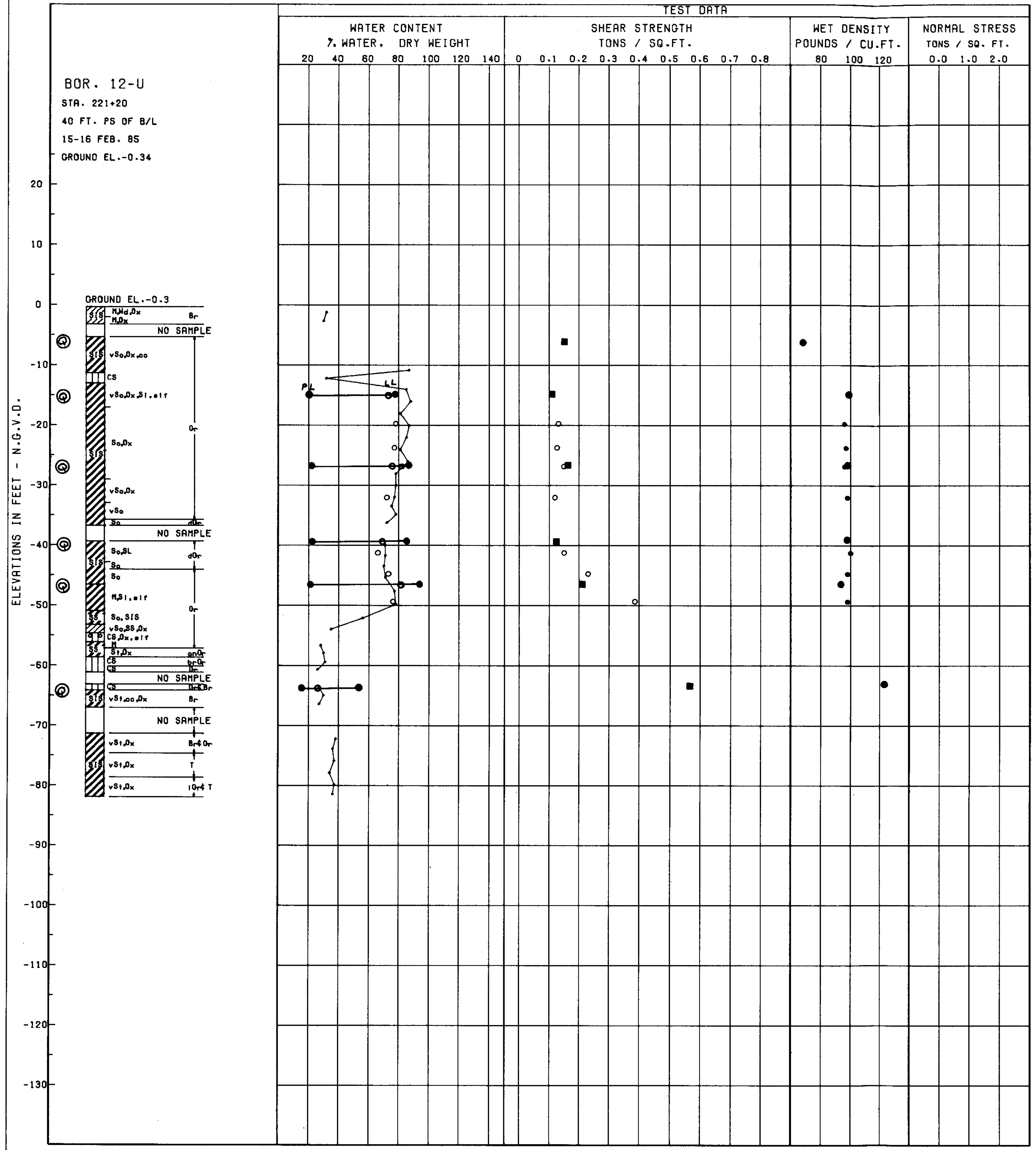
CONSOLIDATION DATA

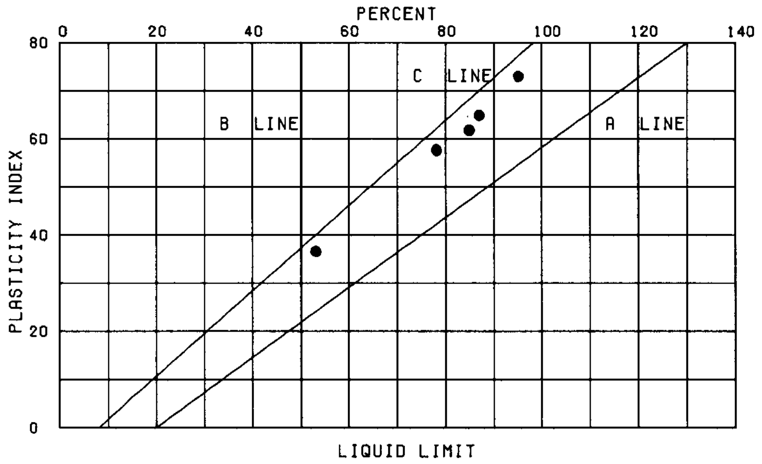
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 6.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

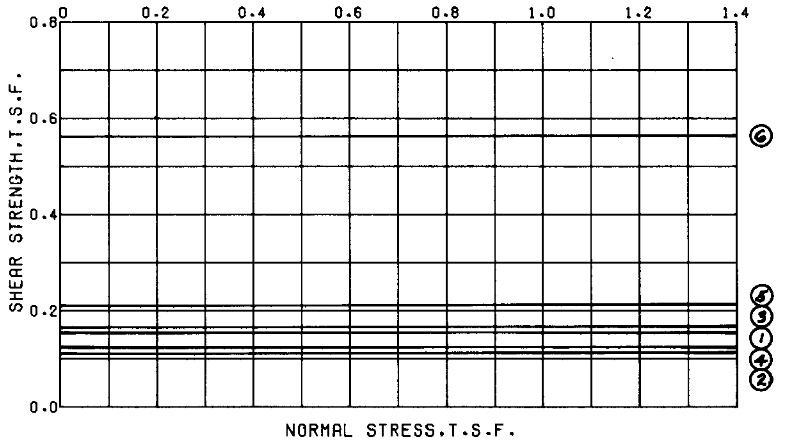
UNDISTURBED BORING 11-U

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO H-2-30197



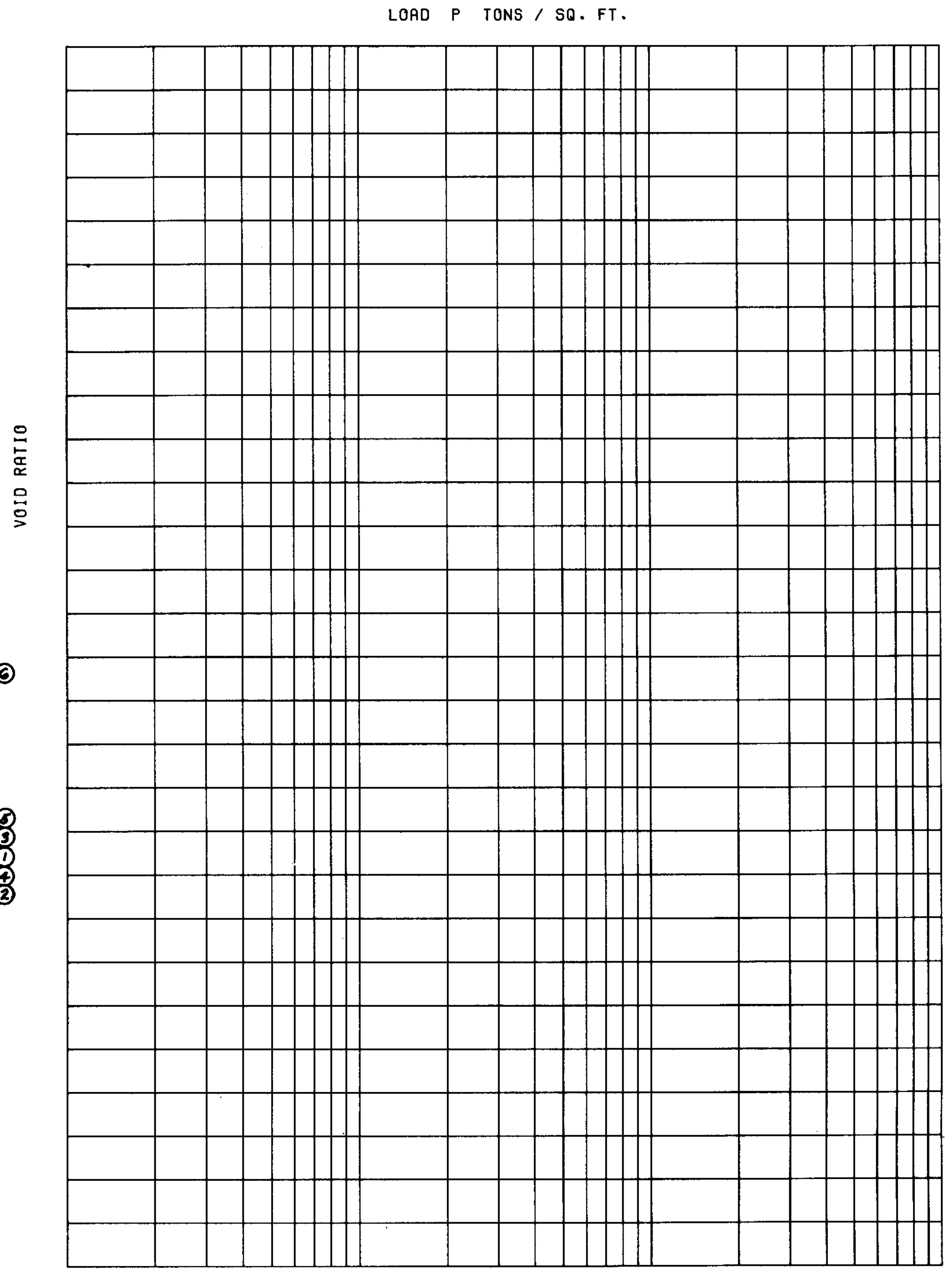


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-6.20	Q	0°	0.155	PT
2	-15.00	Q	0°	0.110	CH
3.	-26.90	Q	0°	0.165	CH
4.	-39.36	Q	0°	0.124	CH
5.	-42.66	Q	0°	0.209	CH
6	-63.46	Q	0°	0.564	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 BORING SEE PLATE 6.

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

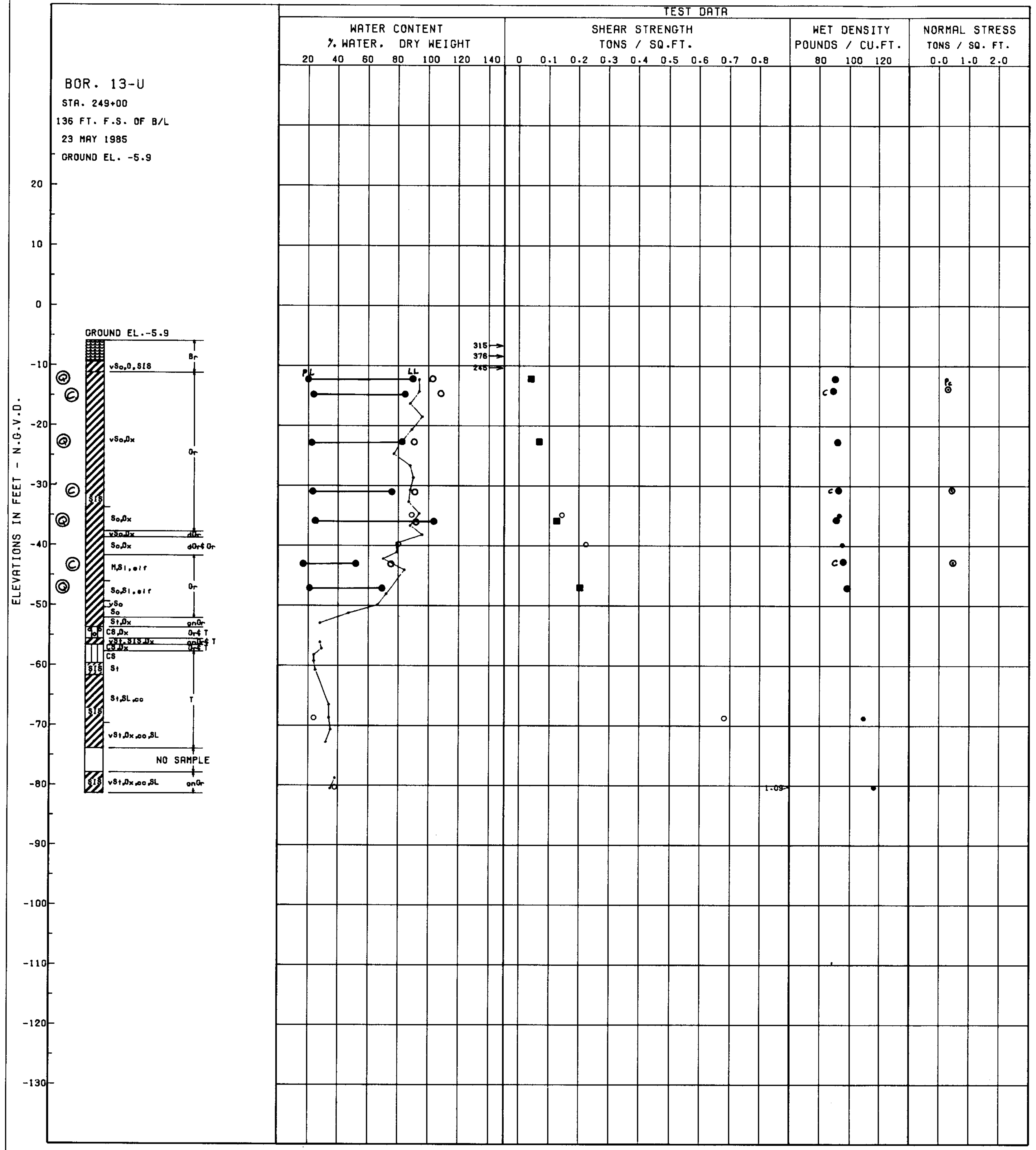
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

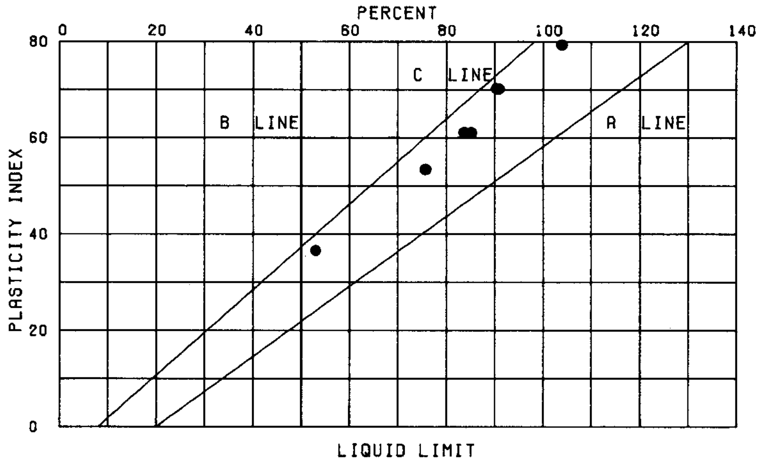
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 12-U

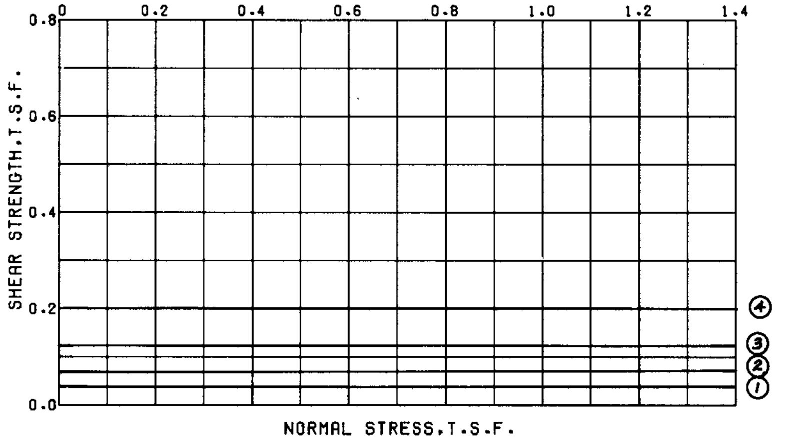
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JULY 1987 FILE NO. H-2-30197



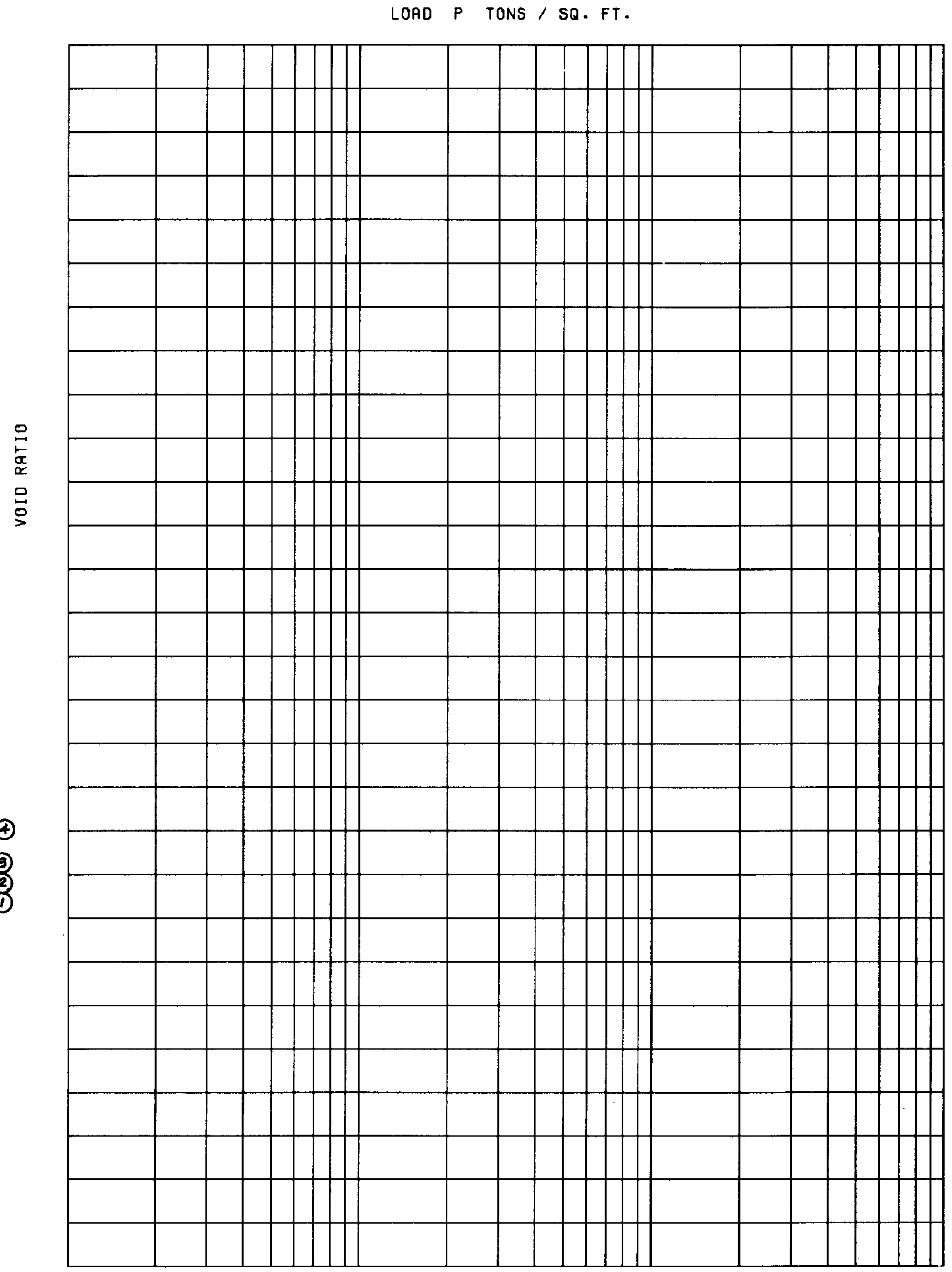


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1.	-12.3	Q	0°	0.037	CH
2.	-22.9	Q	0°	0.068	CH
3.	-35.9	Q	0°	0.120	CH
4.	-46.9	Q	0°	0.200	CH



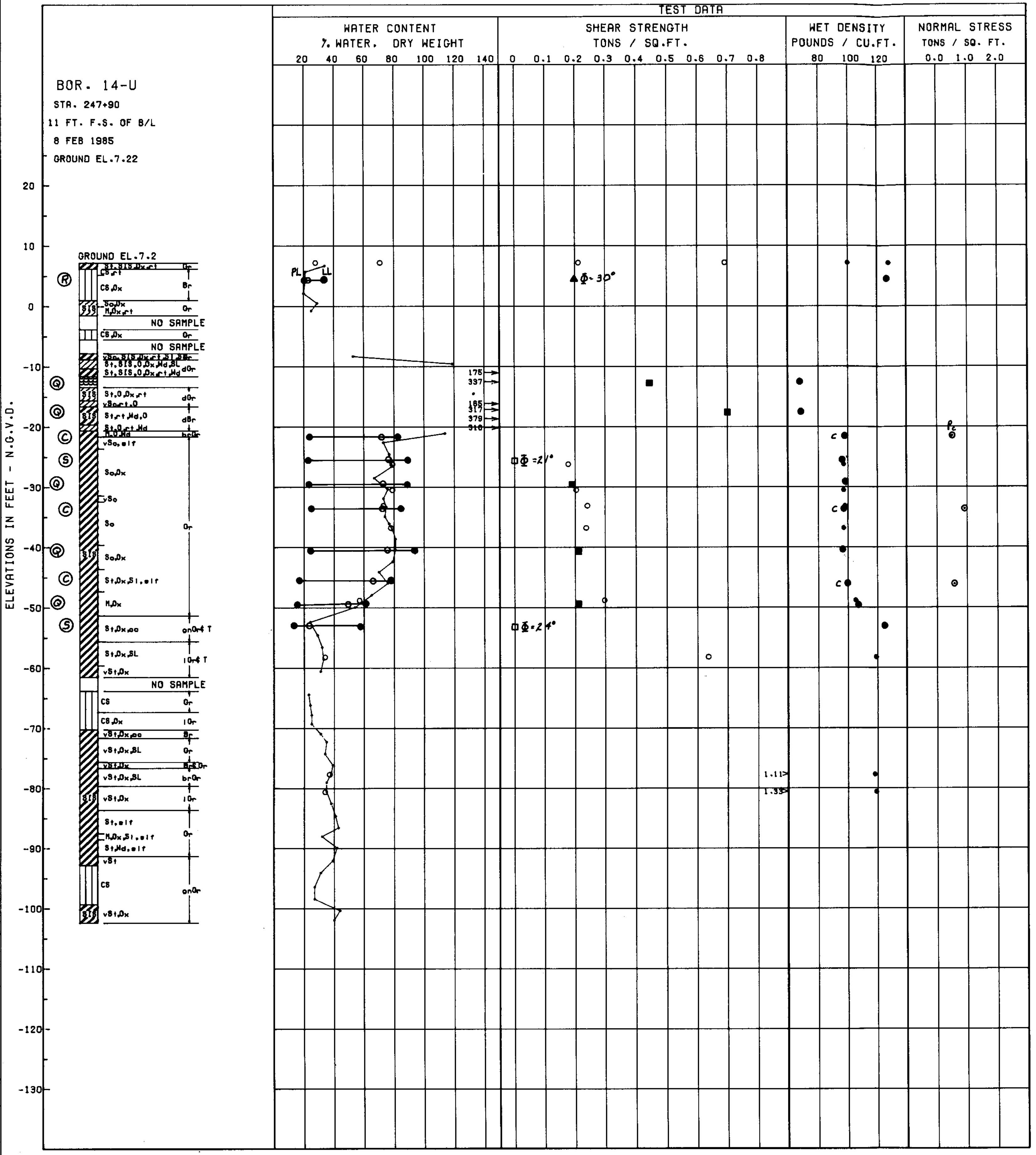
CONSOLIDATION DATA

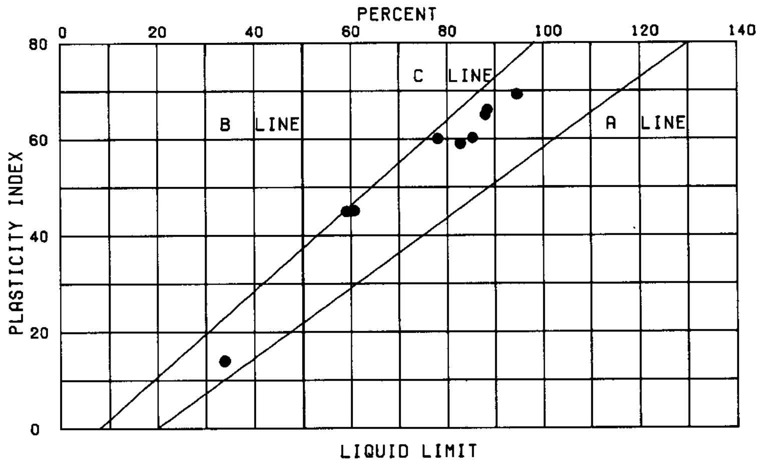
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 7

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

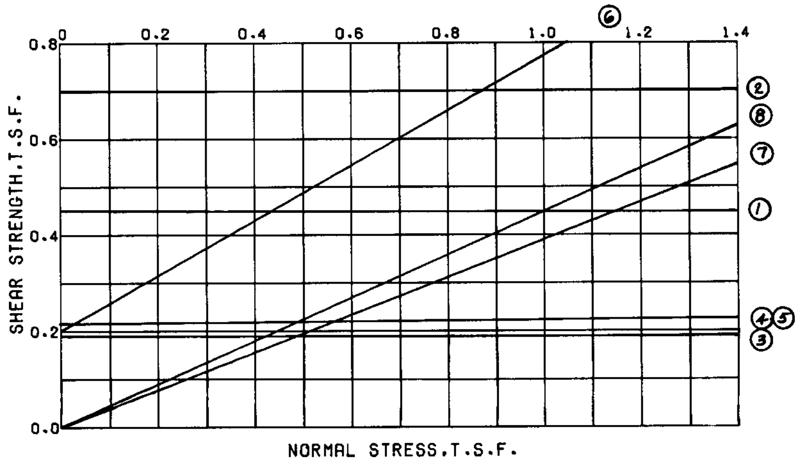
UNDISTURBED BORING 13-U

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



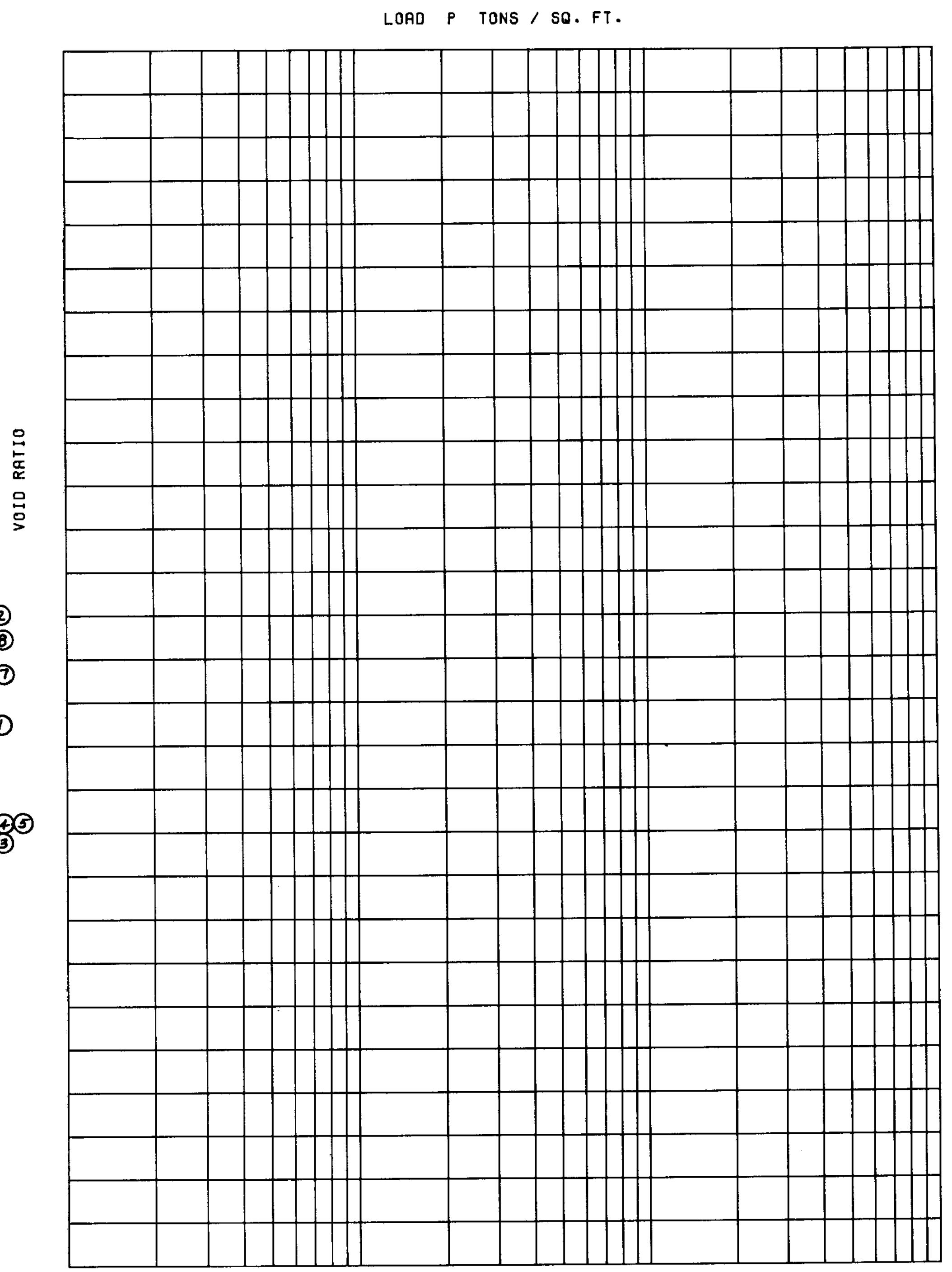


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1	-12.80	Q	0°	0.448	PT
2	-17.70	Q	0°	0.700	PT
3	-29.70	Q	0°	0.192	CH
4	-40.50	Q	0°	0.212	CH
5	-49.78	Q	0°	0.211	CH
6	4.02	R	30°	0.200	CL
7	-25.18	S	21°	0.000	CH
8	-52.98	S	24°	0.000	CH



CONSOLIDATION DATA

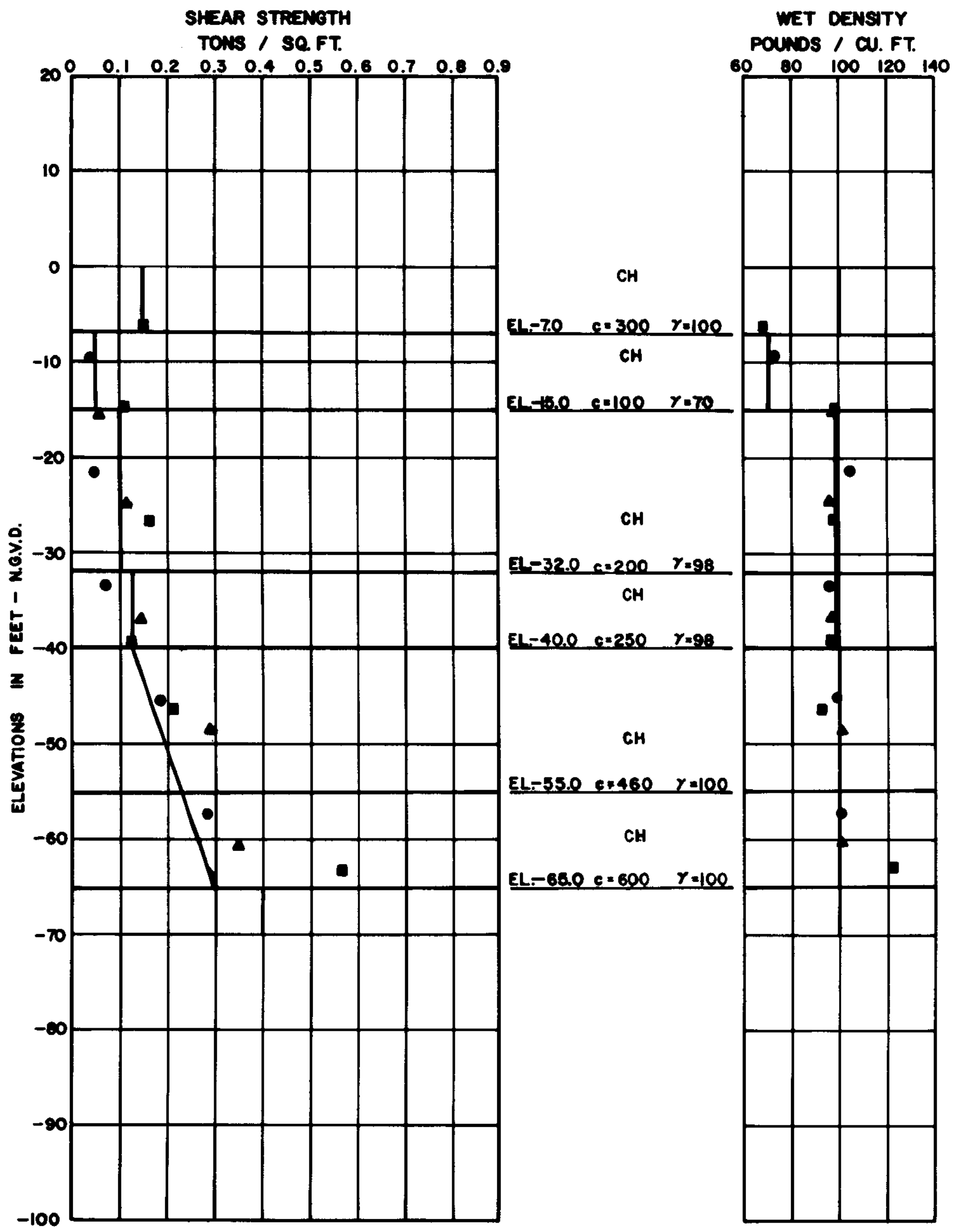
○ - (UC) UNCONFINED COMPRESSION TEST
■ - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORING SEE PLATE 7

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

UNDISTURBED BORING 14-U

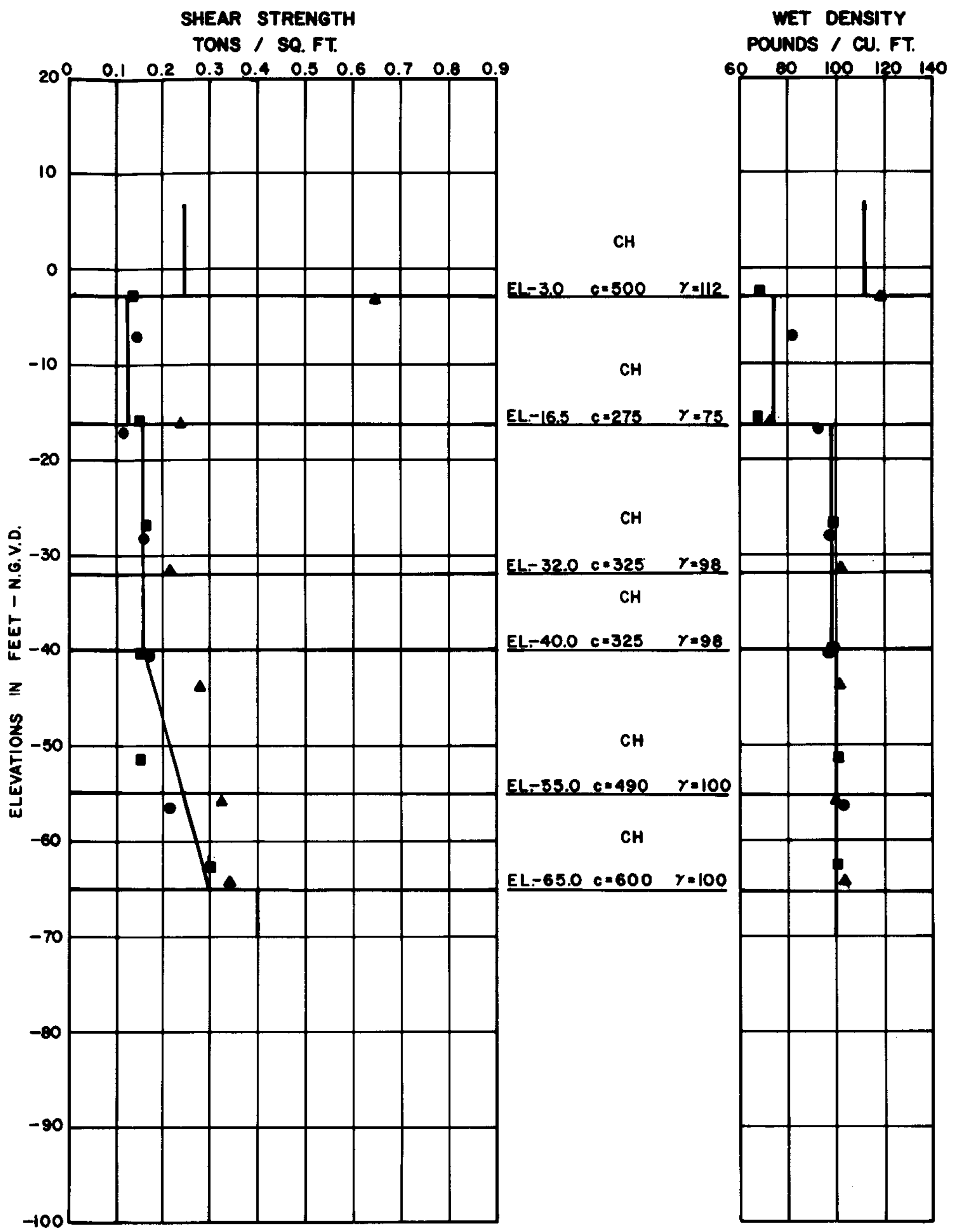
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197

PROTECTED SIDE
50' FROM EXISTING LEVEE C/L



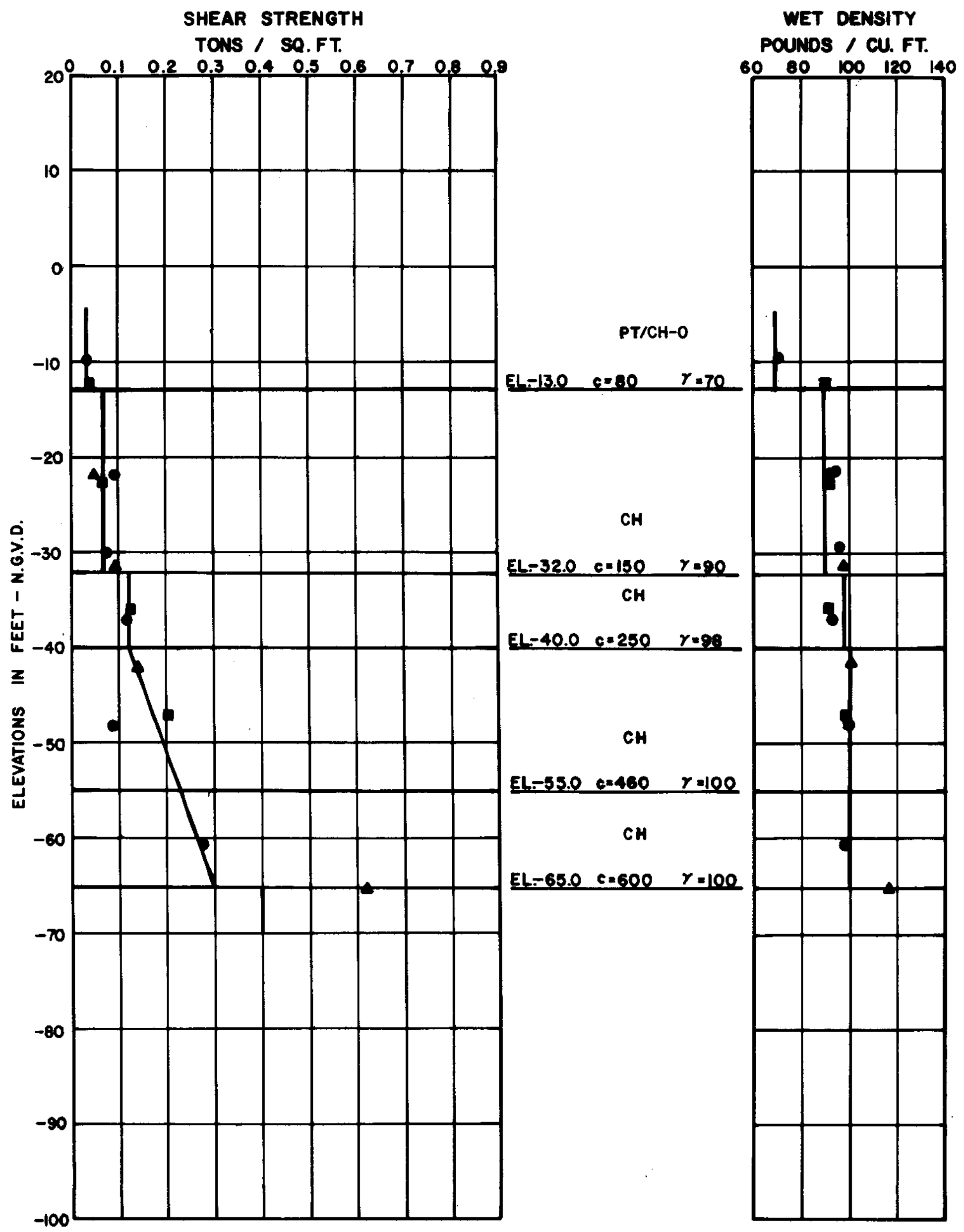
BORING LEGEND:
- ● 4-U
- ▲ 8-U
- ■ 12-U

EXISTING LEVEE C/L
(APPROX. 10' F.S. OF B/L)



BORING LEGEND:
- ● 1-U
- ▲ 3-U
- ■ 6-U

FLOOD SIDE
50' FROM EXISTING LEVEE C/L



BORING LEGEND:
- ● 5-U
- ▲ 9-U
- ■ 13-U

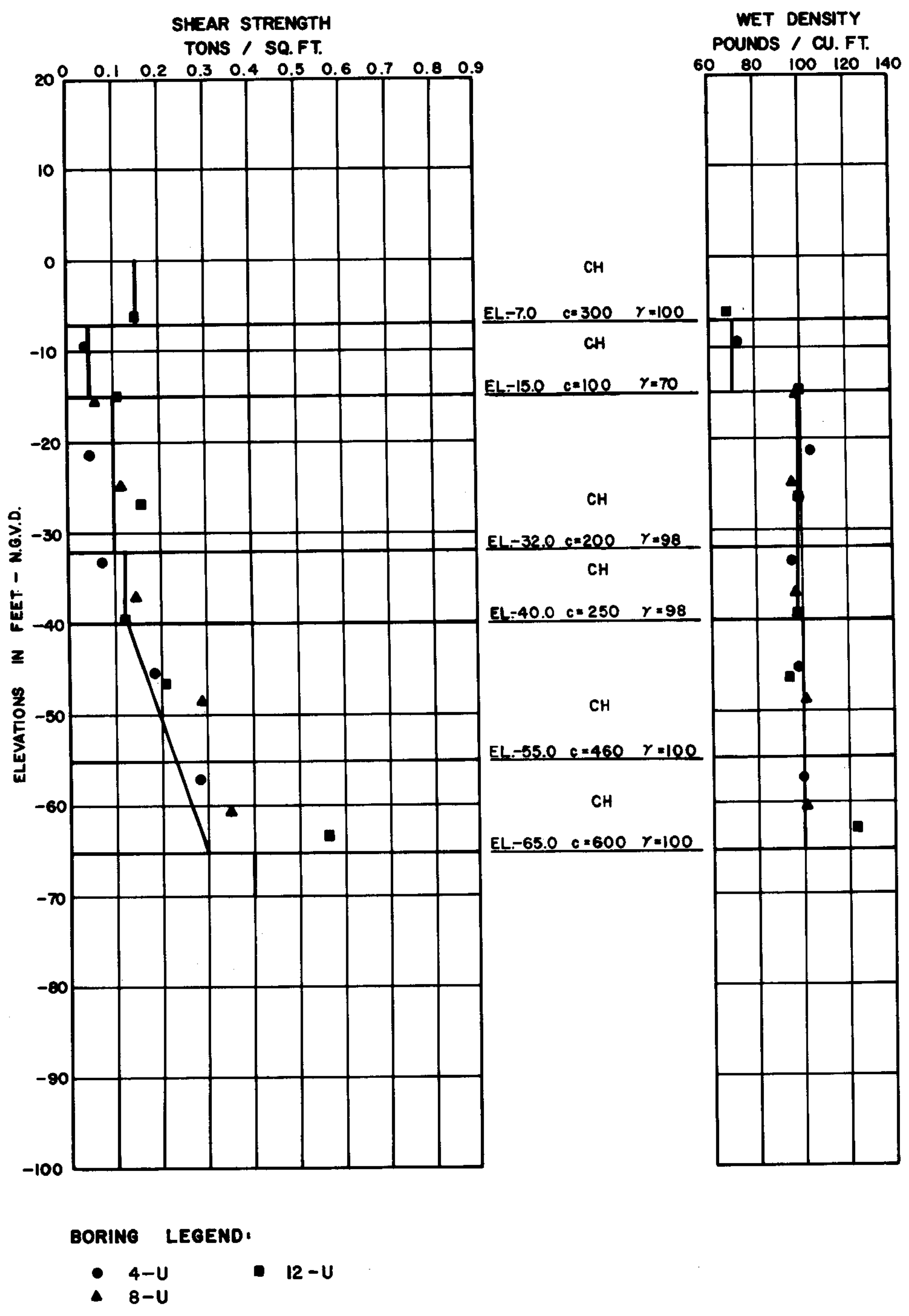
REACH I STA. 74+00 TO STA. 140+00

FOR BORING LOCATIONS SEE PLATES 2 THROUGH 7

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
DESIGN SOIL PARAMETERS
B/L STA. 74+00 TO STA. 140+00
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197

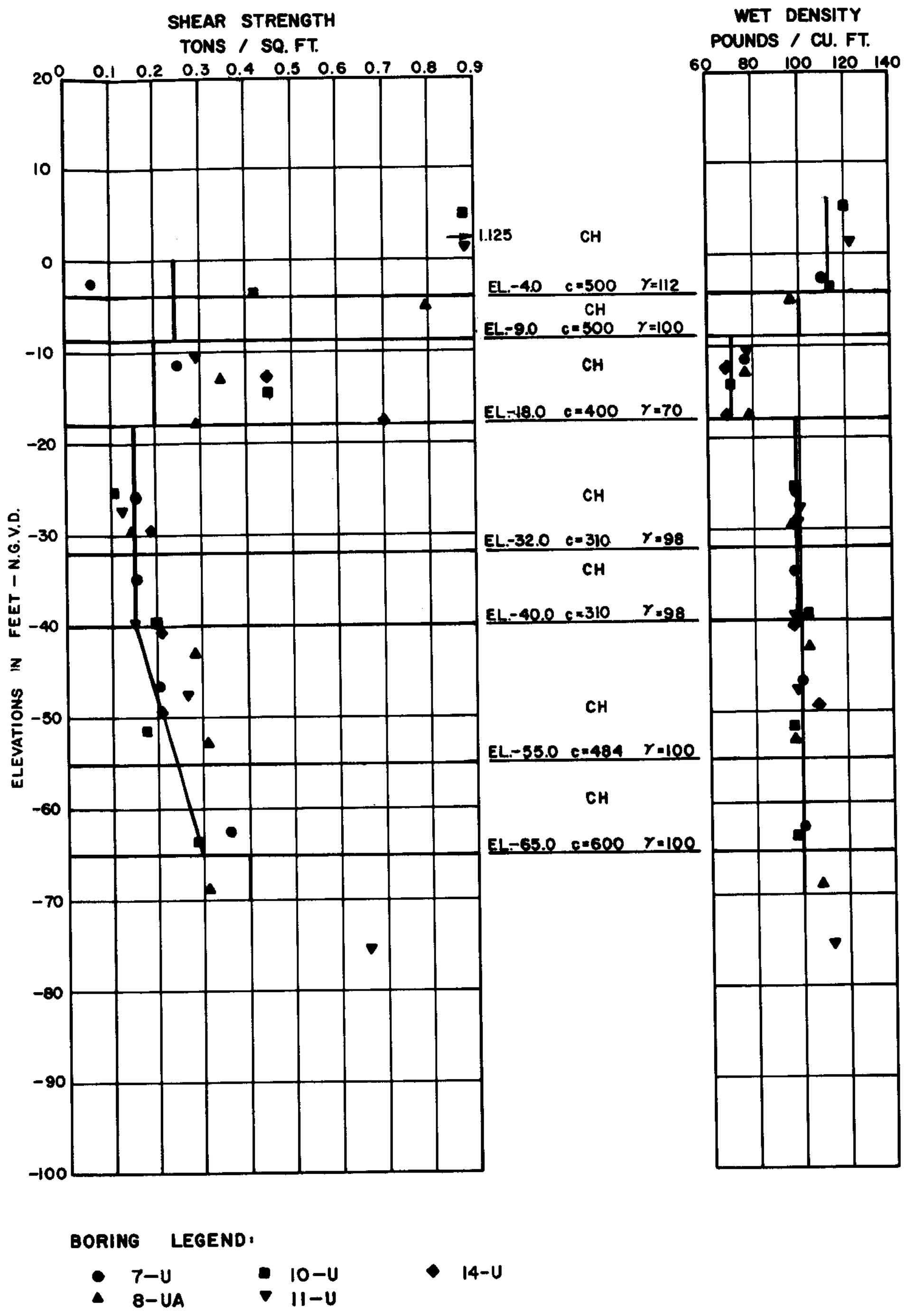
PROTECTED SIDE

50' FROM EXISTING LEVEE C/L



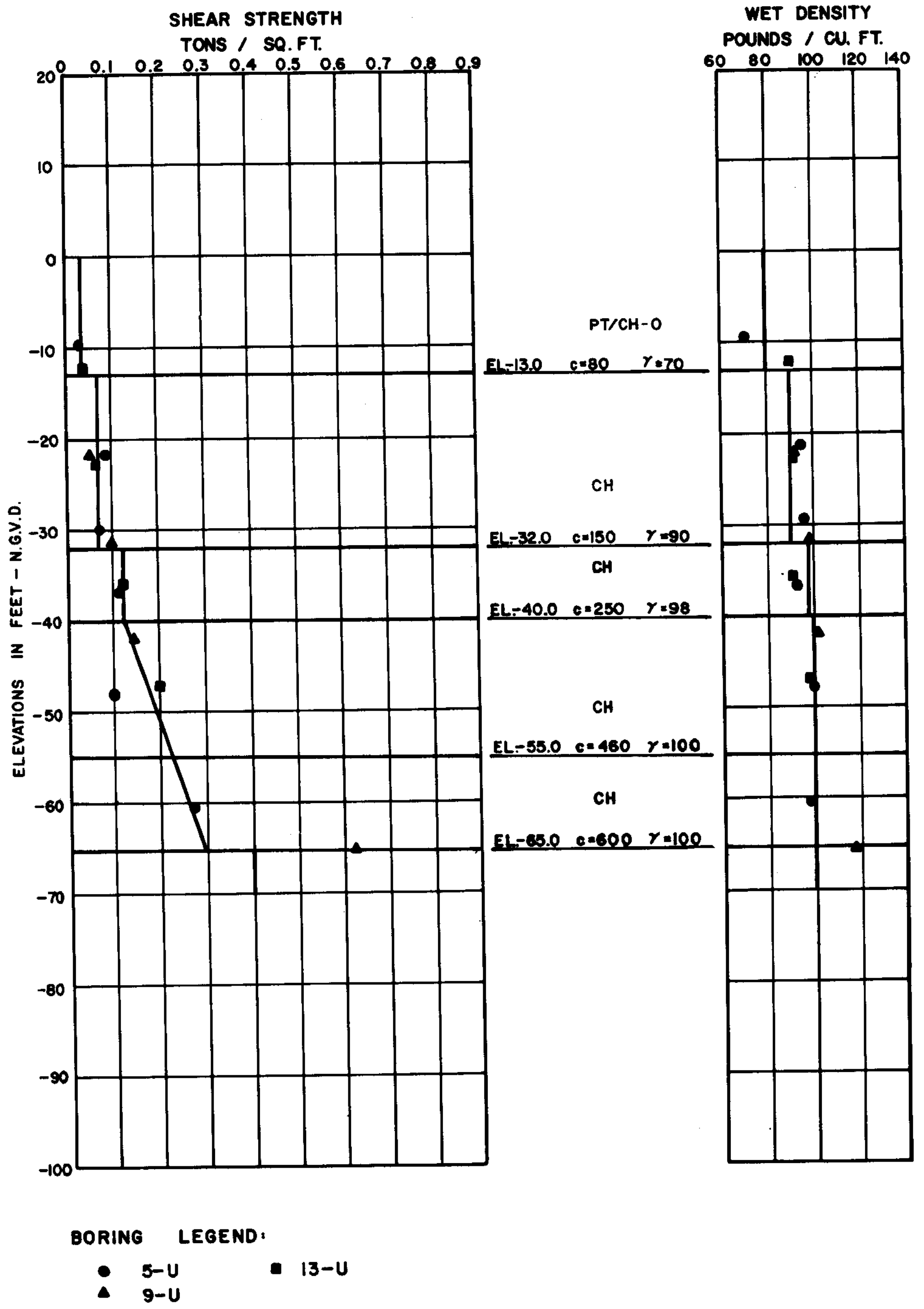
EXISTING LEVEE C/L

(APPROX. 10' F.S. OF B/L)



FLOOD SIDE

50' FROM EXISTING LEVEE C/L



REACH II STA. 140+00 TO STA. 253+80

FOR BORING LOCATIONS SEE PLATES 2 THROUGH 7

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

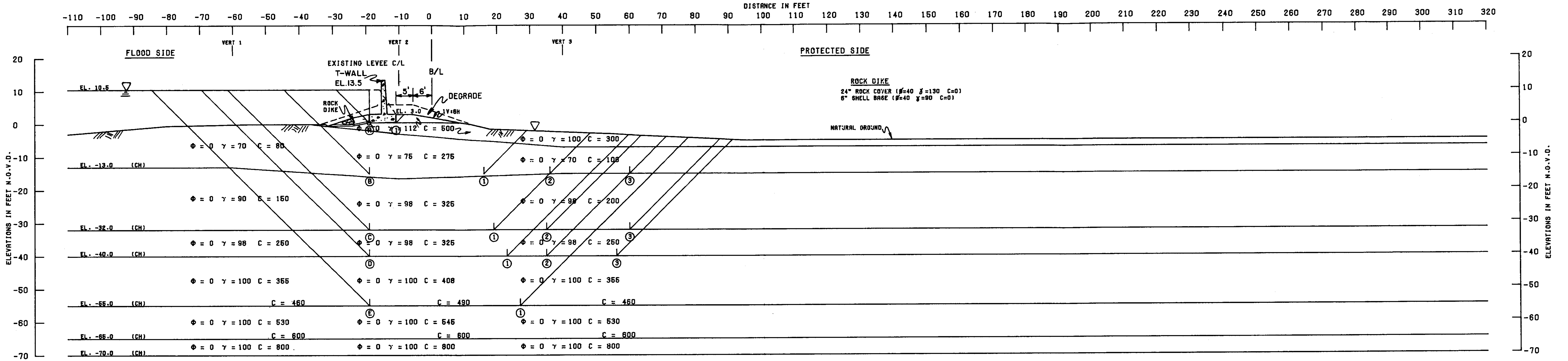
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

DESIGN SOIL PARAMETERS

B/L STA. 140+00 TO STA. 253+80

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

JULY 1987 FILE NO. H-2-30197



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	0.5	2085	4000	2494	3250	350	8579	2900	2.96
B	1	-15.0	6412	8284	5803	23210	7816	20499	15394	1.33
B	2	-15.0	6412	11264	4163	23210	6856	21839	16354	1.34
B	3	-15.0	6412	13692	3478	23210	5523	23582	17687	1.33
C	1	-32.0	13340	11157	12002	66521	38952	36499	27569	1.32
C	2	-32.0	13340	14877	10487	66521	37251	38704	29270	1.32
C	3	-32.0	13340	19908	9828	66521	33895	43076	32626	1.32
D	1	-40.0	16409	12772	14978	96425	62613	44159	33812	1.31
D	2	-40.0	16409	15970	14302	96425	60853	46681	35572	1.31
D	3	-40.0	16409	21239	13714	96425	57277	51362	39148	1.31
E	1	-55.C	25095	22105	24920	169182	123224	72120	45958	1.57

GENERAL NOTES

1. CLASSIFICATION, STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS, SEE NOTE.
2. SHEAR STRENGTH BETWEEN VERTICALS WERE ASSUMED TO VARY LINEARLY BETWEEN THE VALUES INDICATED FOR THESE LOCATIONS.
3. DEEP SEATED STABILITY ANALYSIS UTILIZED A FACTOR OF SAFETY 1.3 INCORPORATED INTO THE SOIL PARAMETERS (C=COHESION VALUE/1.3)

NOTE

SEE BORING DATA PLATE 42 FOR REACH I UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.

DEEP SEATED STABILITY ANALYSIS RESULTS

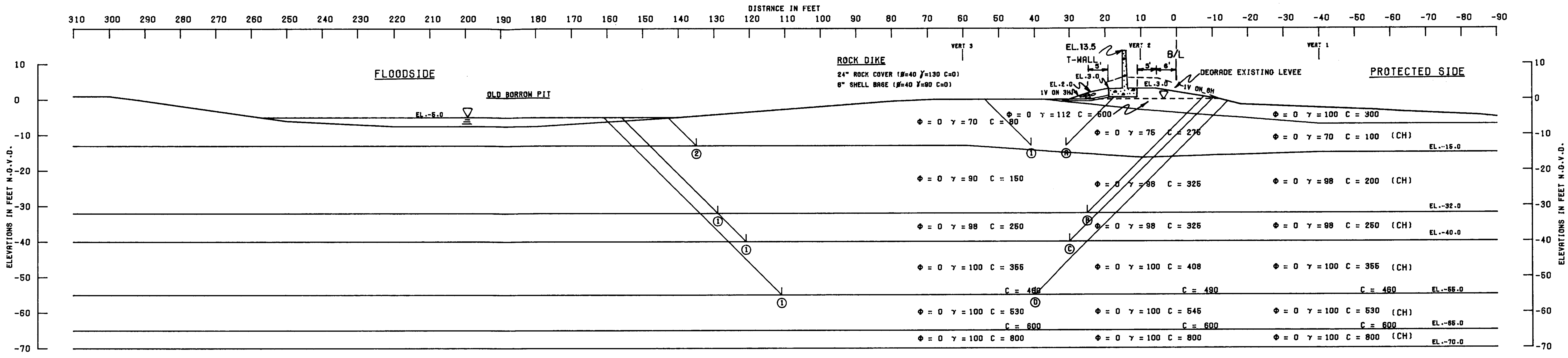
NO	ELEV	$U_A = D_A - R_A$: D_A	$U_A = D_A - R_A$: R_A	$U_P = R_B + R_P + D_P$: R_B	$U_P = R_B + R_P + D_P$: R_P	$U_P = R_B + R_P + D_P$: D_P	U_A	U_P	$U_A - U_P$
A-1	0 5	3250	1605	0	1921	350	1645	2271	-626
B-1	-15.0	23210	4946	6386	4470	7816	18264	18672	-408
B-2	-15.0	23210	4946	8682	3206	6856	18264	18744	-480
B-3	-15.0	23210	4946	10551	2678	5523	18264	18752	-488
C-1	-32.0	66521	10270	8583	9240	38952	56251	56772	-524
C-2	-32.0	66521	10270	11447	8075	37251	56251	56773	-522
C-3	-32.0	66521	10270	15321	7568	33895	56251	56784	-533
D-1	-40.0	96425	12626	9821	11526	62613	83799	83960	-161
D-2	-40.0	96425	12626	12278	11005	60853	83799	84136	-337
D-3	-40.0	96425	12626	16325	10552	57277	83799	84154	-355
E-1	-55.0	169182	19303	17008	19171	123224	149879	159403	-9524

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSES (T-WALL)
B/L STA. 74+00 TO STA. 140+00 (NON-CONT)
REACH IA - PROTECTED SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	-13.0	6832	1736	3348	9083	6020	11916	3063	3.89
Ⓐ ②	-13.0	6832	9960	1252	9083	2304	18044	6779	2.66
Ⓑ ①	-32.0	19726	17744	6829	50688	29385	44299	21303	2.08
Ⓒ ①	-40.0	24245	23425	10829	76862	51311	58499	25551	2.29
Ⓓ ①	-55.0	35138	32780	21432	141266	109588	89350	31678	2.82

NOTES

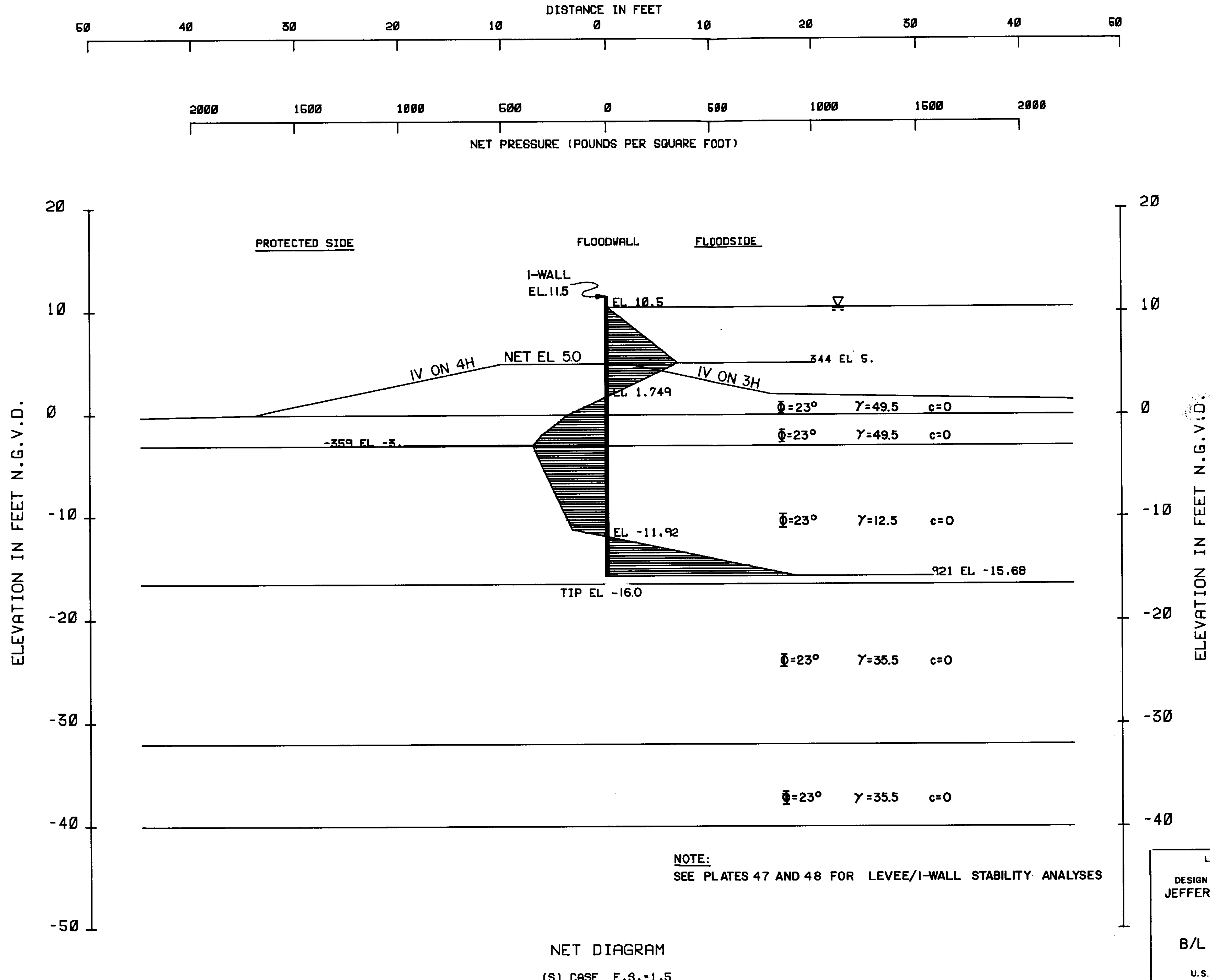
1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 42 FOR REACH I UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSIS (T WALL)
B/L STA. 74+00 TO STA. 140+00 (NON-CONT)
REACH IA - FLOOD SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



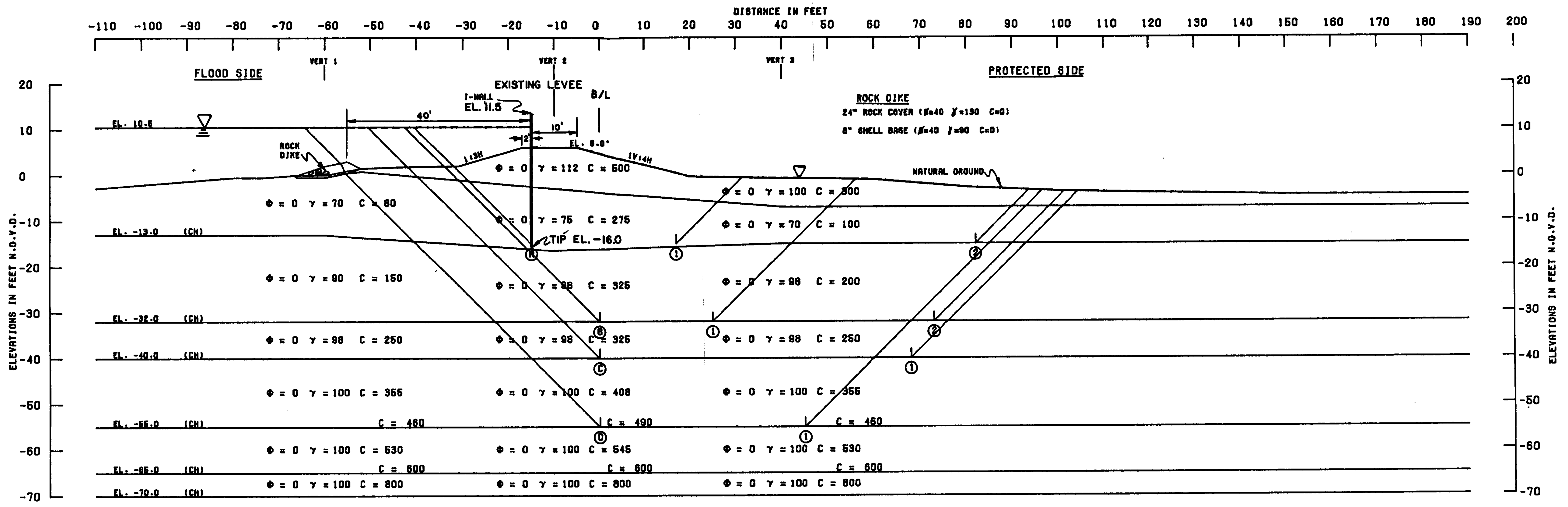
NET DIAGRAM

(S) CASE F.S.=1.5

NOTE:
SEE PLATES 47 AND 48 FOR LEVEE/I-WALL STABILITY ANALYSES

ELEVATION	PRESSURE
10.50	0.0
5.00	343.9
1.75	0.0
0.00	-190.6
-2.00	-314.9
-3.00	-358.9
-11.22	-169.5
-11.92	0.0
-15.68	921.1
-15.68	0.0

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
I-WALL ANALYSIS
B/L STA. 103+50 TO STA. 105+75
REACH IB
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	-15.0	8494	7475	6700	25719	9782	22669	15937	1.42
Ⓐ ②	-15.0	8494	14901	3810	25719	6173	27205	19546	1.39
Ⓑ ①	-32.0	18830	6719	12599	71438	43668	38148	27770	1.37
Ⓑ ②	-32.0	18830	16600	10425	71438	36734	45855	34704	1.32
Ⓒ ①	-40.0	21896	18200	14393	102392	61235	54489	41157	1.32
Ⓓ ①	-55.0	29794	21180	25183	177185	128649	76157	48536	1.57

NOTES

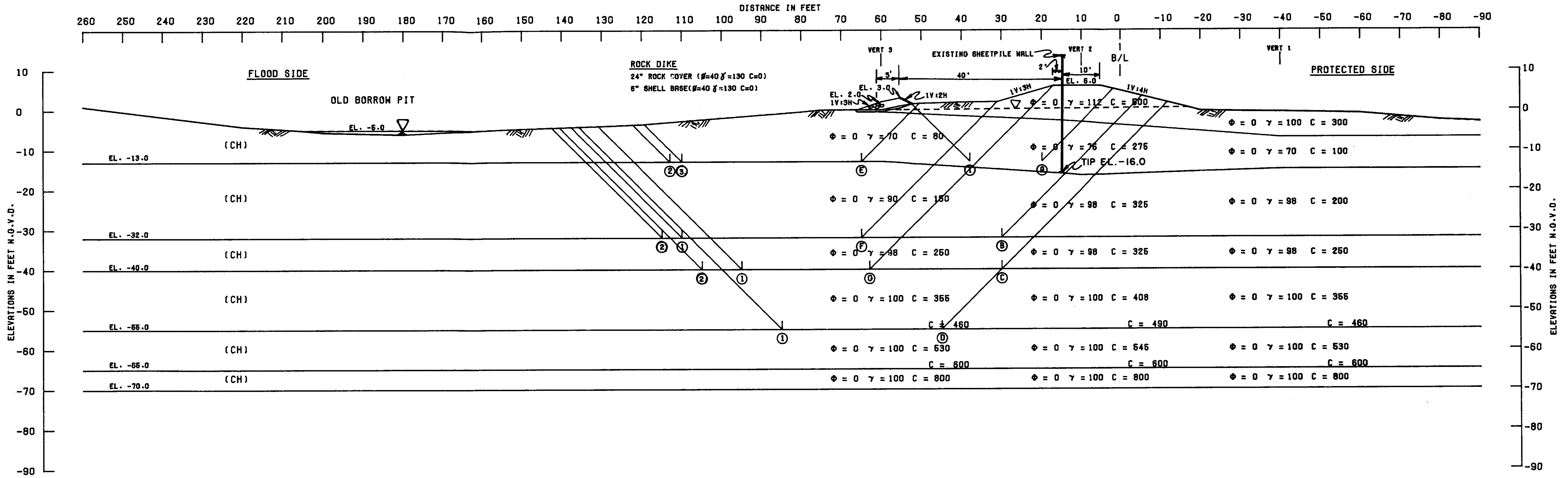
1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 42 FOR REACH I UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.
3. FOR I-WALL ANAYLSIS, SEE PLATE 46.

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSIS (I-WALL)
B/L STA. 103+50 TO STA. 105+75
REACH IB - PROTECTED SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE 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	-13.0	13041	3616	4458	17781	9129	21115	8652	2.44
Ⓐ	②	-13.0	13041	10560	1484	17781	3203	25085	14578	1.72
Ⓑ	①	-32.0	22040	13575	7099	62526	31648	42714	30878	1.38
Ⓒ	①	-40.0	25505	16925	11135	90816	55438	53565	35378	1.51
Ⓓ	①	-55.0	36870	18467	21759	157930	115420	77096	42510	1.81
Ⓔ	③	-13.0	2857	3600	1505	9294	3359	7962	5935	1.34
Ⓕ	②	-32.0	12082	7500	7073	47532	31183	26655	16349	1.63
Ⓖ	②	-40.0	22419	10500	11083	76854	53926	44002	22928	1.92

NOTES

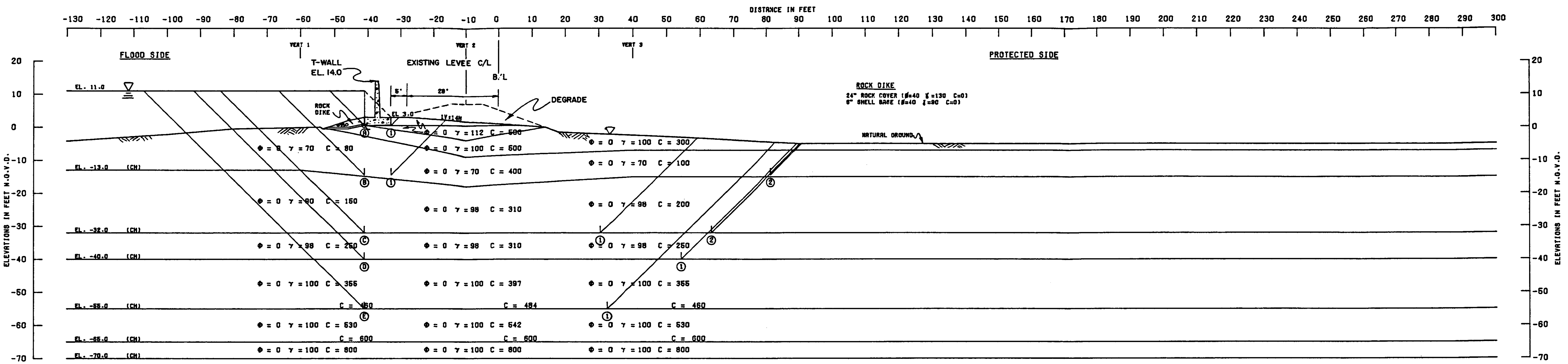
1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 42 FOR REACH I UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.
3. FOR I-WALL ANALYSIS, SEE PLATE 46.

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. [illegible] GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSIS (I-WALL)
B/L STA 103+50 TO 105+75
REACH IB - FLOOD SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	0.5	2085	4000	2500	3570	350	8585	3220	2.67
Ⓑ ①	-14.5	4500	1818	12201	22743	14265	18519	8478	2.18
Ⓑ ②	-14.5	4500	25969	2700	22743	3851	33169	18892	1.76
Ⓒ ①	-32.0	8881	18827	10687	66730	37679	38395	29051	1.32
Ⓒ ②	-32.0	8881	25502	9600	66730	33010	43983	33720	1.30
Ⓓ ①	-40.0	12164	26626	13618	96430	57092	52408	39338	1.33
Ⓔ ①	-55.0	22450	34888	24467	169041	121625	81805	47416	1.73

NOTES

1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 43 FOR REACH II UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH AND UNIT WEIGHT.

DEEP SEATED STABILITY ANALYSIS RESULTS

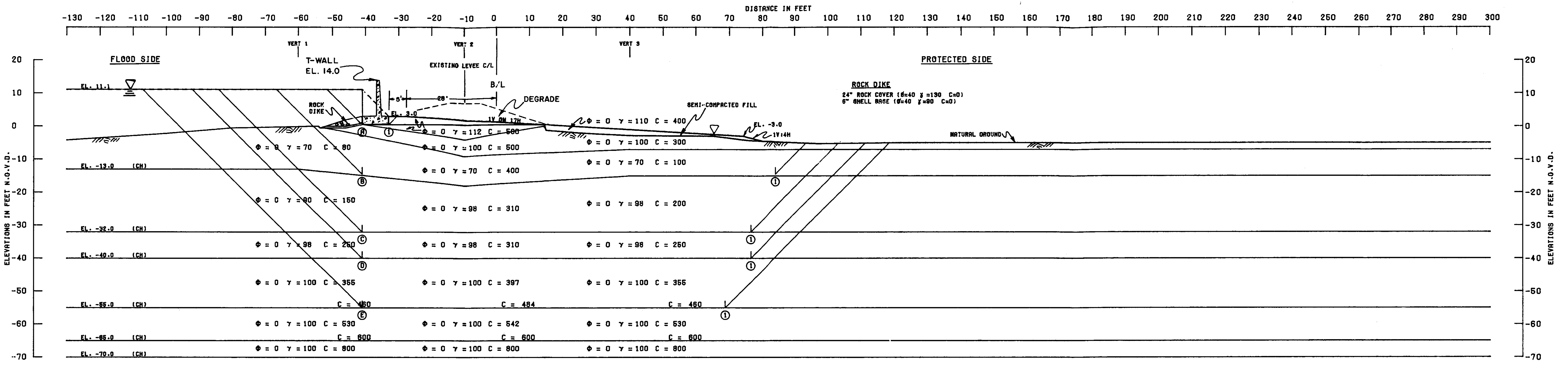
NO.	ELEV.	$U_A = D_A - R_A$: D_A	R_A	$U_P = R_B + R_P + D_P$: R_B	R_P	D_P	U_A	U_P	$U_A - U_P$
A-1	0.5	3570	1605	0	1925	350	1965	2275	-310
B-1	-14.5	22743	3474	1401	9397	14265	19269	25063	-5794
B-2	-14.5	22743	3474	19997	2079	3853	19269	25929	-6660
C-1	-32.0	66730	6828	14457	8230	37681	59902	60368	-466
C-2	-32.0	66730	6828	19600	7392	33010	59902	60002	-100
D-1	-40.0	96430	9348	1705	21557	80604	87082	103866	-16784
D-2	-40.0	96430	9348	20451	10477	57086	87082	88014	-932
E-1	-55.0	169041	17256	26844	18819	121613	151785	167276	-15491

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSES (T-WALL)
B/L STA. 140+50 TO STA. 196+78
REACH IIA — PROTECTED SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	0.5	2085	3200	2500	3636	350	7785	3286	2.37
Ⓑ	①	-14.5	4500	26227	2622	22903	3752	33349	19151	1.74
Ⓒ	①	-32.0	8881	28081	9464	66999	31498	46426	35501	1.31
Ⓓ	①	-40.0	12164	32106	13522	96749	53899	57792	42850	1.35
Ⓔ	①	-55.0	22450	51509	24225	169453	114872	98184	54581	1.80

NOTES

1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 43 FOR REACH II UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH AND UNIT WEIGHT.

DEEP SEATED STABILITY ANALYSIS RESULTS

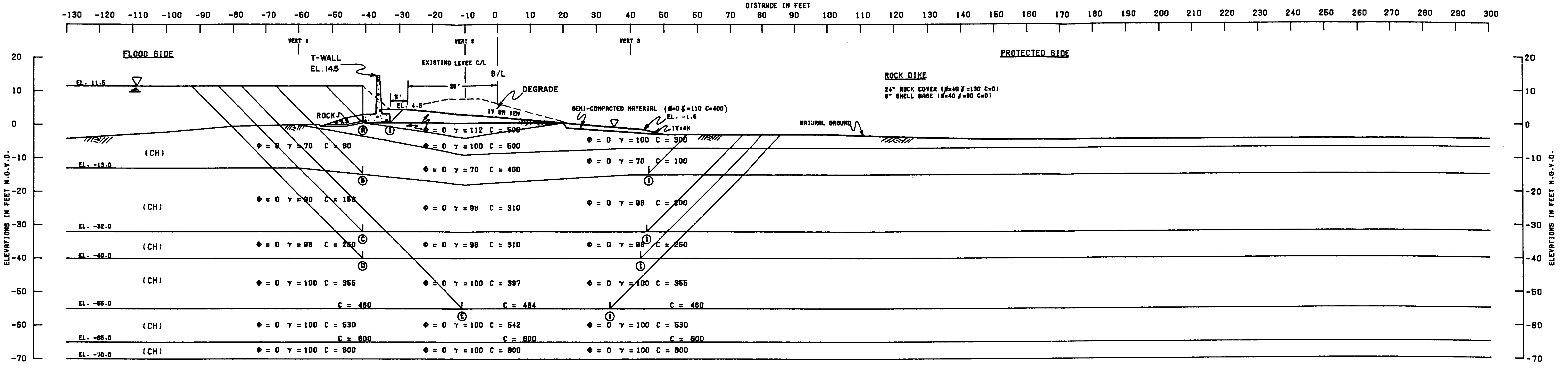
NO	ELEV.	$U_A = D_A - R_A$: D_A	R_A	$U_P = R_B + R_P + D_P$: R_B	R_P	D_P	U_A	U_P	$U_A - U_P$
A-1	0.5	3636	1605	0	1925	350	2031	2275	-244
B-1	-14.5	22903	3474	20197	2019	3753	19429	25969	-6540
C-1	-32.0	66999	6828	21586	7287	31497	60171	60370	-199
D-1	-40.0	96749	9348	24656	10404	53897	87401	88957	-1556
E-1	-55.0	169453	17256	39633	18635	114861	152197	173129	-20932

STABILITY 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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE
STABILITY ANALYSES (T-WALL)
B/L STA. 197+38 TO STA. 205+10
REACH IIB - PROTECTED SIDE
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	0.5	2085	3200	3999	3906	896	9284	3010	3.08
Ⓑ ①	-14.5	4554	22359	3900	23915	6059	30813	17856	1.73
Ⓒ ①	-32.0	8884	21763	10800	68520	37096	41447	31424	1.32
Ⓓ ①	-40.0	12164	23725	14800	98471	61550	50689	36921	1.37
Ⓔ ①	-55.0	26057	21195	25450	166680	125829	72702	40851	1.78

NOTES

1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 43 FOR REACH II UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.

DEEP SEATED STABILITY ANALYSIS RESULTS

NO.	ELEV.	$U_A = D_A - R_A$		$U_P = R_B + R_P + D_P$			U_A	U_P	$U_A - U_P$
		D_A	R_A	R_B	R_P	D_P			
A-1	0 5	3901	1605	0	3080	880	2296	3960	-1664
B-1	-14 5	23915	3515	17217	3003	6044	20400	26264	-5864
C-1	-32 0	68520	6831	16720	8316	37071	61689	62107	-418
D-1	-40 0	98471	9348	18224	11388	61498	89123	91110	-1987

STABILITY NOTES

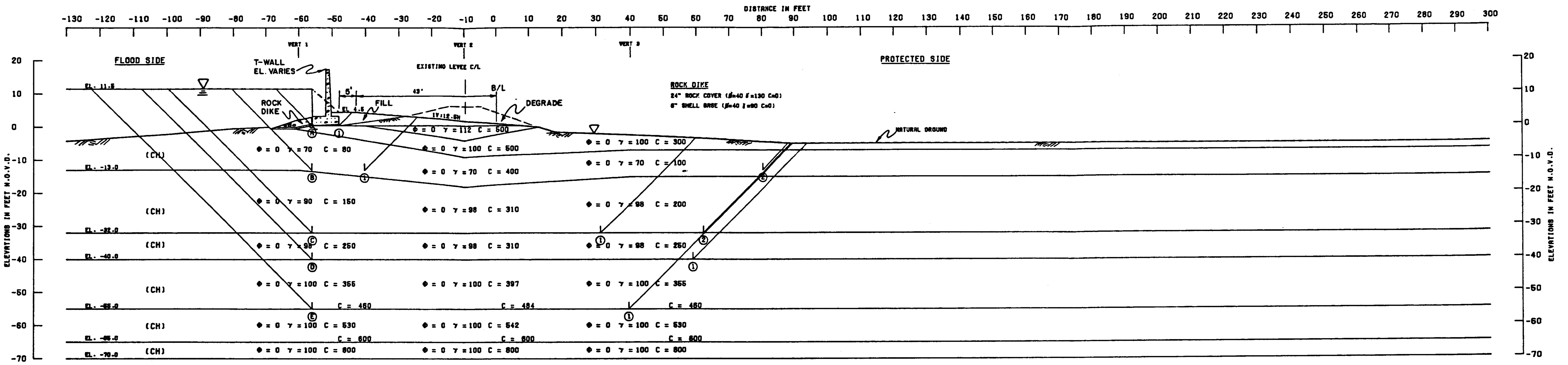
Φ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

STABILITY ANALYSES (T-WALL)
B/L STA. 205+20 TO STA. 231+20
REACH II C - PROTECTED SIDE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE 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	0.5	2085	2	3203	3906	880	5290	3026	1.75
Ⓑ	①	-13.0	2000	2427	10515	20739	13468	14942	7271	2.06
Ⓑ	②	-13.0	2000	28144	2453	20739	2894	32597	17845	1.83
Ⓒ	①	-32.0	7608	21771	10620	67847	37600	39999	30247	1.32
Ⓒ	②	-32.0	7608	28046	9625	67847	33203	45279	34644	1.31
Ⓓ	①	-40.0	11510	31712	13600	97609	56272	56822	41337	1.37
Ⓔ	①	-55.0	21992	45146	24263	170448	119839	91401	50609	1.81

NOTES

1. FOR GENERAL NOTES,SEE PLATE 44
2. SEE BORING DATA PLATE 43 FOR REACH II UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.

DEEP SEATED STABILITY ANALYSIS RESULTS

NO.	ELEV.	$U_A = D_A - R_A$ D_A	R_A	$U_P = R_B + R_P + D_P$ R_B	R_P	D_P	U_A	U_P	$U_A - U_P$
A-1	0.5	3906	1605	0	2466	880	2301	3346	-1045
B-1	-13.0	20739	1550	1873	8099	13468	19189	23440	-4251
B-2	-13.0	20739	1550	21683	1888	2892	19189	26463	-7274
C-1	-32.0	67847	5849	16725	8175	37595	61998	62495	-497
C-2	-32.0	67847	5849	21549	7412	33204	61998	62165	-167
D-1	-40.0	97609	8845	24353	1464	56269	88764	91086	-2322
E-1	-55.0	170448	16905	34704	18665	119850	153543	173219	-19676

STABILITY NOTES

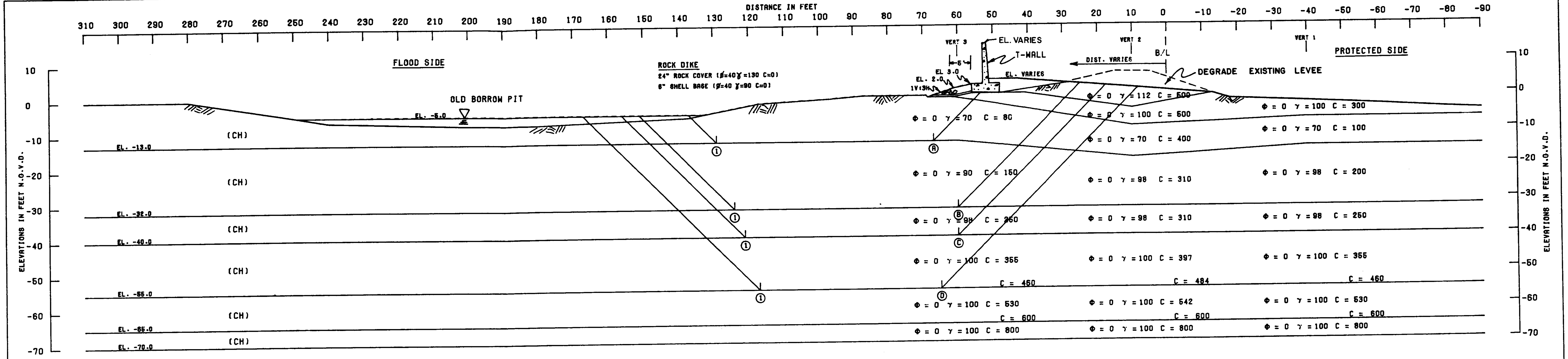
ϕ -- ANGLE OF INTERNAL FRICTION, DEGREES
C -- UNIT COHESION, P.S.F.
∇ -- STATIC WATER SURFACE
D -- HORIZONTAL DRIVING FORCE IN POUNDS
R -- HORIZONTAL RESISTING FORCE IN POUNDS
A -- AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE
B -- AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK
P -- AS A SUBSCRIPT, REFERS TO PASSIVE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

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

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

STABILITY ANALYSES (T-WALL)
B/L STA. 231+30 TO STA. 253+80
REACH II D - PROTECTED SIDE

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197



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	-13.0	2409	4960	1159	8655	2306	8528	6349	1.34
Ⓑ ①	-32.0	17243	9600	6756	53452	29473	33599	23979	1.40
Ⓒ ①	-40.0	23472	15250	10726	81482	51118	49448	30364	1.63
Ⓓ ①	-55.0	36901	23920	21309	149505	108758	82130	40747	2.02

NOTES

1. FOR GENERAL NOTES, SEE PLATE 44
2. SEE BORING DATA PLATE 43 FOR REACH II UNDISTURBED SOIL BORINGS: STRATIFICATION, SHEAR STRENGTH, AND UNIT WEIGHT.

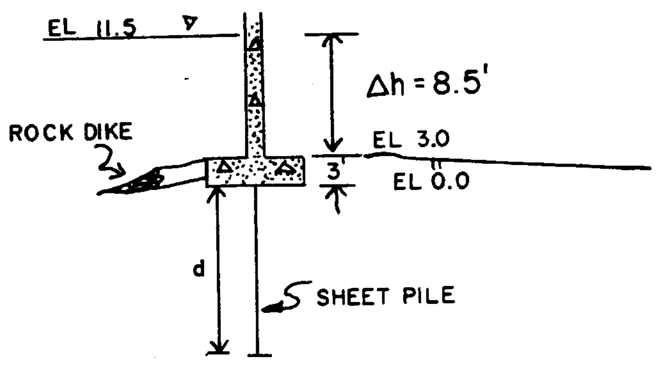
SEEPAGE CUT-OFF CALCULATION (SAMPLE)

LWCR = 3.0 FOR SOFT CLAYS

$$3.0 = \frac{2d+3}{\Delta h}$$

$$d = \frac{(3 \times 8.5)-3}{2}$$

d = 11.25; APPROX. TIP EL -12.0



(TYPICAL)

STABILITY 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

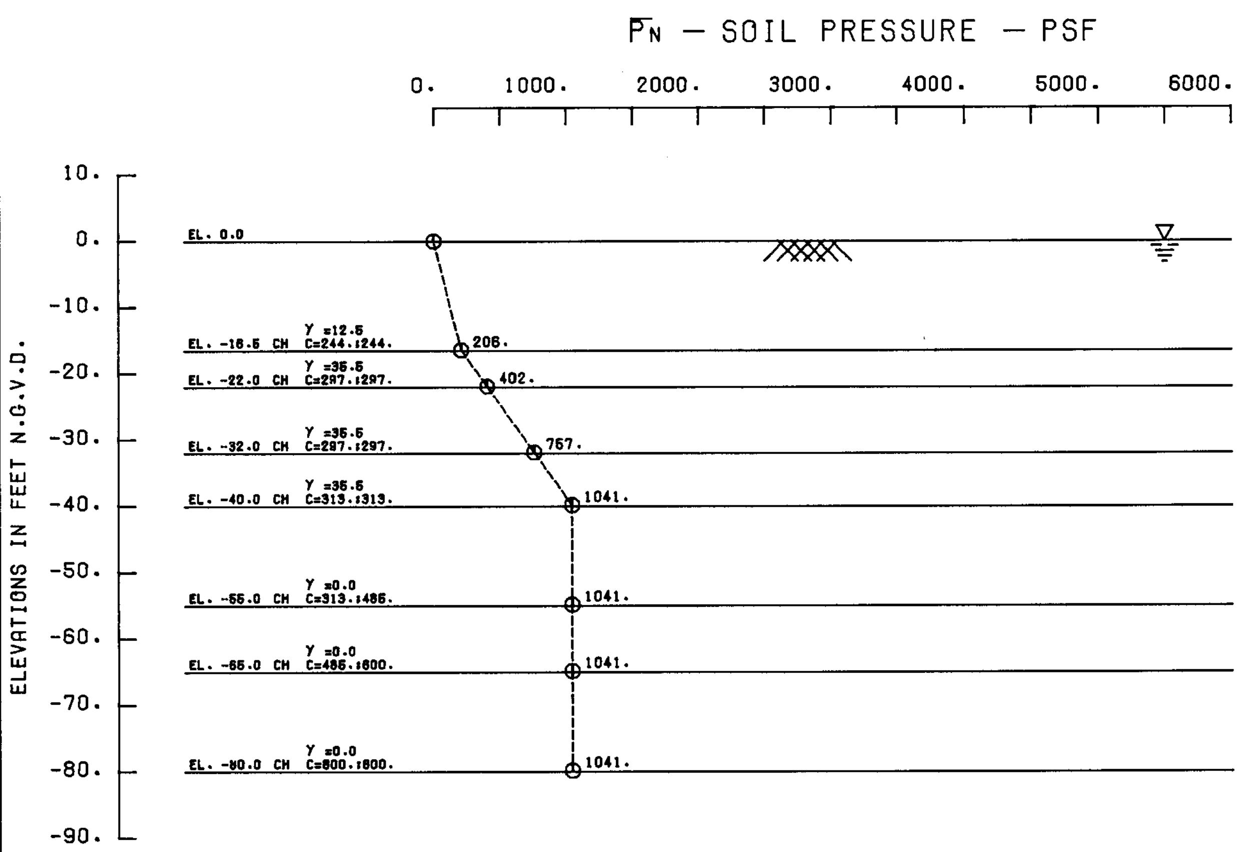
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH - ST. CHARLES PARISH
RETURN LEVEE

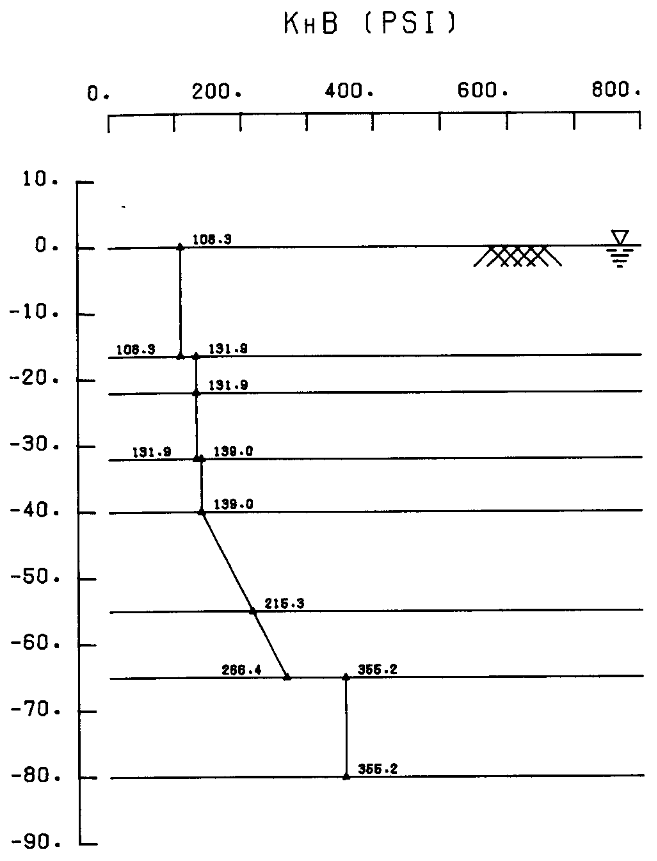
STABILITY ANALYSES (T-WALL)
STA. 140+50 TO STA. 253+80
REACH II A THRU. D - FLOOD SIDE

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

JULY 1987 NO. H-2-30197



S-CASE
CH.CL- Φ=23°



TYPICAL SOIL PROFILE

SOIL STRATIFICATION IS BASED ON GEOLOGIC PROFILE

SHEAR STRENGTH AND WET DENSITIES SEE PLATE 42

D	PILE SPACING IN DIRECTION OF LOADING
1.00	8B
0.85	7B
0.70	6B
0.55	5B
0.40	4B
0.25	3B

C	LOADING CONDITION
1.00	INITIAL LOADING
0.30	CYCLIC LOADING

NOTES: $K_H = \alpha K_1/B = (0.2222\,qu/B)(C)(D)$ COHESIVE

α = 0.4 = Factor of material properties of soil and pile

k_1 = Modulus of subgrade reaction for test plate (pci)

B_1 = Width or diameter of test plate (in)

$K_1 = k_1 B_1$ = 80 qu (psf) = 0.5556 qu (psi)

qu = 2·c = Unconfined compressive strength (psf)

C = Reduction for cyclic loading-not applicable

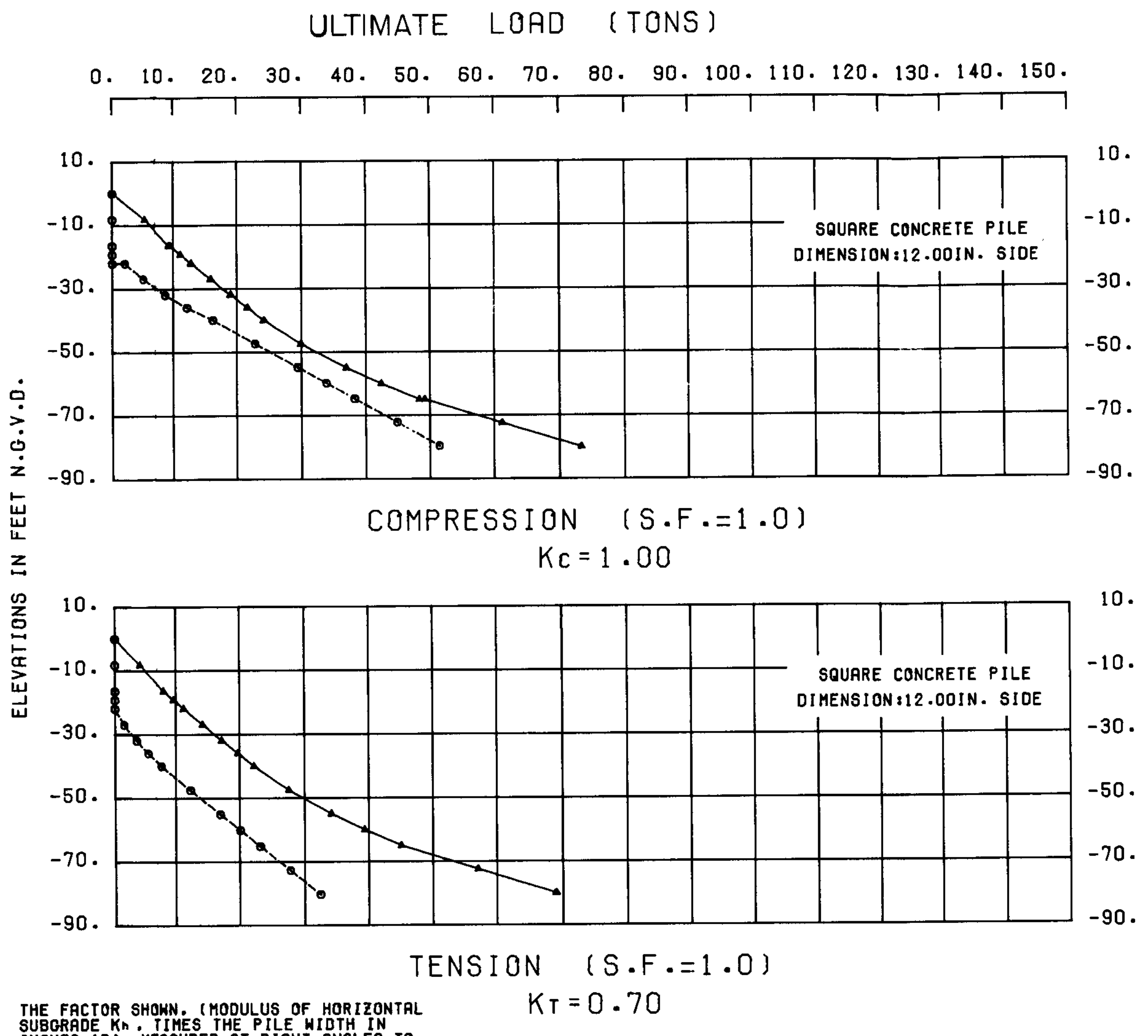
D = Group effect reduction factor

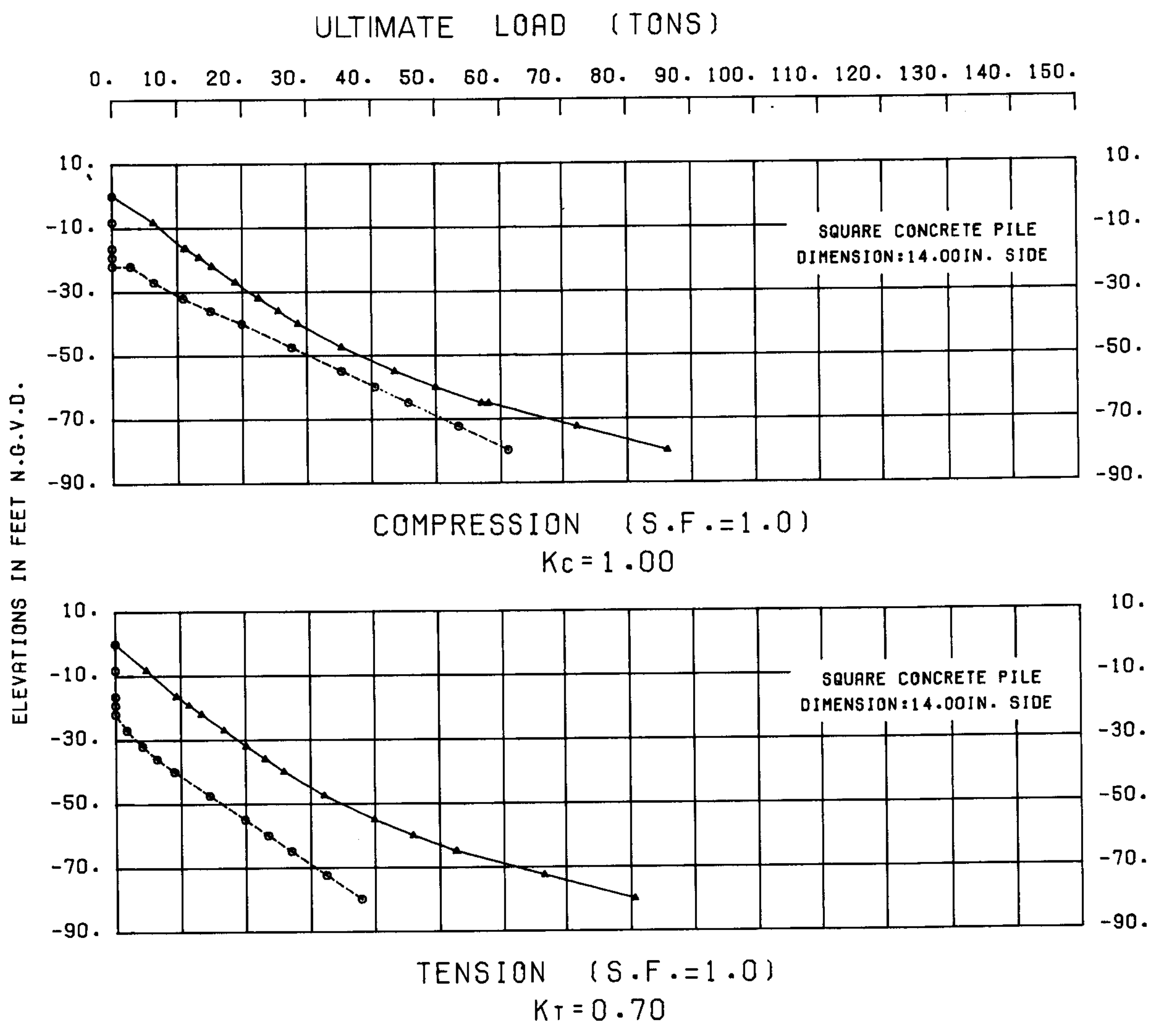
B = Width of pile measured at right angles to the direction of displacement (in)

$K_H = (nh)(Z/B)(C)(D)$ COHESIONLESS

nh = Coefficient of horizontal subgrade reaction (pci)

Z = Depth below equivalent ground surface (in)





THE FACTOR SHOWN, (MODULUS OF HORIZONTAL SUBGRADE K_h, TIMES THE PILE WIDTH IN INCHES (B), MEASURED AT RIGHT ANGLES TO THE DIRECTION OF DISPLACEMENT) MUST BE MODIFIED BY A REDUCTION FACTOR FOR THE EFFECT OF GROUP ACTION (D) AND A REDUCTION FACTOR FOR CYCLIC LOADING (C) EX: $K_h = \frac{0.2222\,qu\,(C)(D)}{(B)}$

LOAD VS. TIP ELEVATION

----- S-CASE

——— Q-CASE

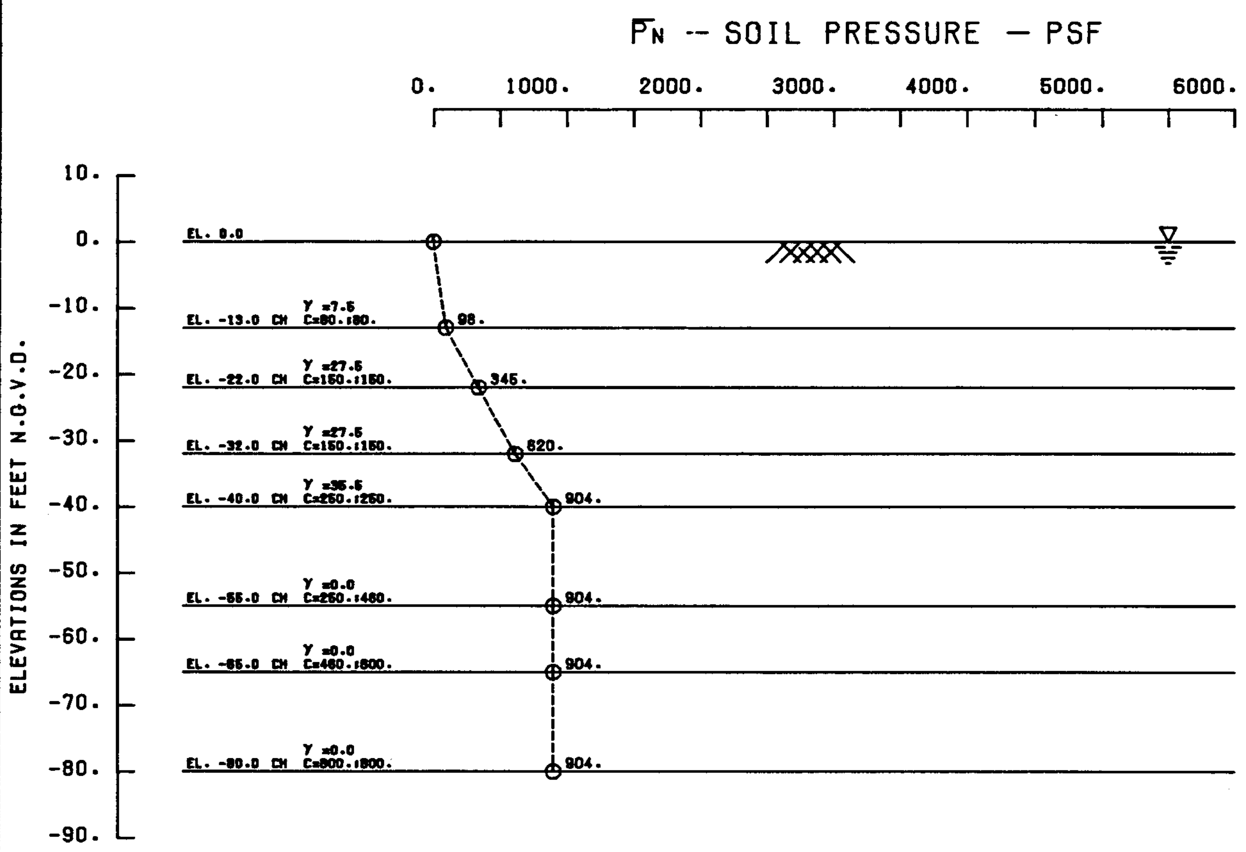
NOTE: ALLOWABLE PILE CAPACITIES SHOULD BE DETERMINED BY INCORPORATING AN ADEQUATE FACTOR OF SAFETY. SEE PAGE 23

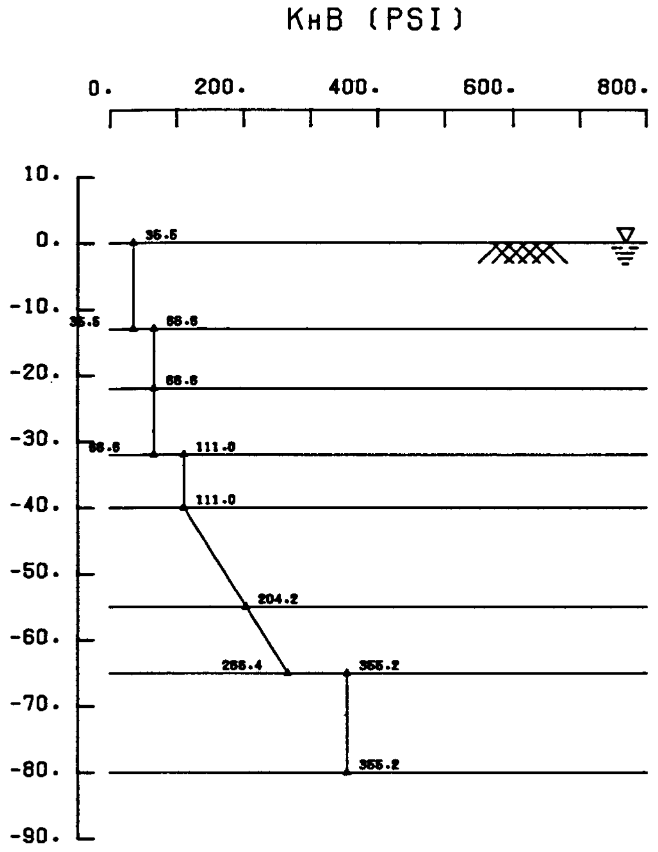
LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH-ST. CHARLES PARISH
RETURN LEVEE

12 AND 14-INCH SQUARE CONCRETE PILES Q&S CASE T-WALL PILE CAP CURVES REACH I-STA. 74+00 TO STA. 139+40.0

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

JULY 1987 FILE NO. H-2-30197





S-CASE

CH.CL- φ=23°

TYPICAL SOIL PROFILE

SOIL STRATIFICATION IS BASED ON GEOLOGIC PROFILE

SHEAR STRENGTH AND WET DENSITIES SEE PLATE 43

D	PILE SPACING IN DIRECTION OF LOADING
1.00	8B
0.85	7B
0.70	6B
0.55	5B
0.40	4B
0.25	3B
C	LOADING CONDITION
1.00	INITIAL LOADING
0.30	CYCLIC LOADING

NOTES: K_H = αK_1/B=(0.2222 qu/B)(C)(D) COHESIVE

α = 0.4 = Factor of material properties of soil and pile

k_1 = Modulus of subgrade reaction for test plate (pci)

B_1 = Width, or diameter of test plate (in)

K_1 = k_1 B_1 = 80 qu (psf) = 0.5556 qu (psi)

qu = 2·c = Unconfined compressive strength (psf)

C = Reduction for cyclic loading-not applicable

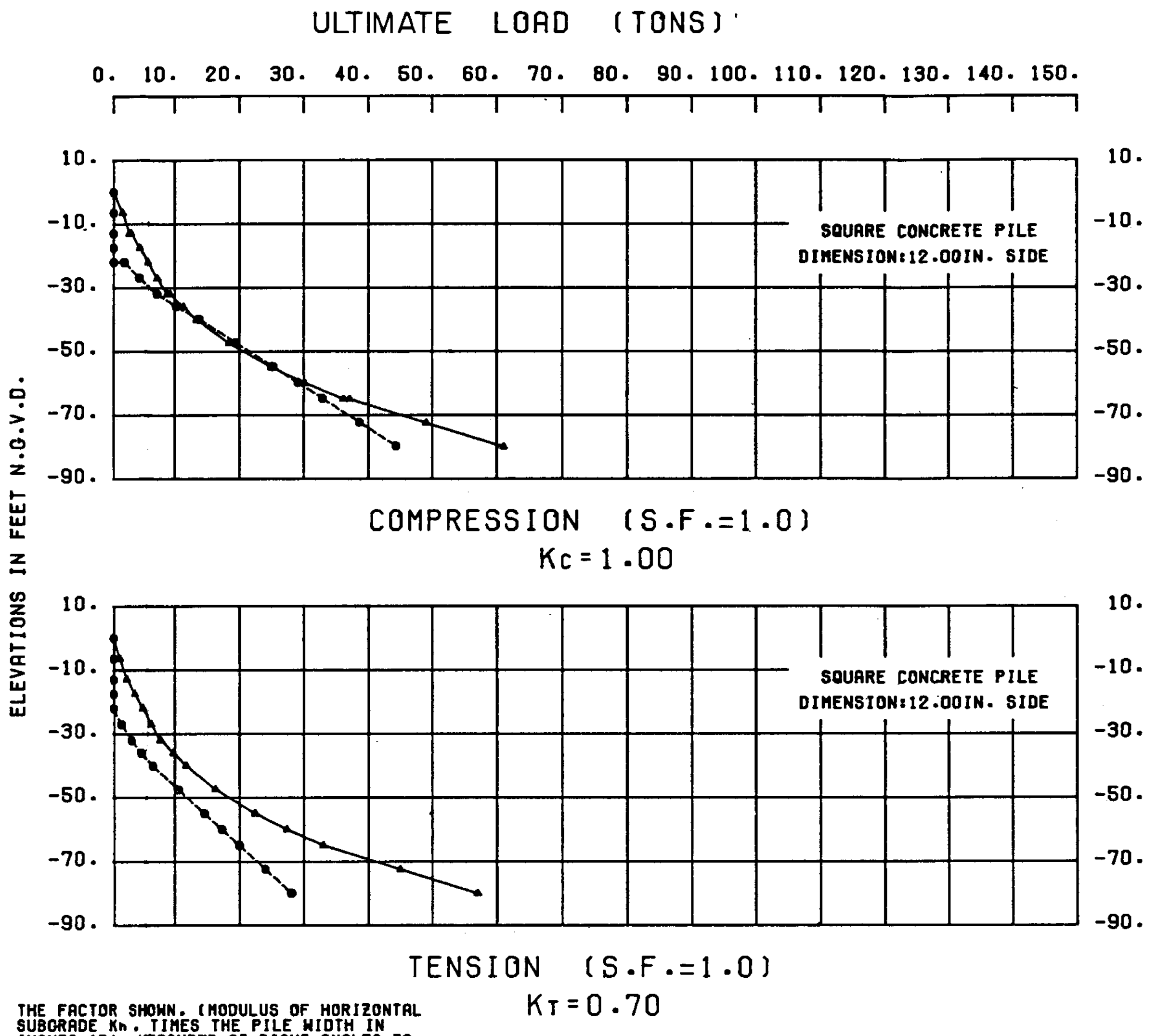
D = Group effect reduction factor

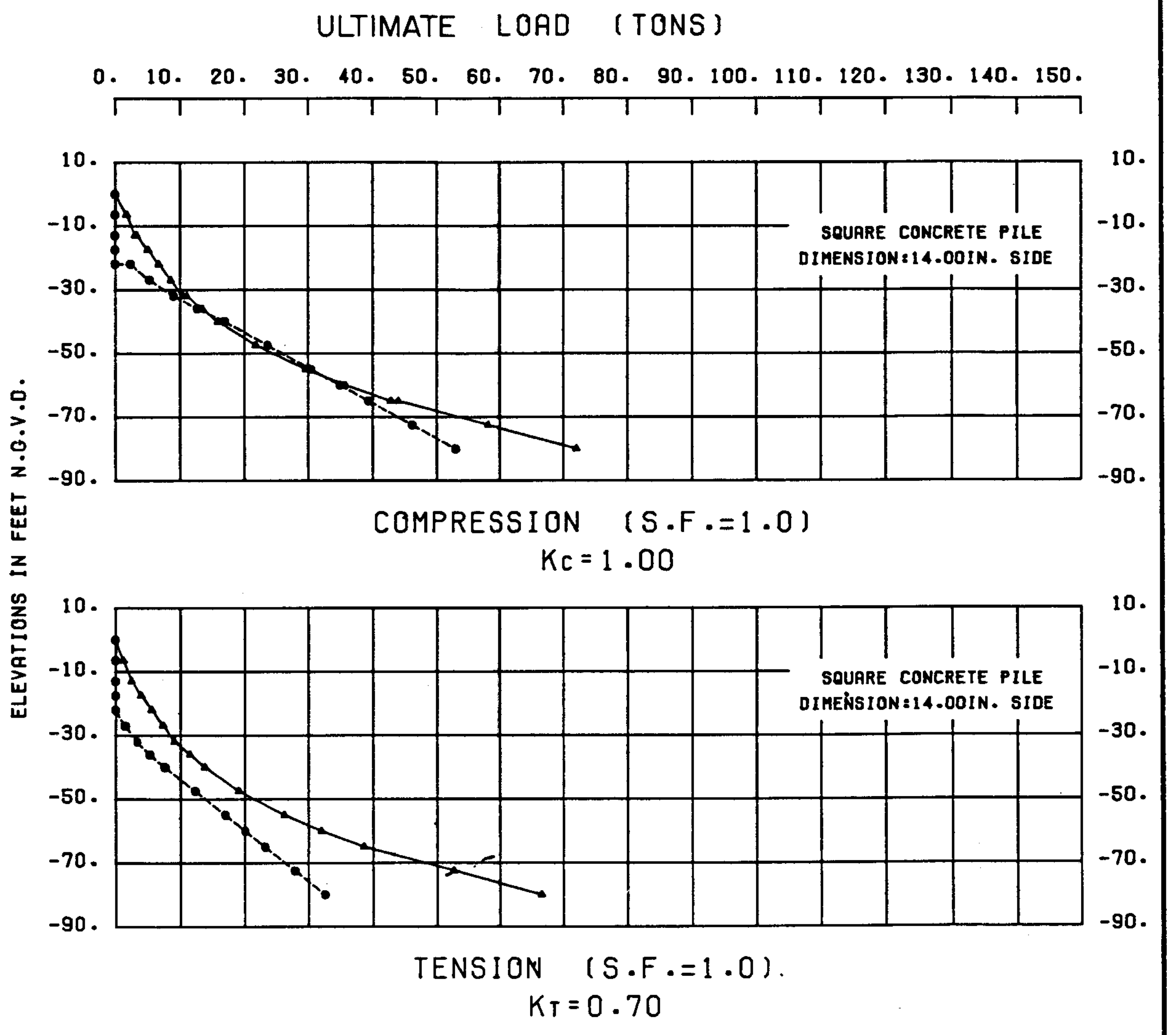
B = Width of pile measured at right angles to the direction of displacement (in)

K_H = (nh)(Z/B)(C)(D) COHESIONLESS

nh = Coefficient of horizontal subgrade reaction (pci)

Z = Depth below equivalent ground surface (in)





THE FACTOR SHOWN. (MODULUS OF HORIZONTAL SUBGRADE K_h. TIMES THE PILE WIDTH IN INCHES (B). MEASURED AT RIGHT ANGLES TO THE DIRECTION OF DISPLACEMENT) MUST BE MODIFIED BY A REDUCTION FACTOR FOR THE EFFECT OF GROUP ACTION (D) AND A REDUCTION FACTOR FOR CYCLIC LOADING (C) EX: $K_h = \frac{0.2222\ qu\ (C)(D)}{(B)}$

LOAD VS. TIP ELEVATION

-·-·-- S-CASE

——— Q-CASE

NOTE: ALLOWABLE PILE CAPACITIES SHOULD BE DETERMINED BY INCORPORATING AN ADEQUATE FACTOR OF SAFETY. SEE PAGE 23

LAKE PONTCHARTRAIN, LA. AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
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12 AND 14-INCH SQUARE CONCRETE PILES Q&S CASE T-WALL PILE CAP. CURVES REACH II - STA. 140+00 TO STA. 253+80
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JULY 1987 FILE NO. H-2-30197

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			Sl		SHELLS
NO SAMPLE					

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

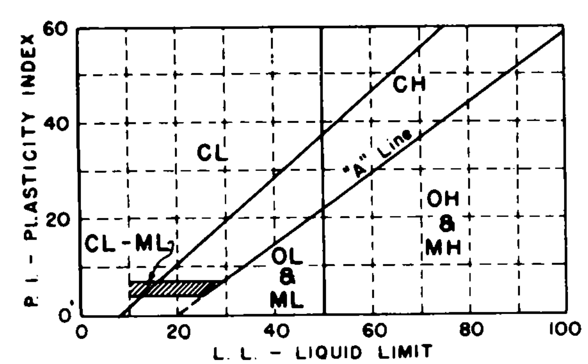
DESCRIPTIVE SYMBOLS

COLOR

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

CONSISTENCY FOR COHESIVE SOILS

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



PLASTICITY CHART

For classification of fine - grained soils

MODIFICATIONS

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

NOTES:

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

Are natural water contents in percent dry weight

When underlined denotes D_{10} size in mm *

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

Are liquid and plastic limits, respectively

SYMBOLS TO LEFT OF BORING

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

FIGURES TO RIGHT OF BORING

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

In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler ($1\frac{3}{8}$" 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 sub-surface 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 in such borings on the dates shown. Absence of water surface data on certain borings indicates that no ground-water data are available from the boring, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of such 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
4	2-10-86	2nd Para. General Notes Revised	LMNED-GS Let. dated 12 Dec. 85
3	5-3-71	ADDED UPPER LIMIT LINE (PI=0.9(LL-8)) ON PLASTICITY CHART	LMVED-G LETTER DTD 29 APRIL 1971
2	6-8-64	SYMBOL FW, NOTE REVISED	ORAL FROM LMVGG 5 JUNE 1964
1	9-17-63	1ST PAR OF GENERAL NOTES REVISED	LMVD MULTIPLE LETTER, DATED 5 SEPT. 1963

SOIL BORING LEGEND

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

APPENDIX A

HYDROLOGY AND HYDRAULICS

Lake Pontchartrain, Louisiana and Vicinity
High Level Plan
Design Memorandum No. 17A- General Design
Jefferson/St. Charles Return Levee
Appendix A

Hydrology and Hydraulics

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LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A- GENERAL DESIGN
JEFFERSON/ST. CHARLES RETURN LEVEE
APPENDIX A
HYDROLOGY AND HYDRAULICS

SECTION I - ANALYSIS

A-1. General. This appendix presents all hydrologic and hydraulic design criteria and analyses associated with the Jefferson/St. Charles return levee. The overall plan of improvement is described in detail in the main body of this memorandum and references to the main text are cited where appropriate.

A-2. Description. The project area is located in southeastern Louisiana between the parishes of Jefferson and St. Charles. The dominant topographic feature is Lake Pontchartrain, a shallow tidal basin approximately 640 square miles in area and 12 feet in depth. Lake Pontchartrain is connected to the Gulf of Mexico through the Rigolets and Chef Menteur Passes, Lake Borgne, and Mississippi and Chandeleur Sounds, and is connected with lesser Lake Maurepas to the west by Pass Manchac.

The levee divides the metropolitan area of Jefferson Parish to the east from the unprotected marsh of St. Charles Parish to the West. The Jefferson Parish area adjacent to the levee is almost totally urbanized. The area is relatively flat. Elevations vary from as high as 13 feet NGVD (National Geodetic Vertical Datum of 1929) near the Mississippi River Levee to -6 feet NGVD near the lake. Storm water drainage is carried by a network of subsurface culverts and open canals which convey the water to 4 pumping stations located at the lake. The area of St. Charles Parish adjacent to this levee from Lake Pontchartrain to the St. Charles Hurricane Protection Levee alinement is open swamp and marsh, unprotected from the high tides and surges of Lake Pontchartrain. Since this land is subject to periodic inundation, it is very sparsely occupied containing a few hunting and fishing camps. Hunting and fishing is the predominant land use in this area. On the protected side of the St. Charles Parish Hurricane Protection Levee alignment, south of Airline Highway, the area is approximately 50 percent occupied by homes and businesses. Land areas are higher in elevation on the protected side of Airline Highway, from 15.0 feet NGVD at the Mississippi River to about 2 feet NGVD at Airline Highway. On the unprotected side land elevations range to as low as 0.5 feet NGVD adjacent to Lake Pontchartrain.

The new levee will protect the western side of Jefferson Parish from hurricane surges emanating into the St. Charles Parish marsh from Lake Pontchartrain. The study area is depicted on Plate A-1.

A-3. Climatology.

a. Climate. The project area is located in a subtropical latitude having mild winters and hot, humid summers. During the summer, prevailing southerly winds produce conditions favorable for convective thundershowers. In the colder seasons, the area experiences frontal passages which produce squalls and sudden temperature drops. River fogs are prevalent in the winter and spring when the temperature of the Mississippi River is somewhat colder than the air temperature. Climatological data for the area are contained in monthly and annual publications by the U.S. Department of Commerce, Weather Bureau, titled "Climatological Data for Louisiana, and "Local Climatological Data, New Orleans, La." Table A-1 lists active meteorological stations in and adjacent to the study area. These stations are also shown on the map in Plate A-2.

TABLE A-1
METEOROLOGIC STATIONS

MAP INDEX NO. (PLATE 2)	LENGTH OF RECORDS (YRS.) TO 1985 PRECIPITATION & TEMPERATURE STATIONS	Precipitation	Temperature
1	NEW ORLEANS - AUDUBON - PARK	97	97
2	NEW ORLEANS - MOISANT AIRPORT	33	33
3	RESERVE (NR)	85	85
4	SLIDELL	30	30
5	DONALDSONVILLE (NR)	97	98
6	LOUISIANA NATURE CENTER	7	7
7	PARADIS (NR)	72	32
OMS	HAMMOND (NR)	90	91
OMS	ST. BERNARD (NR)	21	21
OMS	COVINGTON	93	93
OMS	CARVILLE (NR)	48	47
OMS	BATON ROUGE AIRPORT	118	98
	RECORDING PRECIPITATION STATIONS		
8	NEW ORLEANS ALGIERS	87	-
9	NEW ORLEANS DPS 14 - CITRUS	32	-
10	NEW ORLEANS WATER PLANT - DUBLIN	93	-
11	NEW ORLEANS DPS 5 - JOURDAN	53	-
12	NEW ORLEANS DPS 3 - LONDON	93	-
13	NEW ORLEANS DPS 6 - METAIRIE	38	-
14	GONZALES	9	-
	NON-RECORDING PRECIPITATION STATIONS		
15	NEW ORLEANS CITY HALL	9	-
OMS	BATON ROUGE CENTRAL	8	-
OMS	ABITA SPRINGS FIRE TOWER	14	-

LEGEND: NR NON-RECORDING
OMS OFF MAP STATION

b. Temperature. New Orleans at Moisant Airport has temperature records from 1946. From temperature normals over the period 1951-1980, the mean annual temperature is 68.2° F. Extremes over the period of record are 14° and 102°F. The average temperature in summer is 81.4° F and in the winter is 53.9° F. Temperature normals (1951-1980) for the New Orleans gage at Moisant Airport are shown in Table A-2. Station locations are provided on the map in Plate A-2.

TABLE A-2
MONTHLY TEMPERATURE (°F)
NEW ORLEANS AT MOISANT AIRPORT
30-YEAR NORMALS (1951-1980)

MONTH	MEAN	MAXIMUM	MINIMUM
JAN	52.4	61.8	43.0
FEB	54.7	64.6	44.8
MAR	61.4	71.2	51.6
APR	68.7	78.6	58.8
MAY	74.9	84.5	65.3
JUN	80.3	89.5	70.9
JUL	82.1	90.7	73.5
AUG	81.7	90.2	73.1
SEP	78.5	86.8	70.1
OCT	69.2	79.4	59.0
NOV	60.0	70.1	49.9
DEC	54.6	64.4	44.8
ANNUAL	68.2		

EXTREME MINIMUM: 14°F, 24 January 1963 and 25 December 1983
EXTREME MAXIMUM: 102°F, 22 August 1980
(P.O.R. 1946-1985)

c. Rainfall. Precipitation is generally heavy in two fairly definite rainy periods. Summer showers occur from about mid-June to mid-September, and heavy winter rains generally occur from mid-December to mid-March. The drainage area tributary to Lake Pontchartrain is served by 34 precipitation stations of the U.S. Weather Bureau, with periods of record ranging from 7 to 118 years. Based on the 30-year normals for the period 1951-1980 and from the U.S. Weather Bureau station New Orleans at Moisant Airport, the annual normal precipitation is 59.7 inches, with variations of plus or minus 50 percent. Extreme monthly rainfalls exceeding 12 inches are not uncommon. Average monthly normal rainfalls range from a normal 6.73 inches in July to a normal of 2.66 inches in October. Several stations have experienced calendar months in which no rainfall was recorded. Snow occurs infrequently in the area. An 8.2-inch snowfall occurred in New Orleans on 14-15 February 1895. The last measurable snowfall occurred on 31 December 1963 when 4.5 inches fell in New Orleans. Table A-3 gives the 30 year normals for the New Orleans at Moisant Airport along with the monthly maximum and minimum totals during the normal period. Location of the precipitation stations are shown on Plate A-2.

TABLE A-3
MONTHLY RAINFALL (INCHES)
NEW ORLEANS AT MOISANT AIRPORT
30-YEAR NORMALS (1951-1980)

MONTH	NORMAL	MAXIMUM	MINIMUM
JAN	4.97	13.63	0.54
FEB	5.23	12.49	1.02
MAR	4.73	12.17	0.24
APR	4.50	16.12	0.28
MAY	5.07	14.33	0.99
JUN	4.63	12.28	0.23
JUL	6.73	11.46	2.91
AUG	6.02	16.12	1.68
SEP	5.87	16.74 a/	0.24
OCT	2.66	6.45	0.0 b/
NOV	4.06	11.35	0.45
DEC	5.27	10.77	1.46
ANNUAL	59.74	83.54 c/	39.0 d/

Legend: T - Trace
a/ - Sep 1971
b/ - Oct 1952, Oct 1963
c/ - 1961
d/ - 1962

d. Wind. The U.S. Weather Bureau anemomoter coverage at Moisant Airport in Kenner, Louisiana, was installed in 1949. This anemometer provides the longest record available adjacent to the lake. Table A-4 shows the average monthly wind speeds and its resultant direction for the years 1966-1984. The average wind velocity over this period is 7.8 mph, but winds over 100 mph are experienced occasionally in hurricanes. The predominant wind directions are north-northeast from September through February and south-southeast from March through June. Plate A-3 is a wind rose for New Orleans at Moisant based on the period of record of 1949-1978. The frequency of wind speeds and direction from this wind rose is summarized in Table A-5.

A-4. Hydrologic Regimen.

a. General. The water level in Lake Pontchartrain is subject to variations from direct rainfall, tributary inflow, wind-driven water movements, and flow through the Rigolets and Chef Menteur Passes and the Inner Harbor Navigation Canal caused by tidal variations originating in the Gulf of Mexico. Infrequently, lake level is influenced by diversion of Mississippi River floodflow through Bonnet Carre' Spillway. Combinations of these factors determine the salinity regimen in the lake. Locations and periods of record of hydrologic stations are shown in Table A-6.

b. Runoff and Streamflow. Runoff from the 4,700 square miles north and west of Lakes Pontchartrain and Maurepas, estimated to average five million acre-feet annually, drains into the lakes via the Amite, Tickfaw, Natalbany, Tangipahoa, and Tchefuncta Rivers, and Bayous Lacombe, Bonfouca, and Liberty. Streamflow records are available at six locations on these streams and four locations on Pearl River for the periods of record listed in Table A-7. New Orleans and adjacent parishes are drained by outfall canals that discharge directly into Lake Pontchartrain. Yearly fresh water inflow records show considerable variations, as shown in Table A-7.

TABLE A-4

WIND SUMMARIES, NEW ORLEANS AT MOISANT AIRPORT (1966-1984)

AVERAGE WIND SPEED

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1966	9.6	10.5	9.7	10.7	8.7	7.3	6.2	6.4	5.7	7.6	7.4	8.6	8.2
1967	8.3	9.5	9.0	9.3	9.1	6.8	6.2	5.9	7.0	7.4	8.0	9.8	8.0
1968	9.2	10.0	9.3	9.1	8.4	5.6	5.7	5.2	6.4	6.8	8.9	9.3	7.8
1969	9.7	9.8	10.0	8.6	7.3	7.2	6.5	6.8	6.8	9.7	8.0	9.1	8.3
1970	9.5	9.2	9.8	9.9	8.5	6.8	5.4	6.0	6.7	7.7	8.0	7.4	7.9
1971	8.4	9.8	9.8	8.5	7.9	5.3	5.7	5.0	6.5	4.8	8.0	8.7	7.4
1972	8.9	8.6	9.1	10.2	7.3	9.3	7.5	6.4	7.0	8.3	9.9	9.4	8.5
1973	9.6	10.2	12.0	11.5	10.0	6.7	6.7	6.3	7.9	7.0	9.6	11.4	9.1
1974	9.2	11.0	10.8	10.7	8.2	7.4	5.0	5.2	8.6	7.4	8.5	8.5	8.4
1975	9.4	8.6	11.0	10.0	7.4	6.5	6.5	4.9	6.3	6.4	8.0	7.8	7.7
1976	9.6	8.8	10.5	7.6	8.4	6.9	5.4	5.7	6.0	8.5	7.9	8.2	7.8
1977	9.8	8.5	8.5	7.3	5.7	5.3	4.4	5.5	5.4	6.6	8.1	8.8	7.0
1978	9.1	8.9	8.5	8.6	7.9	5.9	5.5	5.3	6.3	6.1	6.7	10.0	7.4
1979	10.5	9.0	9.3	8.0	7.2	6.5	6.7	4.4	8.0	6.7	8.1	6.3	7.6
1980	7.6	8.0	9.8	8.8	7.5	7.4	5.6	5.7	5.3	5.9	6.4	5.9	7.0
1981	7.6	8.3	7.7	7.3	7.8	6.9	5.7	4.8	5.7	7.0	7.3	8.6	7.1
1982	9.8	8.3	8.9	9.4	6.5	6.2	4.6	4.4	7.1	7.5	7.6	10.0	7.5
1983	8.0	10.0	8.8	10.4	7.8	6.3	5.8	5.3	6.0	6.8	8.3	10.0	7.8
1984	8.0	8.7	7.8	9.4	8.2	4.7	4.1	5.8	9.2	7.6	9.6	8.8	7.7
Average	9.1	9.2	9.5	9.2	7.9	6.6	5.7	5.5	6.7	7.1	8.1	8.8	7.8

TABLE A-4 (cont'd)
WIND SUMMARIES, NEW ORLEANS AT MOISANT AIRPORT (1966-1984)
RESULTANT DIRECTION*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1966	02	04	07	16	07	07	23	15	02	03	03	05	05
1967	03	02	13	15	16	11	21	02	05	06	05	08	09
1968	03	35	12	16	15	19	12	05	06	04	04	06	07
1969	07	02	02	13	09	18	24	09	04	05	36	01	05
1970	03	03	08	17	10	21	20	12	08	03	32	06	09
1971	02	12	13	15	13	23	20	01	07	04	04	12	09
1972	07	07	12	15	04	20	14	34	12	06	02	06	08
1973	02	36	16	16	20	18	24	04	10	07	13	20	12
1974	12	24	16	13	16	16	25	13	05	06	06	16	12
1975	09	21	14	11	15	18	25	17	03	05	08	04	10
1976	04	19	15	15	15	13	25	01	04	02	02	02	07
1977	01	09	13	14	13	21	20	12	15	03	10	13	11
1978	01	01	28	15	16	12	19	11	08	03	08	07	07
1979	01	04	15	14	13	15	17	13	04	11	03	03	08
1980	06	06	09	20	15	22	27	13	09	04	02	02	08
1981	02	02	21	15	13	16	22	11	05	06	10	04	09
1982	11	01	12	10	13	22	21	21	06	06	06	10	09
1983	04	05	29	18	15	12	10	11	07	05	10	03	08
1984	03	08	16	18	14	17	13	18	06	13	04	12	12

* Wind Direction - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm, 09 east, 18 south, 27 west, 36 north. Resultant wind is the vector sum of wind directions and speed divided by number of observations.

TABLE A-5
WINDSPEED
NEW ORLEANS AT MOISANT AIRPORT
PERCENTAGE FREQUENCY (1949-1978)

SPEED GROUPS (MPH)

DIRECTION	0-3	4-13	14-19	20-25	26-32	32+	TOTAL
N	0.0	4.9	2.1	0.3	0.1	0.0	7.4
NNE	0.0	4.0	1.5	0.2	0.0	0.0	5.7
NE	0.0	5.0	1.6	0.2	0.0	0.0	6.8
ENE	0.0	4.9	1.4	0.1	0.0	0.0	6.4
E	0.0	4.3	1.0	0.1	0.0	0.0	5.4
ESE	0.0	3.6	0.7	0.1	0.0	0.0	4.4
SE	0.0	4.0	0.9	0.1	0.0	0.0	5.0
SSE	0.0	4.5	1.6	0.2	0.0	0.0	6.3
S	0.0	6.2	2.1	0.3	0.1	0.0	8.7
SSW	0.0	4.0	0.8	0.2	0.0	0.0	5.0
SW	0.0	3.0	0.4	0.0	0.0	0.0	3.4
WSW	0.0	2.1	0.4	0.0	0.0	0.0	2.5
W	0.0	2.4	0.5	0.1	0.0	0.0	3.0
WNW	0.0	2.0	0.5	0.1	0.0	0.0	2.6
NW	0.0	2.0	0.8	0.2	0.1	0.0	3.1
NNW	0.0	2.7	1.4	0.3	0.1	0.0	4.5
CALM	20.0	-	-	-	-	-	20.00
TOTAL	20.0	59.6	17.7	2.5	0.4	0.0	100.00

TABLE A-6
HYDROLOGIC STATIONS

MAP INDEX NO. (PLATE A-2)	STATION	PERIODS OF RECORD: TYPES OF WATER LEVEL GAGE	PERIODS OF RECORD: RECORDS AVAILABLE THRU 1985	STAGE EXTREMES (NGVD): MAXIMUM	DATE	MINIMUM	DATE
16	Amite River at Port Vincent	Auto Recorder and Staff	Gate Heights, Dec 1954 to Jun 1974 and Jun 1975 to date. Discharge, last observation - Apr 1980	14.59	Apr 83	-1.16	Aug 83
17	Amite River at French Settlement	Auto Recorder and staff	Gage Heights, intermittent 1947-1951 and daily. Dec 1954 to date. Discharge, last observation - 8 in 1977	7.4	Apr 78	-1.5	Dec 54
18	Petite Amite River NR St. Paul	Auto Recorder and Staff	Gage Heights, intermittent Mar 1950 to May 1951 and daily Oct 1951 to date	4.72	Apr 73	-1.6	Dec 56
19	Reserve Canal near Lake Maurepas	Auto Recorder and Staff	Gage Heights, Jan 1979 to date	5.5*	Oct 85**	-1.14	Mar 81
20	Tickfaw River near Springfield	Auto Recorder and Staff	Gage Heights, May 1947 to date. Discharge, last observation - 7 in 1977	6.51*	Oct 85	-1.43	Dec 54
21	Pass Manchac near Pontchatoula	Staff	Gage Heights, July 1955 to date	5.4	Oct 85	-2.0	Jan 61
22	Bayou Bonfouca at Slidell	Staff	Gage Heights, Aug 1962 to date	6.8 (affected by Hurricane)	Aug 69	-0.6	Feb 63
23	Lake Pontchartrain at Frenier	Auto Recorder and Staff	Gage Heights, Sep 1931 to Sep 1965 and Jan 1969 to date	12.09* (watermark)	Sep 65	-2.1	Jan 38

* Caused by hurricane

** From Incomplete Record

TABLE A-6
HYDROLOGIC STATIONS
(CONT'D)

MAP INDEX NO. (PLATE A-2)	STATION	PERIODS OF RECORD: TYPES OF WATER LEVEL GAGE	PERIODS OF RECORD: RECORDS AVAILABLE THRU 1985	STAGE EXTREMES (NGVD): MAXIMUM	DATE	MINIMUM	DATE
24	Lake Pontchartrain at Mandeville	Auto Recorder and Wire Weights	Gage Heights, Sep 1931 to date	6.95*	Sep 47	-2.25	Jan 38
25	Lake Pontchartrain at Midlake near New Orleans	Auto Recorder and Wire Weights	Gage Heights, Aug 1957 to date	6.14*	Oct 85	-1.28	Mar 65
26	Lake Pontchartrain at West End	Auto Recorder and Staff	Gage Heights, Sep 1931 to Nov 1946 and Mar 1949 to date	6.11*	Oct 85	-2.2	Jan 38
27	Lake Pontchartrain (Irish Bayou) near South Shore	Auto Recorder and Staff	Gage Heights, May 1949 to date	7.16*	Aug 69	-1.30	Jul 54
28	Rigolets near Lake Pontchartrain	Auto Recorder and Staff	Gate Heights, Sep 1931 to date	9.0*	Aug 69	-1.90	Jan 38
29	Lake Borgne at Rigolets	Auto Recorder and Staff	Gage Heights, Dec 1957 to Sep 1965 and Jul 1967 to date	12.25* (watermark)	Aug 69	-2.04	Feb 78
30	Chef Menteur Pass near Lake Borgne	Auto Recorder and Staff	Gage Heights, Apr-Jun 1945, Feb & Mar 1950, Jul 57-Sep 65 and Oct 67 to date. Discharge, 1937 and 1945	9.07*	Sep 65	-1.69	Feb 78

* Caused by hurricane

TABLE A-6
HYDROLOGIC STATIONS
(CONT'D)

MAP INDEX NO. (PLATE A-2)	STATION	PERIODS OF RECORD: TYPES OF WATER LEVEL GAGE	PERIODS OF RECORD: RECORDS AVAILABLE THRU 1985	STAGE EXTREMES (NGVD): MAXIMUM	DATE	MINIMUM	DATE
31	Mississippi River - Gulf Outlet at Shell Beach	Auto Recorder and Staff	Gage Heights, Jun 1961 to date	11.06*	Aug 69	-2.7	Mar 65
32	Bayou Dupre at Floodgate (west)	Auto Recorder and staff	Gage Heights, Aug 1975 to date	3.53*	Oct 85	-1.94	Jan 79
33	Bayou Dupre at Floodgate (east)	Auto Recorder and Staff	Gage Heights, Aug 1975 to date	7.61*	Oct 85	-1.78	Feb 78
34	Bayou Bienvenue at Paris Road	Auto Recorder and wire height	Gage Heights, Dec 1974 to date	4.82	May 78	-1.78	Jan 77
35	Bayou Bienvenue at Floodgate (west)	Auto Recorder and Staff	Gage Heights, May 1975 to date	3.91	Apr 80	-2.03**	May 78
36	Bayou Bienvenue at Floodgate (east)	Auto Recorder and Staff	Gage Heights, Dec 1974 to date	7.98	Oct 85	-1.89	Jan 79
37	Intracoastal Waterway near Paris Road Bridge	Auto Recorder and Staff	Gage Heights, Apr 1948 to date	10.04*	Sep 65	-2.19	Mar 65
38	Inner Harbor Navigation Canal near Seabrook Bridge	Auto Recorder and Staff	Gage Heights, Daily, Aug 1962 to date	6.47*	Aug 69	-1.53	Mar 65

* Caused by huricane
** From incomplete record

TABLE A-6
HYDROLOGIC STATIONS
(CONT'D)

MAP INDEX NO. (PLATE A-2)	STATION	PERIODS OF RECORD: TYPES OF WATER LEVEL GAGE	PERIODS OF RECORD: RECORDS AVAILABLE THRU 1985	STAGE EXTREMES (NGVD): MAXIMUM	DATE	MINIMUM	DATE
39	Inner Harbor Navigation Canal (IWW) at Florida Ave. Bridge	Auto Recorder and wire weight	Gage Heights, July 1944 to date	9.82*	Aug 69	-1.45	Jan 81
40	Inner Harbor Navigation Canal (IWW) at New Orleans	Staff	Gage heights, May 1922 to date	10.61* (Highwater mark)	Sep 65	-1.90	Feb 85
41	Intracoastal Waterway at Harvey Lock	Wire Weight	Gage Heights, Jan 1925 to date	4.74*	Oct 85	-1.28	Jan 40
42	Intracoastal Waterway at Algier's Lock	Auto Recorder and Wire Weight	Gage Heights, May 1956 to date	4.45*	Oct 85	-1.64*	Sep 65
OMS	Bayou Terre Aux Bouefs at Delacroix	Auto Recorder and Staff	Gage Heights, May 1975 to date	6.86*	Oct 85	-1.29	Feb 78
OMS	Bayou Barataria at Barataria	Auto Recorder and Staff	Gage Heights, Jan-Sep 1950, 1950, and Nov 1951 to date	4.25*	Oct 85	-0.58	Sep 65
OMS	Bayou Barataria at Lafitte	Auto Recorder and Staff	Gage Heights, Oct 1955 to Dec 1960 and May 1963 to date	5.05*	Oct 85	-0.60	Jan 56

* caused by hurricane
OMS - off map station

TABLE A-7
PERTINENT STREAMFLOW DATA (1938-1984)

INFLOW POINT	TOTAL DRAINAGE AREA MI²	GAGED LOCATION*	GAGED DRAINAGE AREA MI²	PERIOD OF RECORD	AVERAGE DISCHARGE (cfs)	MAXIMUM DISCHARGE RATE (cfs)	MAXIMUM DISCHARGE DATE	MINIMUM DISCHARGE RATE (cfs)	MINIMUM DISCHARGE DATE
Amite River	2,373	NR Denham Springs	1,280	9/38 to date	2,015	112,000	4/8/83 10/18/56	271	10/17/56
Tickfaw River	735	At Holden	247	10/40 to date	372	22,470	4/7/83	65	10/1-4/69
		Natalbany River At Baptist	79.5	8/43 to date	116	9,810	4/7/83	1.8	11/2-5/63
Tangipahoa River	895	At Robert	646	10/38 to date	1,151	85,000	4/7/83	245	10/30/68 thru 11/3/68
Tchefunta River	459	NR Folsom	95.5	1/43 to date	161	29,800	4/5/83	26	9/4/68 and 9/15/68
		Bogue Falaya at Covington	88.2	1964 to date	-	12,700**	4/8/83	-	-
Pearl River	8,689	At Bogalusa	6,573	10/38 to date	9,904	129,000	4/24/79	1,020	10/29/63 thru 11/1/63
		Bogue Chitto NR Bush	1,213	10/37 to date	1,916	131,700	4/8/83	366	10/22, 23, 26, 29/68
		At Pearl River	3,494	10/63-9/70 10/75 to date	9,470 (1964-70)	230,000	4/9/83	1,580	10/24/63 and 11/10/63
		Bogue Lusa Creek At Bogalusa	72.7	10/63 to date	118	9,350	4/7/83	5	10/27-28/67

*U.S. Geological Survey Gage Stations
**Previous Flood Discharge - 8,610 CFS 4/27/64

c. Stages, Salinities, Waves and Tides.

(1) Lake stages.

(a) The Bonnet Carre Spillway is operated as required during major high water seasons on the Mississippi River to divert flows through Lake Pontchartrain in order to insure that a stage of 20 feet on the Carrollton gage is not exceeded at New Orleans. Studies indicate that the operations of the spillway produced maximum increases in lake level of about 0.8 foot in 1937, 1.5 feet in 1945, 1.0 foot in 1950, and 0.7 foot in 1973 and again in 1979. The effects of Bonnet Carre operation on stages in Lake Pontchartrain were evaluated as part of a physical model study made by the U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi, in 1963(1). The report indicates that for the passage of flows at or near the design discharge of 250,000 cfs, the operation of the spillway would increase stages in Lake Pontchartrain by about 0.7 foot for average high water stages in Lake Borgne. An analysis of the effects of Bonnet Carre on lake stages during the 1973 and 1979 operations indicates that these model results are generally valid.

(b) For the 1983 Flood, analysis of observed tidal data of a comparable period before and during the Bonnet Carre Spillway operation indicated the actual rise in lake level was approximately 0.5 foot.

(c) The maximum recorded stage in Lake Pontchartrain of 13.0 feet occurred at Frenier on 29 September 1915. The minimum of minus 2.25 feet occurred at Mandeville on 26 January 1938. The mean lake stage for the period from 1961 through 1985 was 1.5 feet.

(d) Maximum stages occur in Lake Pontchartrain during hurricane activity in the vicinity. A list of high stages recorded during hurricanes is presented in Table A-8.

TABLE A-8
MAXIMUM STAGES - LAKE PONTCHARTRAIN

LOCATION	DATE	STAGE- FT. NGVD	
Mandeville	20 Sep 1909	8.0	
West End	20 Sep 1909	6.2	
Frenier	29 Sep 1915	13.0	
West End	29 Sep 1915	6.0	
West End	19 Sep 1947	5.4	
Mandeville	19 Sep 1947	6.8	
New Orleans	4 Sep 1948	4.9	
Frenier	24 Sep 1956	6.8	"Flossy"
Little Woods	24 Sep 1956	7.0	
West End	24 Sep 1956	5.3	
Mandeville	27 Jun 1957	4.1*	"Audrey"
Frenier	9 Aug 1957	3.3	"Bertha"
Frenier	18 Sep 1957	4.5	"Esther"
Mandeville	10 Sep 1961	5.5	"Carla"
Frenier	17 Sep 1963	4.0	"Cindy"
Mandeville	4 Oct 1964	6.4	"Hilda"
Frenier	10 Sep 1965	12.1	"Betsy"
Frenier	Aug 1969 (Watermark)	4.6	"Camille"
Mandeville	18 Aug 1969	4.6	
West End	17 Aug 1969	5.2	
Irish Bayou	18 Aug 1969	7.2**	
Rigolets	18 Aug 1969	9.0**	
Shell Beach	17 Aug 1969	11.1**	
Mandeville	8 Sep 1974	5.0	"Carmen"
Frenier	8 Sep 1974	4.5	
West End	8 Sep 1974	5.2	
Frenier	5 Sep 1977	4.2	"Babe"
Little Woods	4 Sep 1977	4.5	
Frenier	28 Oct 1985	7.58	"Juan"
Mandeville	28 Oct 1985	6.5	
Midlake	29 Oct 1985	6.14**	
West End	28 Oct 1985	6.1**	
Irish Bayou	28 Oct 1985	6.0 (FIR)	

* Possibly higher, gauge failed during storm.
** New record established.

FIR - From Incomplete Record

(2) Salinities. Diluted saline gulf water enters Lake Pontchartrain from Lake Borgne via the Rigolets and the Chef Menteur Pass and the Mississippi River - Gulf Outlet and Inner Harbor Navigation Canal in large quantities and mixes with the fresh water inflow. The salinity in the eastern portion of Lake Pontchartrain averages about 4.5 parts per thousand with a low of 1.1 part per thousand, and a high of 16.5 parts per thousand. The salinity in the western portion of the lake averages about 1.5 parts per thousand with a low of 0.05 part per thousand, and a high of 8.0 parts per thousand. Salinity is subject to considerable variation with respect to location, seasonal trends, and short-term fluctuations. More intensive data on salinities, tides and currents in Lake Pontchartrain and vicinity are shown in U.S. Army Waterways Experiment Station Report of January 1982 entitled "Lake Pontchartrain and Vicinity Hurricane Protection Plan - Prototype Data Acquisition and Analysis."(2)

(3) Waves. In August 1957, two wave gages were installed on the east side of the Greater New Orleans Expressway Bridge, Station Ten at the north end, and Station Four on the south end. Both are approximately one-quarter mile from shore. In 1958, Station Nine was established at Frenier, with the gage on a tower approximately 1,200 feet from shore. Locations are shown on Plate A-2. Pertinent observed data are listed in Table A-9.

TABLE A-9
WAVE DATA

Station	Significant Waves Range ft.	Significant Waves Wind m.p.h.	Maximum Waves Height ft.	Maximum Waves Date
4	0.1 to 4.9	30	8.3	9 October 1958
9	0.1 to 4.9	29	7.8	9 October 1958
10	0.1 to 5.3	40	9.0	10 May 1959

(4) Tides. The normal tide has a general range of one-half foot in Lake Pontchartrain and is diurnal in nature. However, wind effects usually mask the daily ebb and flood variations. Because of the annual volume of freshwater inflow (estimated to average 5 million acre-feet), tides and storm surges, enormous volumes of water pass in both directions through the Rigolets, Chef Menteur Pass, Lake Borgne, Mississippi Sound, Inner Harbor Navigation Canal, and Mississippi River-Gulf Outlet. With so many variables operating on the several elements of the system, the current patterns are continually changing.

A-5. Description and Verification of Procedures.

a. Hurricane Memorandums. The Hydrometeorological Section (HMS), U.S. Weather Bureau, cooperated in the development of hurricane criteria for experienced and potential hurricanes in the study area. The HMS memorandums provided frequency data, isovel and rainfall patterns, pressure profiles, hurricane paths, and other parameters required for the hydraulic computations. Those relative to experienced hurricanes are based on reevaluation of historic meteorologic and hydrologic data. Those relative to potential hurricanes contain generalized estimates of hurricane parameters that are based on the latest research and concept of hurricane theory. Memorandums pertinent to the study are listed in Section III, Bibliography.

b. Historical Storms used for Verifications. Three observed storms, with known parameters and effects, were used to establish and verify procedures and relationships for determining surge heights, wind tide levels (WTL's), inflow into Lake Pontchartrain, overtopping flows, and ultimately, flood elevations that would result from synthetic hurricanes. Two storms occurred in September of 1915 (4) and September of 1947 (5) (as shown on Plates A-4 and A-5). The third storm occurred on 16 September 1957.

(1) The hurricane of 29 September 1915 had a central pressure index (CPI) of 27.87 inches, an average forward speed of 10 knots, and a maximum wind speed of 99 mph at a radius of 29 nautical miles. This hurricane approached the mainland from the south. At the Lake Borgne entrance to the Rigolets, a high water elevation of about 10 feet was experienced and the average elevation in Lake Pontchartrain rose to 6 feet. This storm was not used for verification of levee overtopping because the present lakefront levee system was not in existence in 1915.

(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 72 mph at a radius of 33 nautical miles. The direction of approach of this hurricane was approximately from the east. In Lake Borgne, at the entrance to the Rigolets, the maximum water surface elevation was 10 feet NGVD, and in Lake Pontchartrain, the maximum elevation was 5 feet NGVD. However, because of the rapid forward speed of this storm, the average water elevation in Lake Pontchartrain did not reach its maximum at the time that the winds were critical to the south shore. The step-type seawall was in place along the New Orleans lakefront during this storm, and a fairly reliable flood line of overtopping flows was available for verification.

(3) Tropical storm Esther occurred on 16 September 1957, and the resultant elevations were accurately registered by stage recording gages at many locations within the study area. These records were available for verification of routing procedures. This storm was not severe enough to cause flooding.

c. Synthetic storms. Computed flood elevations, 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 standard project hurricane (SPH) for the entire Louisiana coast was used for all locations in the study area with changes only in path and forward speed.

(1) SPH for the Louisiana coast was derived by the National Weather Service from a study of 42 hurricanes that occurred in the region over a period of 57 years (6). SPH paths critical to different locations in the study area and isovel patterns at critical hours are shown on Plates A-6 and A-7. Based on subsequent studies of more recent hurricanes, the National Weather Service has revised the SPH wind field patterns and other

characteristics over the years. Wind field patterns were revised after Hurricane Betsy in 1965 to reflect the intensified wind speeds (7), (8), (9). After Hurricane Camille in 1969, the Weather Service completely revised hurricane characteristics for the SPH, including the wind speeds, central pressure and radii. (10) In their latest publication (11) NOAA has expanded and generalized the latest SPH characteristics. For design of the Lake Pontchartrain and Vicinity Hurricane Protection Project High Level Plan, the SPH, as defined after Hurricane Betsy, was used. To assure that all the segments of the project would be compatible, SPH parameters have not been changed since construction began. Modifications and adjustments of these parameters subsequent to Hurricane Betsy have not significantly changed the characteristics of the SPH.

(a) The SPH for the Louisiana coastal region has a frequency of once in 100 years. The CPI that corresponds to this frequency is 27.6 inches. CPI probabilities are based on the following relationship. (12):

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

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

(b) Radius of maximum winds is an index of hurricane size. The average radius of 12 hurricanes occurring in the New Orleans area is 36 nautical miles. From relationships of CPI and radius of maximum winds of gulf coast hurricanes (12), a radius of 30 nautical miles is considered representative for an SPH having a CPI of 27.6 inches.

(c) Different forward speeds are necessary to produce SPH efects at various locations within the study area. In Lake Pontchartrain, the forward speed is a particularly critical factor and may be as important as the track itself. Sufficient time must elapse between the time of maximum elevation at the entrances to Chef Menteur Pass and the Rigolets and the time of maximum critical winds at the Lake Pontchartrain shore in question to allow for maximum inflow into the lake. The SPH for the south shore, patterned after the September 1915 hurricane, has an average forward speed of 6 knots. An average forward speed of 11 knots was used for the SPH along the west shore of Lake Borgne at the entrance to the passes into Lake Pontchartrain.

(d) Maximum theoretical gradient wind (12) is expressed as:

$$V = 73 \sqrt{(P_n - P_o)} - R \ (0.575 \ f)$$

where V_{gx} = maximum gradient wind speed 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 wind speed (30 feet above ground level) (V_x) (13) in the region of highest speeds is obtained as follows:

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

where T = forward speed in miles per hour.

From these relationships, a wind speed of approximately 100 mph was obtained.

(2) Other synthetic storms of different frequency and CPI are derived from SPH. Other CPI's for desired frequencies are obtained from the graph shown on Plate A-8. V_{gx}'s corresponding to any other CPI are determined similarly by use of the method described for the SPH. Variations in CPI's of historic storms were accomplished by the same procedure (12). Characteristics of synthetic storms and some historic storms are listed in Table A-10.

TABLE A-10
HURRICANE CHARACTERISTICS

Hurricane*	CPI inches	Radius of max. winds nautical miles	Forward speed knots	V_x m.p.h.
Sep 1915	27.87	29	10	99
Sep 1947	28.57	33	16	72
Sep 1956	28.76	30	10	80
Sep 1965	27.79	32	20	122
Track A PMH	26.90	30	6	114
Track A SPH	27.60	30	6	100
Track A Mod H	28.30	30	6	83
Track F PMH	26.90	30	11	114
Track F SPH	27.60	30	11	100
Track F Mod H	28.30	30	11	80

* Tracks are shown on Plate A-9.

d. Surges.

Maximum hurricane surge heights along the western shores of Lake Borgne at the entrances to Lake Pontchartrain were computed by use of a one dimensional steady-state wind tide formula. A detailed description of the formula and its verification is contained in Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part I - Chalmette (14).

e. Routing.

Since the major hurricane damage in the study area results from storm induced effects on Lake Pontchartrain, it was necessary to establish a method to determine the hydraulic regimen in the lake at any time during the hurricane occurrence. This procedure involves the construction of a stage hydrograph for Lake Borgne, and the simultaneous hourly calculations of flows through Lake Pontchartrain's natural inlet and outlet passes, tilt and stage-volume relationships in Lake Pontchartrain and Lake Maurepas, accumulated rainfall, and overflow from the lake to the land areas.

(1) Prerequisite to any routing is the choice of an actual or hypothetical hurricane of known or designated characteristics. It is then possible to develop surge heights for any point in Lake Borgne for selected storm. For routing purposes, Long Point, which is east of the mouth of the Rigolets, was selected as the critical point for a hydrograph. The hydrograph for Long Point reflects stages at the mouths of both the Rigolets and Chef Menteur Pass. Construction of such a hydrograph of hourly stages at the mouth of the two passes was based on a method developed by R.O. Reid (15) that was modified by using the maximum surge elevation computed by the incremental setup method as the peak of the hydrograph for the critical period. A comparison of the rising portion of the hydrograph thus derived, with one obtained by computing surge elevations at hourly intervals, indicated agreement between the two methods. Final stages for the recession portion of the hydrograph could not be computed by the incremental setup method because of the offshore wind directions prevailing after the peak stage. The recession produced by Reid's method (15), obtained by rotating the hydrograph about the peak ordinate, indicated stages considerably lower than corresponding stages for the 1947 hurricane surge. The observed stages of the 1957 storm surge also indicated that the recession was somewhat slower at intermediate stages in Lake Borgne. It was therefore necessary to estimate the recession portion of the hydrograph to verify routing procedures. Storm surge hydrographs for Long Point for each storm investigated were determined by identical procedures.

(2) Storms tides flow in and out of Lake Pontchartrain through three major natural passes and an artificial canal. Rating tables, derived by reverse routing of observed storms, were developed for use in routing through the passes and canal. The elevation of Lake Borgne at Long Point was determined from the average of records obtained from automatic tide gage recorders located at the mouths of the passes and at Shell Beach. Elevations of Lake Pontchartrain were determined from records of the automatic tide gages located in Lake Pontchartrain at U.S. Highway 11 and at West End. Although there was a fairly consistent relationship between head and flow, there was no consistency when a parameter of stage was introduced.

The combined rating of the Rigolets, Chef Menteur Pass, flow over U.S. Highway 90 in vicinity of the passes, and Inner Harbor Navigation Canal was based on the period 25 July to 11 August 1957, during which time a minor storm accompanied by moderate stages was experienced. The empirical relationship, $Q = 560H^{0.935}$ was derived from plots of the data, and used to compute a rating table.

(3) Storage tables for the range of stages were made for Lake Pontchartrain. The storage amounts include the volumes contained in the adjacent marsh areas when the stages exceed the surface elevation of these marshes.

(4) Cumulative amount of rainfall that is coincident with the storm signififantly affects the lake elevations and hence the routing procedure. The amount of this rainfall was calculated by the methods described in U.S. Weather Bureau memorandums (16), (17), using a moderate rainfall that would be coincident with a tropical storm. For routing purposes, rainfall was considered as additional inflow into Lake Pontchartrain. The effect of cumulative rainfall is to raise the lake level.

(5) Stages, wind tide elevations, and waves induce flow over the shore protective structures. Adjustments were made in the routing procedure to account for the quantities that overtopped these structures.

(6) With the above-mentioned items resolved, the routing procedure was reduced to the successive approximation type problem in which the variable factors were manipulated until a condition of balance between flows and storages was obtained for the incremental time intervals. A typical routing computation is illustrated on Plate A-10. The 1947 and 1915 hurricanes were routed by this procedure. Routed average stages for Lake Pontchartrain were found to be in reasonable agreement with the observed average stages for the two hurricanes. The degree of agreement between the observed and computed stages that were obtained by use of the routing procedure verifies the methods and rating tables used. Observed and computed average stages for the 1947 and 1957 hurricanes are shown on Plates A-11 and A-12. All other hurricanes studied were routed using similar procedures. The resultant stage hydrograph for the SPH critical to the south shore of Lake Pontchartrain is shown on Plate A-13.

f. Wind Tides. The storms under consideration are accompanied by strong winds. The effect of strong winds blowing over a shallow inclosed body of water, such as Lake Pontchartrain, is to drive large quantities of water ahead of the winds. It was necessary for purposes of routing and overflow computations to determine the windtide levels (WTL) for Lake Pontchartrain. This was accomplished by dividing the lake into four or five segments that are roughly parallel to the wind directions, and by calculating setup and setdown for each of the segments. The average windspeed and average depth in each segment were determined from isovel and hydrographic charts for each wind tide computation. The storm isovel patterns were furnished by the U.S. Weather Bureau (18), (19). The computation of wind along each zone was based on the segmental integration method (20) and was calculated by use of the step-method formulas (21) that were modified as follows:

$$\text{Setup} = d_t \left(\sqrt{\frac{0.00266\ u^2\ FN + 1}{d_t{}^2}} - 1 \right)$$

$$\text{Setdown} = d_t \left(1 - \sqrt{\frac{1 - 0.0026_u{}^2\ \ FN}{d_t{}^2}} \right)$$

Where: Setup or setdown in feet is measured above or below mean water level (m.w.l.) of the surge in the lake.

d_t = av. depth of fetch in feet below m.w.l.
u = windspeed in m.p.h. over fetch
F = fetch length in miles, node to shoreline
N = planform factor, equal generally to unity

(1) Graphs were constructed from the above formulas to determine setup and setdown quickly about any nodal elevation, Plate A-15. Volumes of water along the zones, represented by the setup and setdown with respect to a nodal elevation, were determined and the water surface profiles adjusted until the setup and setdown volumes balanced within 5 percent. Water surface contours were then drawn for several even-foot nodal elevations, and the tilt and WTL's were determined from the contour sketch. In the routing of surges, pertinent wind tides and tilts for other nodal elevations were interpolated from the contour sketches for the even-foot nodes. Typical wind tide computations are illustrated on Plate A-15.

(2) Maximum computed and observed setup elevations for the 1947 hurricane, were 4.9 feet and 5.4 feet at West End. Computed stages for the 1915 hurricane compared favorably with observed high water marks. Wind tide levels for all hurricanes studied were computed by applying the same methods and procedures described above. Maximum surge height contours in the Lake Borgne area and maximum WTL contours in the Lake Pontchartrain area were developed for the SPH. These contours are shown on Plate A-16. The contours represent the maximum elevations that would be experienced for the occurrence of a hurricane in the SPH category for the most critical storm path.

A-6. Frequency estimates.

a. Procedure.

(1) The area along the south shore of Lake Pontchartrain was used in developing a procedure for making frequency estimates since more historical hurricane data were available for this area than for any other location. The maximum WTL or stage for a specific area is a measure of the character of storm that produces it. In order to use data from early hurricanes which caused high wind tides along the south shore of Lake Pontchartrain, it was necesary to analyze meteorologic factors and to adjust the observed data to represent stages that would have occurred had presently existing protective works then been in place. It was found that adjustments were required for the 1983 and 1901 hurricanes. Along the south shore of Lake Pontchartrain, determinations of maximum WTL's were from the adjusted historical data from the locus of points through which a representative WTL-frequency curve would pass in the low-stage, high-frequency region. Probabilities for historical data on the curve shown on Plate A-17 were calculated by means of the formula:

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

The WTL for the PMH, which has an infinite return period, establishes another limit for the frequency curve in the high-stage, low frequency region.

However, because of the lack of historical data for the region of the curve between these two extremes, the synthetic WTL-frequency relationships were developed to show the shape of the curve in this region. In the process of formulating such relationships, it was necessary to correlate the following hurricane parameters: central pressure index, paths of approach, wind velocities, radii to maximum winds, and forward speeds of translation.

(2) Prior to 1900, information of record dealt 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 in 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 there is no locality along the Louisiana coast which is more prone to hurricane attack than other localities.

(3) The first requirement in the development of synthetic frequency relationships for localities within the study area was to select representative critical hurricane paths of approach for the particular locale in question. For the passes into Lake Pontchartrain, track F is the critical path for the design hurricane. For the south shore of Lake Pontchartrain, track A was selected to represent the hurricane situation that would produce critical conditions. These tracks are shown on Plate A-9.

(4) After hurricane paths were selected, surge heights and wind tides were developed, as described previously, for at least three storms of different CPI values for each track. Each hurricane selected for the representative paths were assumed to have the same radius of maximum winds, the same forward speed of translation, and the same adjustment for any land effects. Only CPI's and wind velocities were adjusted to develop these three storms. Results of these computations for the New Orleans reach of Lake Pontchartrain are shown in Table A-11. Wind tide elevations for storms with other CPI values were obtained graphically by plotting the above data and reading from the resulting curves.

TABLE A-11

CENTRAL PRESSURE INDEX VS. WIND TIDE LEVEL
LAKE PONTCHARTRAIN REACH - NEW ORLEANS

PATH A		PATH F	
Central pressure index (CPI) inches	Max. wind tide level NGVD	Central pressure index (CPI) inches	Max. wind tide level NGVD
26.9	12.7	27.6	7.7
27.6	11.2	27.87	6.6
28.5	8.2	28.57	4.8

(5) Hurricane characteristics of area-representative storms were developed in cooperation with U.S. Weather Bureau. This agency has made a generalized study of hurricane frequencies for a 400-mile zone along the central gulf coast, Zone B, from Cameron, La., to Pensacola, Fla., and has presented the results in a memorandum. (12) Frequencies for hurricane central pressure indexes that were presented in the report, as shown on Plate A-8, reflect the probability of hurricane recurrence from any direction in the midgulf coastal area. In order to establish frequencies for the localities 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 HMS memorandum. (12) The average projection along the coast of this 50-mile swath for the azimuths of 42 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-8 was used to represent the CPA-frequencies in the 50-mile subzone that is critical for each study locality.

(6) The azimuths of tracks observed in the vicinity of landfall were divided into quadrants corresponding to the four cardinal points. In Zone B, 24 tracks were from the south, 14 from the east, 3 from the west, and 1 from the north. Hurricanes with tracks having major components from the south or east are more critical relative to WTL's within the study area than hurricanes from other directions. 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 are 180°. Tracks from the east had an average azimuth of 115°. Approximately these azimuths were used in computing WTL's. Further adjustment of the probability of occurrence was made by using two-thirds of the probability for WTL's computed for hurricanes approaching from the south and one-third of the probability for WTL's computed for hurricanes approaching from the east. The probabilities of equal stages for both groups of tracks were then added arithmetically to develop a curve representing a synthetic probability of recurrence of maximum wind tide levels for hurricanes from all directions. Table A-12 presents these computations and those of the previous paragraph for the New Orleans reach.

TABLE A-12

STAGE-FREQUENCY
SOUTH-SHORE - LAKE PONTCHARTRAIN

CPI	ZONE B	New Orleans Reach 80-mi. subzone	WTL	PATH A Freq.* (67% Col. 3)	WTL	PATH F Freq.* (33% Col. 3)
1	2	3	4	5	6	7
in.	occ/100 years		NGVD	occ/100 yrs.	ft. NGVD	occ/100 - yrs.
27.6	1	0.2	11.5	0.13	8.0	0.07
27.8	2	0.4	10.9	0.27	7.0	0.13
28.1	5	1.0	9.8	0.67	6.1	0.33
28.3	10	2.0	9.1	1.34	5.6	0.66
28.6	20	4.0	8.0	2.68	4.9	1.32
29.0	40	8.0	6.5	5.36	4.1	2.64

$$*\text{Freq.} = \frac{100}{\text{Return period years}}$$

(7) Using the shape of the synthetic stage-frequency curve as a guide, it was then possible to complete a final curve for the New Orleans reach between the predetermined limits mentioned previously.

(8) Lack of historical data prevented the similar development of WTL-frequency relationships for other localities within the study area. For the remaining reaches, wind tide levels were calculated for Zone B hurricanes of different frequencies by using different combinations of critical paths and distribution of azimuths of incidence. It followed that a Zone B hurricane of a particular frequency would have the same recurrence period for any locale in the study area since all are within the same subzone. Therefore, the final stage - frequency curves for the remaining areas were developed by plotting the computed stages for several different Zone B hurricanes at the corresponding frequencies indicated for the south shore of Lake Pontchartrain. Only two-thirds of the hurricanes from the south or east are most critical relative to WTL's along the south shore of Lake Pontchartrain, while all of the hurricanes from the south or east are equally critical to the area affected by Lake Borgne. Therefore, the most critical WTL along the south shore of Lake Pontchartrain for a Zone B hurricane of given frequency occurs only two-thirds as often as the most critical WTL along the shores of Lake Borgne for the same hurricane.

b. Relationships. Based on the above described procedures, stage-frequency relationships were established for the south shore of Lake Pontchartrain and the passes into Lake Pontchartrain from Lake Borgne. Stage-frequency curves are shown on Plate A-18.

A-7. Design Hurricane.

a. Selection of the design hurricane. The standard project hurricane was selected as the design hurricane (Des H) due to the urban nature of the study area. 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 event of the occurrence of a hurricane of the intensity and destructive capability of the standard project hurricane.

b. Characteristics. The characteristics of the Des H for the proposed plan of protection are identical to the standard project hurricane described in detail in paragraph A-5. However, due to transposition of the regional SPH to the smaller study area the design hurricane would have a probability of recurrence of only once in about 300 years in the study area. The path of the Des H's was located to produce maximum hurricane tides along the entire length of the proposed structure. The Des H is a theoretical hurricane but ones of similar intensity have been experienced in the area. Table A-13 is a summary of the Des H characteristics.

TABLE A-13
DESIGN HURRICANE CHARACTERISTICS

Location	CPI (inches)	Max. winds (m.p.h)	Radius of max. winds (miles)	Forward speed (knots)	Direction of approach	Track (plate A-6)
Lake Pontchartrain						
South Shore	27.6	100	30	6	South	A

c. Normal predicted tides. The average tidal range in Lake Pontchartrain is 0.5 foot. Lake Pontchartrain has an average elevation of about 1.0 foot. In determining the elevation of design surges and wind tide levels, the mean normal predicted tide was assumed to occur at the critical period.

d. Design tide. The hurricane tide is the maximum stillwater surface elevation experienced at a given location during the passage of a hurricane. It reflects the combined effects of the hurricane surge and wind tide. Design hurricane tides were computed for conditions reflecting the proposed protective works. The resulting elevations, which are identical to those for an SPH, are the same for existing or project conditions.

TABLE A-14
DATA USED TO DETERMINE WAVE CHARACTERISTICS
DESIGN HURRICANE

F	Length of fetch, miles	5
U	windspeed, mph	82
SWL	Stillwater elevation, feet	11.5
d	Average depth of fetch, feet	24.6

e. Levee heights. During the time maximum windtide levels are against the protective levee, the winds are parallel to or leeward of the levee and no wave runup will occur. Prior and subsequent to that time, the winds will be generally perpendicular to the protective embankment, but the height of the wave runup at such time will not exceed the levee design grade. Consequently, wave runup is not the controlling factor in determining the design elevation of the levee. The design elevation was determined by providing 3 feet of freeboard above the maximum windtide level. Table A-15 summarizes the elevations of design windtide levels and the design elevation of the protective levees.

TABLE A-15

DESIGN HURRICANE
WINDTIDE LEVELS AND
DESIGN ELEVATIONS OF PROTECTIVE STRUCTURES

Location W/L Stations	Windtide level ft. n.g.v.d.	Elev. of protective levees ft. n.g.v.d.
181+35.5 to 173+04.7	11.5	Varies*
173+04.7 to 130+70	11.5	14.5
130+70 to 65+20.4	11.0	14.0
65+20.4 to 0	10.5	13.5

* Transition reach whose height and cross section depends upon the design section along the Jefferson Parish Lakefront.

SECTION II - INTERIOR DRAINAGE

A-8. Intercepted Drainage. No runoff will be intercepted by this work. Currently, a levee already exists along the proposed alignment. Modifications to the existing drainage system to accommodate the high level plan levee are not required.

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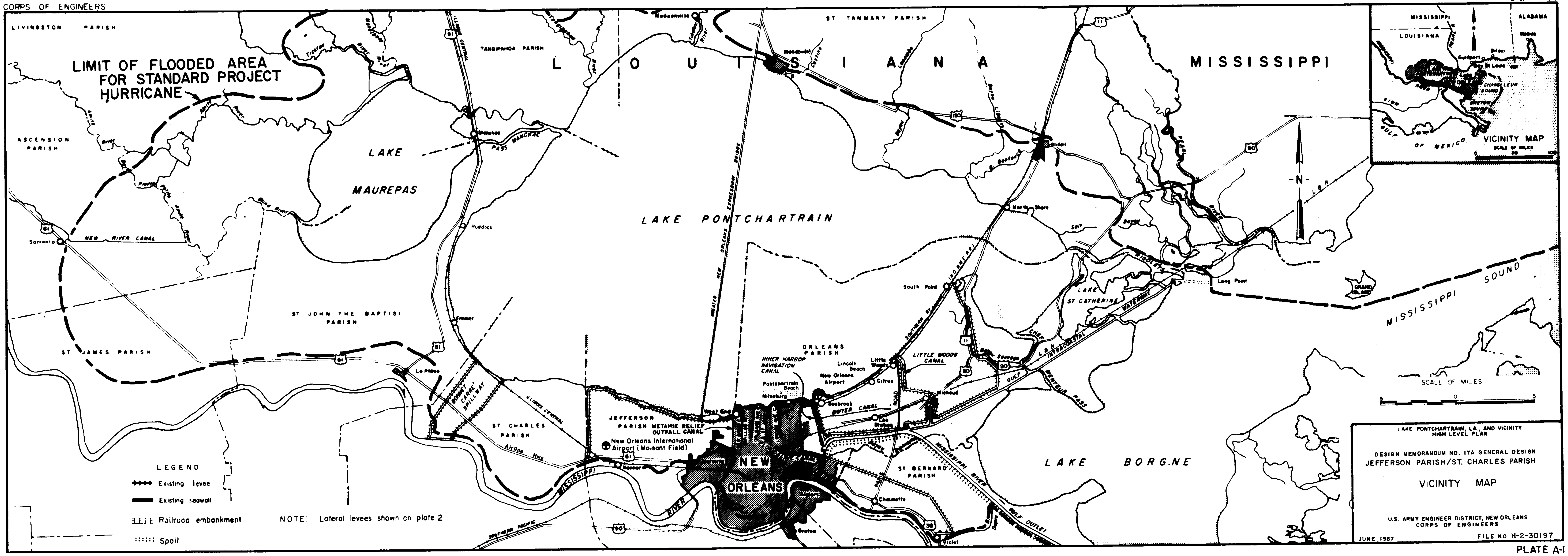
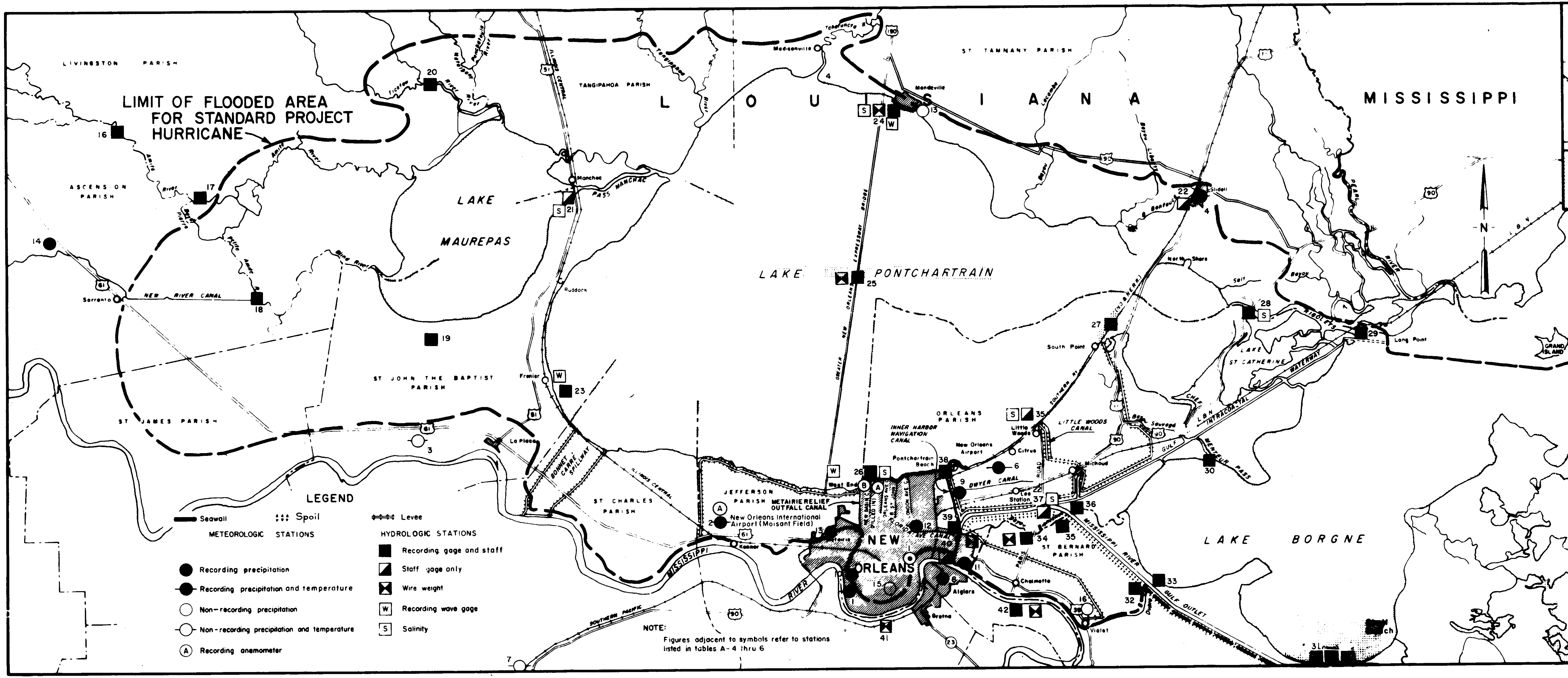


PLATE A-I



LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

METEOROLOGIC AND HYDROLOGIC STATIONS

SCALES AS SHOWN

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1987 FILE NO H-2-30197

PLATE A-2

WIND ROSE

Percentage Frequency
Annual

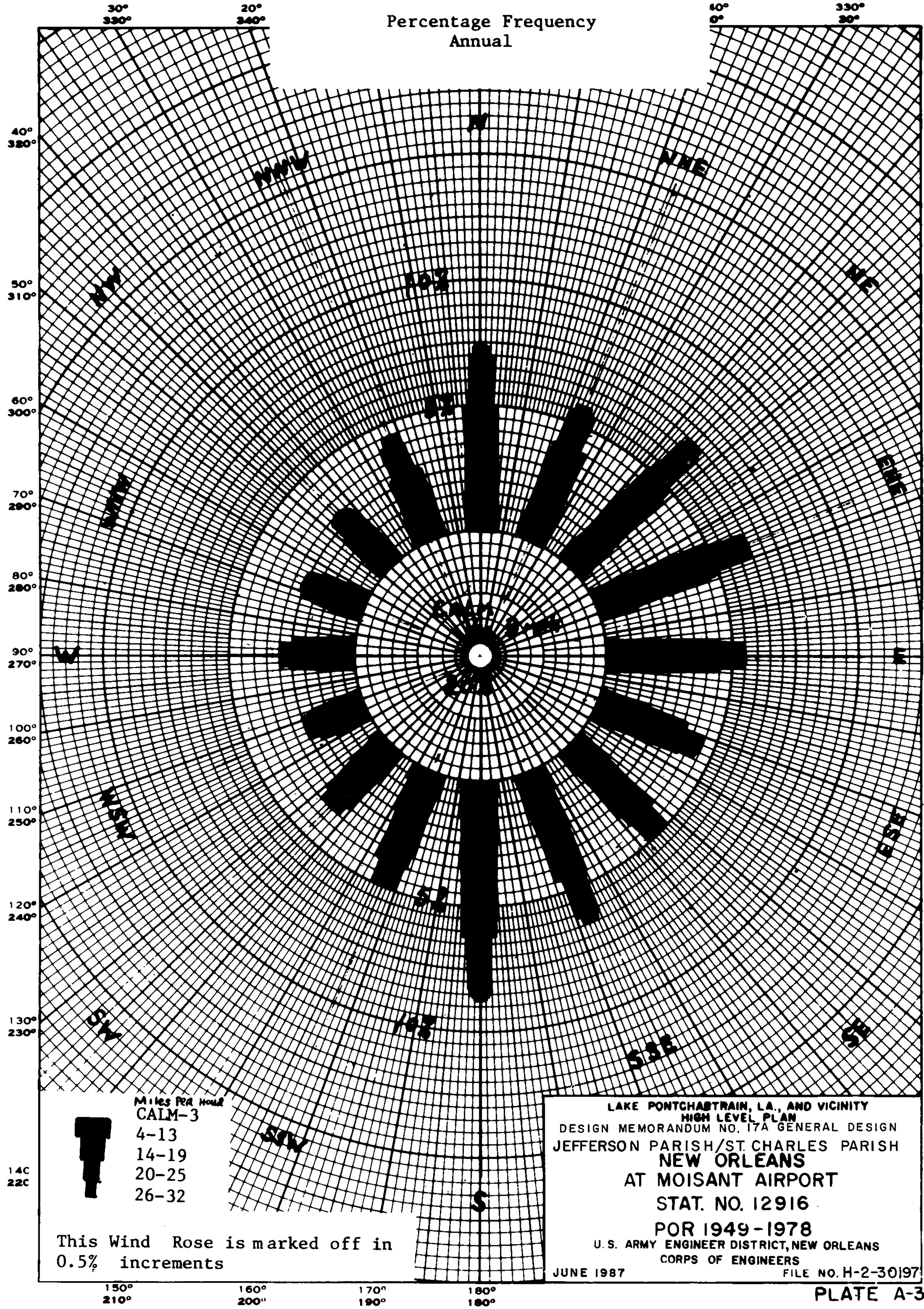
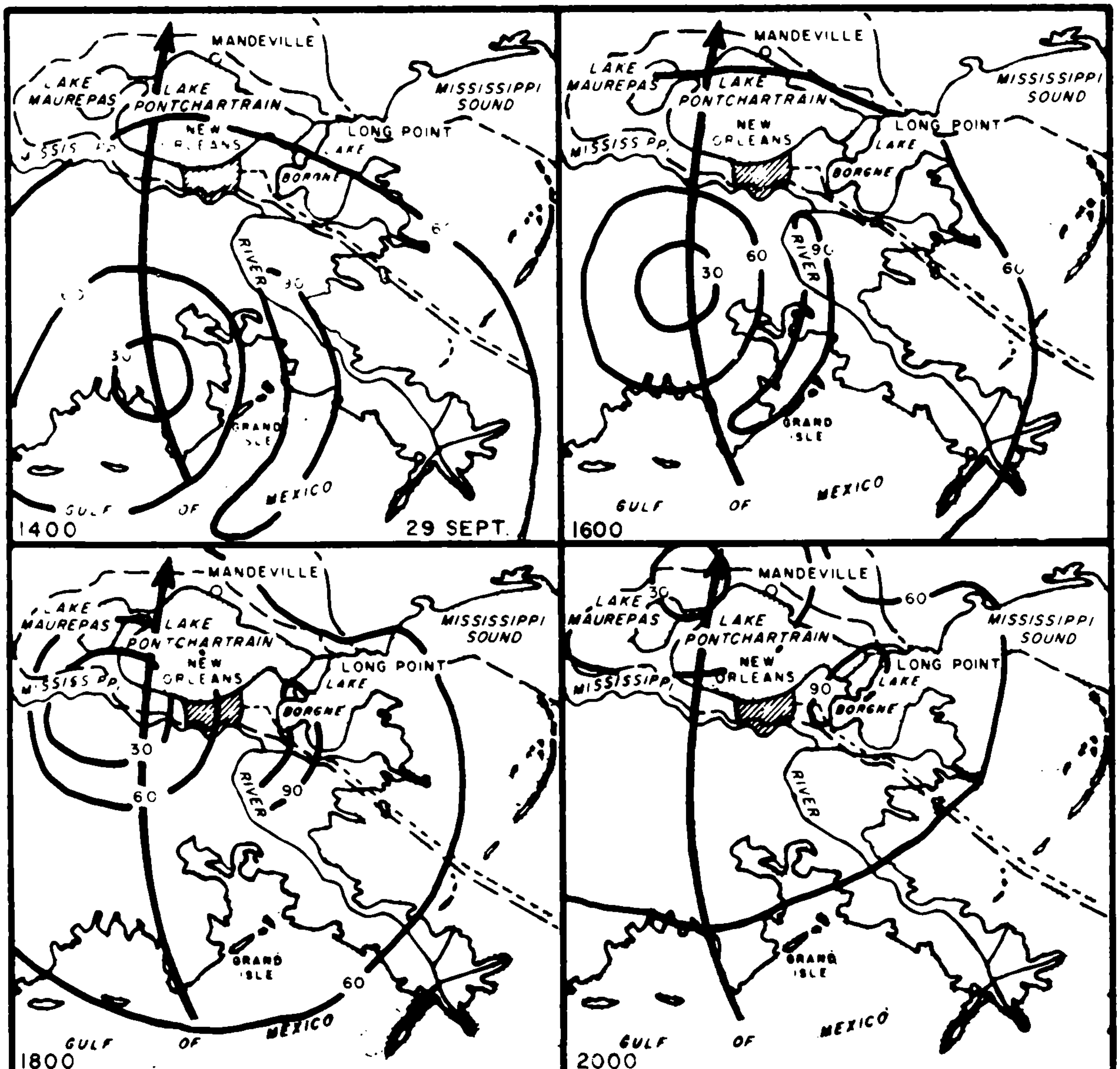
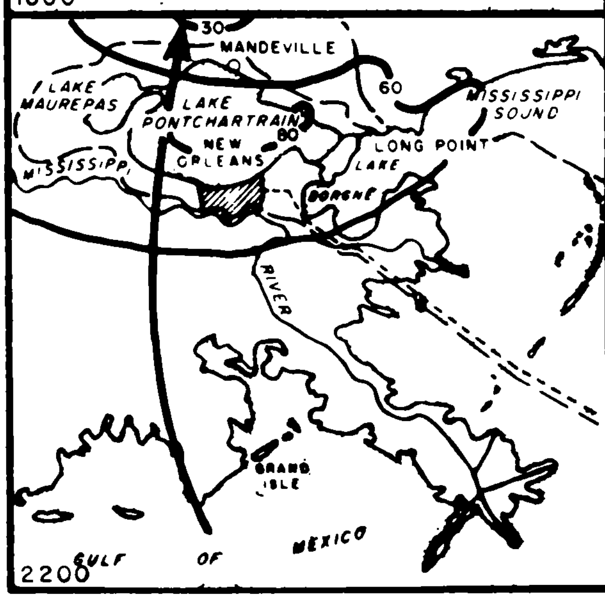


PLATE A-3





LEGEND

- — — Study area
- 30 Average wind velocity
- ← Hurricane path

LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

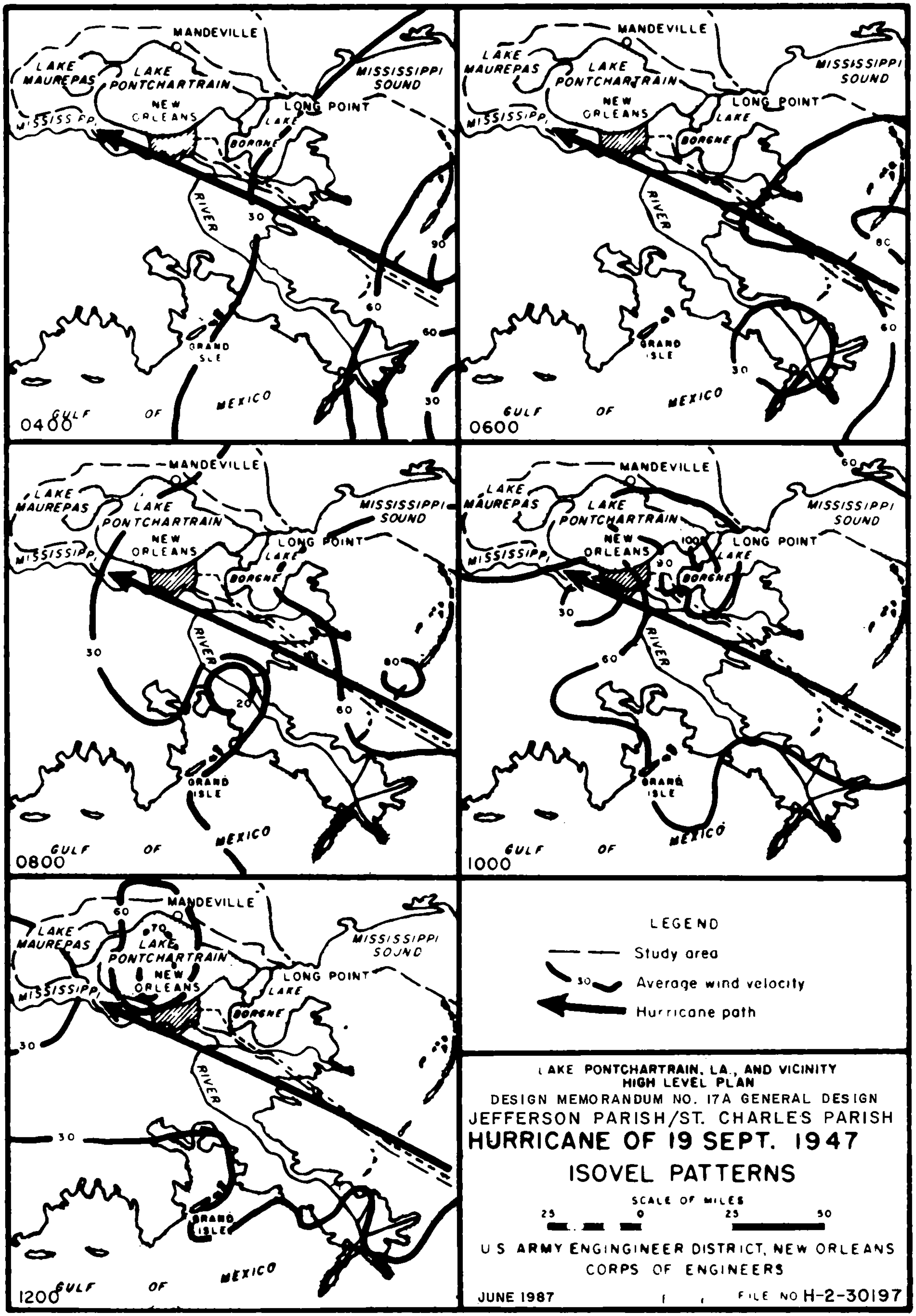
HURRICANE OF 28 SEPT. TO 1 OCT. 1915 ISOVEL PATTERNS

SCALE OF MILES
25 0 25 50

U S ARMY ENGINGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1987 FILE NO H-2-30197

PLATE A-4



LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

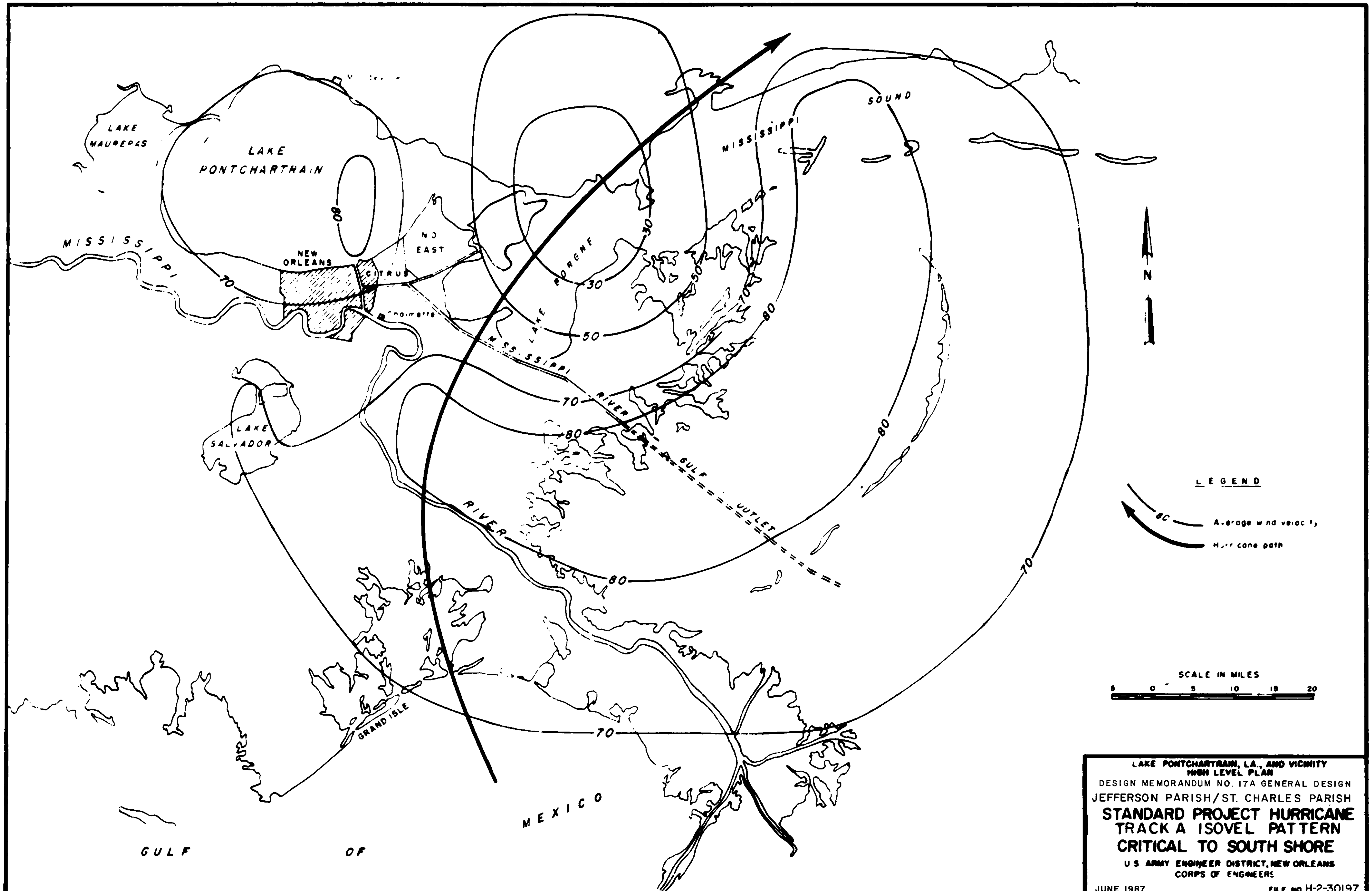
HURRICANE OF 19 SEPT. 1947

ISOVEL PATTERNS

U S ARMY ENGINGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1987 FILE NO H-2-30197

PLATE A- 5



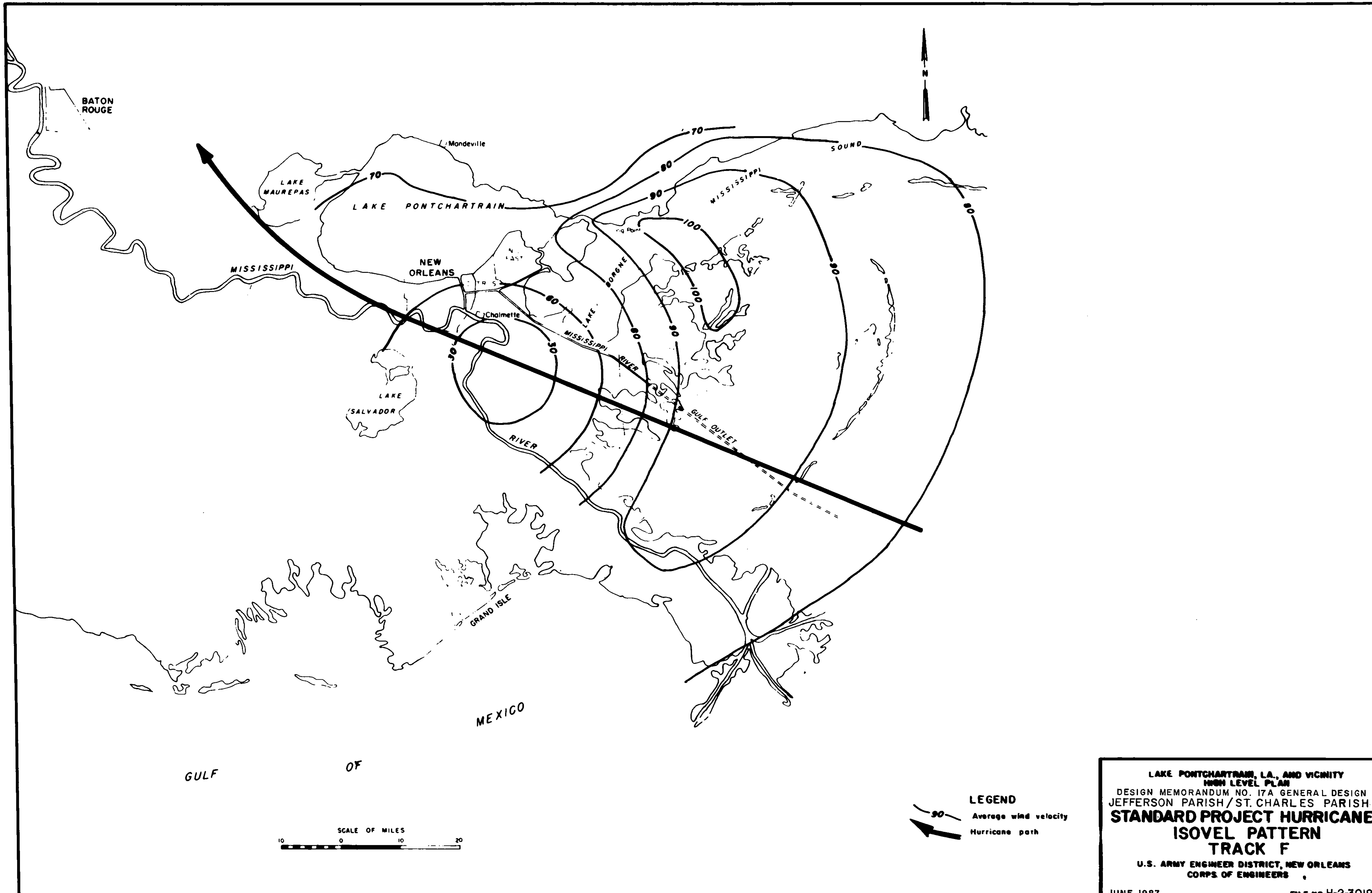
LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

STANDARD PROJECT HURRICANE TRACK A ISOVEL PATTERN CRITICAL TO SOUTH SHORE

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

JUNE 1987 FILE NO H-2-30197

PLATE A-6

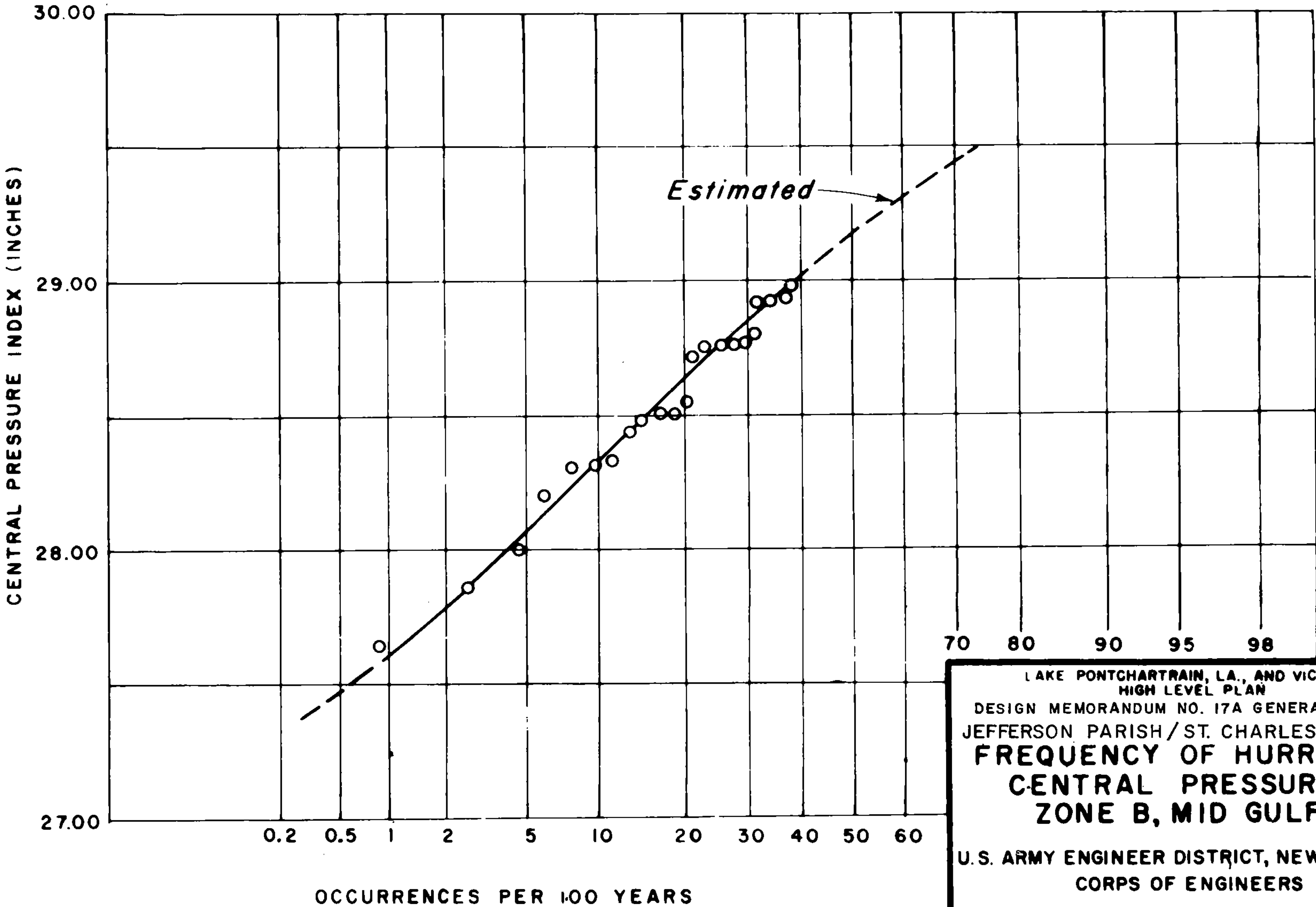


LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH / ST. CHARLES PARISH

STANDARD PROJECT HURRICANE
ISOVEL PATTERN
TRACK F

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

JUNE 1987 FILE NO. H-2-30197



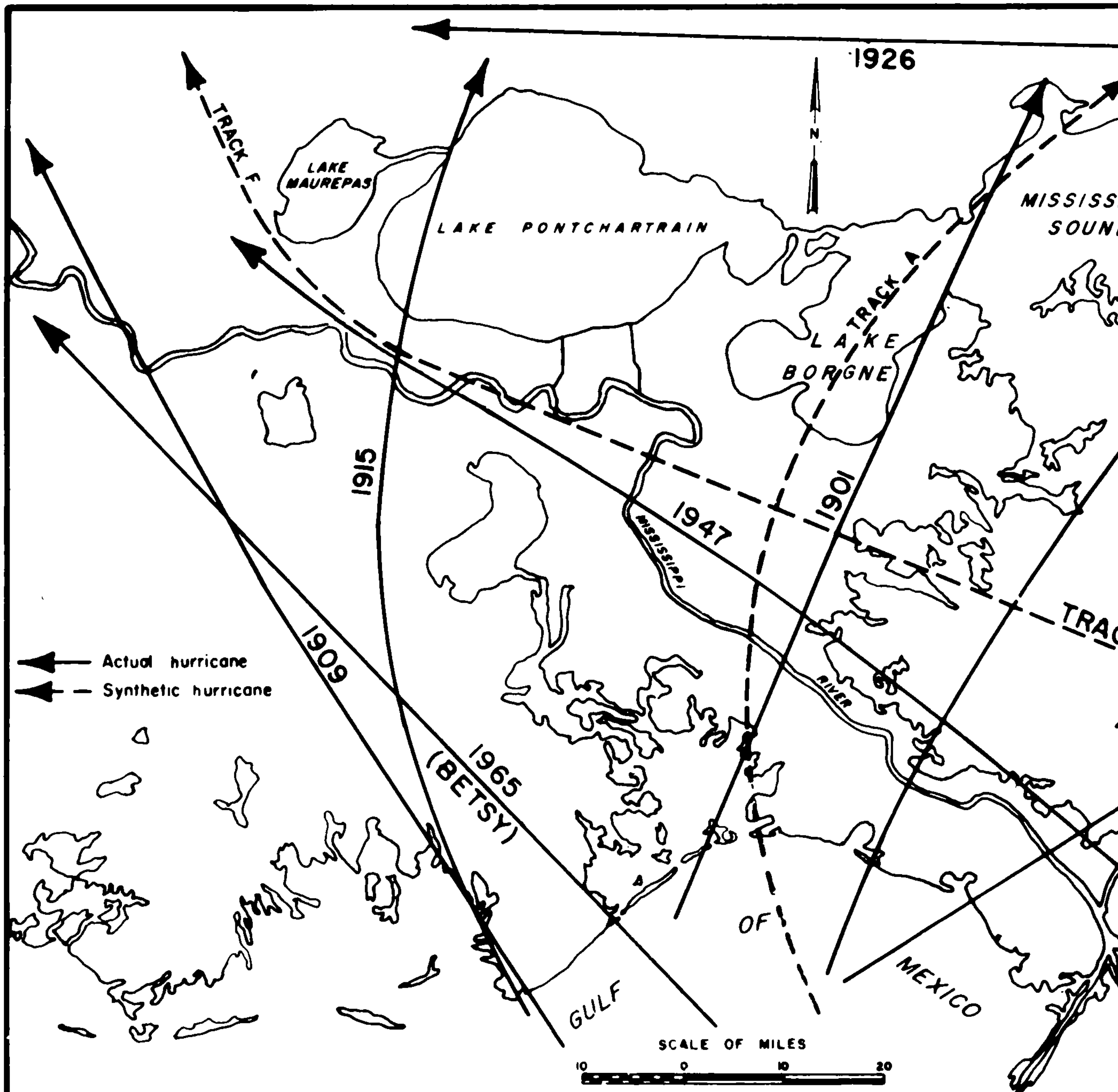
LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH / ST. CHARLES PARISH

FREQUENCY OF HURRICANE CENTRAL PRESSURES ZONE B, MID GULF

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-8



LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN

JEFFERSON PARISH / ST. CHARLES PARISH

HURRICANE TRACKS

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-9

HOURS REFERENCED TO LANDFALL (1)	EL. IN LAKE BORGNE: EL. IN L. BORGNE (2) FEET N.G.V.D.	EL. IN LAKE BORGNE: AV. OF (2) (3) FEET N.G.V.D.	EL. IN LAKE PONTCHARTRAIN: AV. EL. IN L. PONT. (4) FEET N.G.V.D.	EL. IN LAKE PONTCHARTRAIN: EL. AT HWY. 11 (5) FEET N.G.V.D.	EL. IN LAKE PONTCHARTRAIN: AV OF (5) (6) FEET N.G.V.D.	FLOW INTO LAKE PONTCHARTRAIN: HEAD BETWEEN L. BORGNE & L. PONT. (7) FEET	FLOW INTO LAKE PONTCHARTRAIN: FLOW INTO L. PONT. (8) 1000 C.F.S.	FLOW INTO LAKE PONTCHARTRAIN: VOLUME OF FLOW FOR 2 HOURS (9) 1000 D.S.F.	FLOW INTO LAKE PONTCHARTRAIN: RAIN IN L. PONT. (10) FEET	FLOW INTO LAKE PONTCHARTRAIN: VOLUME OF RAIN FOR 2 HOURS (11) 1000 D.S.F.	FLOW INTO LAKE PONTCHARTRAIN: TOTAL INFLOW INTO L. PONT. (12) 1000 D.S.F.	L. PONT. STORAGE: STORAGE IN L. PONT. FOR EL. IN (4) (13) 1000 D.S.F.	L. PONT. STORAGE: Δ STORAGE IN L. PONT. (14) 1000 D.S.F.	OVERFLOW: FLOW OVER L. PONT. LEVEES FOR 2 HOUR (15) 1000 D.S.F.	FLOW INTO L. MAUREPAS: (12)-(14)-(15) (16) 1000 D.S.F.	EL. IN LAKE MAUREPAS: STORAGE IN L. MAUREPAS (17) 1000 D.S.F.	EL. IN LAKE MAUREPAS: AV. EL. IN L. MAUREPAS (18) FEET N.G.V.D.	VERIFICATION — STAGES IN PASS MANCHAC, L. PONT. SIDE: EL. IN PASS MANCHAC (19) FEET N.G.V.D.	L. PONT. SIDE: AV. OF (19) (20) FEET N.G.V.D.	LAKE MAUREPAS SIDE: TILT IN L. PONT. (21) FEET	LAKE MAUREPAS SIDE: TILT IN L. MAUREPAS (22) FEET	LAKE MAUREPAS SIDE: EL. IN PASS MANCHAC (23) FEET N.G.V.D.	LAKE MAUREPAS SIDE: AV. OF (23) (24) FEET N.G.V.D.	FLOW INTO LAKE MAUREPAS: HEAD BETWEEN L. PONT. & L. MAUREPAS (25) FEET	FLOW INTO LAKE MAUREPAS: FLOW INTO L. MAUREPAS (26) 1000 C.F.S.	FLOW INTO LAKE MAUREPAS: VOLUME OF FLOW FOR 2 HOURS (27) 1000 D.S.F.	STAGE IN LAKE MAUREPAS: STORAGE IN L. MAUREPAS (28) 1000 D.S.F.	STAGE IN LAKE MAUREPAS: EL. IN L. MAUREPAS (27) FEET N.G.V.D.
2	9.46		5.94	2.53					0.115			1970.6				225.1	1.12	3.54		1.21	0.24	1.00					226.2	1.13
		9.86			1.21	8.65	4214.0	351.2		13.7	364.9		346.5	2.3	16.1				4.52				0.86	3.66	165.8	13.8		
4	10.25		5.26	0.09					0.052			2317.1				241.2	1.27	5.50		5.41	1.08	0.73					240.0	1.26
		9.91			1.62	8.29	4043.2	336.9		48.0	378.9		351.7	11.6	15.6				6.02				0.90	5.18	184.6	15.4		
6	9.56		6.55	3.14					0.165			2668.8				256.8	1.41	6.55		3.41	0.68	1.07					255.4	1.40
		9.11			4.55	4.56	2310.6	192.6		49.6	242.2		202.5	25.8	13.9				6.08				1.32	4.76	180.5	15.0		
8	8.66		7.28	5.96					0.180			2871.3				270.7	1.58	3.61		-0.35	-0.07	1.57					270.4	1.53
		7.43			7.43	0.00	0.0	0.0		21.0	21.0		-47.7	54.9	13.8				5.11				1.82	3.29	160.2	13.4		
10	6.19		7.11	8.90					0.075			2823.6				284.5	1.65	4.61		-4.29	-0.86	2.08					283.8	1.69

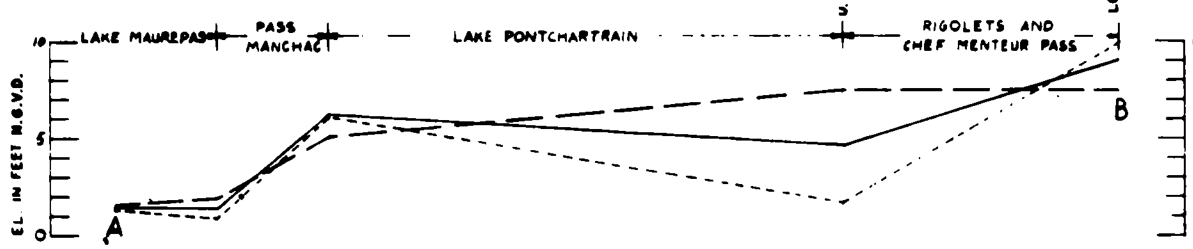
SAMPLE ROUTING

EXPLANATION:

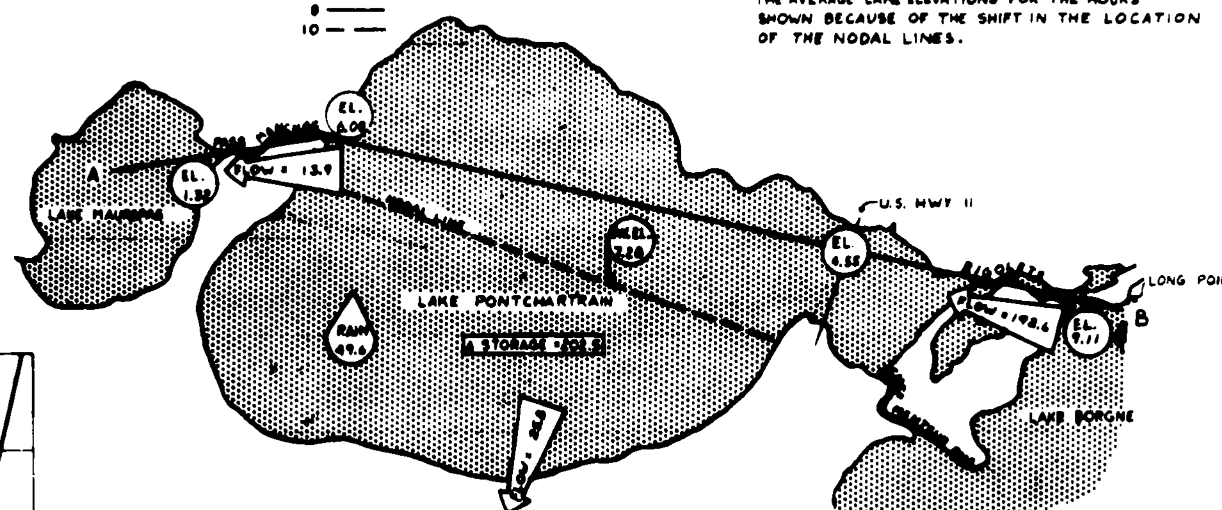
COLUMN (2) FROM LAKE BORGNE HYDROGRAPH DERIVED BY THE METHOD DESCRIBED IN PARAGRAPH I-5 (i) AND SHOWN ON PLATE A-13
(4) ASSUMED
(5) OBTAINED FROM WATER SURFACE CONTOURS DERIVED FROM WIND SETUP COMPUTATIONS FOR LAKE PONT., SAMPLE SHOWN ON PLATE A-15
(7) (3) - (6)
(8) FROM CHEF MENTEUR PASS AND RIGOLETS RATING CURVE SHOWN BELOW
(10) FROM RAINFALL ESTIMATES DESCRIBED IN PARAGRAPH I-5E(A)
(12) (9) + (11)
(13) FROM LAKE PONT. STORAGE CURVE SHOWN BELOW FOR THE ELEVATION IN (4)

COLUMN (14) (13) - (13)
(15) BY THE PROCEDURES DESCRIBED IN PARAGRAPH I-7E
(17) (16) + (17)
(18) CORRESPONDING ELEVATION FOR VOLUME IN (17) FROM LAKE MAUREPAS STORAGE CURVE SHOWN BELOW
(19) SAME AS EXPLANATION FOR (5)
(21) (19) - (5)
(22) 1/5 OF (21), ESTIMATED AS 1/5 OF THE TILT OF LAKE PONTCHARTRAIN SINCE LAKE MAUREPAS IS 1/5 AS WIDE.
(23) (18) - (22)/2
(25) (20) - (24)
(26) FROM PASS MANCHAC RATING CURVE SHOWN BELOW
(28) (17) + (27)
(29) CORRESPONDING ELEVATION FOR VOLUME IN (28) FROM LAKE MAUREPAS STORAGE CURVE SHOWN BELOW

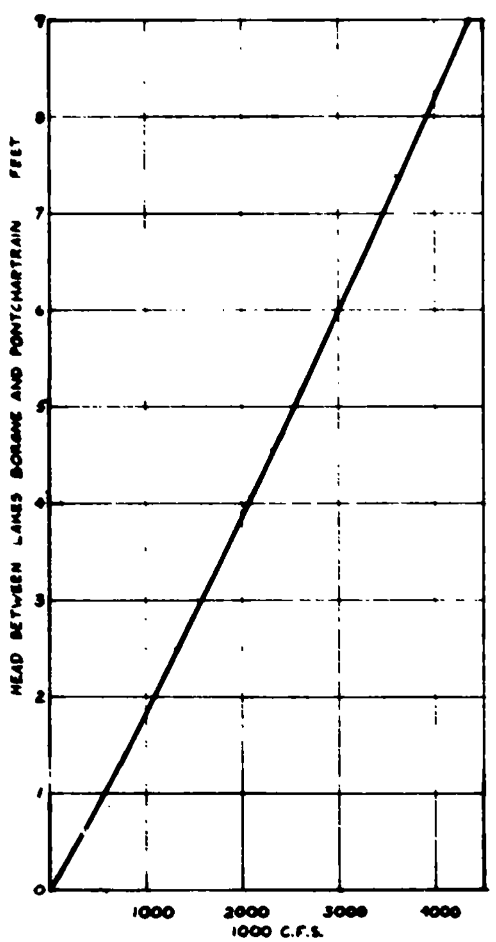
WATER SURFACE PROFILES



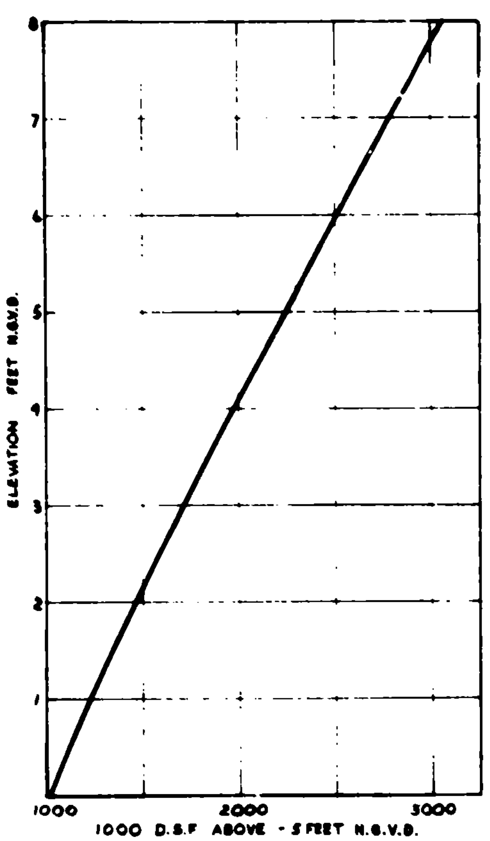
NOTE:
THE LAKE PONTCHARTRAIN PROFILES DO NOT REFLECT THE AVERAGE LAKE ELEVATIONS FOR THE HOURS SHOWN BECAUSE OF THE SHIFT IN THE LOCATION OF THE NODAL LINES.



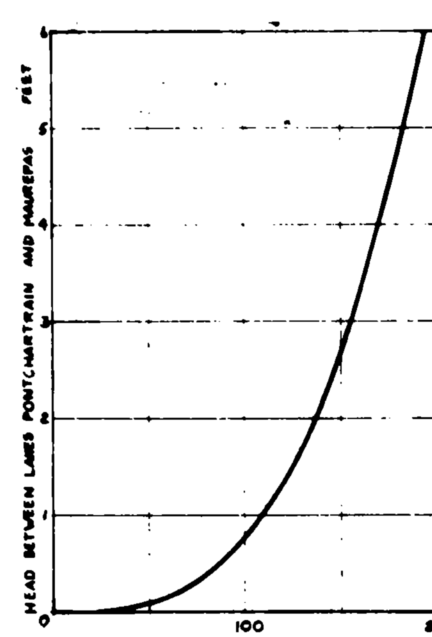
ROUTING DIAGRAM
6 TO 8 HOURS AFTER LANDFALL



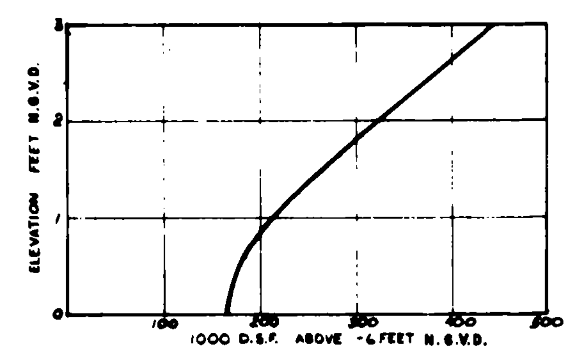
CHEF MENTEUR PASS & RIGOLETS FLOW



LAKE PONTCHARTRAIN STORAGE



PASS MANCHAC FLOW



LAKE MAUREPAS STORAGE

NOTE:
FLOW AND RAIN IN 1000 D.S.F.
ELEVATIONS IN FEET N.G.V.D

LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH / ST. CHARLES PARISH

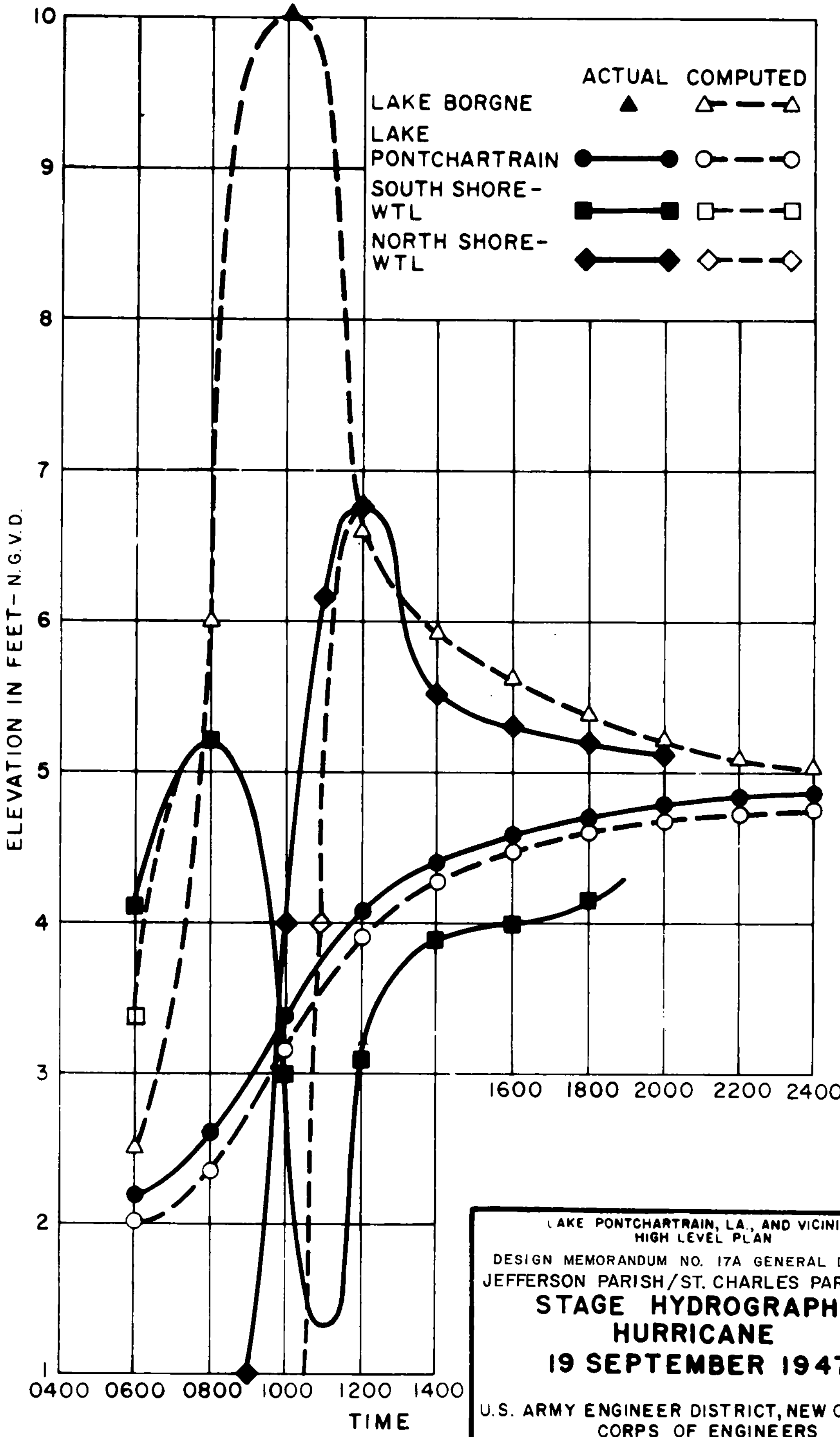
LAKE PONTCHARTRAIN ROUTING

SCALE AS SHOWN

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-10

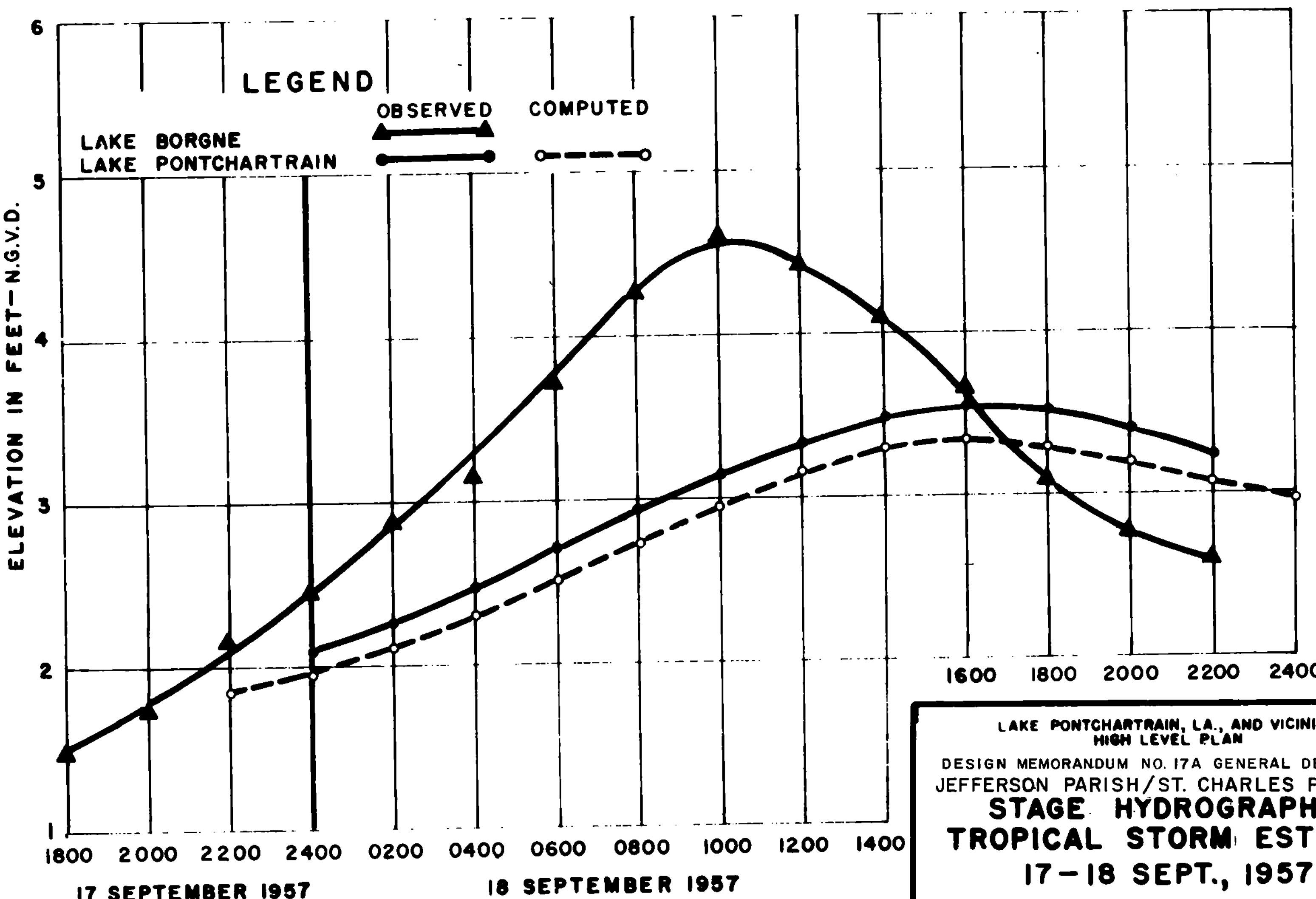


LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

STAGE HYDROGRAPHS
HURRICANE
19 SEPTEMBER 1947

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

JUNE 1987 FILE NO. H-2-30197



LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

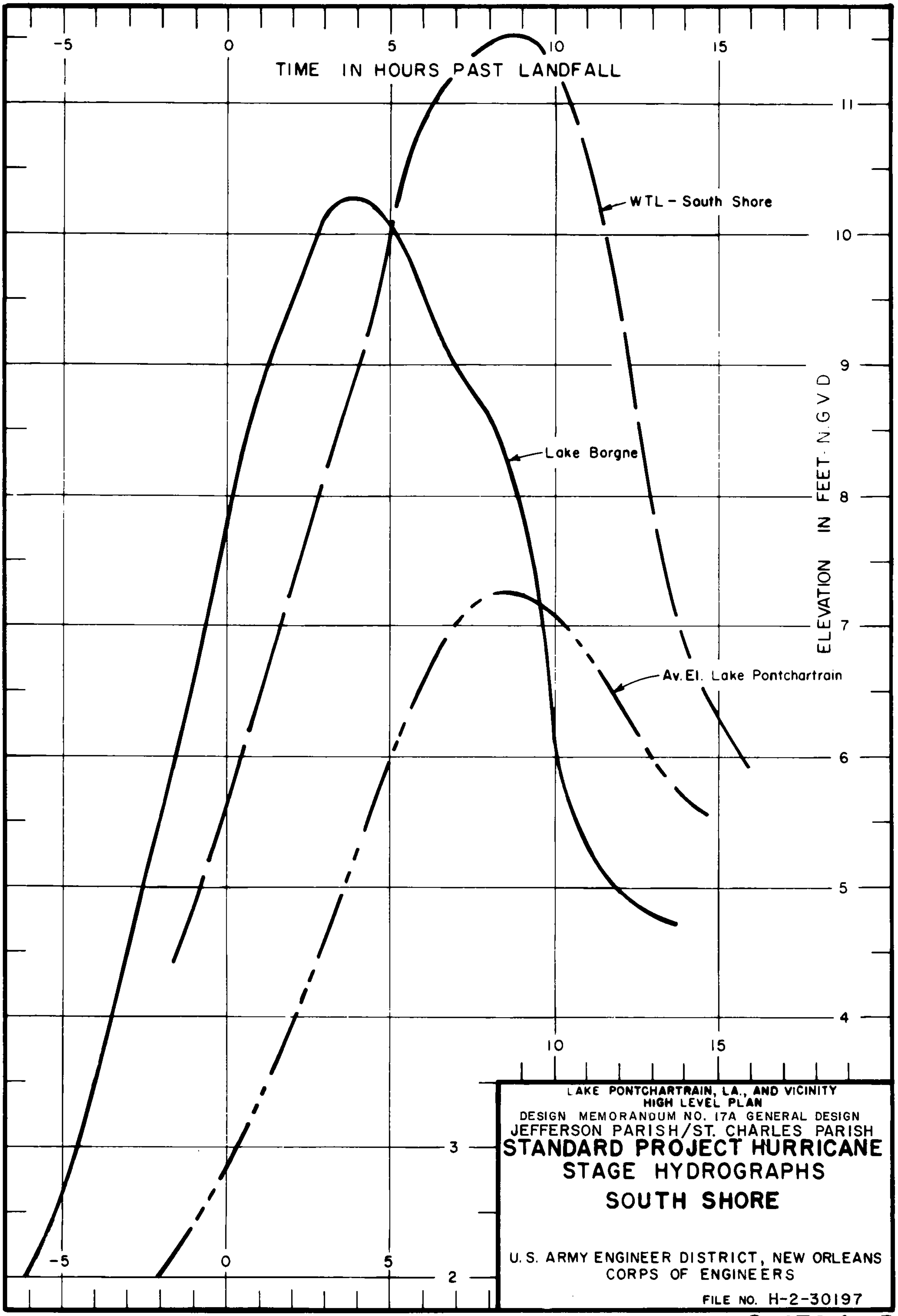
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

STAGE HYDROGRAPHS
TROPICAL STORM ESTHER
17–18 SEPT., 1957

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-12



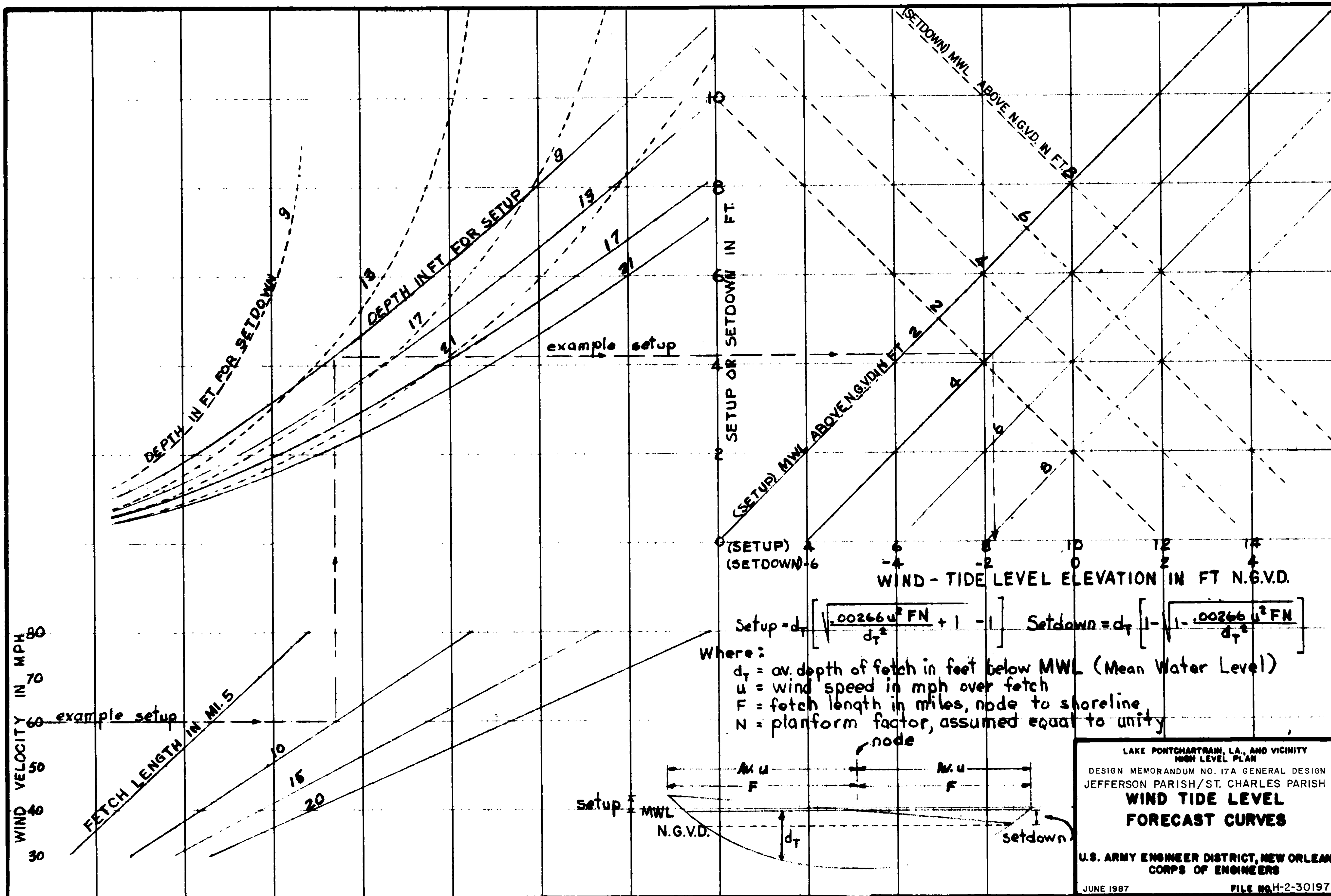
LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

STANDARD PROJECT HURRICANE
STAGE HYDROGRAPHS
SOUTH SHORE

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

FILE NO. H-2-30197

PLATE A-13



$$\text{Setup} = d_T\left[\sqrt{\frac{.00266\,u^2 FN}{d_T^2}+1}-1\right] \qquad \text{Setdown} = d_T\left[1-\sqrt{1-\frac{.00266\,u^2 FN}{d_T^2}}\right]$$

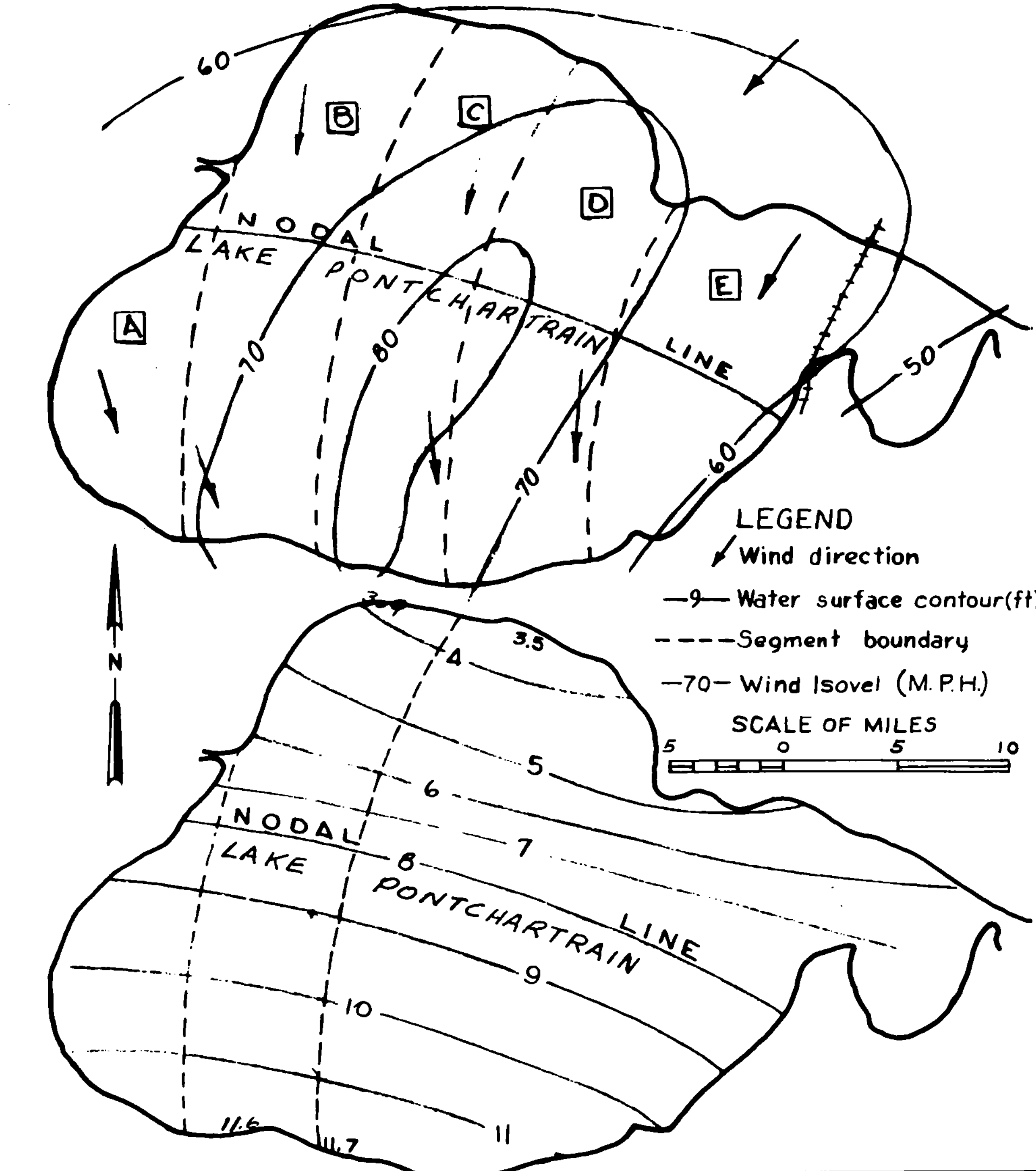
Where:
- d_T = av. depth of fetch in feet below MWL (Mean Water Level)
- u = wind speed in mph over fetch
- F = fetch length in miles, node to shoreline
- N = planform factor, assumed equal to unity

LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

WIND TIDE LEVEL FORECAST CURVES

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

JUNE 1987 FILE NO. H-2-30197



Sample: 8 hours after landfall - Track A-SPH

Setdown:

$$S = 19.2\left[1 - \sqrt{1 - \frac{0.00266(66)^2(12.5)(1.0)}{(19.2)^2}}\right] = -4.1$$

+8.0 - MWL
-4.1
+3.9 = WTL

Setup:

$$S = 20.5\left[\left(\sqrt{\frac{0.00266(70)^2(12.5)(1.0)}{(20.5)^2} + 1}\right) - 1\right] = +3.6'$$

+3.6'
8.0 - MWL
+11.6 - WTL

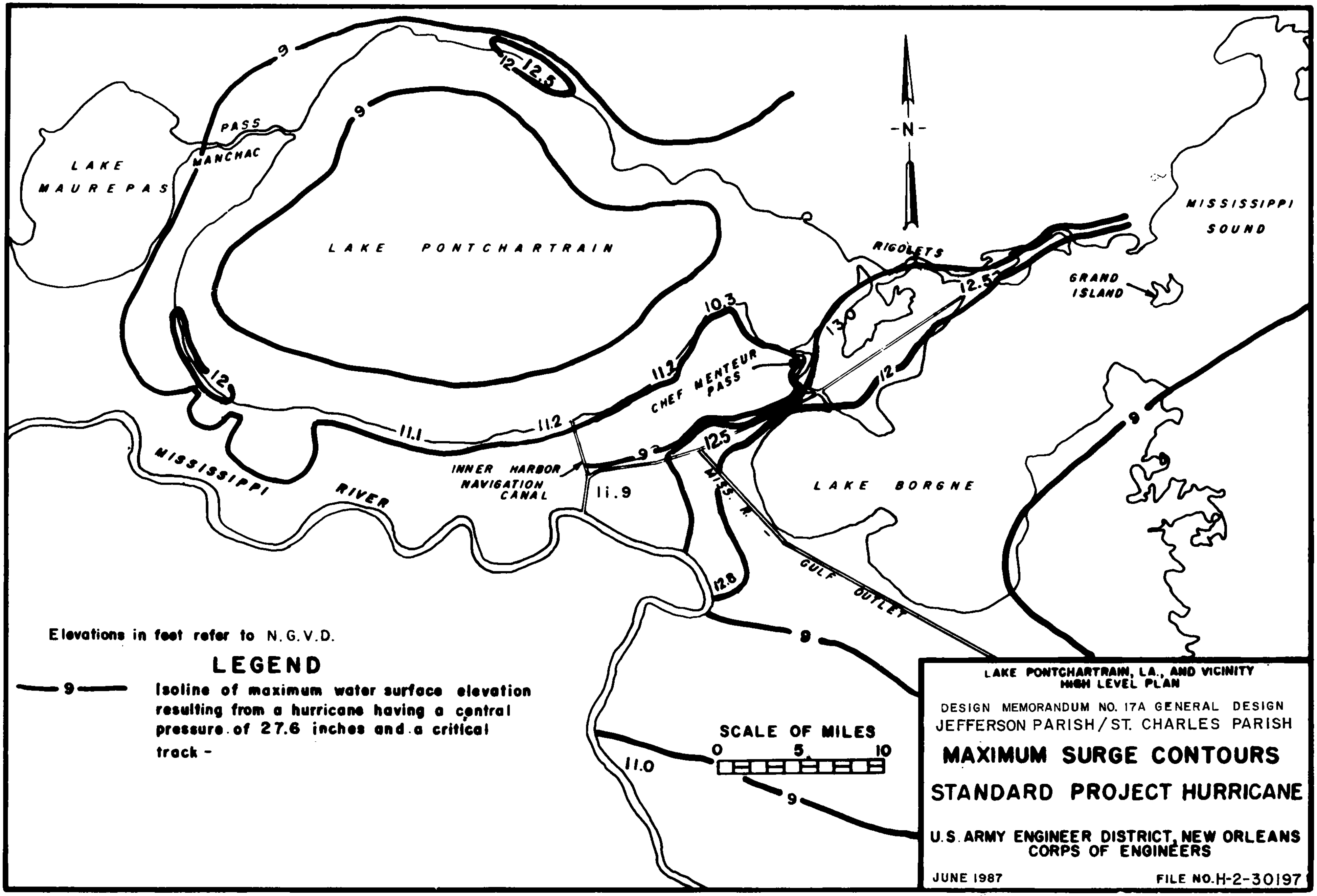
Interpolate with data for MWL = 6.0' to obtain WTL's for routed MWL = +7.28'.

LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

LAKE PONTCHARTRAIN TYPICAL WIND TIDE CONTOURS

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

JUNE 1987 FILE NO. H-2-30197



Elevations in feet refer to N.G.V.D.

LEGEND

—9— Isoline of maximum water surface elevation resulting from a hurricane having a central pressure of 27.6 inches and a critical track -

LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH / ST. CHARLES PARISH

MAXIMUM SURGE CONTOURS
STANDARD PROJECT HURRICANE

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-16

LEGEND

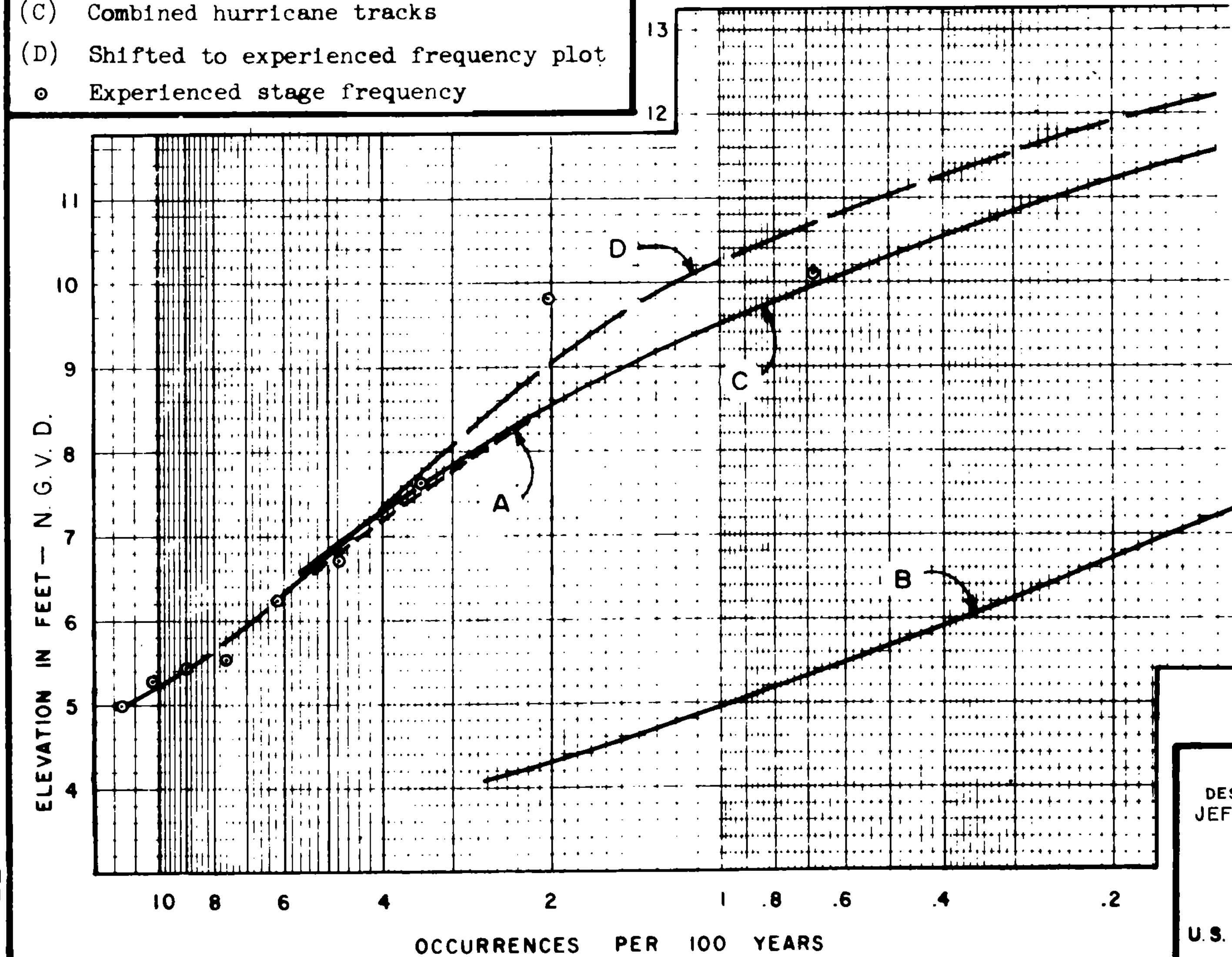
(A) Hurricane tracks from the south

(B) Hurricane tracks from the east

(C) Combined hurricane tracks

(D) Shifted to experienced frequency plot

⊙ Experienced stage frequency



FREQUENCY ANALYSIS

M	Years	Wind tide level (ft.)	(1) Probability
1	1901	10.1	.685
2	1893	9.8	2.05
3	1965	7.6	3.42
4	1915	6.7	4.79
5	1909	6.2	6.16
6	1947	5.5	7.53
7	1956	5.4	8.90
8	1964	5.3	10.27
9	1926	5.0	11.64

(1) Probability

$$P = \frac{100\,(M-0.5)}{Y} \quad \text{where}$$

M = Number of the event (rank)
Y = Number of years of record (73)

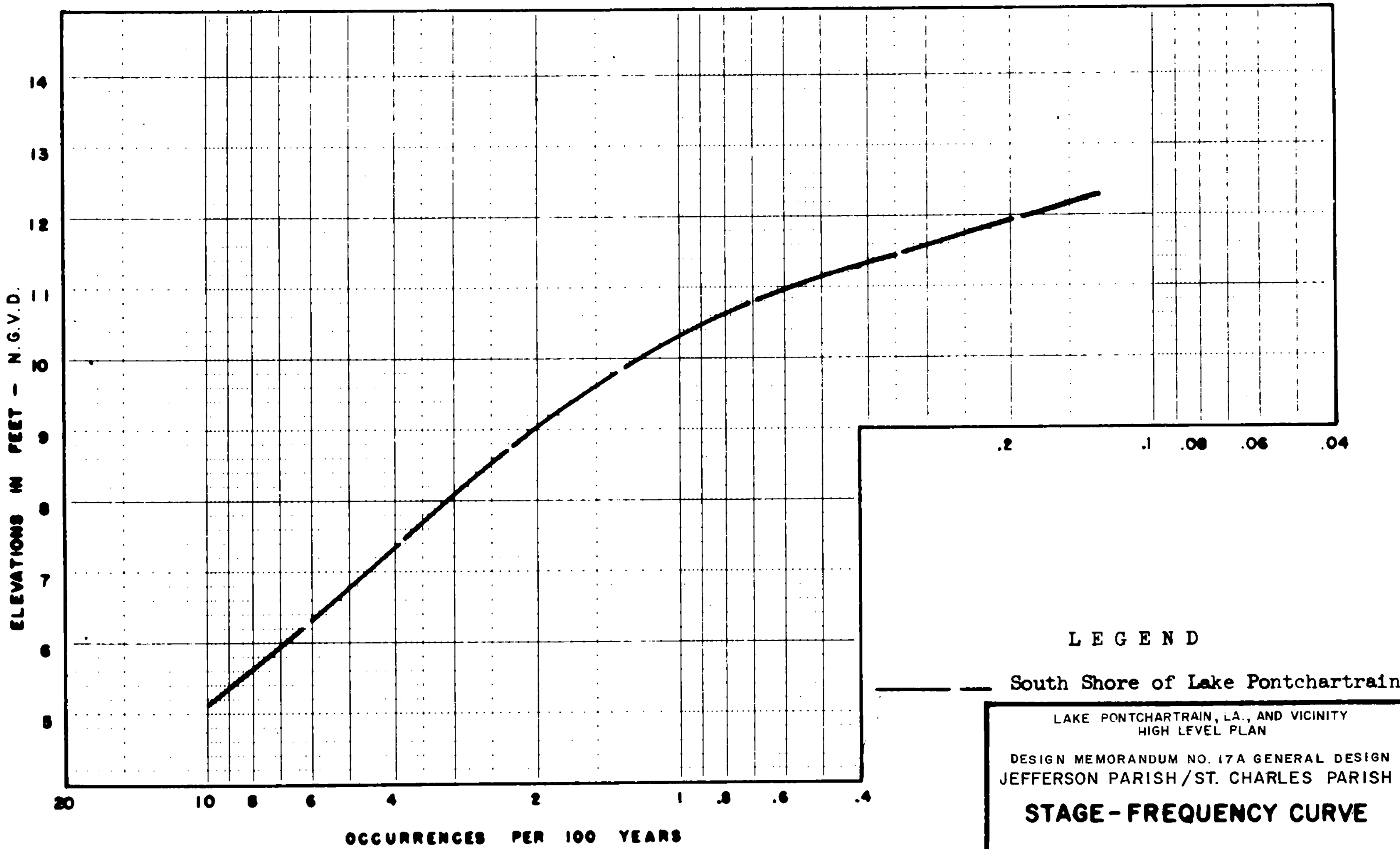
LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN
DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH/ST. CHARLES PARISH

STAGE – FREQUENCY
SOUTH SHORE OF
LAKE PONTCHARTRAIN

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

JUNE 1987 FILE NO. H-2-30197

PLATE A-17



LAKE PONTCHARTRAIN, LA., AND VICINITY
HIGH LEVEL PLAN

DESIGN MEMORANDUM NO. 17A GENERAL DESIGN
JEFFERSON PARISH / ST. CHARLES PARISH

STAGE-FREQUENCY CURVE

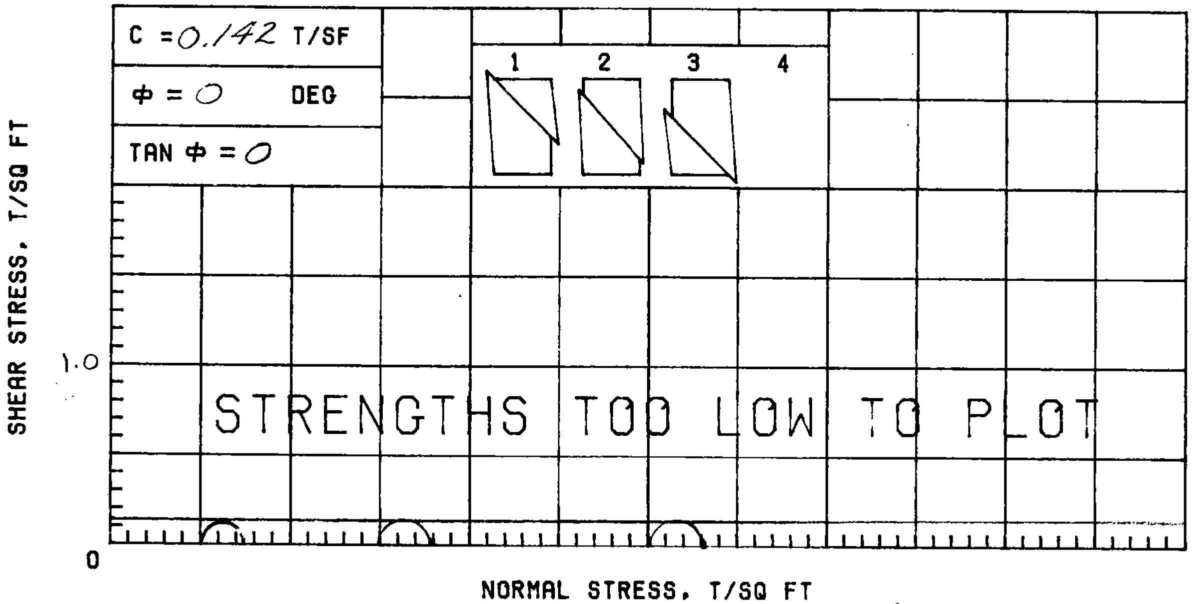
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

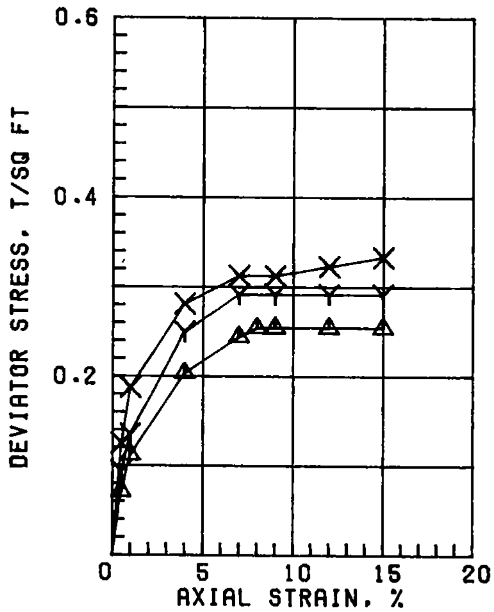
JUNE 1987 FILE NO. H-2-30197

PLATE A-18

APPENDIX B

SOIL TEST DATA SHEETS





γ Sat. 34

SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	145.8	124.2	118.7	
	DRY DENSITY, PCF	31.7	37.0	38.5	
	SATURATION, %	91.2	94.3	94.8	
	VOID RATIO	4.316	3.556	3.381	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.25	0.29	0.31	
TIME TO FAILURE, MIN.		16	14	17	
RATE OF STRAIN INCR.%					
INITIAL DIAMETER, IN.		1.39	1.37	1.37	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 129.6

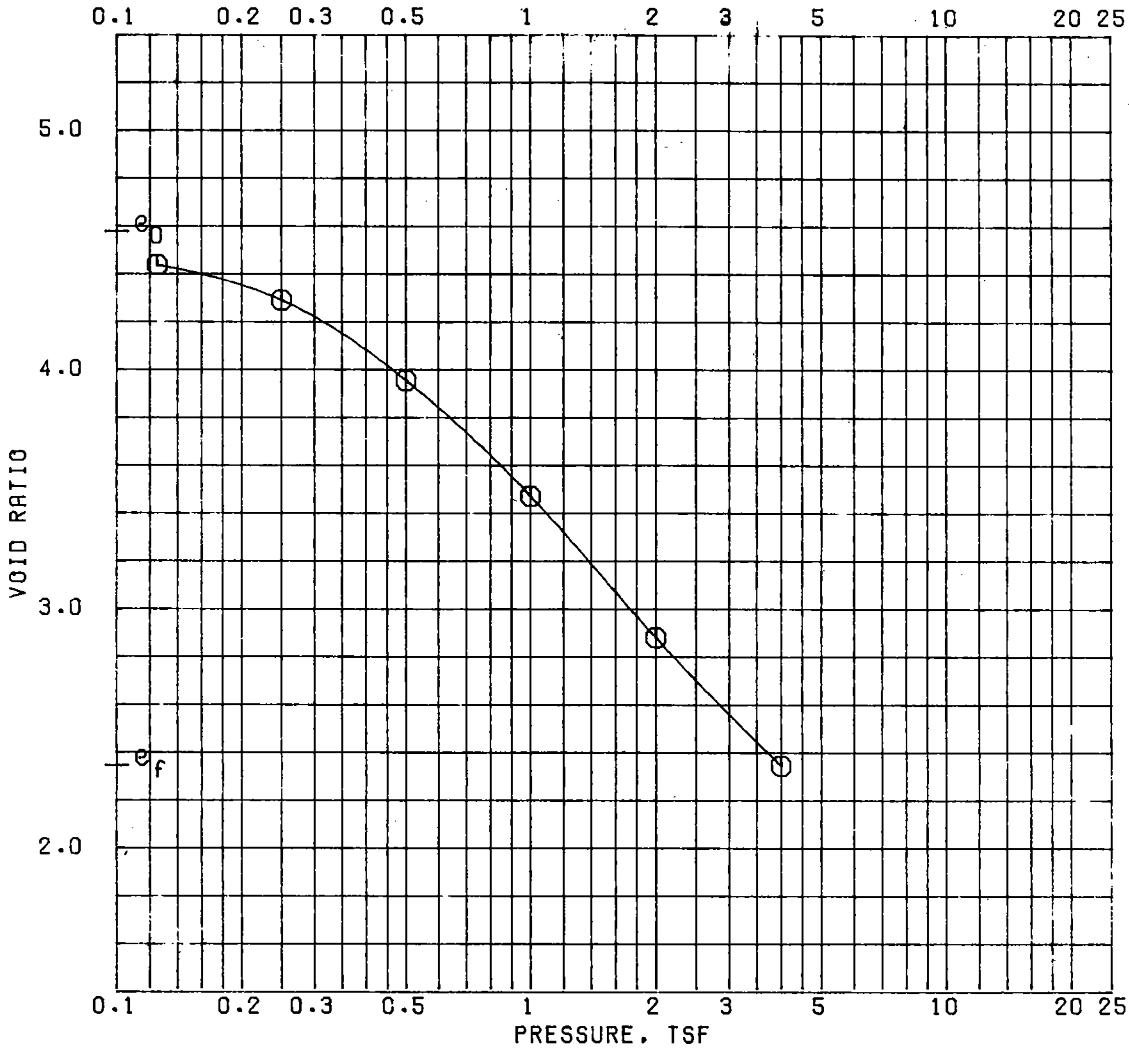
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; ORGANIC MATERIAL

LL 151	PL 54	PI 97	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 1-U	SAMPLE NO. 3-C
DEPTH/ELEV 7.9/-.75	TECH. LRC
LABORATORY USAE WES	DATE 27 JUL 85
TRIAXIAL COMPRESSION TEST REPORT	



γ Sat. 82

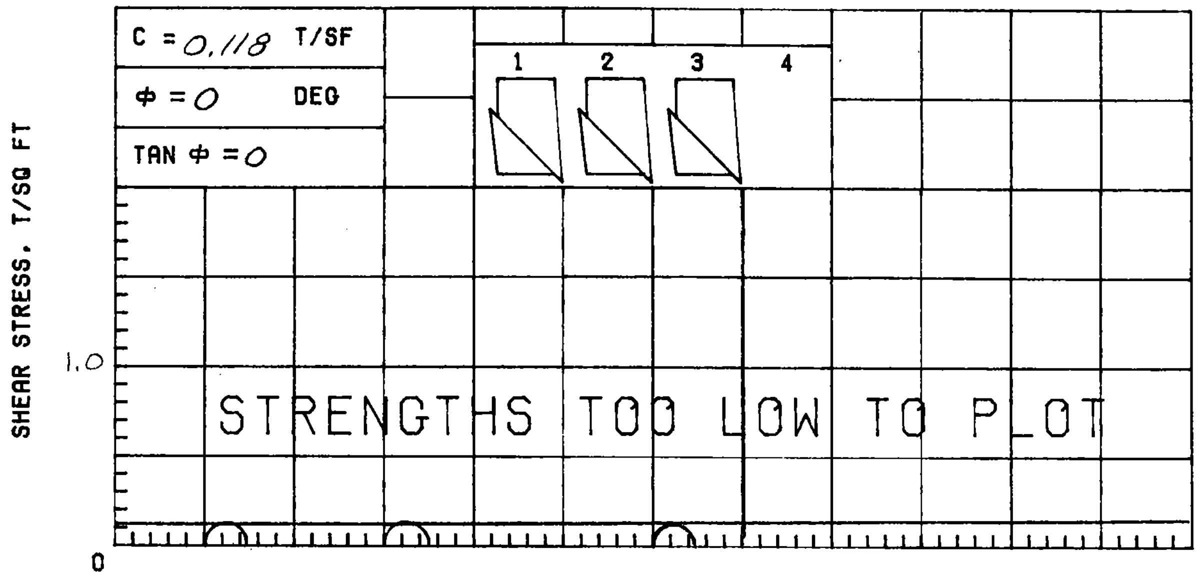
				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	152.3	83.5
PRECONSOL. PRESSURE, TSF		0.42	DRY DENSITY, PCF	30.3	50.5
COMPRESSION INDEX		4.20	SATURATION, %	90.0	96.5
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	4.571	2.339
DIA. IN 4.44	HT. IN 1.134		BACK PRESSURE, TSF		

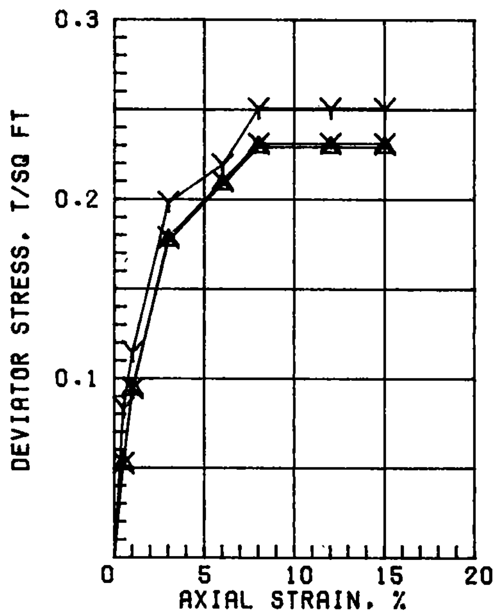
CLASSIFICATION PLASTIC CLAY (CH), DARK GRAY; ORGANIC MATERIAL				
LL 206	PL 44	PI 162	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES	
REMARKS			BORING NO. 1-U	SAMPLE NO. 4-C
			DEPTH/ELEV 12.3/-5.15	DATE 31 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8

C = 0.118 T/SF		
Φ = 0 DEG		
TAN Φ = 0		





8 Sat. 93

SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	91.5	87.3	91.5	
	DRY DENSITY, PCF	47.8	49.0	47.7	
	SATURATION, %	97.7	96.7	97.4	
	VOID RATIO	2.530	2.437	2.535	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.23	0.25	0.23	
TIME TO FAILURE, MIN.		16	16	16	
RATE OF STRAIN INCR.,%					
INITIAL DIAMETER, IN.		1.37	1.37	1.37	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

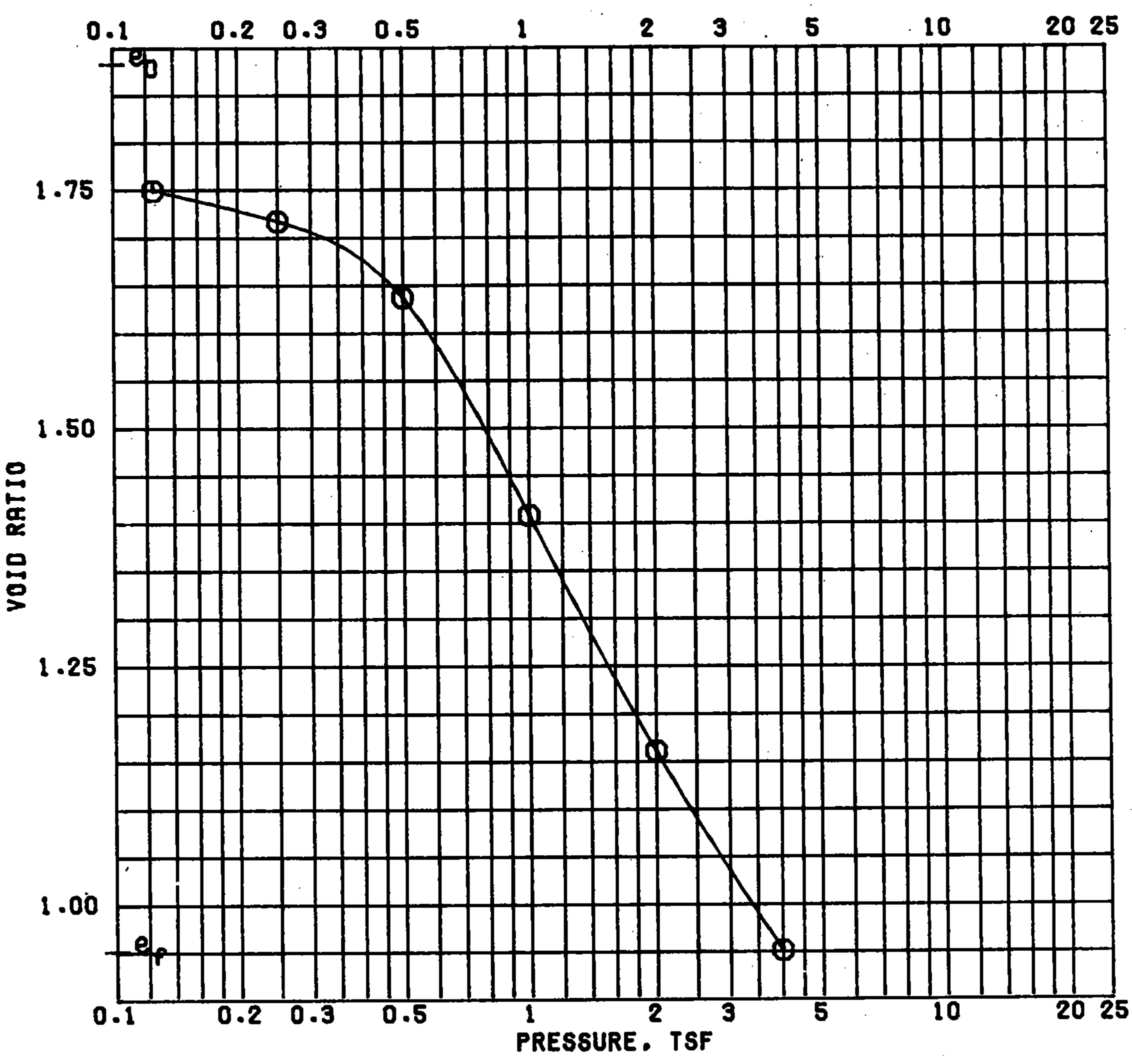
Avg. 90.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY; SILT LENSES; ORGANIC MATERIAL

LL 109	PL 30	PI 79	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 1-U	SAMPLE NO. 7-C
	DEPTH/ELEV 24.4/-17.25	TECH. LRC
	LABORATORY USAE WES	DATE 27 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	69.5	42.0
PRECONSOL. PRESSURE, TSF	0.49	DRY DENSITY, PCF	58.5	86.5
COMPRESSION INDEX	1.68	SATURATION, %	99.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.881	0.950
DIA. IN 4.44	HT. IN 1.122	BACK PRESSURE, TSF		

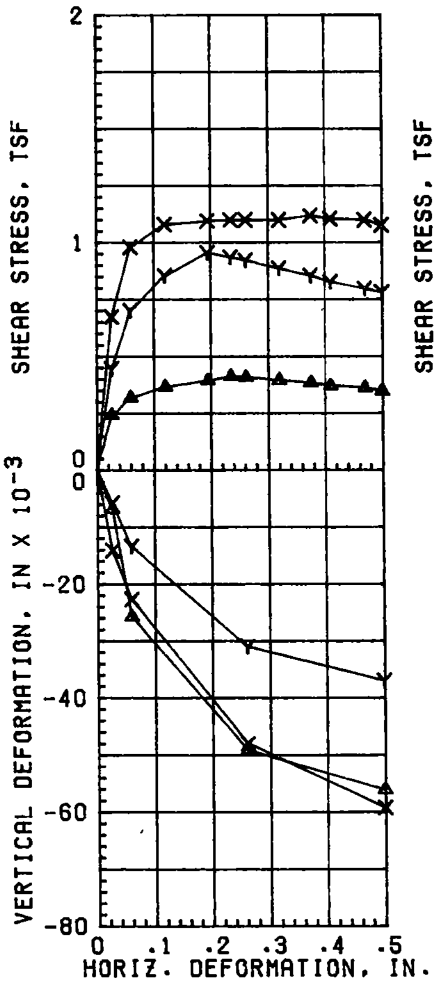
Handwritten above BEFORE TEST: γ Sat 99

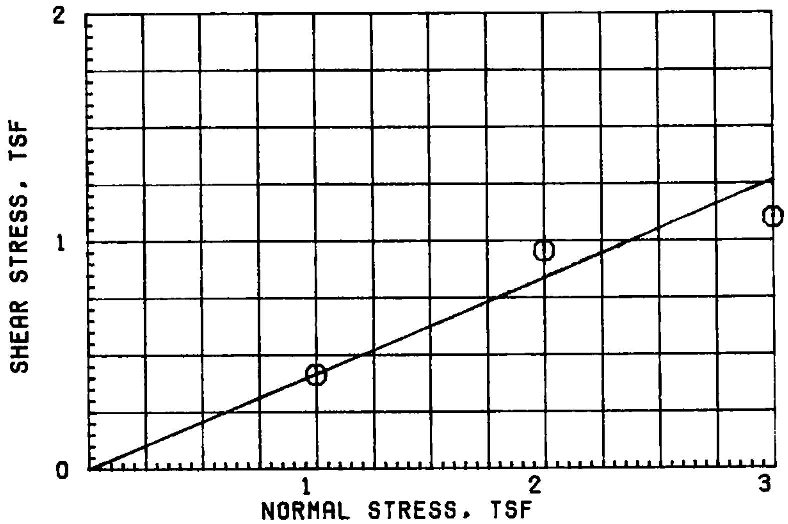
CLASSIFICATION PLASTIC CLAY (CH), GRAY: SILT LENSES

LL 76	PL 21	PI 55	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS		BORING NO. 1-U	SAMPLE NO. 8-B
		DEPTH/ELEV 27.5/-20.35	DATE 31 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8





γ sat 104

ϕ = 23°

TAN ϕ = 0.424

C = 0

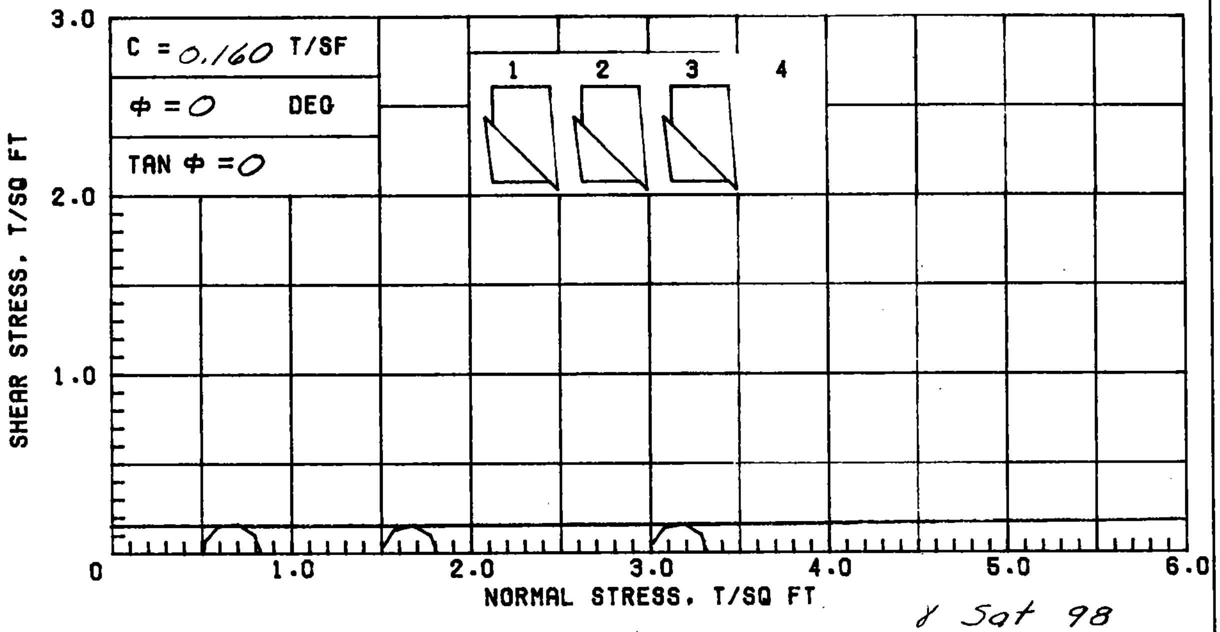
		TEST NO.	1 ▲	2 Y	3 X	
INITIAL	WATER CONTENT, %		59.2	60.5	60.8	Avg. 60.2
	VOID RATIO		1.595	1.597	1.624	
	SATURATION, %		100 +	100 +	100 +	
	DRY DENSITY, PCF		64.9	64.9	64.2	
VOID RATIO AFTER CONSOL						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL	WATER CONTENT, %		53.9	36.5	36.6	
	VOID RATIO					
	SATURATION, %					
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.41	0.95	1.10	
TIME TO FAILURE, MIN			1219	1012	1219	
RATE OF STRAIN, IN/MIN			.00019	.00019	.00019	
ULTIMATE SHEAR STRESS, TSF						

TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.629 IN. THICK

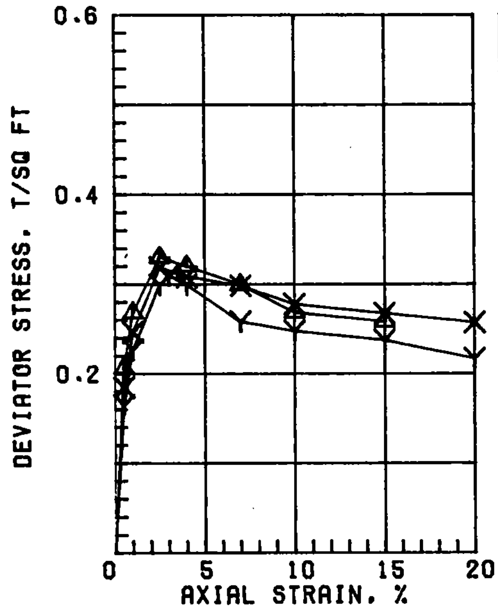
CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 56	PL 18	PI 38		GS 2.70 (EST)

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 1-U	SAMPLE 9-B
	DEPTH/ELEV 31.5/-24.35	DATE 27 AUG 85
	DIRECT SHEAR TEST REPORT	



γ Sat 98



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	76.5	76.8	76.0	
	DRY DENSITY, PCF	55.2	55.3	55.7	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.053	2.050	2.025	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.33	0.31	0.32	
TIME TO FAILURE, MIN.		5	20	17	
RATE OF STRAIN INCR.,%			4	4	
INITIAL DIAMETER, IN.		1.38	1.38	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

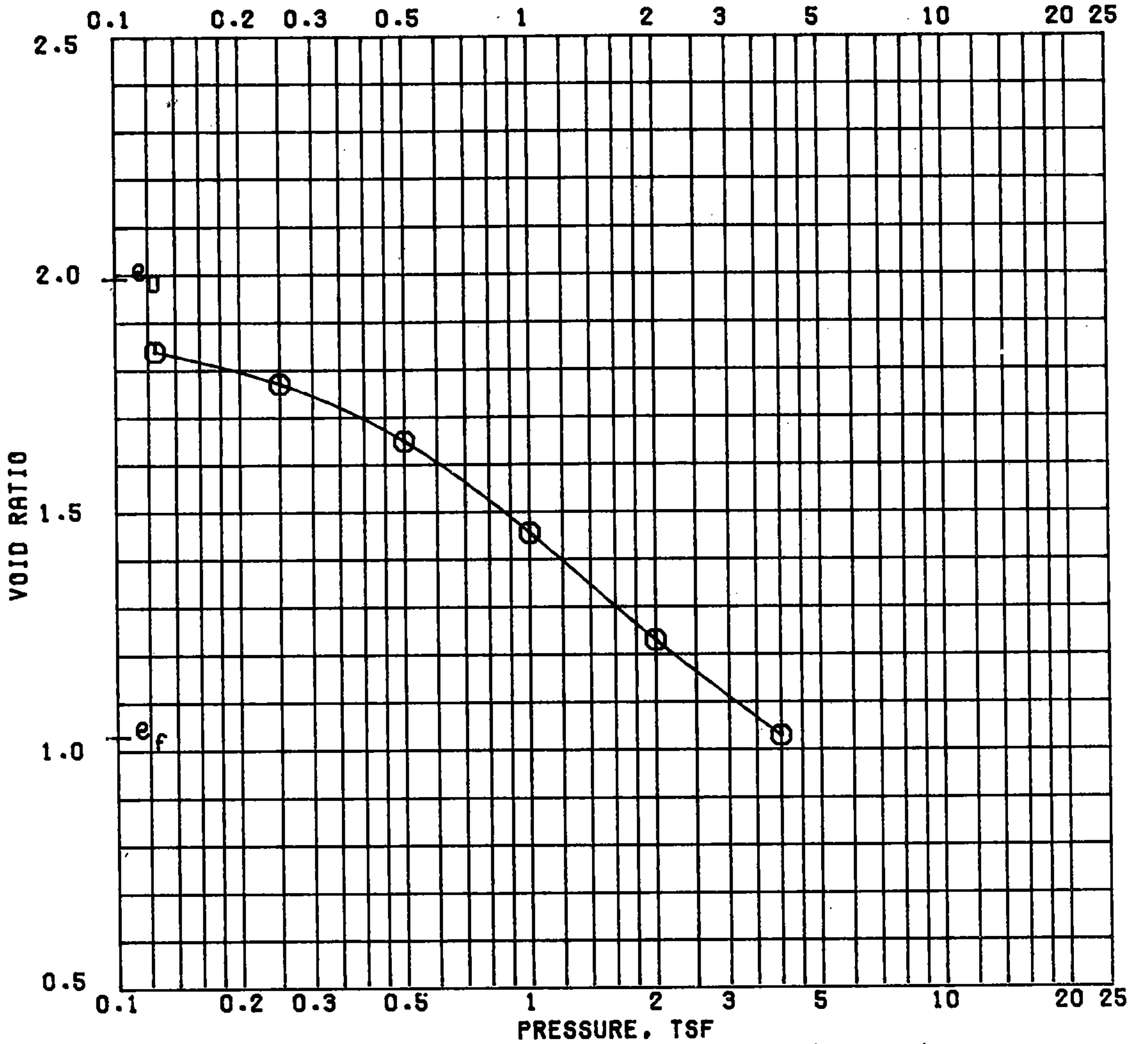
Avg. 76.4

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 80	PL 22	PI 58	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 1-U	SAMPLE NO. 10-C
	DEPTH/ELEV 35.8/-28.65	TECH. LRC
	LABORATORY USAE WES	DATE 27 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	

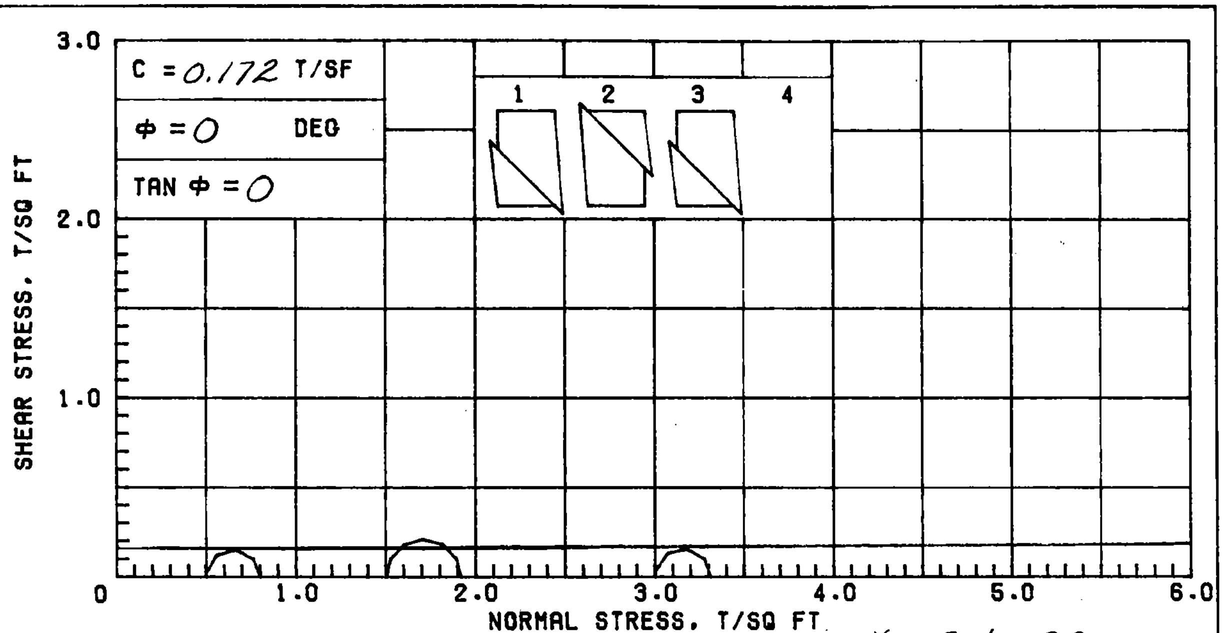


γ Sat 89

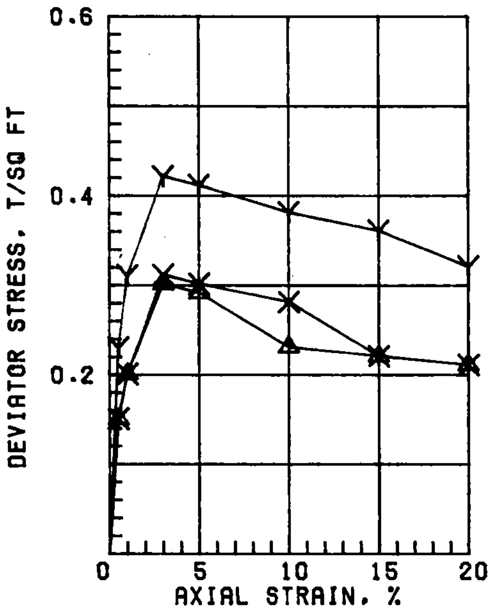
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	72.0	42.4
PRECONSOL. PRESSURE, TSF	0.47	DRY DENSITY, PCF	56.4	83.2
COMPRESSION INDEX	1.70	SATURATION, %	97.8	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.988	1.026
DIA. IN 4.44	HT. IN 1.128	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SILT LENSES				
LL 80	PL 22	PI 58	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES	
REMARKS			BORING NO. 1-U	SAMPLE NO. 12-B
			DEPTH/ELEV 43/-35.85	DATE 31 OCT 85
			CONSOLIDATION TEST REPORT	

SHEET 1 OF 8



γ Sat 98



		▲1	Y2	X3	4
	SPECIMEN NO.	▲1	Y2	X3	4
INITIAL	WATER CONTENT, %	72.1	71.5	72.7	
INITIAL	DRY DENSITY, PCF	57.0	57.8	56.6	
INITIAL	SATURATION, %	99.5	100+	99.3	
INITIAL	VOID RATIO	1.957	1.915	1.977	
BEFORE SHEAR	WATER CONTENT, %				
BEFORE SHEAR	DRY DENSITY, PCF				
BEFORE SHEAR	SATURATION, %				
BEFORE SHEAR	VOID RATIO				
BEFORE SHEAR	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.30	0.42	0.31	
	TIME TO FAILURE, MIN.	6	18	18	
	RATE OF STRAIN INCR.%		6	6	
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 72.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

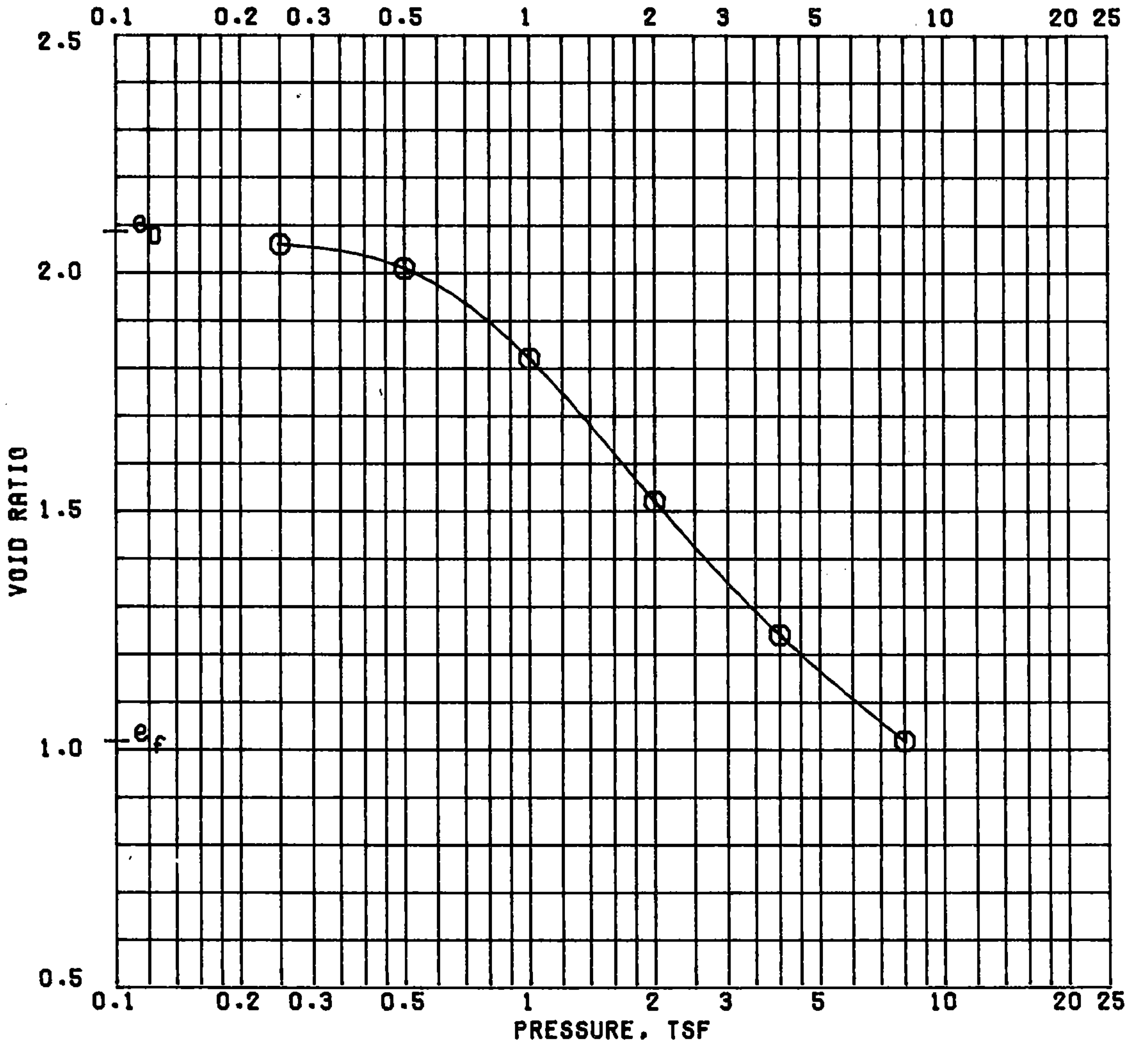
LL 83	PL 25	PI 58	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISH

BORING NO. 1-U	SAMPLE NO. 13-B
DEPTH/ELEV 47.3/-40.15	TECH. KOC
LABORATORY USAE WES	DATE 29 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 97

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	73.5	39.4
PRECONSOL. PRESSURE, TSF	0.71	DRY DENSITY, PCF	54.7	83.7
COMPRESSION INDEX	1.98	SATURATION, %	95.3	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.083	1.015
DIA. IN 4.44	HT. IN 1.128	BACK PRESSURE, TSF		

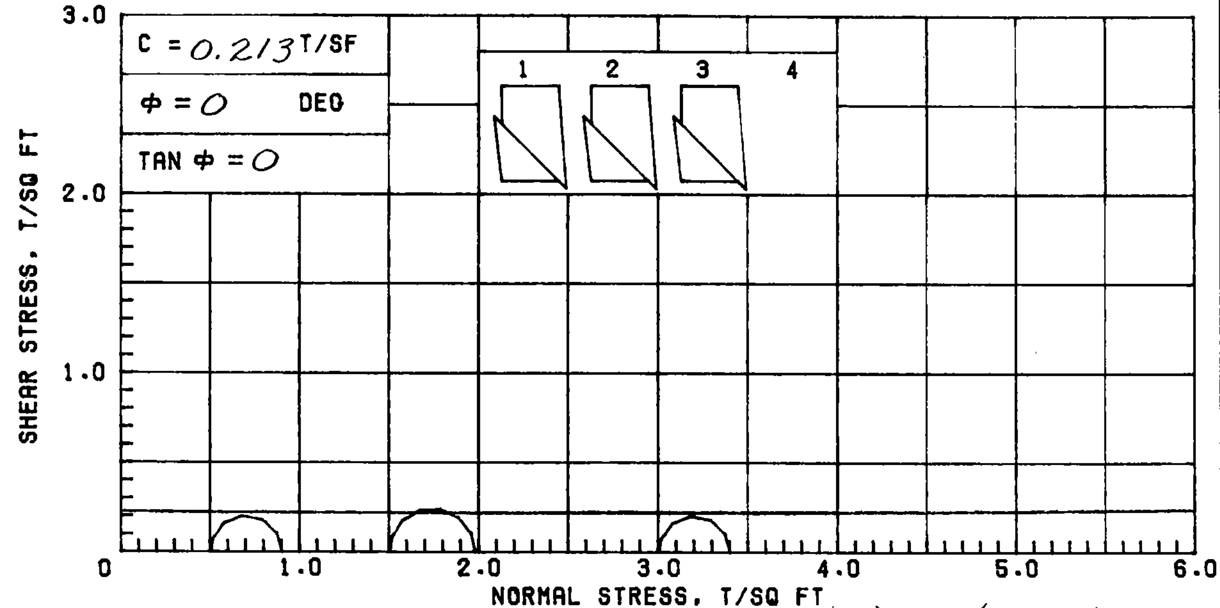
CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 89	PL 24	PI 65	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES

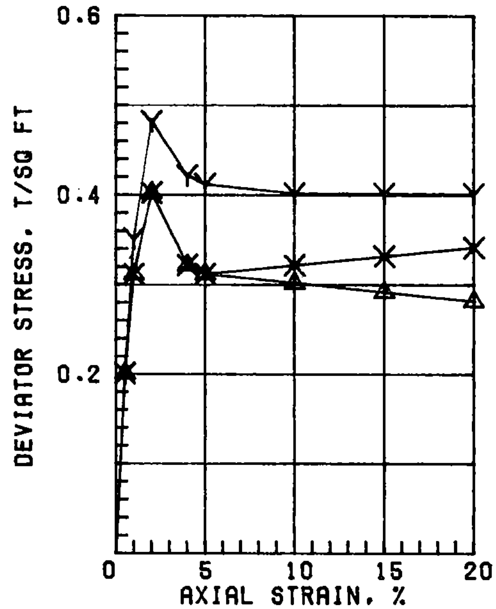
REMARKS	BORING NO. 1-U	SAMPLE NO. 15-B
	DEPTH/ELEV 54.7/-47.55	DATE 31 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



γ sat 104



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	60.8	56.2	59.7	
	DRY DENSITY, PCF	64.1	67.3	64.5	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.629	1.506	1.611	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.40	0.48	0.40	
TIME TO FAILURE, MIN.		4	12	12	
RATE OF STRAIN INCR,%			6	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 58.9

CONTROLLED-STRAIN TEST

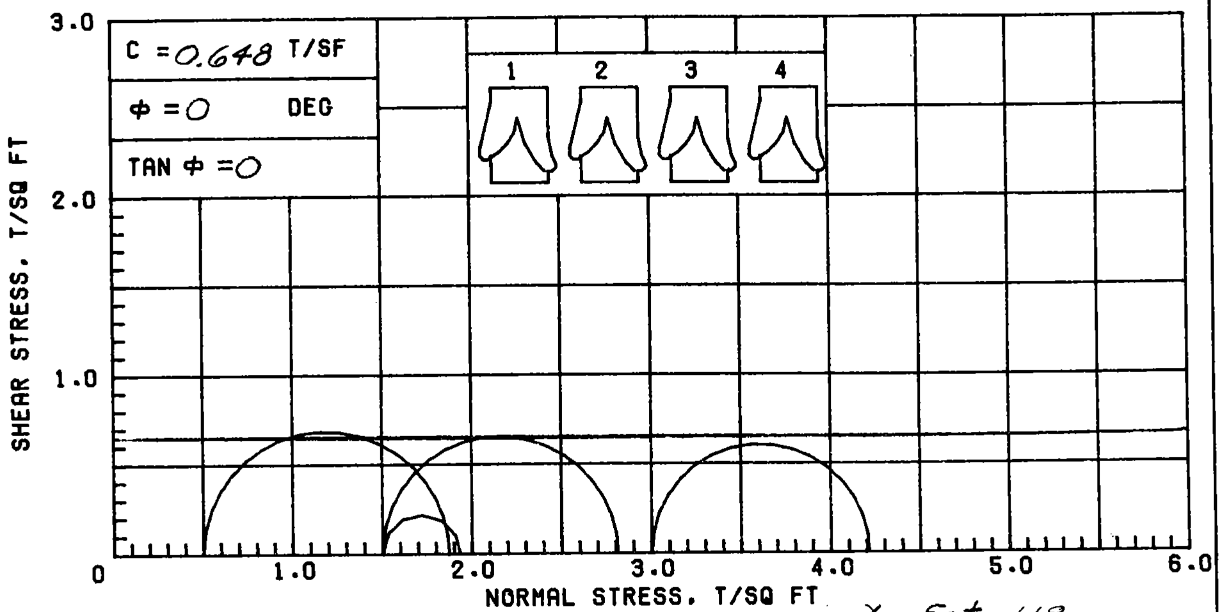
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT SEAMS; SHELL PARTICLES

LL 71	PL 18	PI 53	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

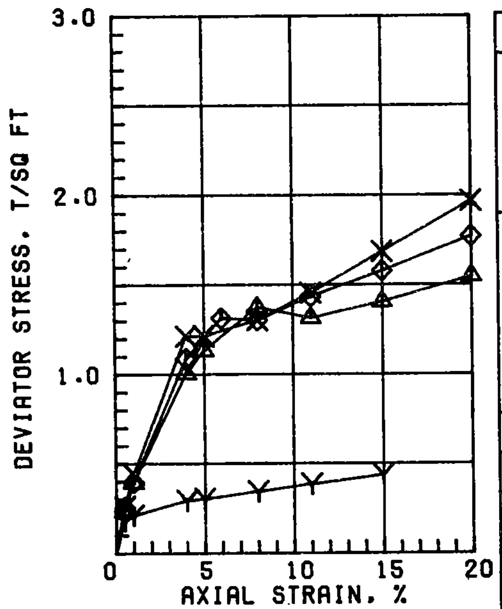
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 1-U	SAMPLE NO. 17-B
DEPTH/ELEV 63.3/-56.15	TECH. KOC
LABORATORY USAE WES	DATE 29 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 118



SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	31.4	42.8	31.5	31.8
	DRY DENSITY, PCF	91.2	79.4	91.2	90.8
	SATURATION, %	100.0	100+	100+	100+
	VOID RATIO	0.848	1.123	0.848	0.857
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	1.5
MAX. DEV. STRESS, TSF		1.37	0.43	1.21	1.31
TIME TO FAILURE, MIN.		16	30	8	18
RATE OF STRAIN INCR.%					
INITIAL DIAMETER, IN.		1.40	1.39	1.40	1.39
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 34.4

CONTROLLED-STRAIN TEST

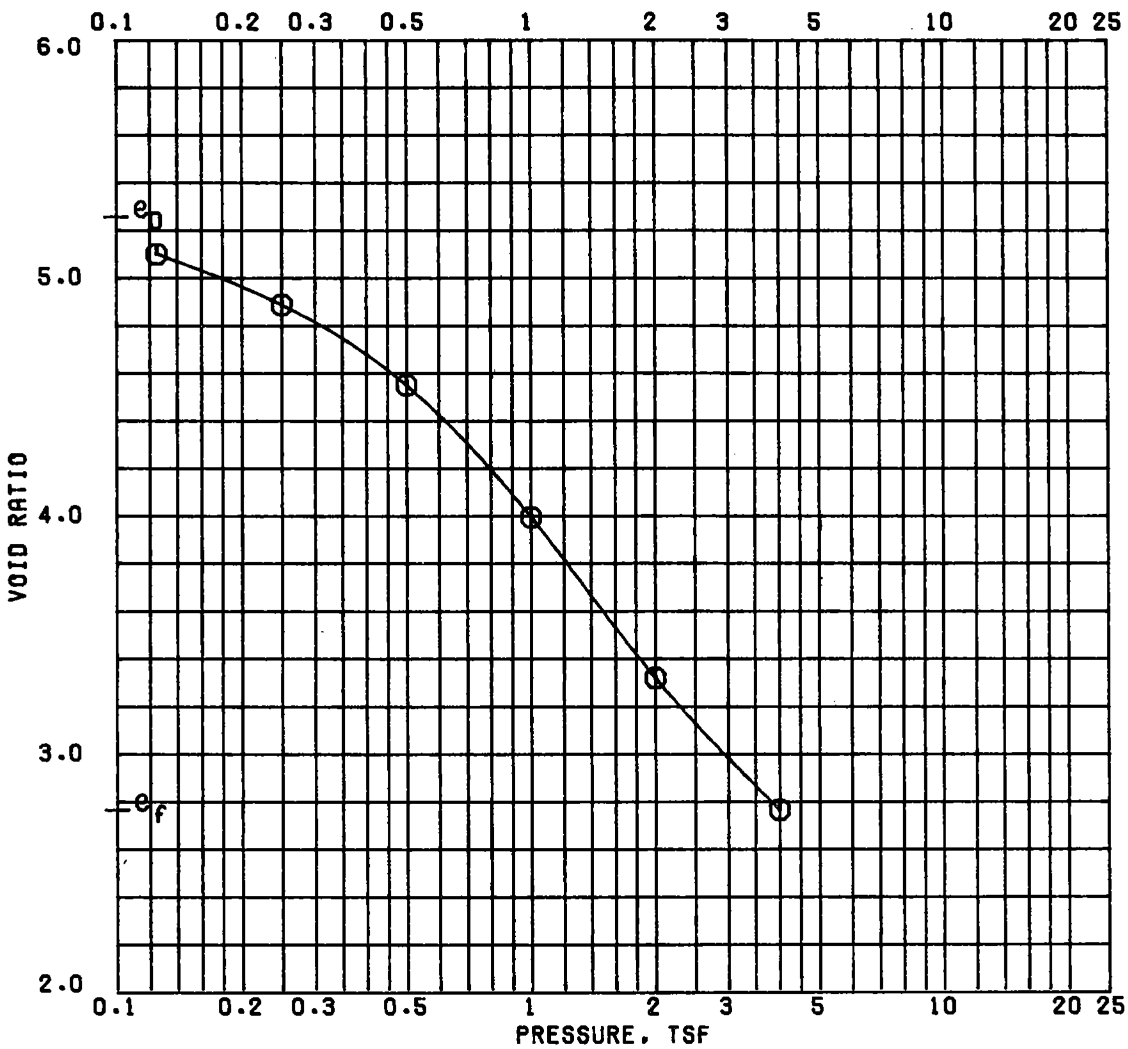
DESCRIPTION OF SPECIMENS: CLAY (CL), LIGHT GRAY

LL 40	PL 19	PI 21	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 3-U	SAMPLE NO. 4-C
DEPTH/ELEV 10.5/-3.09	TECH. PJR
LABORATORY USAE WES	DATE 29 JUL 85

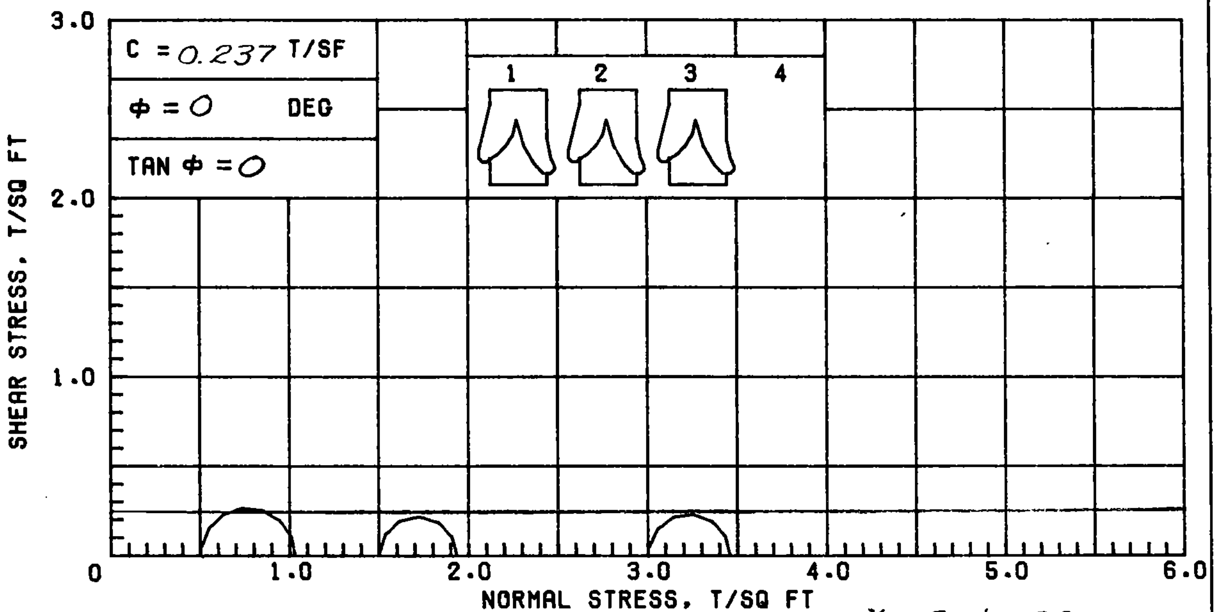
TRIAXIAL COMPRESSION TEST REPORT



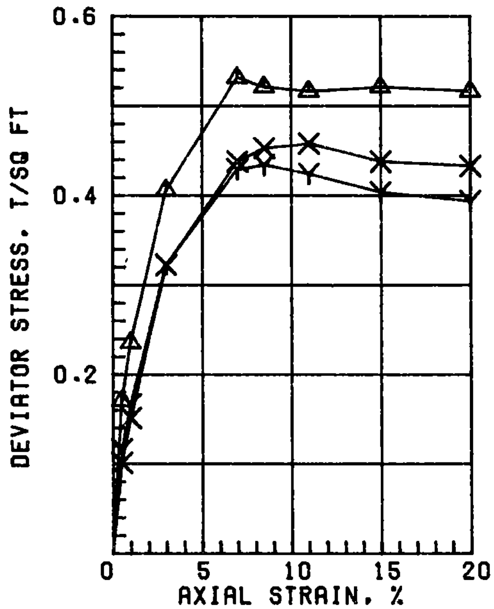
γ Sat 80

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	179.9	98.9
PRECONSOL. PRESSURE, TSF	0.49	DRY DENSITY, PCF	27.0	44.9
COMPRESSION INDEX	4.66	SATURATION, %	92.5	96.8
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	5.250	2.758
DIA. IN 4.44	HT. IN 1.113	BACK PRESSURE, TSF		
CLASSIFICATION	PLASTIC CLAY (CH), GRAY; ORGANIC MATERIAL			
LL 177	PL 57	PI 120	PROJECT LAKE PONT. LA. & VIC HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES	
REMARKS		BORING NO. 3-U	SAMPLE NO. 5-B	
		DEPTH/ELEV 15.0/-7.59	DATE 26 SEP 85	
		CONSOLIDATION TEST REPORT		

SHEET 1 OF 8



γ Sat 73



SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	297.1	289.1	298.0	
	DRY DENSITY, PCF	17.6	17.7	17.4	
	SATURATION, %	93.6	91.7	92.7	
	VOID RATIO	8.570	8.510	8.683	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.53	0.43	0.46	
TIME TO FAILURE, MIN.		14	17	22	
RATE OF STRAIN INCR.,%					
INITIAL DIAMETER, IN.		1.40	1.39	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

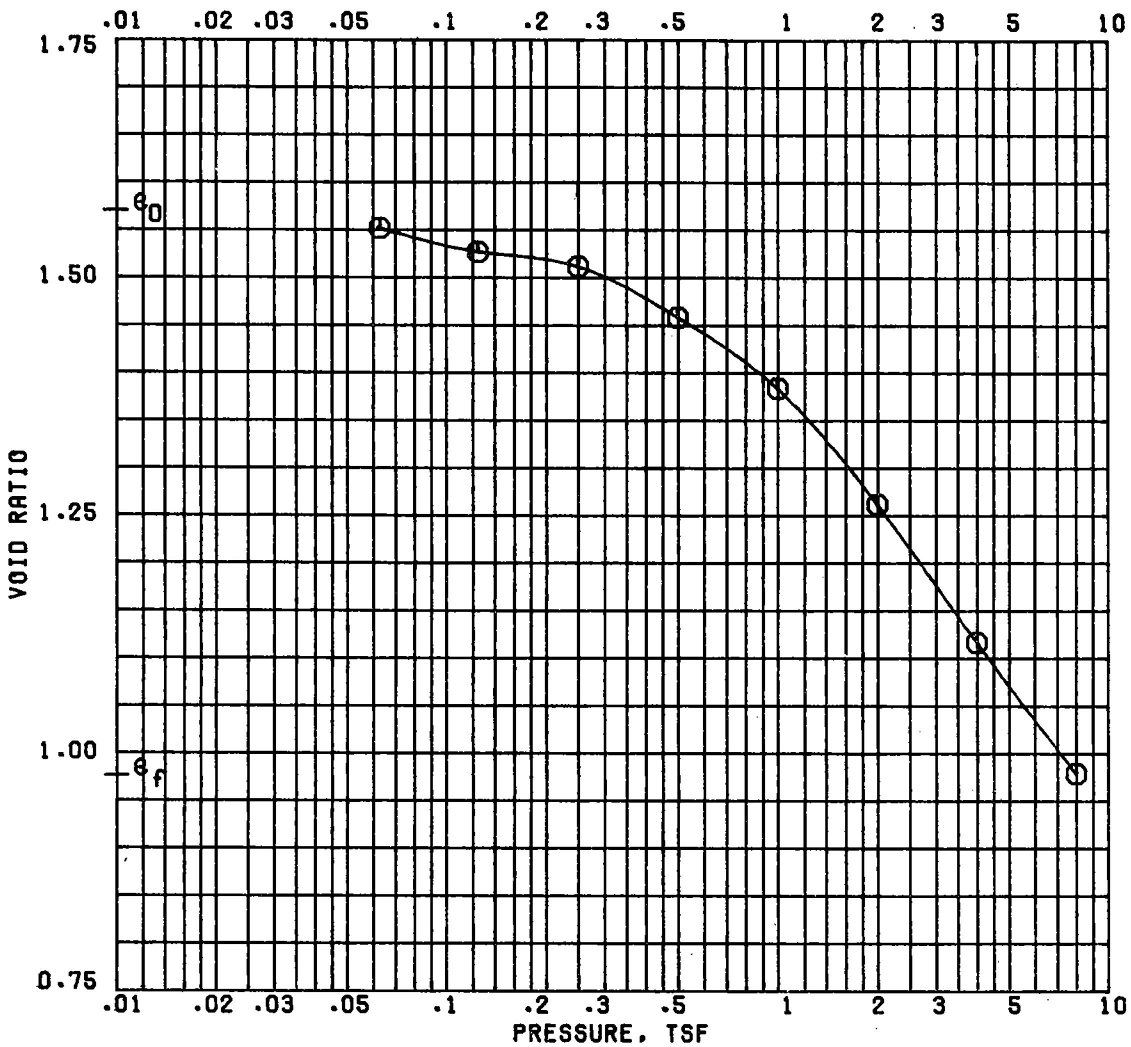
Avg. 294.7

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), DARK BROWN; ORGANIC MATERIAL

LL 427	PL 128	PI 299	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 3-U	SAMPLE NO. 7-C
	DEPTH/ELEV 23.6/-16.19	TECH. PJR
	LABORATORY USAE WES	DATE 29 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 104

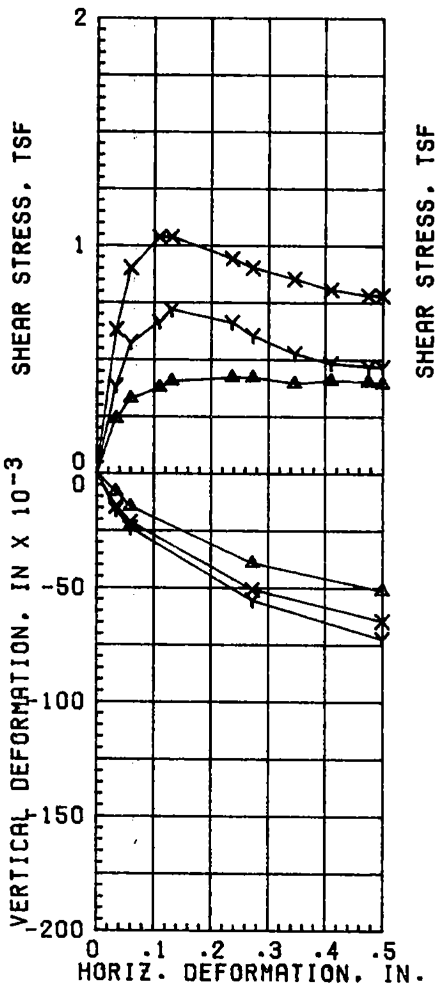
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	54.7	34.9
PRECONSOL. PRESSURE, TSF	0.66	DRY DENSITY, PCF	65.6	85.4
COMPRESSION INDEX	1.48	SATURATION, %	94.2	96.6
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.568	0.974
DIA. IN 4.44	HT. IN 1.124	BACK PRESSURE, TSF		

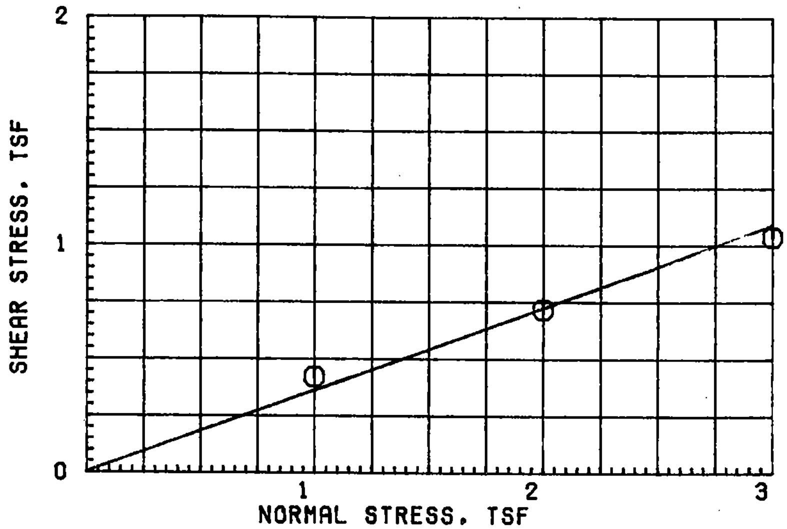
CLASSIFICATION CLAY (CL), GRAY

LL 48	PL 24	PI 24	PROJECT LAKE PONT. LA. & VIC HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS		BORING NO. 3-U	SAMPLE NO. 9-C
		DEPTH/ELEV 32.0/-24.59	DATE 26 SEP 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 9





γ Sat 100

ϕ = 20°

TAN ϕ = 0.364

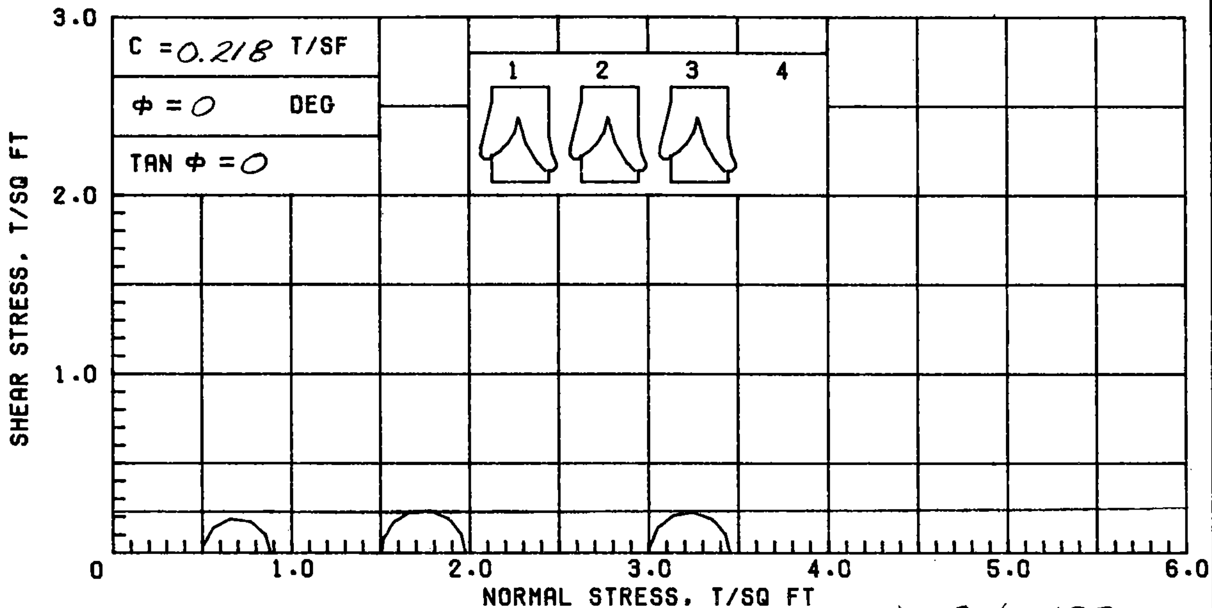
C = 0

TEST NO.		1 ▲	2 Y	3 X	
INITAL	WATER CONTENT, %	66.2	64.5	64.0	Avg. 64.9
	VOID RATIO	1.898	1.795	1.816	
	SATURATION, %	94.2	97.0	95.1	
	DRY DENSITY, PCF	58.1	60.3	59.8	
VOID RATIO AFTER CONSOL					
FIFTY PERCENT CONSOL, MIN		< 1	< 1	< 1	
FINAL	WATER CONTENT, %	51.4	46.1	45.7	
	VOID RATIO				
	SATURATION, %				
NORMAL STRESS, TSF		1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF		0.42	0.72	1.04	
TIME TO FAILURE, MIN		1112	614	516	
RATE OF STRAIN, IN/MIN		.00021	.00021	.00021	
ULTIMATE SHEAR STRESS, TSF					

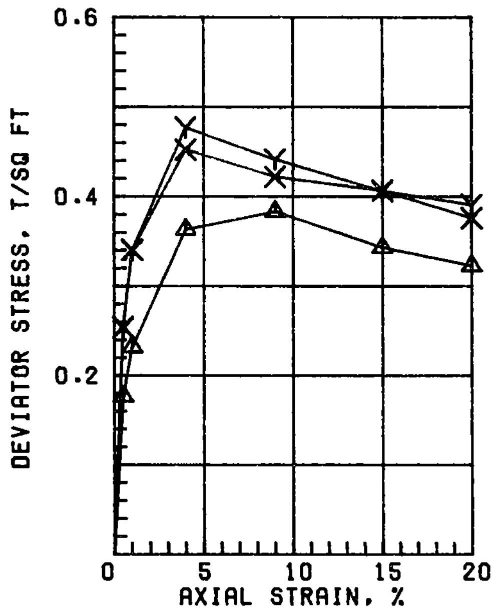
TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.628 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY		

LL 61	PL 19	PI 42		GS 2.70 (EST)

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 3-U	SAMPLE 10-B
	DEPTH/ELEV 34.8/-27.39	DATE 28 AUG 85
	DIRECT SHEAR TEST REPORT	



γ Sat 103



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	60.6	60.1	60.5	
	DRY DENSITY, PCF	64.3	64.4	64.5	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.623	1.617	1.614	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.38	0.48	0.45	
	TIME TO FAILURE, MIN.	20	10	15	
	RATE OF STRAIN INCR.%			8	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

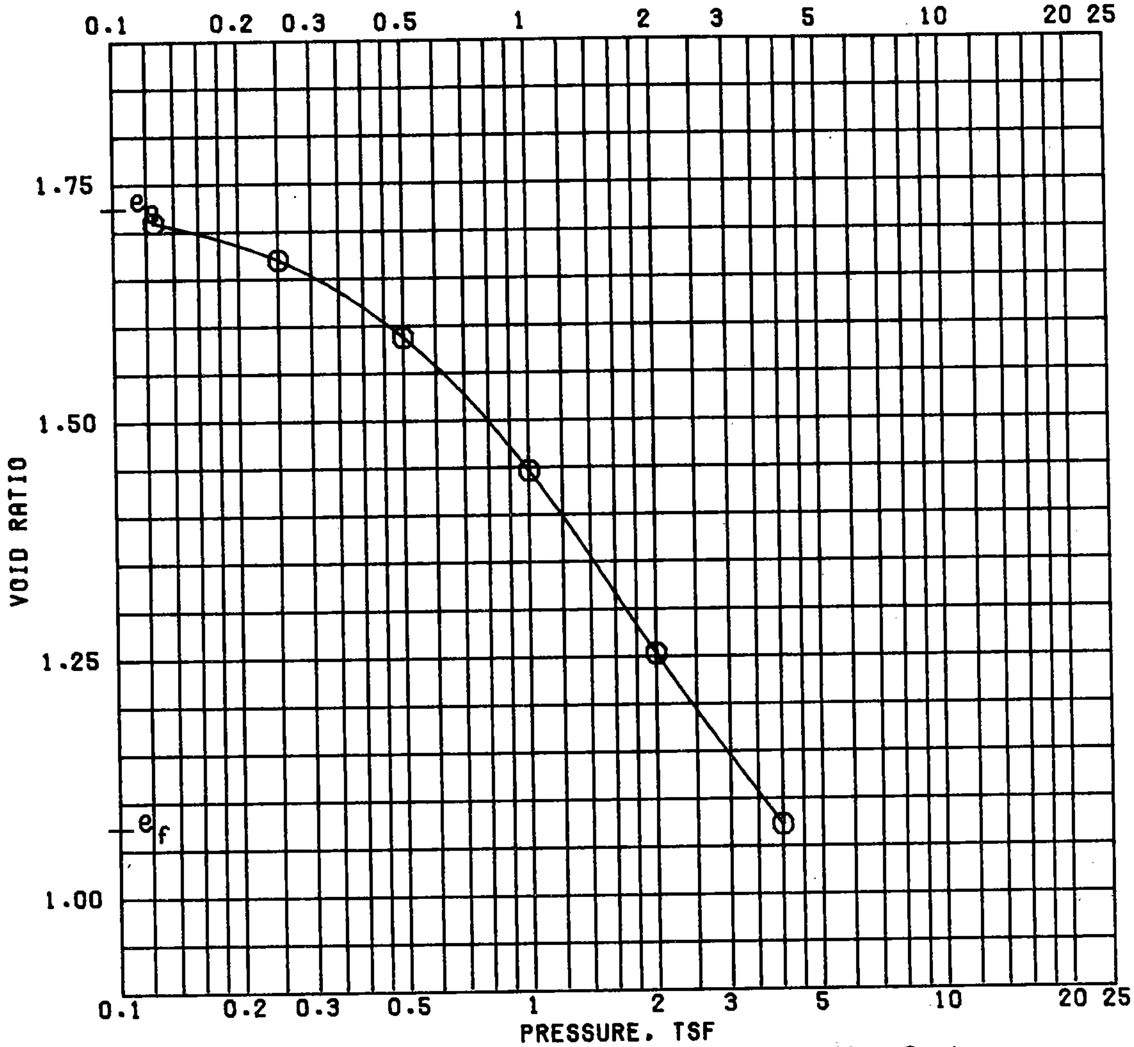
Avg. 60.4

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 63	PL 20	PI 43	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 3-U	SAMPLE NO. 11-B
	DEPTH/ELEV 38.8/-31.39	TECH. PJR
	LABORATORY USAE WES	DATE 29 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



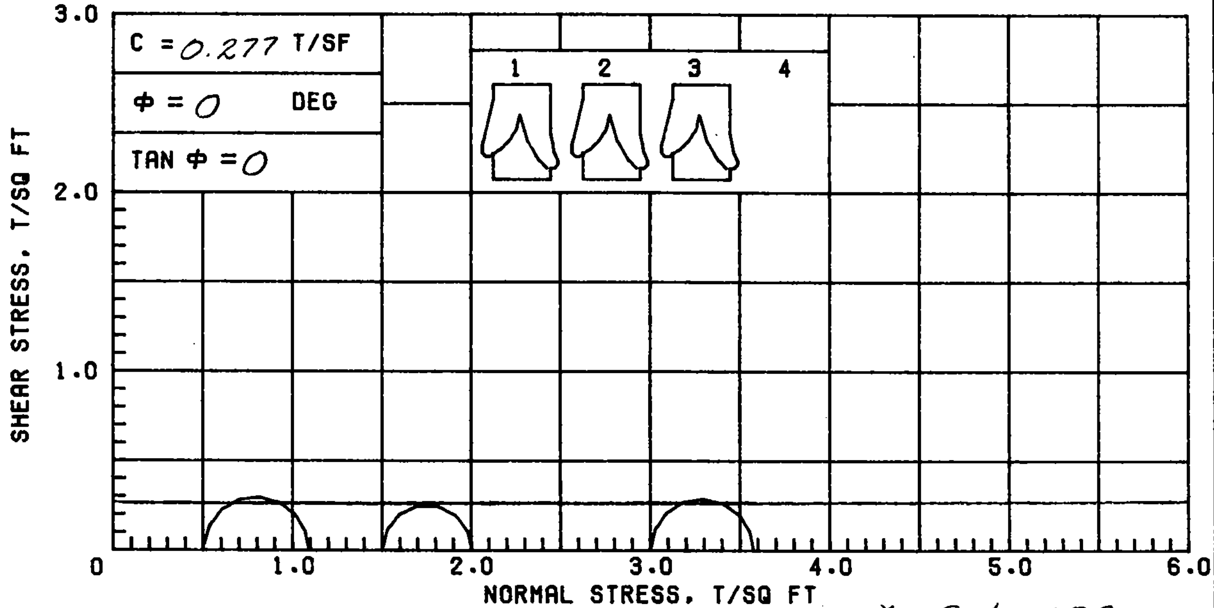
γ Sat 101

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	63.0	41.2
PRECONSOL. PRESSURE, TSF	0.56	DRY DENSITY, PCF	61.9	81.4
COMPRESSION INDEX	1.62	SATURATION, %	98.8	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.722	1.071
DIA. IN 4.44	HT. IN 1.120	BACK PRESSURE, TSF		

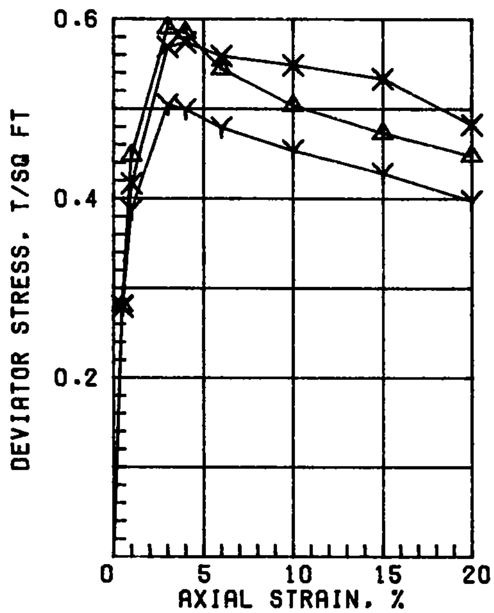
CLASSIFICATION PLASTIC CLAY (CH), GRAY			
LL 91	PL 24	PI 67	PROJECT LAKE PONT. LA. & VIC HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS			BORING NO. 3-U / SAMPLE NO. 12-B
			DEPTH/ELEV 43.2/-35.79 / DATE 27 SEP 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



γ Sat 102



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	67.2	68.0	66.2	
	DRY DENSITY, PCF	60.8	60.5	61.0	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.775	1.785	1.761	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.59	0.50	0.57	
	TIME TO FAILURE, MIN.	6	15	20	
	RATE OF STRAIN INCR.,%		6	6	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

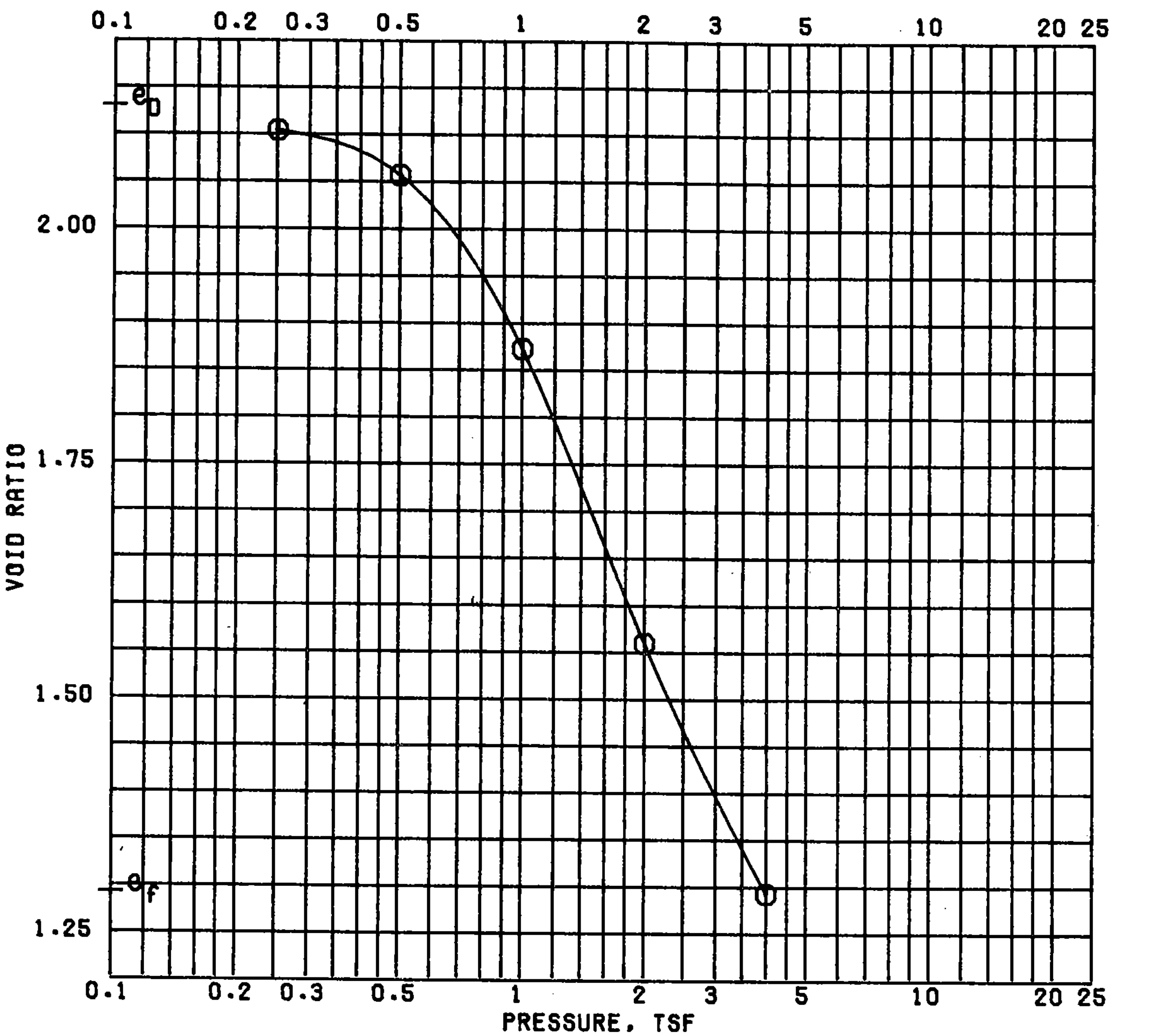
Avg. 67.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 84	PL 22	PI 62	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 3-U	SAMPLE NO. 14-B
	DEPTH/ELEV 51.0/-43.59	TECH. PJR
	LABORATORY USAE WES	DATE 30 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 96

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	77.0	51.5
PRECONSOL. PRESSURE, TSF	0.69	DRY DENSITY, PCF	53.9	73.6
COMPRESSION INDEX	2.05	SATURATION, %	97.6	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.129	1.291
DIA. IN 4.44	HT. IN 1.115	BACK PRESSURE, TSF		

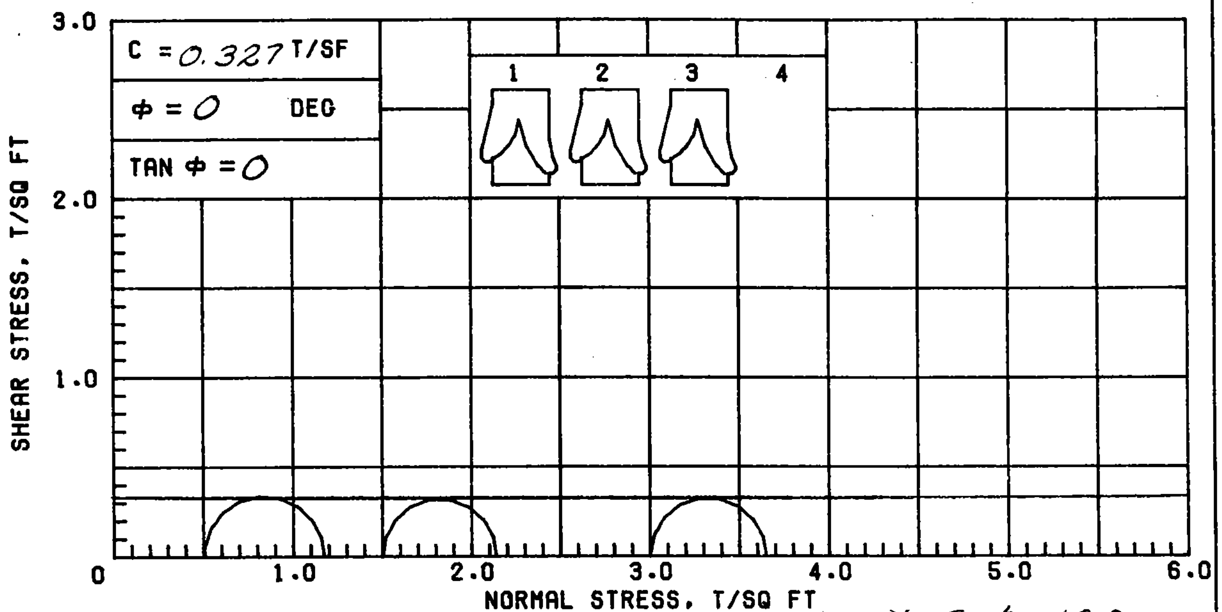
CLASSIFICATION PLASTIC CLAY (CH), GRAY		
LL 74	PL 22	PI 52
GS 2.70 (EST)	D_{10}	
REMARKS		

PROJECT LAKE PONT. LA. & VIC HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

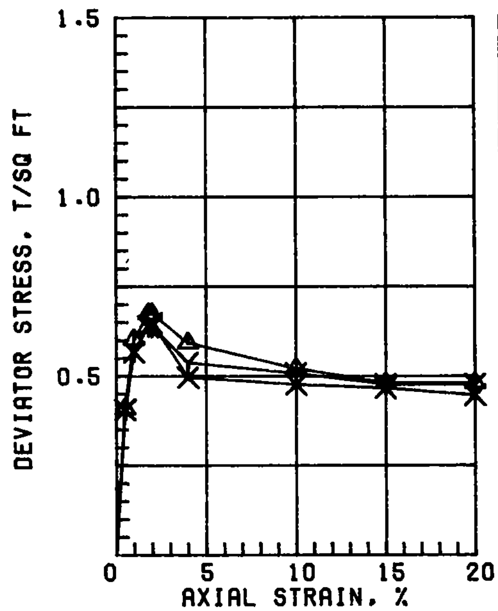
BORING NO. 3-U	SAMPLE NO. 15-B
DEPTH/ELEV 55.0/-47.59	DATE 27 SEP 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 7



γ Sat 100



		Δ1	Y2	X3	4
SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	70.6	70.7	71.1	
	DRY DENSITY, PCF	58.6	58.6	58.5	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.878	1.875	1.881	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.67	0.64	0.65	
TIME TO FAILURE, MIN.		3	16	18	
RATE OF STRAIN INCR.%			4	4	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 70.8

CONTROLLED-STRAIN TEST

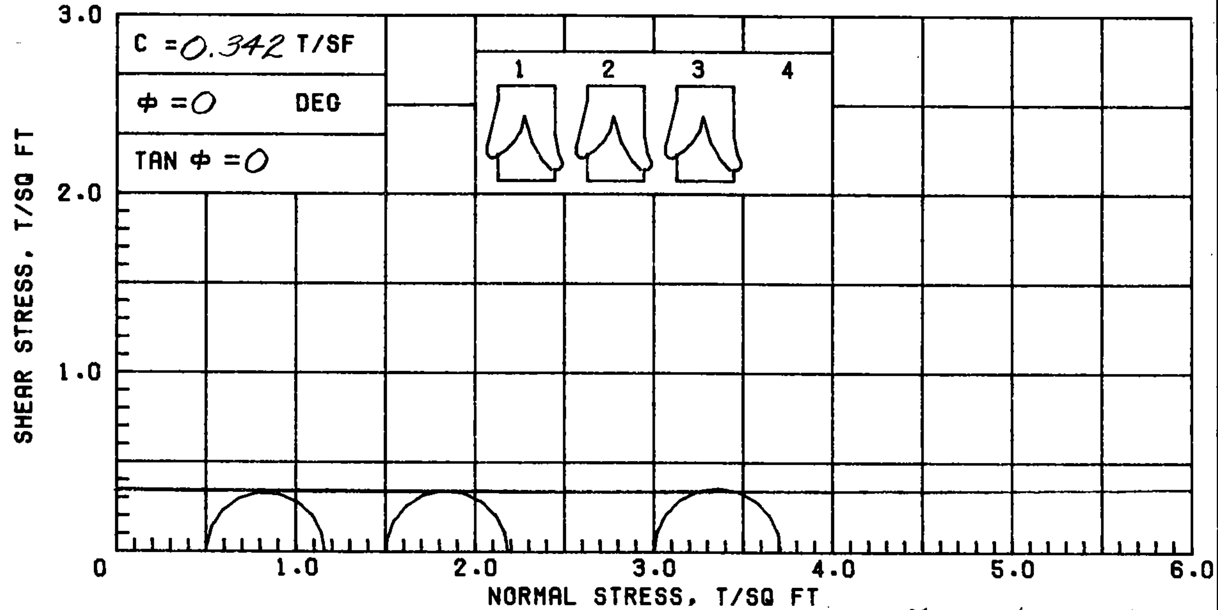
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 80	PL 19	PI 61	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

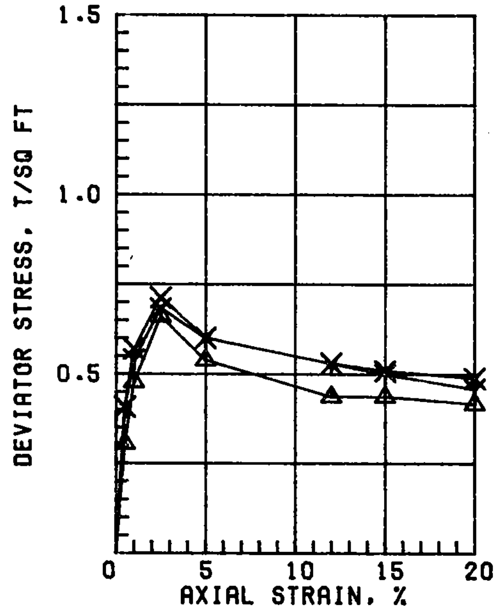
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 3-U	SAMPLE NO. 17-B
DEPTH/ELEV 63.0/-55.59	TECH. PJR
LABORATORY USAE WES	DATE 31 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 104



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	59.6	60.3	60.6	
	DRY DENSITY, PCF	65.2	64.9	64.7	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.583	1.599	1.605	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.66	0.68	0.71	
	TIME TO FAILURE, MIN.	5	14	14	
	RATE OF STRAIN INCR.%		8	7	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

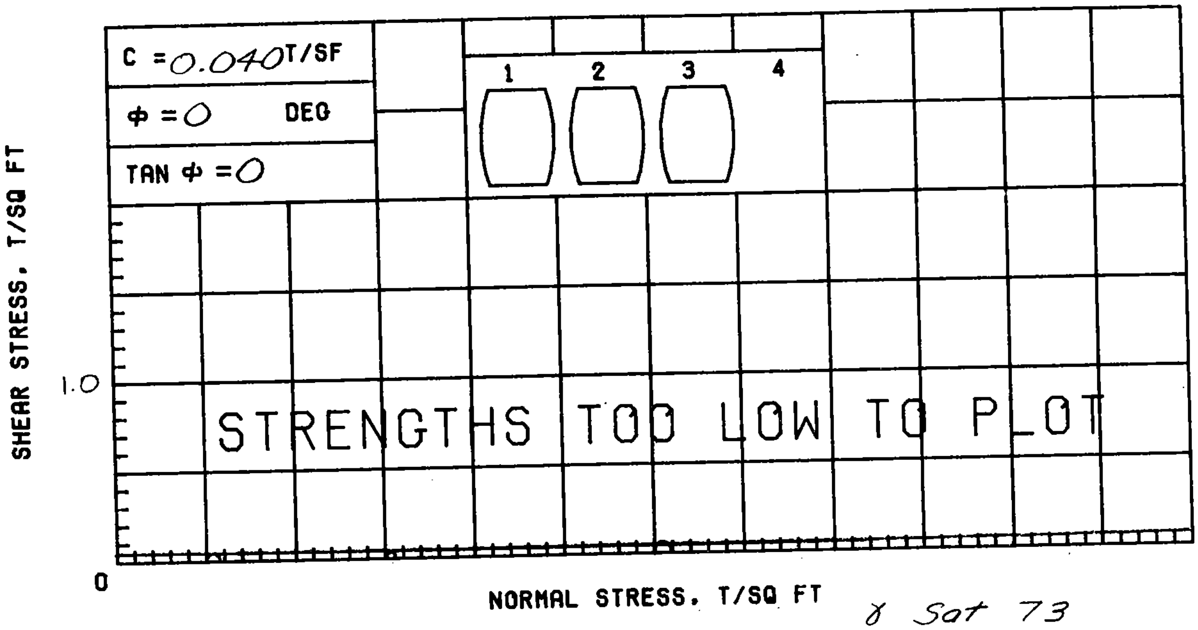
Avg. 60.2

CONTROLLED-STRAIN TEST

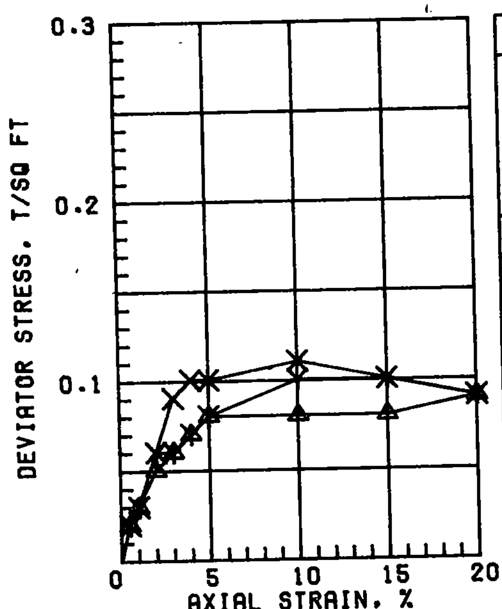
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 68	PL 19	PI 49	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 3-U	SAMPLE NO. 19-B
	DEPTH/ELEV 71.5/-64.09	TECH. PJR
	LABORATORY USAE WES	DATE 31 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 73



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	293.8	330.4	325.7	
	DRY DENSITY, PCF	18.2	16.3	16.0	
	SATURATION, %	96.2	95.4	92.3	
	VOID RATIO	8.247	9.349	9.527	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.08	0.06	0.10	
	TIME TO FAILURE, MIN.	10	4	8	
	RATE OF STRAIN INCR.,%				
	INITIAL DIAMETER, IN.	1.40	1.40	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

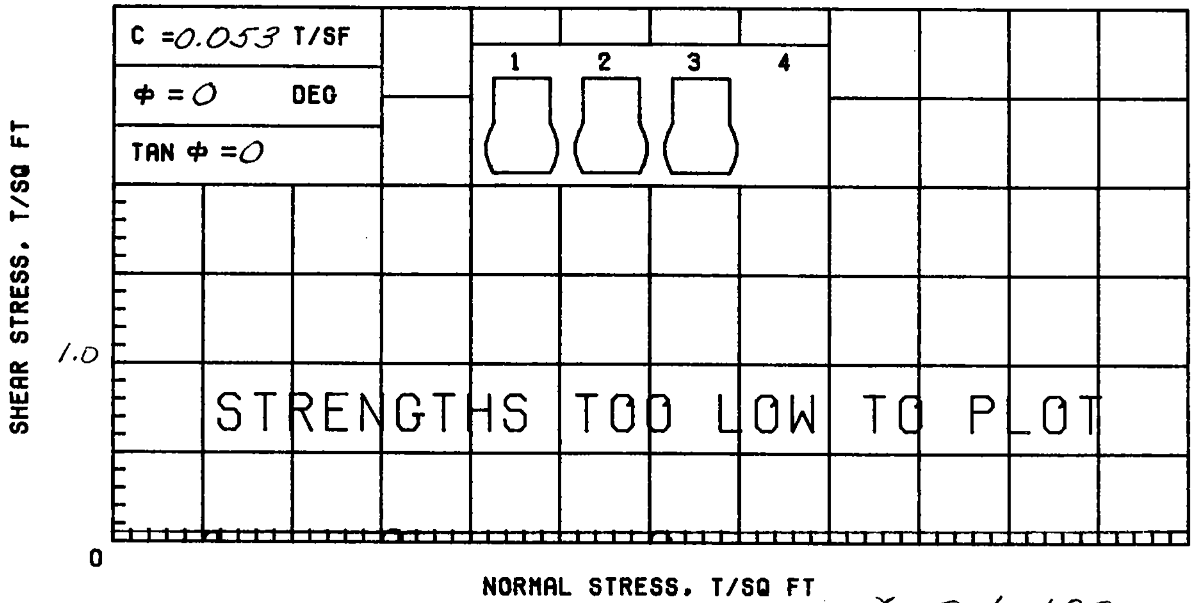
Avg. 316.6

CONTROLLED-STRAIN TEST

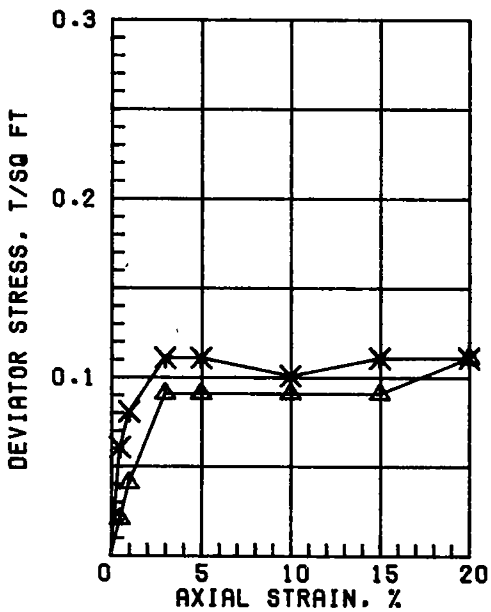
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), DARK BROWN ; HIGHLY ORGANIC

LL 333	PL 78	PI 255	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 4-U	SAMPLE NO. 3-B
	DEPTH/ELEV 7.5/-9.91	TECH. KOC
	LABORATORY USAE WES	DATE 30 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 103



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	57.2	58.7	56.7	
	DRY DENSITY, PCF	64.2	63.5	65.8	
	SATURATION, %	94.9	95.8	97.9	
	VOID RATIO	1.627	1.655	1.564	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.09	0.11	0.11	
	TIME TO FAILURE, MIN.	6	6	6	
	RATE OF STRAIN INCR.%				
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 57.5

CONTROLLED-STRAIN TEST

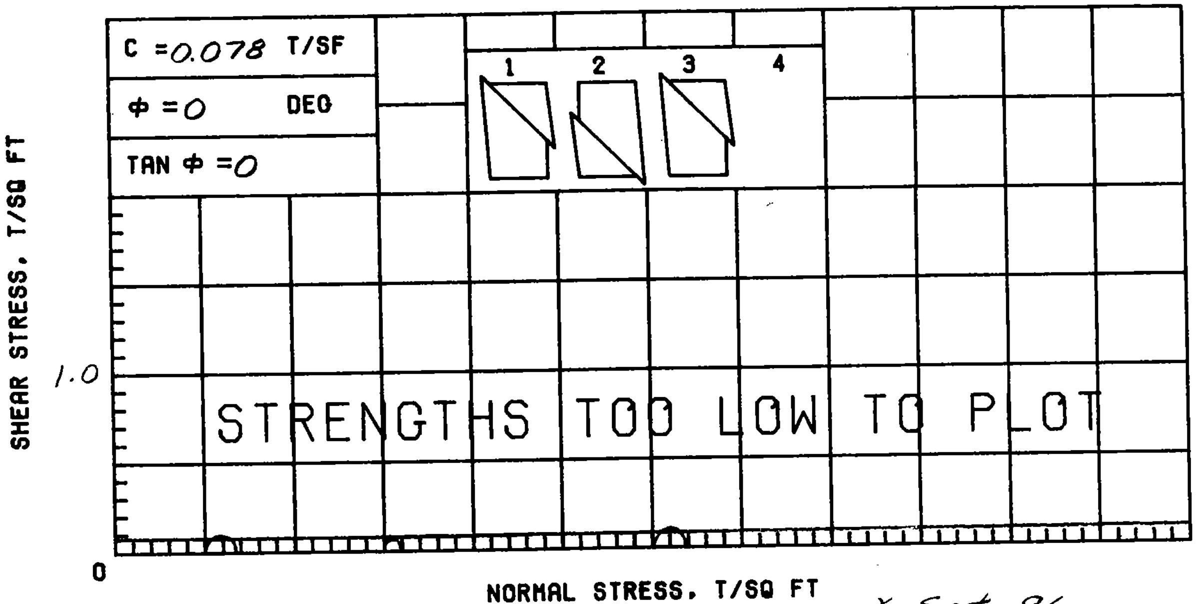
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT POCKETS; SHELL PARTICLES

LL 51	PL 17	PI 34	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

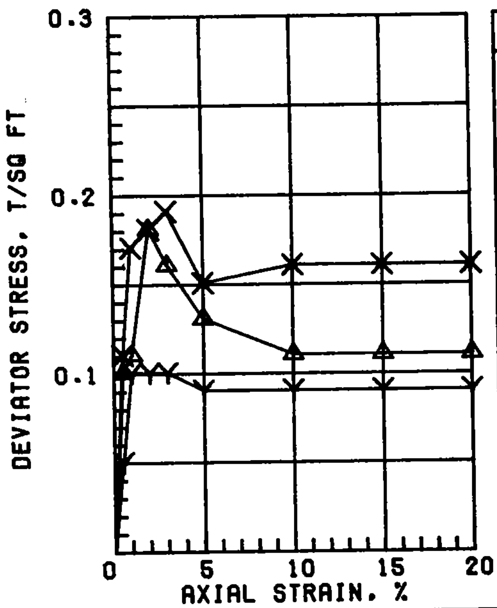
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 4-U	SAMPLE NO. 6-B
DEPTH/ELEV 19.0/-21.41	TECH. KOC
LABORATORY USAE WES	DATE 30 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 96 Avg 79.1



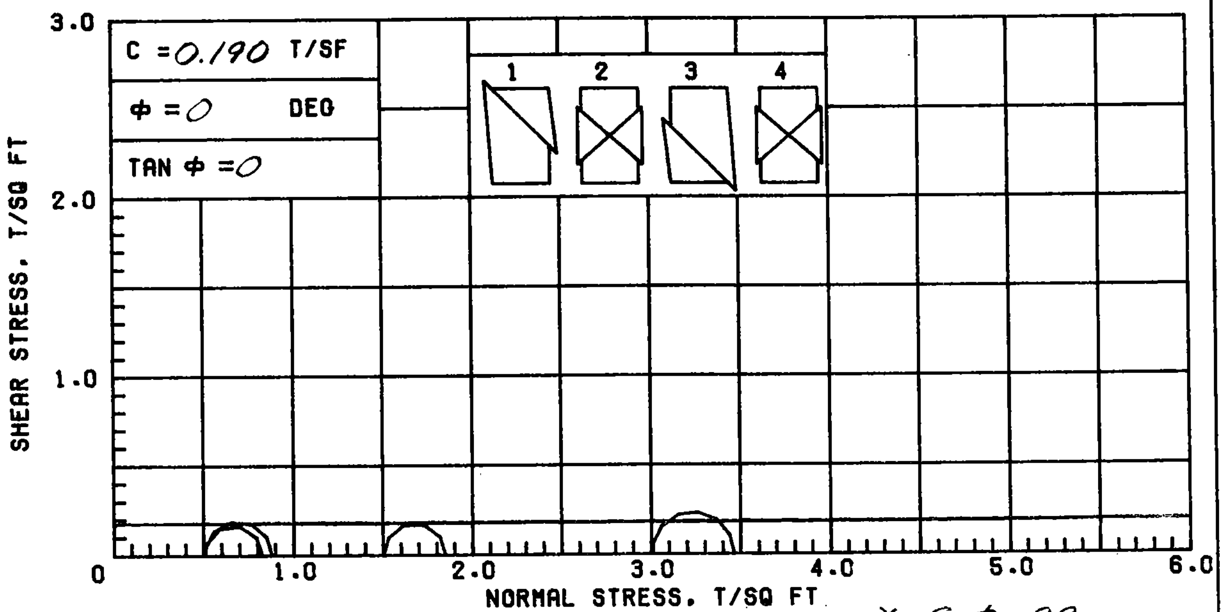
	SPECIMEN NO.	▲1	Y2	X3	4
INITIAL	WATER CONTENT, %	73.5	81.1	82.6	
	DRY DENSITY, PCF	56.0	52.2	52.0	
	SATURATION, %	98.6	98.4	99.5	
	VOID RATIO	2.012	2.226	2.242	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.18	0.10	0.19	
	TIME TO FAILURE, MIN.	4	6	18	
	RATE OF STRAIN INCR.,%		6	6	
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

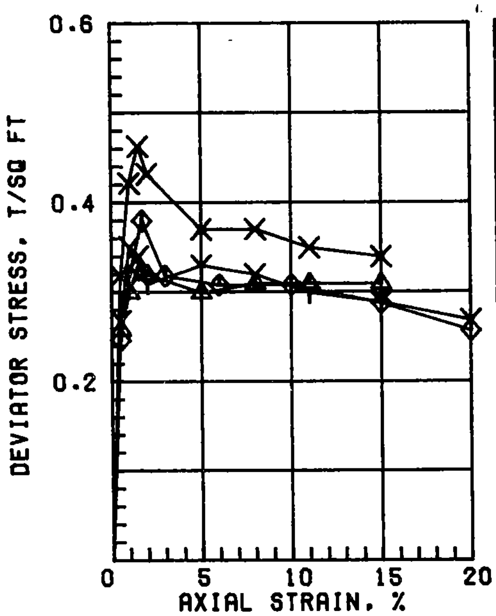
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 83	PL 24	PI 59	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 4-U	SAMPLE NO. 9-B
	DEPTH/ELEV 31.0/-33.41	TECH. KOC
	LABORATORY USAE WES	DATE 30 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



8 Sept 99



	SPECIMEN NO.	△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	69.3	70.0	70.2	70.2
	DRY DENSITY, PCF	58.6	58.4	58.3	58.4
	SATURATION, %	99.8	100+	100+	100+
	VOID RATIO	1.874	1.885	1.891	1.885
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5
MAX. DEV. STRESS, TSF		0.33	0.35	0.46	0.38
TIME TO FAILURE, MIN.		3	12	20	23
RATE OF STRAIN INCR.%			3	3	3
INITIAL DIAMETER, IN.		1.38	1.38	1.38	1.38
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 69.9

CONTROLLED-STRAIN TEST

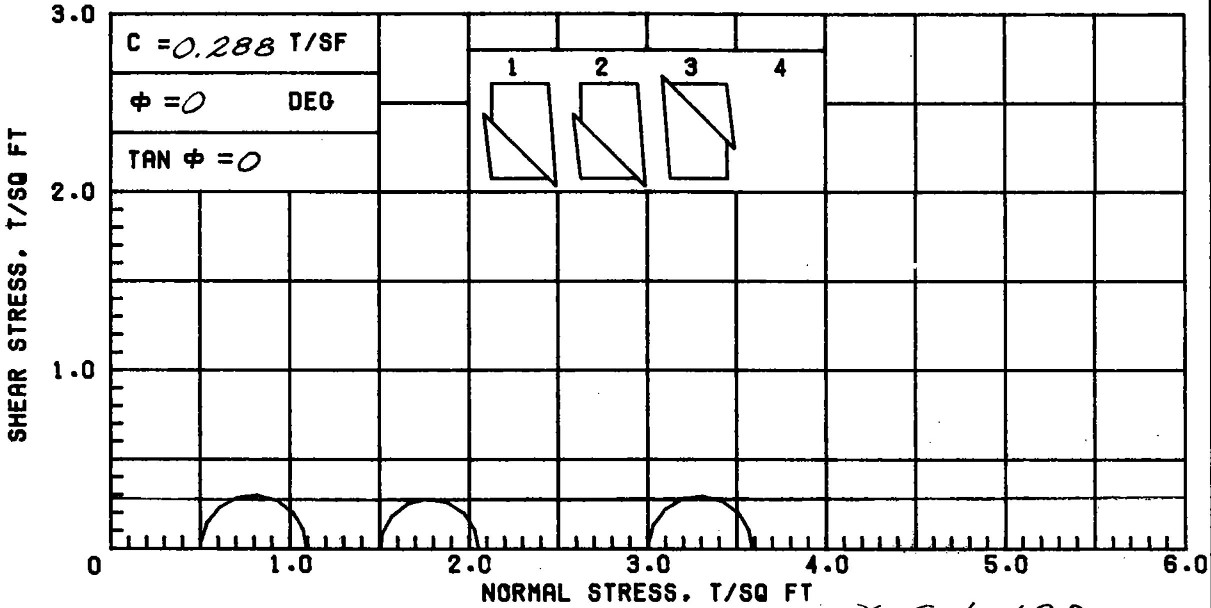
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

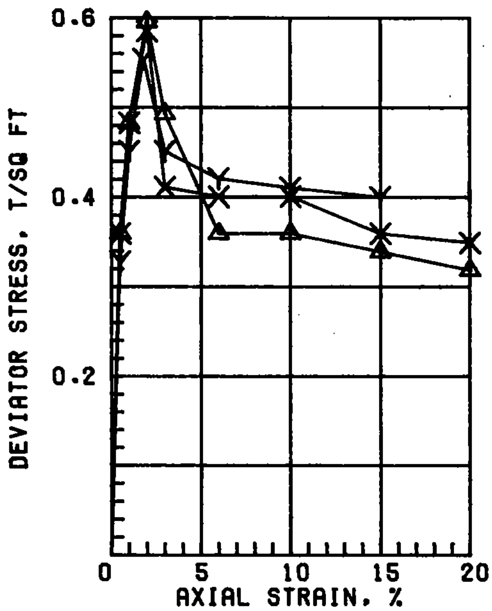
LL 83	PL 23	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 4-U	SAMPLE NO. 12-B
DEPTH/ELEV 43.0/-45.41	TECH. LRC
LABORATORY USAE WES	DATE 30 JUL 85

TRIAXIAL COMPRESSION TEST REPORT





γ Sat 100

SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	68.7	67.9	70.3	
	DRY DENSITY, PCF	59.3	59.2	58.5	
	SATURATION, %	100+	99.2	100+	
	VOID RATIO	1.841	1.849	1.880	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.60	0.55	0.58	
TIME TO FAILURE, MIN.		4	16	17	
RATE OF STRAIN INCR.,%			3	3	
INITIAL DIAMETER, IN.		1.38	1.38	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 69.0

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

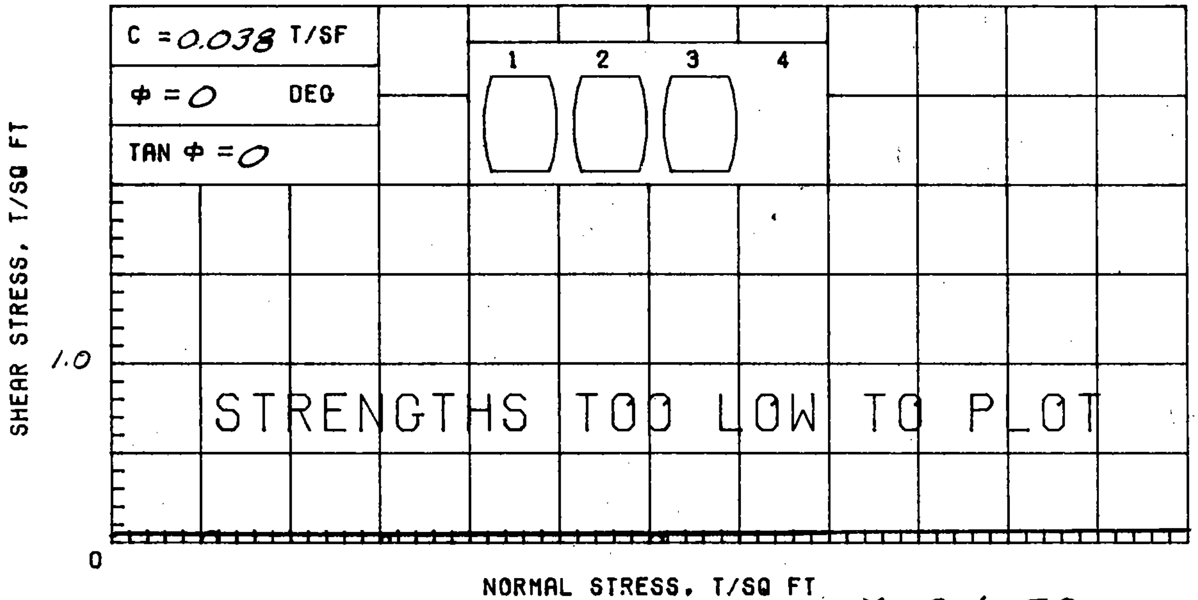
LL 87	PL 25	PI 62	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 4-U	SAMPLE NO. 15-B
	DEPTH/ELEV 55.0/-57.41	TECH. LRC
	LABORATORY USAE WES	DATE 31 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	

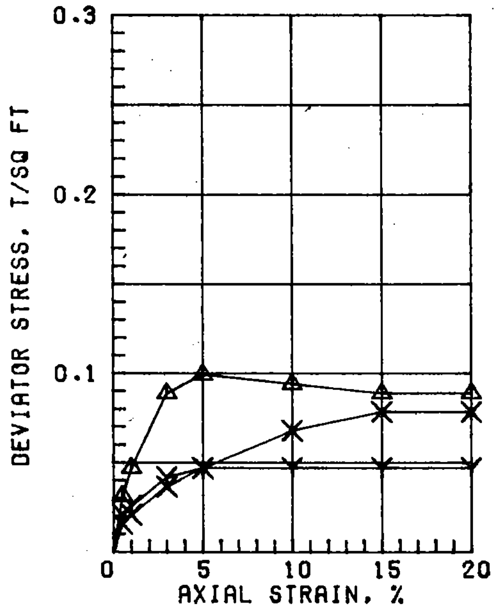
C = 0.038 T/SF

Φ = 0 DEG

TAN Φ = 0



γ Sat 70



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	528.6	397.0	425.1	
	DRY DENSITY, PCF	10.5	13.6	12.8	
	SATURATION, %	95.2	94.3	94.3	
	VOID RATIO	14.998	11.367	12.175	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.10	0.05	0.08	
TIME TO FAILURE, MIN.		10	15	45	
RATE OF STRAIN INCR.%					
INITIAL DIAMETER, IN.		1.37	1.37	1.37	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

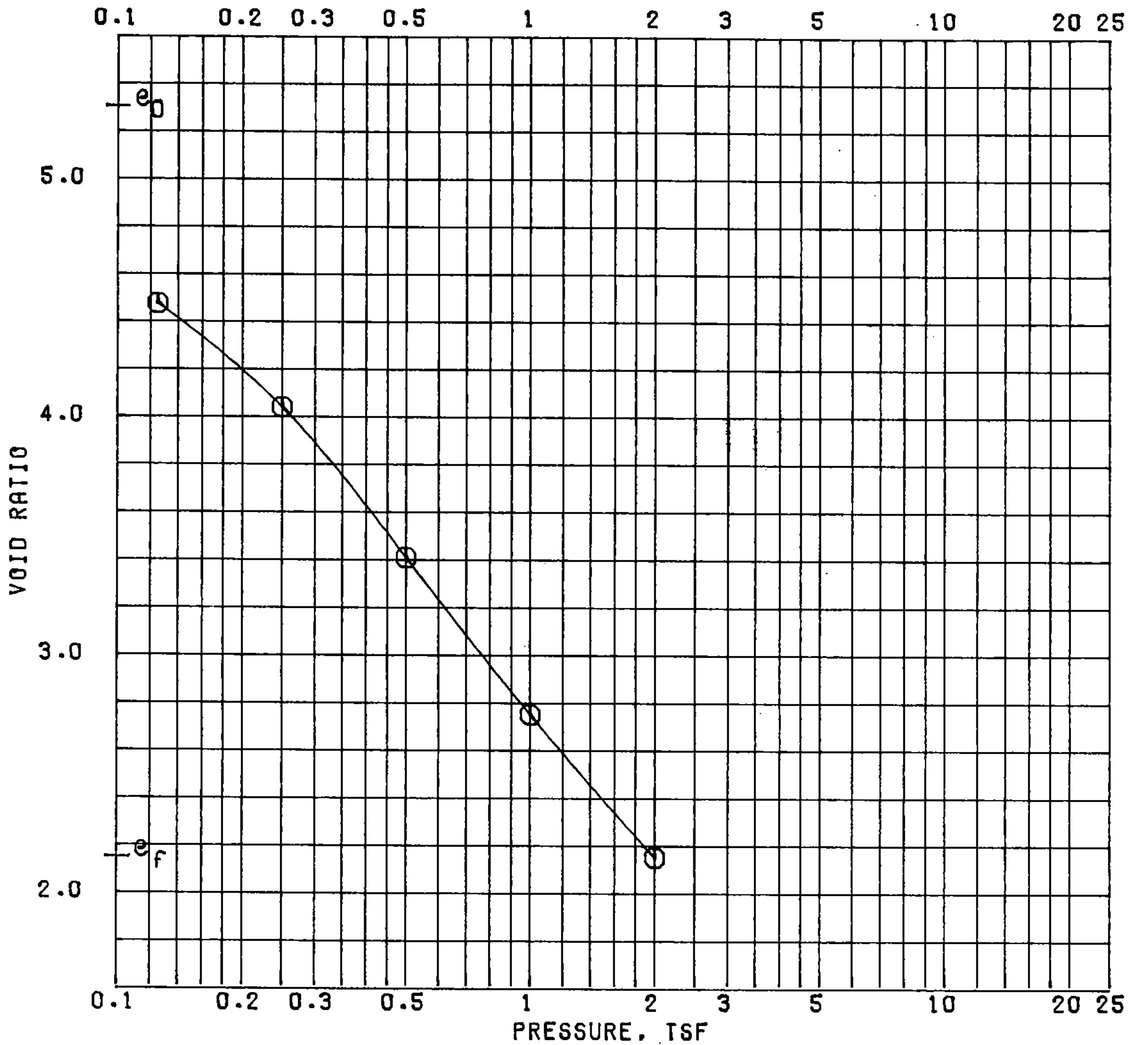
Avg. 450.2

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: ORGANIC CLAY (OH), DARK BROWN

LL 338	PL 77	PI 261	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 5-U	SAMPLE NO. 2-B
	DEPTH/ELEV 5.0/-9.9	TECH. PJR
	LABORATORY USAE WES	DATE 24 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



			γ Sat 79 BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	191.0	89.0
PRECONSOL. PRESSURE, TSF	0.23	DRY DENSITY, PCF	26.8	53.6
COMPRESSION INDEX	4.18	SATURATION, %	97.3	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	5.298	2.144
DIA. IN 4.44	HT. IN 1.122	BACK PRESSURE, TSF		

CLASSIFICATION	PLASTIC CLAY (CH), DARK GRAY; ORGANIC MATERIAL
LL 206	PL 38	PI 168	PROJECT LAKE PONT. LA. & VIC. HURR. PROT
GS 2.70 (EST)	D_{10}	JEFFERSON & ST. CHARLES PARISHES
REMARKS	BORING NO. 5-U	SAMPLE NO. 2-C
	DEPTH/ELEV 6.0/-10.9	DATE 17 OCT 85

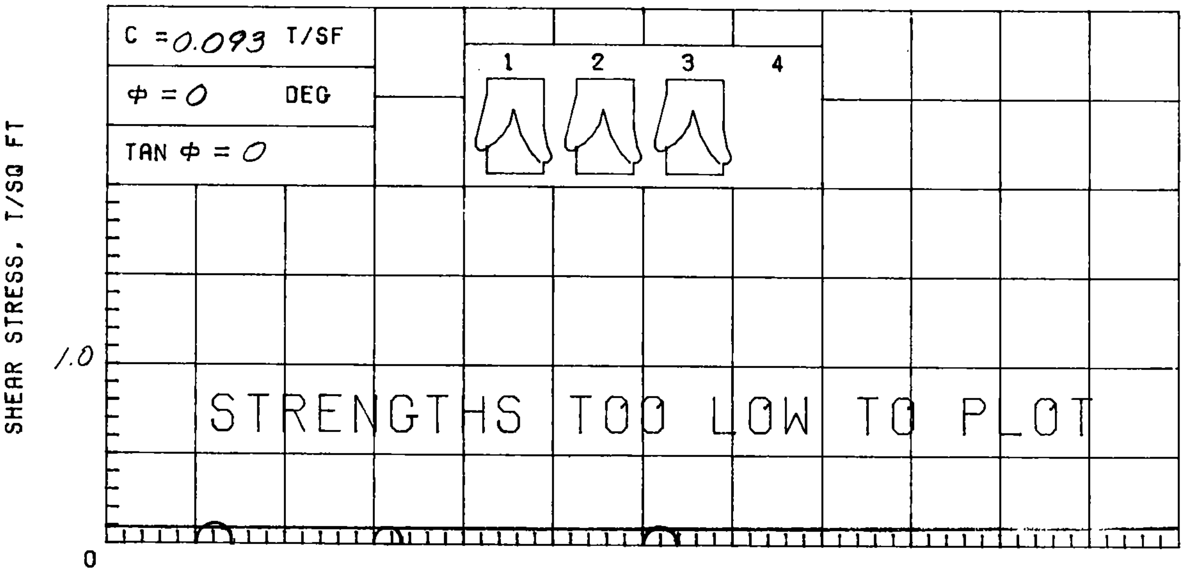
CONSOLIDATION TEST REPORT

SHEET 1 OF 7

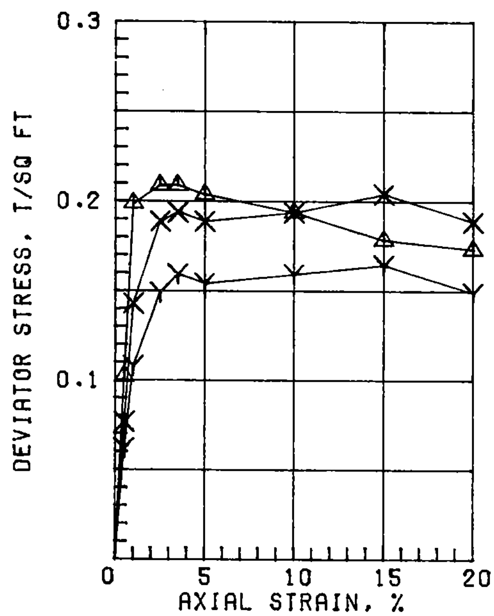
C = 0.093 T/SF

Φ = 0 DEG

TAN Φ = 0



γ Sat 95



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	86.1	86.7	84.1	
	DRY DENSITY, PCF	50.9	50.5	51.5	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.313	2.336	2.270	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.21	0.16	0.19	
TIME TO FAILURE, MIN.		5	21	21	
RATE OF STRAIN INCR.%			5	5	
INITIAL DIAMETER, IN.		1.39	1.38	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 85.6

CONTROLLED-STRAIN TEST

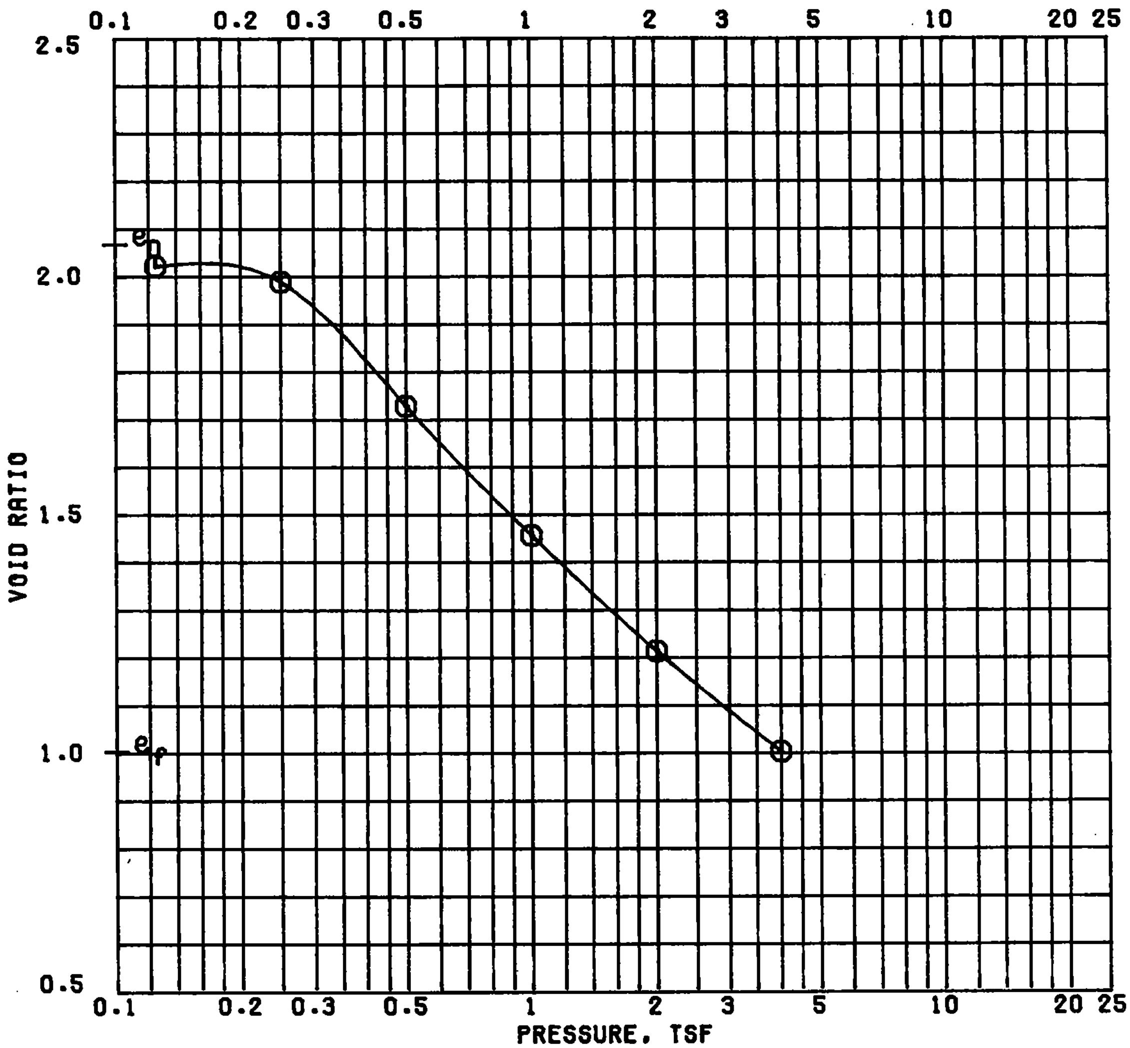
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), LIGHT GRAY; SILT LENSES; SHELLS

LL 87	PL 25	PI 62	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 5-U	SAMPLE NO. 5-B
DEPTH/ELEV 17/-21.9	TECH. PJR
LABORATORY USAE WES	DATE 24 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	80.0	41.5
PRECONSOL. PRESSURE, TSF	0.29	DRY DENSITY, PCF	55.0	84.3
COMPRESSION INDEX	1.98	SATURATION, %	100 +	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.064	1.000
DIA. IN 4.44	HT. IN 1.119	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SHELL PARTICLES		
LL	PL	PI
GS 2.70 (EST)	D_{10}	
REMARKS		

PROJECT LAKE PONT LA & VIC HURR. PROT	
JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 5-U	SAMPLE NO. 5-C
DEPTH/ELEV 18/-22.9	DATE 17 OCT 85

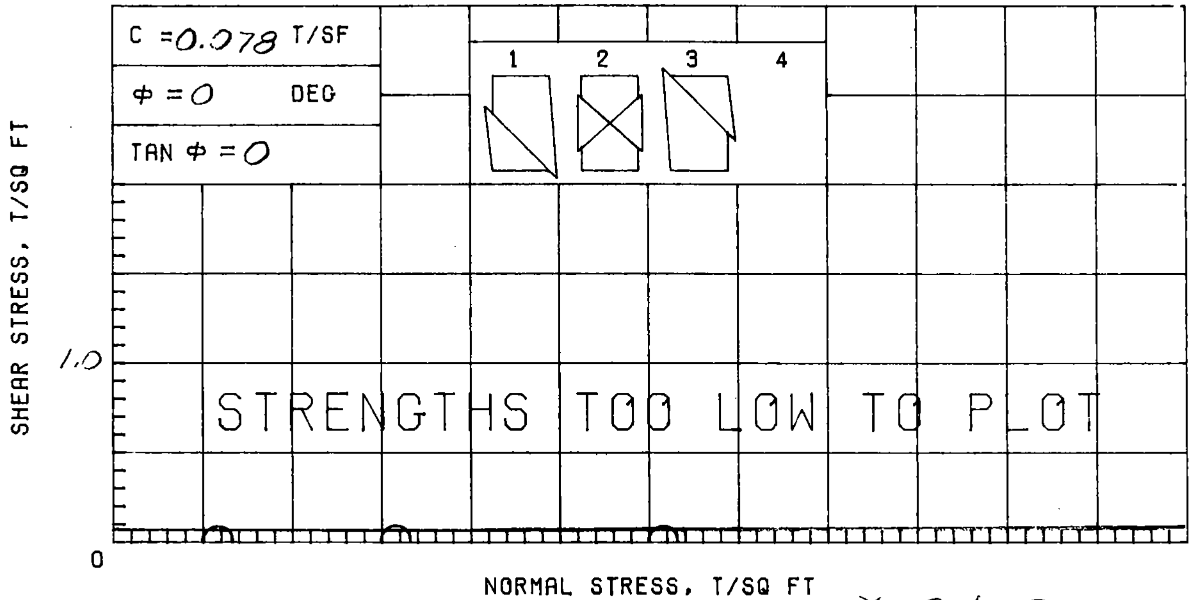
CONSOLIDATION TEST REPORT

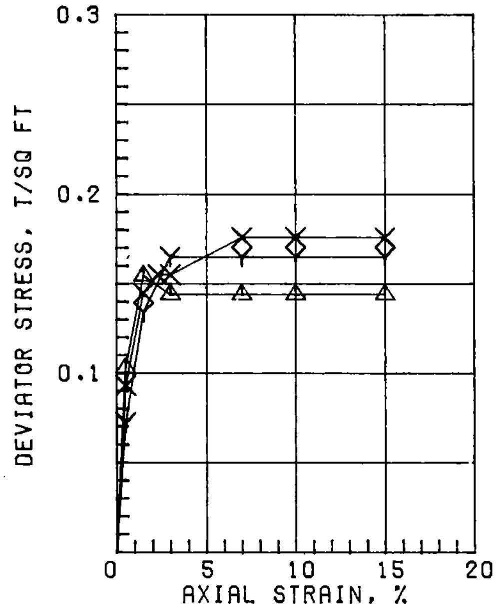
SHEET 1 OF 8

C = 0.078 T/SF

Φ = 0 DEG

TAN Φ = 0





γ Sat 96

SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	83.6	84.6	82.2	
	DRY DENSITY, PCF	52.0	51.9	52.6	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.242	2.246	2.202	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.15	0.16	0.16	
TIME TO FAILURE, MIN.		3	32	15	
RATE OF STRAIN INCR,%			4	3	
INITIAL DIAMETER, IN.		1.38	1.38	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 83.5

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

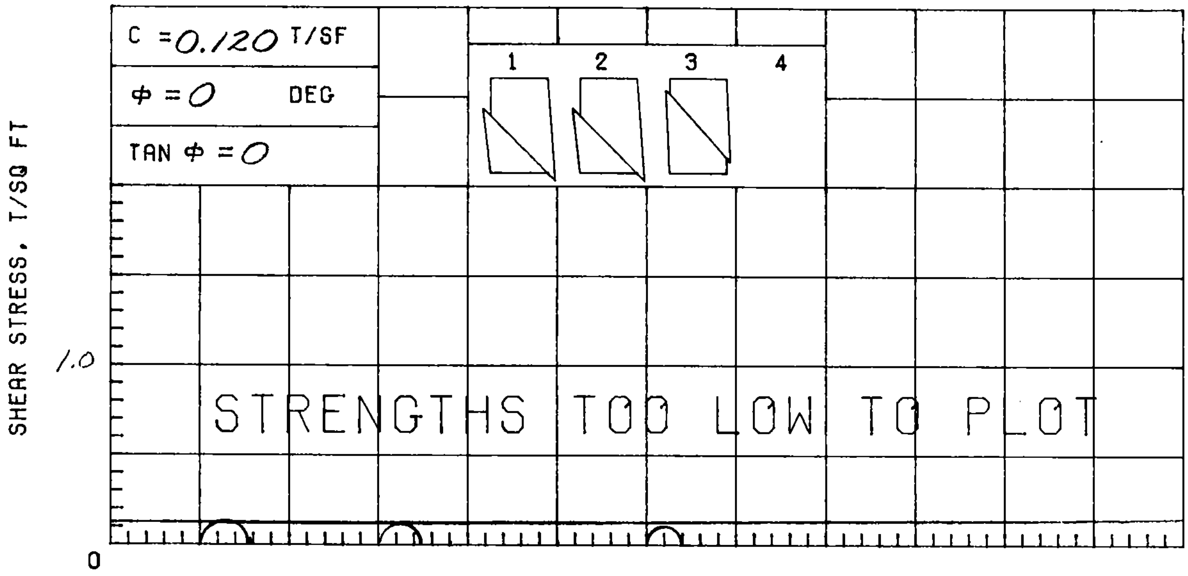
LL 75	PL 24	PI 51	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

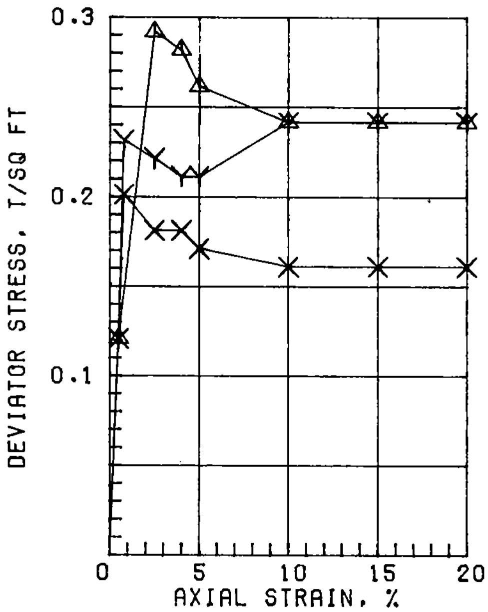
PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 5-U	SAMPLE NO. 7-B
DEPTH/ELEV 25.0/-29.9	TECH. LRC
LABORATORY USAE WES	DATE 21 AUG 85

TRIAXIAL COMPRESSION TEST REPORT

C = 0.120 T/SF	
φ = 0 DEG	
TAN φ = 0	



γ Sat 93



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	87.1	87.5	87.8	
	DRY DENSITY, PCF	50.1	47.8	49.8	
	SATURATION, %	99.3	93.4	99.5	
	VOID RATIO	2.368	2.528	2.383	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.29	0.23	0.20	
TIME TO FAILURE, MIN.		5	5	5	
RATE OF STRAIN INCR.,%			6	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 87.5

CONTROLLED-STRAIN TEST

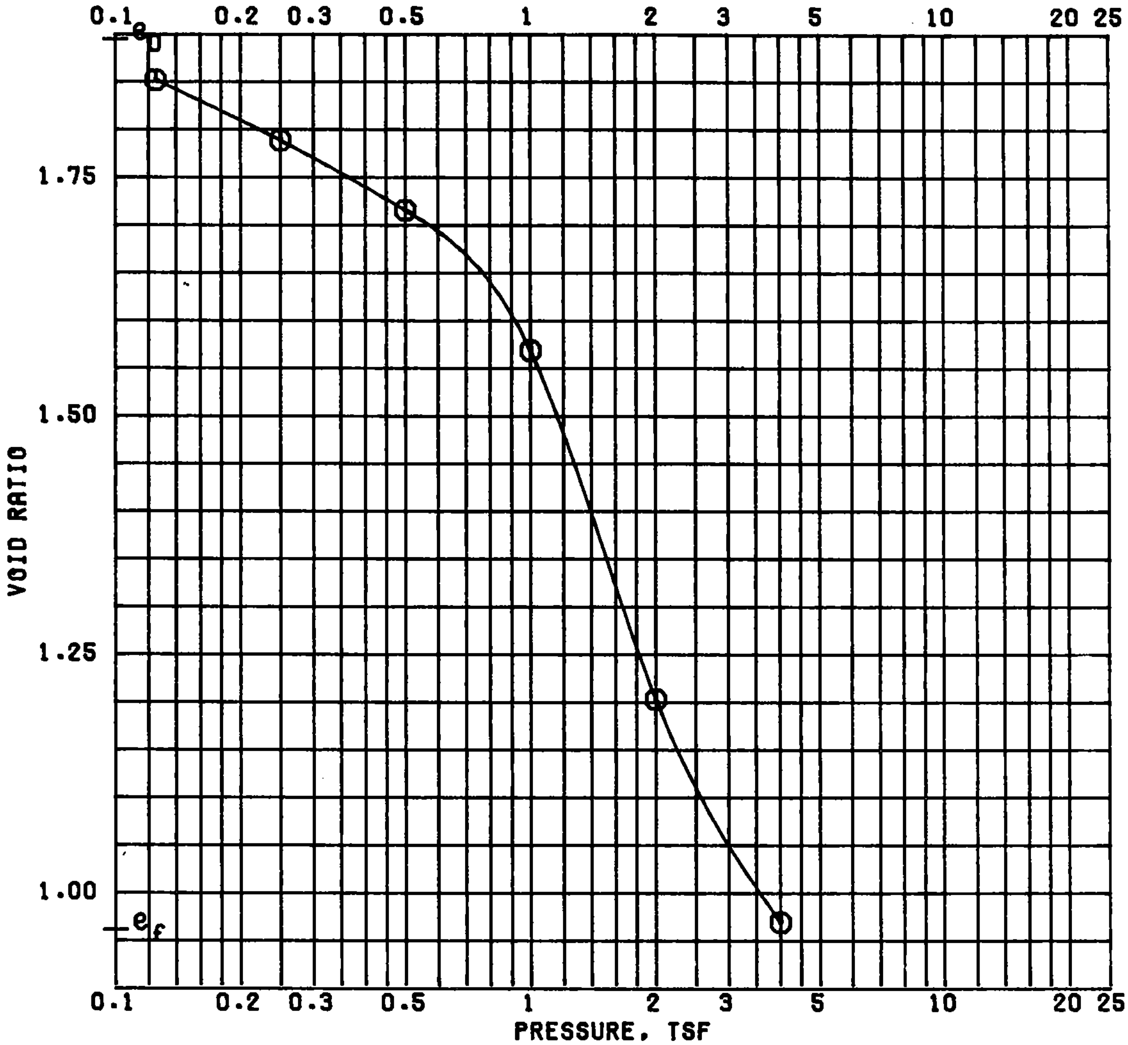
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 97	PL 25	PI 72	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 5-U	SAMPLE NO. 8-C
DEPTH/ELEV 32.0/-36.9	TECH. KOC
LABORATORY USAE WES	DATE 29 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	68.7	42.1
PRECONSOL. PRESSURE, TSF	0.89	DRY DENSITY, PCF	58.3	86.0
COMPRESSION INDEX	1.65	SATURATION, %	97.9	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.893	0.960
DIA. IN 4.44	HT. IN 1.118	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SILT LENSES			
LL 69	PL 21	PI 48	PROJECT LAKE PONT LA & VIC HURR. PROT
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS		BORING NO. 5-U	SAMPLE NO. 9-B
		DEPTH/ELEV 35/-39.9	DATE 17 OCT 85

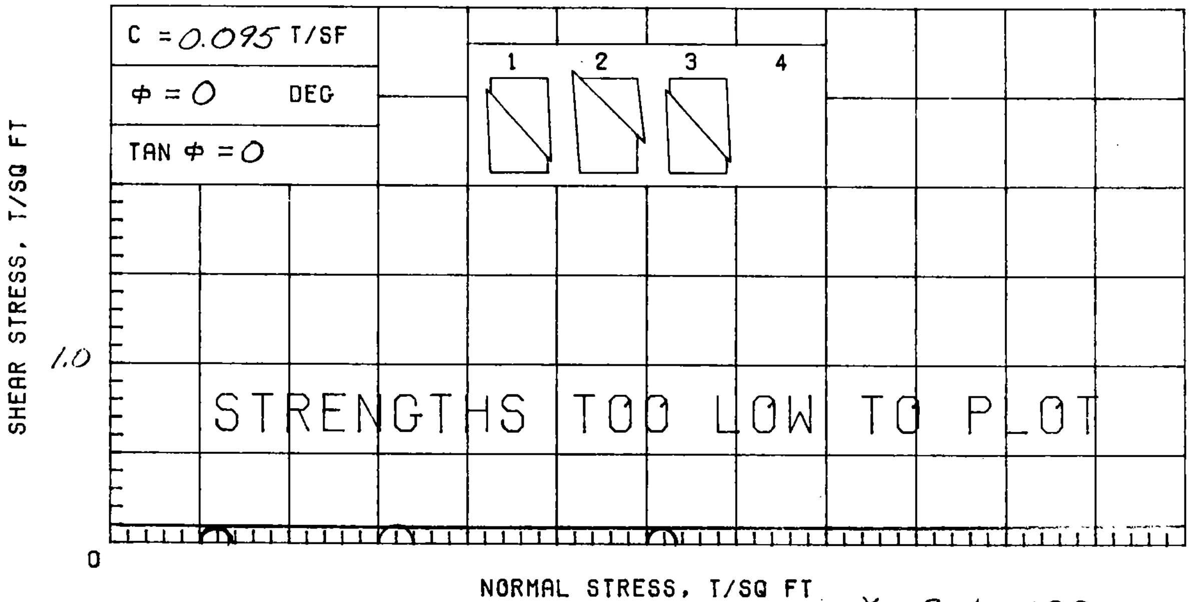
CONSOLIDATION TEST REPORT

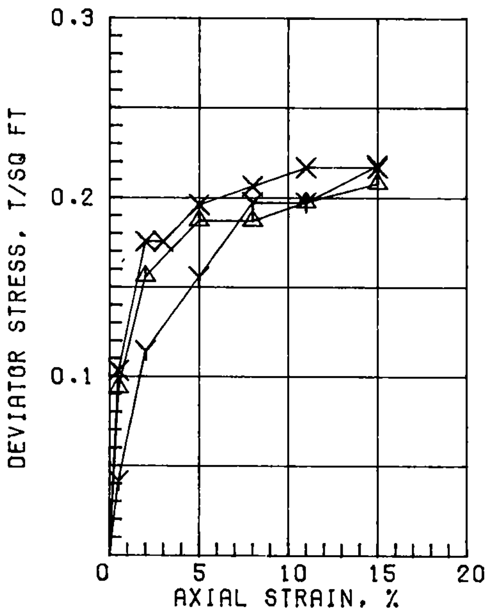
SHEET 1 OF 8

C = 0.095 T/SF

Φ = 0 DEG

TAN Φ = 0





γ Sat 100

		SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL		WATER CONTENT, %	64.7	66.6	65.6	
		DRY DENSITY, PCF	61.3	59.2	60.4	
		SATURATION, %	99.9	97.3	98.8	
		VOID RATIO	1.748	1.848	1.792	
BEFORE SHEAR		WATER CONTENT, %				
		DRY DENSITY, PCF				
		SATURATION, %				
		VOID RATIO				
		BACK PRESS., TSF				
MIN PRIN. STRESS, TSF			0.5	1.5	3.0	
MAX. DEV. STRESS, TSF			0.19	0.20	0.18	
TIME TO FAILURE, MIN.			10	22	5	
RATE OF STRAIN INCR.,%						
INITIAL DIAMETER, IN.			1.37	1.37	1.38	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	

Avg. 65.6

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

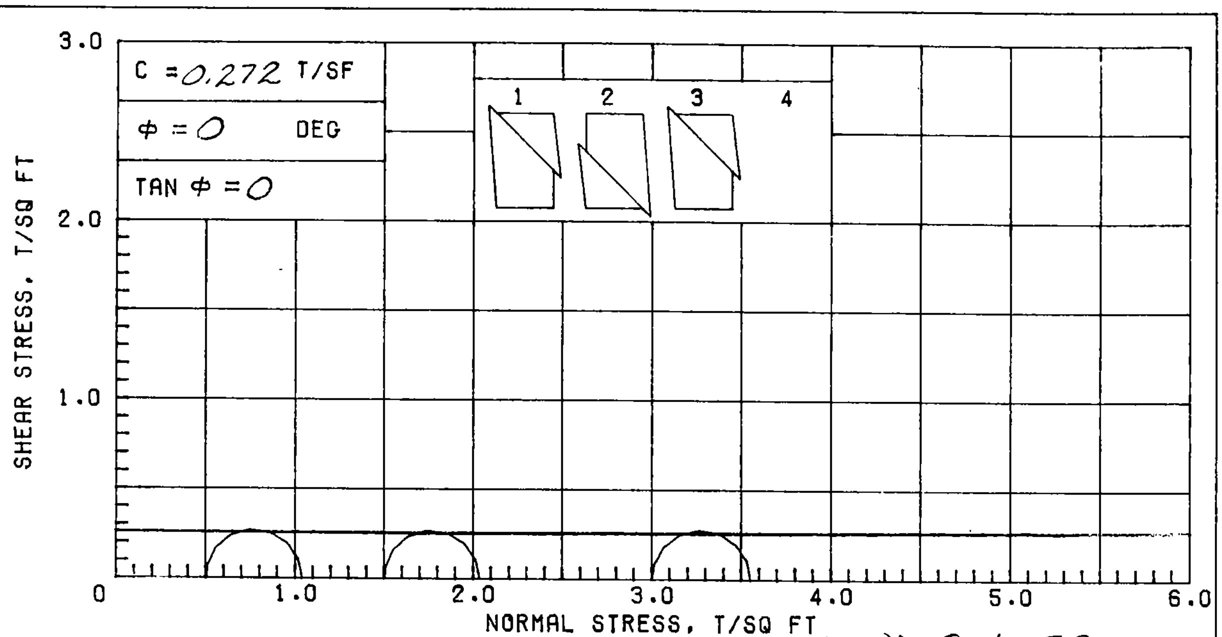
LL 71	PL 20	PI 51	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

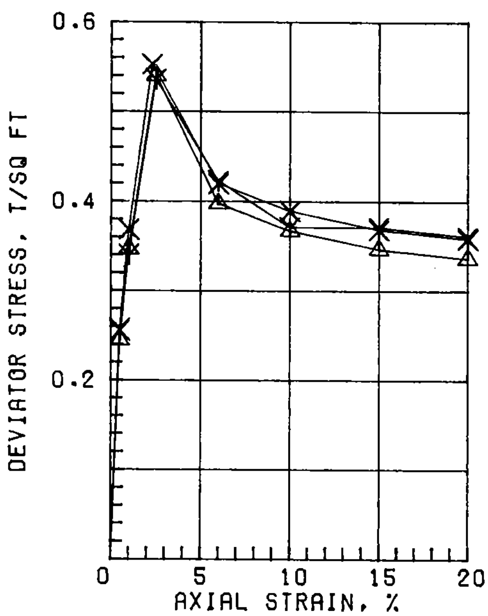
PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

BORING NO. 5-U	SAMPLE NO. 11-B
DEPTH/ELEV 43/-47.9	TECH. LRC
LABORATORY USAE WES	DATE 21 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	70.0	69.7	70.7	
	DRY DENSITY, PCF	57.9	58.3	58.1	
	SATURATION, %	98.9	99.5	100+	
	VOID RATIO	1.911	1.891	1.900	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.54	0.54	0.55	
TIME TO FAILURE, MIN.		5	13	30	
RATE OF STRAIN INCR,%			3	3	
INITIAL DIAMETER, IN.		1.39	1.38	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 70.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

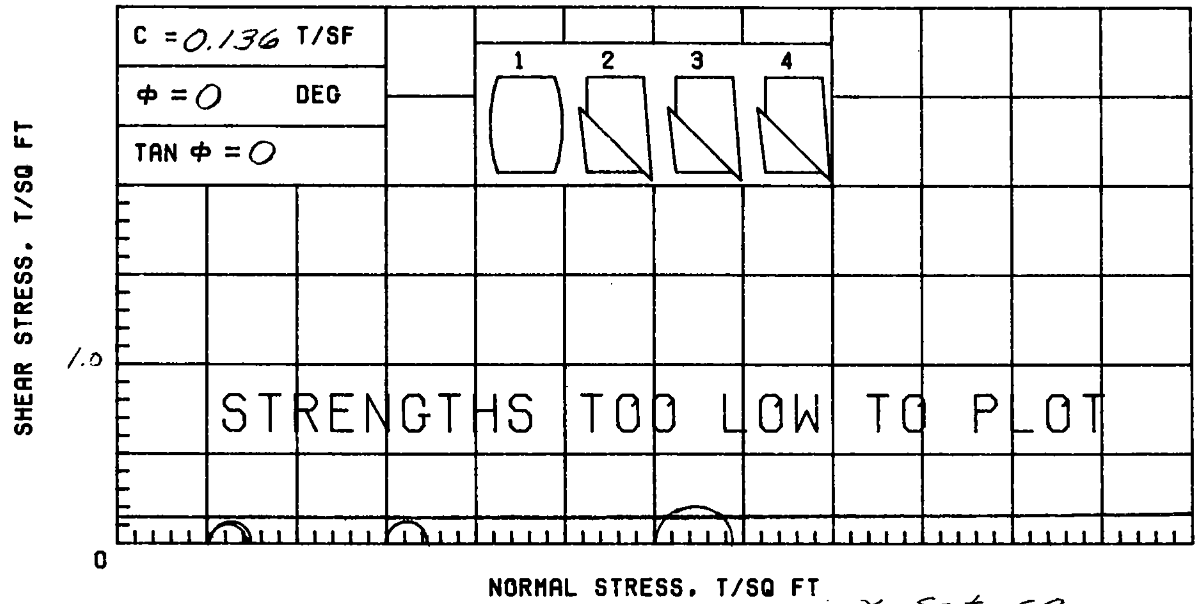
LL 82	PL 22	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

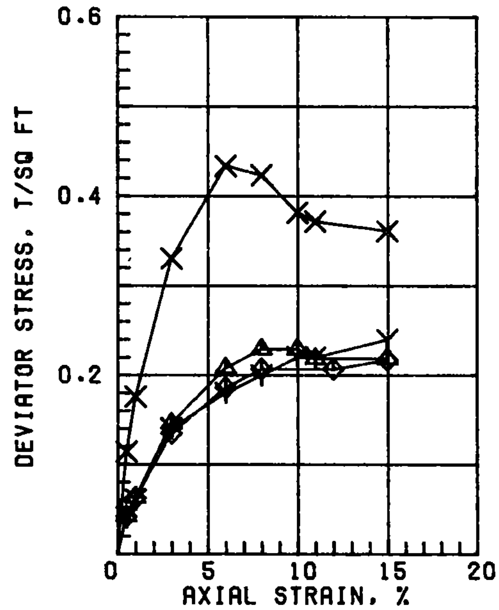
PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

BORING NO. 5-U	SAMPLE NO. 14-B
DEPTH/ELEV 55.4/-60.3	TECH. LRC
LABORATORY USAE WES	DATE 21 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 69



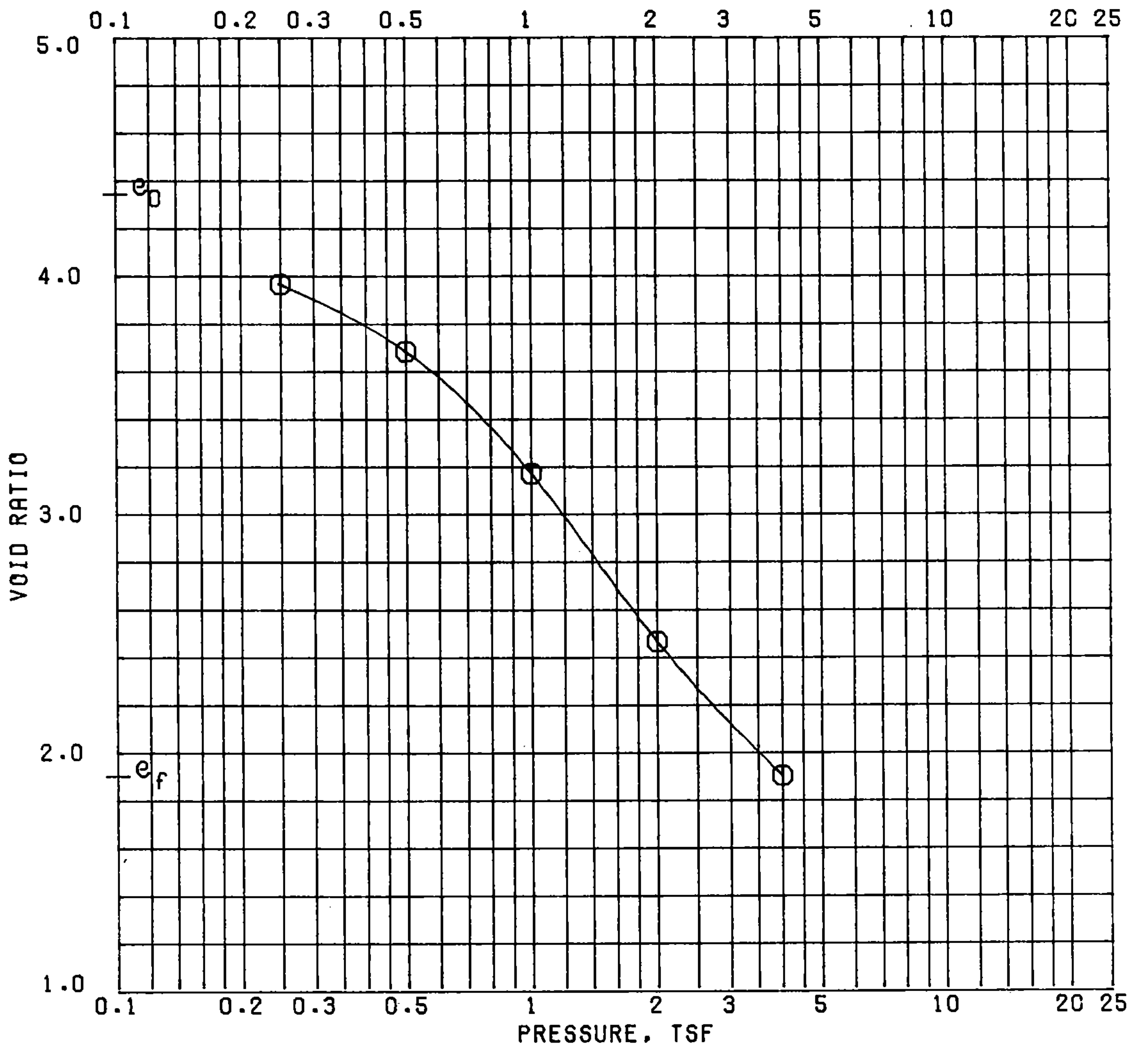
	SPECIMEN NO.	△1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	351.8	320.4	354.0	282.1	Avg. 327.1
	DRY DENSITY, PCF	14.8	15.1	15.3	17.8	
	SATURATION, %	97.1	90.6	100+	96.6	
	VOID RATIO	6.158	6.015	5.934	4.963	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	0.5	
	MAX. DEV. STRESS, TSF	0.23	0.22	0.43	0.21	
	TIME TO FAILURE, MIN.	15	23	12	15	
	RATE OF STRAIN INCR.%					
	INITIAL DIAMETER, IN.	1.37	1.40	1.38	1.38	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PEAT (PT), BLACK

LL	PL	PI	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

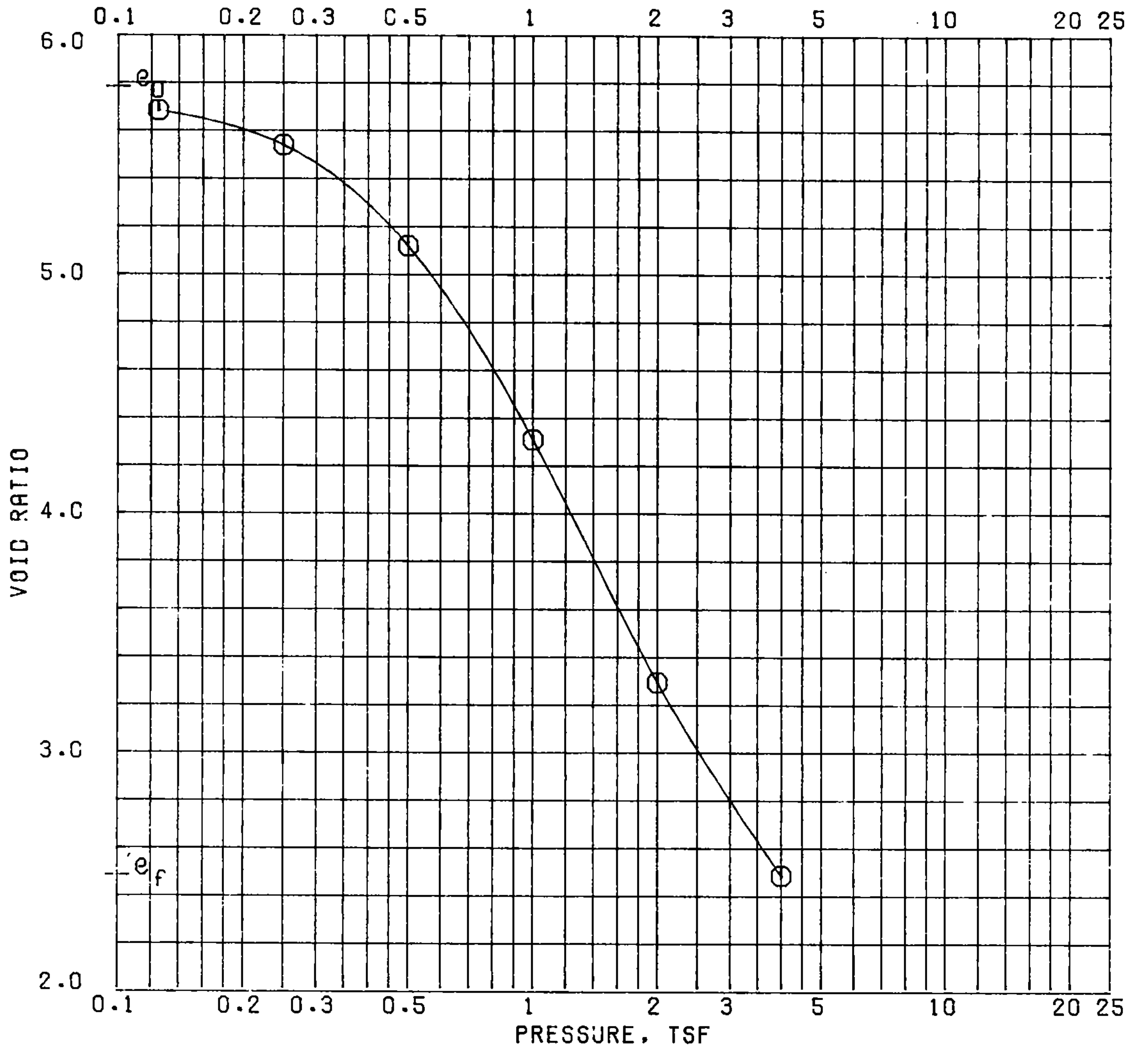
REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 6U	SAMPLE NO. 4-B
	DEPTH/ELEV 10.0/-2.85	TECH. LRC
	LABORATORY USAE WES	DATE 31 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



8 Sat 79

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	164.6	90.5
PRECONSOL. PRESSURE, TSF	0.64	DRY DENSITY, PCF	28.1	51.7
COMPRESSION INDEX	3.64	SATURATION, %	91.1	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	4.339	1.897
DIA. IN 4.44	HT. IN 1.120	BACK PRESSURE, TSF		
CLASSIFICATION ORGANIC CLAY (OH), DARK BROWN				
LL 268 / PL 90 / PI 178		PROJECT LAKE PONT. LA. & VIC. HURR PROT		
GS 2.40 (EST)	D_{10}	JEFFERSON & ST. CHARLES PARISH		
REMARKS		BORING NO. 6-U	SAMPLE NO. 4-C	
		DEPTH/ELEV 11.0/-3.85	DATE 23 SEP 85	
		CONSOLIDATION TEST REPORT		

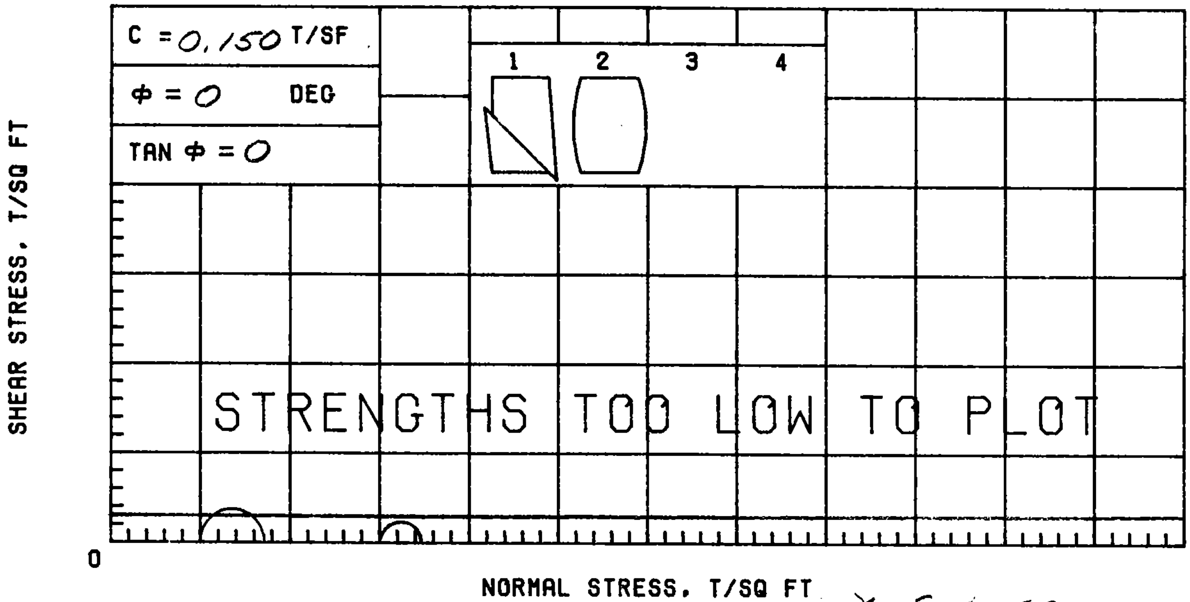
SHEET 1 OF 7



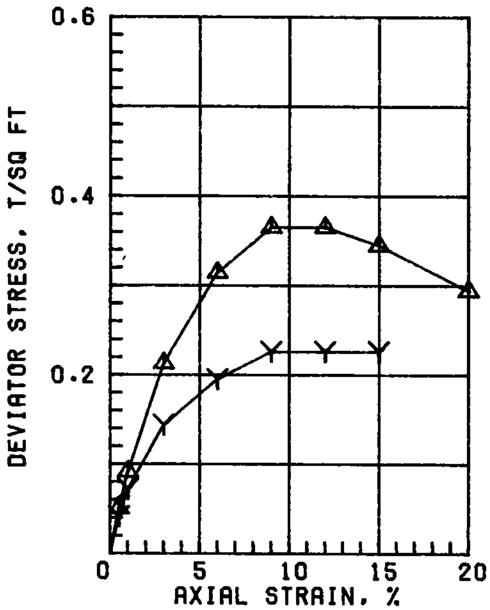
γ Sat 69

				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	321.5	157.1
PRECONSOL. PRESSURE, TSF		0.46	DRY DENSITY, PCF	15.7	30.5
COMPRESSION INDEX		5.40	SATURATION, %	94.6	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	5.779	2.480
DIA. IN 4.44	HT. IN 1.122		BACK PRESSURE, TSF		
CLASSIFICATION	PEAT (PT), DARK BROWN				
LL 400	PL 166	PI 234	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.		
GS 1.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES		
REMARKS			BORING NO. 6-U	SAMPLE NO. 7-B	
			DEPTH/ELEV 22.5/-15.35	DATE 23 SEP 85	
			CONSOLIDATION TEST REPORT		

SHEET 1 OF 8



8 Sat 68



	SPECIMEN NO.	△1	Y2	3	4
INITIAL	WATER CONTENT, %	436.3	320.8		
	DRY DENSITY, PCF	11.7	14.9		
	SATURATION, %	92.1	89.3		
	VOID RATIO	8.051	6.104		
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5		
	MAX. DEV. STRESS, TSF	0.37	0.23		
	TIME TO FAILURE, MIN.	18	17		
	RATE OF STRAIN INCR.%				
	INITIAL DIAMETER, IN.	1.39	1.38		
	INITIAL HEIGHT, IN.	3.00	3.00		

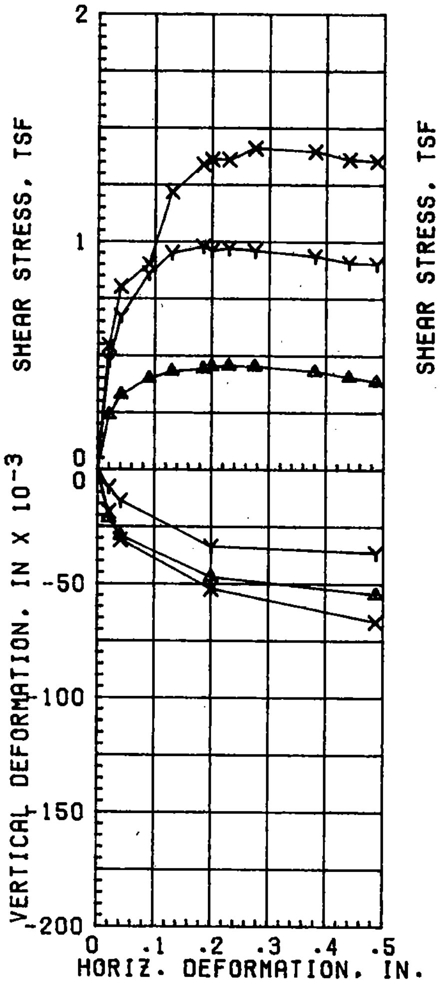
Avg. 378.6

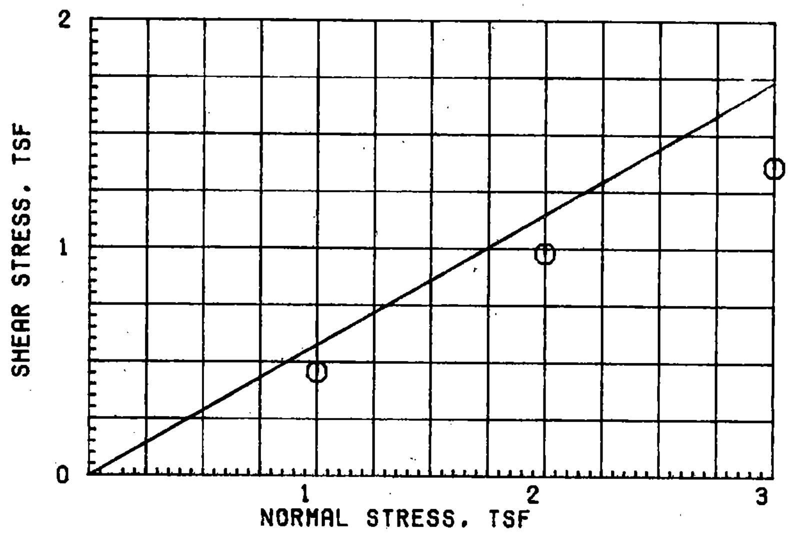
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PEAT (PT), BLACK

LL	PL	PI	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
INSUFFICIENT MATERIAL FOR THIRD	JEFFERSON & ST. CHARLES PARISH	
SPECIMEN.	BORING NO. 6-U	SAMPLE NO. 7-C
	DEPTH/ELEV 23.0/-15.85	TECH. LRC
	LABORATORY USAE WES	DATE 31 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	





γ Sat 102

Φ = 30°

TAN Φ = 0.577

C = 0

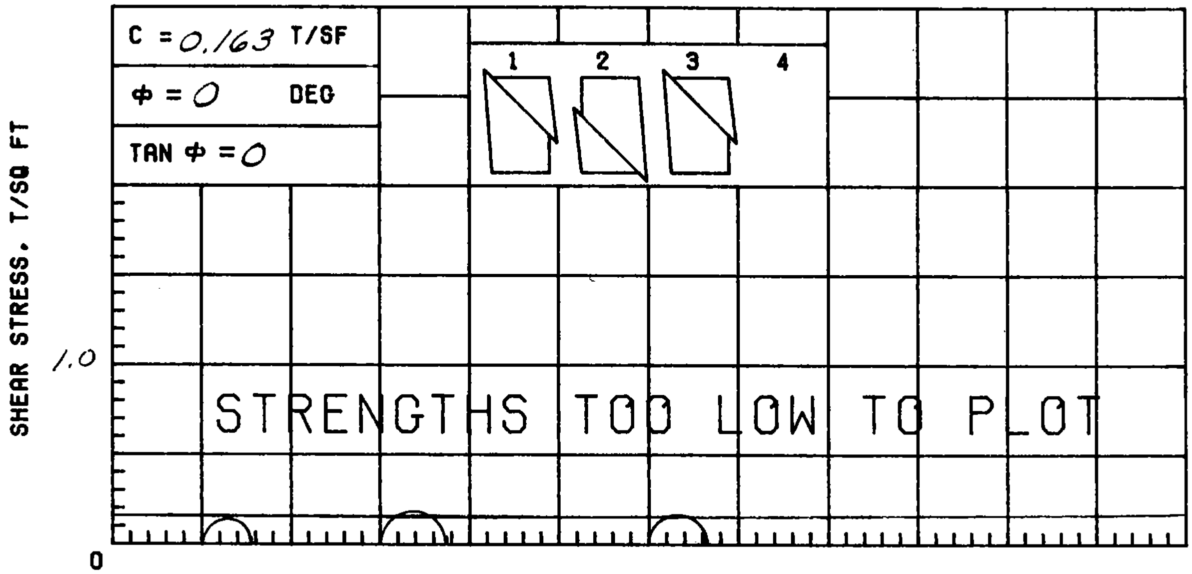
		TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %		56.8	59.4	59.6	58.6
	VOID RATIO		1.605	1.675	1.675	
	SATURATION, %		95.6	95.7	96.1	
	DRY DENSITY, PCF		64.7	63.0	63.0	
VOID RATIO AFTER CONSOL						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL	WATER CONTENT, %		44.0	33.2	30.2	
	VOID RATIO					
	SATURATION, %					
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.46	0.98	1.36	
TIME TO FAILURE, MIN			1330	1070	1157	
RATE OF STRAIN, IN/MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, TSF						

TYPE SPECIMEN UNDISTURBED	3 00 IN. SQUARE	0.629 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY		

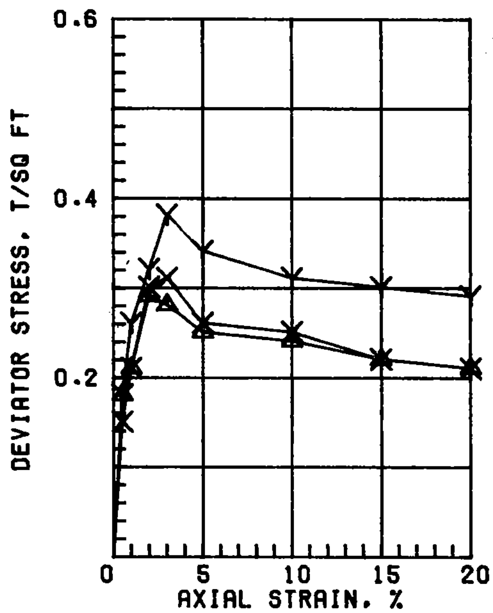
LL 56	PL 18	PI 38		GS 2.70 (EST)

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 6-U	SAMPLE 9-C
	DEPTH/ELEV 30.7/-23.55	DATE 28 AUG 85

DIRECT SHEAR TEST REPORT



8 Sep 99



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	68.9	67.8	69.6	
	DRY DENSITY, PCF	58.2	59.7	58.0	
	SATURATION, %	98.2	100+	98.6	
	VOID RATIO	1.895	1.823	1.907	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.29	0.38	0.31	
	TIME TO FAILURE, MIN.	4	18	18	
	RATE OF STRAIN INCR.%		6	6	
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 68.8

CONTROLLED-STRAIN TEST

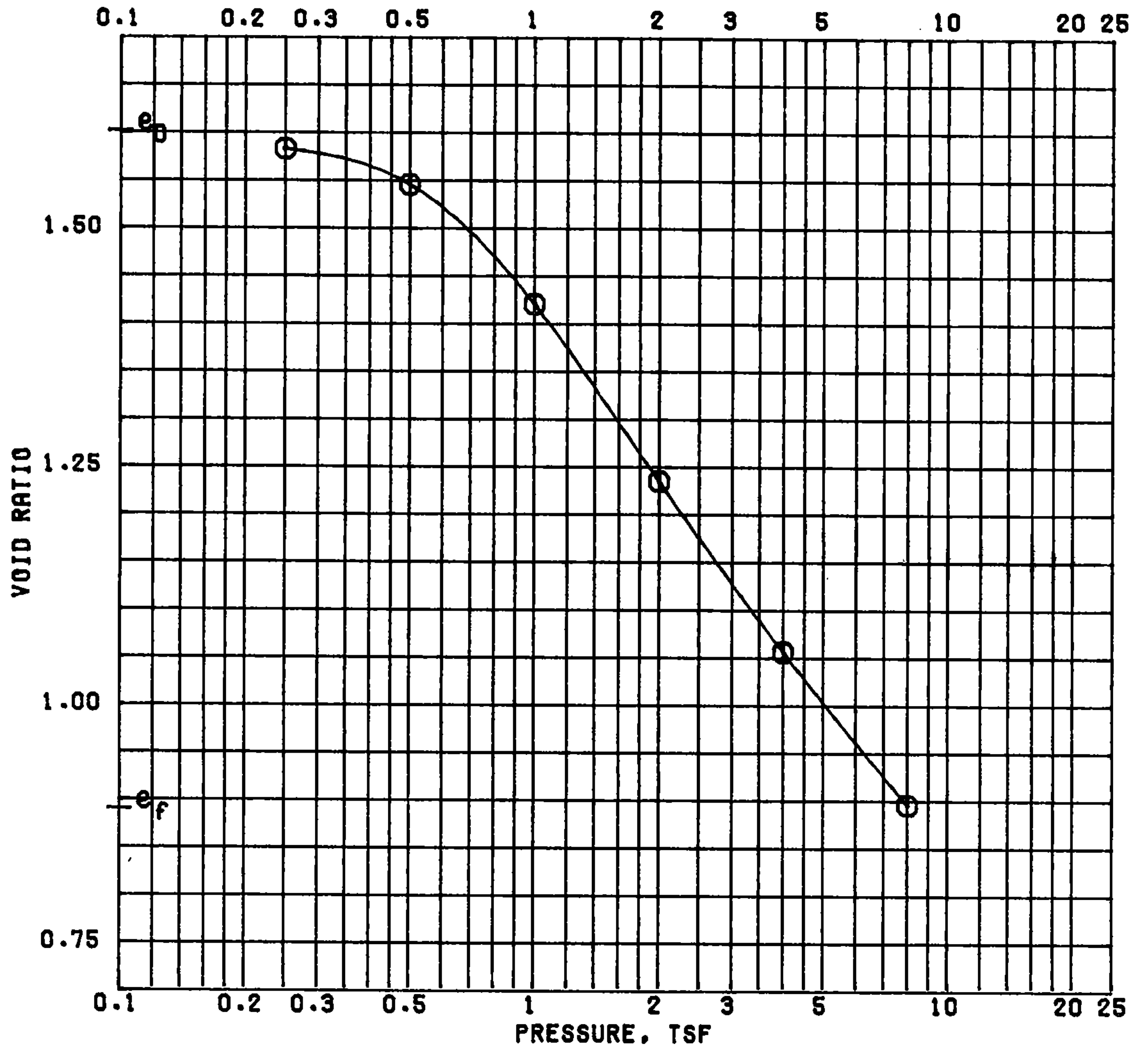
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 78	PL 24	PI 54	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 6-U	SAMPLE NO. 10-B
DEPTH/ELEV 34.0/-26.85	TECH. KOC
LABORATORY USAE WES	DATE 31 JUL 85

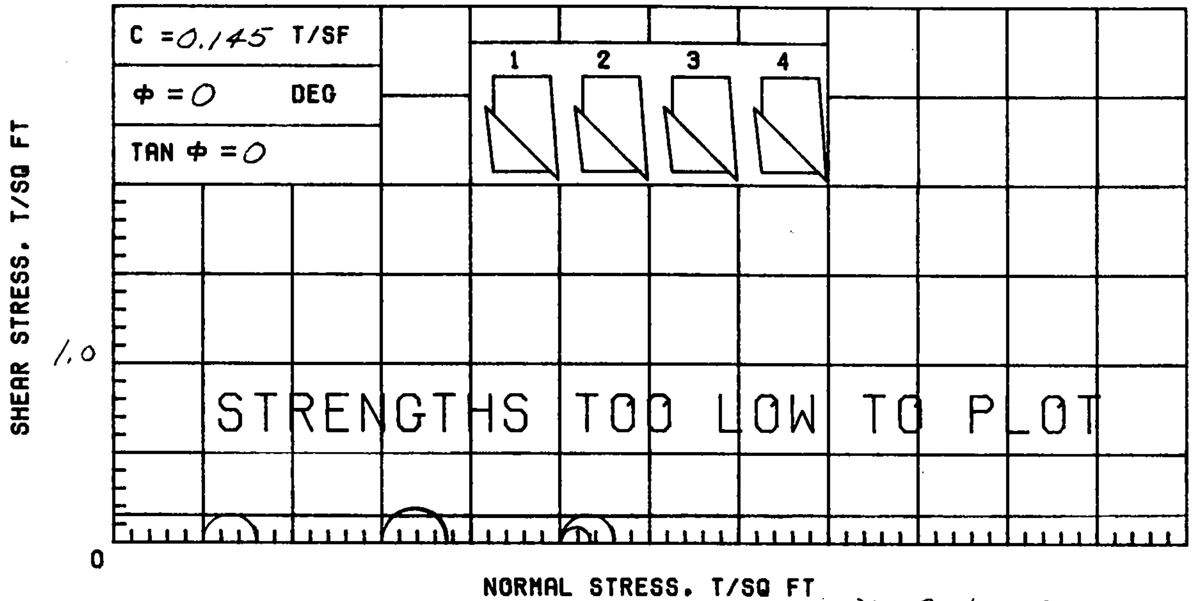
TRIAXIAL COMPRESSION TEST REPORT



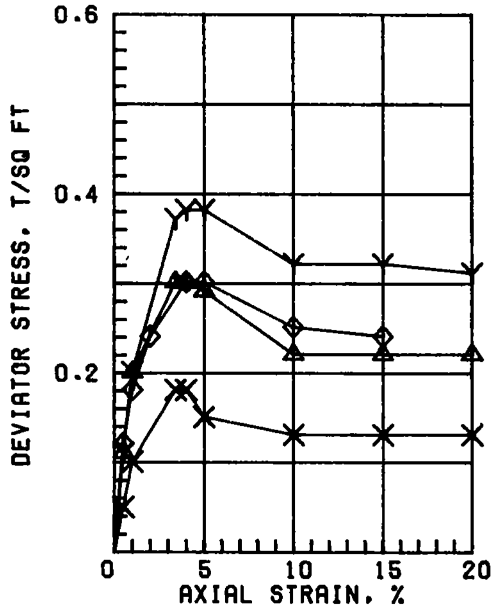
γ Sat 103

				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	57.4	34.7
PRECONSOL. PRESSURE, TSF		0.69	DRY DENSITY, PCF	64.8	89.2
COMPRESSION INDEX		1.53	SATURATION, %	96.9	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	1.600	0.889
DIA. IN 4.44	HT. IN 1.108		BACK PRESSURE, TSF		
CLASSIFICATION	PLASTIC CLAY (CH), GRAY				
LL	PL	PI	PROJECT LAKE PONT. LA & VIC. HURR. PROT		
GS 2.70 (EST)	D_{10}		JEFFERSON & STA. CHARLES PARISHES		
REMARKS			BORING NO. 6-U	SAMPLE NO. 10-C	
			DEPTH/ELEV 35.0/-27.85	DATE 23 SEP 85	
			CONSOLIDATION TEST REPORT		

SHEET 1 OF 8



γ Sat 98



	SPECIMEN NO.	△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	75.0	72.1	72.2	73.7
	DRY DENSITY, PCF	55.4	56.2	56.2	56.3
	SATURATION, %	99.0	97.3	97.6	99.7
	VOID RATIO	2.045	2.001	1.998	1.996
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	3.0
	MAX. DEV. STRESS, TSF	0.30	0.38	0.18	0.30
	TIME TO FAILURE, MIN.	7	24	20	24
	RATE OF STRAIN INCR.%		6	6	6
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	1.40
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00

Avg. 73.3

CONTROLLED-STRAIN TEST

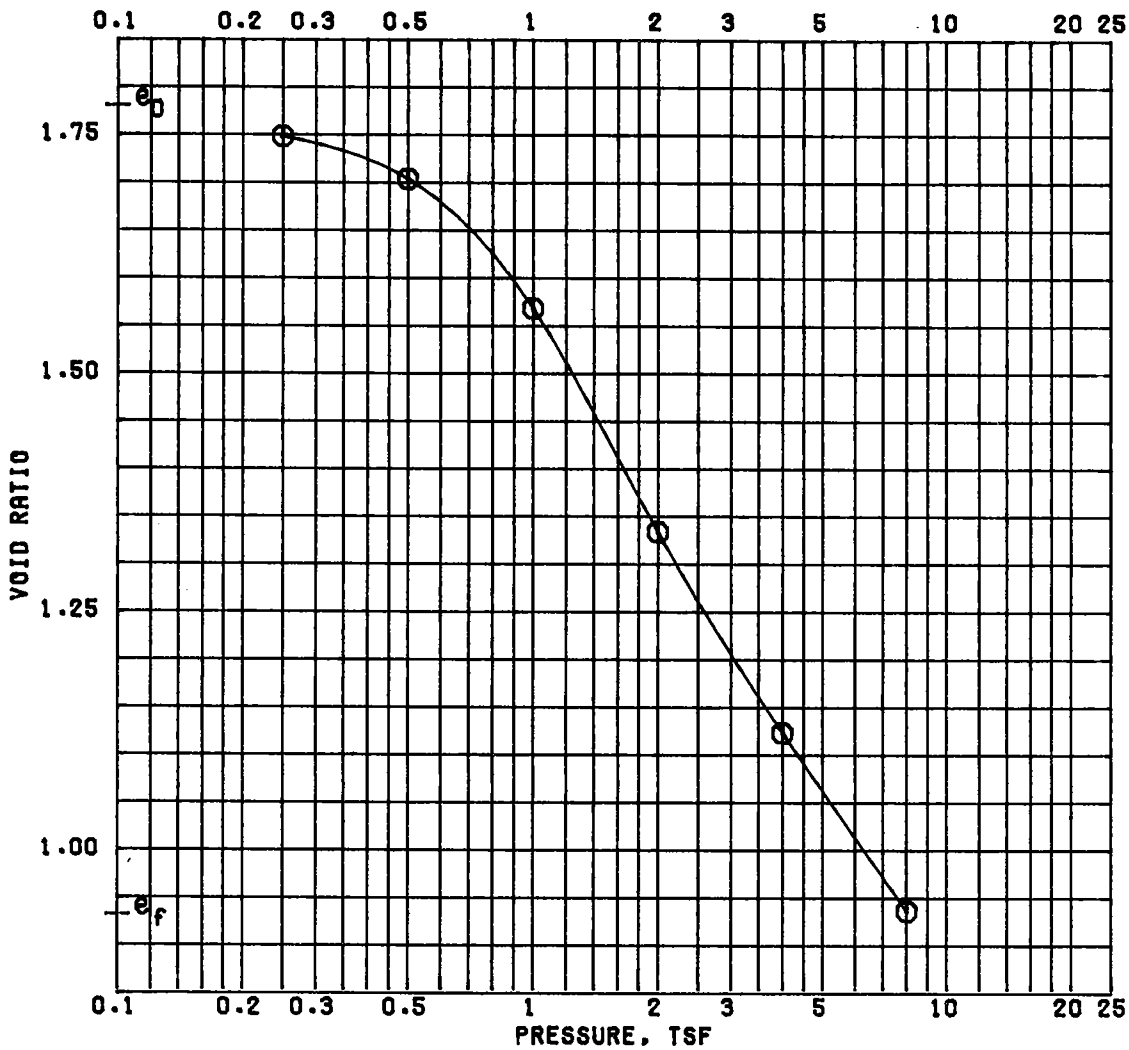
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT SEAMS

LL 82	PL 24	PI 58	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 6-U	SAMPLE NO. 13-C
DEPTH/ELEV 47.4/-40.25	TECH. KOC
LABORATORY USAE WES	DATE 31 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



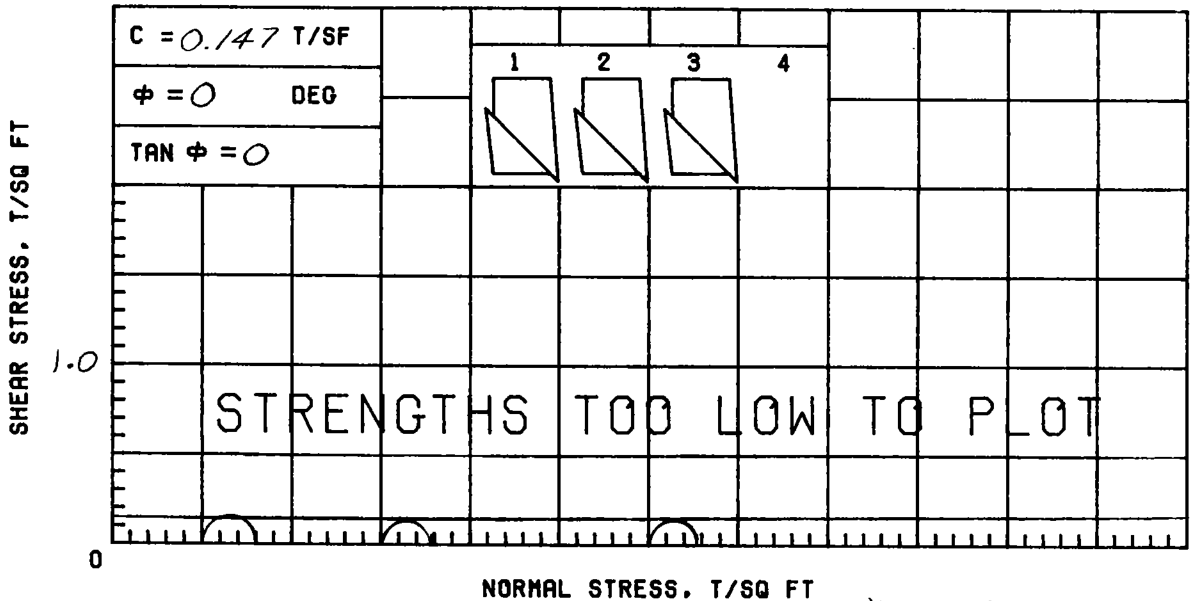
γ Sat 101

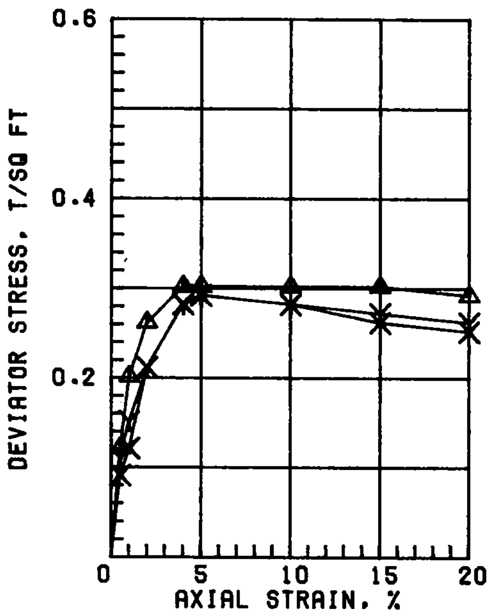
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	63.8	37.2
PRECONSOL. PRESSURE, TSF	0.74	DRY DENSITY, PCF	60.7	87.3
COMPRESSION INDEX	1.68	SATURATION, %	96.9	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.779	0.930
DIA. IN 4.44	HT. IN 1.110	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY			
LL 81	PL 23	PI 58	PROJECT LAKE PONT. LA & VIC. HURR. PROT
GS 2.70 (EST)	D_{10}		JEFFERSON & STA. CHARLES PARISHES
REMARKS			BORING NO. 6-U / SAMPLE NO. 14-B
			DEPTH/ELEV 50.5/-43.35 / DATE 23 SEP 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8





γ Sat 100

		SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL		WATER CONTENT, %	64.2	64.5	65.3	
		DRY DENSITY, PCF	60.2	60.2	59.9	
		SATURATION, %	96.3	96.7	97.1	
		VOID RATIO	1.801	1.801	1.816	
BEFORE SHEAR		WATER CONTENT, %				
		DRY DENSITY, PCF				
		SATURATION, %				
		VOID RATIO				
		BACK PRESS., TSF				
MIN PRIN. STRESS, TSF			0.5	1.5	3.0	
MAX. DEV. STRESS, TSF			0.30	0.29	0.29	
TIME TO FAILURE, MIN.			8	10	10	
RATE OF STRAIN INCR.%						
INITIAL DIAMETER, IN.			1.40	1.40	1.40	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	

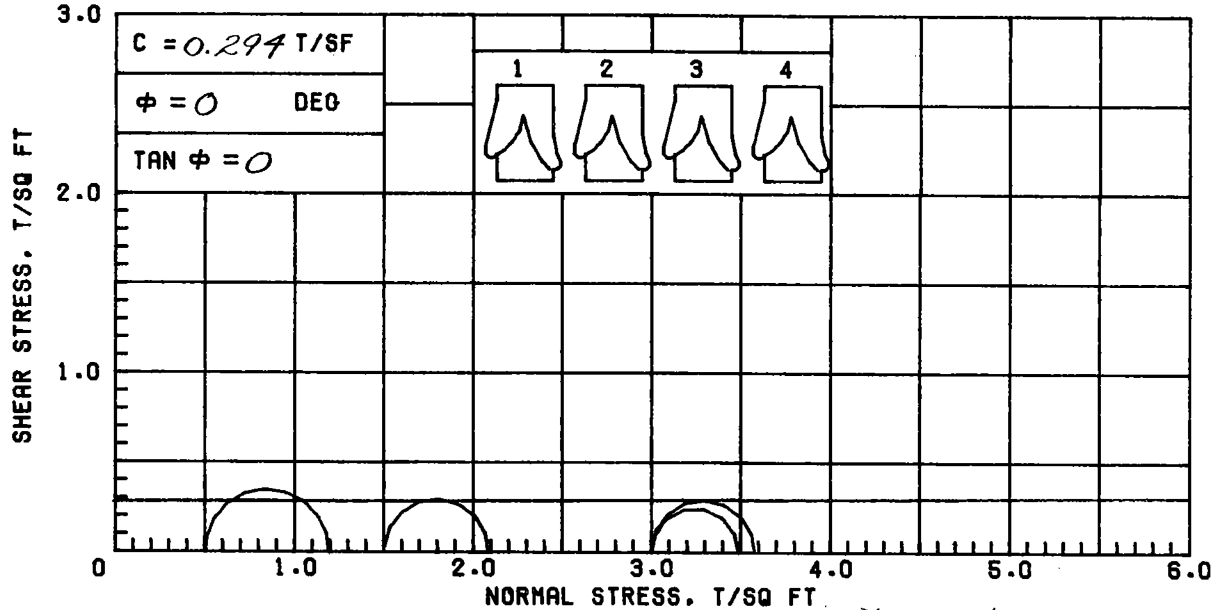
Avg. 64.7

CONTROLLED-STRAIN TEST

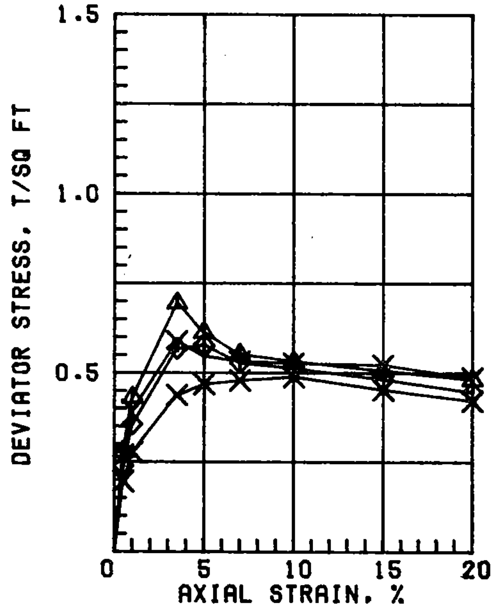
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 82	PL 22	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 6-U	SAMPLE NO. 16-C
	DEPTH/ELEV 58.6/-51.45	TECH. KOC
	LABORATORY USAE WES	DATE 01 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 100



SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	70.6	70.1	69.9	70.6
	DRY DENSITY, PCF	58.6	58.7	58.5	58.4
	SATURATION, %	100+	100+	100+	100+
	VOID RATIO	1.879	1.872	1.883	1.885
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	3.0
MAX. DEV. STRESS, TSF		0.69	0.59	0.49	0.58
TIME TO FAILURE, MIN.		7	15	43	21
RATE OF STRAIN INCR,%			7		7
INITIAL DIAMETER, IN.		1.39	1.39	1.38	1.39
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 70.3

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

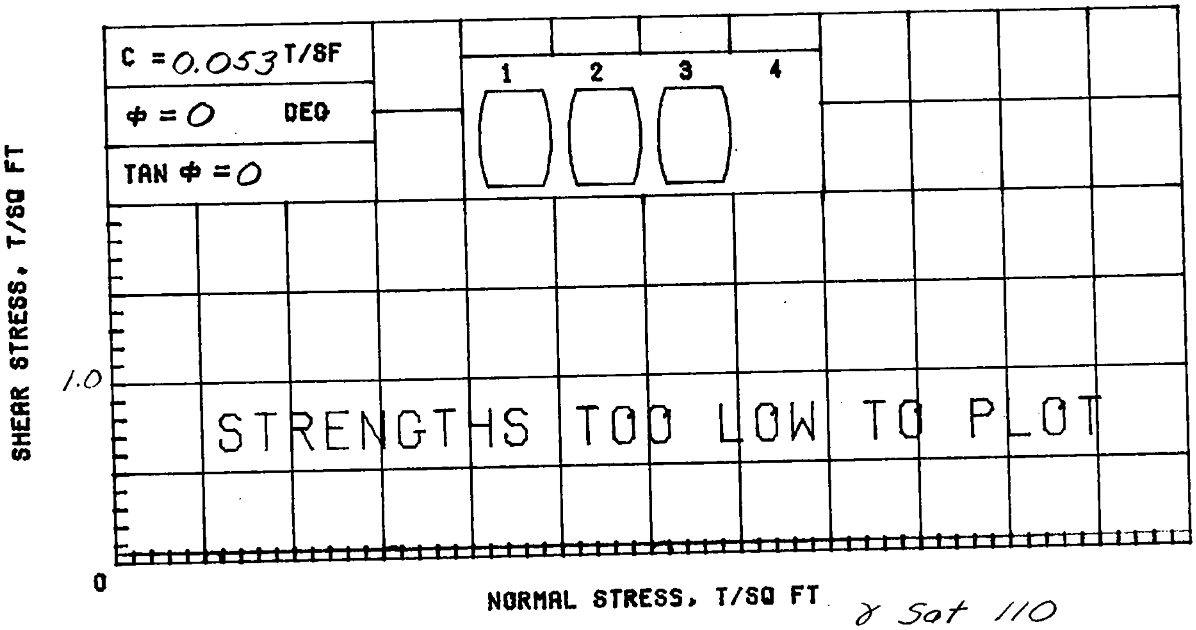
LL 90	PL 22	PI 68	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

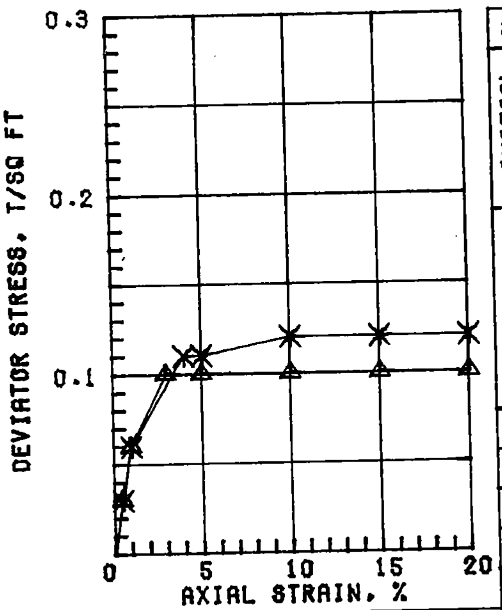
PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISH

BORING NO. 6-U	SAMPLE NO. 19-B
DEPTH/ELEV 70.0/-62.85	TECH. PJR
LABORATORY USAE WES	DATE 01 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 110



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	43.8	39.8	43.7	
	DRY DENSITY, PCF	73.6	78.5	74.7	
	SATURATION, %	91.7	93.6	94.0	
	VOID RATIO	1.290	1.149	1.255	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.10	0.11	0.11	
	TIME TO FAILURE, MIN.	6	24	24	
	RATE OF STRAIN INCR.,%		6	6	
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 42.4

CONTROLLED-STRAIN TEST

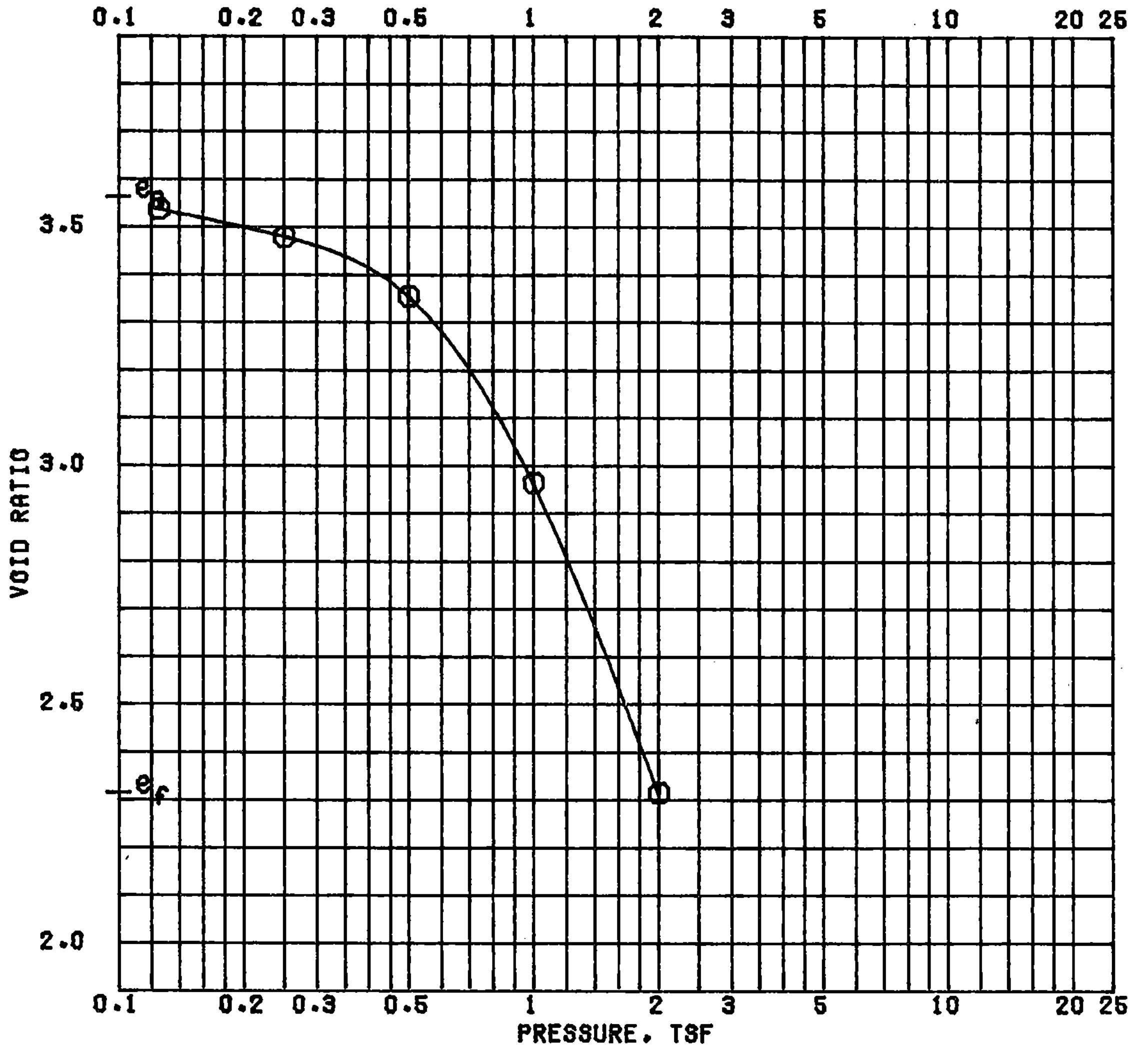
DESCRIPTION OF SPECIMENS: CLAY (CL), GRAY; ORGANIC MATERIAL

LL 49	PL 16	PI 33	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 4-B
DEPTH/ELEV 10.0/-2.15	TECH. KOC
LABORATORY USAE WES	DATE 18 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 72

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	210.0	150.1
PRECONSOL. PRESSURE, TSF	0.68	DRY DENSITY, PCF	23.3	32.1
COMPRESSION INDEX	3.33	SATURATION, %	100 +	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	3.559	2.311
DIA. IN 4.44	HT. IN 1.111	BACK PRESSURE, TSF		

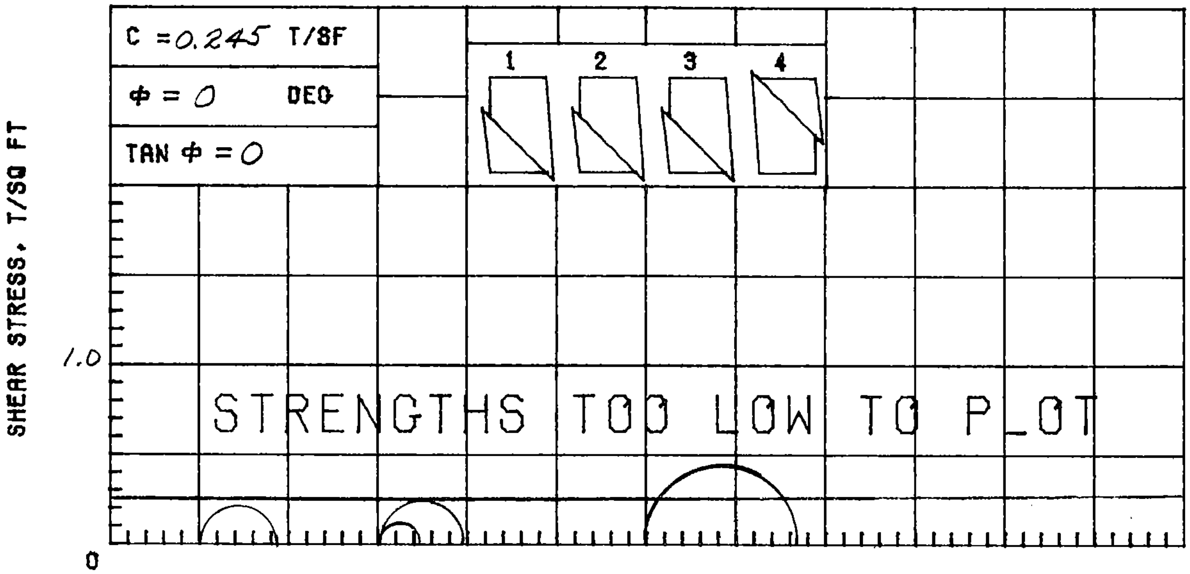
CLASSIFICATION PEAT (PT), DARK BROWN

LL 472	PL 235	PI 237	PROJECT LK. PONT. & VIC. HURR. PROT.
GS 1.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISH

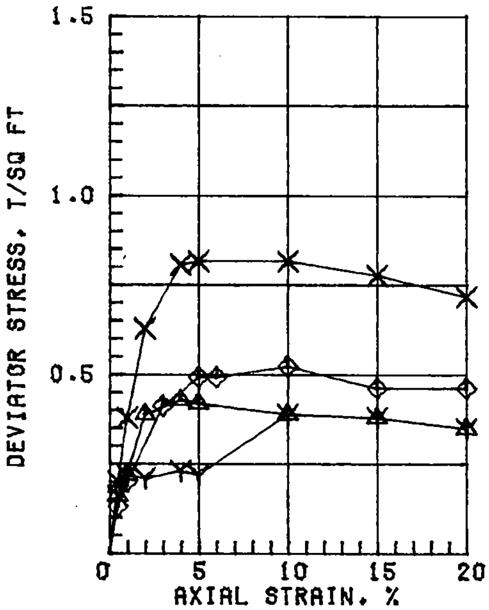
REMARKS	BORING NO. 7-U	SAMPLE NO. 6-B
	DEPTH/ELEV 18.0/-10.15	DATE 22 MAY 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 7



γ Sat 77



		Δ1	Y2	X3	Φ4	
	SPECIMEN NO.	Δ1	Y2	X3	Φ4	Avg
INITIAL	WATER CONTENT, %	206.3	183.2	198.1	215.8	200.9
	DRY DENSITY, PCF	24.3	26.5	24.8	23.0	
	SATURATION, %	95.8	94.4	94.5	94.0	
	VOID RATIO	5.167	4.658	5.030	5.509	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	1.5	
	MAX. DEV. STRESS, TSF	0.43	0.22	0.82	0.49	
	TIME TO FAILURE, MIN.	8	6	30	30	
	RATE OF STRAIN INCR.,%		6	6	6	
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00	

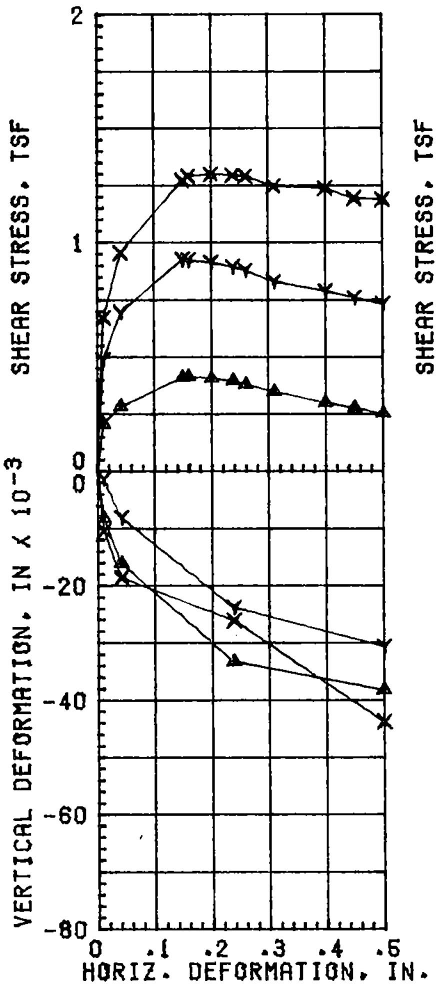
CONTROLLED-STRAIN TEST

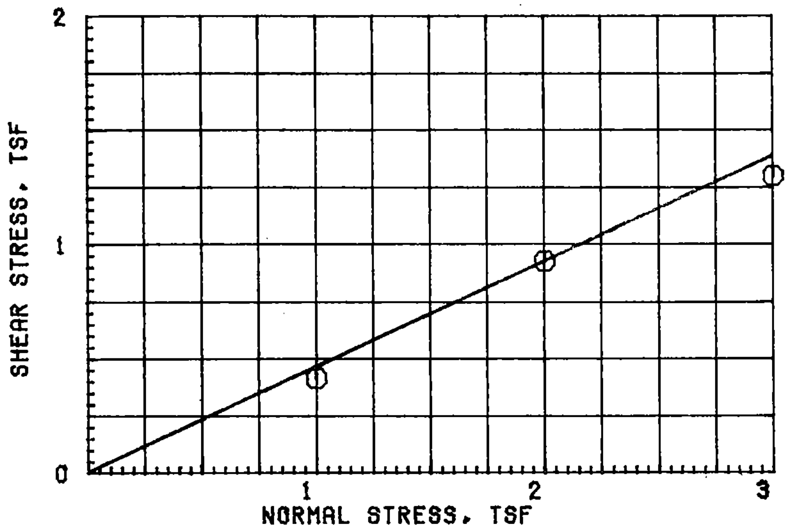
DESCRIPTION OF SPECIMENS: ORGANIC CLAY (OH), BLACK; POCKETS OF PLASTIC CLAY (CH)

LL 249	PL 85	PI 164	GS 2.40 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	
	PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH
	BORING NO. 7-U — SAMPLE NO. 6-C
	DEPTH/ELEV 19.0/-11.15 — TECH. KOC
	LABORATORY USAE WES — DATE 21 JUN 85

TRIAXIAL COMPRESSION TEST REPORT





γ Sat 101

		TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %		54.4	54.7	56.9	55.3
INITAL	VOID RATIO		1.773	1.758	1.788	
INITAL	SATURATION, %		82.8	84.0	86.0	
INITAL	DRY DENSITY, PCF		60.8	61.1	60.4	
VOID RATIO AFTER CONSOL						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL	WATER CONTENT, %		50.9	32.3	31.4	
FINAL	VOID RATIO					
FINAL	SATURATION, %					
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.42	0.93	1.30	
TIME TO FAILURE, MIN			879	824	1099	
RATE OF STRAIN, IN/MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, TSF						

$\phi = 25^\circ$

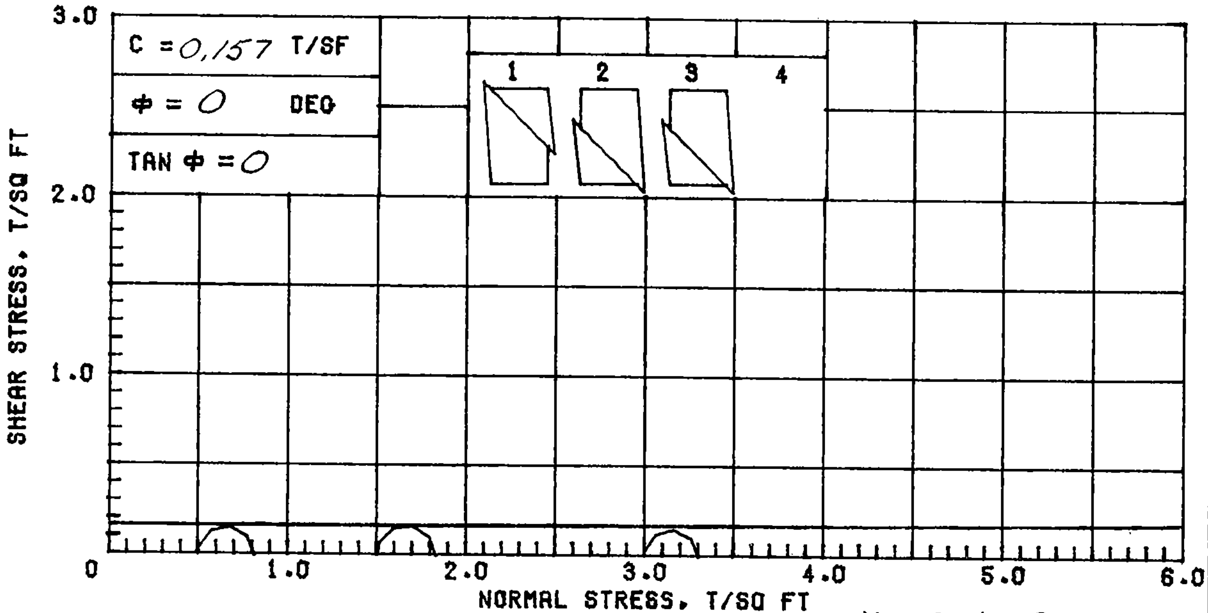
TAN $\phi = 0.466$

C = 0

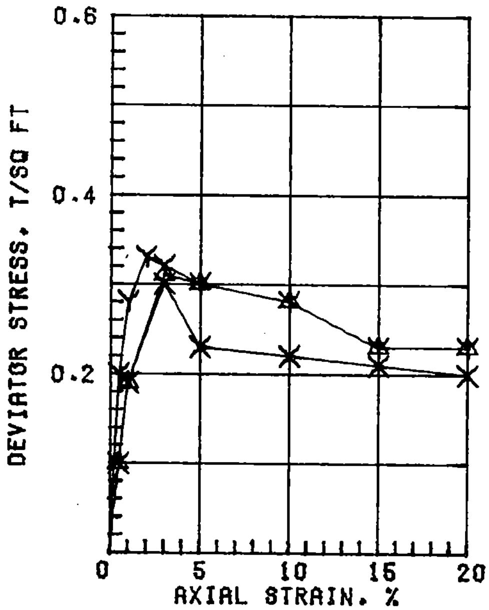
TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.553 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY		

LL 64	PL 19	PI 45		GS 2.70 (EST)

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 7-U	SAMPLE 8-C
	DEPTH/ELEV 27/-19.5	DATE 23 JUL 85
	DIRECT SHEAR TEST REPORT	



γ Sat 98



CONTROLLED-STRAIN TEST

		▲1	Y2	X3	4
SPECIMEN NO.		▲1	Y2	X3	4
INITIAL	WATER CONTENT, %	72.7	73.4	75.2	
	DRY DENSITY, PCF	56.6	56.0	57.0	
	SATURATION, %	99.3	98.7	100+	
	VOID RATIO	1.977	2.007	1.956	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.31	0.33	0.30	
TIME TO FAILURE, MIN.		6	12	18	
RATE OF STRAIN INCR.,%			6	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 73.8

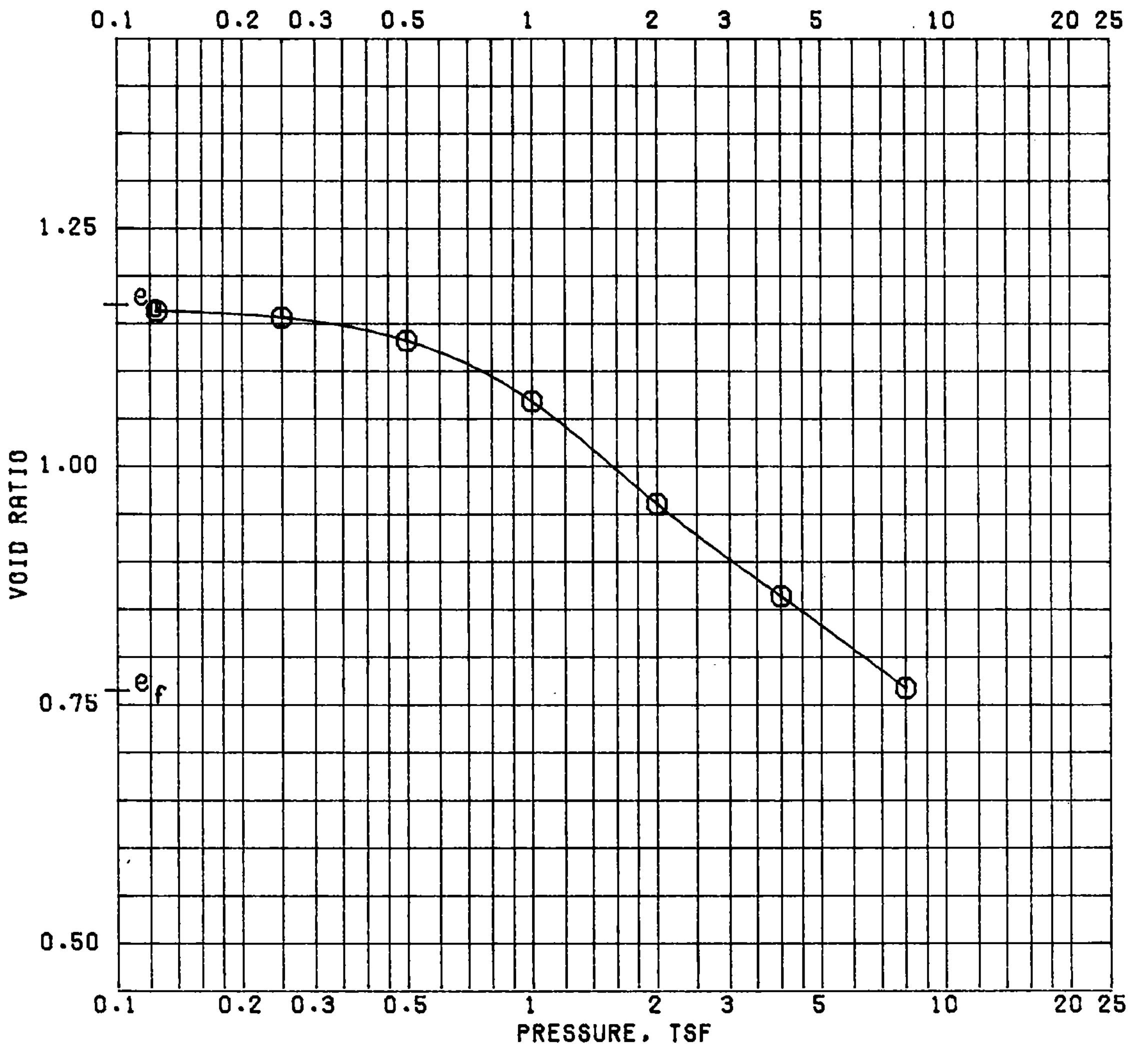
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT SEAMS

LL 87	PL 22	PI 65	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 10-B
DEPTH/ELEV 33.8/-25.95	TECH. KOC
LABORATORY USAE WES	DATE 21 JUN 85

TRIAXIAL COMPRESSION TEST REPORT

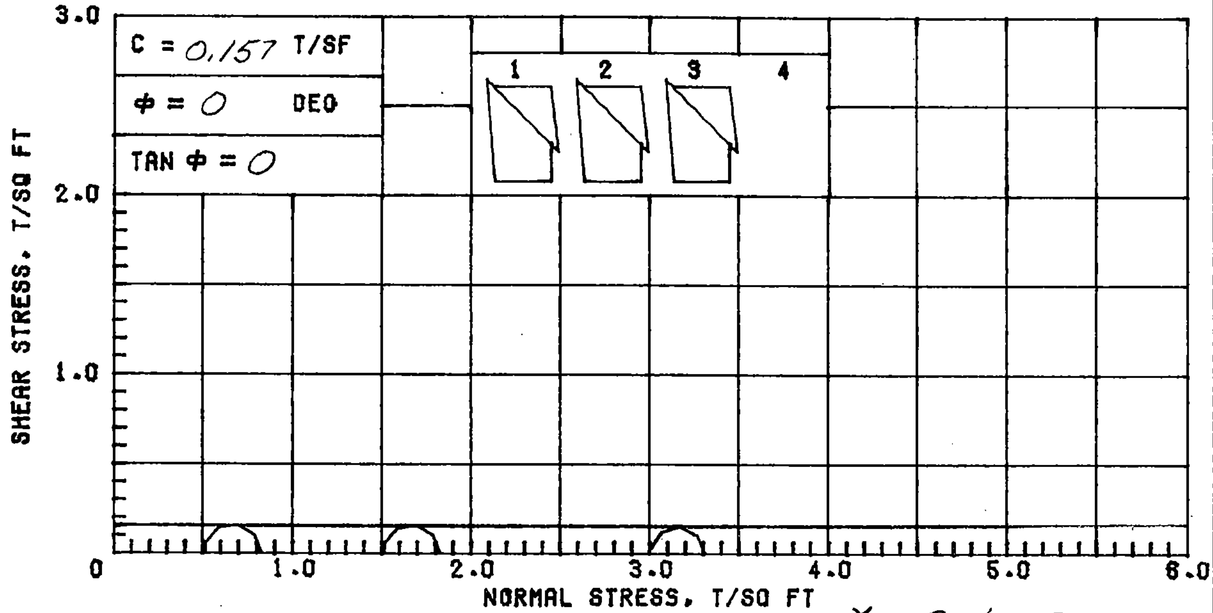


γ Sat 111

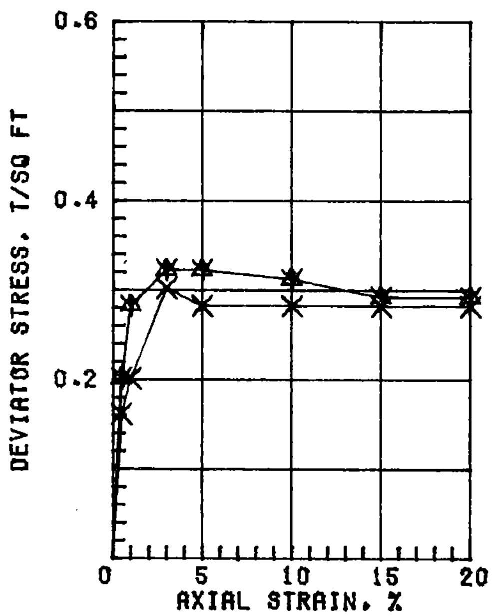
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	40.8	28.2
PRECONSOL. PRESSURE, TSF	0.73	DRY DENSITY, PCF	77.8	95.6
COMPRESSION INDEX	1.12	SATURATION, %	94.4	99.8
TYPE SPECIMEN UNDISTURBED		VOID RATIO	1.168	0.763
DIA. IN 4.44	HT. IN 1.118	BACK PRESSURE, TSF		

CLASSIFICATION CLAY (CL), GRAY			
LL 46	PL 19	PI 27	PROJECT LK. PONT. & VIC. HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISH
REMARKS		BORING NO. 7-U	SAMPLE NO. 10-C
		DEPTH/ELEV 35.0/-27.15	DATE 23 MAY 85
		CONSOLIDATION TEST REPORT	

SHEET 1 OF 9



γ Sat 97



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	74.8	83.3	75.6	
	DRY DENSITY, PCF	55.7	52.8	55.1	
	SATURATION, %	99.5	100+	99.1	
	VOID RATIO	2.029	2.190	2.059	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.32	0.32	0.30	
TIME TO FAILURE, MIN.		6	18	18	
RATE OF STRAIN INCR.,%			7	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 77.9

CONTROLLED-STRAIN TEST

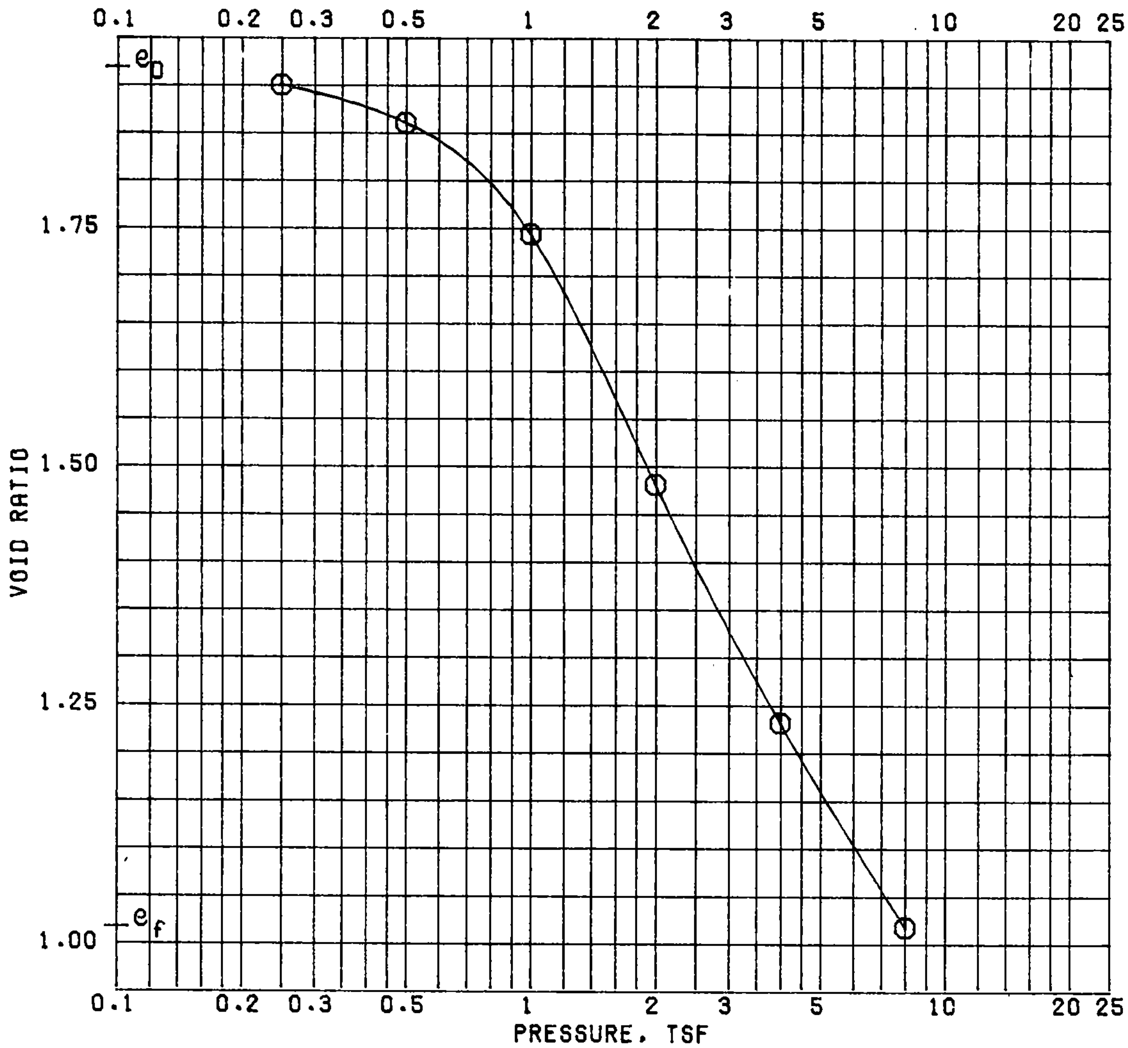
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 89	PL 25	PI 64	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 12-C
DEPTH/ELEV 42.6/-34.75	TECH. KOC
LABORATORY USAE WES	DATE 24 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



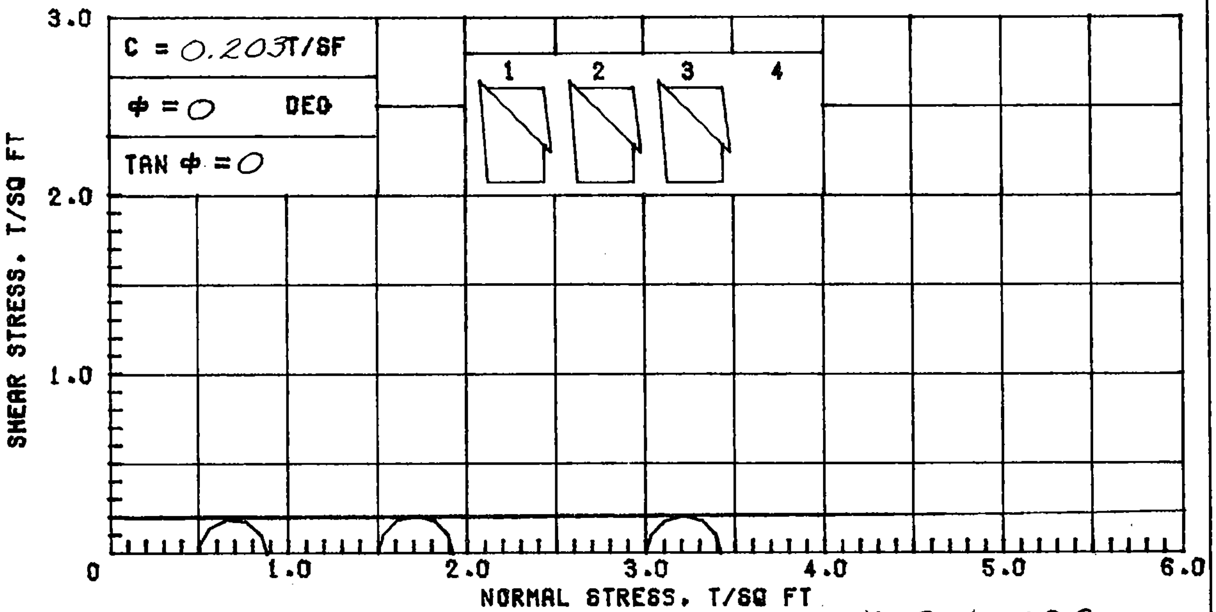
				BEFORE TEST	AFTER TEST
				γ Sat	99
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	69.1	39.6
PRECONSOL. PRESSURE, TSF		0.87	DRY DENSITY, PCF	57.8	83.6
COMPRESSION INDEX		1.81	SATURATION, %	97.3	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	1.917	1.016
DIA. IN 4.44	HT. IN 1.123		BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY		
LL 87	PL 24	PI 63
GS 2.70 (EST)	D_{10}	
REMARKS		

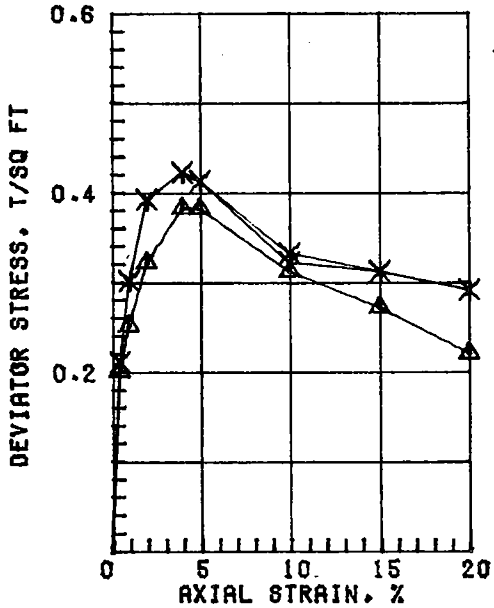
PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 13-C
DEPTH/ELEV 46.7/-38.85	DATE 24 MAY 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



8 Sat 100



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	67.5	68.3	68.4	
	DRY DENSITY, PCF	59.9	59.[illegible]	59.8	
	SATURATION, %	100+	100.0	100+	
	VOID RATIO	1.813	1.844	1.819	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.38	0.42	0.42	
	TIME TO FAILURE, MIN.	8	24	24	
	RATE OF STRAIN INCR.%		6	6	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

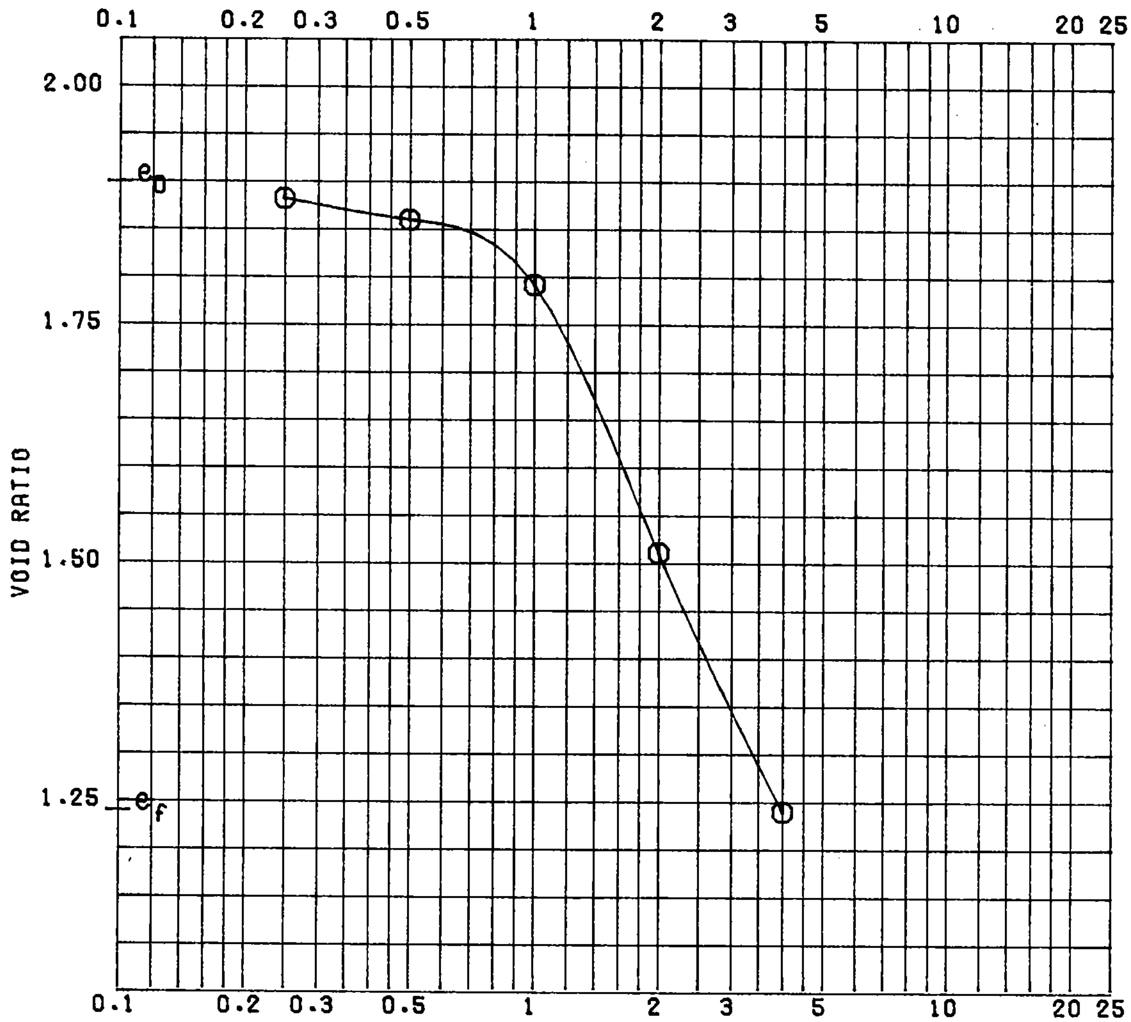
Avg. 68.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; 1/4" SILT LAYERS

LL 86	PL 26	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 7-U	SAMPLE NO. 15-B
	DEPTH/ELEV 54.0/-46.15	TECH. KOC
	LABORATORY USAE WES	DATE 25 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	



8 Sat 99

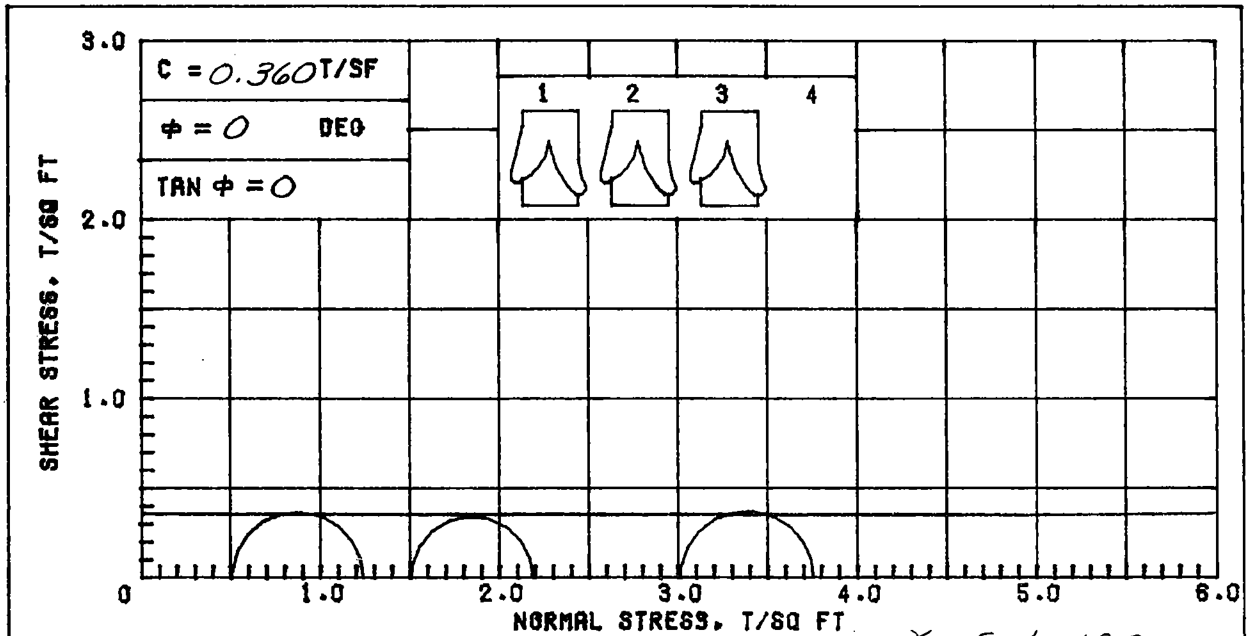
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	69.5	47.4
PRECONSOL. PRESSURE, TSF	1.00	DRY DENSITY, PCF	58.2	75.3
COMPRESSION INDEX	1.82	SATURATION, %	98.9	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.897	1.238
DIA. IN 4.44	HT. IN 1.124	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY		
LL 89	PL 24	PI 65
GS 2.70 (EST)	D_{10}	
REMARKS		

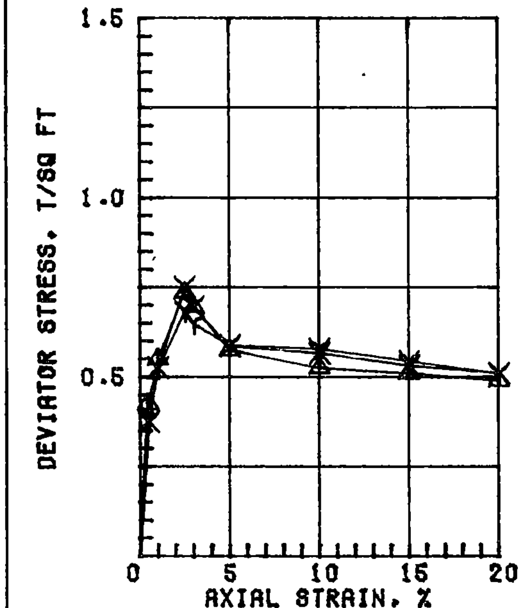
PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 16-C
DEPTH/ELEV 59.0/-51.15	DATE 29 MAY 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 7



γ Sat 100



SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	68.9	68.2	68.9	
	DRY DENSITY, PCF	59.3	59.6	59.3	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.842	1.826	1.845	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.73	0.68	0.75	
TIME TO FAILURE, MIN.		5	15	15	
RATE OF STRAIN INCR.,%			5	5	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 68.7

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

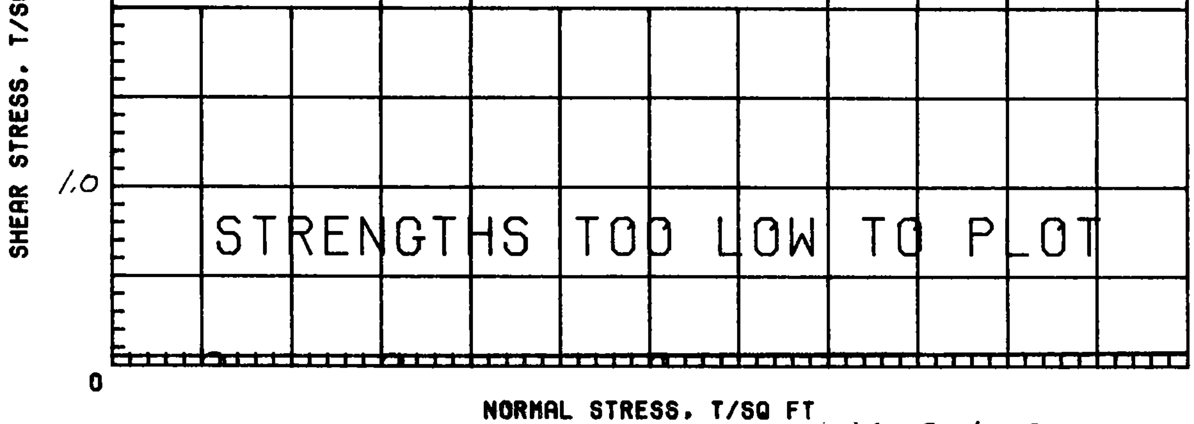
LL 90	PL 26	PI 64	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

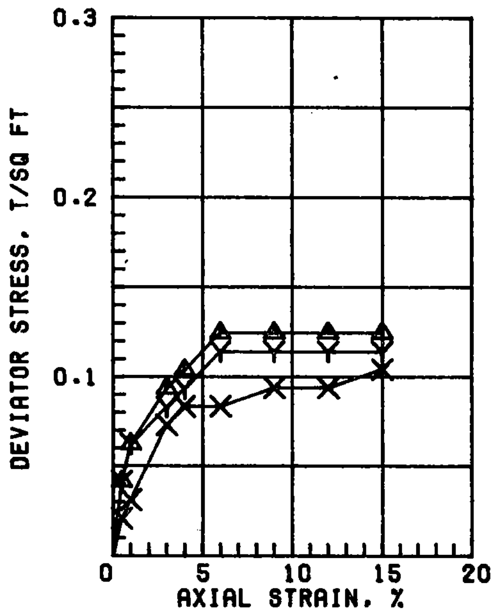
REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 7-U	SAMPLE NO. 19-B
DEPTH/ELEV 70/-62.2	TECH. PJR
LABORATORY USAE WES	DATE 25 JUN 85

TRIAXIAL COMPRESSION TEST REPORT

C = 0.052 T/SF	
Φ = 0 DEG	
TAN Φ = 0	





γ Sat 97

	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	83.0	79.9	78.2	
	DRY DENSITY, PCF	52.4	53.9	54.7	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.217	2.129	2.081	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.12	0.11	0.08	
	TIME TO FAILURE, MIN.	12	13	9	
	RATE OF STRAIN INCR.%				
	INITIAL DIAMETER, IN.	1.37	1.37	1.37	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

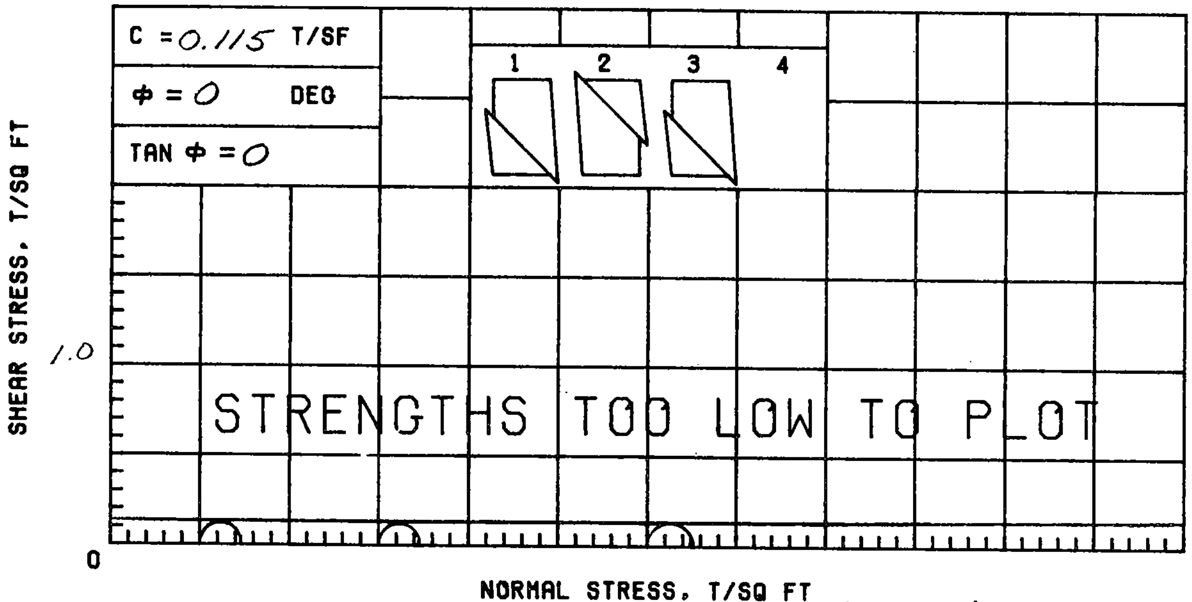
Avg. 80.4

CONTROLLED-STRAIN TEST

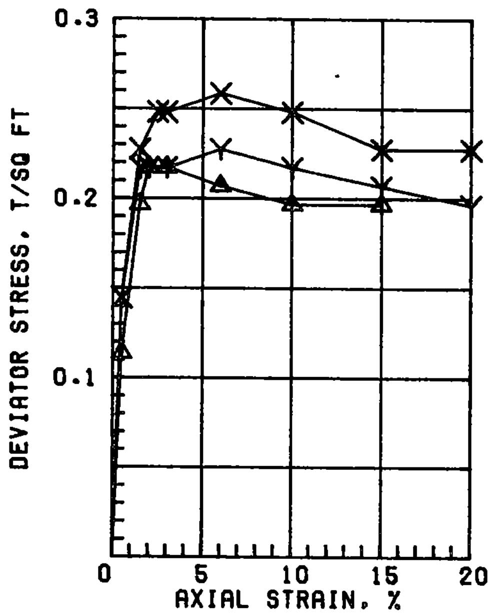
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 90	PL 23	PI 67	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 8-U	SAMPLE NO. 5-B
	DEPTH/ELEV 13.8/-15.6	TECH. LRC
	LABORATORY USAE WES	DATE 01 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 96



		Δ1	Y2	X3	4
	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	85.0	81.1	78.1	
INITIAL	DRY DENSITY, PCF	51.2	53.2	54.7	
INITIAL	SATURATION, %	100+	100+	100+	
INITIAL	VOID RATIO	2.291	2.171	2.080	
BEFORE SHEAR	WATER CONTENT, %				
BEFORE SHEAR	DRY DENSITY, PCF				
BEFORE SHEAR	SATURATION, %				
BEFORE SHEAR	VOID RATIO				
BEFORE SHEAR	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.22	0.22	0.25	
	TIME TO FAILURE, MIN.	4	12	33	
	RATE OF STRAIN INCR.%		4	3	
	INITIAL DIAMETER, IN.	1.38	1.38	1.38	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 81.4

CONTROLLED-STRAIN TEST

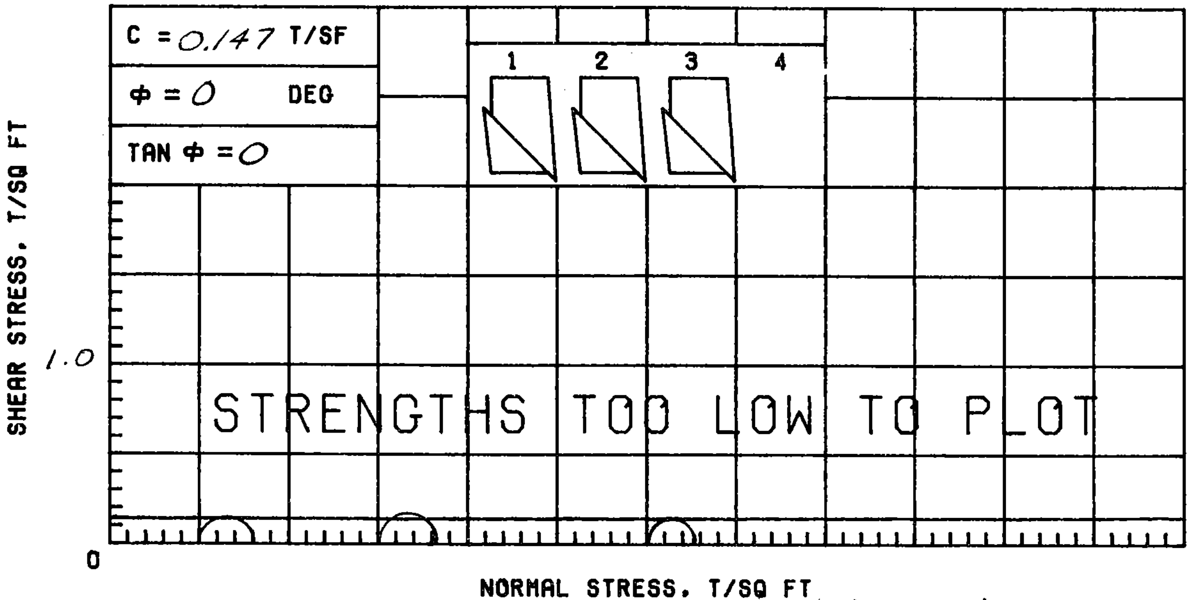
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 81	PL 21	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

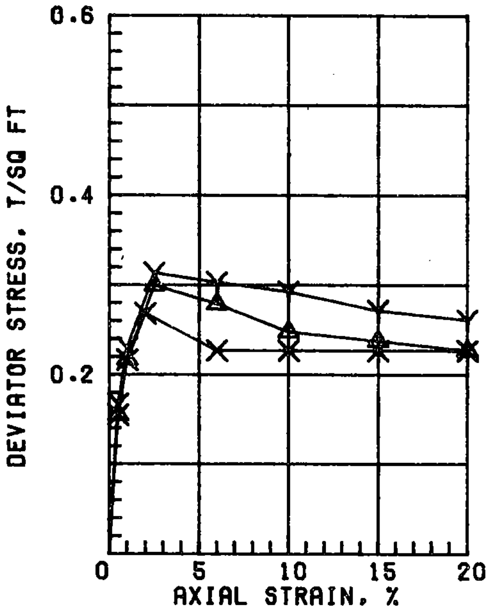
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 8-U	SAMPLE NO. 7-B
DEPTH/ELEV 22.4/24.6	TECH. LRC
LABORATORY USAE WES	DATE 01 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



8 Sept 97



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	78.1	78.1	78.8	
	DRY DENSITY, PCF	54.5	54.4	54.2	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.093	2.096	2.109	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.30	0.31	0.27	
TIME TO FAILURE, MIN.		5	22	15	
RATE OF STRAIN INCR,%			3	3	
INITIAL DIAMETER, IN.		1.38	1.37	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

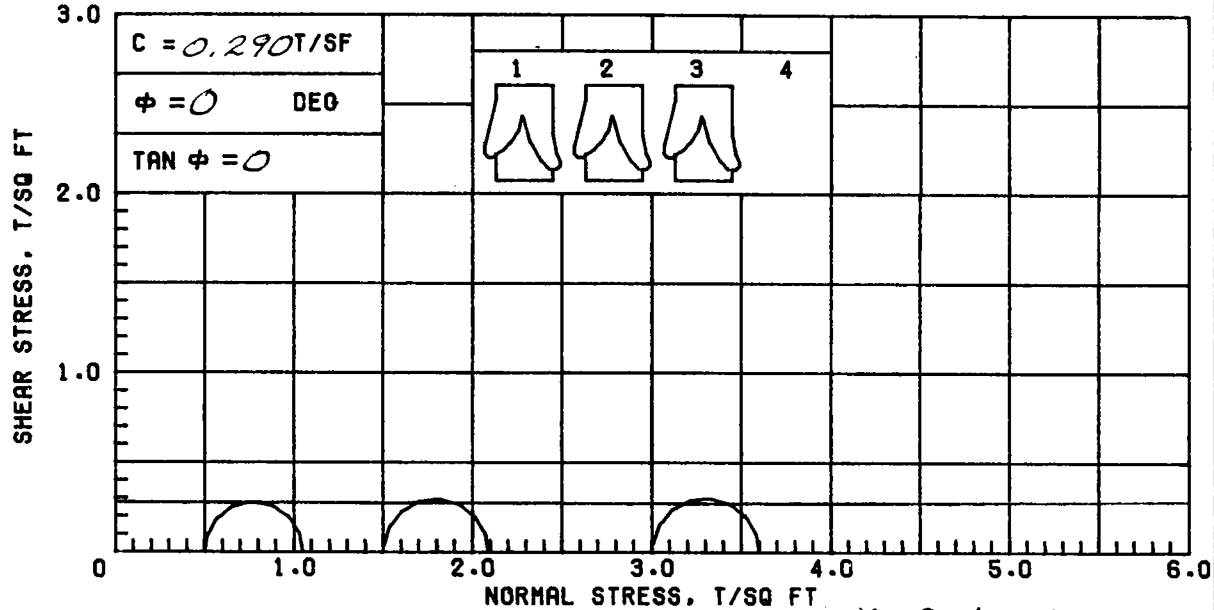
Avg. 78.3

CONTROLLED-STRAIN TEST

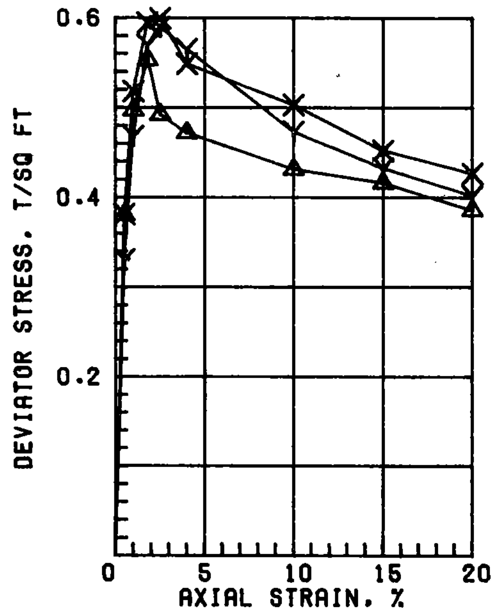
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 82	PL 23	PI 59	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 8-U	SAMPLE NO. 10-B
	DEPTH/ELEV 34.9/-36.7	TECH. LRC
	LABORATORY USAE WES	DATE 02 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 101



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	68.9	70.1	70.2	
	DRY DENSITY, PCF	59.9	59.3	59.3	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.814	1.841	1.840	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.55	0.59	0.60	
	TIME TO FAILURE, MIN.	4	22	22	
	RATE OF STRAIN INCR.%		4	4	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 69.7

CONTROLLED-STRAIN TEST

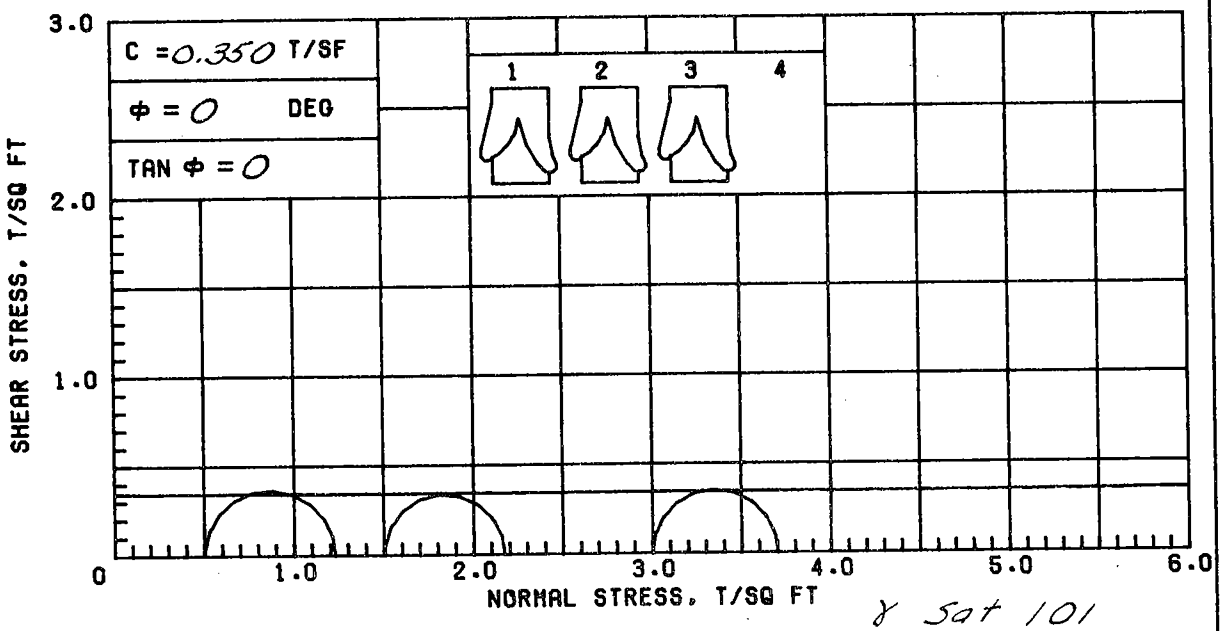
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 83	PL 23	PI 60	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 8-U	SAMPLE NO. 12-C
DEPTH/ELEV 44.0/-45.8	TECH. PJR
LABORATORY USAE WES	DATE 01 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



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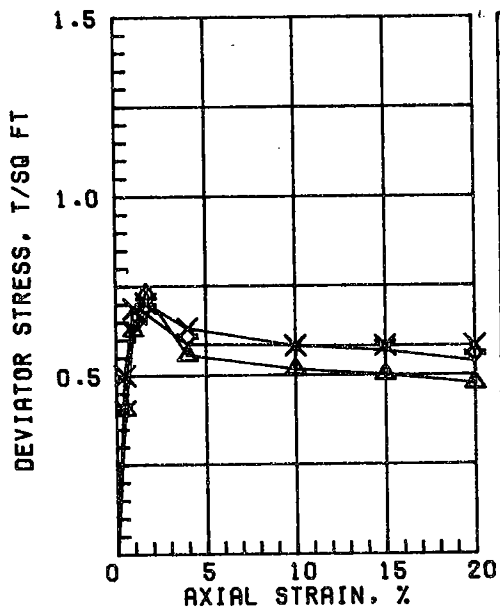


	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	72.1	70.6	69.5	
	DRY DENSITY, PCF	58.4	59.0	59.4	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.888	1.856	1.838	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.73	0.67	0.70	
	TIME TO FAILURE, MIN.	3	15	15	
	RATE OF STRAIN INCR.%		4	4	
	INITIAL DIAMETER, IN.	1.39	1.39	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 70.7

CONTROLLED-STRAIN TEST

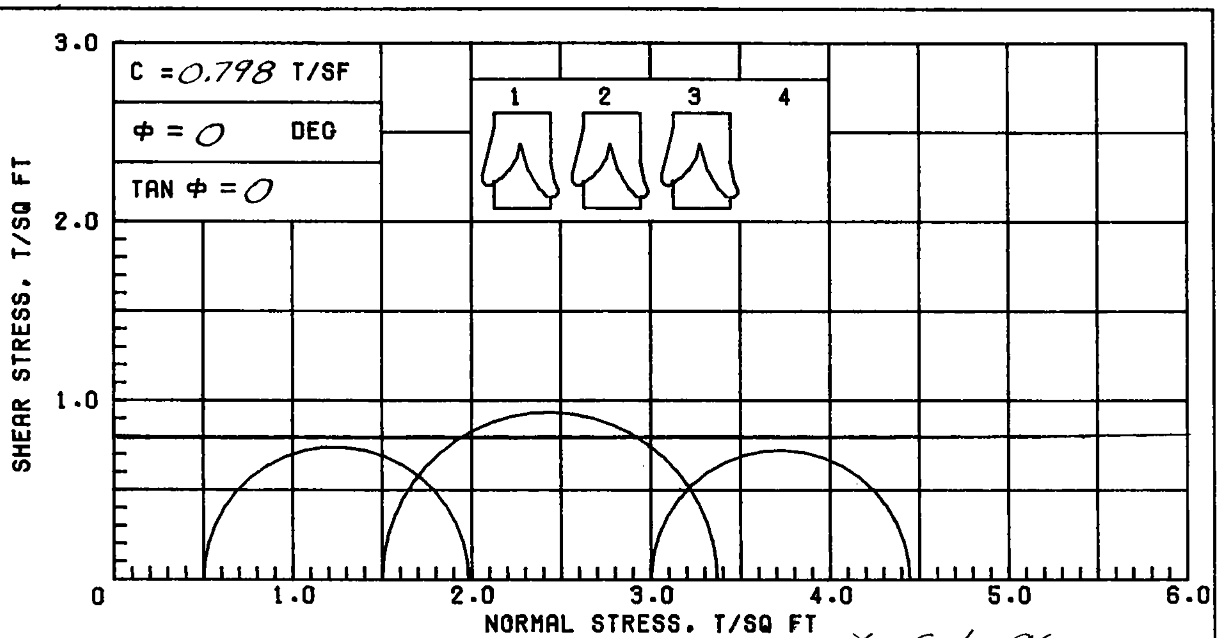
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 90	PL 21	PI 69	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

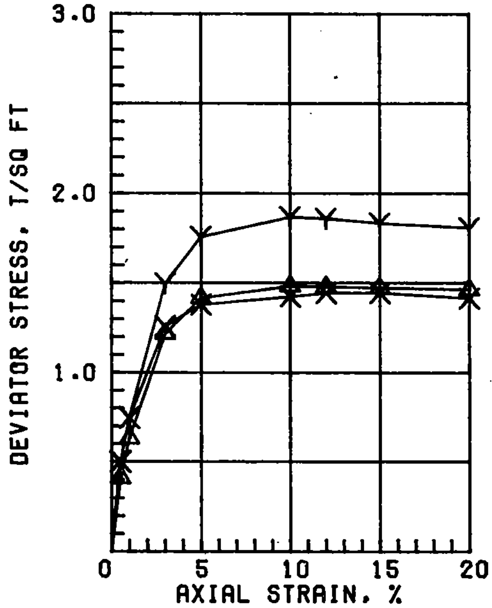
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 8-U	SAMPLE NO. 16-B
DEPTH/ELEV 58.8/-60.6	TECH. PJR
LABORATORY USAE WES	DATE 01 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 96



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	70.4	68.3	66.0	
	DRY DENSITY, PCF	51.6	52.5	55.2	
	SATURATION, %	84.0	83.4	86.7	
	VOID RATIO	2.264	2.210	2.055	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		1.48	1.87	1.44	
TIME TO FAILURE, MIN.		20	15	18	
RATE OF STRAIN INCR.%					
INITIAL DIAMETER, IN.		1.38	1.39	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 68.2

CONTROLLED-STRAIN TEST

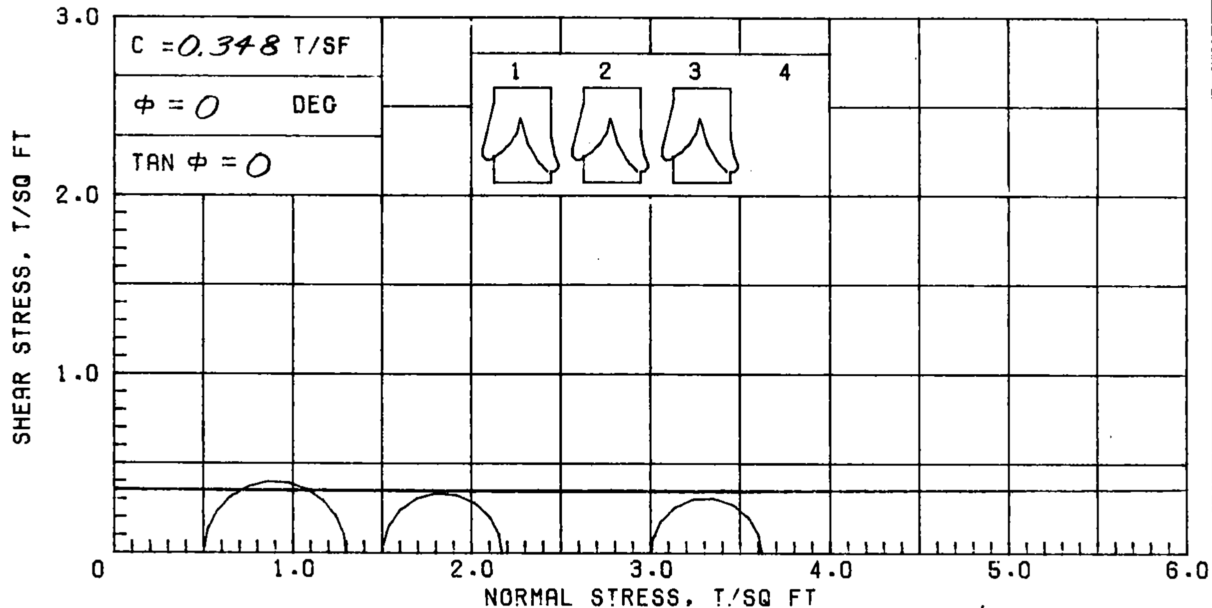
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), DARK BROWN; ORGANIC MATERIAL

LL 116	PL 40	PI 76	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

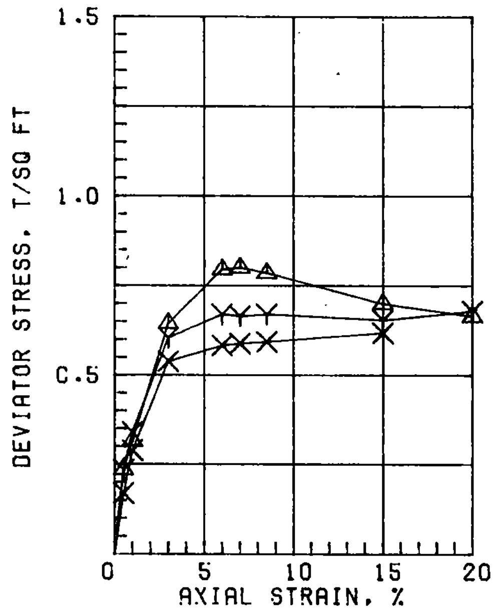
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 8-UA	SAMPLE NO. 5-B
DEPTH/ELEV 12.2/-5.21	TECH. PJR
LABORATORY USAE WES	DATE 10 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 77



			SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	209.1	205.1	198.9	
INITIAL	DRY DENSITY, PCF	24.0	24.3	24.9	
INITIAL	SATURATION, %	95.8	95.4	95.0	
INITIAL	VOID RATIO	5.241	5.161	5.022	
BEFORE SHEAR	WATER CONTENT, %				
BEFORE SHEAR	DRY DENSITY, PCF				
BEFORE SHEAR	SATURATION, %				
BEFORE SHEAR	VOID RATIO				
BEFORE SHEAR	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.80	0.67	0.62	
TIME TO FAILURE, MIN.		14	14	34	
RATE OF STRAIN INCR.%					
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

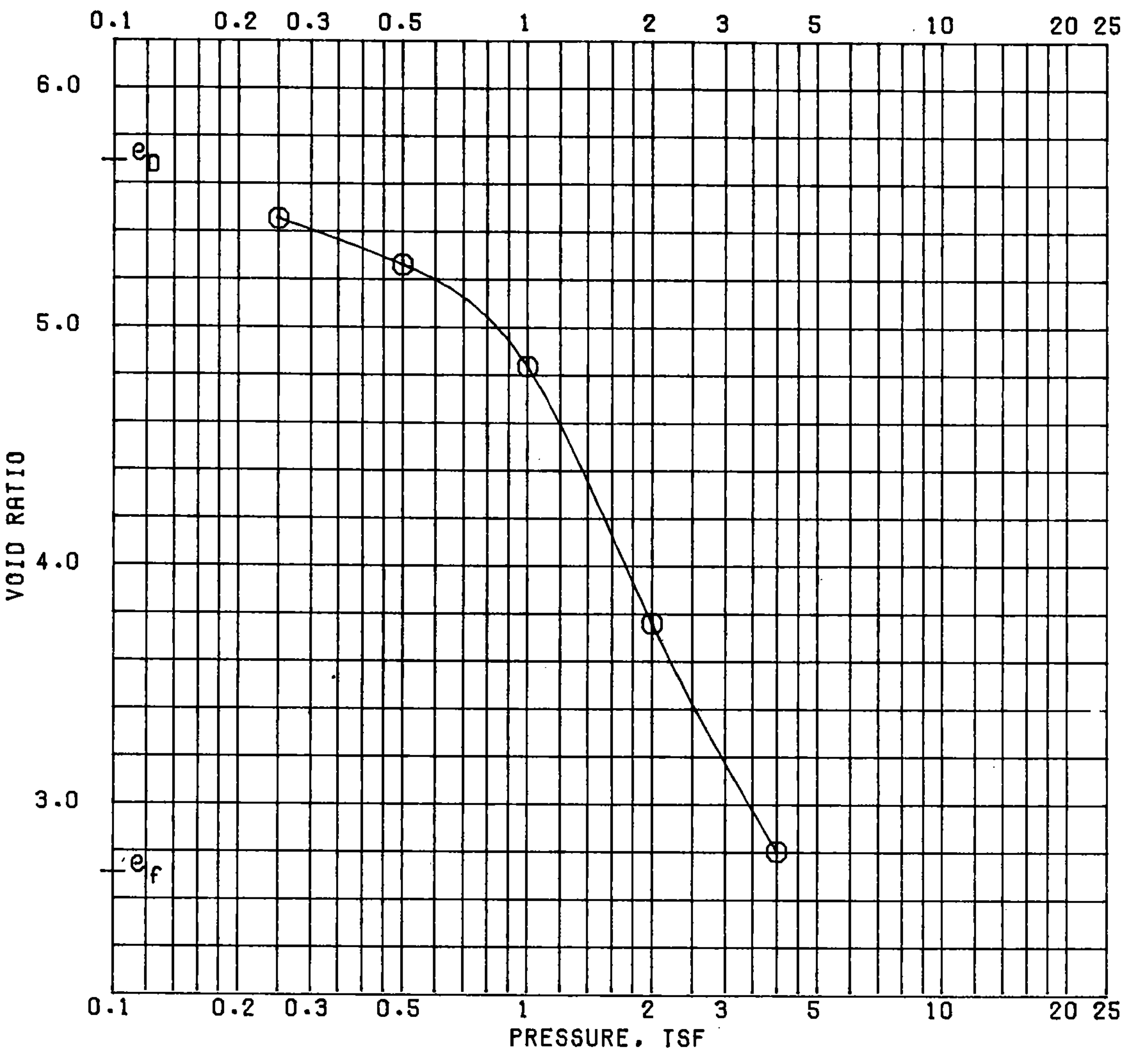
Avg. 204.4

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; ORGANIC CLAY (OH), DARK BROWN

LL 334	PL 130	PI 204	GS 2.40 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR PROT	
	JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 8-UA	SAMPLE NO. 7-B
	DEPTH/ELEV 20 / -13.01	TECH. PJR
	LABORATORY USAE WES	DATE 24 SEP 85
	TRIAXIAL COMPRESSION TEST REPORT	



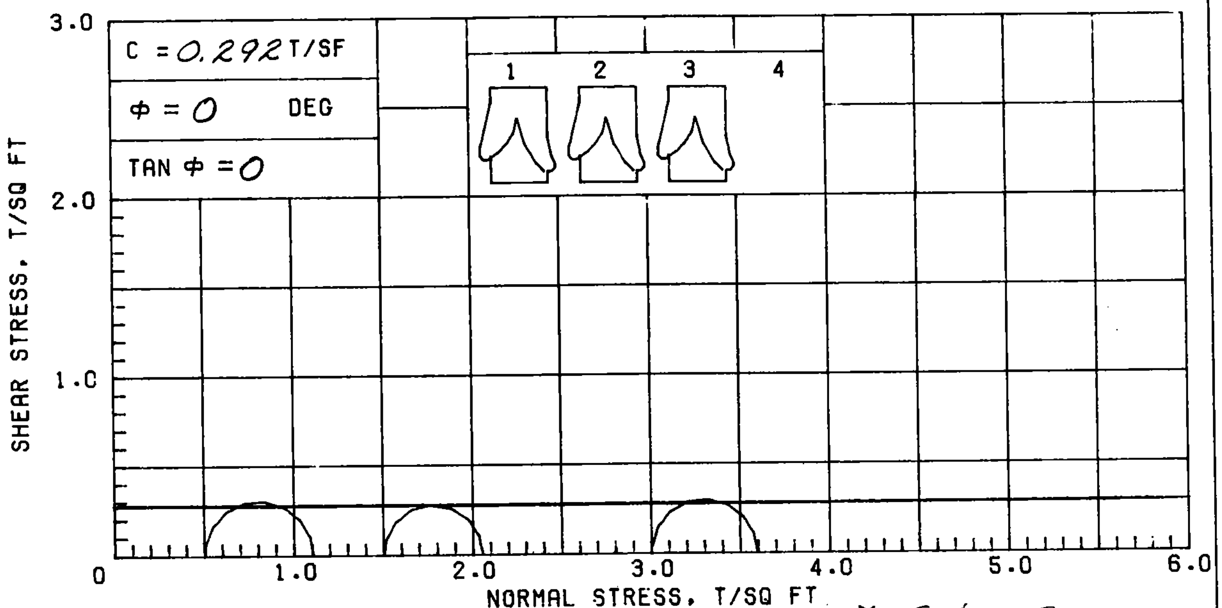
γ Sat 69

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	326.4	170.8
PRECONSOL. PRESSURE, TSF	0.90	DRY DENSITY, PCF	15.9	28.7
COMPRESSION INDEX	5.12	SATURATION, %	97.6	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	5.686	2.704
DIA. IN 4.44	HT. IN 1.132	BACK PRESSURE, TSF		

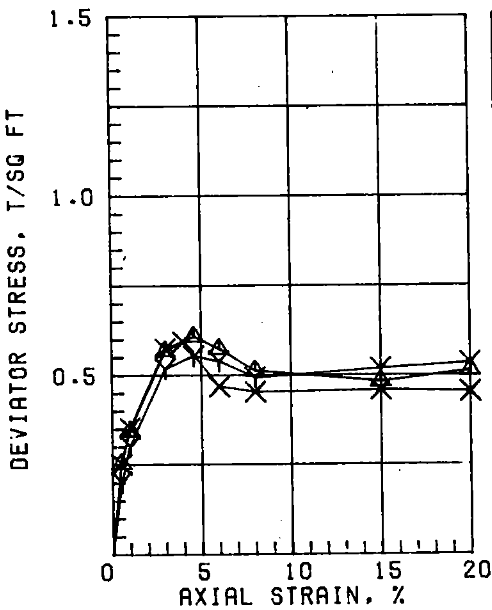
CLASSIFICATION PEAT (PT), BROWN			
LL 452	PL 250	PI 202	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
GS 1.70 (EST)	D_{10}		JEFFERSON & ST. CHARELS PARISHES
REMARKS			BORING NO. 8-UA / SAMPLE NO. 8-B
			DEPTH/ELEV 23.9/-16.9 / DATE 16 NOV 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 7



γ Sat 79



		Δ1	Y2	X3	4
SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	202.0	189.0	181.0	
	DRY DENSITY, PCF	25.2	26.6	27.5	
	SATURATION, %	95.8	95.6	95.5	
	VOID RATIO	5.693	5.339	5.119	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.61	0.55	0.59	
TIME TO FAILURE, MIN.		9	17	15	
RATE OF STRAIN INCR,%			8	8	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 190.7

CONTROLLED-STRAIN TEST

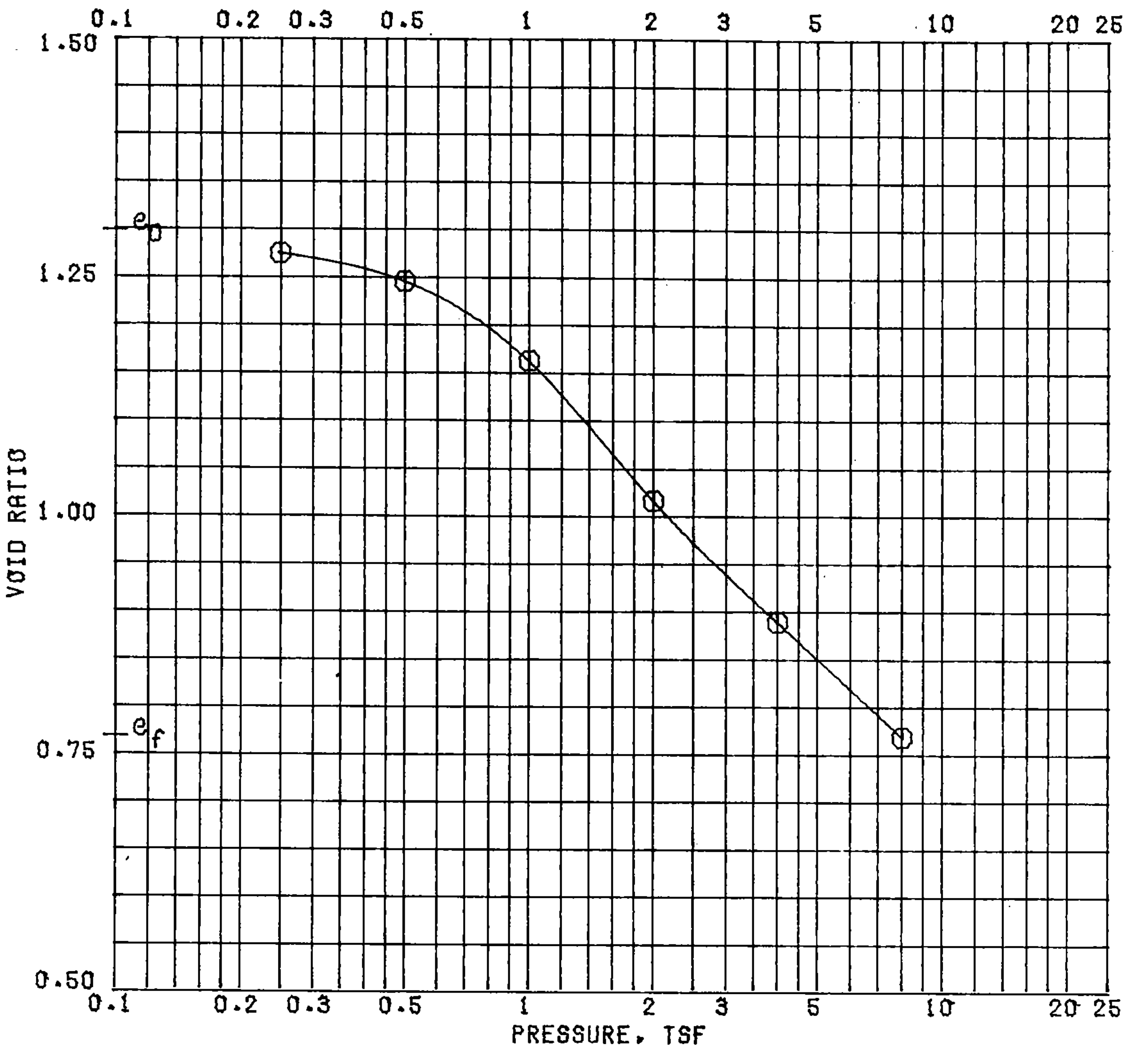
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; ORGANIC MATERIAL

LL 227	PL 68	PI 159	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT	
JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 8-UA	SAMPLE NO. 8-C
DEPTH/ELEV 24.8 / -17.8	TECH. PJR
LABORATORY USAE WES	DATE 11 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 109

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	46.0	29.0
PRECONSOL. PRESSURE, TSF	0.80	DRY DENSITY, PCF	73.4	95.4
COMPRESSION INDEX	1.21	SATURATION, %	95.8	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.297	0.767
DIA. IN 4.44	HT. IN 1.117	BACK PRESSURE, TSF		

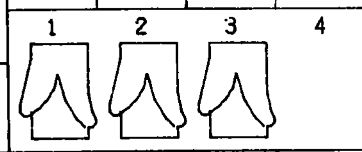
CLASSIFICATION PLASTIC CLAY (CH), GRAY		
LL 57 / PL 21 / PI 36	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
GS 2.70 (EST) / D_{10}	JEFFERSON & ST. CHARELS PARISHES	
REMARKS	BORING NO. 8-UA	SAMPLE NO. 10-C
	DEPTH/ELEV 32.8/-25.8	DATE 20 NOV 85
	CONSOLIDATION TEST REPORT	

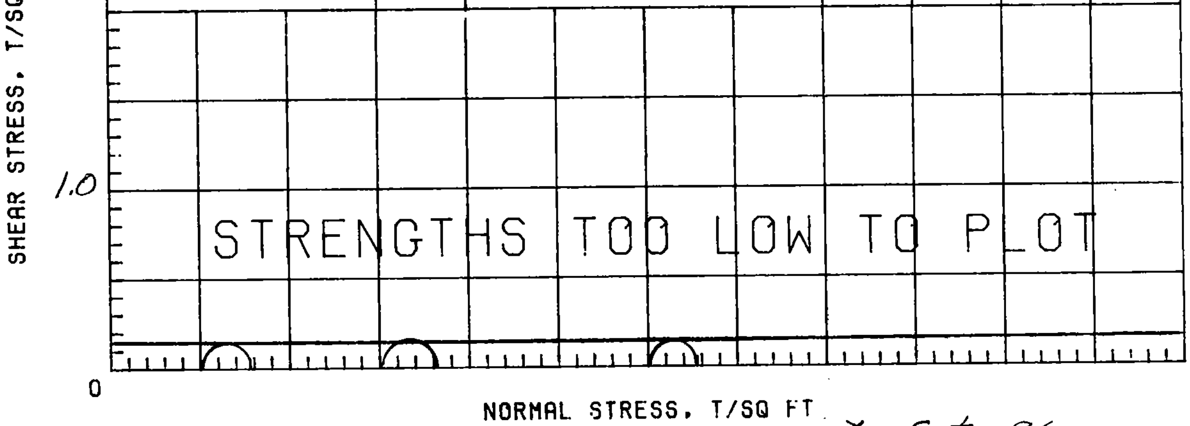
SHEET 1 OF 8

C = 0.147 T/SF

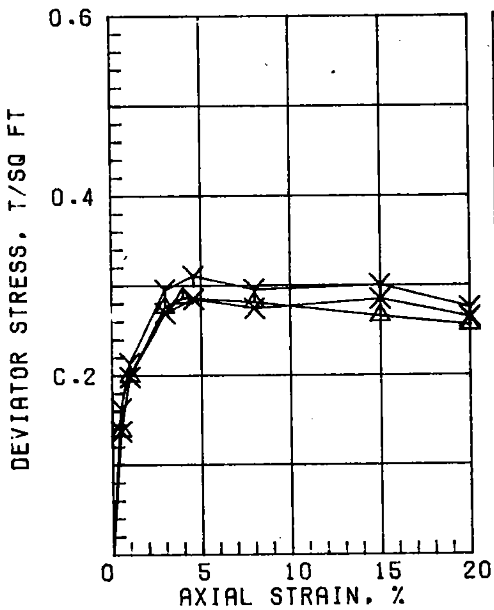
Φ = 0 DEG

TAN Φ = 0





8 Sat 96



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	81.7	81.7	77.1	
	DRY DENSITY, PCF	52.7	52.7	54.4	
	SATURATION, %	100+	100+	99.1	
	VOID RATIO	2.199	2.197	2.100	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.29	0.31	0.28	
	TIME TO FAILURE, MIN.	8	17	17	
	RATE OF STRAIN INCR.,%		8	8	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 80.2

CONTROLLED-STRAIN TEST

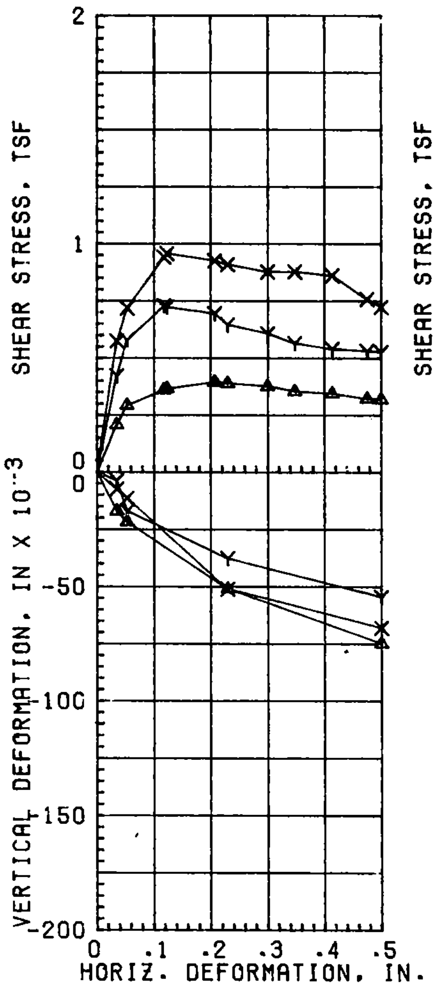
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

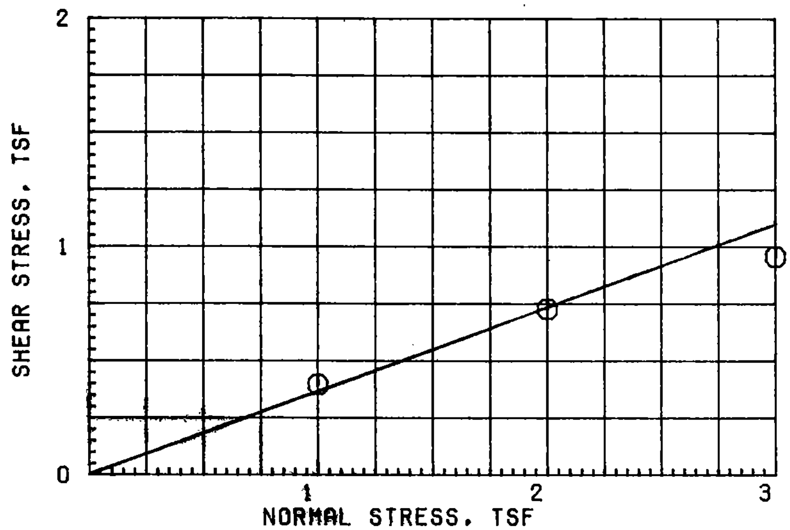
LL 85	PL 26	PI 59	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 8-UA	SAMPLE NO. 11-C
DEPTH/ELEV 36.9 / -29.9	TECH. PJR
LABORATORY USAE WES	DATE 11 SEP 85

TRIAXIAL COMPRESSION TEST REPORT





γ Sat 100

ϕ = 20°

TAN ϕ = 0.364

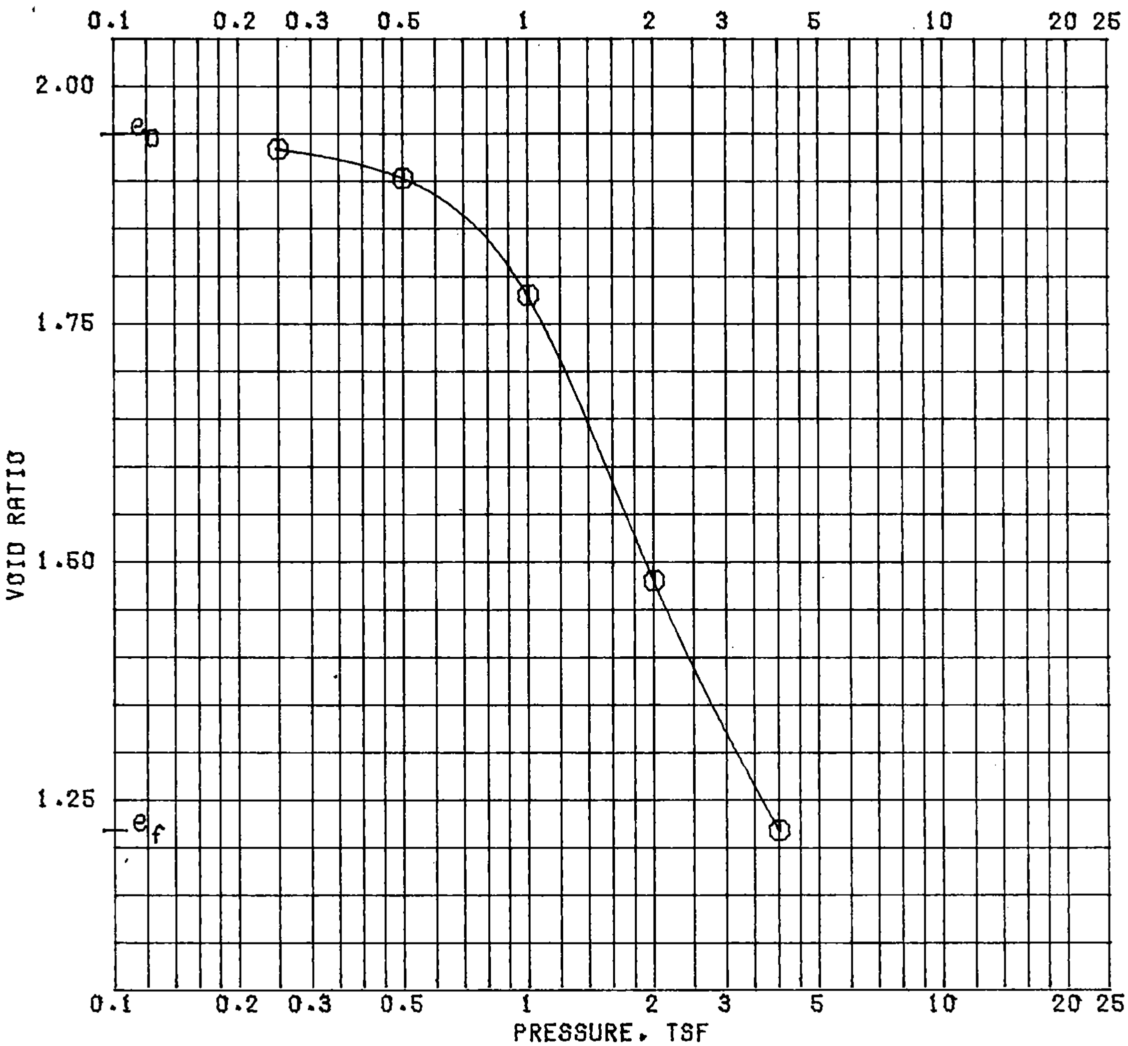
C = 0

		TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %		64.0	64.4	67.8	65.4
	VOID RATIO		1.806	1.815	1.931	
	SATURATION, %		95.7	95.8	94.7	
	DRY DENSITY, PCF		60.0	59.9	57.5	
VOID RATIO AFTER CONSOL.						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL	WATER CONTENT, %		47.5	45.6	41.3	
	VOID RATIO					
	SATURATION, %					
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.40	0.73	0.96	
TIME TO FAILURE, MIN			1132	646	673	
RATE OF STRAIN, IN/MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, TSF						

TYPE SPECIMEN UNDISTURBED			3.00 IN. SQUARE	0.628 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY				
LL 81	PL 26	PI 55		GS 2.70 (EST)

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR PROT	
	JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 8-UA	SAMPLE 12-B
	DEPTH/ELEV 40/ -33.0	DATE 09 DEC 85

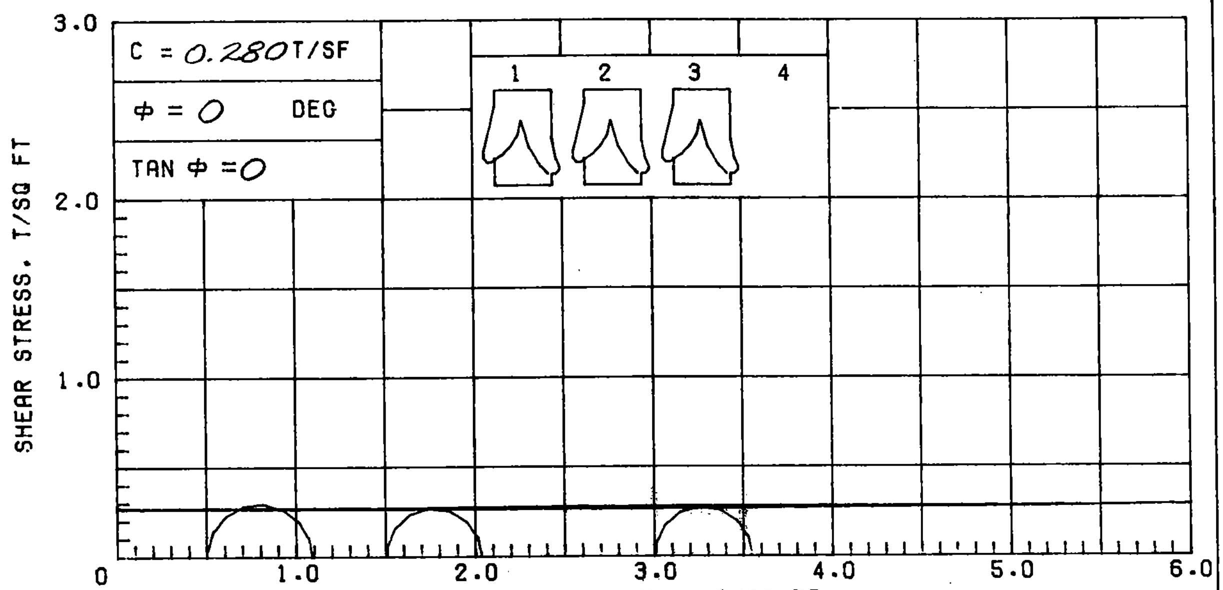
DIRECT SHEAR TEST REPORT



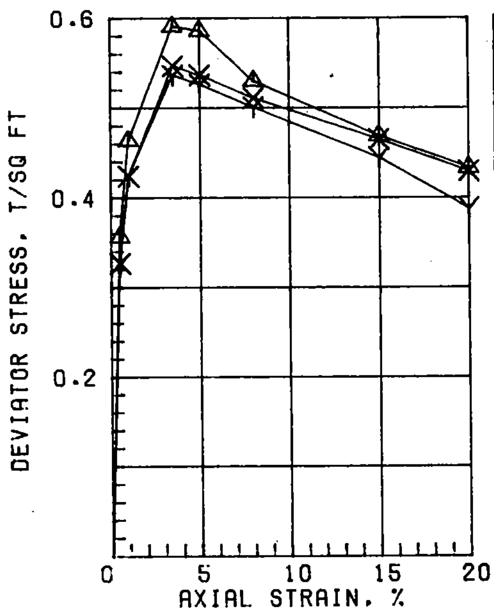
γ Sat 99

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	71.2	46.8
PRECONSOL. PRESSURE, TSF	0.85	DRY DENSITY, PCF	57.2	76.1
COMPRESSION INDEX	1.87	SATURATION, %	98.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.948	1.216
DIA. IN 4.44	HT. IN 1.120	BACK PRESSURE, TSF		
CLASSIFICATION PLASTIC CLAY (CH), GRAY				
LL 83	PL 22	PI 61	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARELS PARISHES	
RE. ARKS		BORING NO. 8-UA	SAMPLE NO. 13-B	
		DEPTH/ELEV 44.5 / -37.5	DATE 20 NOV 85	
		CONSOLIDATION TEST REPORT		

SHEET 1 OF 7



γ Sat 103



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	60.8	63.7	62.3	
	DRY DENSITY, PCF	64.2	62.5	63.1	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.626	1.698	1.670	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.59	0.54	0.55	
	TIME TO FAILURE, MIN.	7	15	14	
	RATE OF STRAIN INCR,%		8	5	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 62.3

CONTROLLED-STRAIN TEST

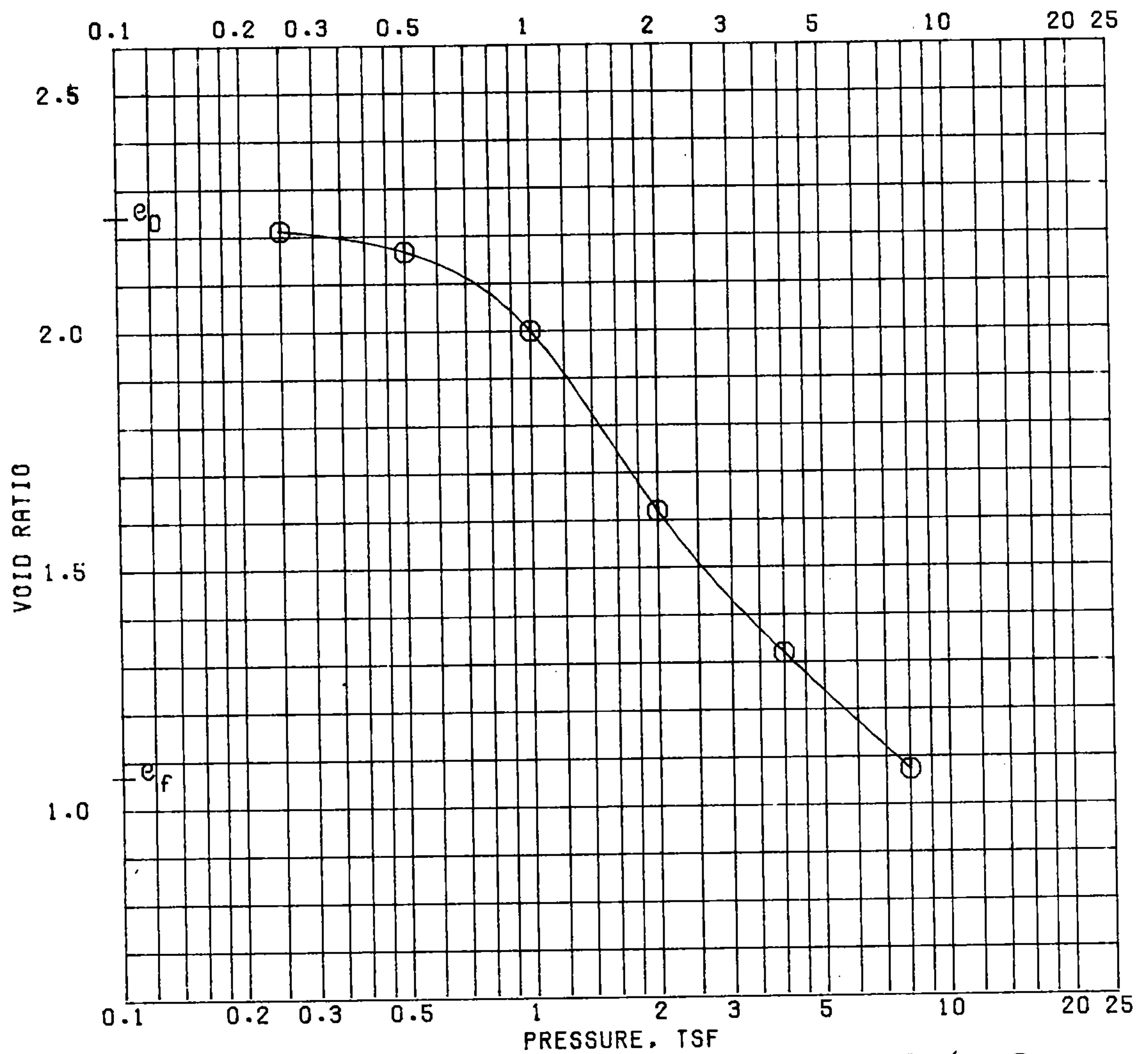
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 75	PL 22	PI 53	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT	
JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 8-UA	SAMPLE NO. 14-C
DEPTH/ELEV 50 / -43.0	TECH. PJR
LABORATORY USAE WES	DATE 12 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



8 Sat 95

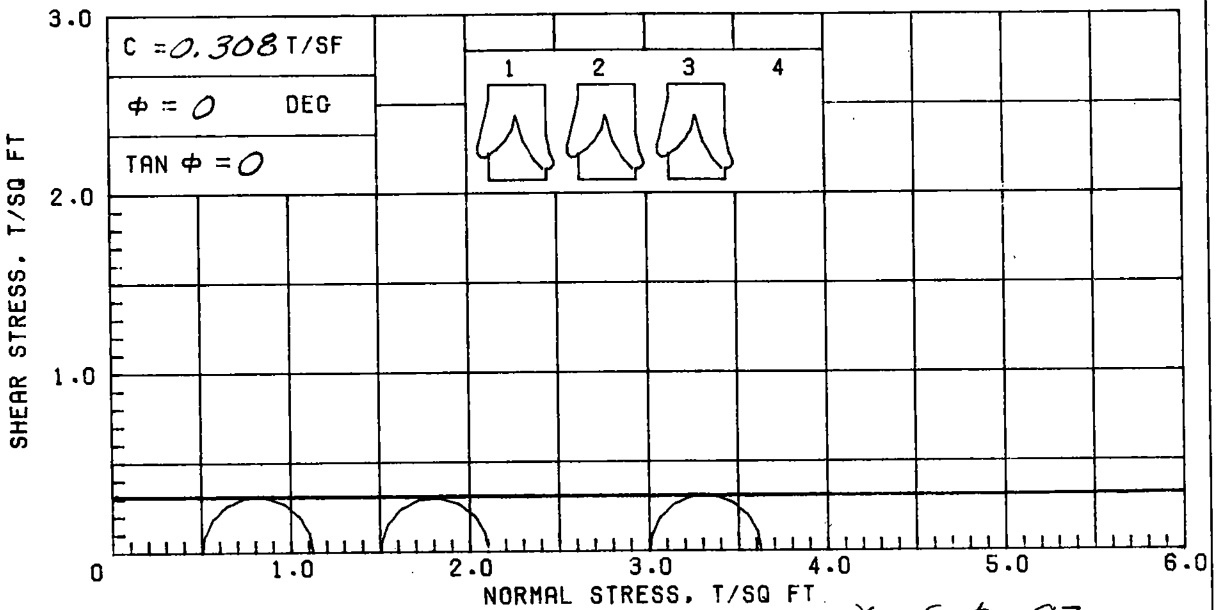
				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	81.6	41.2
PRECONSOL. PRESSURE, TSF		0.86	DRY DENSITY, PCF	52.0	81.7
COMPRESSION INDEX		2.10	SATURATION, %	98.5	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	2.239	1.064
DIA. IN 4.44	HT. IN 1.116		BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SILT LENSES

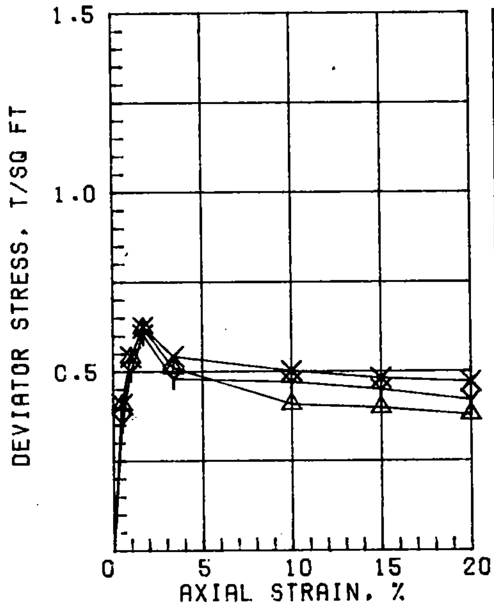
LL 85	PL 22	PI 63	PROJECT LAKE PONT LA & VIC HURR PROT	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES	
REMARKS			BORING NO. 8-UA	SAMPLE NO. 16-C
			DEPTH/ELEV 56.8/-49.8	DATE 21 NOV 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



γ Sat 97



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	80.2	81.5	79.5	
	DRY DENSITY, PCF	54.1	53.7	54.2	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	2.115	2.141	2.108	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.62	0.60	0.63	
TIME TO FAILURE, MIN.		3	15	15	
RATE OF STRAIN INCR.,%			3	3	
INITIAL DIAMETER, IN.		1.39	1.38	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

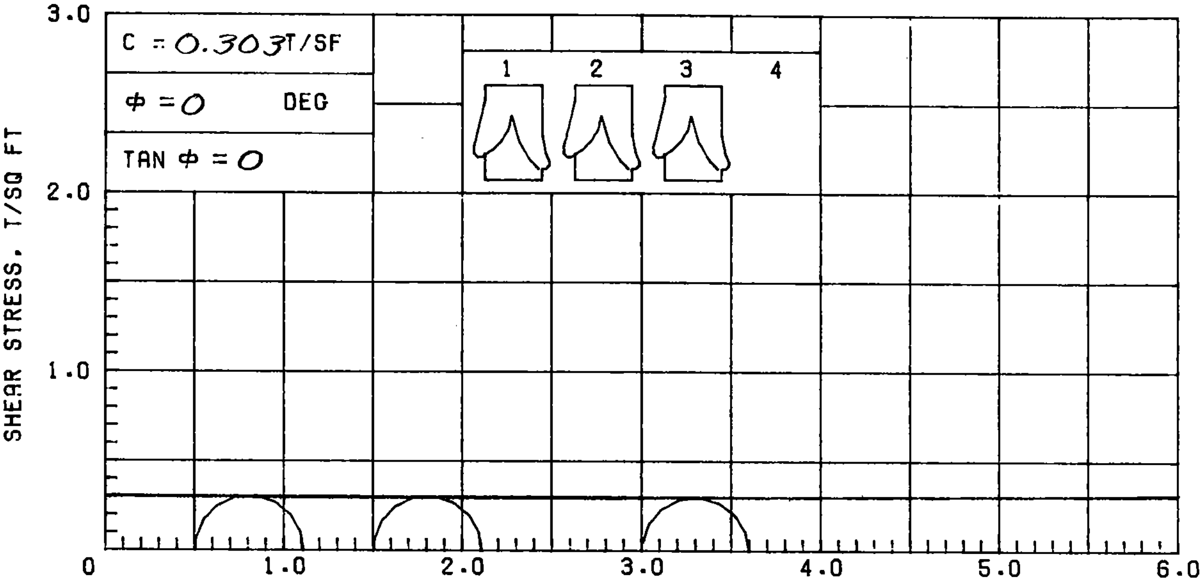
Avg. 80.4

CONTROLLED-STRAIN TEST

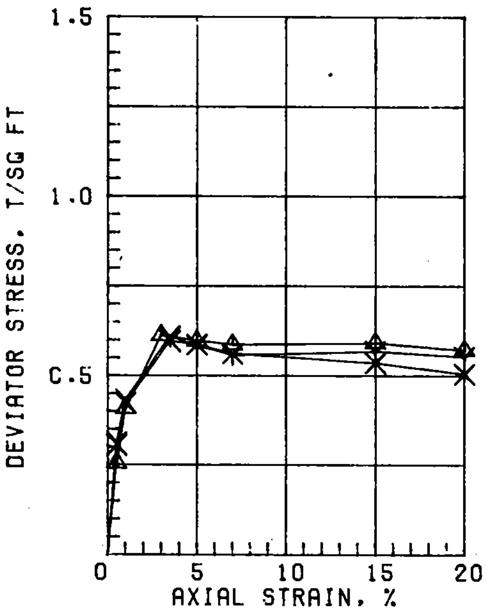
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SLICKENSIDED

LL 94	PL 26	PI 68	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR PROT	
	JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 8-UA	SAMPLE NO. 17-B
	DEPTH/ELEV 60 / -53.0	TECH. PJR
	LABORATORY USAE WES	DATE 12 SEP 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 108



SPECIMEN NO.		Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	48.5	52.6	48.1	
	DRY DENSITY, PCF	73.2	70.7	73.4	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.303	1.384	1.295	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.61	0.61	0.60	
TIME TO FAILURE, MIN.		6	18	18	
RATE OF STRAIN INCR.,%			7	7	
INITIAL DIAMETER, IN.		1.39	1.37	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 49.7

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY; SILT LENSES; SHELLS

LL 56	PL 16	PI 40	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

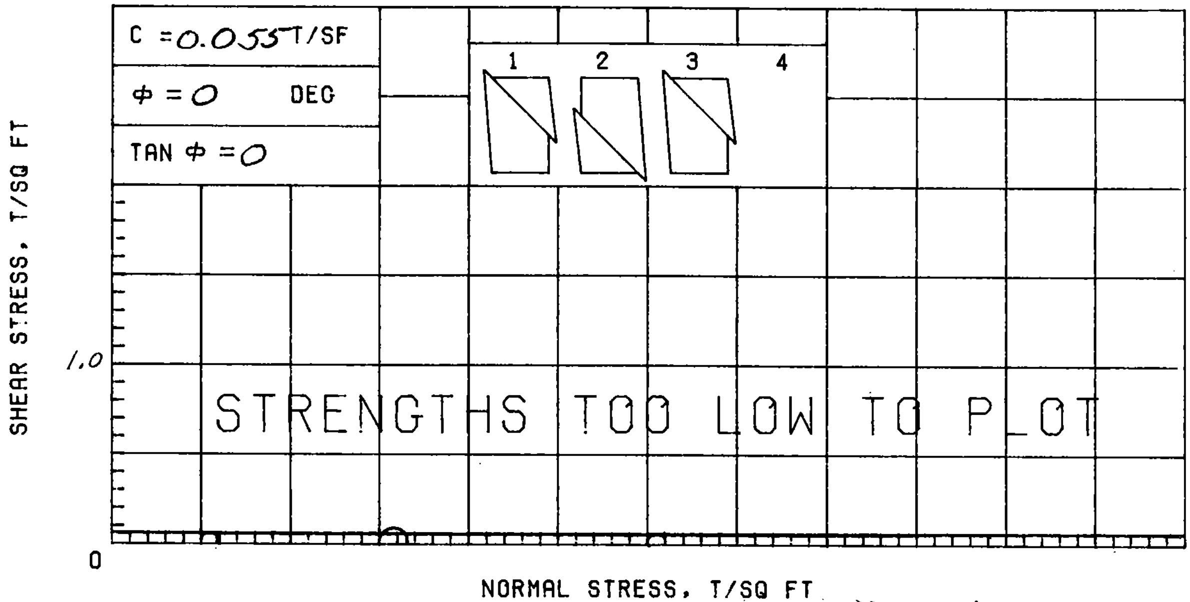
PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 8-UA	SAMPLE NO. 21-B
DEPTH/ELEV 76/-69.0	TECH. PJR
LABORATORY USAE WES	DATE 24 SEP 85

TRIAXIAL COMPRESSION TEST REPORT

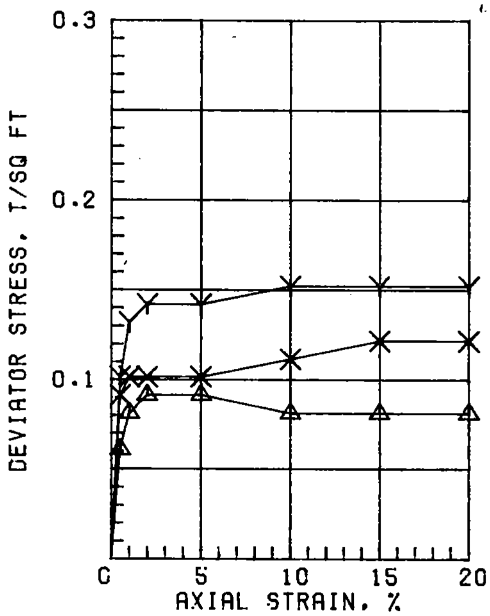
C = 0.055 T/SF

φ = 0   DEG

TAN φ = 0



γ Sat 93



		SPECIMEN NO.	△1	Y2	X3	4
INITIAL		WATER CONTENT, %	84.9	93.8	91.5	
		DRY DENSITY, PCF	48.7	48.1	49.0	
		SATURATION, %	93.1	100+	100+	
		VOID RATIO	2.462	2.501	2.440	
BEFORE SHEAR		WATER CONTENT, %				
		DRY DENSITY, PCF				
		SATURATION, %				
		VOID RATIO				
		BACK PRESS., TSF				
MIN PRIN. STRESS, TSF			0.5	1.5	3.0	
MAX. DEV. STRESS, TSF			0.09	0.14	0.10	
TIME TO FAILURE, MIN.			4	12	6	
RATE OF STRAIN INCR.,%				6	6	
INITIAL DIAMETER, IN.			1.39	1.39	1.39	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	

Avg. 90.1

CONTROLLED-STRAIN TEST

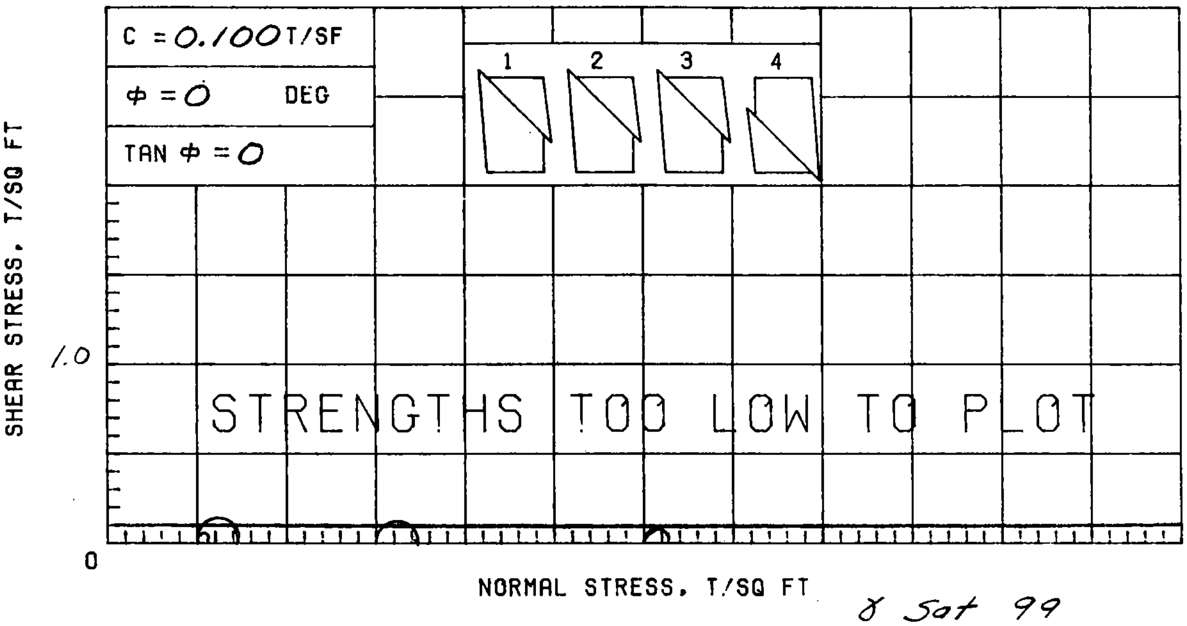
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 85	PL 23	PI 62	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

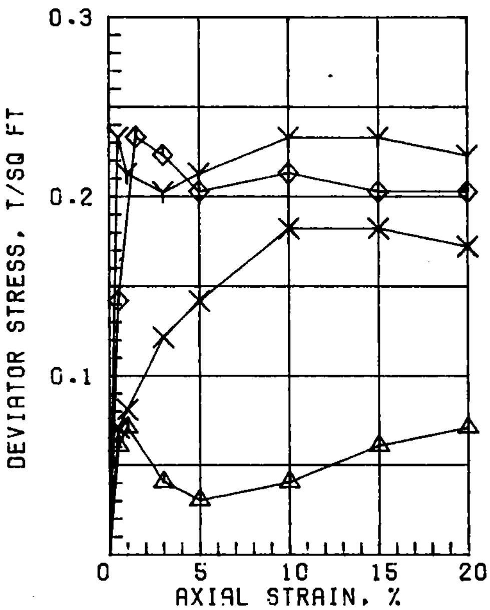
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 9-U	SAMPLE NO. 5-B
DEPTH/ELEV 17/-21.9	TECH. KOC
LABORATORY USAE WES	DATE 24 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99



SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	71.3	72.0	72.9	71.8
	DRY DENSITY, PCF	56.9	57.5	57.0	57.4
	SATURATION, %	98.2	100+	100+	100+
	VOID RATIO	1.960	1.932	1.957	1.939
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5
MAX. DEV. STRESS, TSF		0.07	0.23	0.14	0.23
TIME TO FAILURE, MIN.		2	3	29	9
RATE OF STRAIN INCR.%			6	6	6
INITIAL DIAMETER, IN.		1.39	1.39	1.39	1.39
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 72.2

CONTROLLED-STRAIN TEST

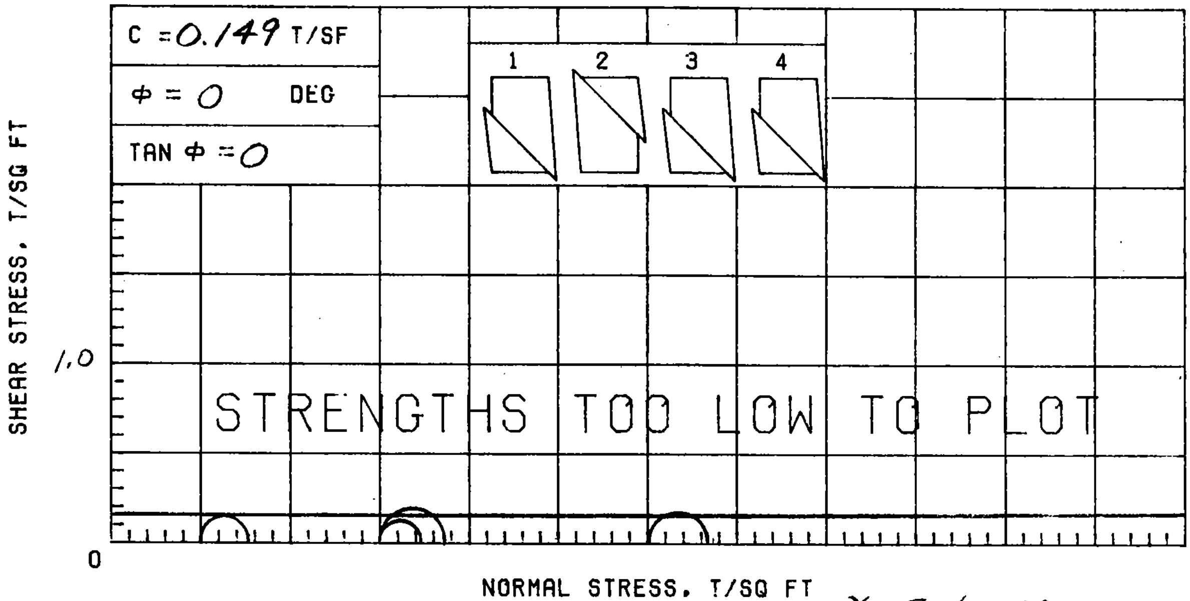
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 79	PL 22	PI 57	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

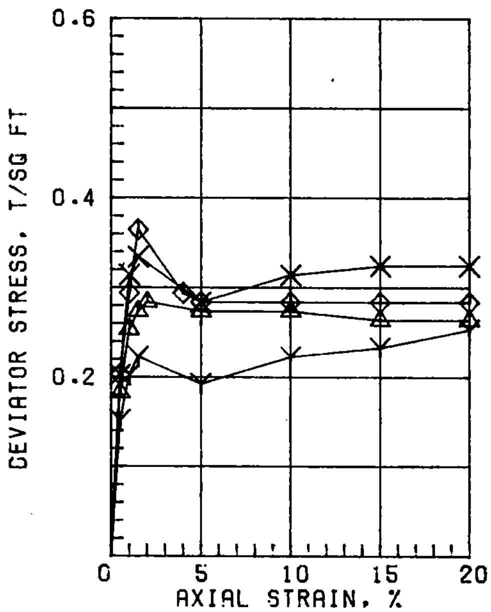
REMARKS;

PROJECT LAKE PONT. LA. & VIC. HURR PROT	
JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 9-U	SAMPLE NO. 7-C
DEPTH/ELEV 26.4/-31.3	TECH. KOC
LABORATORY USAE WES	DATE 24 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 101



		△1	Y2	X3	◇4
SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	63.0	62.7	67.4	65.2
	DRY DENSITY, PCF	62.6	62.5	58.9	61.6
	SATURATION, %	100+	99.7	97.6	100+
	VOID RATIO	1.695	1.698	1.864	1.736
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	1.5
MAX. DEV. STRESS, TSF		0.28	0.22	0.33	0.36
TIME TO FAILURE, MIN.		4	10	7	3
RATE OF STRAIN INCR,%			5	7	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	1.39
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 64.6

CONTROLLED-STRAIN TEST

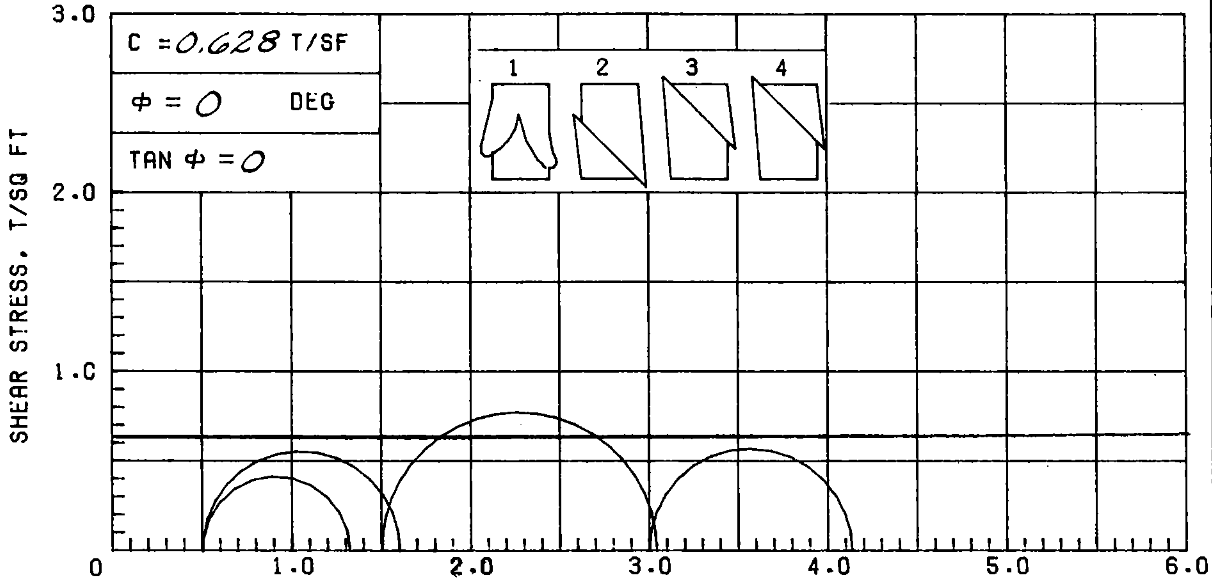
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 74	PL 22	PI 52	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

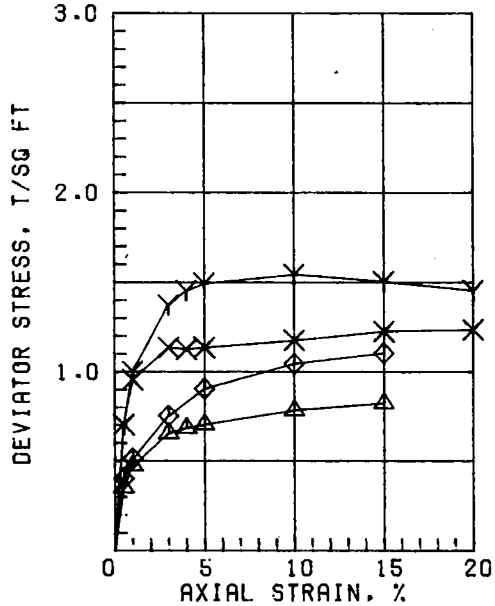
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 9-U	SAMPLE NO. 10-B
DEPTH/ELEV 37.0/-41.9	TECH. KOC
LABORATORY USAE WES	DATE 25 SEP 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 118



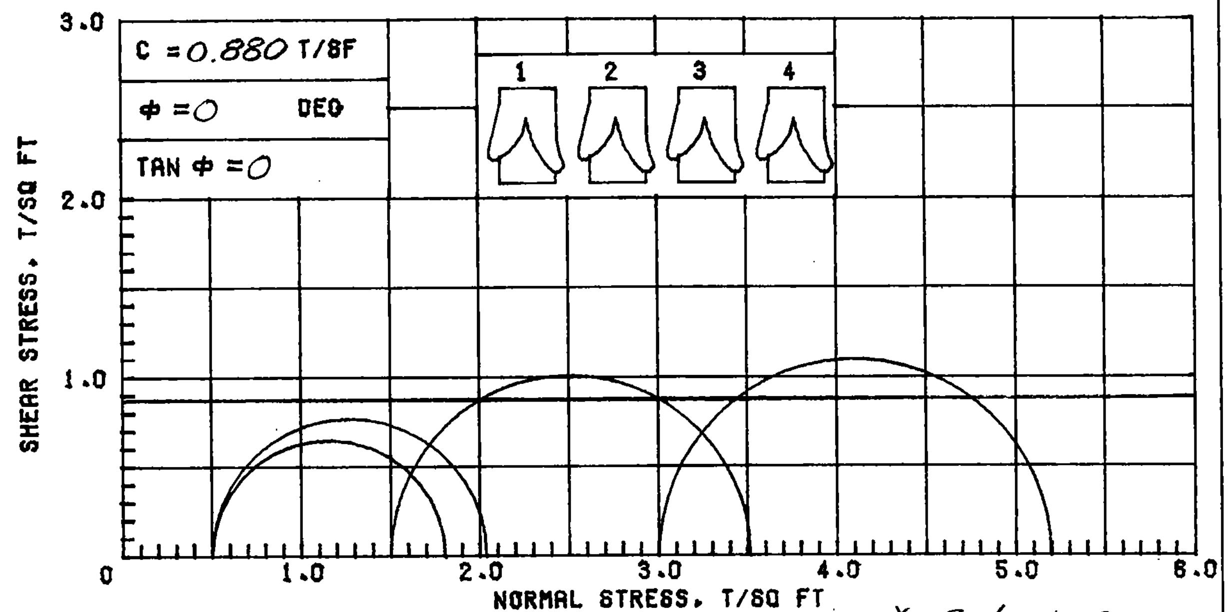
		Δ1	Y2	X3	◇4	
SPECIMEN NO.		Δ1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	32.3	31.1	31.2	37.0	Avg. 33.1
	DRY DENSITY, PCF	89.0	90.3	89.9	85.2	
	SATURATION, %	97.5	96.9	96.2	100+	
	VOID RATIO	0.894	0.866	0.876	0.979	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5	
MAX. DEV. STRESS, TSF		0.82	1.54	1.13	1.10	
TIME TO FAILURE, MIN.		30	20	6	30	
RATE OF STRAIN INCR.,%						
INITIAL DIAMETER, IN.		1.40	1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

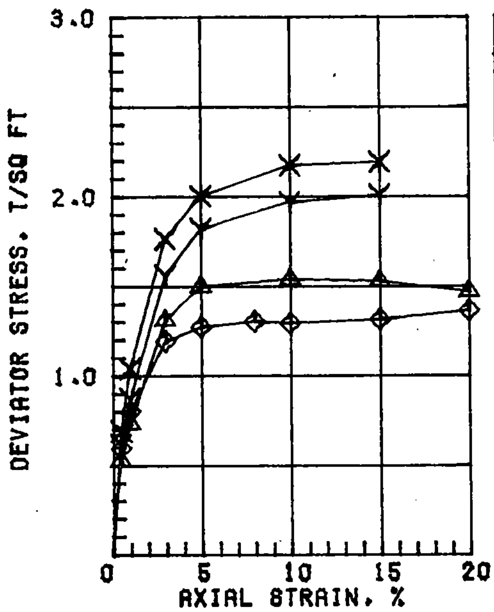
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT SEAMS & POCKETS

LL 51	PL 16	PI 35	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR PROT JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 9-U	SAMPLE NO. 16-B
	DEPTH/ELEV 60.6/-65.3	TECH. KOC
	LABORATORY USAE WES	DATE 26 SEP 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 120



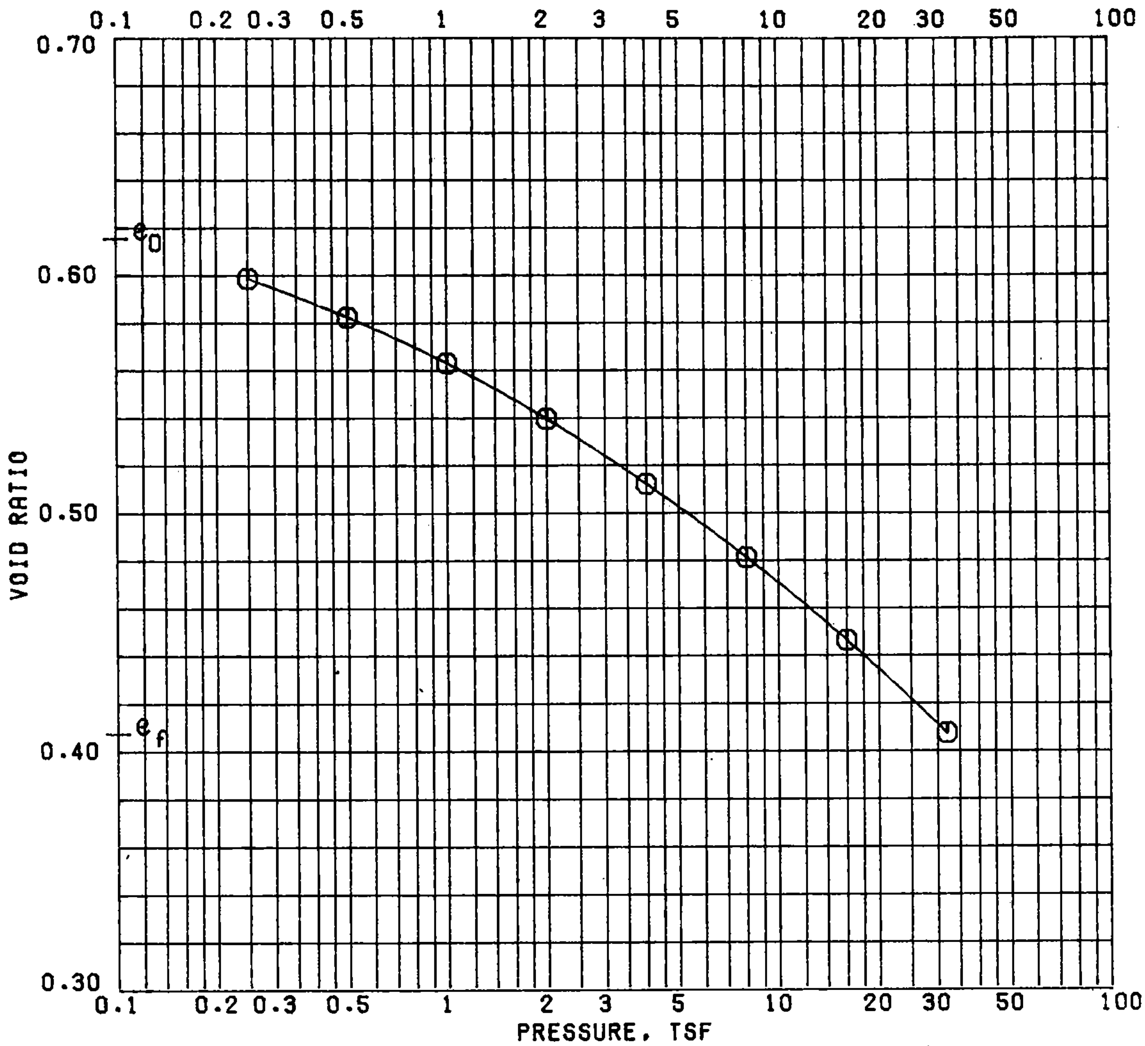
	SPECIMEN NO.	△1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	27.9	28.5	30.1	30.6	Avg. 29.3
	DRY DENSITY, PCF	93.8	93.2	91.0	90.7	
	SATURATION, %	94.6	95.2	95.3	96.1	
	VOID RATIO	0.796	0.808	0.852	0.859	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	0.5	
	MAX. DEV. STRESS, TSF	1.54	2.01	2.19	1.30	
	TIME TO FAILURE, MIN.	20	25	23	16	
	RATE OF STRAIN INCR.,%					
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	1.40	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), BROWN; SILT SEAMS

LL 53	PL 17	PI 36	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 10-U	SAMPLE NO. 2-B
	DEPTH/ELEV 3.3/5.0	TECH. PJR
	LABORATORY USAE WES	DATE 25 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat. 131

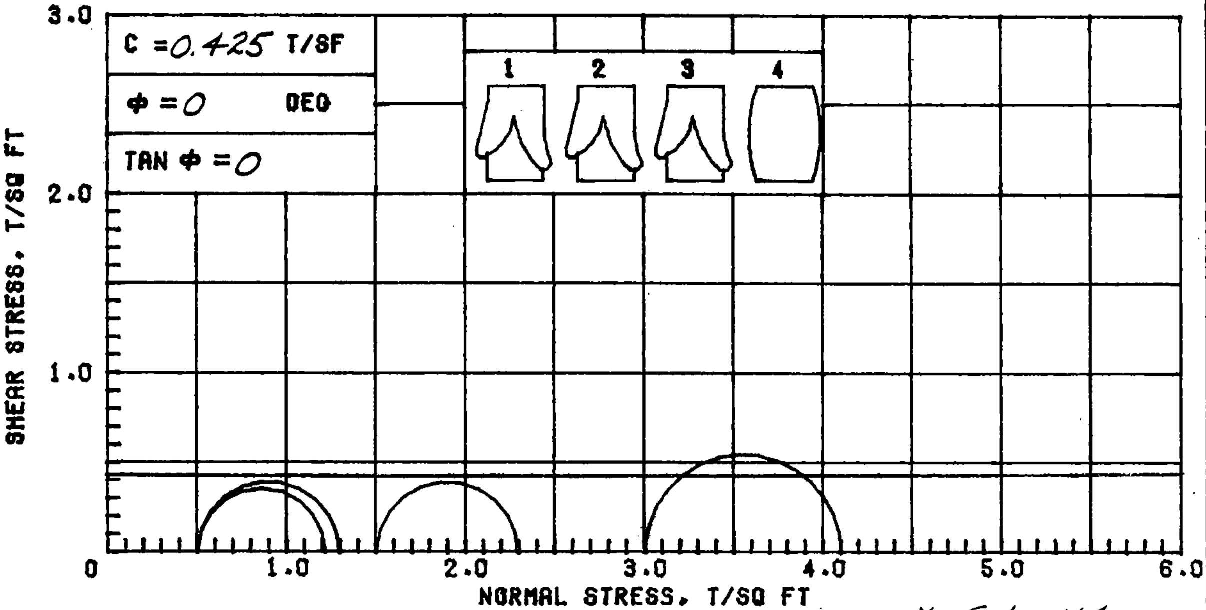
				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	25.0	15.3
PRECONSOL. PRESSURE, TSF		0.62	DRY DENSITY, PCF	104.4	119.8
COMPRESSION INDEX		0.58	SATURATION, %	100 +	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	0.615	0.407
DIA. IN 4.44	HT. IN 1.124		BACK PRESSURE, TSF		

CLASSIFICATION CLAY (CL), GRAY; ORGANIC MATERIAL

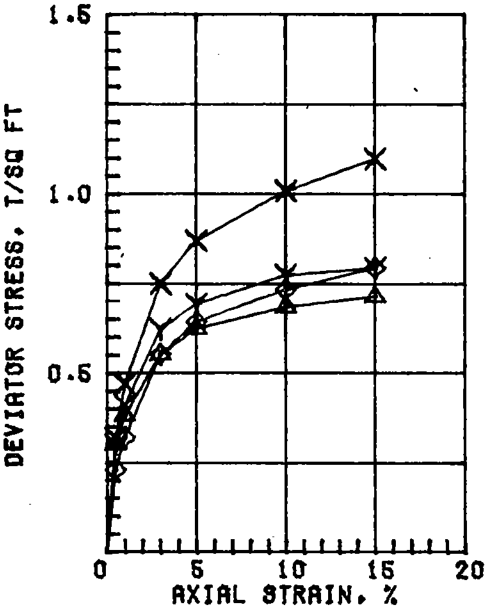
LL 42	PL 21	PI 21	PROJECT LK. PONT. & VIC. HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISH	
REMARKS			BORING NO. 10-U	SAMPLE NO. 4-B
			DEPTH/ELEV 10.6/-2.32	DATE 24 MAY 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 10



γ Sat 114



SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	37.3	38.3	37.1	35.9
	DRY DENSITY, PCF	82.7	81.9	82.6	83.5
	SATURATION, %	97.1	97.8	96.2	95.3
	VOID RATIO	1.037	1.057	1.041	1.018
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5
MAX. DEV. STRESS, TSF		0.72	0.79	1.10	0.79
TIME TO FAILURE, MIN.		30	30	31	31
RATE OF STRAIN INCR,%					
INITIAL DIAMETER, IN.		1.39	1.40	1.40	1.40
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 37.2

CONTROLLED-STRAIN TEST

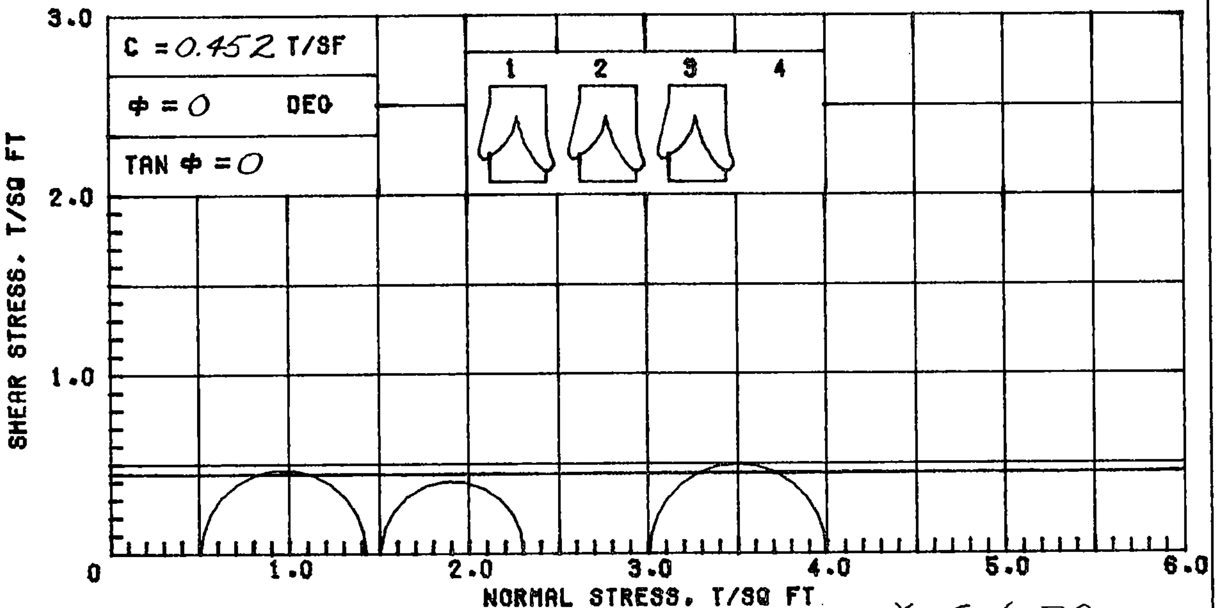
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT SEAMS; ORGANIC MATERIAL

LL 54	PL 21	PI 33	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

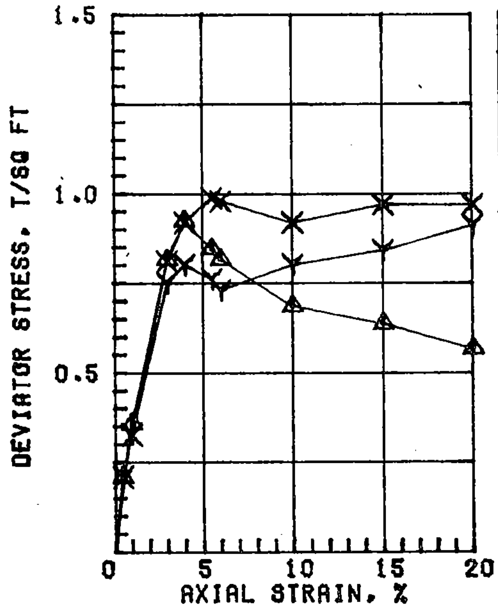
REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 10-U	SAMPLE NO. 4-C
DEPTH/ELEV 11.5/-3.22	TECH. PJR
LABORATORY USAE WES	DATE 26 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



8 Sat 70



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	293.7	325.0	294.7	
	DRY DENSITY, PCF	17.7	16.2	17.7	
	SATURATION, %	99.6	99.4	100+	
	VOID RATIO	5.001	5.557	5.002	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.92	0.80	0.99	
TIME TO FAILURE, MIN.		8	17	23	
RATE OF STRAIN INCR.,%			6		
INITIAL DIAMETER, IN.		1.40	1.40	1.41	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 304.5

CONTROLLED-STRAIN TEST

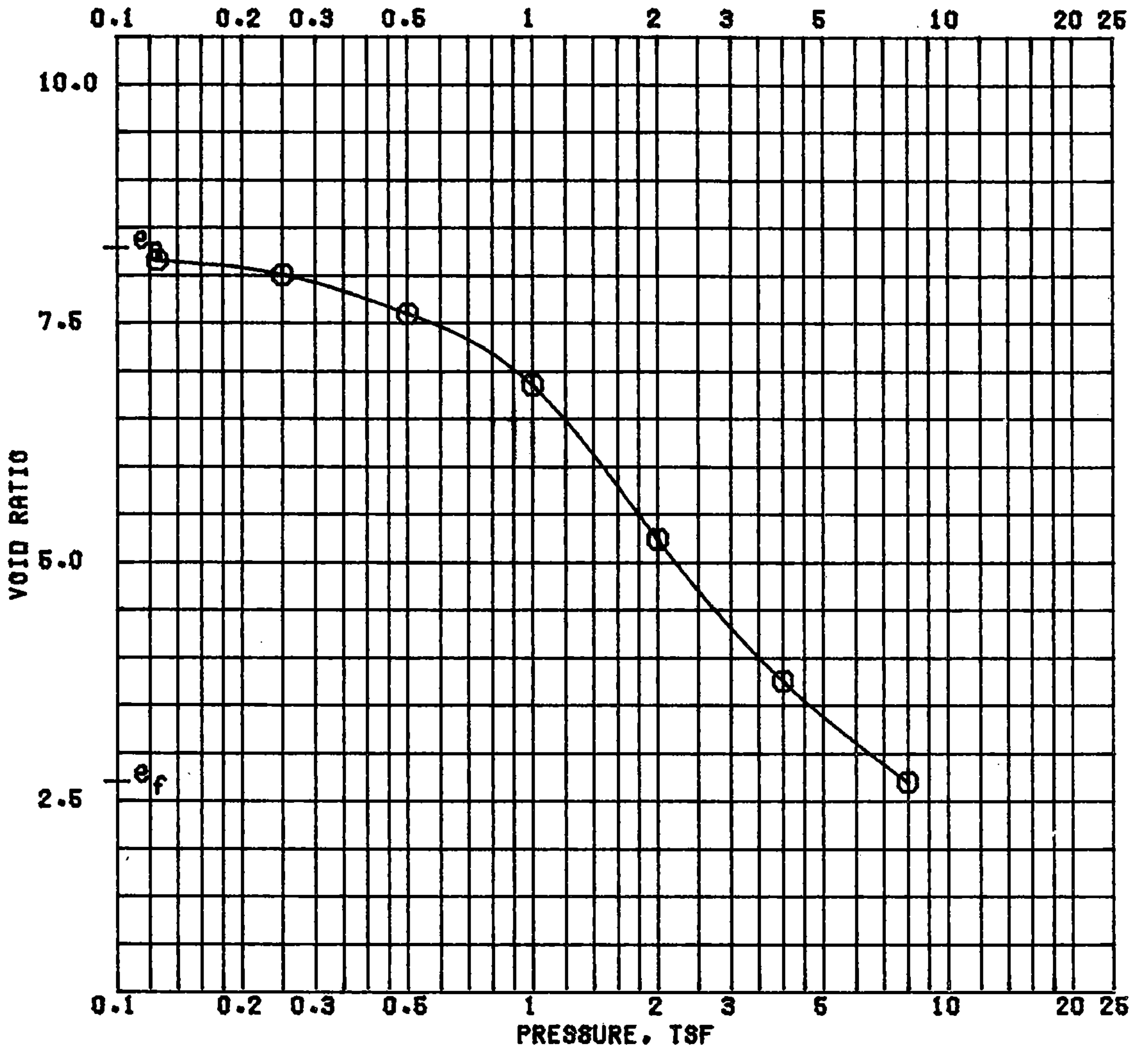
DESCRIPTION OF SPECIMENS: PEAT (PT), DARK BROWN

LL 449	PL 180	PI 269	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 10-C	SAMPLE NO. 7-B
DEPTH/ELEV 22.6/-14.3	TECH. PJR
LABORATORY USAE WES	DATE 26 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



8 Sof 67

		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	434.3	182.6
PRECONSOL. PRESSURE, TSF	0.90	DRY DENSITY, PCF	11.4	26.8
COMPRESSION INDEX	7.20	SATURATION, %	89.3	100 +

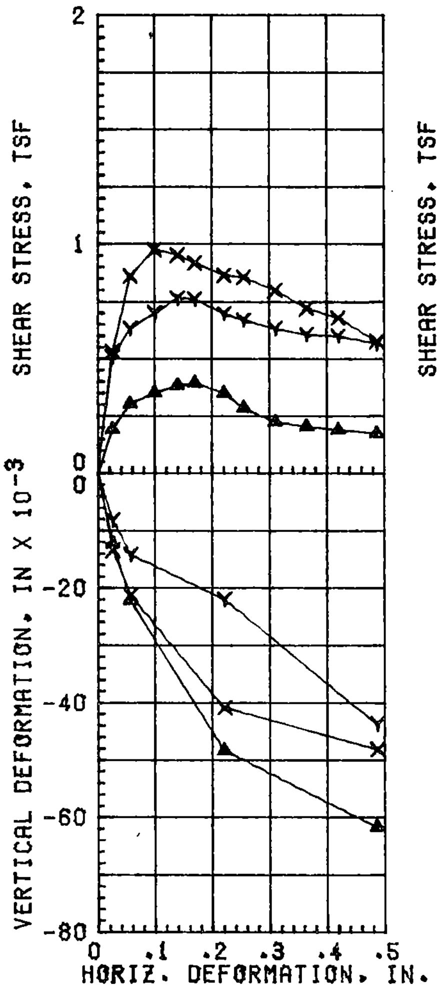
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	8.269	2.683
DIA. IN 4.44	HT. IN 1.126	BACK PRESSURE, TSF		

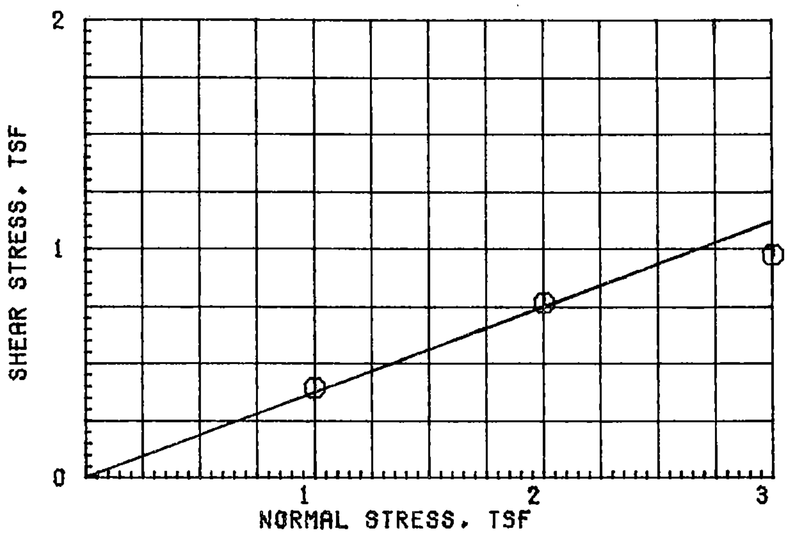
CLASSIFICATION PEAT (PT), DARK BROWN

LL	PL	PI	PROJECT LK. PONT. & VIC. HURR. PROT.	
GS 1.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISH	
REMARKS			BORING NO. 10-U	SAMPLE NO. 7-C
			DEPTH/ELEV 23.5/-15.22	DATE 07 JUN 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 9





γ Sat 99

		TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %		64.4	64.2	69.2	65.9
	VOID RATIO		2.027	1.787	1.847	
	SATURATION, %		85.7	97.1	100 +	
	DRY DENSITY, PCF		55.7	60.5	59.2	
VOID RATIO AFTER CONSOL						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL	WATER CONTENT, %		59.2	47.8	38.5	
	VOID RATIO					
	SATURATION, %					
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.39	0.76	0.98	
TIME TO FAILURE, MIN			984	811	579	
RATE OF STRAIN, IN/MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, TSF						

ϕ = 20° 30'

TAN ϕ = 0.374

C = 0

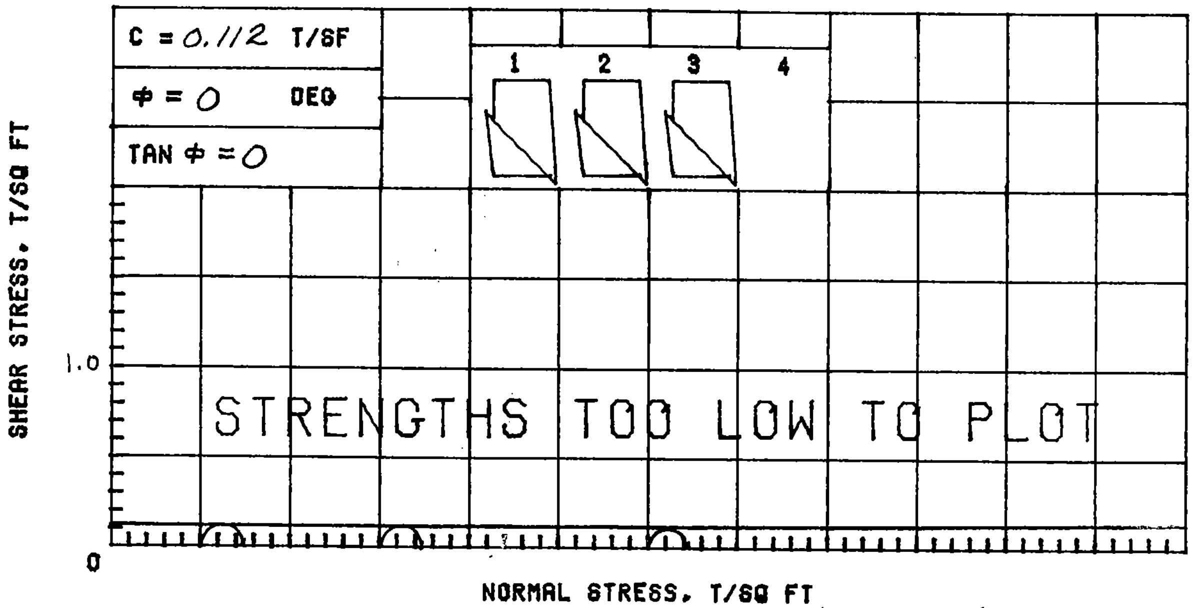
TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.629 IN. THICK

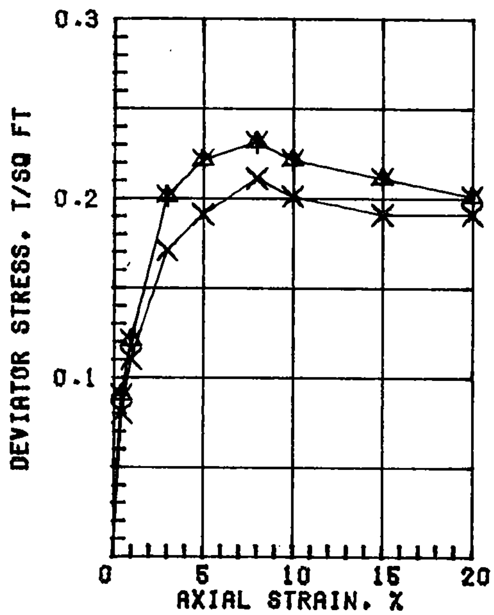
CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 75	PL 21	PI 54		GS 2.70 (EST)

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 10U	SAMPLE 9-B
	DEPTH/ELEV 31/-22.72	DATE 25 JUL 85

DIRECT SHEAR TEST REPORT





γ Sat 98

		Δ1	Y2	X3	4
	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	74.9	75.1	73.9	
INITIAL	DRY DENSITY, PCF	55.6	55.6	55.9	
INITIAL	SATURATION, %	100+	99.7	98.9	
INITIAL	VOID RATIO	2.019	2.033	2.017	
BEFORE SHEAR	WATER CONTENT, %				
BEFORE SHEAR	DRY DENSITY, PCF				
BEFORE SHEAR	SATURATION, %				
BEFORE SHEAR	VOID RATIO				
BEFORE SHEAR	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.23	0.23	0.21	
	TIME TO FAILURE, MIN.	16	16	16	
	RATE OF STRAIN INCR.,%				
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 74.6

CONTROLLED-STRAIN TEST

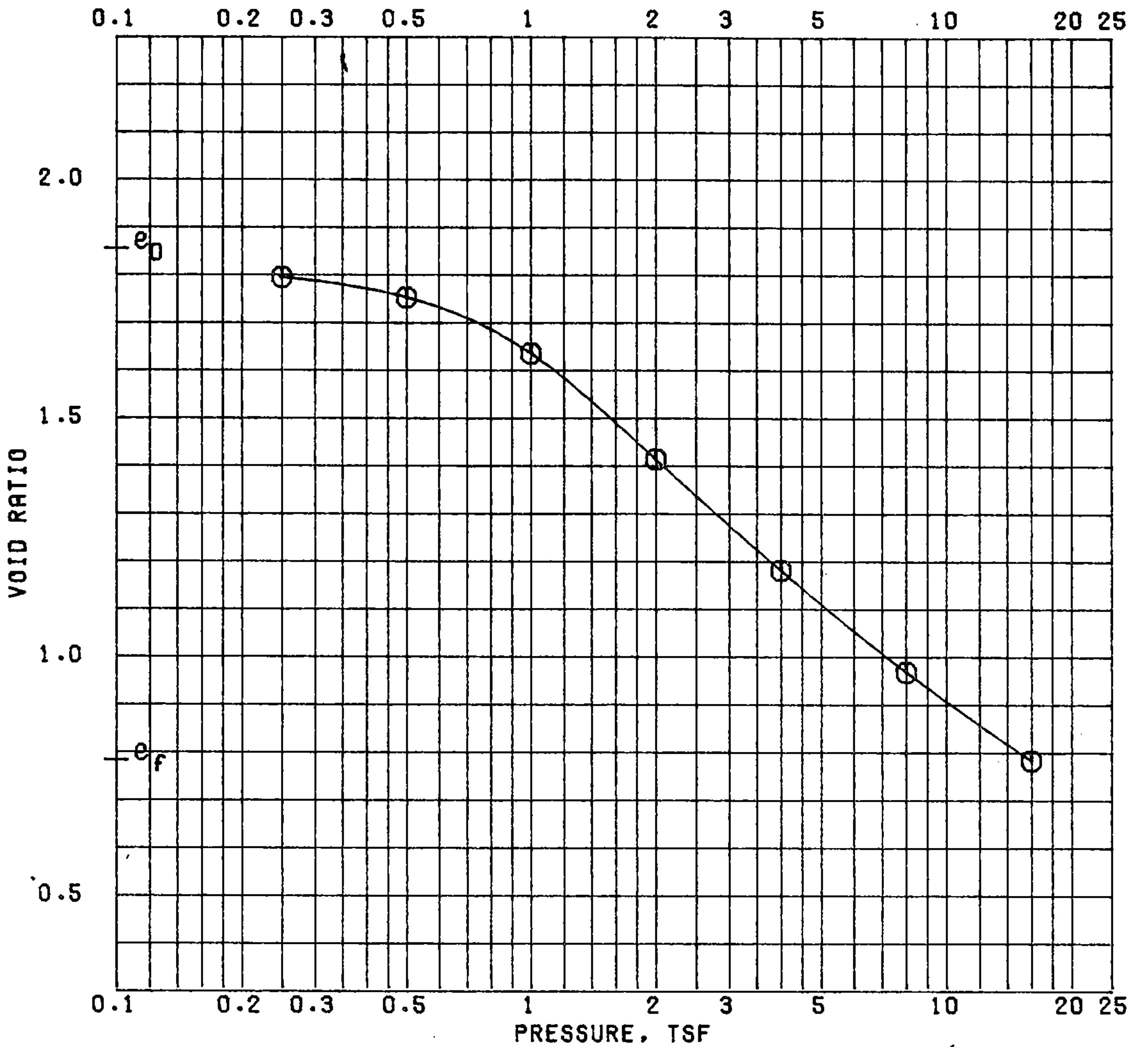
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 86	PL 23	PI 63	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 10-U	SAMPLE NO. 10-B
DEPTH/ELEV 34.6/-26.32	TECH. KOC
LABORATORY USAE WES	DATE 25 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



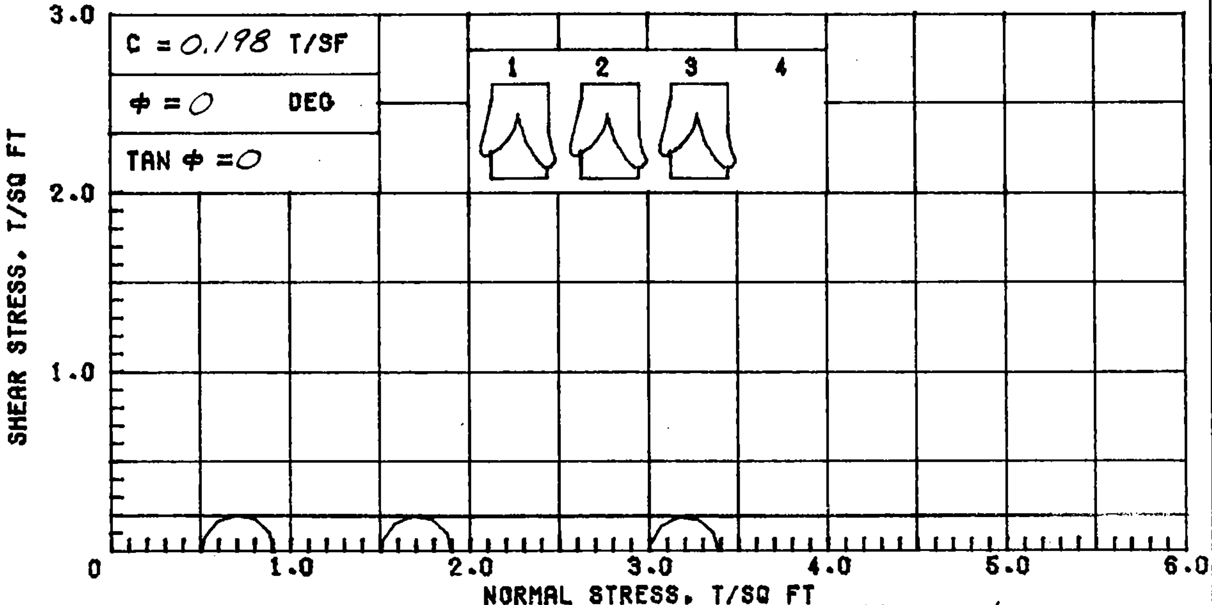
γ Sat 100

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	67.0	34.0
PRECONSOL. PRESSURE, TSF	0.90	DRY DENSITY, PCF	59.1	94.7
COMPRESSION INDEX	1.64	SATURATION, %	97.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.852	0.780
DIA. IN 4.44	HT. IN 1.124	BACK PRESSURE, TSF		

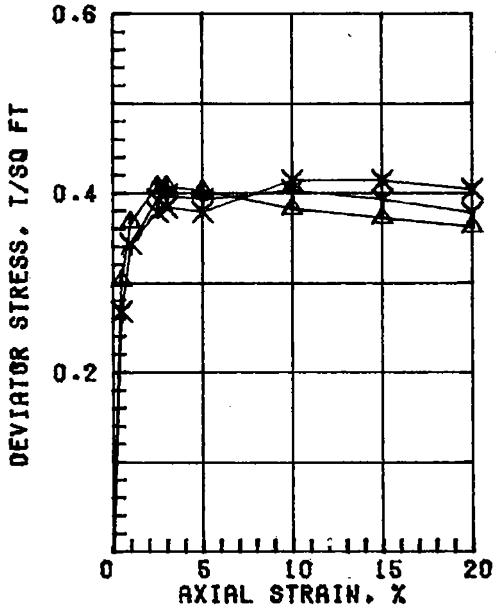
CLASSIFICATION PLASTIC CLAY (CH), GRAY		
LL 81 · PL 23 · PI 58	PROJECT LK. PONT. & VIC. HURR. PROT.	
GS 2.70 (EST) · D_{10}	JEFFERSON & ST. CHARLES PARISH	
REMARKS	BORING NO. 10-U	SAMPLE NO. 11-B
	DEPTH/ELEV 38.8/-30.52	DATE 07 JUN 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 9



γ Sat 104



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	58.0	58.0	57.6	
	DRY DENSITY, PCF	66.2	66.1	66.3	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.546	1.549	1.543	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.41	0.40	0.38	
	TIME TO FAILURE, MIN.	5	21	18	
	RATE OF STRAIN INCR.,%		5	5	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 57.9

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

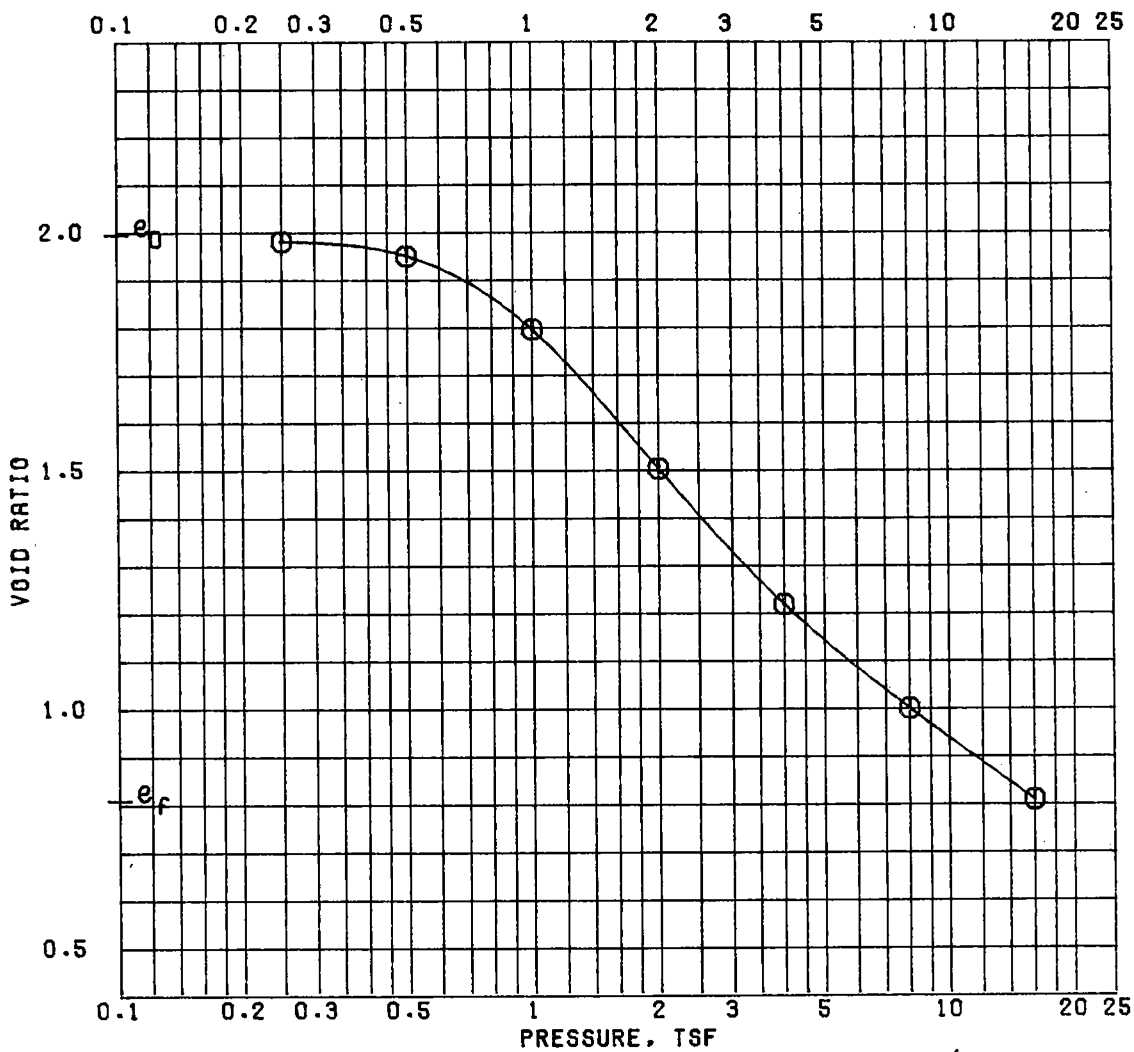
LL 69	PL 21	PI 48	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISH

BORING NO. 10-U	SAMPLE NO. 13-C
DEPTH/ELEV 47.9/-39.6	TECH. PJR
LABORATORY USAE WES	DATE 27 JUN 85

TRIAXIAL COMPRESSION TEST REPORT

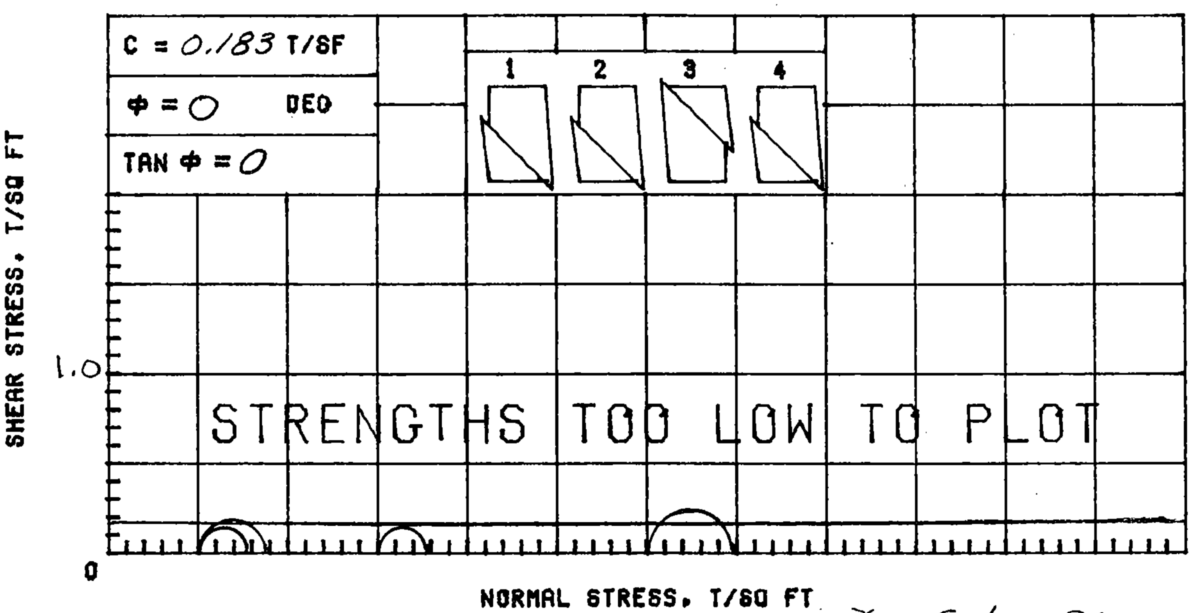


γ Sat 98

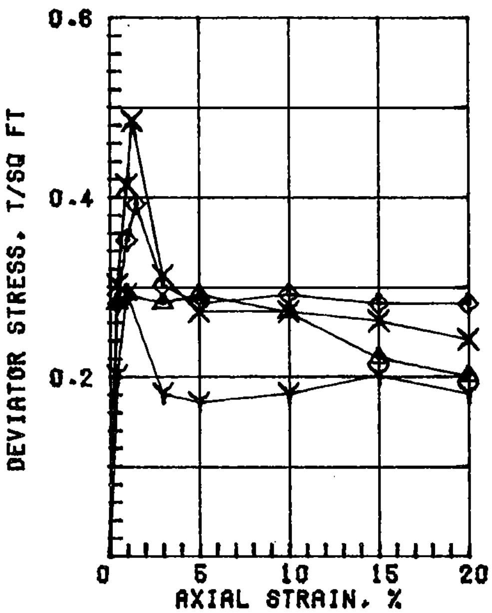
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	72.0	32.7
PRECONSOL. PRESSURE, TSF	0.75	DRY DENSITY, PCF	56.3	93.3
COMPRESSION INDEX	1.96	SATURATION, %	97.5	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.992	0.806
DIA. IN 4.44	HT. IN 1.118	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SHELLS		
LL 96 | PL 23 | PI 73	PROJECT LK. PONT. & VIC. HURR. PROT.	
GS 2.70 (EST) | D_{10}	JEFFERSON & ST. CHARLES PARISH	
REMARKS	BORING NO. 10-U	SAMPLE NO. 16-B
	DEPTH/ELEV 58.8/-50.52	DATE 07 JUN 85
	CONSOLIDATION TEST REPORT	

SHEET 1 OF 9



γ Sat 96



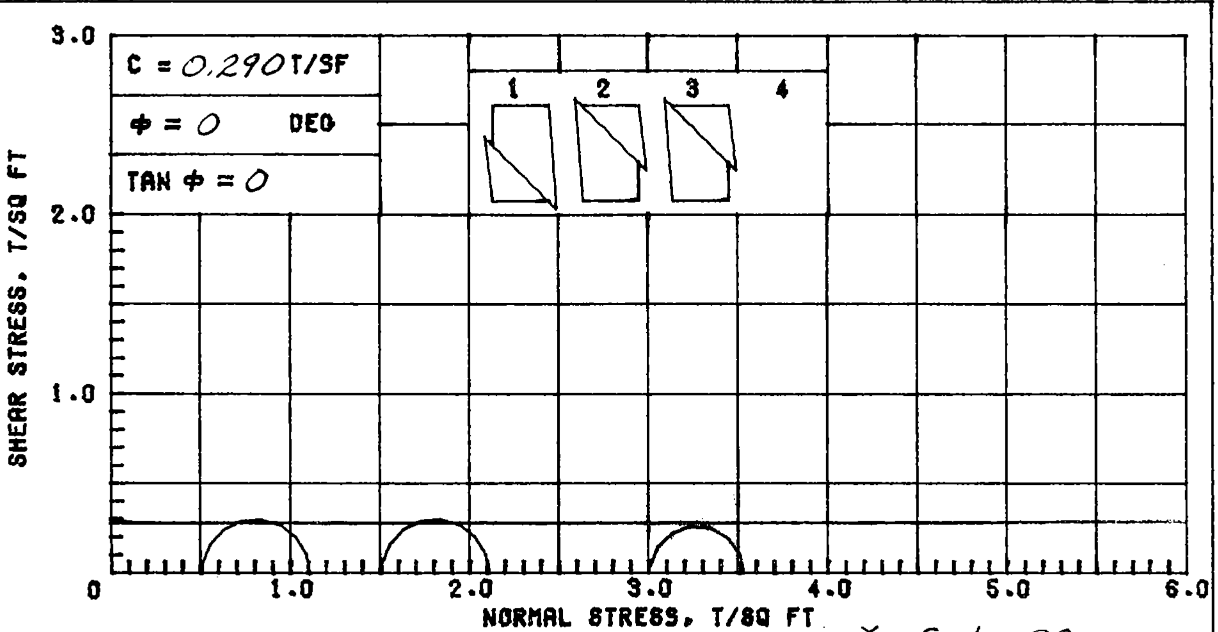
		▲1	Y2	X3	◇4	
	SPECIMEN NO.	▲1	Y2	X3	◇4	Avg.
INITIAL	WATER CONTENT, %	78.4	82.6	86.0	75.6	80.7
	DRY DENSITY, PCF	54.1	51.6	50.9	55.2	
	SATURATION, %	100.0	98.3	100+	99.3	
	VOID RATIO	2.118	2.269	2.313	2.056	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5	
MAX. DEV. STRESS, TSF		0.29	0.29	0.49	0.39	
TIME TO FAILURE, MIN.		2	6	8	9	
RATE OF STRAIN INCR.,%			6	6	6	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

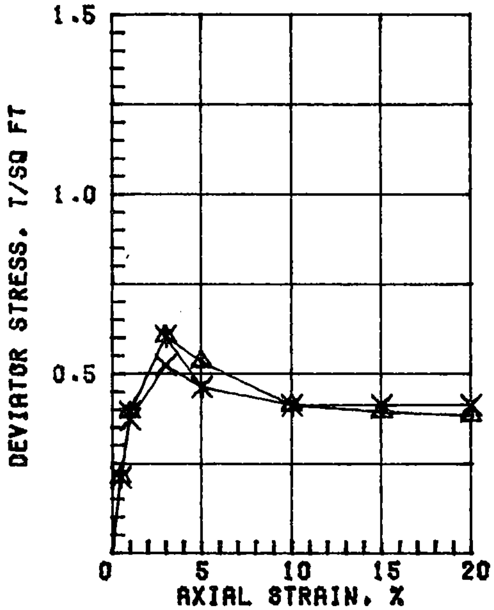
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SHELL PARTICLES

LL 87	PL 20	PI 67	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 10-U	SAMPLE NO. 18-C
	DEPTH/ELEV 58.6/-51.52	TECH. KOC
	LABORATORY USAE WES	DATE 25 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 98



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	70.1	71.9	75.1	
	DRY DENSITY, PCF	57.2	56.0	54.3	
	SATURATION, %	97.2	96.5	96.4	
	VOID RATIO	1.946	2.012	2.103	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.61	0.61	0.52	
	TIME TO FAILURE, MIN.	6	18	18	
	RATE OF STRAIN INCR.,%		6	6	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

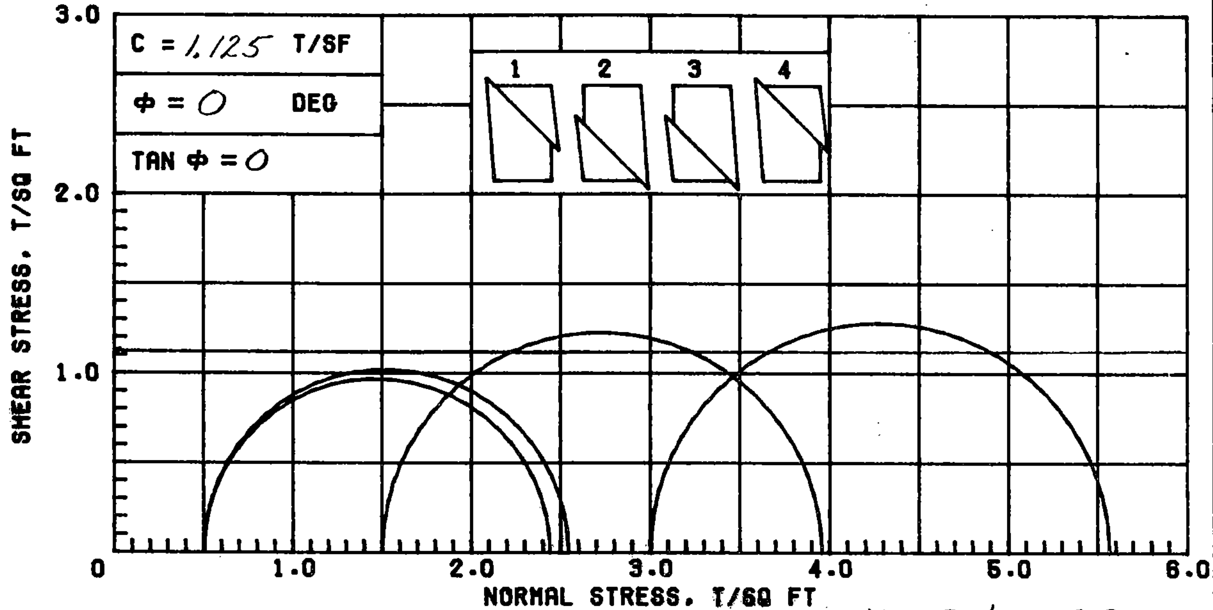
Avg. 72.4

CONTROLLED-STRAIN TEST

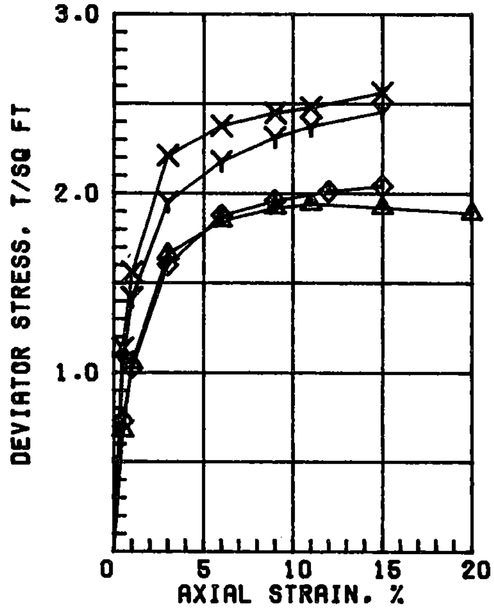
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; ORGANIC MATERIAL

LL 100	PL 24	PI 76	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 10-U	SAMPLE NO. 19-C
	DEPTH/ELEV 71.7/-63.42	TECH. KOC
	LABORATORY USAE WES	DATE 26 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 123



SPECIMEN NO.		△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	27.0	25.8	25.7	25.9
	DRY DENSITY, PCF	95.9	96.5	96.8	97.1
	SATURATION, %	96.1	93.4	93.6	95.0
	VOID RATIO	0.758	0.746	0.741	0.736
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5
MAX. DEV. STRESS, TSF		1.94	2.46	2.56	2.04
TIME TO FAILURE, MIN.		28	30	30	30
RATE OF STRAIN INCR.,%					
INITIAL DIAMETER, IN.		1.38	1.38	1.38	1.38
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 26.1

CONTROLLED-STRAIN TEST

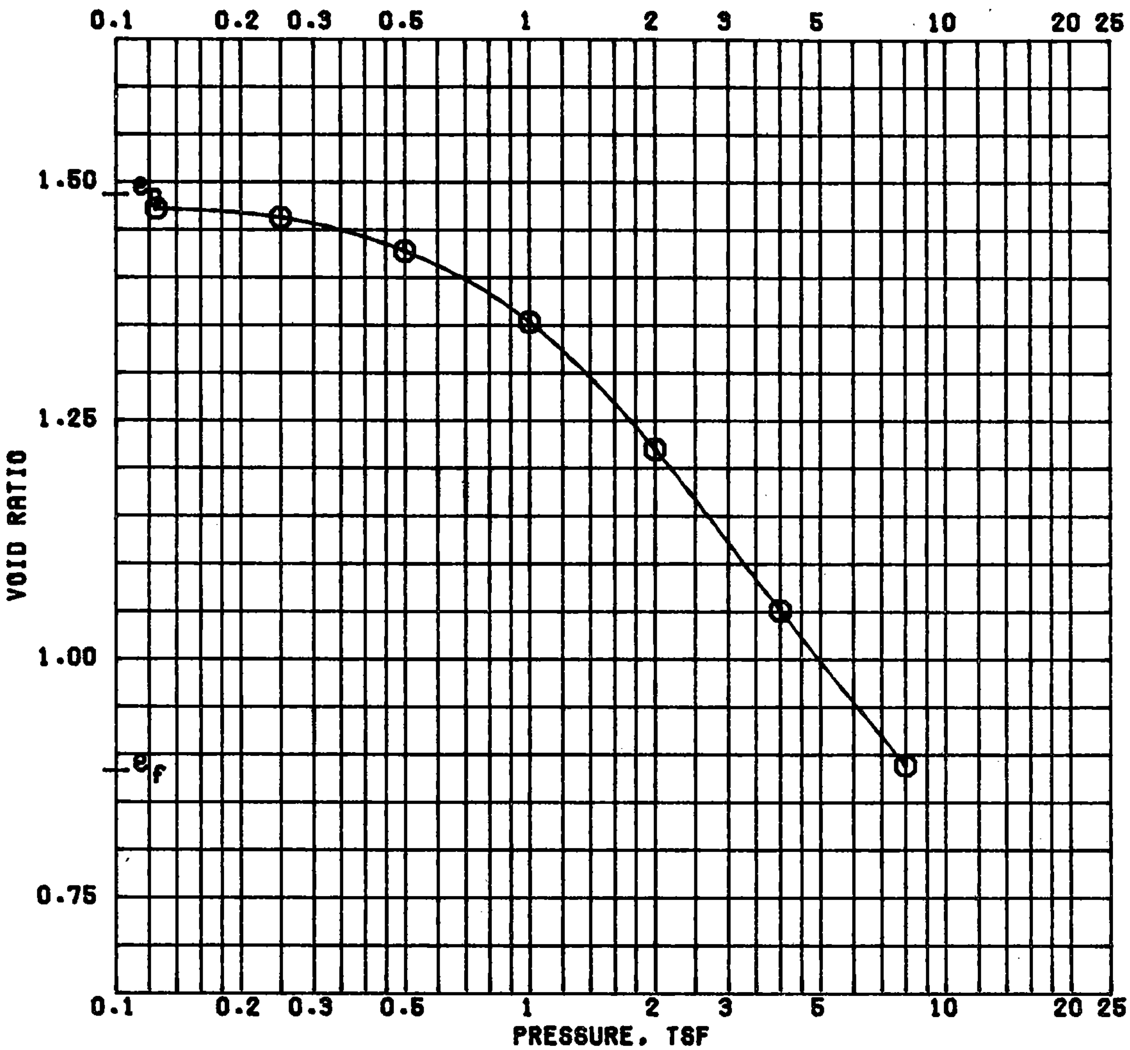
DESCRIPTION OF SPECIMENS: CLAY (CL), GRAY

LL 49	PL 18	PI 31	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 11-U	SAMPLE NO. 3-C
DEPTH/ELEV 7.9/0.10	TECH. LRC
LABORATORY USAE WES	DATE 12 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



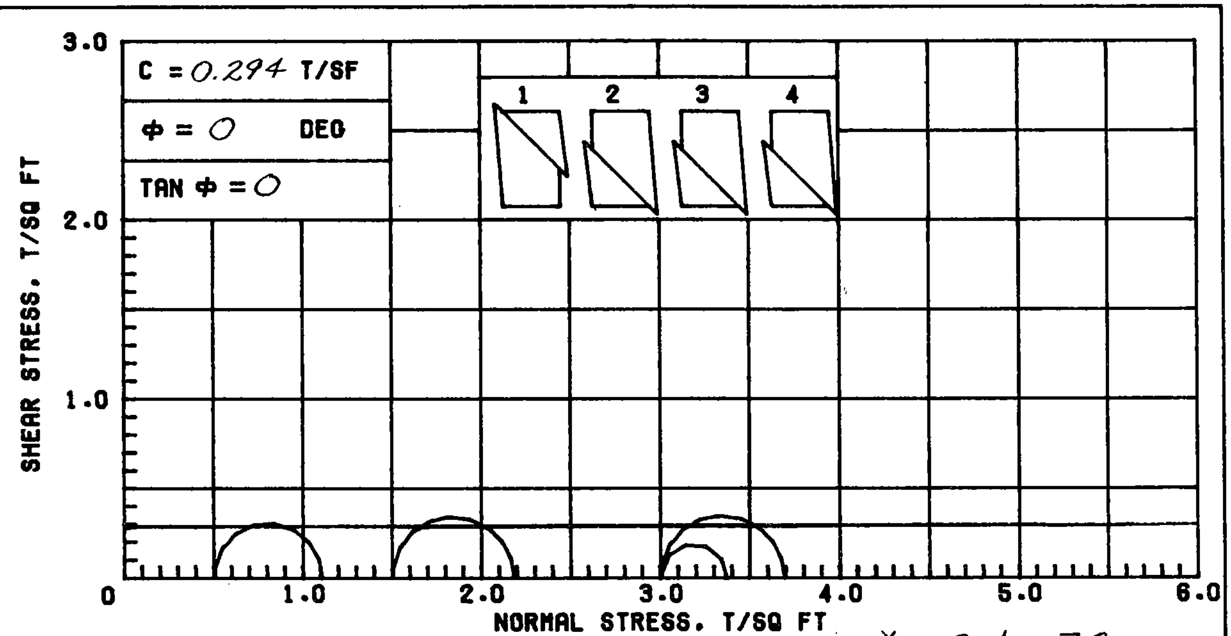
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	53.7	34.5
PRECONSOL. PRESSURE, TSF	1.18	DRY DENSITY, PCF	67.8	89.6
COMPRESSION INDEX	1.36	SATURATION, %	97.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.485	0.881
DIA. IN 4.44	HT. IN 1.116	BACK PRESSURE, TSF		

γ Sat 105

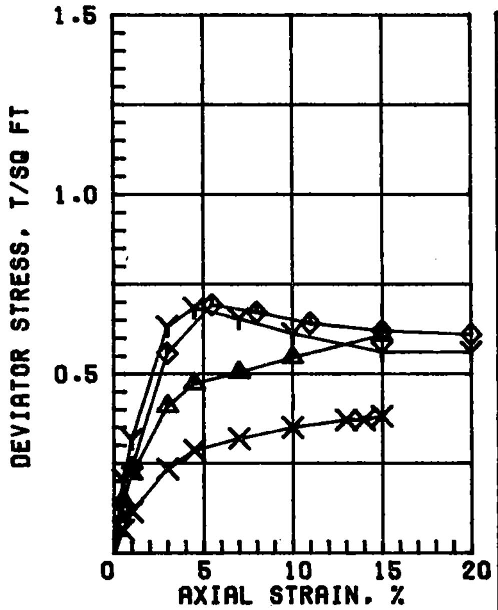
CLASSIFICATION PLASTIC CLAY (CH), GRAY; SHELL FRAGMENTS			
LL 65	PL 19	PI 46	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS			BORING NO. 11-U / SAMPLE NO. 5-C
			DEPTH/ELEV 15.6/-7.6 / DATE 05 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 9



γ Sat 78



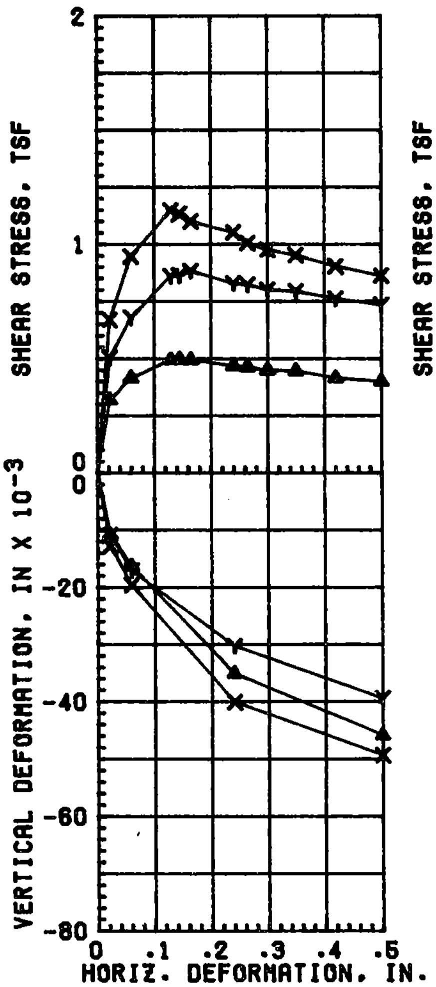
SPECIMEN NO.		△1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	152.4	165.4	215.9	275.6	Avg. 202.3
	DRY DENSITY, PCF	30.7	29.1	22.2	18.7	
	SATURATION, %	91.6	93.1	88.4	92.8	
	VOID RATIO	4.490	4.794	6.595	8.017	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	3.0	
MAX. DEV. STRESS, TSF		0.61	0.68	0.37	0.69	
TIME TO FAILURE, MIN.		29	9	55	11	
RATE OF STRAIN INCR.,%						
INITIAL DIAMETER, IN.		1.37	1.39	1.36	1.38	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00	

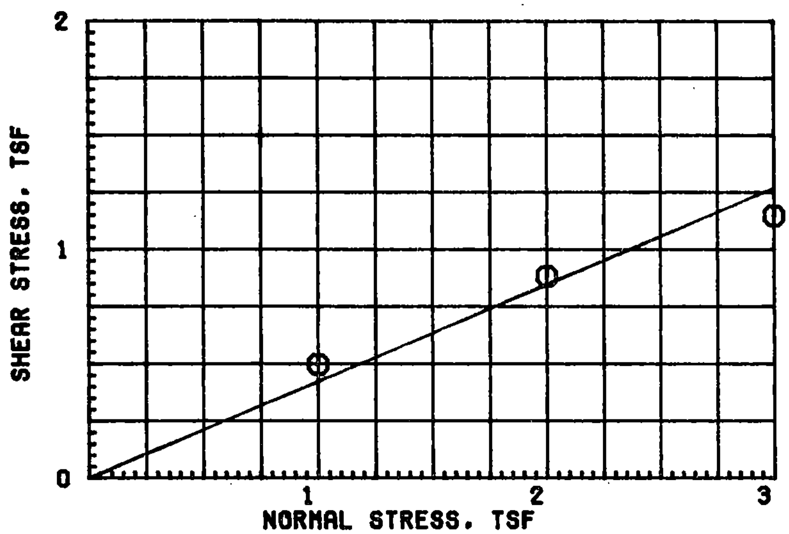
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: ORGANIC CLAY (OH), BLACK; ROOTS

LL	PL	PI	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LAKE PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 11-U	SAMPLE NO. 6-B
	DEPTH/ELEV 19.0/-11.0	TECH. LRC
	LABORATORY USAE WES	DATE 12 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	





γ sat 101

ϕ = 23°

TAN ϕ = 0.424

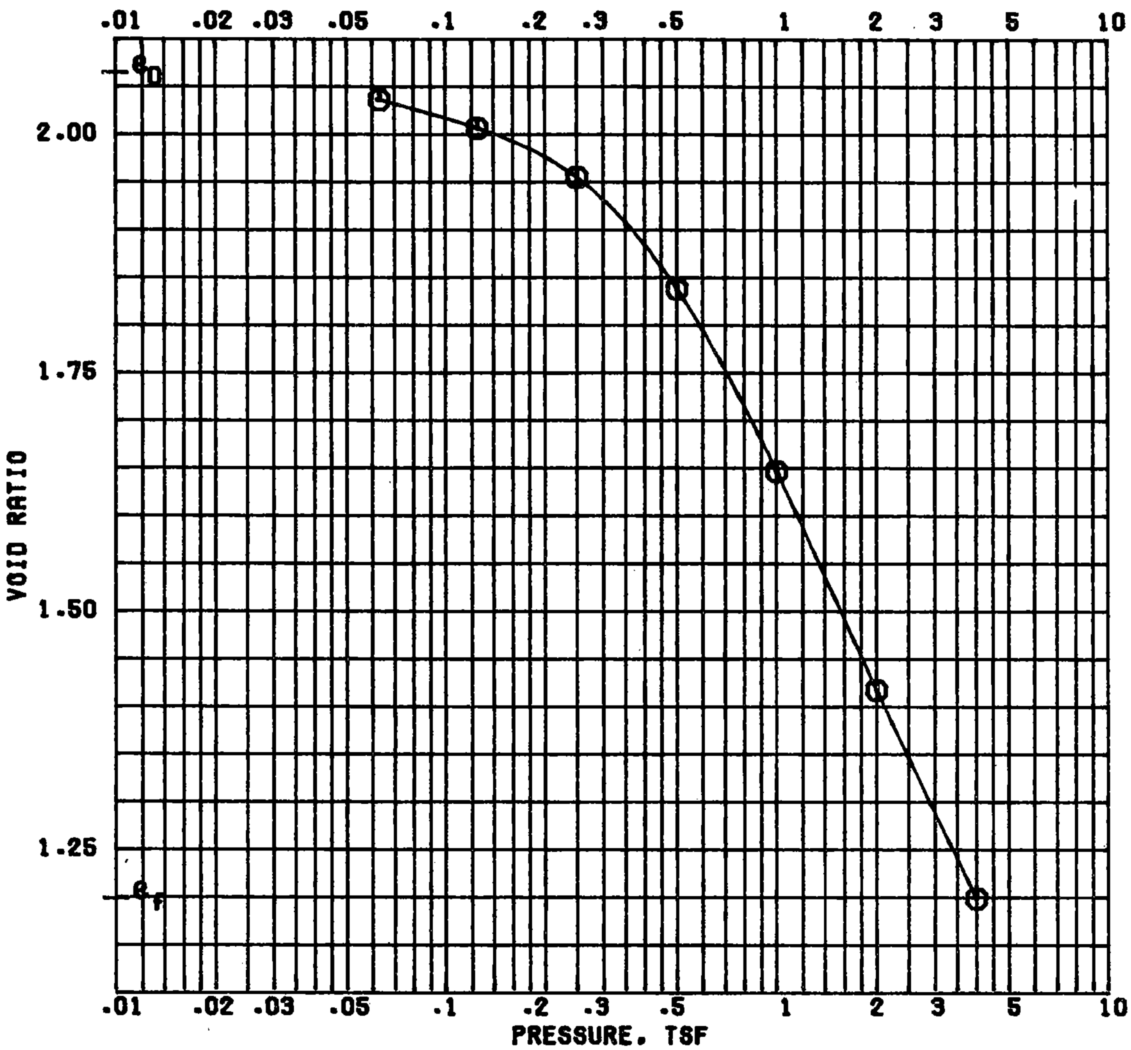
C = 0

TEST NO.		1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %	60.3	62.9	61.6	61.6
	VOID RATIO	1.737	1.762	1.747	
	SATURATION, %	93.7	96.4	95.2	
	DRY DENSITY, PCF	61.6	61.0	61.3	
VOID RATIO AFTER CONSOL					
FIFTY PERCENT CONSOL, MIN		< 1	< 1	< 1	
FINAL	WATER CONTENT, %	39.2	37.2	37.4	
	VOID RATIO				
	SATURATION, %				
NORMAL STRESS, TSF		1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF		0.50	0.88	1.15	
TIME TO FAILURE, MIN		814	926	730	
RATE OF STRAIN, IN/MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, TSF					

TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.629 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY		

LL 70	PL 19	PI 51		GS 2.70 (EST)

REMARKS:	PROJECT LK. PONT. LA. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 11-U	SAMPLE 9-B
	DEPTH/ELEV 31.5/-23.5	DATE 25 SEP 85
	DIRECT SHEAR TEST REPORT	



γ Sat 97

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	74.5	45.5
PRECONSOL. PRESSURE, TSF	0.38	DRY DENSITY, PCF	55.0	76.7
COMPRESSION INDEX	1.93	SATURATION, %	97.5	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.063	1.197
DIA. IN 4.44	HT. IN 1.114	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 70 | PL 20 | PI 50

GS 2.70 (EST) | D_{10}

REMARKS

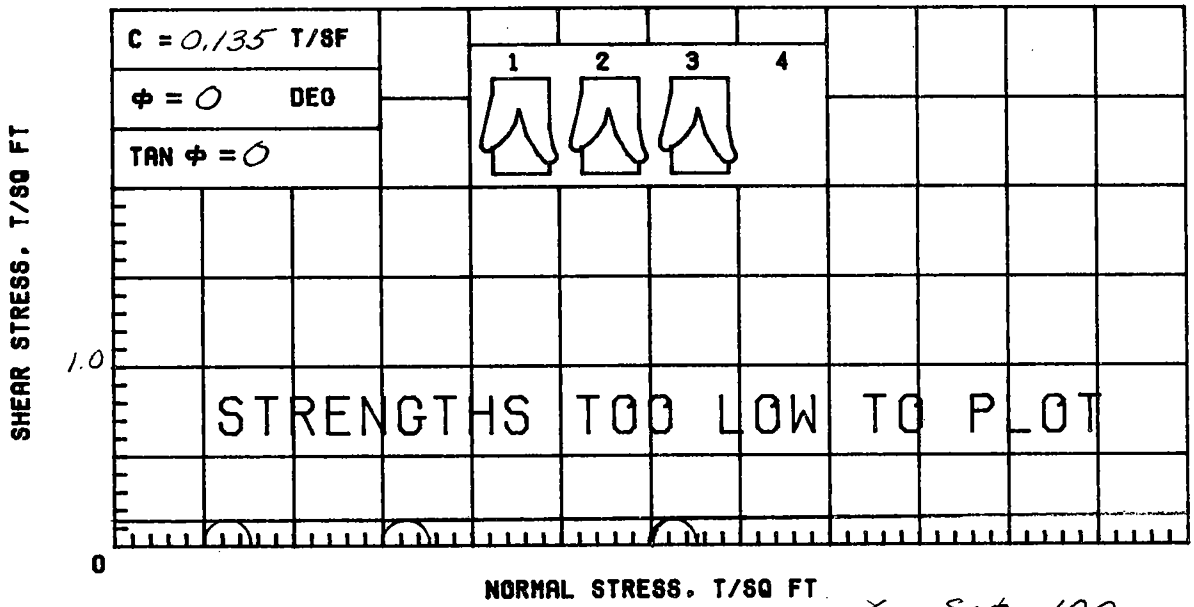
PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

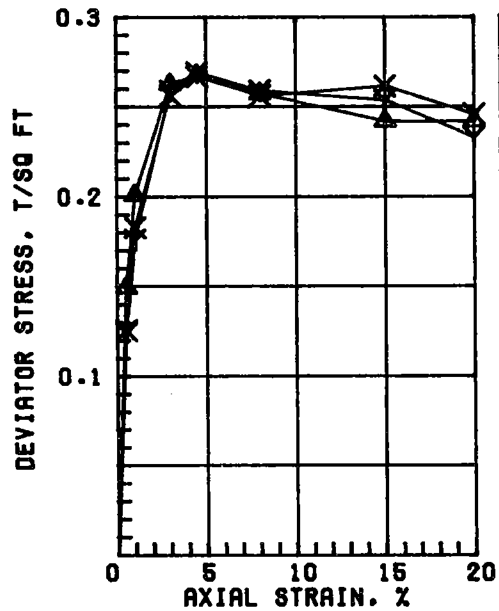
BORING NO. 11-U | SAMPLE NO. 9-C

DEPTH/ELEV 31.9/-23.9 | DATE 07 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8





γ Sat 100

		SPECIMEN NO.	△1	Y2	X3	4
INITIAL		WATER CONTENT, %	66.5	70.4	74.8	
		DRY DENSITY, PCF	59.5	58.8	56.8	
		SATURATION, %	100+	100+	100+	
		VOID RATIO	1.832	1.866	1.967	
BEFORE SHEAR		WATER CONTENT, %				
		DRY DENSITY, PCF				
		SATURATION, %				
		VOID RATIO				
		BACK PRESS., TSF				
MIN PRIN. STRESS, TSF			0.5	1.5	3.0	
MAX. DEV. STRESS, TSF			0.27	0.27	0.27	
TIME TO FAILURE, MIN.			9	17	17	
RATE OF STRAIN INCR.%				8	8	
INITIAL DIAMETER, IN.			1.38	1.38	1.37	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	

Avg. 71.2

CONTROLLED-STRAIN TEST

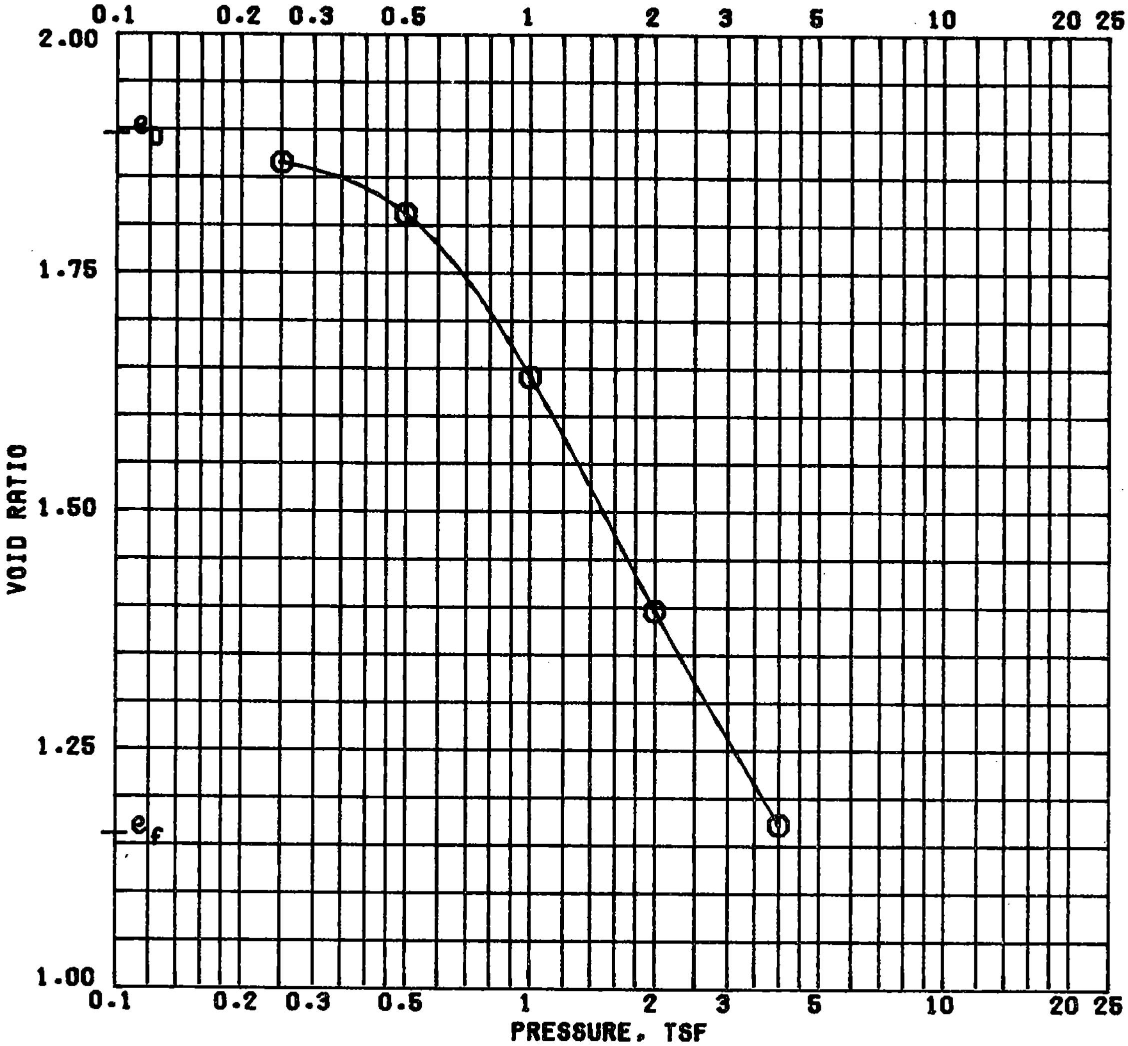
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; 1/16" HORIZONTAL SILT LENSES

LL 72	PL 19	PI 53	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 11-U	SAMPLE NO. 10-C
DEPTH/ELEV 35.9/-27.9	TECH. PJR
LABORATORY USAE WES	DATE 12 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	68.5	44.1
PRECONSOL. PRESSURE, TSF	0.63	DRY DENSITY, PCF	58.2	78.1
COMPRESSION INDEX	1.79	SATURATION, %	97.6	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.894	1.159
DIA. IN 4.44	HT. IN 1.125	BACK PRESSURE, TSF		

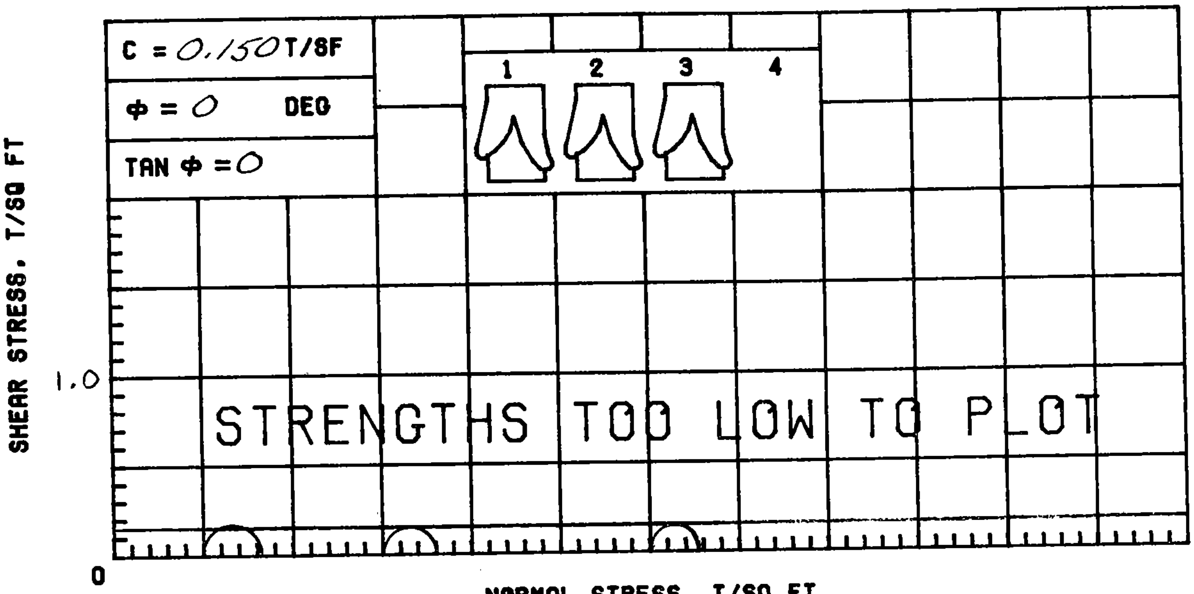
CLASSIFICATION	PLASTIC CLAY (CH), GRAY	
LL 80	PL 22	PI 58
GS 2.70 (EST)	D_{10}	
REMARKS		

PROJECT LAKE PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

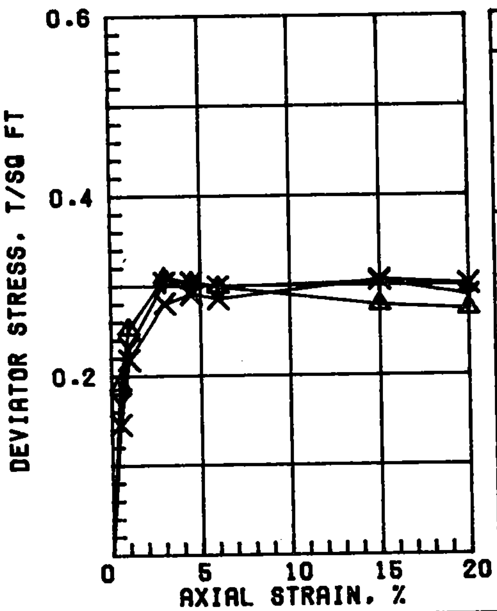
BORING NO. 11-U	SAMPLE NO. 12-C
DEPTH/ELEV 44.0/-36.0	DATE 08 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 7



8 Sept 98



	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	73.7	73.7	74.0	Avg. 73.8
	DRY DENSITY, PCF	56.5	56.5	56.3	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.985	1.983	1.994	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.31	0.30	0.29	
	TIME TO FAILURE, MIN.	8	15	23	
	RATE OF STRAIN INCR.%		6	7	
	INITIAL DIAMETER, IN.	1.38	1.38	1.37	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

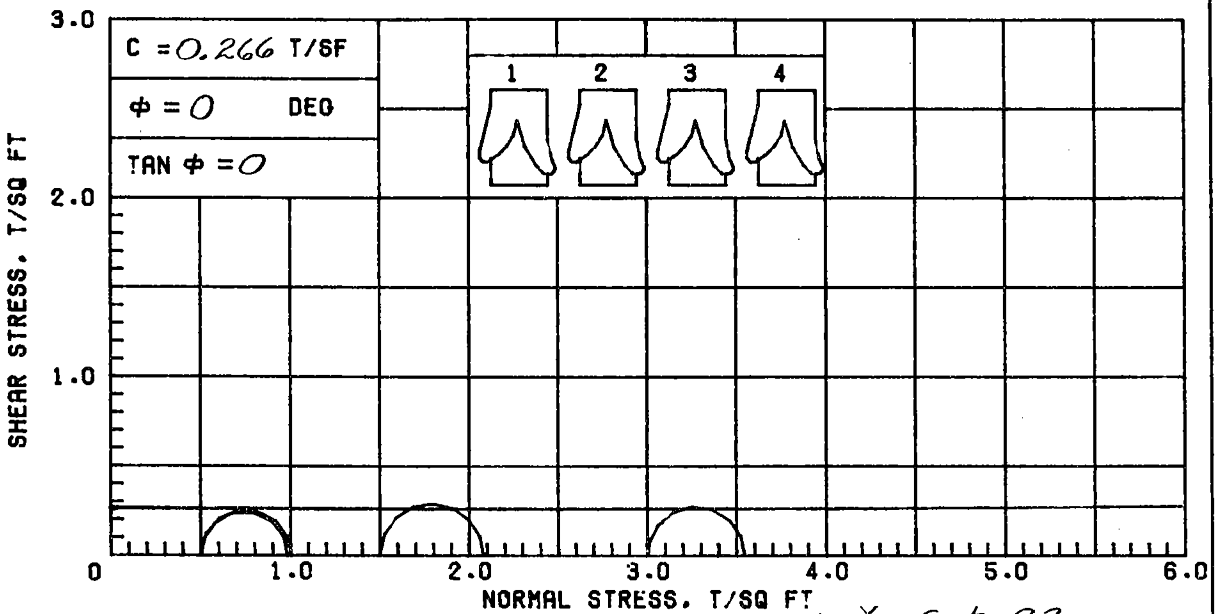
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 67	PL 23	PI 14	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

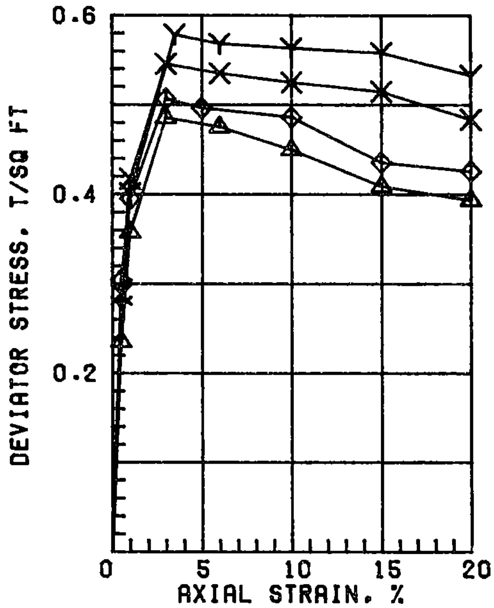
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 11-U	SAMPLE NO. 13-C
DEPTH/ELEV 48.0/-40.0	TECH. PJR
LABORATORY USAE WES	DATE 12 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99



	SPECIMEN NO.	△1	Y2	X3	◇4	Avg.
INITIAL	WATER CONTENT, %	72.0	66.7	71.2	69.5	69.9
	DRY DENSITY, PCF	56.8	58.8	57.2	58.0	
	SATURATION, %	98.8	96.6	98.6	98.5	
	VOID RATIO	1.968	1.865	1.949	1.905	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	0.5	
	MAX. DEV. STRESS, TSF	0.49	0.58	0.55	0.51	
	TIME TO FAILURE, MIN.	6	18	15	18	
	RATE OF STRAIN INCR.,%		6	6	6	
	INITIAL DIAMETER, IN.	1.39	1.39	1.38	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

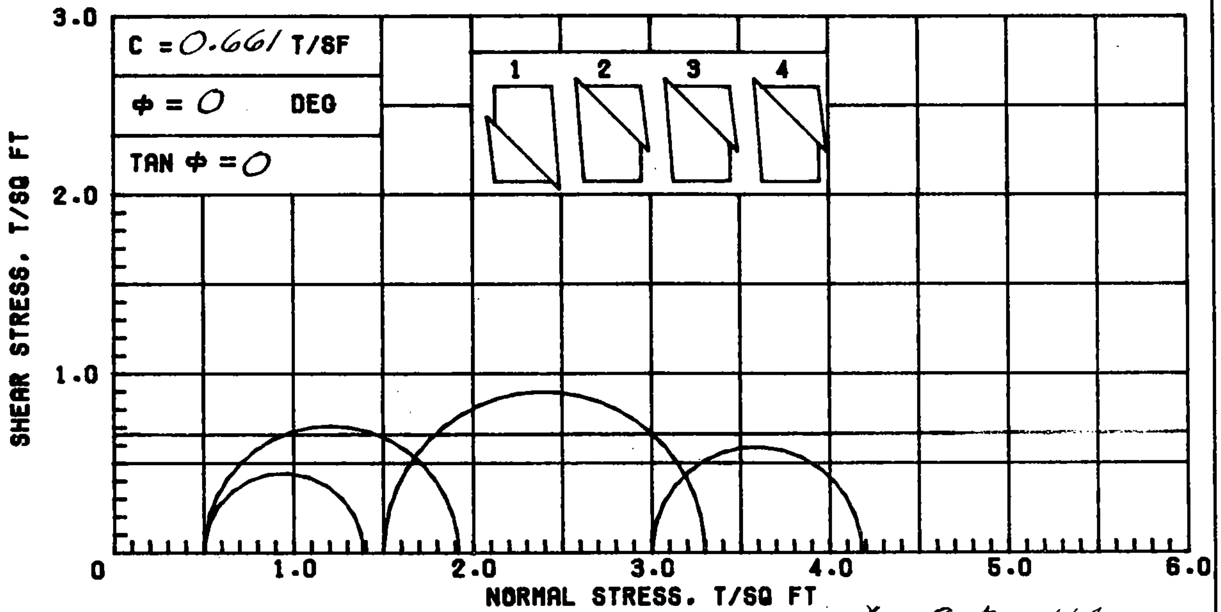
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SMALL SHELL FRAGMENTS

LL 76	PL 21	PI 55	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

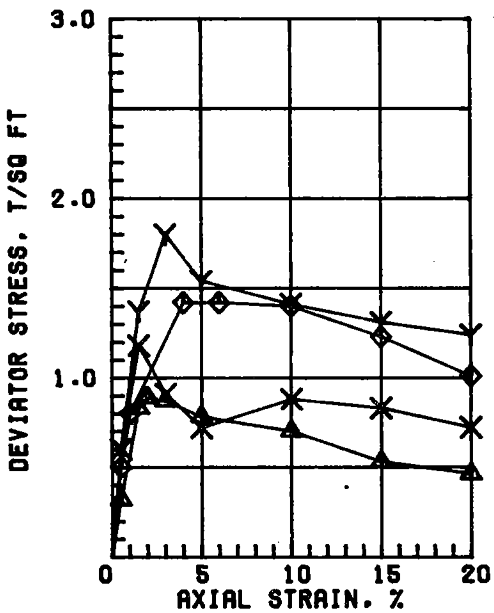
REMARKS:

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 11-U	SAMPLE NO. 15-C
DEPTH/ELEV 56.0/-48.0	TECH. PJR
LABORATORY USAE WES	DATE 12 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 114



		△1	Y2	X3	◇4	
SPECIMEN NO.		△1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	37.7	37.6	39.3	37.9	Avg. 38.1
INITIAL	DRY DENSITY, PCF	82.7	82.0	81.2	83.3	
INITIAL	SATURATION, %	98.0	96.3	98.7	100+	
INITIAL	VOID RATIO	1.039	1.055	1.075	1.023	
BEFORE SHEAR	WATER CONTENT, %					
BEFORE SHEAR	DRY DENSITY, PCF					
BEFORE SHEAR	SATURATION, %					
BEFORE SHEAR	VOID RATIO					
BEFORE SHEAR	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5	
MAX. DEV. STRESS, TSF		0.89	1.80	1.18	1.42	
TIME TO FAILURE, MIN.		4	22	9	24	
RATE OF STRAIN INCR.%			5	6	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), BROWN; SILT LAYERS; CONCRETIONS

LL 79	PL 21	PI 58	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

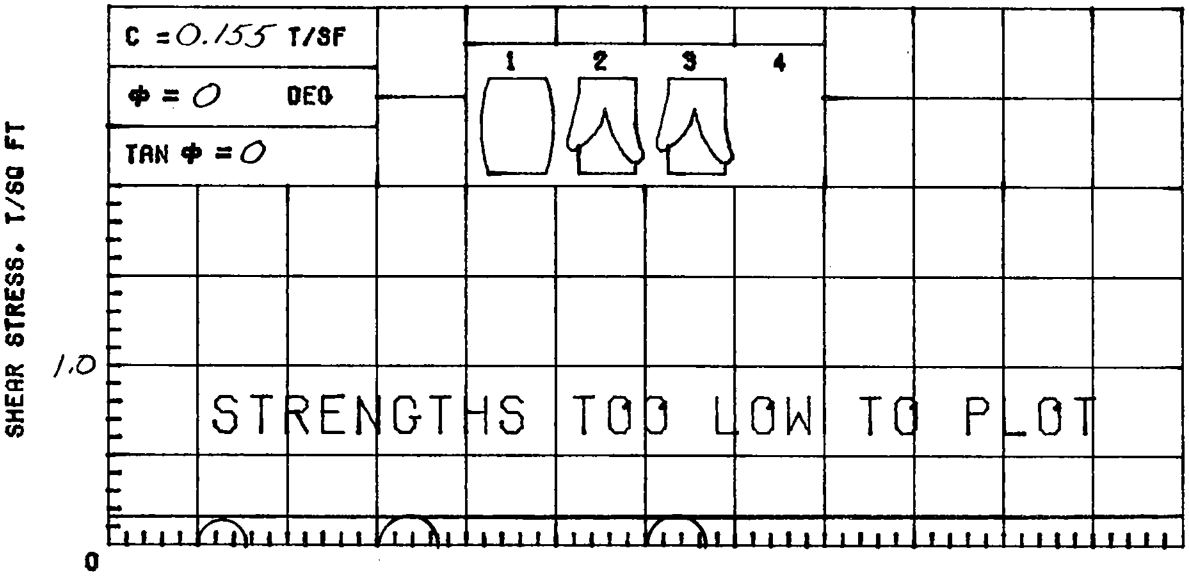
PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 11-U	SAMPLE NO. 22-B
DEPTH/ELEV 83.4/-75.4	TECH. KOC
LABORATORY USAE WES	DATE 12 AUG 85

TRIAXIAL COMPRESSION TEST REPORT

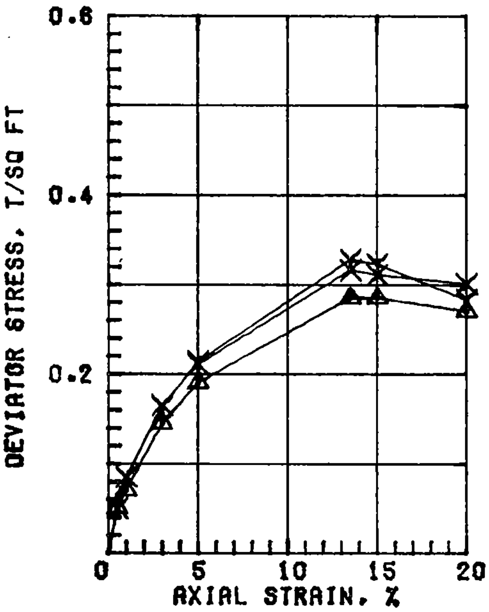
C = 0.155 T/SF

Φ = 0 DEG

TAN Φ = 0



γ Sat 68



			SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	445.1	442.1	422.7		Avg. 436.6
	DRY DENSITY, PCF	12.2	12.4	12.7		
	SATURATION, %	97.9	99.0	97.3		
	VOID RATIO	7.727	7.592	7.384		
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0		
MAX. DEV. STRESS, TSF		0.28	0.33	0.32		
TIME TO FAILURE, MIN.		27	20	20		
RATE OF STRAIN INCR.,%						
INITIAL DIAMETER, IN.		1.40	1.40	1.40		
INITIAL HEIGHT, IN.		3.00	3.00	3.00		

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PEAT (PT), DARK BROWN

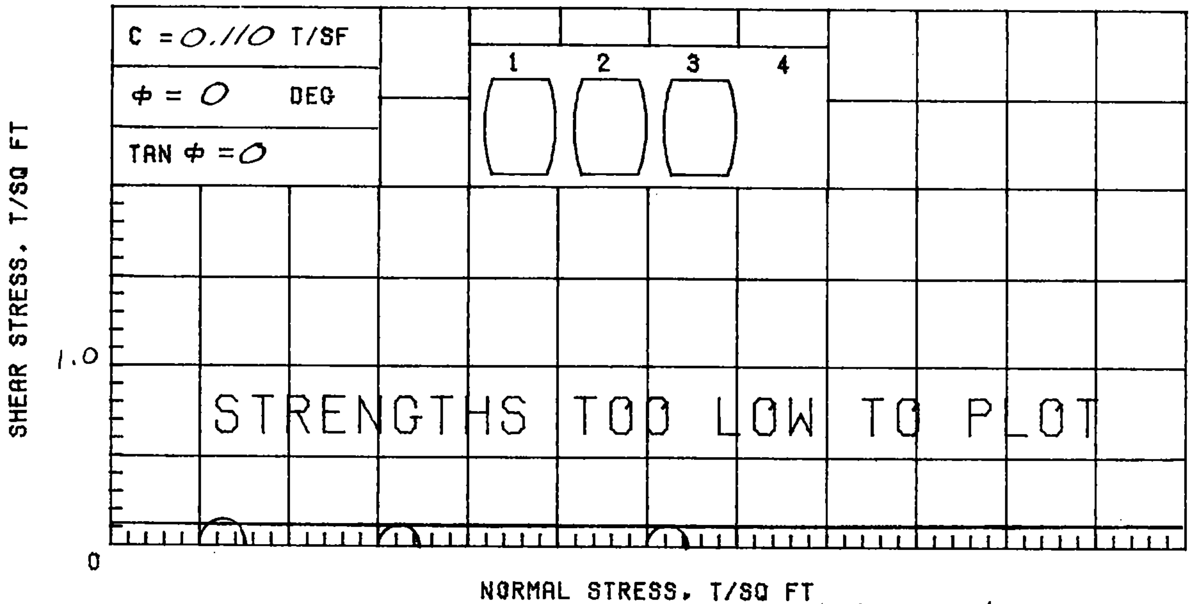
LL 562	PL 187	PI 375	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 12-U	SAMPLE NO. 3-B
	DEPTH/ELEV 6.5/-6.2	TECH. PJR
	LABORATORY USAE WES	DATE 27 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	

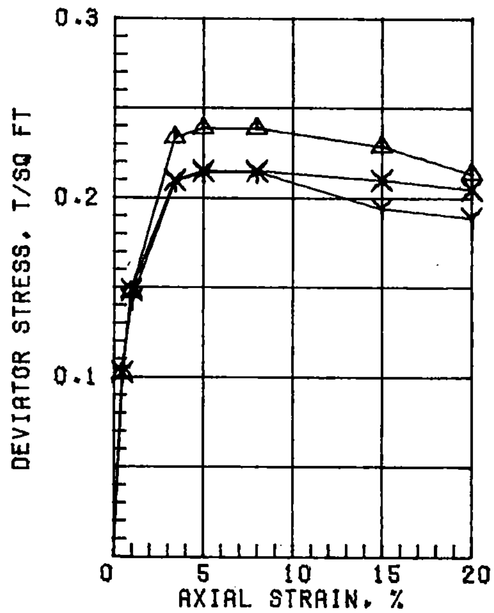
C = 0.110 T/SF

Φ = 0 DEG

TAN Φ = 0



γ Sat 99



		SPECIMEN NO.	△1	Y2	X3	4
INITIAL		WATER CONTENT, %	72.6	74.3	73.7	
		DRY DENSITY, PCF	57.2	56.7	56.7	
		SATURATION, %	100+	100+	100+	
		VOID RATIO	1.945	1.972	1.972	
BEFORE SHEAR		WATER CONTENT, %				
		DRY DENSITY, PCF				
		SATURATION, %				
		VOID RATIO				
		BACK PRESS., TSF				
MIN PRIN. STRESS, TSF			0.6	1.5	3.0	
MAX. DEV. STRESS, TSF			0.24	0.21	0.21	
TIME TO FAILURE, MIN.			10	19	19	
RATE OF STRAIN INCR.,%					8	
INITIAL DIAMETER, IN.			1.39	1.39	1.39	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	

Avg. 73.5

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 78	PL 20	PI 58	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

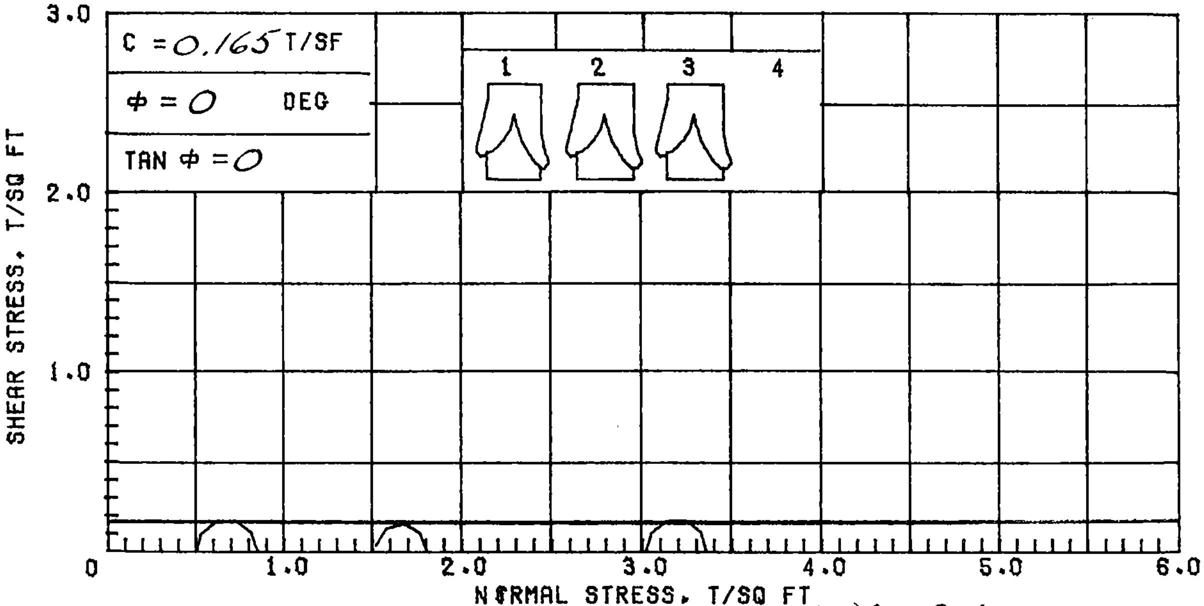
PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 12-U	SAMPLE NO. 5-C
DEPTH/ELEV 15.3/-15.0	TECH. PJR
LABORATORY USAE WES	DATE 28 JUN 85

TRIAXIAL COMPRESSION TEST REPORT

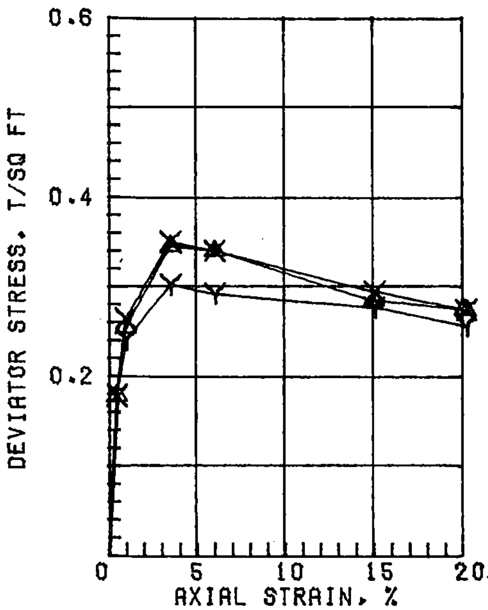
C = 0.165 T/SF

Φ = 0 DEG

TAN Φ = 0



γ Sat 98



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	75.8	79.1	75.2	
INITIAL	DRY DENSITY, PCF	55.7	54.5	56.0	
INITIAL	SATURATION, %	100+	100+	100+	
INITIAL	VOID RATIO	2.026	2.093	2.011	
BEFORE SHEAR	WATER CONTENT, %				
BEFORE SHEAR	DRY DENSITY, PCF				
BEFORE SHEAR	SATURATION, %				
BEFORE SHEAR	VOID RATIO				
BEFORE SHEAR	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.34	0.30	0.35	
	TIME TO FAILURE, MIN.	7	18	18	
	RATE OF STRAIN INCR.,%		6	6	
	INITIAL DIAMETER, IN.	1.39	1.39	1.39	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

Avg. 76.7

CONTROLLED-STRAIN TEST

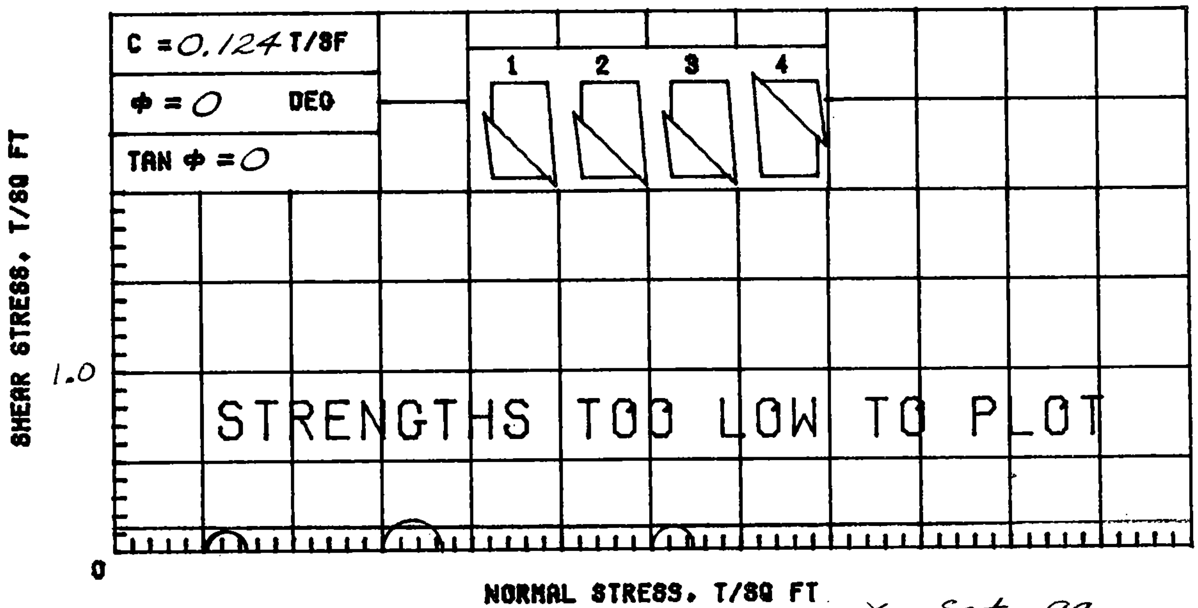
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 87	PL 22	PI 65	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

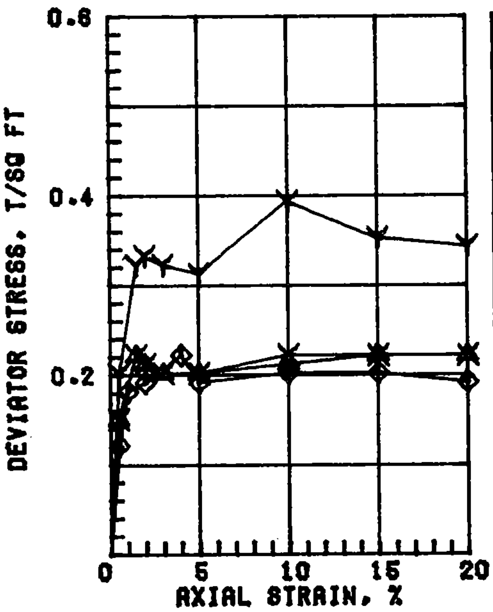
REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 12-U	SAMPLE NO. 8-C
DEPTH/ELEV 27.2/-26.9	TECH. PJR
LABORATORY USAE WES	DATE 28 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 99



SPECIMEN NO.		▲1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	69.8	68.9	69.6	69.8
	DRY DENSITY, PCF	57.6	58.3	58.5	57.9
	SATURATION, %	97.9	98.3	99.9	98.8
	VOID RATIO	1.925	1.893	1.881	1.911
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	0.5
MAX. DEV. STRESS, TSF		0.22	0.33	0.22	0.22
TIME TO FAILURE, MIN.		3	12	9	6
RATE OF STRAIN INCR.%			6	6	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	1.39
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

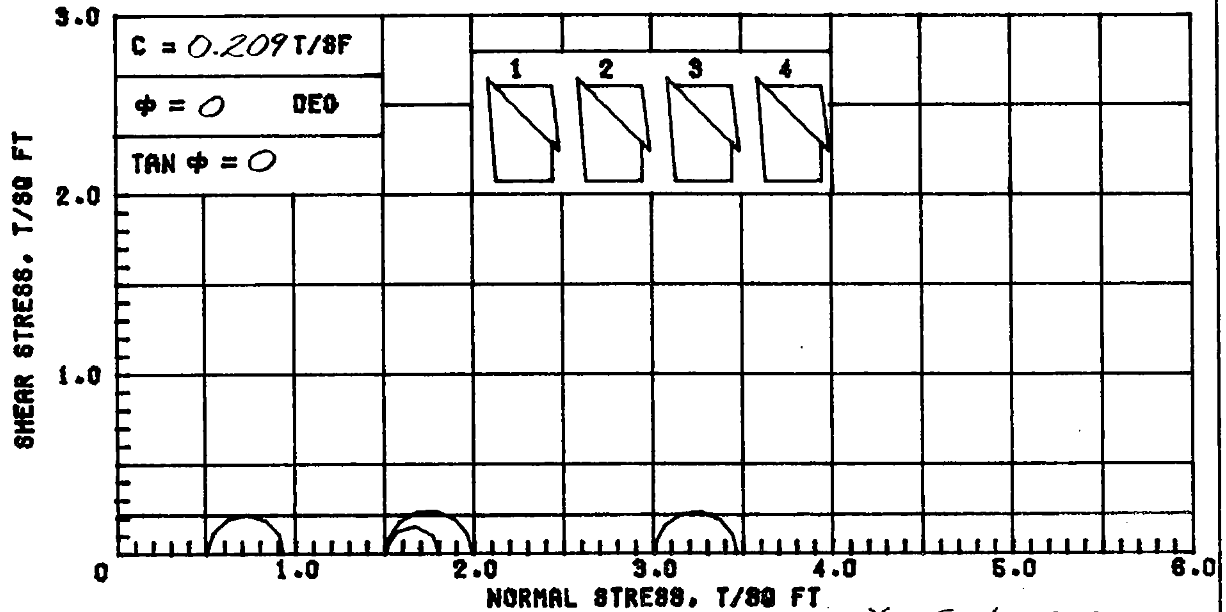
Avg. 69.5

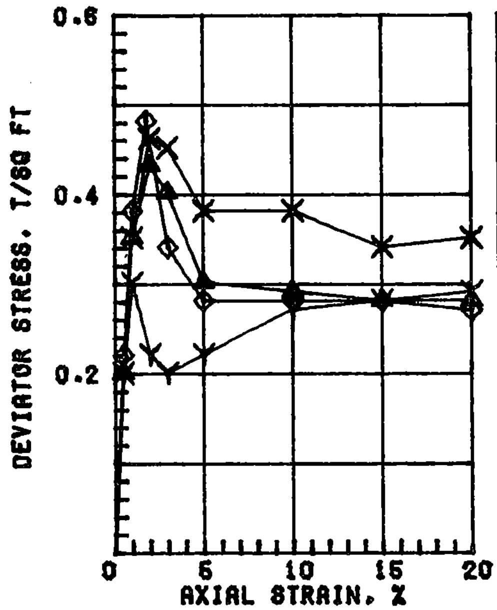
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 85	PL 23	PI 62	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 12-U	SAMPLE NO. 11-B
	DEPTH/ELEV 39.7/-39.36	TECH. KOC
	LABORATORY USAE WES	DATE 27 JUN 85
	TRIAXIAL COMPRESSION TEST REPORT	





γ Sat 95

SPECIMEN NO.		Δ1	Y2	X3	◊4
INITIAL	WATER CONTENT, %	84.3	82.6	80.0	80.2
	DRY DENSITY, PCF	50.9	51.6	52.5	52.8
	SATURATION, %	98.4	99.1	97.7	98.9
	VOID RATIO	2.314	2.257	2.210	2.190
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	1.5
MAX. DEV. STRESS, TSF		0.43	0.30	0.46	0.48
TIME TO FAILURE, MIN.		4	8	12	11
RATE OF STRAIN INCR.%			4	6	6
INITIAL DIAMETER, IN.		1.40	1.40	1.40	1.40
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00

Avg. 81.8

CONTROLLED-STRAIN TEST

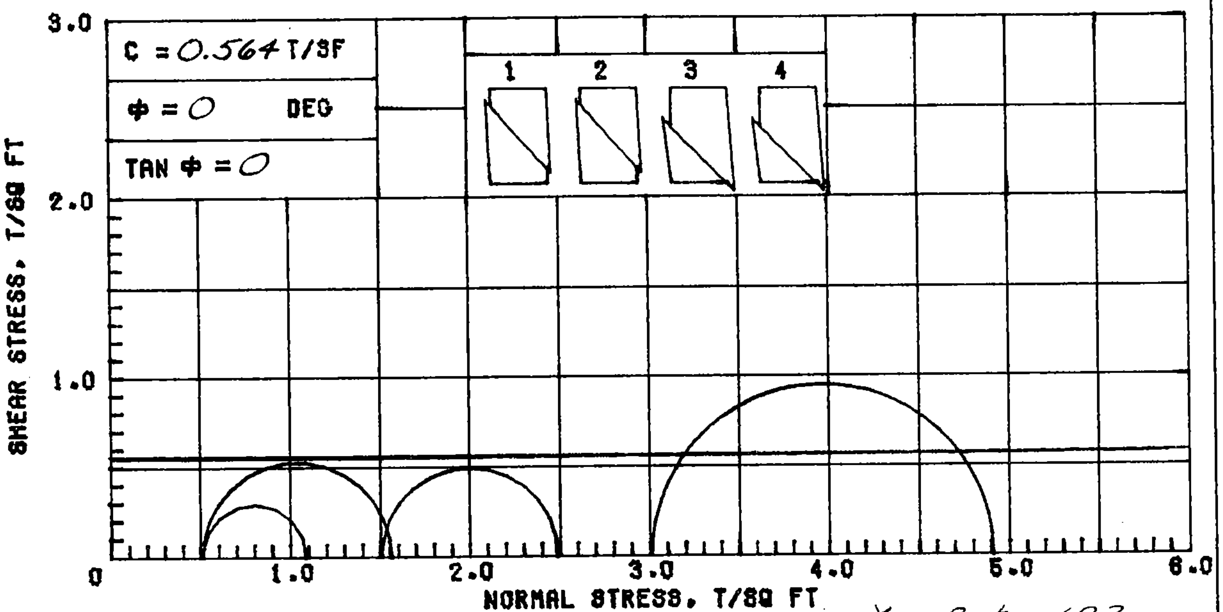
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SHELL PARTICLES

LL 95	PL 21	PI 74	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

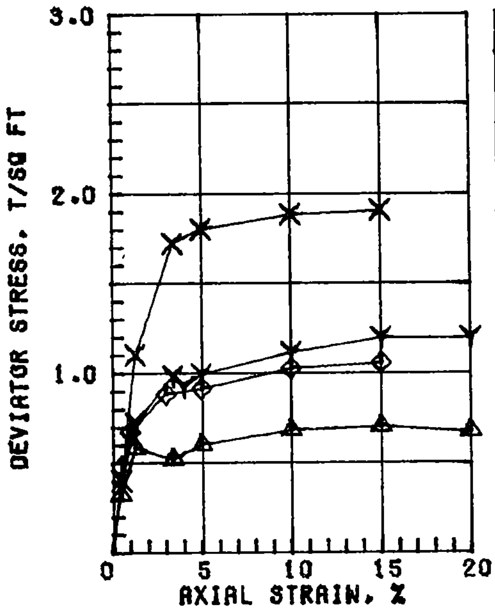
REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 12-U	SAMPLE NO. 13-B
DEPTH/ELEV 48/47.66	TECH. KOC
LABORATORY USAE WES	DATE 27 JUN 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 123



	SPECIMEN NO.	△1	Y2	X3	◇4
INITIAL	WATER CONTENT, %	27.9	27.3	27.5	28.0
	DRY DENSITY, PCF	96.0	96.1	97.6	94.5
	SATURATION, %	99.5	97.8	100+	96.4
	VOID RATIO	0.757	0.753	0.726	0.785
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	0.5
	MAX. DEV. STRESS, TSF	0.58	0.98	1.90	1.05
	TIME TO FAILURE, MIN.	3	20	60	30
	RATE OF STRAIN INCR.%		6		
	INITIAL DIAMETER, IN.	1.40	1.40	1.40	1.40
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	3.00

Avg. 27.7

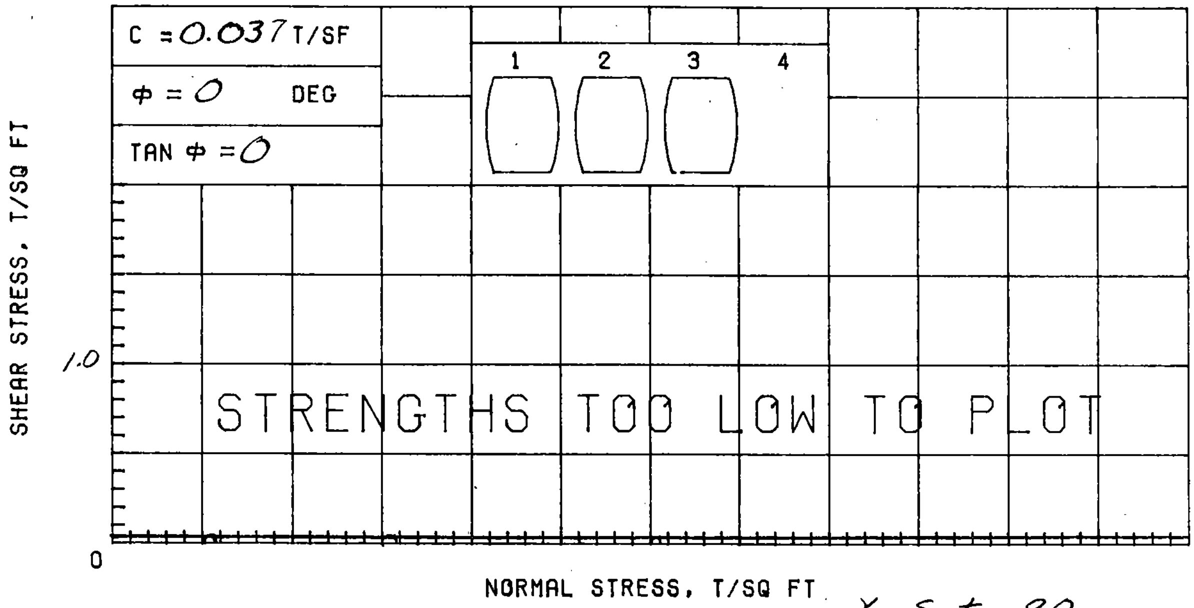
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; 1/4" SILT LAYERS

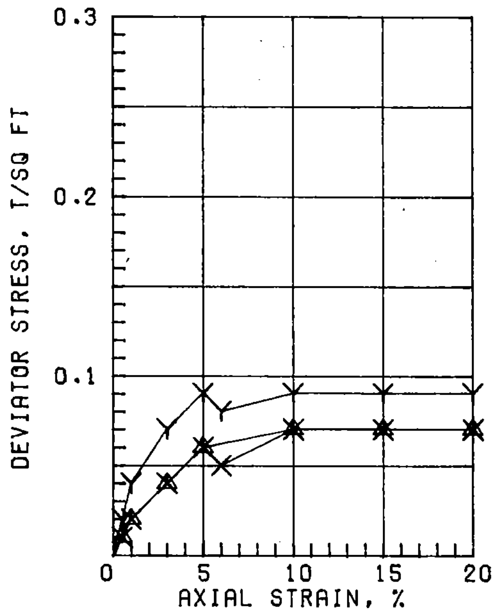
LL 53	PL 16	PI 37	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:		
	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 12-U	SAMPLE NO. 17-B
	DEPTH/ELEV 63.8/-63.46	TECH. KOC
	LABORATORY USAE WES	DATE 17 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	

C = 0.037 T/SF
φ = 0 DEG
TAN φ = 0



8 Sat 90



		△1	Y2	X3	4
	SPECIMEN NO.	△1	Y2	X3	4
INITIAL	WATER CONTENT, %	106.5	102.7	101.1	
	DRY DENSITY, PCF	41.9	42.4	45.6	
	SATURATION, %	95.1	93.2	100+	
	VOID RATIO	3.023	2.976	2.696	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.07	0.09	0.06	
TIME TO FAILURE, MIN.		20	30	30	
RATE OF STRAIN INCR,%			6	6	
INITIAL DIAMETER, IN.		1.40	1.40	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

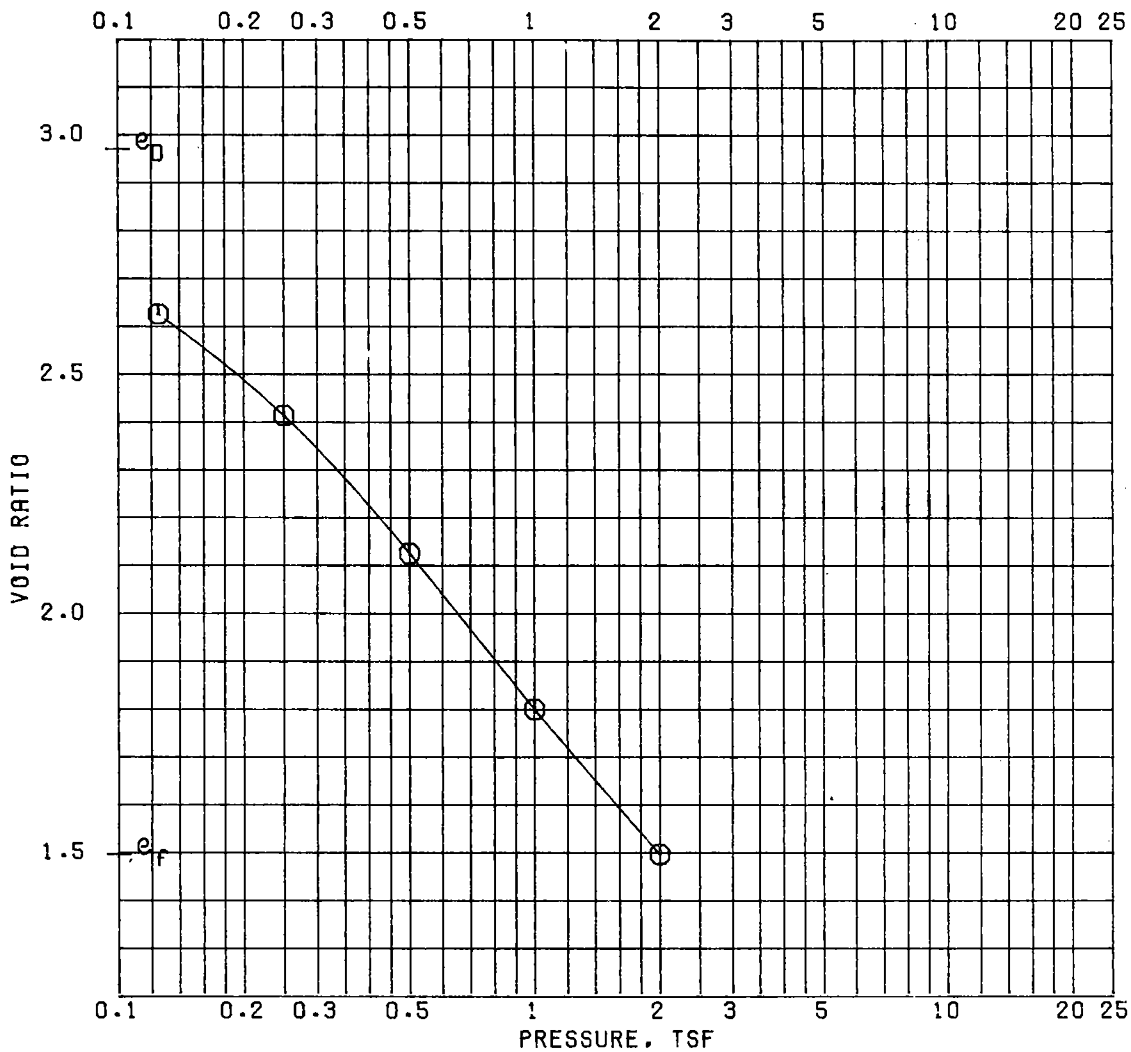
Avg. 103.4

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 90	PL 20	PI 70	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 13-U	SAMPLE NO. 2-C
	DEPTH/ELEV 6.4/-12.3	TECH. KOC
	LABORATORY USAE WES	DATE 22 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



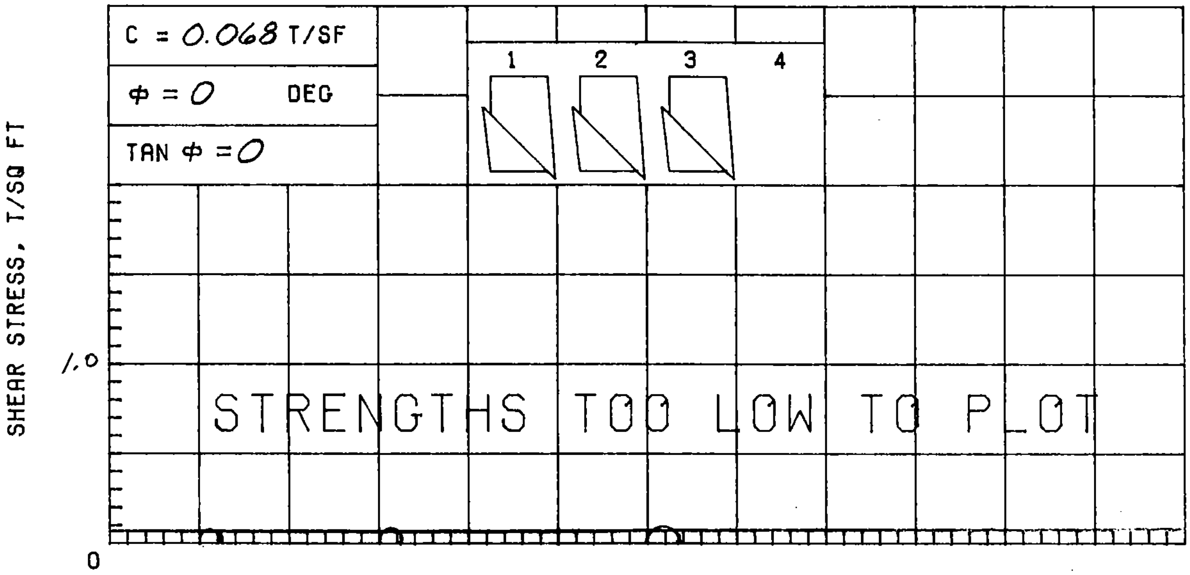
γ Sat 89

			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	108.2	69.0
PRECONSOL. PRESSURE, TSF	0.28	DRY DENSITY, PCF	42.5	67.6
COMPRESSION INDEX	2.42	SATURATION, %	98.5	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.967	1.493
DIA. IN 4.44	HT. IN 1.102	BACK PRESSURE, TSF		
CLASSIFICATION PLASTIC CLAY (CH), GRAY				
LL 85 / PL 24 / PI 61		PROJECT LAKE PONT. LA. & VIC. HURR. PROT		
GS 2.70 (EST)	D_{10}	JEFFERSON & ST. CHARLES PARISHES		
REMARKS		BORING NO. 13-U	SAMPLE NO. 3-B	
		DEPTH/ELEV 8.7/-14.6	DATE 22 OCT 85	

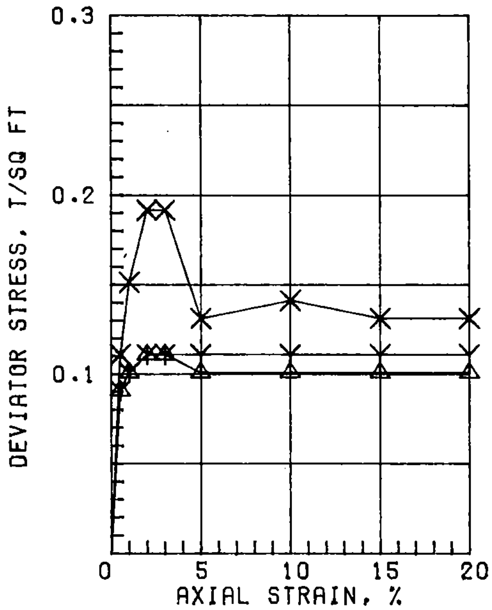
CONSOLIDATION TEST REPORT

SHEET 1 OF 7

C = *0.068* T/SF	
Φ = *0* DEG	
TAN Φ = *0*	



γ sat 92



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	91.5	91.1	92.7	
	DRY DENSITY, PCF	47.6	47.9	47.3	
	SATURATION, %	97.2	97.6	97.5	
	VOID RATIO	2.541	2.519	2.567	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.11	0.11	0.19	
TIME TO FAILURE, MIN.		4	12	12	
RATE OF STRAIN INCR,%			6	6	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

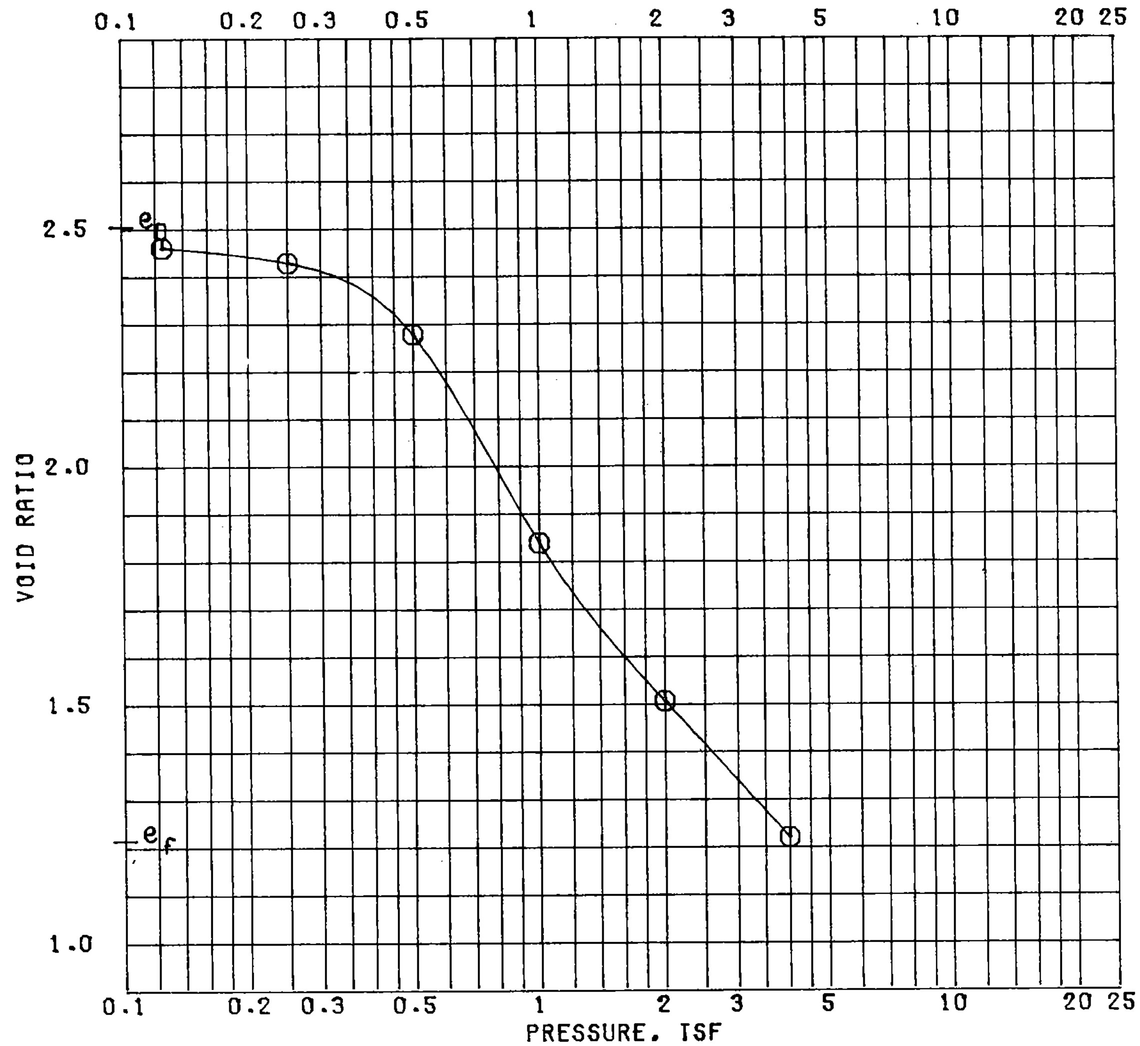
Avg. 91.8

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 84	PL 23	PI 61	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 13-U	SAMPLE NO. 5-B
	DEPTH/ELEV 17.0/-22.9	TECH. KOC
	LABORATORY USAE WES	DATE 22 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	

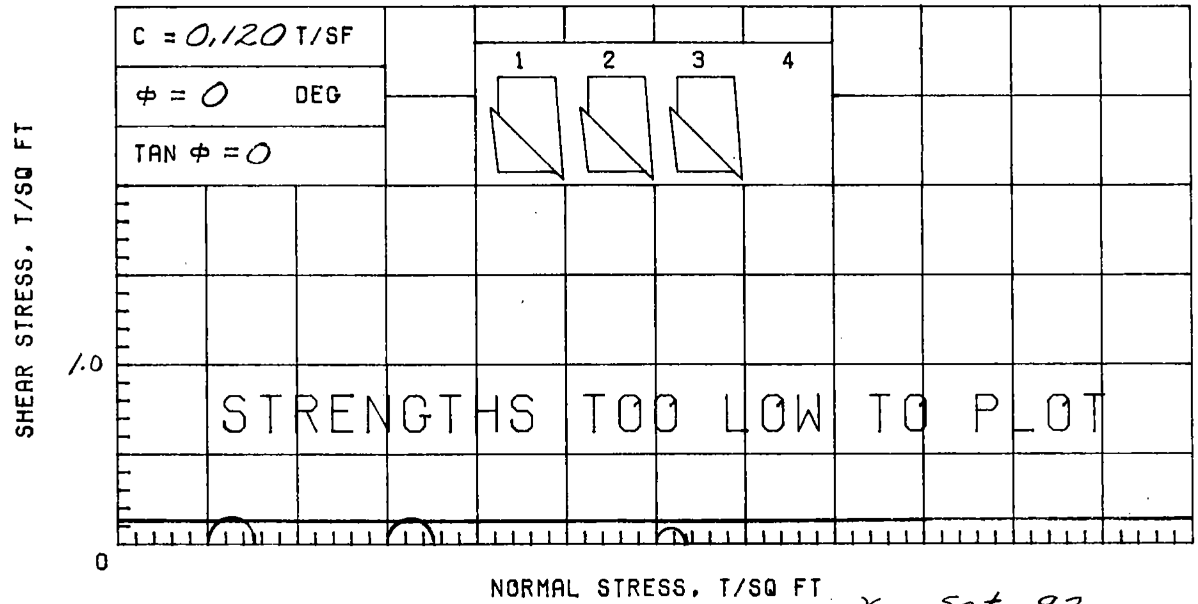


γ Sat 93

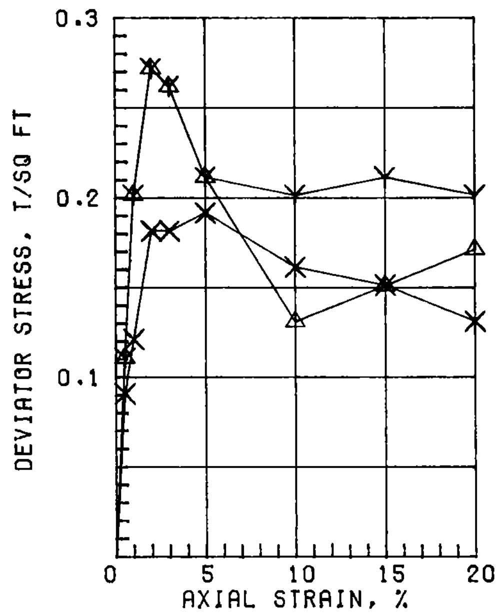
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	91.4	47.7
PRECONSOL. PRESSURE, TSF	0.45	DRY DENSITY, PCF	48.2	76.2
COMPRESSION INDEX	2.38	SATURATION, %	98.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.500	1.211
DIA. IN 4.44	HT. IN 1.126	BACK PRESSURE, TSF		
CLASSIFICATION PLASTIC CLAY (CH), GRAY				
LL 76	PL 23 / PI 53	PROJECT LAKE PONT. LA. & VIC. HURR. PROT		
GS 2.70 (EST)	D_{10}	JEFFERSON & ST. CHARLES PARISHES		
REMARKS		BORING NO. 13-U	SAMPLE NO. 7-B	
		DEPTH/ELEV 25.0/-30.9	DATE 25 OCT 85	

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



γ Sat 92



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	91.8	93.1	93.8	
	DRY DENSITY, PCF	47.6	47.2	46.6	
	SATURATION, %	97.5	97.8	96.8	
	VOID RATIO	2.542	2.570	2.617	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.27	0.27	0.18	
TIME TO FAILURE, MIN.		4	12	15	
RATE OF STRAIN INCR.,%			6	4	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 92.9

CONTROLLED-STRAIN TEST

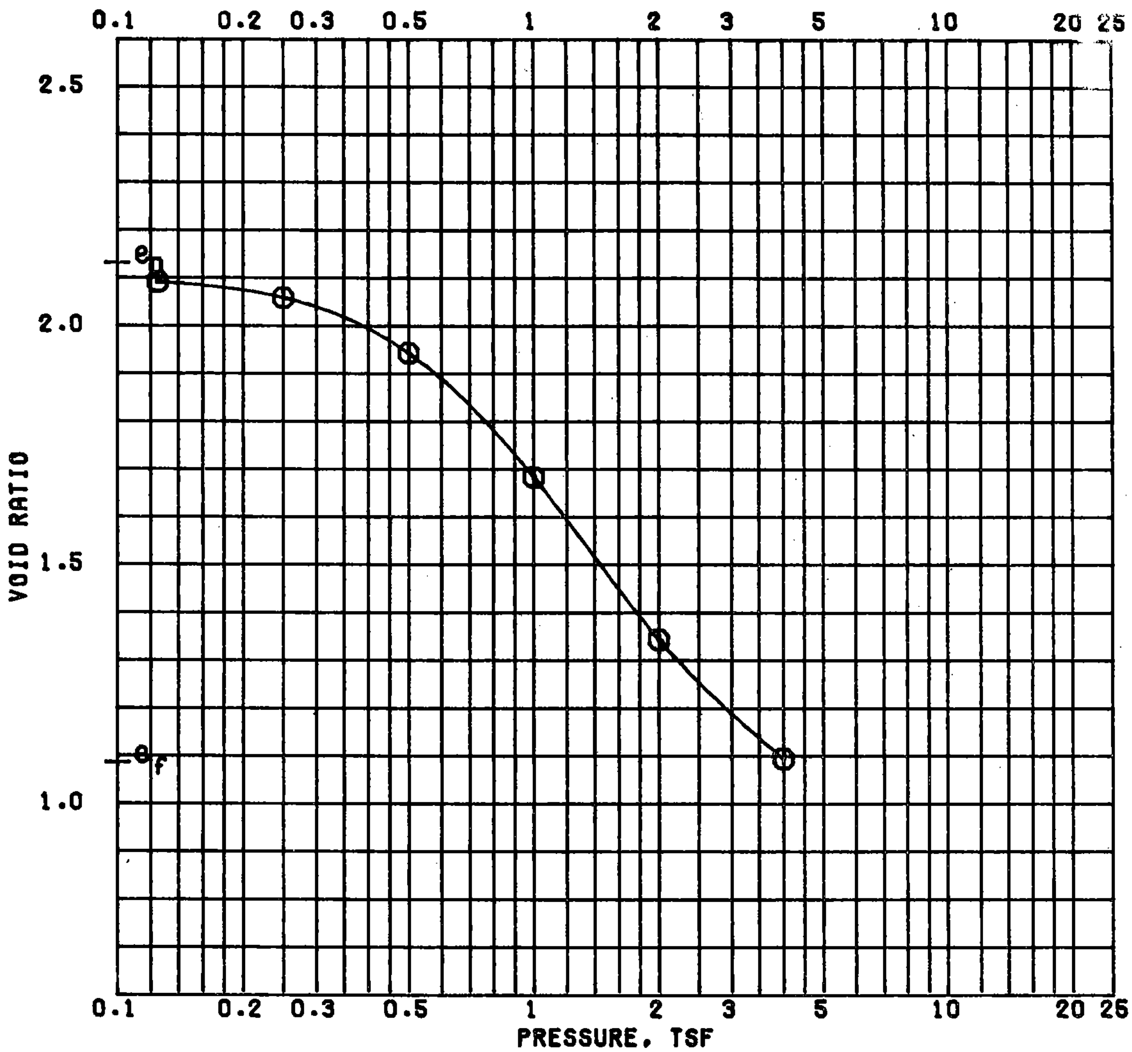
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY

LL 104	PL 25	PI 79	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;

PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
BORING NO. 13-U	SAMPLE NO. 8-C
DEPTH/ELEV 30.0/-35.9	TECH. KOC
LABORATORY USAE WES	DATE 22 AUG 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 96

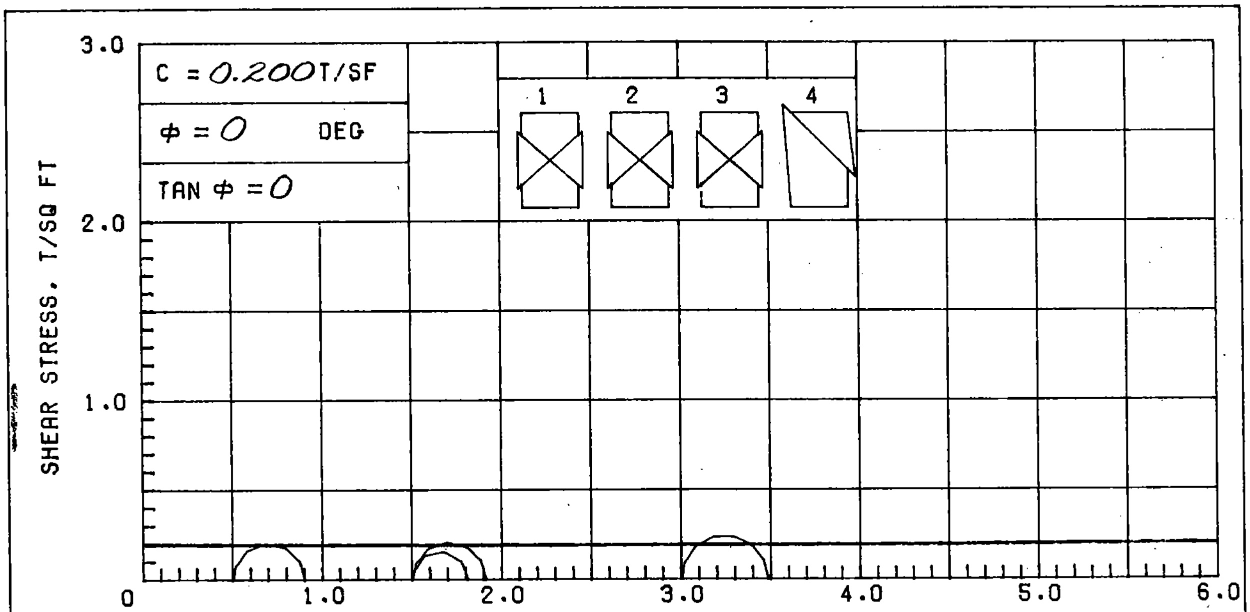
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	75.9	45.9
PRECONSOL. PRESSURE, TSF	0.46	DRY DENSITY, PCF	53.9	80.9
COMPRESSION INDEX	2.00	SATURATION, %	96.3	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	2.126	1.083
DIA. IN 4.44	HT. IN 1.131	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SHELLS

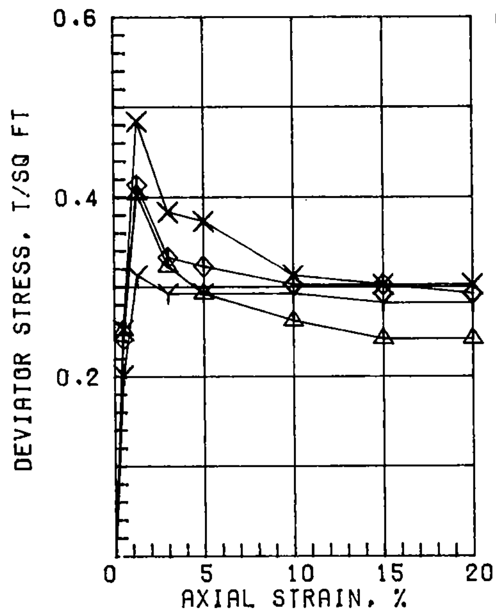
LL 53	PL 17	PI 36	PROJECT LAKE PONT LA & VIC HURR. PROT
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISHES
REMARKS		BORING NO. 13-U	SAMPLE NO. 10-B
		DEPTH/ELEV 37.0/-42.9	DATE 28 OCT 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8



γ Sat 99



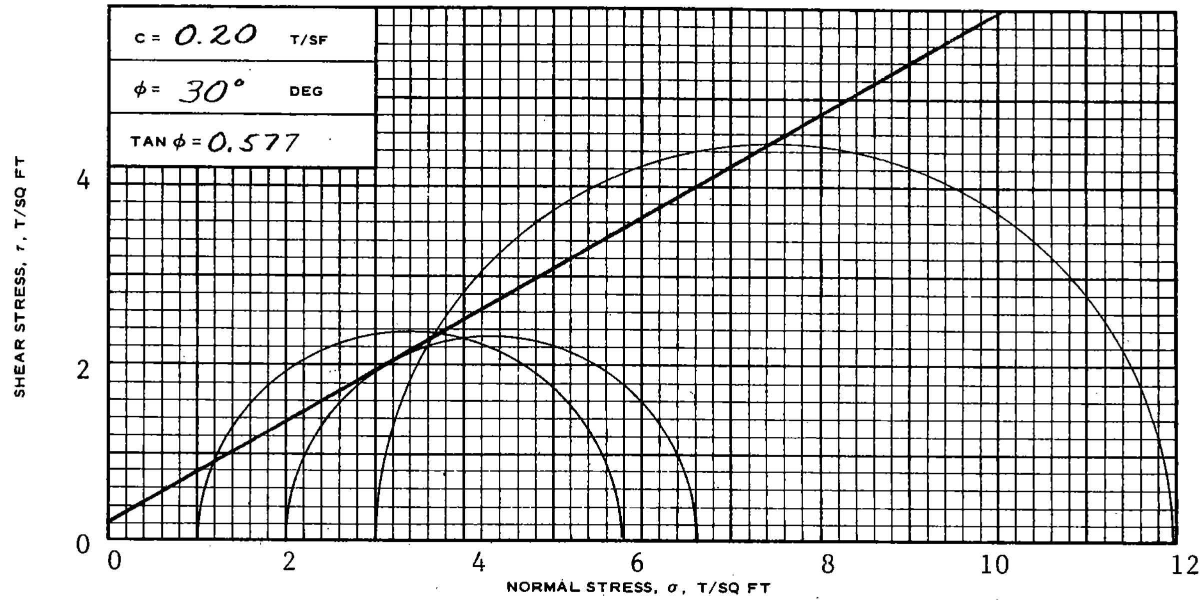
	SPECIMEN NO.	△1	Y2	X3	◇4	
INITIAL	WATER CONTENT, %	69.8	69.6	69.7	72.1	Avg. 70.3
	DRY DENSITY, PCF	57.5	57.4	57.9	57.3	
	SATURATION, %	97.5	97.0	98.6	100+	
	VOID RATIO	1.933	1.937	1.909	1.941	
BEFORE SHEAR	WATER CONTENT, %					
	DRY DENSITY, PCF					
	SATURATION, %					
	VOID RATIO					
	BACK PRESS., TSF					
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	1.5	
MAX. DEV. STRESS, TSF		0.40	0.31	0.48	0.41	
TIME TO FAILURE, MIN.		3	11	12	8	
RATE OF STRAIN INCR.,%			4	4	4	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	3.00	

CONTROLLED-STRAIN TEST

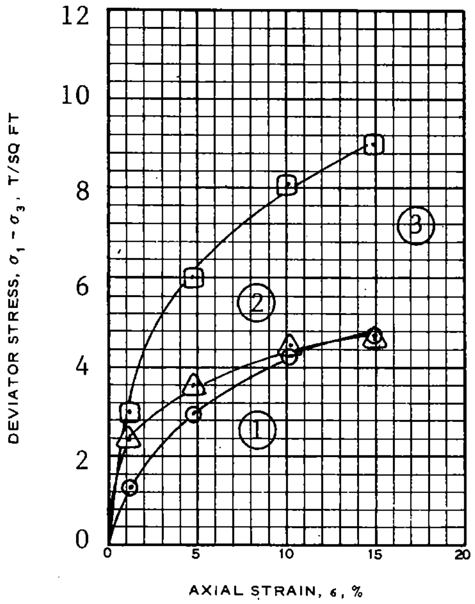
DESCRIPTION OF SPECIMENS; PLASTIC CLAY (CH), GRAY; SILT POCKETS; SHELLS

LL 91	PL 21	PI 70	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS;		
	PROJECT LAKE PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES	
	BORING NO. 13-U	SAMPLE NO. 11-B
	DEPTH/ELEV 41.0/-46.9	TECH. KOC
	LABORATORY USAE WES	DATE 23 AUG 85
	TRIAXIAL COMPRESSION TEST REPORT	



γ Sat 127



SPECIMEN NO.			1	2	3	Avg.
INITIAL	WATER CONTENT, %	w_o	21.9	23.1	21.3	22.1
INITIAL	DRY DENSITY LB/ CU FT	γd_o	102.6	100.7	103.7	
INITIAL	SATURATION, %	S_o	91.0	91.6	90.8	
INITIAL	VOID RATIO	e_o	0.655	0.686	0.638	
BEFORE SHEAR	WATER CONTENT, %	w_c	25.1	25.1	23.9	
BEFORE SHEAR	DRY DENSITY LB/CU FT	γd_c	104.4	103.8	103.4	
BEFORE SHEAR	SATURATION, %	S_c	100+	100+	100+	
BEFORE SHEAR	VOID RATIO	e_c	0.626	0.637	0.642	
BEFORE SHEAR	FINAL BACK PRESSURE, T/SQ FT	u_o	4.32	4.32	4.32	
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0	
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	4.79	4.64	8.99	
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f	1000	1000	1000	
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o	1.37	1.37	1.36	
INITIAL HEIGHT, IN.		H_o	3.00	3.00	3.00	

CONTROLLED- STRAIN TEST

DESCRIPTION OF SPECIMENS CLAY (CL), BROWN

LL 34	PL 20	PI 14	Gs 2.72 (EST)	TYPE OF SPECIMEN UNDISTURBED	TYPE OF TEST $\overline{R}$

REMARKS:

PROJECT	LK. PONT. LA. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISHES
BORING NO. 14-U	SAMPLE NO. 2-B
DEPTH/ELEV 3.2/4.02	
LABORATORY USAEWES	DATE 5 AUGUST 1985

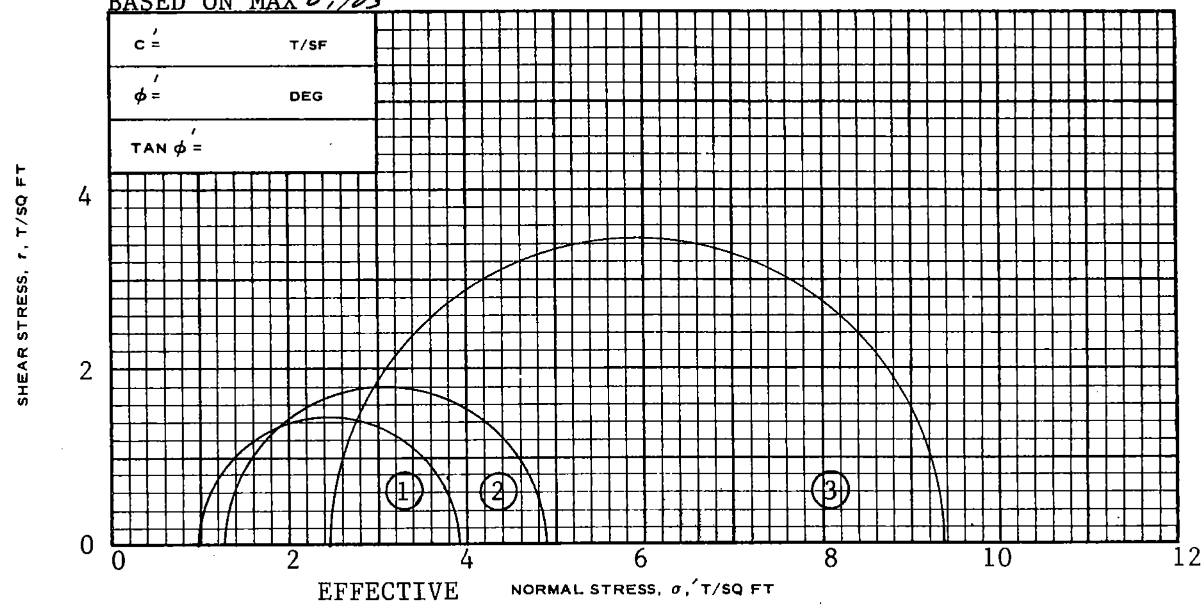
SHEET 1 OF 2

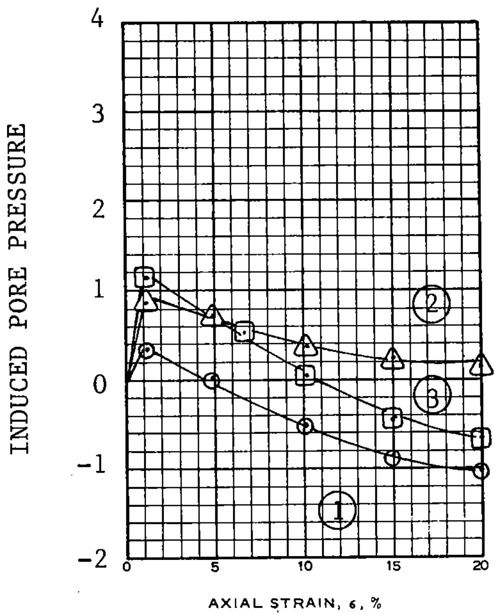
JMS **TRIAXIAL COMPRESSION TEST REPORT**

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110–2–1906)

BASED ON MAX σ_1'/σ_3'

c' =	T/SF
φ' =	DEG
TAN φ' =	





SPECIMEN NO.			1	2	3	
INITIAL	WATER CONTENT, %	w_o				
	DRY DENSITY LB/CU FT	γd_o				
	SATURATION, %	S_o				
	VOID RATIO	e_o				
BEFORE SHEAR	WATER CONTENT, %	w_c				
	DRY DENSITY LB/CU FT	γd_c				
	SATURATION, %	S_c				
	VOID RATIO	e_c				
	FINAL BACK PRESSURE, T/SQ FT	u_o				
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	0.99	1.27	2.47	
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	2.92	3.60	6.90	
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f				
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o				
INITIAL HEIGHT, IN.		H_o				

CONTROLLED- TEST

DESCRIPTION OF SPECIMENS

LL	PL	PI	Gs	TYPE OF SPECIMEN	TYPE OF TEST

REMARKS:

PROJECT LK. PONT. LA. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISHES

BORING NO. 14-U | SAMPLE NO. 2-B

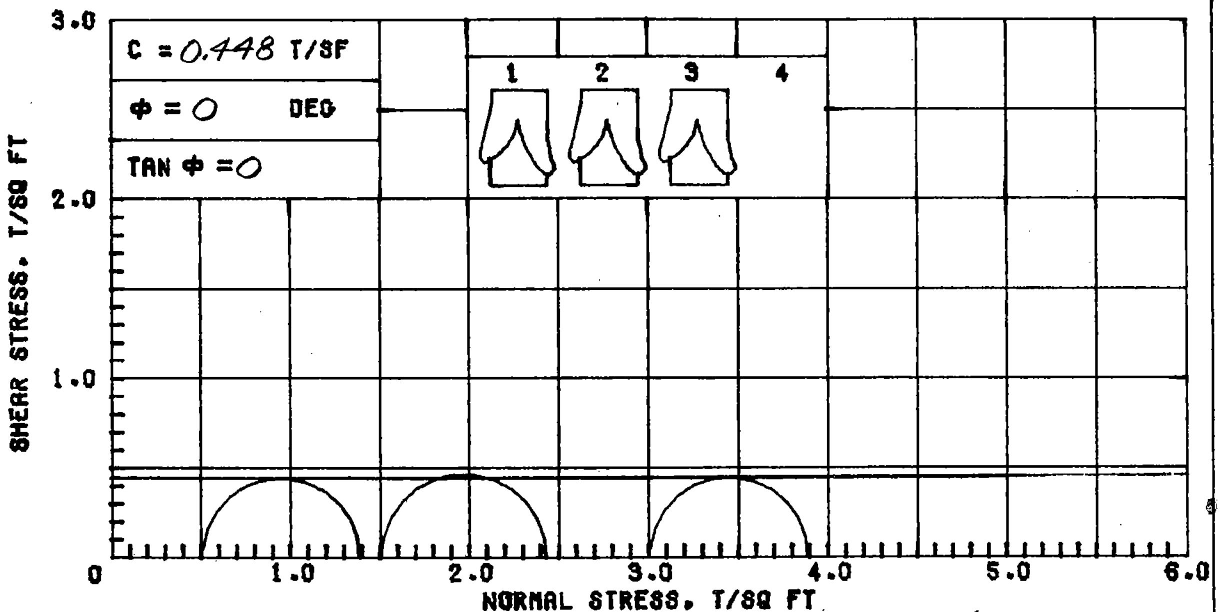
DEPTH/ELEV 3.2/4.02

LABORATORY USAEWES | DATE 5 AUGUST 1985

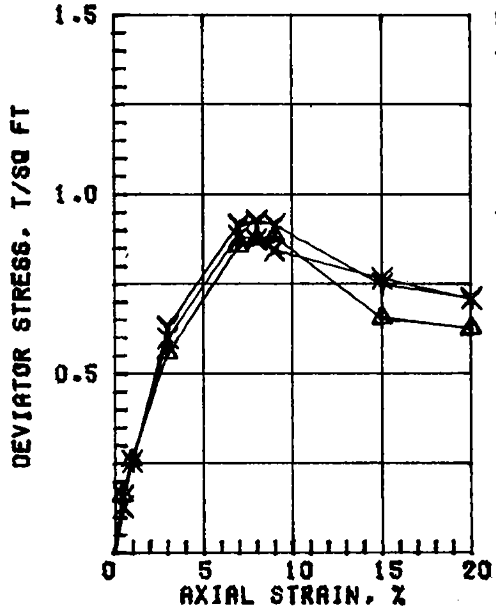
SHEET 2 OF 2

JMS **TRIAXIAL COMPRESSION TEST REPORT**

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT *(EM 1110-2-1906)*



γ Sat 68



	SPECIMEN NO.	Δ1	Y2	X3	4
INITIAL	WATER CONTENT, %	422.4	374.6	358.9	
	DRY DENSITY, PCF	12.5	13.9	14.5	
	SATURATION, %	96.2	98.2	96.3	
	VOID RATIO	7.468	6.619	6.333	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
	MIN PRIN. STRESS, TSF	0.5	1.5	3.0	
	MAX. DEV. STRESS, TSF	0.88	0.93	0.88	
	TIME TO FAILURE, MIN.	18	16	14	
	RATE OF STRAIN INCR.%				
	INITIAL DIAMETER, IN.	1.40	1.41	1.41	
	INITIAL HEIGHT, IN.	3.00	3.00	3.00	

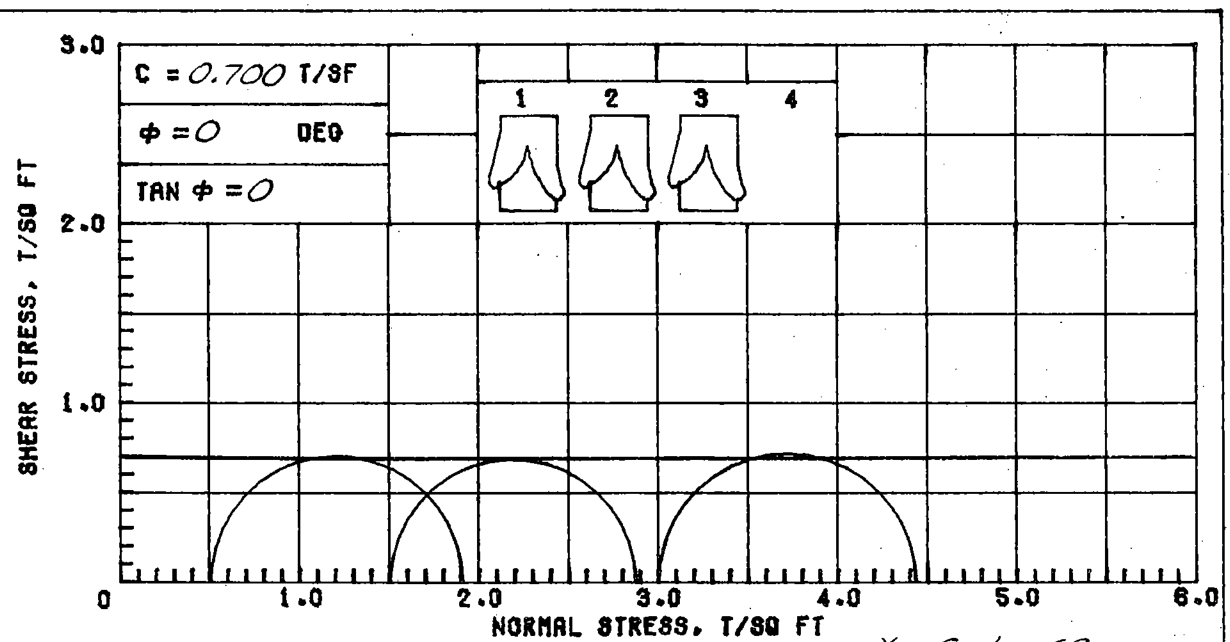
Avg. 385.7

CONTROLLED-STRAIN TEST

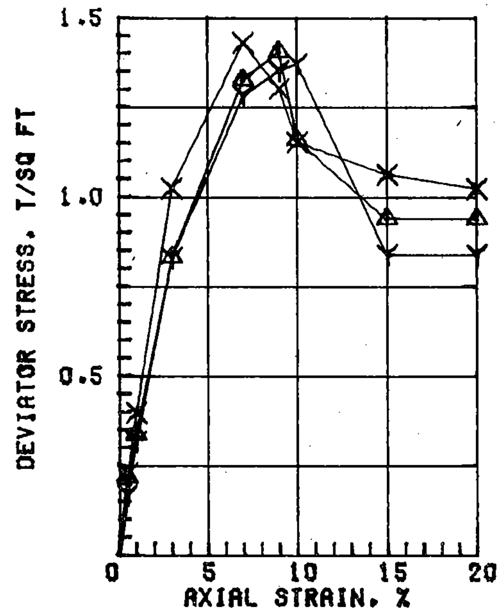
DESCRIPTION OF SPECIMENS: PEAT (PT), DARK BROWN

LL 427	PL 239	PI 188	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 14-U	SAMPLE NO. 7-B
	DEPTH/ELEV 20/-12.8	TECH. PJR
	LABORATORY USAE WES	DATE 08 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	



8 Sat 69



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	362.0	364.5	363.9	
	DRY DENSITY, PCF	14.3	14.3	14.3	
	SATURATION, %	96.0	96.7	96.1	
	VOID RATIO	6.410	6.410	6.436	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		1.40	1.37	1.43	
TIME TO FAILURE, MIN.		18	20	14	
RATE OF STRAIN INCR.,%					
INITIAL DIAMETER, IN.		1.41	1.41	1.40	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 363.5

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PEAT (PT), DARK BROWN

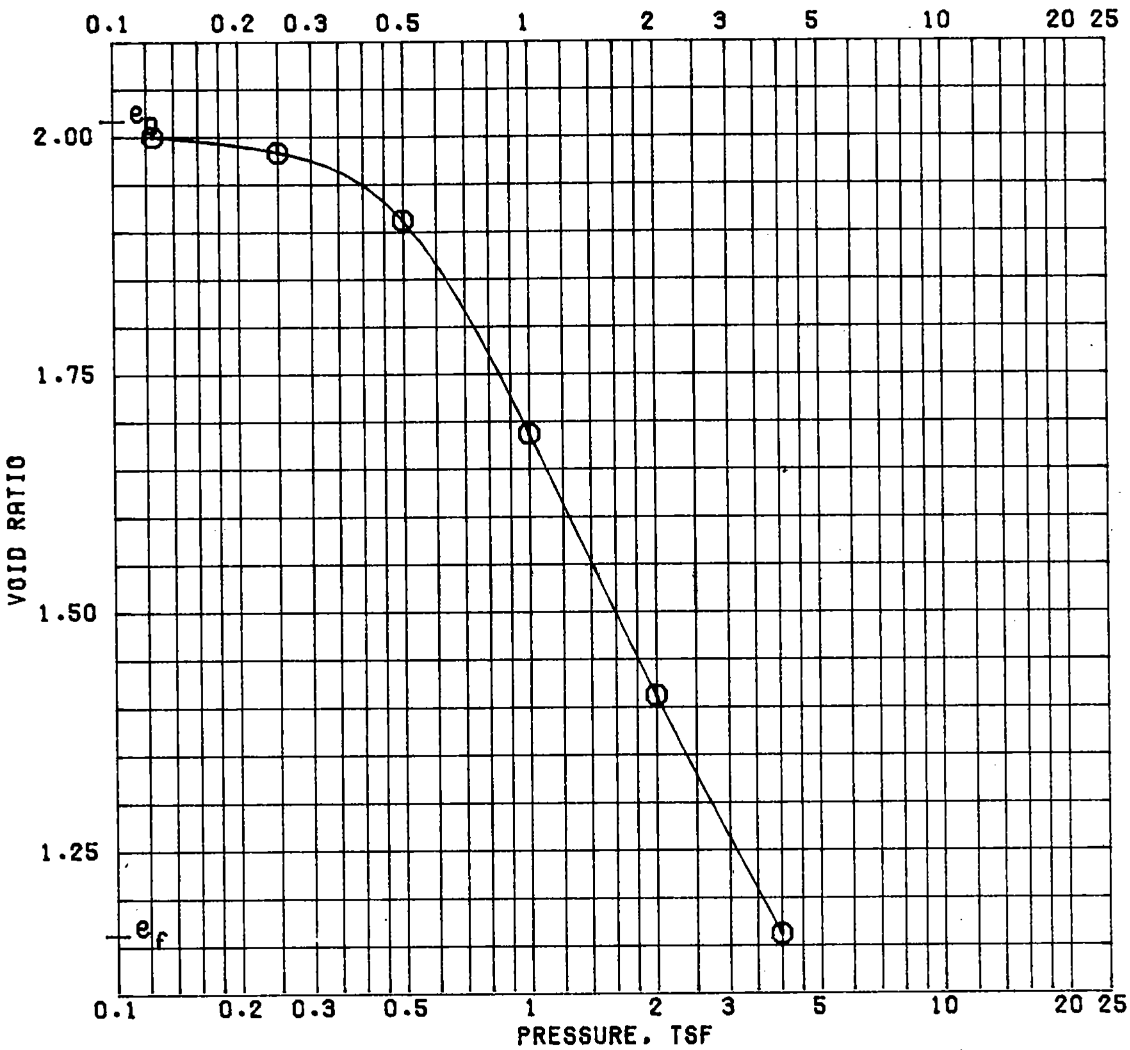
LL 626	PL 400	PI 226	GS 1.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISH

BORING NO. 14-U	SAMPLE NO. 8-C
DEPTH/ELEV 24.9/-17.7	TECH. PJR
LABORATORY USAE WES	DATE 08 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



γ Sat 98

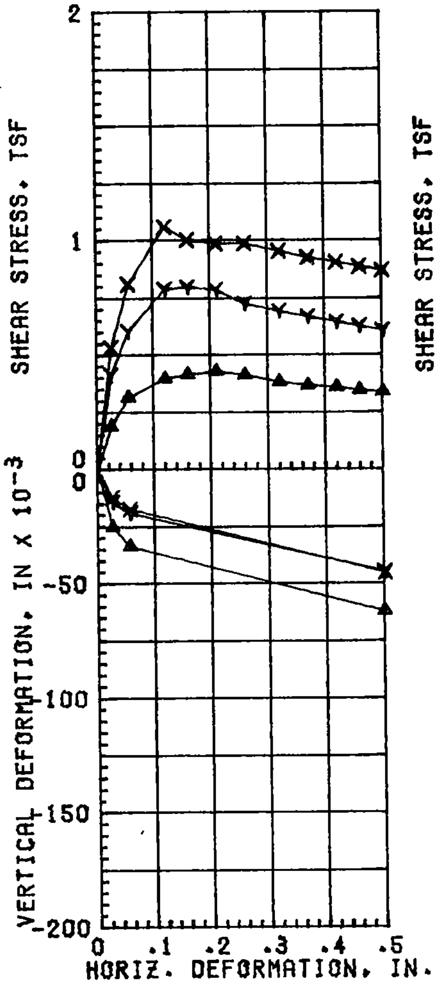
				BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF			WATER CONTENT, %	72.5	44.5
PRECONSOL. PRESSURE, TSF		0.52	DRY DENSITY, PCF	55.9	78.0
COMPRESSION INDEX		1.88	SATURATION, %	97.2	100 +
TYPE SPECIMEN	UNDISTURBED		VOID RATIO	2.014	1.160
DIA. IN 4.44	HT. IN 1.130		BACK PRESSURE, TSF		

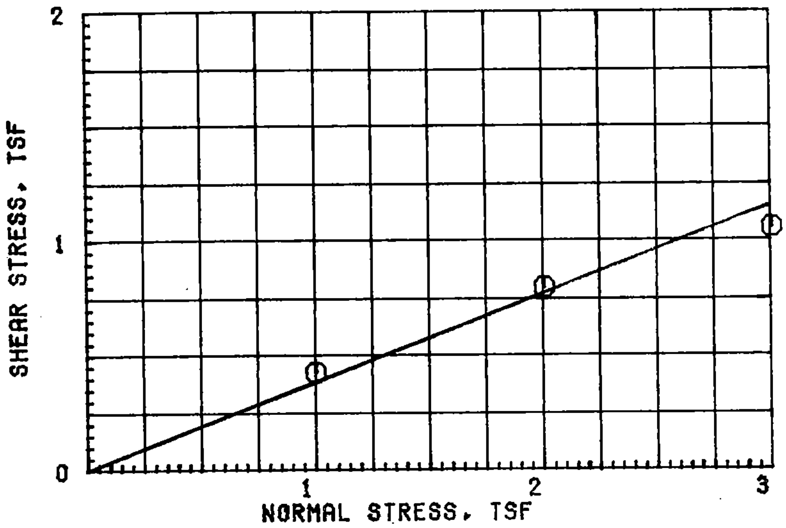
CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 83	PL 24	PI 59	PROJECT LK. PONT. & VIC. HURR. PROT.	
GS 2.70 (EST)	D_{10}		JEFFERSON & ST. CHARLES PARISH	
REMARKS			BORING NO. 14-U	SAMPLE NO. 9-C
			DEPTH/ELEV 28.9/-21.68	DATE 30 MAY 85

CONSOLIDATION TEST REPORT

SHEET 1 OF 8





γ Sat 97

ϕ = 21°

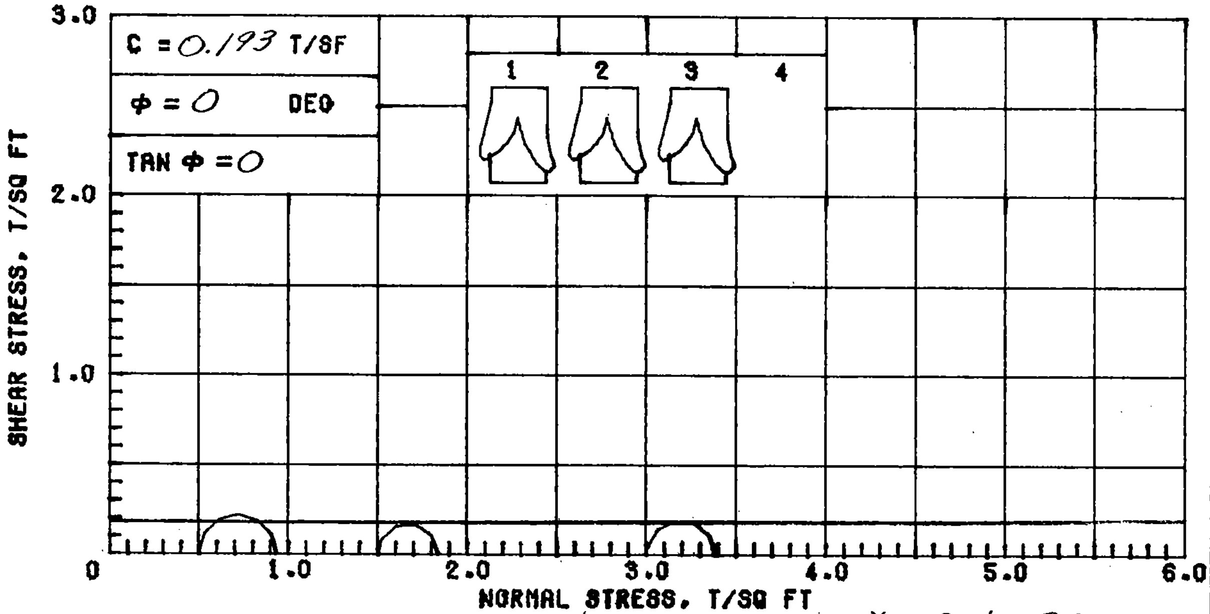
TAN ϕ = 0.384

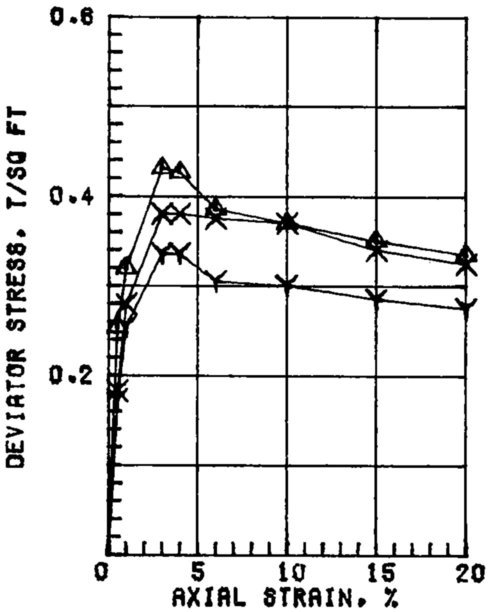
C = 0

		TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL		WATER CONTENT, %	79.9	75.0	78.0	77.6
		VOID RATIO	2.135	2.027	2.117	
		SATURATION, %	100 +	100 +	99.5	
		DRY DENSITY, PCF	53.7	55.7	54.0	
VOID RATIO AFTER CONSOL						
FIFTY PERCENT CONSOL, MIN			< 1	< 1	< 1	
FINAL		WATER CONTENT, %	54.3	45.9	43.5	
		VOID RATIO				
		SATURATION, %				
NORMAL STRESS, TSF			1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF			0.43	0.80	1.06	
TIME TO FAILURE, MIN			1112	847	835	
RATE OF STRAIN, IN/MIN			.00019	.00019	.00019	
ULTIMATE SHEAR STRESS, TSF						

TYPE SPECIMEN UNDISTURBED			3.00 IN. SQUARE	0.829 IN. THICK
CLASSIFICATION PLASTIC CLAY (CH), GRAY				
LL 89	PL 23	PI 66		GS 2.70 (EST)

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT.	
	JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 14-U	SAMPLE 10-B
	DEPTH/ELEV 32.4/-25.18	DATE 29 JUL 85
	DIRECT SHEAR TEST REPORT	





γ Sat 99

SPECIMEN NO.		▲1	Y2	X3	4
INITIAL	WATER CONTENT, %	72.6	73.1	72.8	
	DRY DENSITY, PCF	57.6	57.2	57.5	
	SATURATION, %	100+	100+	100+	
	VOID RATIO	1.928	1.945	1.932	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.43	0.34	0.38	
TIME TO FAILURE, MIN.		6	15	15	
RATE OF STRAIN INCR.%			6	6	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

Avg. 72.8

CONTROLLED-STRAIN TEST

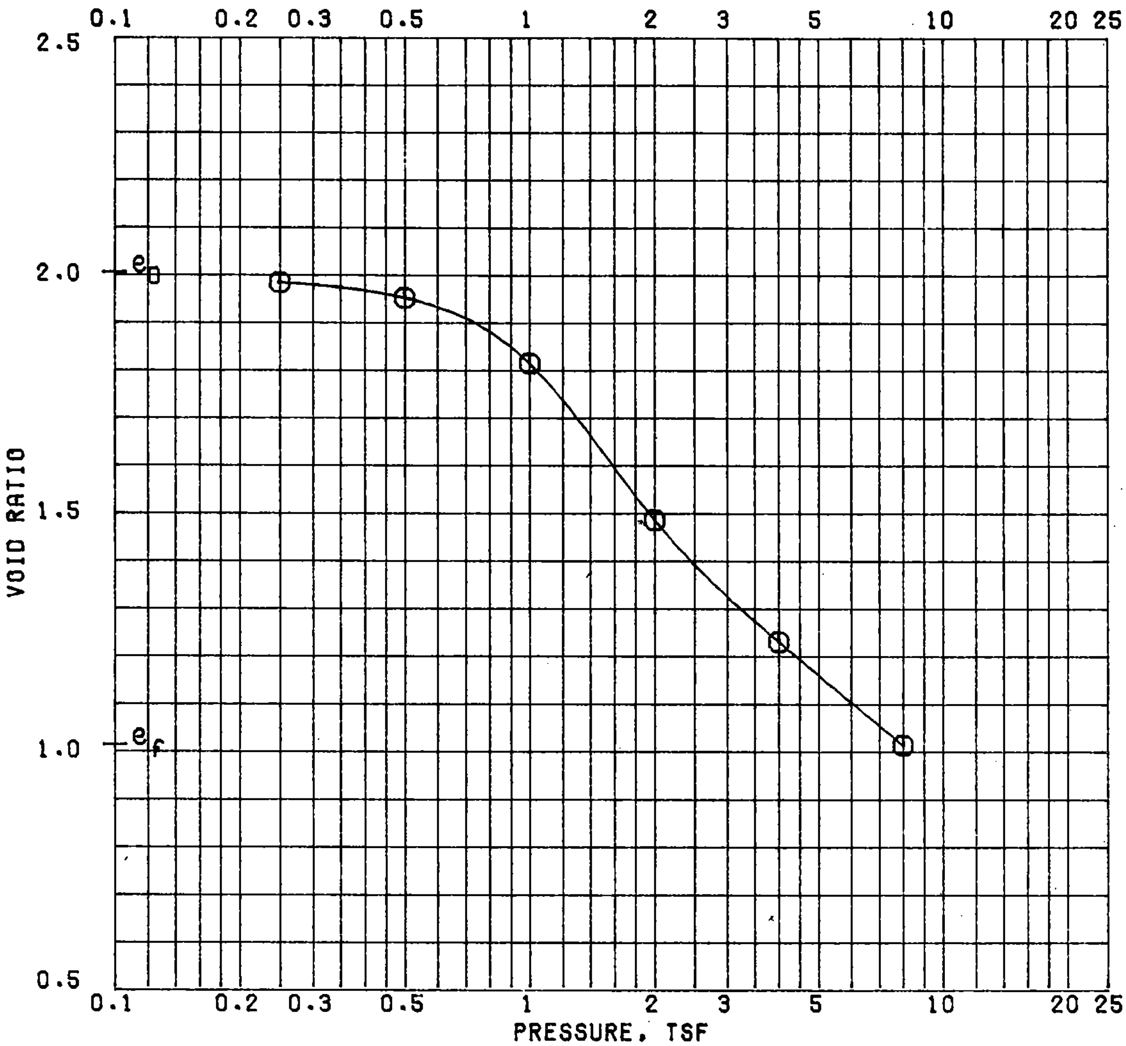
DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT LENSES

LL 88	PL 23	PI 65	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
BORING NO. 14-U	SAMPLE NO. 11-C
DEPTH/ELEV 36.9/-29.7	TECH. PJR
LABORATORY USAE WES	DATE 09 JUL 85

TRIAXIAL COMPRESSION TEST REPORT



8 Sat 98

	BEFORE TEST	AFTER TEST
WATER CONTENT, %	73.1	39.5
DRY DENSITY, PCF	56.2	83.9
SATURATION, %	98.6	100 +
VOID RATIO	2.002	1.010
BACK PRESSURE, TSF		

OVERBURDEN PRESSURE, TSF	
PRECONSOL. PRESSURE, TSF	0.86
COMPRESSION INDEX	1.94
TYPE SPECIMEN	UNDISTURBED
DIA. IN 4.44	HT. IN 1.122

CLASSIFICATION PLASTIC CLAY (CH), GRAY

LL 85 | PL 25 | PI 60

GS 2.70 (EST) | D_{10}

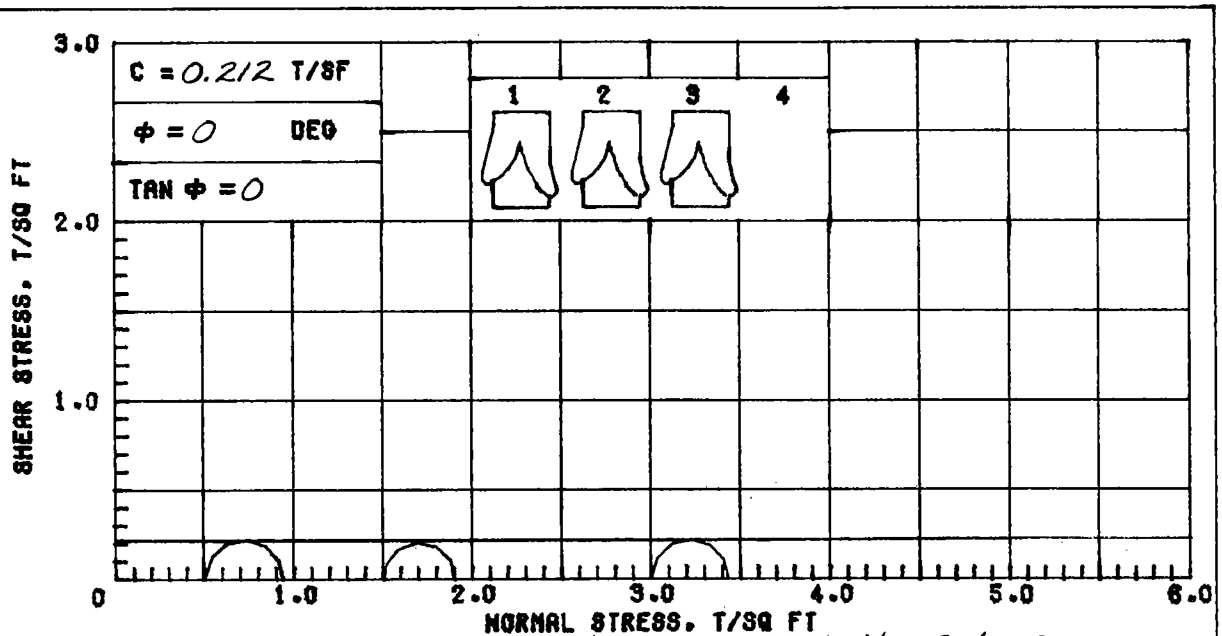
REMARKS

PROJECT LK. PONT. & VIC. HURR. PROT.
JEFFERSON & ST. CHARLES PARISH

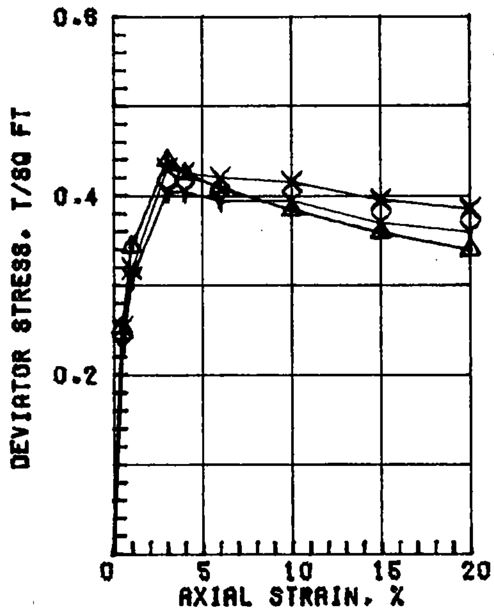
BORING NO. 14-U | SAMPLE NO. 12-C

DEPTH/ELEV 40.7/-33.48 | DATE 31 MAY 85

CONSOLIDATION TEST REPORT



γ Sat 97



SPECIMEN NO.		△1	Y2	X3	4
INITIAL	WATER CONTENT, %	76.2	76.0	76.0	
	DRY DENSITY, PCF	55.1	55.1	55.1	
	SATURATION, %	99.9	99.6	99.6	
	VOID RATIO	2.059	2.060	2.061	
BEFORE SHEAR	WATER CONTENT, %				
	DRY DENSITY, PCF				
	SATURATION, %				
	VOID RATIO				
	BACK PRESS., TSF				
MIN PRIN. STRESS, TSF		0.5	1.5	3.0	
MAX. DEV. STRESS, TSF		0.44	0.40	0.43	
TIME TO FAILURE, MIN.		6	15	15	
RATE OF STRAIN INCR.%			6	6	
INITIAL DIAMETER, IN.		1.39	1.39	1.39	
INITIAL HEIGHT, IN.		3.00	3.00	3.00	

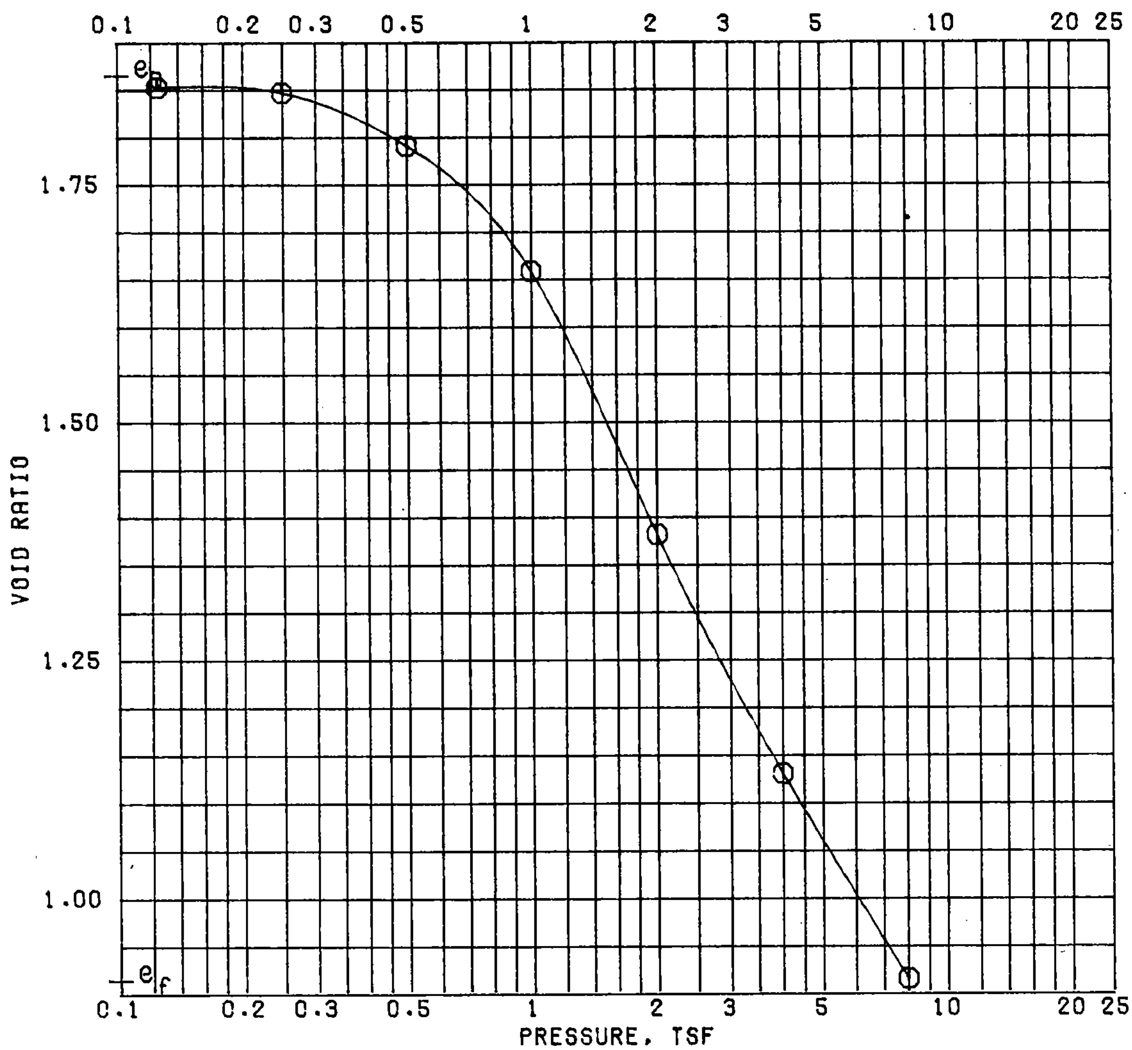
Avg. 76.1

CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY

LL 94	PL 25	PI 69	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 14-U	SAMPLE NO. 14-8
	DEPTH/ELEV 47.7/-40.5	TECH. PJR
	LABORATORY USAE WES	DATE 09 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	

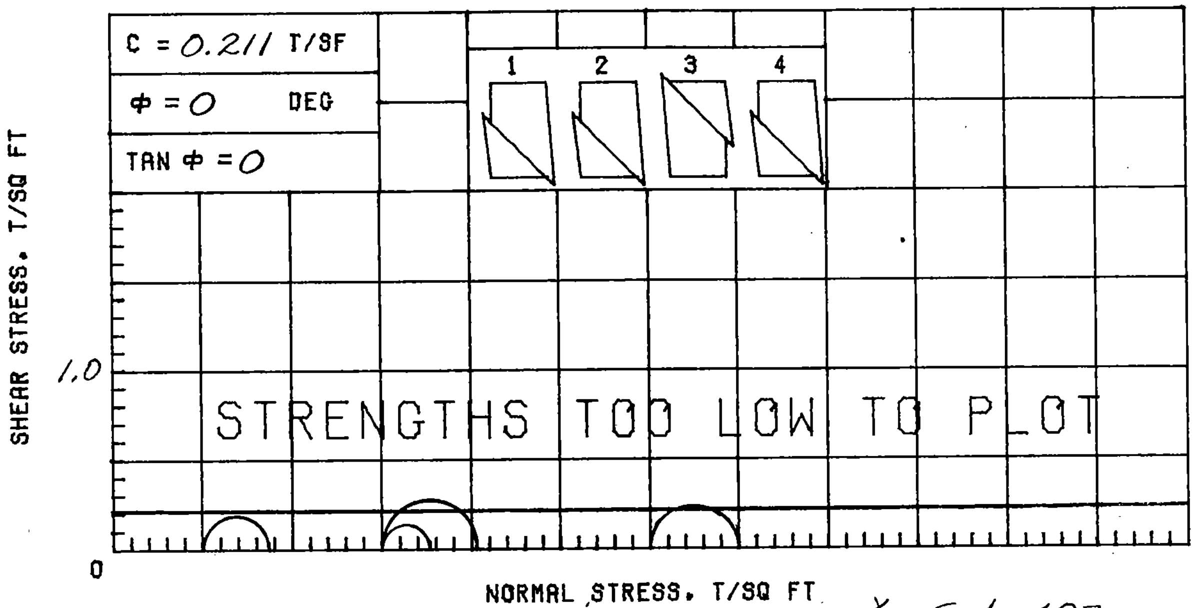


γ Sat 100

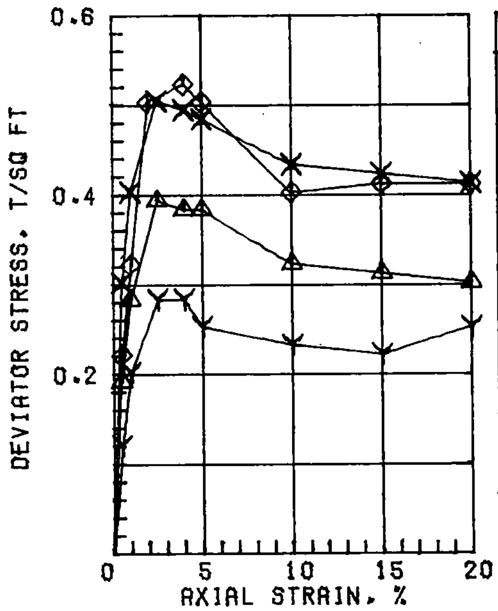
			BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, TSF		WATER CONTENT, %	66.1	35.1
PRECONSOL. PRESSURE, TSF	0.62	DRY DENSITY, PCF	58.9	88.1
COMPRESSION INDEX	1.78	SATURATION, %	95.7	100 +
TYPE SPECIMEN	UNDISTURBED	VOID RATIO	1.863	0.913
DIA. IN 4.44	HT. IN 1.118	BACK PRESSURE, TSF		

CLASSIFICATION PLASTIC CLAY (CH), GRAY; SHELL PARTICLES			
LL 78 PL 18 PI 60	PROJECT LK. PONT. & VIC. HURR. PROT.		
GS 2.70 (EST) D_{10}	JEFFERSON & ST. CHARLES PARISH		
REMARKS	BORING NO. 14-U	SAMPLE NO. 15-C	
	DEPTH/ELEV 52.9/-45.68	DATE 01 JUN 85	
	CONSOLIDATION TEST REPORT		

SHEET 1 OF 9



γ Sat 107



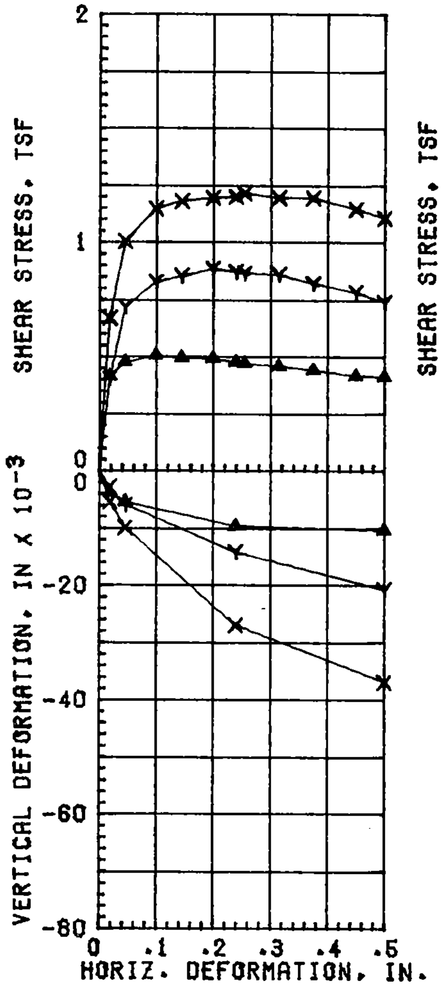
		SPECIMEN NO.	△1	Y2	X3	◇4	
INITIAL		WATER CONTENT, %	48.2	58.0	50.3	43.7	Avg. 50.1
		DRY DENSITY, PCF	72.2	65.1	71.1	77.0	
		SATURATION, %	97.4	98.7	99.2	99.3	
		VOID RATIO	1.336	1.587	1.369	1.189	
BEFORE SHEAR		WATER CONTENT, %					
		DRY DENSITY, PCF					
		SATURATION, %					
		VOID RATIO					
		BACK PRESS., TSF					
MIN PRIN. STRESS, TSF			0.5	1.5	3.0	1.5	
MAX. DEV. STRESS, TSF			0.39	0.28	0.50	0.52	
TIME TO FAILURE, MIN.			5	15	15	24	
RATE OF STRAIN INCR.,%				6	6	6	
INITIAL DIAMETER, IN.			1.39	1.39	1.39	1.40	
INITIAL HEIGHT, IN.			3.00	3.00	3.00	3.00	

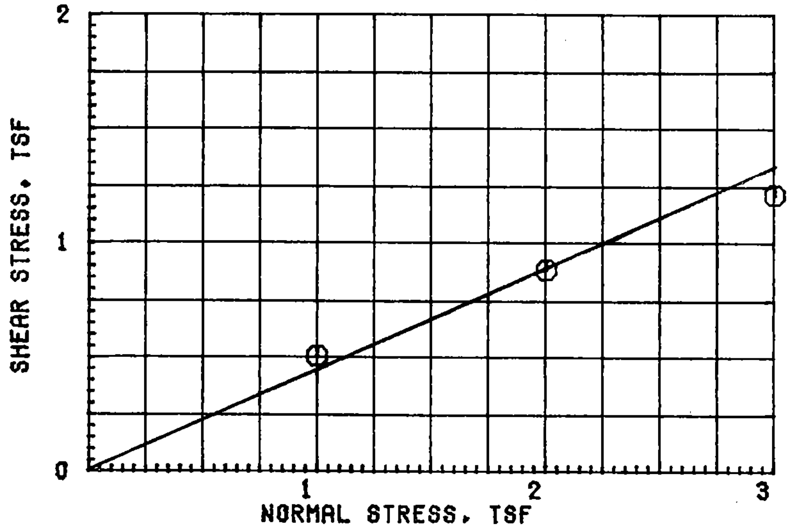
CONTROLLED-STRAIN TEST

DESCRIPTION OF SPECIMENS: PLASTIC CLAY (CH), GRAY; SILT POCKETS

LL 61	PL 16	PI 45	GS 2.70 (ESTIMATED)	UNDISTURBED SPECIMEN	Q TEST

REMARKS:	PROJECT LK. PONT. & VIC. HURR. PROT. JEFFERSON & ST. CHARLES PARISH	
	BORING NO. 14-U	SAMPLE NO. 16-C
	DEPTH/ELEV 57.0/-49.78	TECH. KOC
	LABORATORY USAE WES	DATE 08 JUL 85
	TRIAXIAL COMPRESSION TEST REPORT	





γ sat 125

ϕ = 24°

TAN ϕ = 0.445

C = 0

	TEST NO.	1 ▲	2 Y	3 X	Avg.
INITAL	WATER CONTENT, %	24.7	24.2	23.8	24.2
INITAL	VOID RATIO	0.708	0.690	0.683	
INITAL	SATURATION, %	94.1	94.8	93.9	
INITAL	DRY DENSITY, PCF	98.6	99.7	100.1	
VOID RATIO AFTER CONSOL					
FIFTY PERCENT CONSOL. MIN		< 1	< 1	< 1	
FINAL	WATER CONTENT, %	24.9	22.0	20.6	
FINAL	VOID RATIO				
FINAL	SATURATION, %				
NORMAL STRESS, TSF		1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, TSF		0.51	0.89	1.22	
TIME TO FAILURE, MIN		545	1090	1390	
RATE OF STRAIN, IN/MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, TSF					

TYPE SPECIMEN UNDISTURBED	3.00 IN. SQUARE	0.553 IN. THICK

CLASSIFICATION PLASTIC CLAY (CH), BROWN

LL 59	PL 14	PI 45		GS 2.70 (EST)

REMARKS:

PROJECT LK. PONT. & VIC. HURR. PROT.	
JEFFERSON & ST. CHARLES PARISH	
BORING NO. 14-U	SAMPLE 17-B
DEPTH/ELEV 60.2/-52.98	DATE 29 JUL 85

DIRECT SHEAR TEST REPORT

APPENDIX C

U.S. FISH & WILDLIFE SERVICE

United States Department of the Interior
FISH AND WILDLIFE SERVICE
POST OFFICE BOX 4305
103 EAST CYPRESS STREET
LAFAYETTE, LOUISIANA 70502

June 3, 1987

Colonel Lloyd K. Brown
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Colonel Brown:

Reference is made to the General Design Memorandum (GDM) for the Jefferson Parish/St. Charles Parish Return Levee (Design Memorandum No. 17A) feature of the Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project. That document presents the essential data, assumptions, and information used in developing the recommended design for the above-referenced project feature and is to be transmitted for review and approval by the Division Engineer, Lower Mississippi Valley Division. This report on the plan recommended in the GDM is a supplement to the Fish and Wildlife Coordination Act Report (FWCAR) which was submitted in July 1984 and attached to the Corps of Engineers (Corps) Main Report and Supplement I to the Environmental Impact Statement (EIS) for this project. This supplemental report constitutes the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The findings presented in this report have been coordinated with the Louisiana Department of Wildlife and Fisheries and the National Marine Fisheries Service.

The Jefferson Parish/St. Charles Parish Return Levee, as proposed in the Corps' July 1984 Main Report and EIS, would extend 4.9 miles along the boundary between those two parishes, from the Lake Pontchartrain shoreline southward to Airline Highway (U.S. Highway 61). Because of the proposed runway extension for the New Orleans International Airport, only the northernmost 3.4 miles of levee are being addressed in the present GDM. The levee segment that will follow the perimeter of the airport runway extension and extend southward to Airline Highway will be addressed in a later GDM and supplemental FWCAR. The levee described in the present GDM will be continuous and will be constructed within the area directly affected by the existing levee. The levee plans call for 17,845 feet of T-wall and 290 feet of I-wall. The existing levee will be degraded to 3.0 feet National Geodetic Vertical Datum. Excess levee material will be used to construct the Jefferson Parish Lakefront Levee Reach; the impacts of constructing that feature will be discussed in our report on the GDM to be prepared for that levee reach.

The existing levee to be affected by the proposed improvements is frequently mowed. Predominant vegetation on the levee includes perennial grasses and herbs. Marsh elder, Chinese tallow, black willow, and elderberry also occur along the western edge of the levee. Because of human disturbance and vegetative structure, the levee is thought to provide habitat of limited value to fish and wildlife. Therefore, the levee habitat to be affected by the proposed levee work has been designated as Resource Category 4, as defined in the FWS Mitigation Policy (Federal Register, Volume 46, No. 15, January 23, 1981).

The existing levee to be modified is bounded to the east (protected side) by residential or commercial development or areas that will likely undergo such development in the near future. The levee is bounded to the west (flood side) by a 19,000-acre wetland complex frequently referred to as the LaBranche Wetlands. Wetland cover types adjacent to the flood side of the levee include a canal (estuarine open water excavated), estuarine emergent marsh, and palustrine forested wetlands (wetland classification system according to Cowardin et al. 1979).

Parish Line Canal (estuarine open water excavated), which has been designated as Resource Category 3 habitat, extends along the west side of the levee for its entire length. That canal provides access for estuarine-dependent fishes and shellfishes moving into and out of the LaBranche Wetlands and for sport fishermen pursuing freshwater and yptuarine-dependent species. The adjacent estuarine emergent marsh is dominated by saltmeadow cordgrass. Plant species commonly occurring in thé palustrine forested wetlands include bald cypress, red maple, bulltongue, Chinese tallow, black willow, wax myrtle, and marsh elder.

The LaBranche Wetlands complex serves as an important nursery area for estuarine-dependent fishes and shellfishes and has been identified by the Fish and Wildlife Service as one of the 14 key wetland areas along the Central Gulf Coast that are considered vital habitat for wintering waterfowl. The area reportedly winters an estimated 25,000 ducks and 11,000 coots and is heavily utilized by hunters. The most numerous species of ducks are mallard, gadwall, American wigeon, lesser scaup, pintail, green-winged teal, shoveler, ring-necked duck, and blue-winged teal.

The status of threatened or endangered species within the area is not known to have changed since the EIS for this project was completed in July 1984. However, because a bald eagle nest is located relatively close to this levee reach and about 3 years have passed since the endangered species consultation for this project occurred, it is recommended that the Corps contact our Endangered Species personnel to reaffirm the previous findings. The request should be directed to:

Field Supervisor
U.S. Fish and Wildlife Service
Jackson Mall Office Center
300 Woodrow Wilson Avenue, Suite 316
Jackson, Mississippi 39213

The principal impact to fish and wildlife resources associated with construction of the referenced levee segment will be attributable to temporary increases in turbidity in Parish Line Canal. Corresponding temporary reductions in the benthic and plankton populations in that canal can be anticipated along with an unquantified but relatively minor reduction in local populations of those fishes and shellfishes that are dependent upon these food sources. This impact will be limited primarily to the construction period and is expected to subside as vegetation is re-established on the levee.

Because of the nature of the work proposed for this levee reach and the relatively minor, short-term impacts attributable to that work, little opportunity exists for enhancement of fish and wildlife or on-site mitigation of impacts to those resources. Furthermore, a plan to mitigate unavoidable fish and wildlife impacts associated with the entire Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project is being proposed in the form of shoreline protection along that portion of Lake Pontchartrain which lies adjacent to Manchac Wildlife Management Area in St. John the Baptist Parish. Therefore, the Fish and Wildlife Service has no recommendations regarding modifications to the plan described in the GDM.

Please advise us of any significant changes proposed in the GDM as it proceeds through the Corps' review and approval process so that we may provide you with appropriate findings and recommendations relative to those changes.

Sincerely yours,

David W. Frugé
Field Supervisor

cc: EPA, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
FWS, Atlanta, GA (AWE)
FWS, Jackson, MS
FWS, Washington, D.C. (ES/FP)

LITERATURE CITED

Cowardin, Lewis M., Virginia Carter, Francis C. Golet, and Edward T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Fish and Wildlife Service, Office of Biological Services. FWS/OBS-79/31. 103 pp.