GRAND ISLE AND VICINITY LOUISIANA

PHASE II

General Design Memorandum

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

New Orleans District

beach erosion and hurricane protection

NGINEER DISTRICT, NEW ORLEANS
IGINEERS
S, LOUISIANA

JUNE 1980

45

DISPOSITION FORM

For use of this form, see AR 340-15, the proponent agency is TAGCEN.

REFERENCE OR OFFICE SYMBOL	SUBJECT		
LMNED-MP	Grand Isle & Vicinity, Louisiana Phase II Design Conference 30 August 1979		
TO C/Const Div	FROM C/Engr Div	DATE 23 August 1979 Stutts/mt/303	CMT 1

1. Reference is made to the conversation between Messrs Dan Cooper of your Division and Vann Stutts of Engr Div subject as above.

2. As per conversation, it is requested that a representative from Construction Div attend the referenced conference. I understand Mr. Stutts hand carried to Mr. Cooper copies of the tentative agenda along with other pertinent information relevant to the project schedule and design. Should you require additional information please contact Mr. Stutts of Des Memo Br.

CHATRY

DA FORM 1 FEB 62 2496 REPLACES DD FORM 96, WHICH IS OBSOLETE.

☆ U.S. GPO:1976-0-765-037/15

LMNED-MP

Grand Isle & Vicinity, Louisiana Phase II Design Conference 30 August 1979

C/Const Div C/Engr Div 23 August 1979

Stutts/mt/303

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CHATRY

LMNED-MP

Grand Isle & Vicinity, LA, Phase II Design Conference
30 August 1979

THRU C/Engr Div

C/Design Memo Br

23 Aug 79
Mr. Stutts/jm/303

TO C/Design Br
C/Hyd & Hydro Br
C/F&M Br

1. Inclosed is a copy of the agenda for the subject conference.

2. It is requested that you review this agenda. If there are topics in your respective areas of expertise that you feel need to be added to this agenda, please notify Mr. Stutts of Design Memo Branch.

1 Incl
as

HARRINGTON

AGENDA

Grand Isle & Vicinity, LA
Design Conference Meeting
30 August 1979
New Orleans District
Corps of Engineers

Time		
0830	Welcoming	Mr. Chatry
0835	Briefing - History of Projects & Current Status of Designs	Mr. Stutts
0850	Sand Resource Survey - Source of Construction & Annual Nourishment Materials	Mr. Kemp
0945	Coffee Break	
1000	Selected Plan Design Sections & Overfill Ratios - Previous Emergency Restorations	Mr. Dement
1100	Vegetation Plan & Field Nursery	Mr. Carlton
1200	Lunch	
1245	Construction Methods	Mr. Dement
1330	Miscellaneous Construction Items Localized Protection East End State Park Culvert Beach Access (Public & Private) Sand Fencing	Mr. Dement & others
1430	Monitoring Plan	Mr. Comb
1445	Break	
1500	Summary of Recommendation by OCE & LMVD Participants	--
1530	End of Conference	

LMVED-TD (NOD 19 Jul 79) 1st Ind
SUBJECT: Grand Isle & Vicinity, La.

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 16 AUG 79

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

1. The suggested date of 30 Aug 79 and the meeting place of the District are satisfactory.

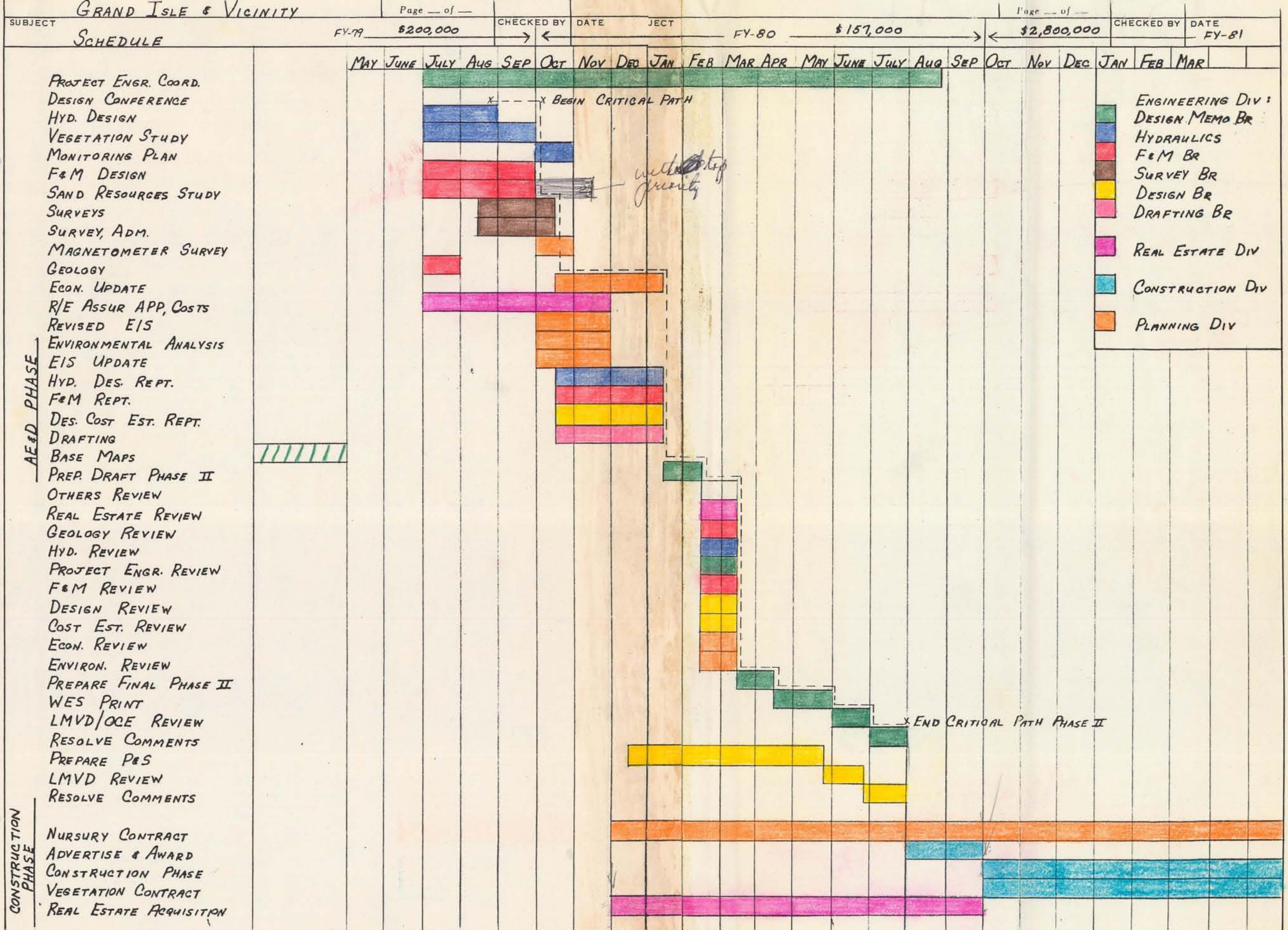
2. After telecons with Mr. George Lowe (DAEN-CWE-BB), OCE will be sending Messrs. Jake Lockhart (Hyd) and Richard Davidson (Soils). Mr. Davidson will be attending the Red River Waterway meeting on 28 and 29 Aug 79 and will stay over for the 30 Aug 79 meeting.

3. The Division office will tentatively be sending Messrs. Pigott (Con-Ops Div), Weaver and Cave (GSM Br), and Walker and Cook (WC Br).

FOR THE DIVISION ENGINEER:

for Robert J Kaufman
R. H. RESTA
Chief, Engineering Division

CF w bas ltr:
DAEN-CWE-BB



LMV FORM 1 AUG 68 107a COMPUTATION SHEET

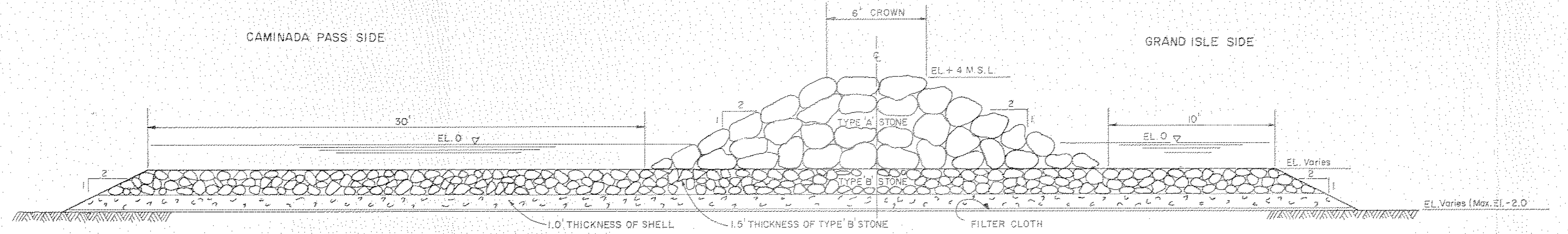
FORM 1G 68 107a COMPUTATION SHEET

PLAN

SCALE IN FEET

500 0 500 1000 1500

NOTES:
INSIDE THE PLAN AREA POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.
PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978



SIZE OF PIECES

TYPE 'A' STONE 300 LBS. TO 4500 LBS.
TYPE 'B' STONE 25 LBS. TO 200 LBS.

TYPICAL JETTY SECTION

SCALE IN FEET

500 0 500 1000 1500

LEGEND

- 1953 TRAVERSE
- CENTERLINE OF AUTHORISED AND CONSIDERED PLANS
- (1) LOUISIANA HIGHWAY

GRAND ISLE AND VICINITY
LOUISIANA
PHASE I GDM

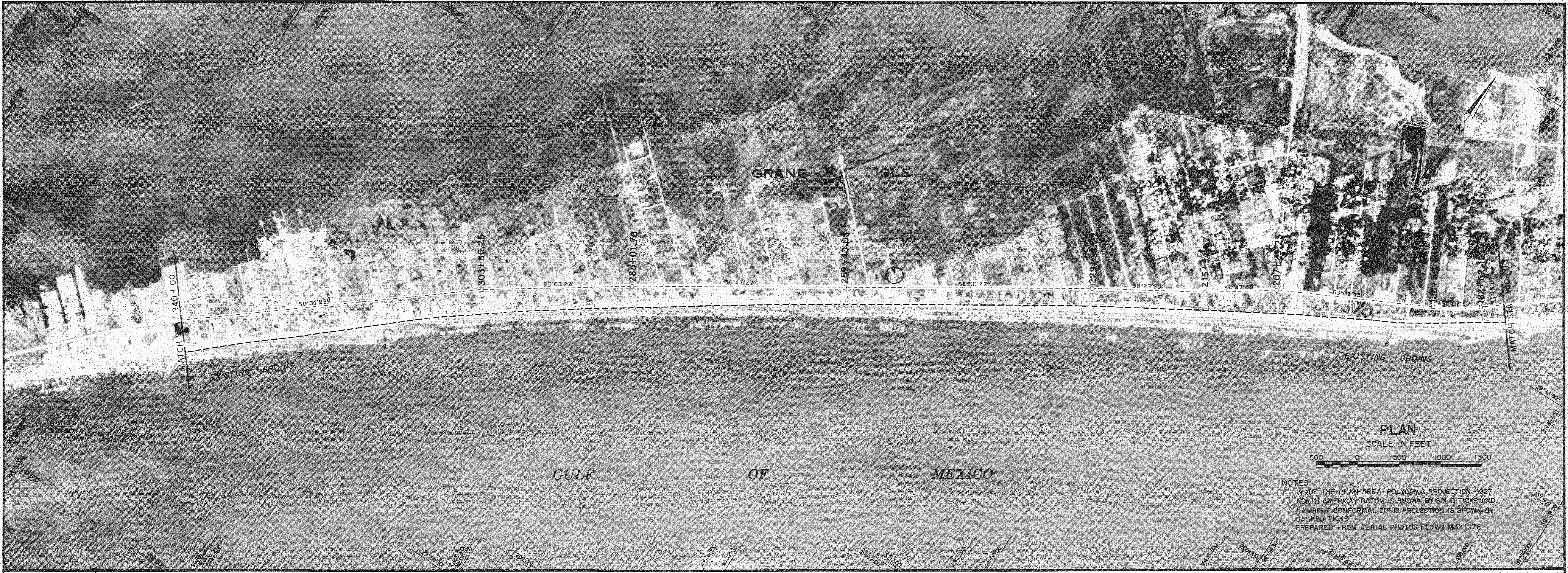
PLAN AND JETTY CROSS SECTION

SCALE AS SHOWN

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

FILE NO. H-2-28578

PLATE 2



LEGEND

----------	1953 TRAVERSE
— — — — —	CENTERLINE OF AUTHORISED AND CONSIDERED PLANS
(1)	LOUISIANA HIGHWAY

GRAND ISLE AND VICINITY
LOUISIANA
PHASE I GDM

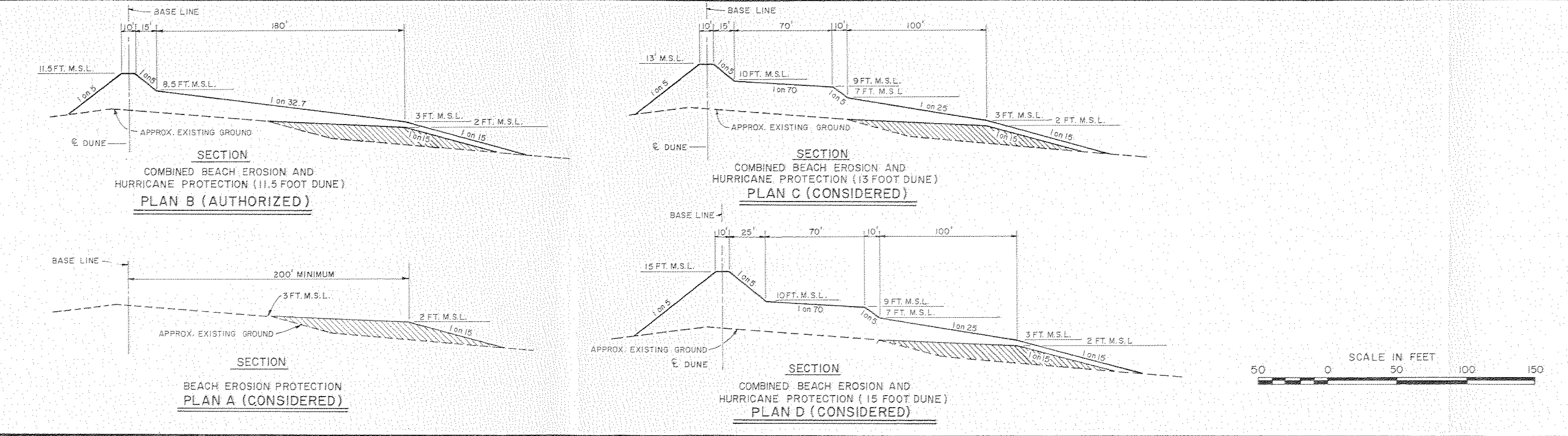
BEACH PLAN

SCALE AS SHOWN

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

FILE NO. H-2-28578

PLATE 3



LEGEND

- ---------- 1953 TRAVERSE
- — — — — CENTERLINE OF AUTHORISED AND CONSIDERED PLANS
- (1) LOUISIANA HIGHWAY

GRAND ISLE AND VICINITY
LOUISIANA
PHASE I GDM

PLAN AND BEACH CROSS SECTIONS

SCALE AS SHOWN

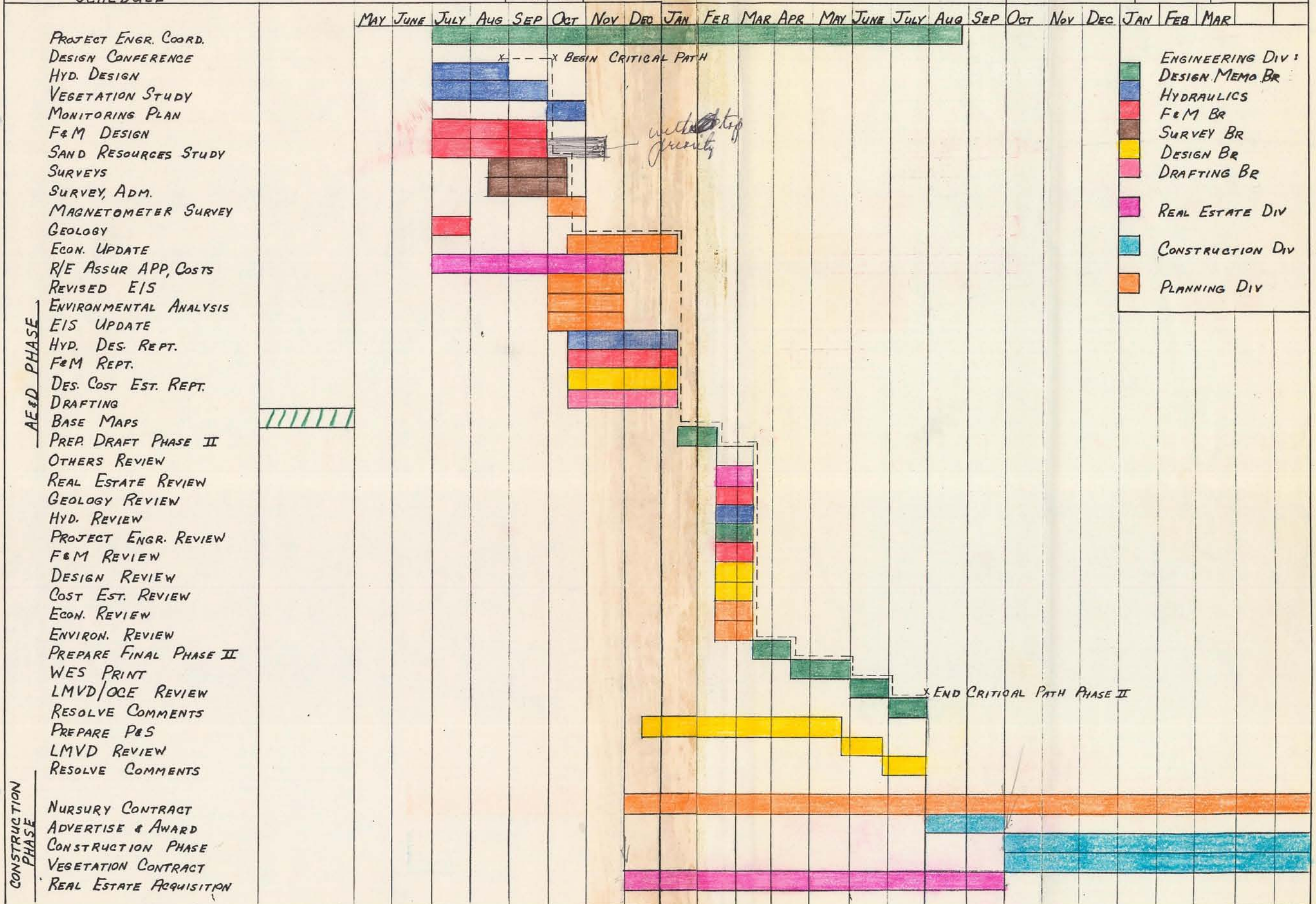
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

FILE NO. H-2-28578

GRAND ISLE & VICINITY | Page — of — | | | Page — of —

SUBJECT: SCHEDULE | CHECKED BY | DATE | CHECKED BY | DATE

FY-79 $200,000 → | ← FY-80 $157,000 → | ← $2,800,000 FY-81



LMV FORM 1 AUG 68 107a COMPUTATION SHEET | FORM 1 AUG 68 107a COMPUTATION SHEET

LMVED-TD (NOD 24 Jul 80) 5th Ind
SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 18 DEC 80

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

Satisfactory.

FOR THE DIVISION ENGINEER:

for Robert I Kaufman
R. H. RESTA
Chief, Engineering Division

CF w 10 cy 4th Ind:
DAEN-CWE-B (10 cy)

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

REPLY TO
ATTENTION OF:

LMNED-MP

24 July 1980

SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject design memorandum is submitted herewith for review in accordance with provisions of ER 1110-2-1150 dated 1 October 1971.

2. a. Status of EIS. A final Environmental Impact Statement was filed with the Council of Environmental Quality on 8 October 1976. An update statement was prepared with the Phase I General Design Memorandum and was submitted to EPA on 17 August 1979. Notice of availability was published in the Federal Register on 24 August 1979 and the 30 day waiting period for approval ended 23 September 1979. A Supplemental Information Report was prepared to reflect design refinements which are detailed in the subject report. The Supplemental Information Report was furnished to the public on 9 June 1980. A copy of this report is reprinted as appendix F to the subject report.

b. Section 404 Evaluation. The provisions of Section 404 of the Clear Water Act were met by a draft Section 404(b)(1) Evaluation dated 26 December 1978 (included in draft revised EIS), a public notice issued on 22 January 1979, certification from the State of Louisiana on 30 January 1979, and the District Engineer's signature on the final 404 Evaluation Report on 18 May 1979.

c. Status of Cultural Resources Investigations. An intensive on-the-ground cultural resources survey of the project area was conducted by a Corps of Engineers' archeologist in April 1978. A copy of the survey report was furnished to the Louisiana State Historic Preservation Officer and by letter of 31 January 1979 he furnished clearance for that portion of the project covered in the report. No cultural resources were located in the construction area. Between 25 February and 1 March 1980, a proton magnetometer survey was performed by Texas A&M Anthropology Research Laboratory on the proposed Grand Isle Offshore Borrow Area. Six Magnetic Anomalies were located within the proposed borrow area. Further evaluation of these anomalies to identify them and determine their significance in accordance with National Register criteria will be required or the anomalies locations will be avoided entirely during construction.

d. Endangered Species. The project will have no adverse impact on any species listed as endangered or threatened under the Endangered Species Act of 1973, nor will it adversely impact any marine mammals protected by the Marine Mammal Protection Act of 1972.

3. The subject design memorandum was initially scheduled for submission in March 1980. Submission has been delayed in hope that the formal assurances with local interests could be executed and accepted before the report was submitted. Local interest had given every indication that assurances would be forthcoming imminently. However, we now have concluded that the assurances will not be furnished in the immediate future; thus to avoid any further delays, we are transmitting the design memorandum for technical review. Submission of the design memorandum in July 1980 will not affect the scheduled construction and funding programs for the subject project.

4. Approval of this design memorandum is recommended.

1 Incl (16 cys fwd sep)
As Stated

THOMAS A. SANDS
Colonel, CE
District Engineer

LMVED-TD (NOD 24 Jul 80) 1st Ind
SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 12 SEP 80

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

Approved, subject to satisfactory resolution of the following comments:

a. Para 3a(4), page 2; and para 14a, page 28. In the fifth line of para 3a(4), change "15 years" to "10 years" to agree with item d on page 22 of H.D. 94-369.

b. Para 5d(2)(b), page 7. This paragraph indicates that the east end borrow area (Model 3), was not selected because possible environmental consequences had not been analyzed, and a dredge pipe length of about 7.5 miles would be required to reach the western limit of project. The east end borrow area contains cleaner and coarser sands than the proposed borrow, and consequently, significantly smaller quantities of overfill would be required. Since the eastern edge of the proposed offshore borrow area is about 4 miles from the eastern limit of the project, the option of utilizing the east end borrow area, which is immediately adjacent to the east end of the project, to construct about 2 miles or more of the eastern end of the project should be further investigated and given serious consideration. This option would result in significant cost savings.

c. Para 7a, page 10. The three relocations mentioned should be described and included in the cost estimate. Also, the estimated cost of relocations should be shown on Table 5 under the appropriate cost account code.

d. Para 8b, page 11. This paragraph indicates nine companies have dredges with Coast Guard certification. Only two companies, each with two dredges, that normally bid in this area have dredges that comply with the Seagoing Barge Act. A third company is presently constructing a dredge to meet these standards. The availability of dredges should be further investigated during preparation of plans and specifications.

e. Table 2, page 17. The benefits shown in Table 2 do not agree with those presented in the 1980 LMV Form 23. Since both are based on the June 1979 Phase I GDM and 1 October 1980 price levels, the numbers should be identical except for the area redevelopment benefits. This discrepancy should be reconciled.

LMVED-TD (NOD 24 Jul 80) 1st Ind 12 SEP 80
SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

f. Para 13b(1), page 20.

(1) The cost account code should be shown for each item in the cost comparison and an explanation of the difference for each item should be in accordance with Appendix A of EM 1110-2-1301, 31 July 1980.

(2) The cost should be compared to the latest approved incremental PB-3, not the latest full-funding PB-3. The latest incremental cost estimate effective 1 October 1980 was approved 10 April 1980 and should be used for comparison.

g. Table 4, pages 22, 23, and 24. A Detail Cost Estimate, broken down by cost account codes, should be included in the report. The price level date should also be shown on each page.

h. Table 5, page 25. The Detailed Project Schedule (PB-2A) should not be labeled as a full-funding PB-2A as para 13 on page 16 has already indicated that all costs are presented based on 1 October 1980 price levels.

i. Plates 2 through 10. Apparently, surface drainage on the Gulf side of the highway is toward the Gulf. If this is the case, the proposed dune embankment may block this drainage. This could be particularly critical in areas where the natural ground is depressed between baseline Stas 192 and 180 and 126 to 115. This should be investigated and discussed in more detail.

j. Appendix A, Plates A-4, A-5, and A-6.

(1) Borings B-20 and B-21, which are outside the proposed borrow area, indicate about 10 and 8 ft, respectively, of sandy material similar to that indicated by the borings within the borrow area. However, at the locations of these two borings, the isopach map on Plate A-6 indicates a thickness of such material of only about 1 ft or less. Therefore, based on borings B-20 and B-21, and also on boring B-23, which indicates about 11 ft of sandy material and which is located just outside of and west of the proposed borrow pit, it appears that the borrow pit should be shifted westward to encompass the areas represented by these borings.

(2) A soil boring legend plate should be included in Appendix A.

k. Refer to comments in red on pages 3, 20, 32, A-1, and A-3; and on Plates A-9, A-10, and A-11 of Appendix A.

FOR THE DIVISION ENGINEER:

wd 15 cy incl

R. H. RESTA
Chief, Engineering Division

CF w 10 cy Phase II GDM:
DAEN-CWE-B (10 cy)

ED-7

LMNED-MP (NOD 24 Jul 80) 2nd Ind
SUBJECT: Grand Isle and Vicinity, Louisiana - Phase II General Design Memorandum

DA, New Orleans District, Corps of Engineers, P.O. Box 60267, New Orleans, Louisiana 70160 2 October 1980

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

1. Reference: LMVED-TD 1st Ind dated 2 Sep 80.

2. In response to comments contained in the referenced Indorsement the following responses are offered by like paragraph designations:

a. Para 3.a.(4), Page 2; and Para 14.a., Page 28. Concur. The period of Federal involvement should agree with the cited House Document. However, the subject DM recommends that this period be extended to a 15 year period as outlined by the referenced Public Law in para 14.a.

b. Para 5.d.(2)(b), Page 7. Concur. The east end borrow site will be further investigated as a possible auxiliary or secondary source for construction or maintenance of the project.

c. Para 7.a., Page 10. The three relocations mentioned in paragraph 7.a. are properly classified under the 01 cost account code for lands and damages. The structures in question are beach camps and are not the primary residence of the owners. The sentence giving rise to the confusion in paragraph 7.a., page 10 should be changed from "In doing so, the number of relocations were. . ." to "In doing so, the number of structures impacted by the dune construction were. . . ."

d. Para 8.b., Page 11. Concur. The availability of certified dredges will be further investigated during the development of plans and specifications.

e. Table 2, Page 17. Concur. The form 23 is in error and a revised copy has been resubmitted.

f. Para 13.b.(1), Page 20:

(1) Concur. Paragraph 13.b.(1) has been revised in accordance with the referenced EM. The revisions are contained in inclosure 2.

(2) Concur. See inclosure 2.

g. Table 4, Pages 22, 23, and 24. Concur. Table 4 is included as Inclosure 3 and has been revised so that the appropriate cost account number appears opposite its line item in the table. The 1 Oct 80 price level date has also been added at the top of the table.

LMNED-MP (NOD 24 Jul 80) 2nd Ind 2 October 1980
SUBJECT: Grand Isle and Vicinity, Louisiana - Phase II General Design Memorandum

h. Table 5, Page 25. Concur. Table 5 has been revised and is inclosed (Incl 4), the full funding designation has been removed and the price level date indicated at the top of the table.

i. Plates 2 through 10. Concur. At the present time, there is no city drainage system at Grand Isle, nor are there plans to construct one. Heavy rains have produced and will continue to cause temporary street flooding on the island. The runoff is more or less adequately disposed of mainly by percolation and seepage through the sand. The newly constructed dune will not hamper this process. Low spots adjacent to the proposed dune may exist at various locations near the beach and could collect and temporarily hold water. The exact location of these problem areas will not be known until construction of the sand dune has started. Modifications to the contract may be required to fill in these low areas.

j. Appendix A, Plates A-4, A-5, and A-6

(1) It is true that boring logs for borings B-20 and B-21 show 8 to 10 feet of sandy materials which are similar to the borrow area boring logs, however, the isopach map shown on plate A-6 was developed for materials having minimum D-50 grain size distributions of 0.12MM. A recheck of the sieve analysis for borings B-20, B-21 and B-23 confirms that the maps are plotted correctly. Therefore, the borrow areas should remain in the location depicted on plate A-6.

(2) Concur. Copies of the soil boring legend plate were inadvertently left out of the report. Plate A is inclosed as inclosure 5.

k. Comments shown in red are noted.

FOR THE DISTRICT ENGINEER:

FREDERIC M. CHATRY
Chief, Engineering Division

4 Incl
wd incl 1
Added 4 incl (16 cys)
2.-5. As Stated

LMVED-TD (NOD 24 Jul 80) 3d Ind
SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 19 NOV 80

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

The information furnished and actions described in the 2d Ind are satisfactory except as discussed below:

a. Para 2b. Since the subject DM will serve as the basis for preparation of plans and specifications, your investigations regarding the use of the east end borrow area should be completed and your recommendations furnished prior to submission of plans and specifications.

b. Para 2i. It is not apparent why the location of significant low spots adjacent to the proposed dune cannot be identified prior to the start of construction of the sand dune. The plan and profile plates in the GDM indicate that such low spots will exist between about baseline Stas 192 to 180 and 126 to 115. The need to fill such areas should be evaluated and determined prior to submittal of plans and specifications so that such work can be included in the plans and specifications and the project cost estimate.

FOR THE DIVISION ENGINEER:

4 Incl
2-5. wd 10 cy

for Robert I Kaufman
R. H. RESTA
Chief, Engineering Division

CF w 10 cy 2d Ind & Incl 2-5:
DAEN-CWE-B (10 cy)

ED - TD

LMNED-MP (NOD 24 Jul 80) 4th Ind
SUBJECT: Grand Isle and Vicinity, Louisiana - Phase II General Design Memorandum

DA, New Orleans District, Corps of Engineers, P.O. Box 60267, New Orleans, Louisiana 70160 9 December 1980

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

1. Reference: LMVED-TD 3rd Ind dated 19 November 1980.

2. In response to comments contained in the referenced Indorsement the following responses are offered by like paragraph designations:

a. Para 2.b. Concur. The District recommends that the east end site be acquired only as a back-up to the primary offshore site or for use as a source for future renourishment construction. During Phase II studies this area was investigated and found to contain suitable material to nourish or construct portions of the Grand Isle project. Studies also indicate that the primary offshore borrow area is a sufficient source of material to construct and to provide a number of nourishments to the project. An advantage of the use of the offshore borrow area is that sands located there are not in the active littoral zone. Removing sand from the offshore borrow site and placing it on the beach will provide a "new" source of beach material. The precision of the calculation of the renourishment factors exceeds the accuracy of the assumptions used in determining them and therefore they should not be used as the sole reason to select a borrow area. Calculations in the DM show that sufficient material is available in the offshore borrow area to construct the project with advanced maintenance quantities. Exhausting the offshore borrow area will result in long term cost savings since the offshore borrow area will deteriorate as a source for nourishment as it will be contaminated by fine materials from the nearshore bottom while collecting some material from the beach. Whereas, future nourishment should be able to use the east end borrow area to recycle longshore transport coming from the island. Accordingly, action to acquire the east end borrow site has been initiated for the above cited purposes.

b. Para 2.i. During the Plans and Specifications phase of design, significant low spots adjacent to the proposed dune will be identified and plans to fill these low areas will be shown on the construction plans.

FOR THE DISTRICT ENGINEER:

wd all Incl

FREDERIC M. CHATRY
Chief, Engineering Division

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

REPLY TO
ATTENTION OF:

LMNED-MP

24 July 1980

SUBJECT: Grand Isle and Vicinity, Louisiana Phase II General Design Memorandum

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

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b. Section 404 Evaluation. The provisions of Section 404 of the Clear Water Act were met by a draft Section 404(b)(1) Evaluation dated 26 December 1978 (included in draft revised EIS), a public notice issued on 22 January 1979, certification from the State of Louisiana on 30 January 1979, and the District Engineer's signature on the final 404 Evaluation Report on 18 May 1979.

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4. Approval of this design memorandum is recommended.

1 Incl (16 cys fwd sep)
As Stated

Thomas A. Sands
THOMAS A. SANDS
Colonel, CE
District Engineer

Grand Isle and Vicinity, Louisiana
Phase II General Design Memorandum

TABLE OF CONTENTS

TABLE OF CONTENTS CONT'D

TABLES

TABLE OF CONTENTS (Cont'd)

PLATES

APPENDICES

Grand Isle & Vicinity, Louisiana
Phase II General Design Memorandum

PERTINENT DATA

ECONOMIC & FINANCIAL DATA

Estimated Total First Cost	Units $
Federal	8,310,000
Non Federal	5,490,000
Total First Cost	13,800,000
Preauthorization Construction	1,180,000*
Lands and Damages	2,380,000
Non Federal Cash required	2,110,000

Cost Apportionment	Units $
Hurricane Protection	10,800,000
Beach Erosion Control	3,000,000

Benfit Cost Analysis	Units $
Estimated average annual Benefits	2,180,000
Estimated average annual Cost	1,486,000
Benefit Cost Ratio	1.5 to 1
Project Life	50 years
Project Interest Rate	6 7/8

Estimated Average Annual Nourishment Costs	Units $
Federal Share (First 15 years)	33,000
Non Federal	398,000
Total Estimated Annual Nourishment Cost	431,000

PHYSICAL DATA

Project Template Dimensions	
Dune Crest Elevation	11.5 Ft NGVD**
Dune Top Width	10 Ft
Dune Side Slopes	
Protected Side	1V on 5H
Gulf Side	1V on 5H
Dune Berm Elevation	8.5 NGVD
Dune Berm Slope	1V on 33H

* Work accomplished by local interests.
**Unless otherwise indicated, all elevations in this report are referenced to National Geodetic Vertical Datum (NGVD)

PERTINENT DATA (Cont'd)

Estimated Fill Quantity

Estimated Annual Erosion Rate	100,000 cu. yds/yr
Renourishment Interval	4 years

Beach Dune Vegetation

Type and Estimated Quantity of Plants	
Sea Oats	50,000
Bitter Panicum	550,000

GRAND ISLE AND VICINITY, LOUISIANA
PHASE II
GENERAL DESIGN MEMORANDUM

1. Authority. The Senate Public Works Committee on 1 October 1976 and the House Public Works Committee on 23 September 1976 adopted resolutions under the provisions of Section 201 of Public Law 89-298 approving the project for beach erosion and hurricane protection for Grand Isle and Vicinity, Louisiana. These resolutions state, in part, as follows:

"That pursuant to the provisions of Section 201 of Public Law 298, 89th Congress (79 Stat. 1073), the project for beach erosion and hurricane protection at Grand Isle and Vicinity, Louisiana, is hereby approved substantially in accordance with the recommendations of the Secretary of the Army and the Chief of Engineers in House Document Numbered 94-639, at an estimated Federal cost of $5,709,000."

2. Scope and Purpose. This report is of the General Design Memorandum, Phase II scope and, taken in conjunction with the Phase I report dated June 1979 provides the basis and record for the design of the selected plan. The information presented in this report is in general limited to the investigations and designs conducted during the Phase II study period and only where necessary have data appearing in the Phase I document been reproduced to aid in review of this document. Investigations and studies conducted during Phase II were to assure that the authorized project will fulfill project objectives and needs of the Town of Grand Isle, Louisiana.

3. Local Cooperation. The items of local cooperation presented in the authorizing document are presented below. The cost have been revised based on design studies made for this Phase II GDM and are October 1980 price levels.

a. Requirements. Local interests are required to furnish assurances that they will:

(1) Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project, currently estimated to cost $2,380,000;

(2) Accomplish without cost to the United States all relocations and alterations of building, streets, utilities, and other structures and improvements made necessary by the construction of the project;

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

(4) Assure maintenance, repairs, and periodic beach nourishment of the project after completion as may be required to serve the intended purposes in accordance with regulations prescribed by the Secretary of the Army, except that the Federal Government will contribute, for a initial period of 15 years, a sum currently estimated at $33,000 annually toward the cost of beach nourishment associated with beach erosion prevention, subject to a final determination on the basis of conditions of public use and ownership at the time of construction;

(5) Provide a cash contribution for the hurricane protection function in an amount sufficient to insure that the local investment in cash, equivalent work, and fair market value of lands and relocations are at least equal to 30 percent of all first costs allocated to that function; which cash contribution is presently estimated at $860,000;

(6) Contribute in cash or equivalent work an amount sufficient to pay the non-Federal share of construction costs allocated to beach erosion control, that amount presently estimated at $2,250,000 less $1,000,000 credit for completed work or $1,250,000 the final amount to be determined at the time of project construction in accordance with cost-sharing procedures for beach erosion control as defined in the report;

(7) Obtain approval by the Chief of Engineers, prior to commencement of any work on shore and beach protection phases of the Project if undertaken separately from the recommended combined project, of detailed plans and specifications for the work contemplated and also the arrangements of prosecuting such work, excluding the preauthorization jetty construction;

(8) Assure continued public ownership of the shore upon which the amount of Federal participation in the beach protection phase is based, and its administration for public use during the life of the Project, and assure continued availability for public use of privately-owned shores;

(9) Assure that water pollution that would endanger the health of bathers will not be permitted;

(10) Adopt and enforce appropriate ordinances to provide for the preservation of the improvement and its protective vegetation;

(11) At least annually inform interests affected that the Project will not provide any substantial protection from hurricane flooding on the bay side, or from hurricane surges higher in elevation than those of Hurricane Betsy of 9 September 1965;

(12) Comply with the provisions of the "Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, and

(13) Agree to the requirements of Section 221 of the Flood Control Act of 1970.

b. Requirements of PL 91-611 and PL 91-646.

(1) PL 91-611: Local interests are legally qualified to execute the assurances.

(2) PL 91-646: A Constitutional Amendment was provided by the Louisiana Legislature on 1 February 1972 allowing local interests to comply. No cost to local interests is anticipated.

c. Current Status of Assurances. Formal assurances were requested in a letter dated 4 September 1979 to the Louisiana Department of Transportation and Development Office of Public Works. In an 8 January 1980 meeting between Representatives of the Town of Grand Isle, Louisiana, State Office of Public Works and Corps personnel, the town representatives indicated that the town would provide the assurances on the project. An agreement between the State Office of Public Works and the Town would require that the "cash contribution" required to construct the project would be provided by the State Office of Public Works. Formal assurances have not been executed by the Town of Grand Isle, Louisiana at this time. However, execution of the assurances is anticipated in the near future. State support for the project has been demonstrated through the Governor's office and provisions to provide the cash contributions have been included in the 1980 Capital Outlay Bill.

d. Status of Clearances of Relocations or Other Negotiations Affecting Construction. All negotiations for relocations are the responsibility of local interests. In response to the request to the Town of Grand Isle real estate easement requirements for the construction of the project were informally furnished in November 1979 so that the required negotiations could be started at the earliest practical date. Formal request for the required easements will be made when assurances are completed. Table 5 shows the local interests scheduled earnings for the lands and damages feature for the Grand Isle, Louisiana project.

4. Location of Project and Tributary Area. Grand Isle is located on the Gulf of Mexico in Jefferson Parish, Louisiana, about 50 miles south of New Orleans and 45 miles northwest of Southwest Pass of the Mississippi River. Grand Isle is the westernmost of the barrier islands lying across the mouth of Barataria Bay. The island extends about 7.5 miles in a generally northeast to southwest direction and is about 1.75 miles in width at the center. Grand Terre Islands are to the northeast and Cheniere Caminada, the mainland, is to the west of Grand Isle. Plate 1 shows the project location and vicinity map.

5. Hydrology & Hydraulics.

a. General. The Phase I GDM described verification of procedures, frequency estimates, wave energy frequency estimates, design hurricane, and design criteria. Specific items covered included hurricane memorandums, historical storms for verification, synthetic storms, surges, wave runup, selection of the design hurricane, normal predicted tide, design tide, and the design criteria for the jetty at Caminada Pass, beach nourishment, and design profiles. Appendix B of Phase I GDM described in detail the factors pertinent to the problem, the shore history, and the analysis of the problem. Some of these topics required additional treatment for the Phase II GDM and for the preparation of plans and specifications due to additional field data, comments received as a result of the milestone 41 design conference, and comments on the Phase I GDM by OCE. The items that received additional treatment as a result of comments from OCE include wave runup analysis, design criteria for the jetty at Caminada Pass, and the computation of beach renourishment rates. The items that received additional discussion as a result of the milestone 41 design conference include design profiles and other plans investigated. The items for which additional field data was collected include design profiles and beach nourishment rate.

b. Wave Runup Analysis. Wave runup on the beach and dune at Grand Isle was computed using methodology from the US Army Coastal Engineering Research Center's Shore Protection Manual. Details of the computations are given in the Phase I GDM, Appendix B, pages B-23 through B-25. The wave runup analysis contained therein addresses the full wave spectrum and additional analysis were not warranted during Phase II studies.

c. Design Criteria for the Jetty at Caminada Pass. Caminada Pass is not currently a navigation project of the Corps of Engineers or the State of Louisiana. Basically, the jetty at Caminada Pass is not designed to maintain the entrance free of shoaling, but to anchor the western extremity of Grand Isle. The jetty is a hardpoint or artificial headland and functions primarily as a terminal groin. The jetty has been in place since 1972 and the end of the island has behaved as planned.

d. Beach Nourishment and Frequency of Renourishment.

(1) General. During the preparation of the Phase I GDM, estimated nourishment quantities and renourishment rates were based on historical data and construction records from the emergency restoration of the Grand Isle dune in 1961 and 1965. Rationale for renourishment are explained in the Phase I GDM (Page B-31). The selected plan (Plan B) requires building a much larger dune and beach berm cross section than has been built in the past. The design section calls for a beach berm varying in elevation from 8.5 to 3.0 feet NGVD and extending 200 feet gulfward of the centerline of the dune. This design will assure

that the waves will break a sufficient distance from the dune centerline and that wave runup will not overtop the dune El. 11.5 NGVD for the design storm (50-year frequency). Appendix B of the Phase I Report, (page B-3) assumed a loss ratio of 5 to 1 applied to the 1.5 million cubic yards required for the in-place cross section. This overfill ratio was an estimate based on emergency beach nourishments where the beach fill extended just beyond the waters edge. Based on Phase II studies and experience by other Corps Districts, this estimate is considered to be too conservative.

(2) Overfill Ratio and Renourishment Factor Determination.

(a) Overfill Ratio. To establish a systematic approach to the beach fill problem the Coastal Engineering Research Center was consulted on methods of computing overfill ratios and periodic renourishment requirements. The recommended and adopted procedure is outlined in the CERC Shore Protection Manual and Technical Paper No. 77-6, "Review of Design Elements for Beach-Fill Evaluation," dated June 1977. For the Grand Isle project, to determine an overfill ratio for a pumped beach and dune project, grain size distributions (gsd) were compared between the existing beach and the planned borrow sites. Core samples were obtained to prepare the necessary gsd's of native beach, offshore borrow area and east end borrow area. For the native beach, a series of 2-foot long sub-surface samples were collected along 5 profiles at elevations of +6, +3, 0, -3, and -6 NGVD. Baseline stations for these samples were:

Line I (Sta 95+57)
Line II (Sta 155+03)
Line III (Sta 235+26)
Line IV (Sta 295+34)
Line V (Sta 345+65)

Samples of the native beach were sieved at the 1/4 Ø intervals.

At the location of possible offshore sand sources the Waterways Experiment Station obtained and analyzed a seismic bottom profile for the offshore area fronting Grand Isle from the -6-foot contour to approximately 7,000 feet gulfward of Grand Isle. To verify the general findings of the seismic profile, a network of borings were cored and analyzed within this offshore area and are identified on plate A-4. The area identified as the optimum offshore borrow site encompasses a rectangular area approximately 1,500 feet wide and 8,700 feet long located approximately 1/2 mile offshore in water depths of about 12 feet. Boring number 4, 20, 24, 25, 27, 28, 40, and 46 lie within this selected offshore borrow area.

Each core was sampled at 1-foot intervals and the samples were sieved at 1/4 ϕ intervals as recommended by CERC. The remaining offshore borings were analyzed at standard sieve sizes and are in the files of the New Orleans District.

At the east end borrow area near Barataria Pass, 3 borings were obtained with a vibra core. As for the offshore area, each foot of the cores was sampled and the samples were sieved at 1/4 ϕ intervals.

A composite of gsd calculated for three primary areas and these gsd's became the models by which a statistical comparison was made between the native beach and the borrow areas. The first model was prepared from 25 samples of native beach and nearshore profiles taken on five ranges perpendicular to the alinement of the project dune. First a gsd was determined for each of the 25 samples. Then the average gsd was calculated by averaging the percent coarser by weight for each profile line and finally an average gsd was computed by averaging the percent coarser by weight for each 1/4 ϕ interval from 1.00 to 4.00 ϕ units for the five profile lines. This final gsd has been termed model 1. A similar procedure was used for 45 samples of the five borings in the offshore borrow area to derive gsd's for each sample and then each boring and finally a composite gsd for the offshore borrow area was derived and termed model 2. The same procedure was used for 33 samples of the three vibracores to derive gsd's for each sample and then each vibracore and finally a composite gsd for the east end borrow area which has been termed model 3.

The 3 models (native beach, offshore borrow area, and east end (back up) borrow area) were then plotted with cumulative per cent coarser on the ordinate and 1/4 ϕ intervals on the abscissa. Graphs of the 3 models are in figures 1 through 3 in Appendix C. After plotting the 3 models, the 16th and 84th percentiles were selected from the cumulative plots. These ϕ sizes are then used to compute the ϕ mean diameter and the phi standard deviation using the following formulas:

Mean:

$$M\phi = \frac{\phi 84 + \phi 16}{2}$$

Standard Deviation:

$$\sigma\phi = \frac{\phi 84 - \phi 16}{2}$$

Once these standard statistical parameters are known, the overfill factor (R_A) and the renourishment factor (R_J) can be calculated by appropriate formulas or derived from graphs shown on figure 5-3 and 5-4 in Volume II in the Shore Protection Manual. These graphs were extracted from Volume II and are shown in this GDM as figures 4 and 5 in Appendix C. Computations showing comparisons of models 1, 2, and 3 are also contained in Appendix C. These techniques have not been fully tested in the field and should be used only as a general indication of possible fill behavior. The overfill ratio (R_A) computed for the Grand Isle project using the selected offshore borrow area (model 2) is 1.40. The renourishment factor (R_J) which is the ratio at which borrow material will erode to the rate at which natural beach or native material will erode is 0.90. The average slope of the foreshore slope of the natural beach which is not under the influence of the jetties and tidal passes is approximately 1 vertical on 33 horizontal (1:33). The Phase I GDM showed a project slope of 1 on 15. This slope and combined berm slope (1:33) satisfy project objectives in preventing wave overtopping for the design storm. However, due to the interaction of waves, littoral currents and sorting action, the overfill ratio of 1.4 must be applied to the outer zone of the cross section which will be called the active zone. This zone is defined as the polygon or wedge created by the triangle formed starting at the +3.0 NGVD beach berm elevation and bounded by the 1 on 15 construction slope, the existing bottom, and the assumed 1 on 33 berm slope. This wedge is required to build an offshore underwater platform for the combined beach nourishment and dune restoration project. This active zone contains approximately 600,000 cubic yards of sand. Applying the 1.4 overfill ratio (R_A) to the active zone yields an additional 240,000 cubic yards which must be added to the estimated quantities formed by Phase II template shown on plate 10.

(b) Renourishment Factor. As documented in the Phase I GDM an estimated 100,000 cubic yards of sandfill material will be required annually to maintain the dune and beach berm. To reduce unit costs, periodic beach renourishment would be accomplished by placement of 400,000 cubic yards at 4-year intervals. This scheduled interval for renourishment does not require adjustments since the renourishment factor using models 1 and 2 was computed to be 0.90 or close to unity. The use of model 3 in conjunction with model 1 gave an overfill ratio of 1.02 and a renourishment factor of 1.0. If this borrow area were to be selected, the overfill could be reduced from 240,000 to 12,000 cubic yards in computing the required construction quantities. The borrow area upon which model 3 is based was not selected due to its proximity to Barataria Pass where possible environmental consequences had not been analyzed. The use of this borrow area would also require the laying approximately 7.5 miles of dredge pipe since the borrow area is located on the extreme eastern end of Grand Isle.

e. Design Profiles. As documented in the Phase I GDM on page B-32, the beach and dune design profile is based on the natural beach and dune slopes at Grand Isle. During the preparation of the Phase II GDM, a more constructible design template was developed and quantity take-offs were computed to establish dredging requirements. Therefore, during Phase II design, efforts were directed at trying to characterize the beach and dune with a section which would be obtained when hydraulic fill was placed under normal wave conditions. This section was used to compute the quantities needed to construct the project and is shown on plate 10. As stated in the Phase I GDM, the hurricane protection profile was determined from an estimate of the quantity of material likely to be eroded during the occurance of the design storm. Hurricane "Betsy" (1965) was used as a model in estimating this loss. Using comparative surveys taken just before and after Hurricane "Betsy", it was estimated that during this storm approximately 600,000 cubic yards of sand had been lost from the combined dune and beach sections. To provide a factor of safety, the estimated quantity was increased by a factor of 2 and the profile was then adjusted to prevent wave runup and overtopping. A number of other design constraints influenced the final template which is recommended in this report. Constraints are discussed in detail in Section 7. Also as discussed in the Phase I GDM, recreational requirements dictate a minimum beach width required to satisfy project objectives.

f. Other Plans Investigated. In the Phase I GDM several alternative plans were discussed. Plans considered in detail included beach fill, beach fill with groins, beach fill and dune, levees and bulkheads, offshore breakwaters, extension of jetty at eastern end of the island (Barataria Pass Jetty), jetty at western end of the island at Caminada Pass, and revetment with spur dikes at the western end of the island near Caminada Pass. Various armorings of the dune were considered such as cellular concrete block revetments and Longard Tubes; however, they were considered to be economically infeasible or unjustified for application for the entire project reach. The possible solutions considered in detail and evaluated during the Phase I studies in the preliminary stages of plan formulation were discussed on pages 66-75 of the Phase I GDM. Plans investigated further during preparation of this report include offshore segmented breakwater, cellular concrete revetment for dune protection, and pocket filter cloth for dune protection. In the current analysis, the offshore segmented breakwater appears to be an economic alternative to renourishment of the dune, depending on experience with the renourishment rate and developmental studies on offshore breakwaters for shoreline erosion control. In the current analysis, the cellular concrete revetment and the pocket filter cloth fail to provide benefits to offset their costs. Details of the other plans investigated are contained in Appendix C.

6. Geology and Soils. The geology and soils investigations that were conducted during the Phase II GDM design studies were limited to investigations designed to confirm the existence of suitable borrow sources of sands in the offshore area fronting Grand Isle and the testing and analyzing of the collected boring data. The Phase I GDM had identified two potential borrow sites for construction of the beach fill and dune. These sites were located at each end of the island just gulfward of the tidal passes. Appendix A, Geology & Soils discusses in detail the investigations and studies conducted during Phase II and recommends use of a single 300 acre borrow site located near the center of the island approximately 3,000 feet offshore in a depth of 12 feet of water. The dimensions of the proposed site are approxiately 1,500 feet wide by 8,700 feet long and studies indicate that approximately 3.9 million cubic yards of suitable material may be removed from the borrow source. Location of the Phase II proposed borrow area is shown on Plate 11. Analysis of the boring logs for the dune alinement would indicate that from a soils standpoint the project template provides a stable section and sectional stability should not be a problem during construction. Examples of the standard stability analysis performed in connection with Phase II studies are in Appendix A.

7. Description of Proposed Structures and Improvements.

a. Project Description. Plan B is identified in the Phase I GDM as the recommended and selected plan of protection for Grand Isle, Louisiana. The plan provides for a combined hurricane wave damage protection and beach erosion control for the entire gulfward shore of Grand Isle. Project limits are shown on plate 11. The project dune section is designed to provide wave damage protection for hurricanes having a return frequency of once in 50 years and critical to the gulf shore of Grand Isle. The rationale for the volume of material likely to erode during the design storm is contained in Paragraph 5.e. above. Design features include construction of a sand beach and vegetated dune and a 2,600-foot long jetty (terminal groin) on the western end of the Island at Caminada Pass. Beach and dune construction will be accomplished by hydraulic dredge from an offshore borrow area. Dune dimensions as specified for Plan B include a 10-foot dune crest at elevation 11.5 NGVD sloping at 1 vertical to 5 horizontal on both the gulfside and protected sides of the dune crest. The protected side slope extends from the crest downward to its intersection with the natural ground elevation and the gulfside slope extends downward until it intersects the beach fill berm at elevation 8.5 NGVD. At elevation 8.5 NGVD the gulfward beach berm slopes at a 1 vertical on 32.7 (33 rounded) horizontal downward to elevation 3 NGVD and thence from this point at 1 vertical on 15 horizontal to its intersection with the natural beach or gulf bottom. During Phase II design studies, Plan B has been slightly modified to provide for a more constructible section. Examination of existing beach profiles not directly influenced by the jetties at each end of the island would indicate that the 1 vertical on 15 horizontal slope specified shoreward of the beach berm could not be constructed and that the underwater slopes of the shoreward terminus would more closely approximate 1 vertical on 33 horizontal slope which had been specified for the above water beach slope. Thus, the 1 vertical on 15 horizontal slope has been eliminated from the template and the 1 vertical on 33 horizontal slope was extended gulfward until it intersects the natural beach or gulf bottom. Representative beach profiles and the accompanying modified project template are shown on Plate 10. Plan details depicting the dune alinement and fill slopes are illustrated on plates 2 through 9. Additionally, minor alinement changes were made to minimize the number of relocations required to construct the project. In doing so, the number of relocations were reduced from 10 to 3 during Phase II studies. Where alinement changes were made, the cost effectiveness of the gulfward shift was analyzed by comparing the cost for increased yardage incurred versus the cost of relocation. Where cost effective, alinement shifts were made. The Phase II estimated volume of in-place sand required to construct the project is 2.3 million cubic yards. This represents an increase of 800,000 cubic yards over the Phase I estimate. The Phase II estimated volume to be dredged is 2.54 million cubic yards. This quantity includes the estimated overfill required because of non-compatability of borrow material to the natural beach material. An explanation of the overfill ratio calculated for Grand Isle is in paragraph 5.d.(2) above. Further comparison of Phase I and Phase II volumetric estimates is in paragraph 7.b. below.

b. Comparison of Phase I and Phase II Estimated Volumes of Sandfill. Using the Phase II project template described in paragraph 7.a. above and the new field survey beach profiles obtained during the months of August-October 1979, it was estimated that 2.3 million cubic yards of sandfill would be required to construct the project. This estimate represents an increase of 800,000 cubic yards more sand than estimated in Phase I GDM estimate. The Phase I volumetric estimate was based on a survey conducted in May 1978. During the intervening 14 to 16 months, hurricanes "Bob", 10-11 July 1979 and "Frederic", 12-13 September 1979 passed near Grand Isle and caused considerable degrading of the beach and dune. Field inspection after hurricane "Bob" revealed that approximately 60-80 percent of the then existing dune had been damaged or destroyed. Although hurricane "Frederic" went ashore a considerable distance to the east of Grand Isle, the already exposed beach received additional damage. The Phase II field survey which had been originally scheduled for the week of 8 July 1979 was postponed to the end of August to allow for as much natural rebuilding of the beach to occur as possible and still keep the report on schedule. Analysis of the Phase I and Phase II surveys showed that approximately 170,000 cubic yards of beach sand had been lost during the intervening time. Because of field inspections conducted before and after hurricane "Bob", it is believed that most of the losses occurred during this storm. Phase II alinement studies and subsequent alinement changes account for an additional 30,000 increase of cubic yards. Thus an increase of approximately 200,000 cubic yards of sandfill materials occuring between Phase I and Phase II studies can be accounted for due to storm activity and dune alinement changes. Of the total increase of 800,000 cubic yards between Phase I and Phase II studies, the remaining 600,000 cubic yard increase is directly attributable to slope modifications discussed in paragraph 7.a. above. The narrow wedge of sandfill contained between the authorized Phase I Plan B template and the Phase II template contains the additional 600,000 cubic yards of required sandfill.

c. Preauthorization Construction By Local Interests. In view of the imminent danger to property on the western end of the island and the fact that the Corps of Engineers had no authority or funds available to construct emergency works of the magnitude required to halt the erosion, the Louisiana legislature appropriated $1 million for the emergency work in 1971. The construction of a jetty along the western end of Grand Isle and placement of sandfill on its landside, in accordance with the authorized plan, was completed in July 1972 by contract of the Louisiana Office of Public Works. By letter dated 17 June 1971 the Louisiana Office of Public Works requested that moneys spent by the state for this emergency preauthorization construction be credited toward the non-Federal share of the first cost of the proposed Federal project, when and if a Federal project is approved. Design criterion for the jetty is described in the Phase I GDM in paragraph 8.a., page B-31, Appendix B. Since its construction, the jetty has operated as designed and the shoreline on the extreme western end of Grand Isle has enjoyed a period of stability. Further clarification of the purpose of jetty is contained in paragraph 5.c. above.

8. Construction Procedures and Water Control Plans.

a. Proposed Method of Construction. A hydraulic pipeline cutterhead dredge will pump the material from the borrow area, located about 3,000 to 4,500 feet offshore, directly to the beach. The dredge must have a minimum of 20- to 27-inch pipeline and when needed will employ booster pumps to move the material along the beach. The pipeline will be submerged through the surf zone. The borrow area contains a minimum thickness of 8 feet of usable sand and is in 12 feet of water. Dredge relocation within the borrow area will be minimized for economical operation and reduction of gulf floor disturbance. Wave heights of 4 feet or less should not stop dredging operation and these wave conditions are expected to prevail 95 percent of the time (See page B-5 of the Phase I GDM). Fill material on the beach will require grading to obtain the dune section and dressing so that beach grass may be planted on the dune.

b. Equipment Availability. Based on the location of the borrow area, it has been determined that dredges operating in this region of the Gulf of Mexico will require Coast Guard certification. Information on the proposed project along with a request of certified dredge availability for construction of this project was sent to 19 companies operating in the coastal waters. Nine affirmative responses expressing the capability and interest in bidding on the project have been received to date. Experience gained by the Jacksonville District in connection with beach nourishment projects using a 27-inch cutterhead pipeline dredge operating in 45 feet of water and pumping from 9,000 feet offshore would indicate that the successful contractor should be able to move over 270,000 cu. yds. of material per month. Downtime due to weather in connection with the Jacksonville District's projects averaged about 25 percent of the working time.

c. Order of Work. Access to the work area has been granted by the Town of Grand Isle from LA Hwy. 1. Several existing access roads can be used by the contractor which make the beach accessible without crossing private lands. The access roads are listed below and are shown on plates 2 through 9. Dike construction will be by land-based equipment. The dike has two purposes; one being to allow the sand to collect for shaping the dune, and the other to protect the island from dredge effluent draining toward the highway. Construction of the dike and pumping of sand for the dune will commence at the west end of the island at dune station 0+00. Beach material will be used to build the dike landside of the dune centerline as shown on plate 10. Sand for the dune will be pumped on the gulfside of the dike to approximate elevation 10.0 NGVD and the sand allowed to seek its own slope to the gulf, approximately 1 vertical on 33 horizontal. As soon as the sand has consolidated, the dune will be shaped to the section shown on plate 10. After final shaping of the dune by land-based equipment, the dune will be planted with two types of coastal vegetation, namely sea oats and bitter panicum, to prevent erosion. Planting will begin after a minimum of 1 inch of rainfall has fallen. This amount of rainfall is necessary to cleanse the dune of salt. Wooden crossover walks will be constructed over the dune at approximately 1/2 mile intervals.

d. Access Roads. Construction access to the work area has been provided by the Town of Grand Isle on most of the existing and proposed streets from LA Hwy. 1 to the beach. The following streets along with rights-of-way widths have been designated as access roads to the job site:

Burnett	40 feet
Jackson Ave	40 feet
Raspberry Ln	40 feet
Olive	40 feet
Apple	40 feet
Iris	40 feet
Elm	60 feet
Willow	60 feet
Yacht Harbor	40 feet
State Park Road	20 feet

All roads and streets listed are undeveloped and composed of sand except for Burnett, which is asphalt paved over approximately 100 feet of its length. These roadways were chosen because of the easement widths and the relative safe distances from adjacent houses and building. Should the contractor decide to use any other rights-of-way, he must obtain permission from the Contracting Officer. No improvement to any of the roadways is necessary. The contractor will be required to maintain all streets used by his equipment.

e. Construction Time. The anticipated construction time for the project is 13 months.

f. Real Estate Requirements

(1) Beach Dune. Acquisition of all rights-of-way and easements are the responsibility of the local sponsor. Plates 2 through 9 show the required rights-of-way for the dune construction. A permanent easement of 50 feet landward from the dune centerline is considered adequate for project maintenance. In addition to the 50-foot permanent easement, an additional 20-foot temporary construction easement will also be required. The contractor will be required to work around improvements located within the 20 foot temporary easement. Approximately 290 parcels of privately owned lands are located within the required rights-of-way. As previously mentioned, the negotiations and acquisitions of these properties is the responsibility of the local sponsors.

(2) Field Nursery. A temporary easement for planting the dune grass species field nursery has been acquired from the Louisiana Office of Recreation and Tourism, Office of State Parks by the Town of Grand Isle, Louisiana. The location of the approximately 6 acre easement is on the West End State Park's Property and is shown on plate 2. In a letter dated 27 February 1980 the Town of Grand Isle granted right of entry to the Federal Government for a period of 5 years for development of a nursery to support construction of this project.

9. Schedule for Design and Construction. A copy of the Fully Funded Phase II detailed project schedule (PB 2A) is shown in Table 5. All major construction activities associated with the Grand Isle & Vicinity project are given by feature (standard accounts) in Table 5. Presented are detailed breakdowns of the cost estimate, the work completed, and the proposed construction schedule, which includes a quarterly basis for the current and budget year 1981 and the remaining work scheduled for FY 82. Table 5 also relates the individual contracts and hired labor jobs to the applicable standard features (accounts) and subfeatures for this project.

10. Environmental Analysis.

a. Phase II Changes in Impacts Assessment. Changes that have occurred in project design subsequent to the Phase I GDM will cause minor changes in the impact. Additionally, an increased understanding of dune construction, since Phase I, imparts a more realistic assessment of impacts. These changes are reported in the Supplemental Information Report included as Appendix F. The most significant change in project design is with the size and location of the borrow area. In the original report there were two borrow areas planned. One was to be located off the eastern end and the other off the western end of the island totaling 187 acres. Now there is to be only one borrow area located off the center of the island totaling 300 acres, although the entire area is not expected to be used during construction. Short-term impacts on water quality are not expected to be as great as before since borrow will no longer come from the vicinity of the two tidal passes. Since construction time has been shortened, plants and animals will be able to recolonize sites sooner than previously thought. Less sand will actually be lost to the gulf than previously expected, so the indiscriminant covering of benthic habitat will be reduced. However, present understanding indicates that 25 acres more water bottom will be covered than originally anticipated. Now, unlike before, most water bottoms covered will be part of the construction area. Primary impacts of the project will be loss of slow moving or sessile benthic organisms, temporary increases in turbidity adjacent to borrow area and beach, possible detrimental impact to organisms due to release of zinc, and loss of productivity during the time necessary for recolonization.

b. Cultural Resources Survey. Between 25 February and 1 March 1980, a proton magnetometer survey was performed by Texas A&M Anthropology Research Laboratory on the proposed Grand Isle offshore borrow area. During the course of the survey two magnetic anomalies were located just outside the survey area, near the northwest and southeast corners respectively, and six magnetic anomalies were located within the proposed borrow area. Further evaluation of these magnetic anomalies to identify them and determine their significance according to National Register criteria must be made and mitigation or protection plans, if appropriate, will be formulated prior to construction, or the locations of the magnetic anomalies will be completely avoided.

11. Sources of Construction Material.

a. Dune & Beach Fill Material. Plate 11 shows the location of the proposed offshore borrow area. Sections 4 and 5.a. and Appendix A of this report give details of the engineering investigations and studies that were conducted in establishing the location of this borrow area.

b. Dune Vegetation.

(1) General. Appendix C, Page C-3 of the Phase I GDM outlined proposed changes to the vegetation plan for the Grand Isle dune project. Material contained in this report further expands on the proposed changes.

(2) Brief History of Existing Sea Oats Nursery. At the request of the New Orleans District office the Town of Grand Isle ordered approximately 10,000 sea oats plants from the supplier (Horticultural Systems, Inc., Bradenton, Florida) and planted them during August 1979 on West End Park property dedicated for nursery use by the Louisiana Department of Culture, Recreation and Tourism to the Town of Grand Isle. (See plate 2 for nursery location.) Planting procedures were in accordance with the recommended vegetation plan prepared by Dr. W. W. Woodhouse, Jr., Dept. of Soil Science, North Carolina State University, Raleigh. The entire vegetation plan as prepared by Dr. Woodhouse is appended (Appendix B). As construction funds for the Grand Isle & Vicinity project were not available until 1 Oct 79 for maintenance, heavy loss of plants occurred due to competition from weeds. City employees, and members of the Cresent Soil & Water Conservation District, visited the site and performed some maintenance as time and other job requirements permitted. Chemical analysis of the soil in the nursery site, prepared by the L.S.U. Extension Service, indicated soil salinities were not high enough to affect seedling survival. Thus, this factor was eliminated from further consideration as a possible cause for plant failures. Replanting of 3,000 sea oat seedlings is tentatively scheduled for May 1980. Planting of dune panic grass, from natural stands existing on Grand Isle (see Appendix B for details), will be attempted during 1980. In addition, a maintenance contract for the nursery site is to be let during early 1980, which may be renewed to total approximately 3 years.

c. Summary of Planting Requirements. Planting requirements are expected to be substantial; early estimates are for about 600,000 plants, with an additional 75,000 plants available for replanting storm-damaged or drought-related failures. Plant spacings are proposed as follows:

Location	No. Rows	Spacing	Width
front	2	3.5 ft on centers	7.0 ft
front	3	3.0 ft on centers	9.0 ft
front	4	2.5 ft on centers	10.0 ft
front	4	2.0 ft on centers	8.0 ft
top	8	1.5 ft on centers	12.0 ft
back	4	2.0 ft on centers	8.0 ft
back	7	3.0 ft on centers	21.0 ft
			75.0 ft

Spacing is for bitter panicum. Two rows of sea oats would be meshed within this spacing, dependent somewhat on the supply of plants.

It is anticipated that vegetative reproduction of nursery plants will provide sufficient plants for the project. Should the need arise for additional plants, supplemental purchases will be made from a commercial supplier.

12. Environmental Quality Enhancement Measures.

a. Dune Walkover Structures. To limit destruction of the dune and loss of plants as a result of foot traffic, walk-over structures will be placed across the dune at selected 1/2 mile intervals. These structures, preferably constructed of timber, will permit ease of access to Grand Isle beaches while protecting the sand dune from erosion. Appendix D contains a copy of "Beach Dune Walkover Sructures" by Todd L. Walton, Jr. and Thomas C. Skinner, published by The Florida Cooperative Extension Service Marine Advisory Program. This publication gives a recommended design for the walkover structure and is supplied as an example of the type structure that will meet the objective for this feature. Walkover structures will be required at public access points at approximately ½ mile intervals.

b. Dune Vegetation Plan. Sea oats and bitter panicum will be planted on the dune throughout the project area. This artificial revegetation will not only aid in erosion control but will enhance the wildlife value and aesthetics of the area. Vegetation planting is thoroughly covered in Appendix B to this report.

13. Economic Update and Phase II Project Cost Estimate.

a. Economic Analysis. The economic justification of the project was based on a comparison of the average annual benefits with the average annual costs. Benefits and costs were expressed in comparable monetary terms by discounting both to their present values in 1982 (project base year). The magnitude of the discounted future benefits and of all costs was a function of the project life (50 years, 1982-2032) and the authorized Federal interest rate (6-7/8 percent). All costs and benefits presented herein are based on 1 October 1980 price levels.

(1) Annual Charges. The estimated average annual charges derived from the project first costs amount to $1,486,000, as shown below:

TABLE 1

SUMMARY OF AVERAGE ANNUAL CHARGES

	Federal ($)	Non-Federal ($)	Total ($)
1. Project first costs	8,310,000	5,490,000	13,800,000
2. Present value of first costs (base year: 1982)	8,190,000	6,457,000	14,647,000
3. Average Annual Charges			
(a) Interest	563,000	444,000	1,007,000
(b) Amortization	21,000	17,000	38,000
(c) Periodic beach[1/] nourishment	33,000	382,000	415,000
(d) Dune and jetty maintenance	-	16,000	16,000
(e) Beach monitoring	10,000	-	10,000
(f) Total average annual charges	627,000	859,000	1,486,000

1/ This estimate is based on 15-year Federal participation in project maintenance.

(2) Annual benefits. The average annual benefits to be derived from project construction are an estimated $2,180,000. These benefits were based on the Grand Isle and Vicinity, Louisiana, Phase I General Design Memorandum dated June 1979 and are presented below based on current (1 October 1980) price levels.

TABLE 2

SUMMARY OF AVERAGE ANNUAL BENEFITS

Category	Benefit ($)
1. Erosion prevention	
(a) Existing	423,000
(b) Future	88,000
2. Inundation reduction	
(a) Existing	734,000
(b) Future	57,000
3. Intensification	73,000
4. Recreation	605,000
5. Area redevelopment	200,000
TOTAL	2,180,000

(3) Benefit-to-cost ratio. The total average annual benefits of $2,180,000 and the total average annual charges of $1,486,000 result in a benefit-to-cost ratio of 1.5 to 1.

(a) Allocation of costs. First costs have been allocated to the beach erosion and hurricane protection functions of the plan by use of the separable-costs-remaining-benefits method, as described in the Phase I General Design Memorandum. This procedure results in $10,800,000 being allocated to hurricane protection and $3,000,000 to shore protection, as shown in Table 3.

TABLE 3
COSTS ALLOCATIONS

Line	Item	Shore Protection ($)	Hurricane Protection ($)	Combined Project ($)
1.	Average annual benefits1/	691,000	1,289,000	1,980,000
	Combined project costs			
2.	Interest and amortization2/			1,021,000
3.	Periodic nourishment			415,000
4.	Other maintenance			16,000
5.	Beach monitoring			10,000
			Total	1,462,000
	Alternative project costs			
6.	Interest and amortization2/	385,000	1,021,000	
7.	Periodic nourishment	320,000	415,000	
8.	Other maintenance	3,000	16,000	
9.	Beach monitoring	10,000	10,000	
	Total	718,000	1,462,000	
	Separable costs of each			
10.	Interest and amortization2/	0	636,000	
11.	Periodic nourishment	0	95,000	
12.	Other maintenance	0	13,000	
	Total	0	744,000	
13.	Remaining benefits	691,000	545,000	
14.	Limit on remaining benefits	718,000	545,000	
15.	Ratios	57%	43%	
16.	Interest and amortization2/	219,000	166,000	385,000
17.	Periodic nourishment	182,000	138,000	320,000
18.	Other maintenance	2,000	1,000	3,000
19.	Beach monitoring	6,000	4,000	10,000
	Total	409,000	309,000	718,000
	Allocated combined costs			
20.	Interest and amortization2/	219,000	802,000	1,021,000
21.	Periodic nourishment	182,000	233,000	415,000
22.	Other maintenance	2,000	14,000	16,000
23.	Beach monitoring	6,000	4,000	10,000
	Total	409,000	1,053,000	1,462,000
24.	First costs	3,000,000	10,800,000	$13,800,000

1/ Exclusive of Area Redevelopment benefits.
2/ Based on the present value at the base year (1982) of project first costs.

(b) Apportionment of costs. All costs have been apportioned between Federal and non-Federal interest in accordance with the cost-sharing formula adopted in the Flood Control Act of 1958 for Narragansett Bay, Rhode Island; New Bedford, Massachusetts; and Texas City, Texas, projects. The costs allocated to shore protection were apportioned between Federal and non-Federal interests in accordance with the provisions of Public Law 826, 84th Congress, as amended. Apportionment ratios, derived by the procedure described in the Phase I General Design Memorandum, resulted in a Federal first cost of $8,310,000 and a non-Federal first cost of $5,490,000.

(c) Federal responsibilities. The Federal Government would provide 25 percent of the cost allocated to the shore protection function, estimated at $750,000 (.25 X $3,000,000), and not more than 70 percent of the hurricane protection function, estimated at $7,560,000 (.70 X $10,800,000).

(d) Non-Federal responsibilities. Non-Federal interests would provide 75 percent of the costs allocated to the shore protection function, estimated at $2,250,000 (.75 X $3,000,000), and not less than 30 percent of the hurricane protection function, estimated at $3,240,000 (.30 X $10,800,000).

b. Phase II Project Cost Estimate.

(1) Comparison of Costs. The cost of $13,800,000 represents an increase of $500,000 from the latest fully funded PB-3 effective 1 Oct 79. A comparison of the latest approved PB-3 and the Phase II GDM is shown below:

	PB-3 eff. 1 Oct 79 ($)	Phase II GDM eff. 1 Oct 80 ($)	Difference ($)
Lands and Damages	3,240,000	2,380,000	-860,000
Breakwater & Seawalls	1,000,000	1,000,000	0
Beach Replenishment	7,840,000	9,420,000	+1,580,000
Engineering & Design	520,000	500,000	-20,000
Supervision and Administration	600,000	500,000	-100,000
TOTAL	13,200,000	13,800,000	+500,000

(2) Detail Project Cost Estimate. Table 4 gives a breakdown of the Plan B Phase II detail project cost estimate. It should be noted that the unit cost for sandfill has not been detailed by reaches as was done in the Phase I GDM. This is because the project construction plan no longer calls for two borrow areas. The Phase II proposed offshore borrow area is more centrally located and will result in shorter pump distances and hence a savings in cost should accrue. Another factor that affects the unit cost of the sandfill is the increased quantities required to construct the project. Taken these facts into consideration the Phase II unit cost for sandfill is essentially the same as the weighted unit cost set forth in the Phase I GDM.

TABLE 4
PHASE II COST ESTIMATE - PLAN B

COMBINED BEACH EROSION AND HURRICANE PROTECTION
(dune elevation at 11.5 feet, NGVD)

FIRST COST				
Item	Quantity	Unit	Unit cost $	Cost $
PREAUTHORIZATION CONSTRUCTION BY NON-FEDERAL INTERESTS:				
Jetty				
Riprap	30,700	ton	11.50	353,000
Shell	7,100	cu.yd.	7.00	50,000
Filter Cloth	197,300	sq.ft.	0.19	37,000
Sandfill	640,000	cu.yd.	0.93	595,000
Subtotal				1,035,000
Engineering and design (±6%)				62,000
Supervision and administration (±8%)				83,000
Total - preauthorization construction[1/]				1,180,000
POST-AUTHORIZATION CONSTRUCTION:				
Mobilization and Demobilization	L.S.	--	--	300,000
Retention Dike	37,000	l.f.	5.00	185,000
Sandfill	2,540,000	cu.yd.	2.50	6,350,000
Shaping	400,000	cu.yd.	1.00	400,000
Dune Vegetation				
Field Nursery	L.S.	--	--	105,000
Planting & Fertilizing	L.S.	--	--	245,000
Beach Dune Walkover	15	--	$4,000	60,000
Subtotal				7,645,000
Contingencies (±20%)				1,529,000
Subtotal				9,200,000
Engineering and design				500,000
Supervision and administration				500,000
Total - postauthorization construction				10,200,000
RIGHTS-OF-WAY[2/]				
Lands and Improvements				1,570,000
Severance				11,000
Contingencies (±25%)				394,000
Resettlement (P.L. 91-646)				5,000
Acquisition Cost (290 Tracts)				
Acquisition by Others	290	tract	825	240,000
Hired Labor	290	tract	550	160,000
Total - Rights-of-way				2,380,000

TABLE 4 (Cont'd)
PHASE II COST ESTIMATE - PLAN B

COMBINED BEACH EROSION AND HURRICANE PROTECTION
(dune elevation at 11.5 feet, NGVD)

FIRST COST				
Item	Quantity	Unit	Unit cost $	Cost $
SUMMARY OF FIRST COSTS:				
Preauthorization Construction				1,180,000
Postauthorization Construction				10,200,000
Rights-of-way				2,380,000
Total first cost				13,800,000
PERIODIC BEACH NOURISHMENT (4-year intervals beginning after construction)				
Mobilization and Demobilization	L.S.	--	--	300,000
Sandfill	400,000	cu.yd.	2.50	1,000,000
Subtotal				1,300,000
Contingencies (±25%)				325,000
Subtotal				1,625,000
Engineering and design (±6%)				97,500
Supervision and administration (±8%)				130,000
Total cost of one periodic nourishment				1,852,500
Present worth of periodic nourishment cost $1,850,000 rounded brought back at years, 4, 8, 10, . . . 48 = $1,850,000 (3.1472) =				5,820,000
Total of present worths				5,820,000
Amortization factor[3]				.07132
Annual cost for periodic nourishment				415,000
BEACH MONITORING (cost/year for first 4 years only)				
Gaging	L.S.	--	--	10,000
Surveys	L.S.	--	--	24,000
Aerial Photography	L.S.	--	--	1,000
Subtotal				35,000
Contingencies (20%)				7,000
Total[4]				42,000
Present worth of Incremental Monitoring Cost $42,000 brought back at years 1, 2, 3, and 4 3.3968 =				143,000
Total Present Worth				143,000
Amortization Factor				.07132
				10,000

TABLE 4 (Cont'd)
PHASE II COST ESTIMATE - PLAN B

COMBINED EROSION AND HURRICANE PROTECTION
(dune elevation at 11.5 feet, NGVD)

FIRST COST

Item	Quantity	Unit	Unit cost	Cost
			$	$
DUNE MAINTENANCE:				
Annual maintenance such as fertilization and minor replacement (3 times per year @ $25/acre)	155	a.c.	85.00	13,000
Jetty maintenance	L.S.	--	--	3,000
SUMMARY OF ANNUAL COSTS:				
Interest and Amortization 5/				
Periodic Beach Nourishment				415,000
Monitoring				11,000
Jetty and Dune Maintenance				16,000
Total annual costs				442,000

1/ Does not include cost of aids to navigation; actual cost of preauthorization construction was $1 million excluding engineering and design.
2/ Unit costs for perpetual and construction easements are based on 75% and 20% of the fee value of the land, respectively.
3/ Amortization over 50-year period @ 6 7/8%.
4/ This cost represents incremental cost above the annual monitoring cost of $1,000 to be incurred for the project life of 50 years.
5/ See paragraph 12. a.(1) annual charges for Interest & Amortization.

TABLE 5

DETAILED PROJECT SCHEDULE(PB2A)
THOUSANDS OF DOLLARS

FULLY FUNDED 1 Jun 80
CLASS, FLOOD CONTROL, LOCAL PROTECTION

APPROP, CONSTRUCTION, GENERAL

LEGEND CODES
A = ADVERTISING & AWARD
C = REIMBURSE CONTR OR AE
D = DESIGN MEMO
E = EARNINGS
H = HIRED LABOR
L = LOCAL INTEREST
N = NEGOTIATIONS
- = NO EARNINGS
P = PLANS & SPECS
R = REVIEW & APPV

ACCT	ITEM	COST TO 9-30-79 / PROJ EST	SCHED EXPEND	CURRENT FY 1980 1Q	2Q	3Q	4Q	SCHED EXPEND	BUDGET FY 1981 1Q	2Q	3Q	4Q	FUTURE FYS 1982	1983	1984	1985 RM BAL
01	LANDS & DAMAGES	2380	610				610 EEE	1770	1770 E							
10	BREAKWATERS&SEAWALLS	1000 1000														
17	BEACH REPLENISHMENT	9420	10	0	0	0	10	7085	1755	1730	1800	1800	2325			
	DUNE CONSTRUCTION NOV80 CC	9000			PP	PPPPPPP	PPRRRR	6865	1720 RAAEEE	1715 EEEEEE	1715 EEEEEE	1715 EEEEEE	2135 EE			
	VEGETATION NURSERY DEC79 CC	120	10	0	0	0	10 AAEEEE	70	35 EEEEEE	15 EEEEEE	10 EEEEEE	10 EEEEEE	40 EEE			
	DUNE VEGETATION APR81 CC	300						150			75 EEEEEE	75 EEEEEE	150 EEE			
30	ENGR & DESIGN	320 500	118	37	38	27	16	47	12	15	15	5	15			
31	SUPERVISION & ADMIN	28 500	14	5	5	3	1	358	90	90	90	88	100			
	TOTAL COST - SCHED PROJECT ESTIMATE	1348 13800	752	42	43	30	637	9260	3627	1835	1905	1893	2440			

EFF DATE 01 JAN 1980	DIVN, LOWER MISSISSIPPI VALL DIST, NEW ORLEANS DISTRICT	REGION, LOWER MISSISSIPPI BASIN, COASTAL LOUISIANA	PROJECT, GRAND ISLE AND VIC., LA. 75315	PAGE 1 OF 3 PAGES

TABLE 5 CONT

DETAILED PROJECT SCHEDULE(PB2A) FULLY FUNDED 1 Jun 80

APPROP, CONSTRUCTION, GENERAL THOUSANDS OF DOLLARS CLASS, FLOOD CONTROL, LOCAL PROTECTION

LEGEND CODES					
	A = ADVERTISING & AWARD	D = DESIGN MEMO	H = HIRED LABOR	N = NEGOTIATIONS	P = PLANS & SPECS
	C = REIMBURSE CONTR OR AE	E = EARNINGS	L = LOCAL INTEREST	- = NO EARNINGS	R = REVIEW & APPV

ACCT	ITEM	COST TO 9-30-79 PROJ EST	SCHED EXPEND	CURRENT FY 1980 1Q	2Q	3Q	4Q	SCHED EXPEND	BUDGET FY 1981 1Q	2Q	3Q	4Q	FUTURE FYS 1982	1983	1984	1985 RM BAL
						FINANCIAL	DATA									
	FED AND NON-FED															
	TOTAL COST - SCHED	1348	752	42	43	30	637	9260	3627	1835	1905	1893	2440			
	PROJECT ESTIMATE	13800														
	UNDELIVERED ORDERS	9	-9													
	TOTAL OBLIGATIONS	1357	163					9260					2440			
	FEDERAL FUNDS															
	TOTAL COST - SCHED	348	142	42	43	30	27	6030	1627	1425	1495	1483	1790			
	PROJECT ESTIMATE	8310														
	UNDELIVERED ORDERS	9	-9													
	TOTAL OBLIGATIONS	357	133					6030								
	NON-FEDERAL FUNDS															
	TOTAL COST - SCHED	1000						3230	2000	410	410	410	650			
	PROJECT ESTIMATE	5490	610				610									
	UNDELIVERED ORDERS															
	TOTAL OBLIGATIONS	1000						3230					650			

EFF DATE 01 JAN 1980	DIVN, LOWER MISSISSIPPI VALL DIST, NEW ORLEANS DISTRICT	REGION, LOWER MISSISSIPPI BASIN, COASTAL LOUISIANA	PROJECT, GRAND ISLE AND VIC., LA. 75315	PAGE 2 OF 3 PAGES

TABLE 5 CONT

DETAILED PROJECT SCHEDULE(PB2A) — FULLY FUNDED — 1 Jun 80

APPROP, CONSTRUCTION, GENERAL — THOUSANDS OF DOLLARS — CLASS, FLOOD CONTROL, LOCAL PROTECTION

LEGEND CODES A = ADVERTISING & AWARD, C = REIMBURSE CONTR OR AE, D = DESIGN MEMO, E = EARNINGS, H = HIRED LABOR, L = LOCAL INTEREST, N = NEGOTIATIONS, - = NO EARNINGS, P = PLANS & SPECS, R = REVIEW & APPV

ACCT	ITEM	COST TO 9-30-79 PROJ EST	SCHED EXPEND	CURRENT FY 1980 1Q	2Q	3Q	4Q	SCHED EXPEND	BUDGET FY 1981 1Q	2Q	3Q	4Q	FUTURE FYS 1982	1983	1984	1985 RM BAL
	METHOD OF FINANCING															
	FED AND NON-FED															
	ALLOCATIONS	1363	157													
	UNOB CARRYOVER PFY		6													
	TOTAL AVAIL FOR OBL		163													
	APPROPRIATION REQUIRED							9260					2440			
	FEDERAL FUNDS															
	ALLOCATIONS	363	127													
	UNOB CARRYOVER PFY		6					30								
	TOTAL AVAIL FOR OBL		133													
	APPROPRIATION REQUIRED							6000					1790			
	NON-FEDERAL FUNDS															
	CONTRIBUTIONS	1000	610													
	UNOB CARRYOVER PFY															
	TOTAL AVAIL FOR OBL															
	CONTROBUTION REQUIRED							3230					650			

EFF DATE	DIVN / DIST	REGION / BASIN	PROJECT	PAGE
01 JAN 1980	DIVN, LOWER MISSISSIPPI VALL DIST, NEW ORLEANS DISTRICT	REGION, LOWER MISSISSIPPI BASIN, COASTAL LOUISIANA	PROJECT, GRAND ISLE AND VIC., LA. 75315	PAGE 3 OF 3 PAGES

14. Operation and Maintenance.

a. General. Operation and maintenance (O&M) of the Grand Isle project is primarily the responsibility of the local sponsor. The project authorization specifies limited federal participation for the first 10 years following project construction. However, Section 156 of P.L. 94-587 allows extension of the authorized period to 15 years where appropriate. In view of the uncertainties and potential variability of annual maintenance requirements for beach nourishment projects in general, the District Engineer recommends extension of the Federal involvement period from 10 years to 15 years. This action will help assure project success and minimize to the fullest extent possible the burden imposed on local interests in providing the annual maintenance cost for this project. During the Phase II design conference, the subject of operation and maintenance was discussed in detail and it was recommended that an O&M manual for this project be prepared. (See MFR appendix D). The preparation of this manual is scheduled so that it will be available approximately 6 months after construction is initiated on the project.

b. Monitoring.

(1) General. The monitoring program for Grand Isle, as its basic objective, will quantify the functional and structural behavior of the sand dune and west end jetty. Quantified data, developed by this monitoring program, will serve as a basis for evaluating the effectiveness of the beach and dune in resisting wave attack and the jetty in stabilizing the west end of Grand Isle. The monitoring program involves three phases of data collection. These phases cover pre construction, construction, and post construction periods for the completed dune and beach, including vegetation. Quantified information to be obtained involves compilation of data on base conditions, cross-section and the postconstruction behavior. The sections that follow provide details concerning specific items of data to be collected.

(2) Data Collection. Surveillance of the environment and changes in the beach, inspection of the structures and observation of changes in the nearshore bottom began with the reconnaissance report by documenting existing conditions and continued at regular scheduled intervals through survey, Phase I Design Memorandum, Phase II Design Memorandum and will continue during construction so as to document the as-built conditions and observe the behavior or changes in the beach, dunes and physical environment. The following items of data collection are to be included in the surveillance program at the specified time intervals.

(a) Wave Data. Available wave data near Grand Isle has been gathered and used. A wave gage will be installed after completion of construction. The type of instrument will probably be a pressure type wave gage, but CERC will be queried as to the proper gage for Grand Isle. The gage should be maintained for three years to provide a statistical base.

(b) Littoral Environment Observations (LEO). LEO stations will be established at two sites to collect the following data on a twice daily basis: surf observations, wind observations, foreshore slope, longshore currents, rip currents and beach cusps using the methods described by J. H. Balsillie in "Surf Observations and Longshore Current Prediction," 1958. LEO stations will be located near baseline station 100+00 and 300+00.

(c) Water Level Variations. The water level at the time of damages to a dune can be a significant factor. Water levels will be obtained by a recording bubbler type tide gage on the gulfside of Grand Isle. The tide gage can be located in a public building such as the library with the tube extended out through the surf zone. However, the actual site for the gage will be established during the construction phase.

(d) Topographic and Bathymetric Surveys. Topographic and bathymetric survey data will be obtained in order to establish:

(1) The functional behavior of the sand dune by monitoring changes in the beach and nearshore bottom;

(2) The structural integrity of the dune and west end jetty by monitoring the crest elevation, and dimensions of the dune, beach and jetty;

(3) The sand trapping rate of the vegetative portions of the installation by measuring the changes in the contour of the land; and

(4) The functional behavior of the jetty at the west end of Grand Isle.

Surveys will be made before, during, and after construction to document the pre- and as-built condition. Surveys should continue quarterly thereafter until sufficient data is available to reduce the frequency to annually (probably 2 years). Typical layout of the profile lines is shown on plates 12 and 13. Economic consideration may necessitate modification of the frequency and scope of surveys. For example, the full survey quarterly intervals. During the preconstructuction survey and annually thereafter, surficial sand samples will be obtained along the profile shown on plate 11 at the elevation intervals used for the overfill ratio analysis. (See section 4.d.)

(e) Visual Inspection. A technical representative charged with the conduct of this monitoring program will inspect the dune monthly during construction and the first year after construction. During the life of the project, someone from the local assuring agency will perform monthly inspections. To facilitate these visual inspections, elevation reference posts will be established about 500 feet on centers. As alternatives the post on dune crossovers may be utilized.

(1) An engineer from the New Orleans District will make annual inspection before the start of the hurricane season and prepare a report for the District Engineer on pertinent findings and recommendations.

(2) The dune will be checked for continuity and any deterioration reported to Chief Engineering Division who will determine if repairs are required to restore the section of the dune. Repairs generally will be performed before the hurricane season to prevent failure of the project.

(3) The vegetation will be inspected at the beginning, middle, and end of the growing season to determine the health, growth rate, and new species present, as described in guidelines for vegetation monitoring received from CERC.

(f) Photographic Documentation. Ground level photographs will be taken during the monthly visual inspection to document the behavior and integrity of the dune. Uncontrolled vertical color aerial photography will be obtained quarterly for 2 years after construction and annually thereafter. Acceptable film types are type 2448 color negative or type 2445 color positive, using normal exposure. As vegetation is of primary importance in preventing wind blown erosion, color infrared aerial photography using type 2443 color IR with a Wratten 12 filter and normal exposure should supplement or possibly supplant the normal color aerial photography in the Spring and Fall. The film should be flown so that the image scale is 1:2400 (1"=200") on a 9"x9" format with 60% overlap. Flights will be scheduled at the time of MLW if possible.

(3) Data Reduction, Collation and Analysis. This section is included as part of the monitoring program with the view that provisions must be made for establishing an effective system for data transfer to

the responsible technical representative for decision-making purposes. New Orleans District will be responsible for establishing and maintaining the system of data collection described above as well as performing required data reduction and analyses.

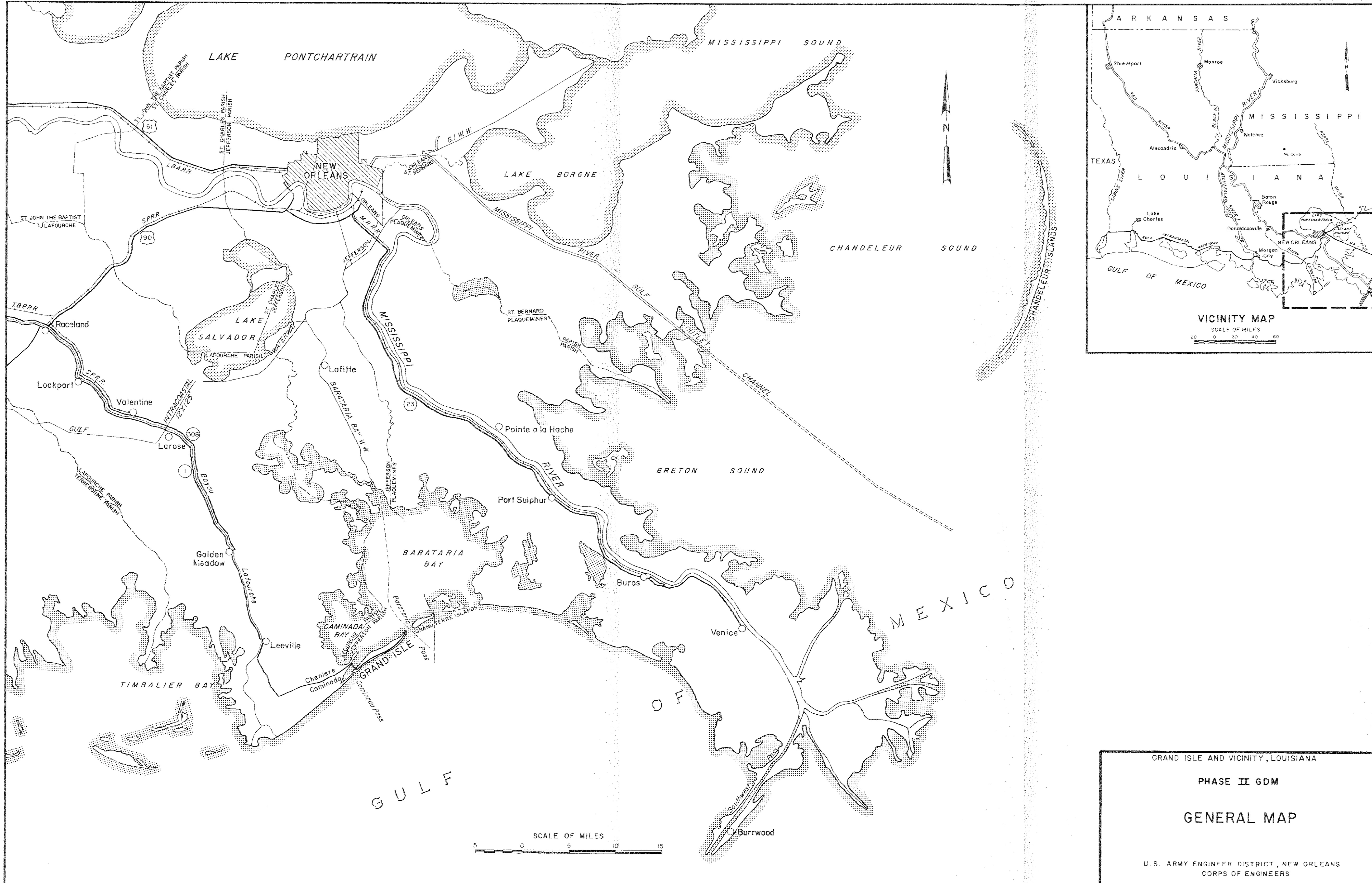
(a) Wave Statistics. These statistics will be compiled using standard CERC analysis techniques.

(b) Analysis of Littoral Environment Observations. Standard CERC analyses of the LEO data will be performed routinely for the stations established for this monitoring. Techniques and applications are discussed by Szuwalski (1970), Bruno and Hiipakka (1973), Balsillie and Bruno (1973), Balsillie (1975a) and Balsillie (1975b). The analyses presently used consist of the following routines: LEO; Number of Observations; Summary Report; Breaker Period and Breaker Height Frequency and Cumulative Frequency Histograms; Breaker Period versus Time Wind Roses; Longshore Current Versus Time; and Predicted Longshore Transport Rates. They are described in "Littoral Environment Observation Program at the Coastal Engineering Research Center" by J. H. Balsillie and R. O. Bruno.

(c) Shoreline Changes. Volumetric accreation and erosion will be monitored by comparing successive surveys and aerial photographs. In this way a check on the integrity of the beach and dune system will be monitored and renourishment requirements can be assessed well in advance so that emergency situations can be avoided. The operation and maintenance manual for the project will contain information relative to the maximum shoreline retreat or volumetric erosion that should be allowed before action is initiated to start a renourishment contract. It is estimated that 18 months lead time will be necessary to fund and mobilize renourishment of the dune. Engineering judgement will be needed to predict when erosion will reach the critical quantity. In addition, however, blowouts and minor breaks in the continuity of the dune should be repaired before the hurricane season by reshaping the sand available on the beach.

15. Water Conservation Measures. The use of water conservation measures in the construction of the Grand Isle and Vicinity project was investigated during the planning and design stages. It was concluded that the nature and scope of construction required at Grand Isle, Louisiana did not afford the opportunity to use these measures during construction. However, the selection of a hardy and resistant species of vegetation will reduce the need for future irrigation requirements during drought periods. Two such species have been specified in this report. On the negative side for water conservation, it should be pointed out that construction of the project will effect future demands for consumptive use of potable drinking water. This is because of the expected increases in public use of the beach.

16. Recommendations. It is recommended that this Phase II General Design Memorandum be approved as a basis to prepare plans and specifications for the selected plan as described in paragraph 6.a., subject to local interests satisfying all of the requirements of local cooperation listed in paragraph 2.



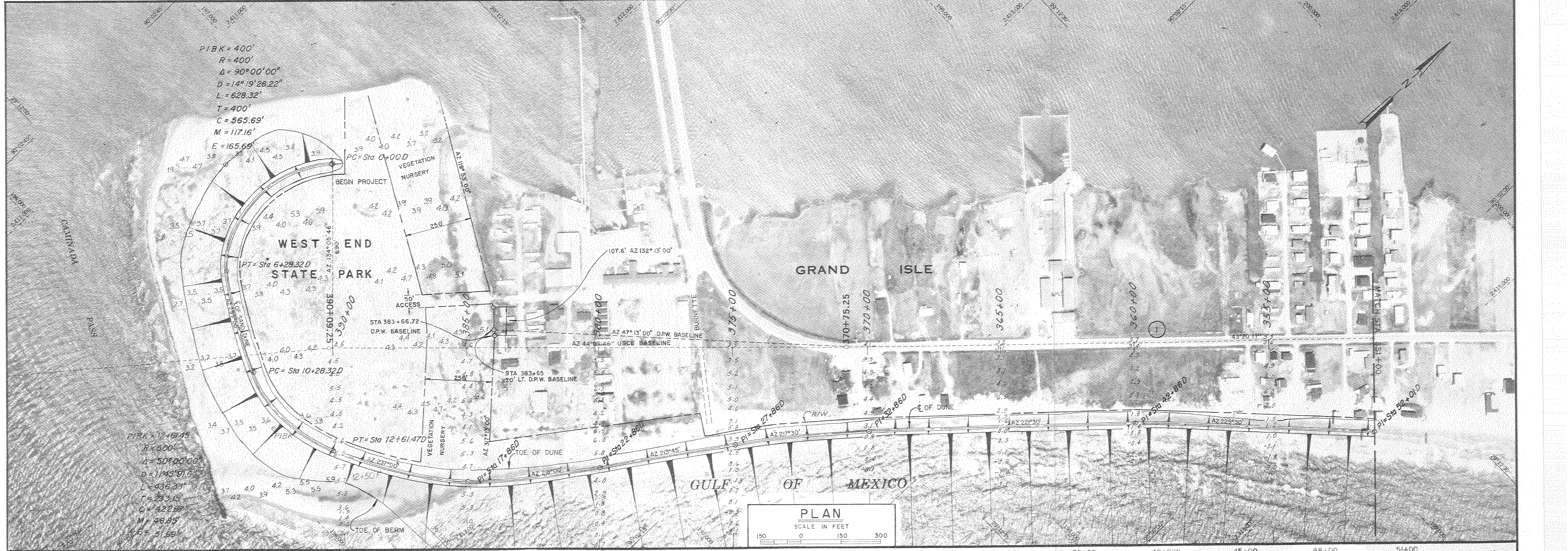
GRAND ISLE AND VICINITY, LOUISIANA

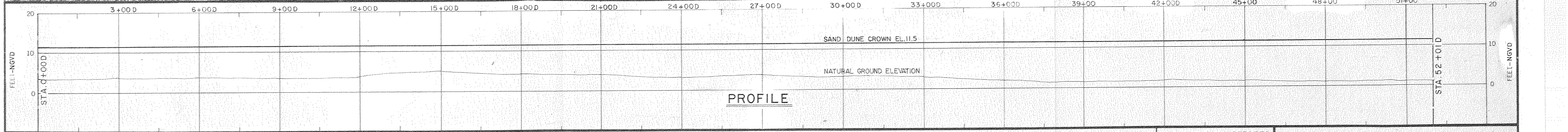
PHASE II GDM

GENERAL MAP

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

JUNE 1980 FILE NO. H-2-29038





PROFILE

TOPOGRAPHIC DATA OBTAINED FROM SURVEYS CONDUCTED NOV. 1979
CONSTRUCTION ACCESS ROADS ARE SHOWN BY STREET NAMES.
INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.
PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
390+00	392'
385+00	500'
380+00	450'
375+00	370'
370+00	315'
365+00	310'
360+00	305'
355+00	325'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

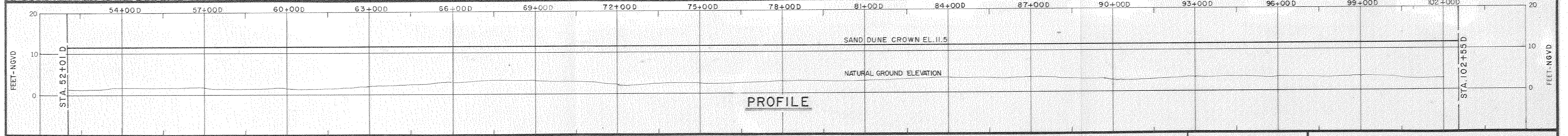
PLAN AND PROFILE

STA. 0+00D TO STA. 52+01D

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

DATE: JUNE 1980 FILE NO. H-2-29038

PLATE 2



NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
350+00	360'
345+00	400'
340+00	380'
335+00	355'
330+00	340'
325+00	325'
320+00	305'
315+00	255'
310+00	260'
305+00	260'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

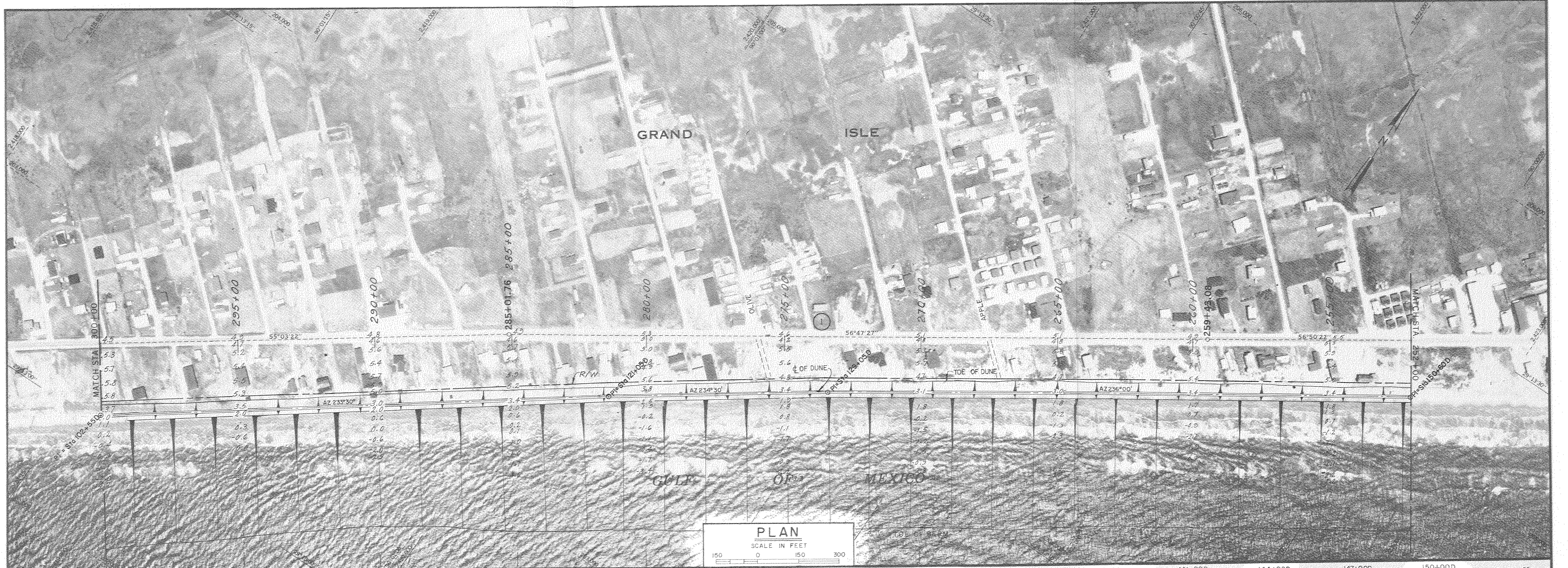
PLAN AND PROFILE

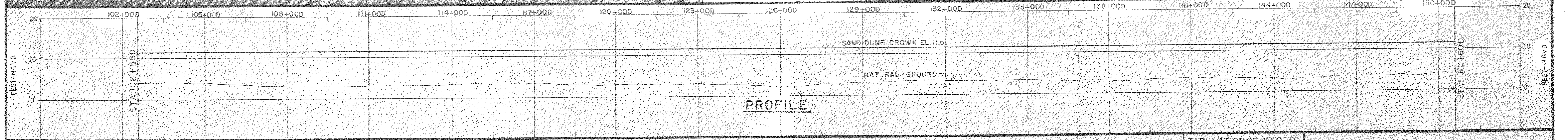
STA. 52+01 D TO STA. 102+55 D

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

DATE: JUNE 1980

FILE NO. H-2-29038





NOTES:

INSIDE THE PLAN AREA. POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.
PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
300+00	265'
295+00	260'
290+00	250'
285+00	245'
280+00	220'
275+00	210'
270+00	200'
265+00	200'
260+00	205'
255+00	205'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

PLAN AND PROFILE

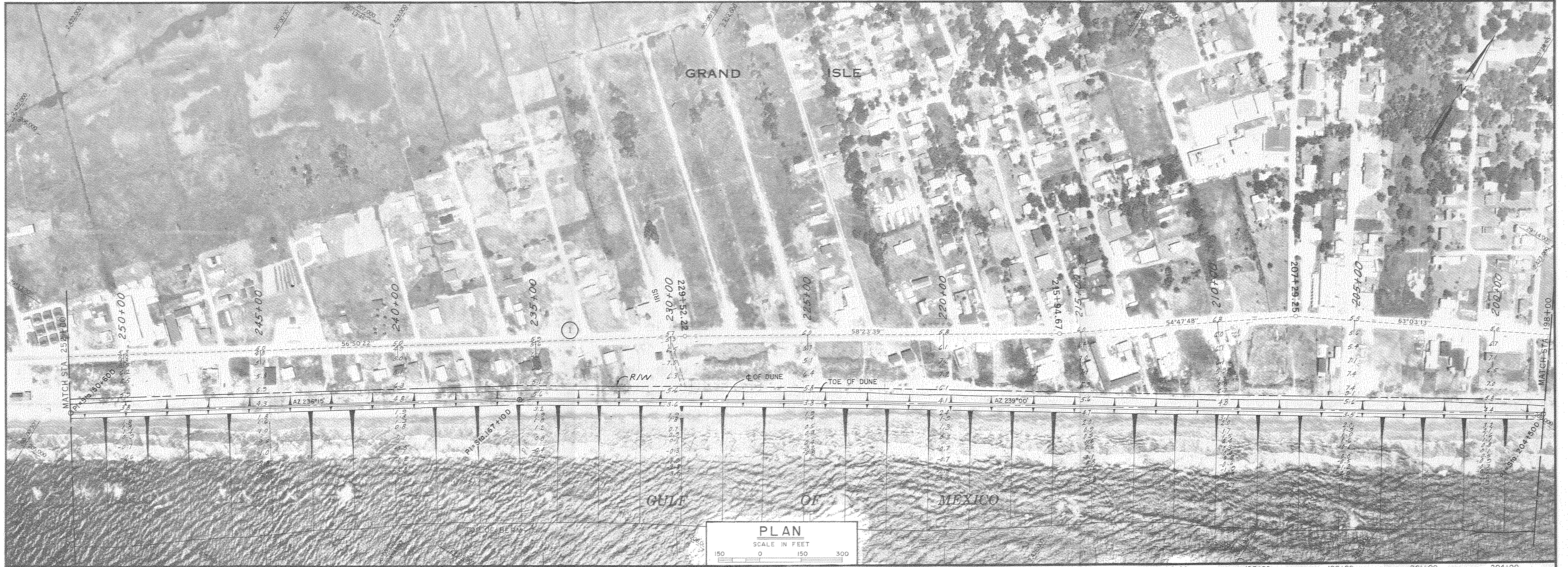
STA. 102+55D TO STA. 150+60D

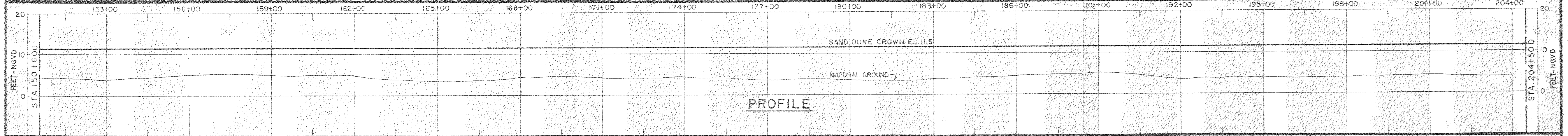
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: JUNE 1980

FILE NO. H-2-29038

PLATE 4





NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
250+00	207'
245+00	206'
240+00	210'
235+00	206'
230+00	235'
225+00	245'
220+00	255'
215+00	275'
210+00	317'
205+00	330'
200+00	305'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

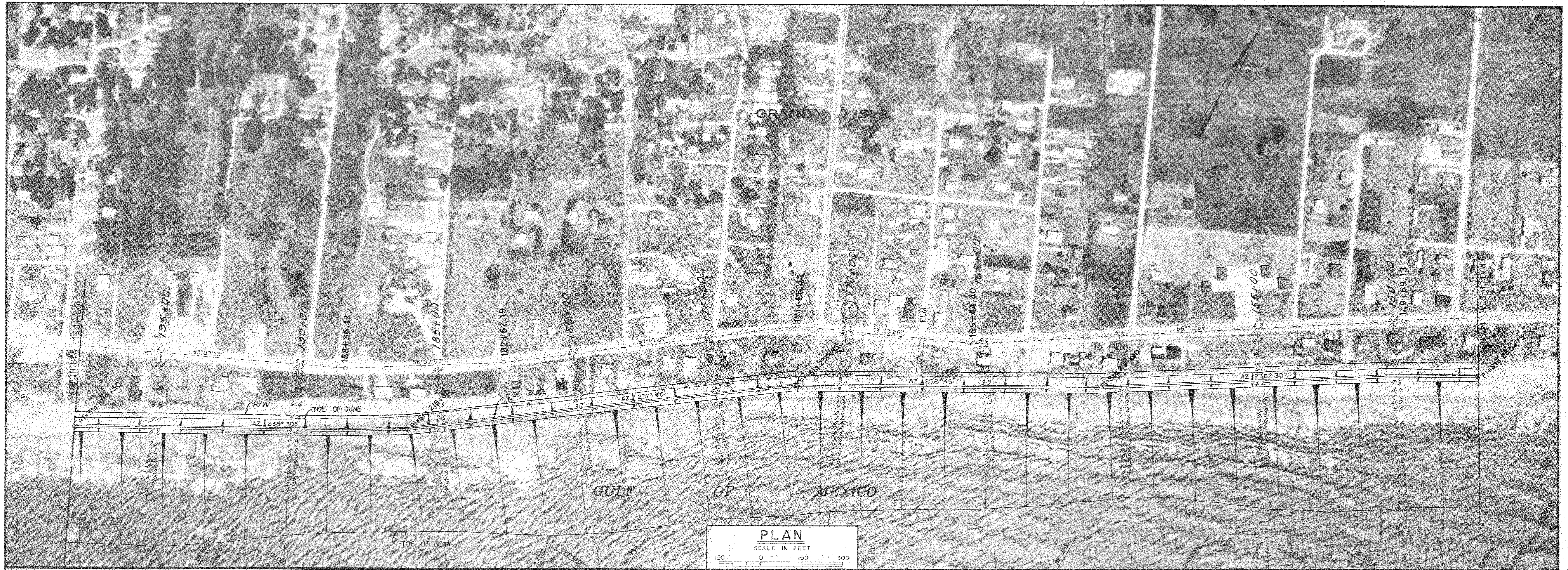
PLAN AND PROFILE

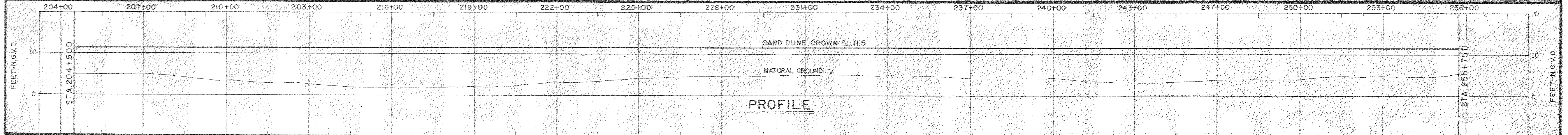
STA. 150+60D TO STA. 204+50D

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

DATE: JUNE 1980

FILE NO. H-2-29038





NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
195+00	275'
190+00	240'
185+00	220'
180+00	200'
175+00	210'
170+00	200'
165+00	160'
160+00	185'
155+00	195'
150+00	200'

GRAND ISLE AND VICINITY
LOUISIANA

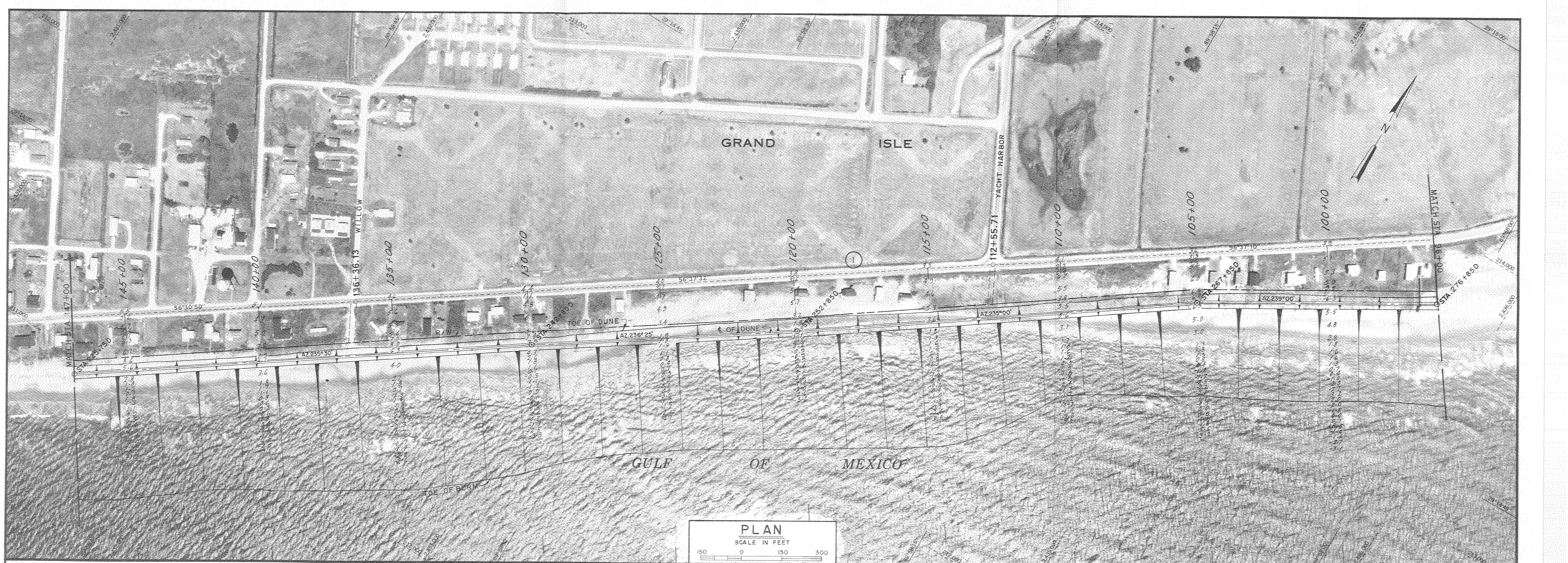
PHASE II GDM

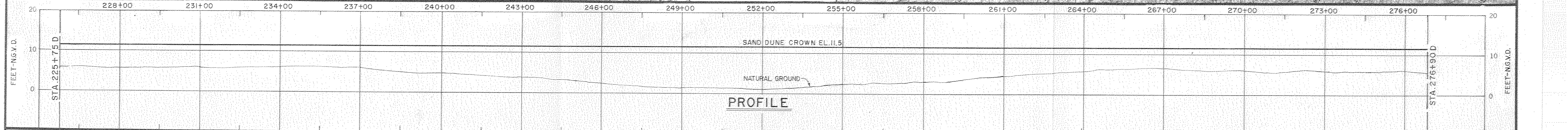
PLAN AND PROFILE

STA. 204+50D TO STA. 255+75D

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

DATE: JUNE 1980 FILE NO. H-2-29038





NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
145+00	215'
140+00	205'
135+00	205'
130+00	200'
125+00	205'
120+00	210'
115+00	200'
110+00	195'
105+00	185'
100+00	215'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

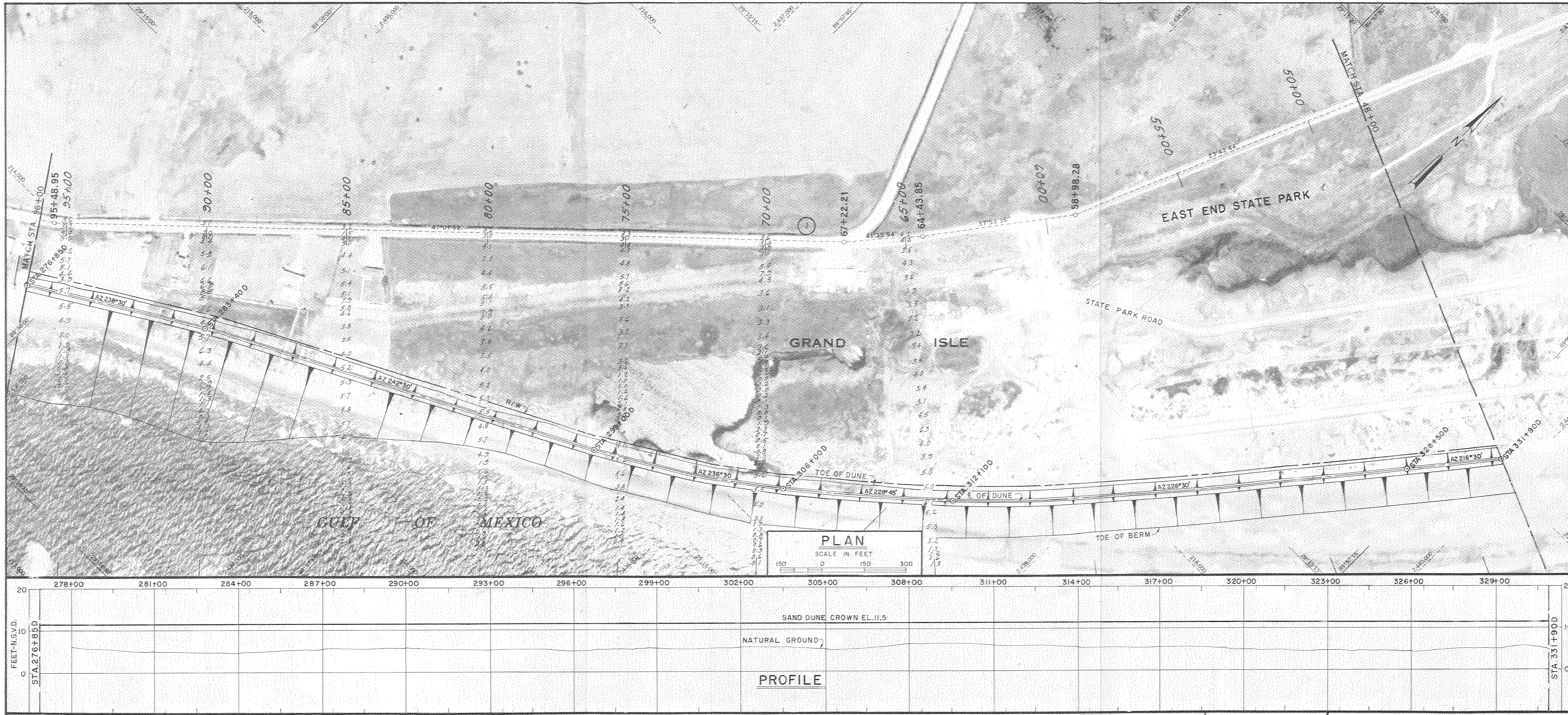
PLAN AND PROFILE

STA. 255+75D TO STA. 309+90D

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

DATE: JUNE 1980 FILE NO. H-2-29038

PLATE 7



NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

TABULATION OF OFFSETS

BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
95+00	255'
90+00	370'
85+00	510'
80+00	685'
75+00	795'
70+00	885'
65+00	947'
60+00	1015'
55+00	1185'
50+00	1335'

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

PLAN AND PROFILE

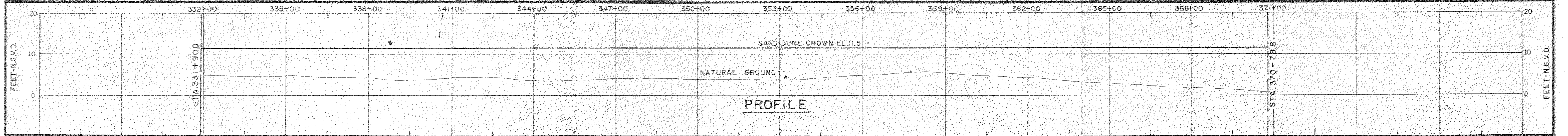
STA. 309+90D TO STA. 364+35D

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

DATE: JUNE 1980

FILE NO. H-2-29038

PLATE 8



TABULATION OF OFFSETS	
BASELINE STATION	OFFSET TO DUNE ℄ (Ft.)
45+00	1470'
40+00	1560'
35+00	1585'
30+00	1560'
25+00	1530'

NOTES:

INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.
PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

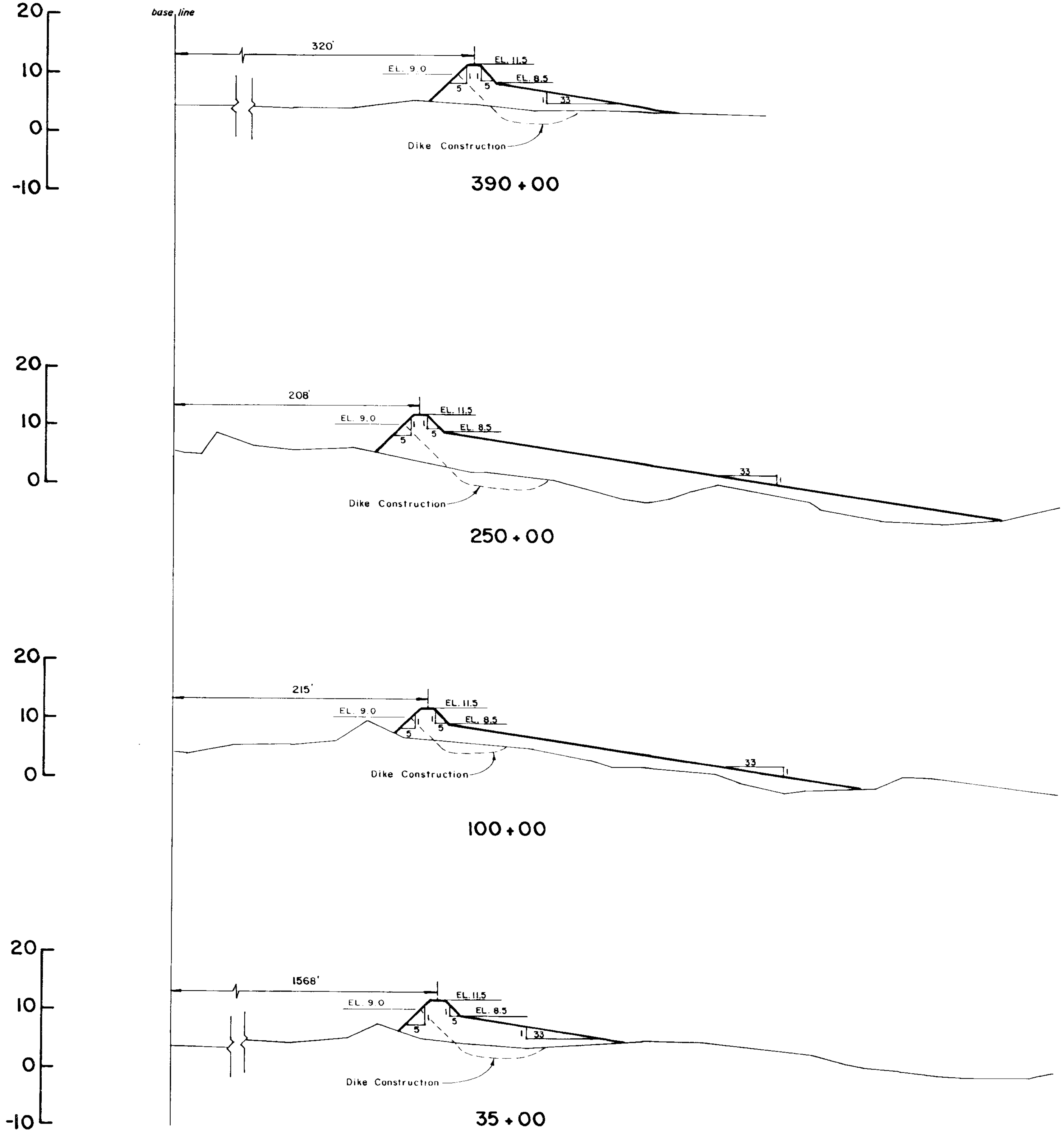
PLAN AND PROFILE

STA. 364+35D TO STA. 405+00D

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

DATE: JUNE 1980 FILE NO. H-2-29038

PLATE 9



Notes:

Stations shown are baseline stations.
Elevation measured in N.G.V.D.

50 0 50 100

Vertical scale: 1" = 10'-0"

Horizontal scale: 1" = 50'-0"

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

TYPICAL SECTIONS

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

DATE: JUNE 1980 FILE NO. H-2-29038

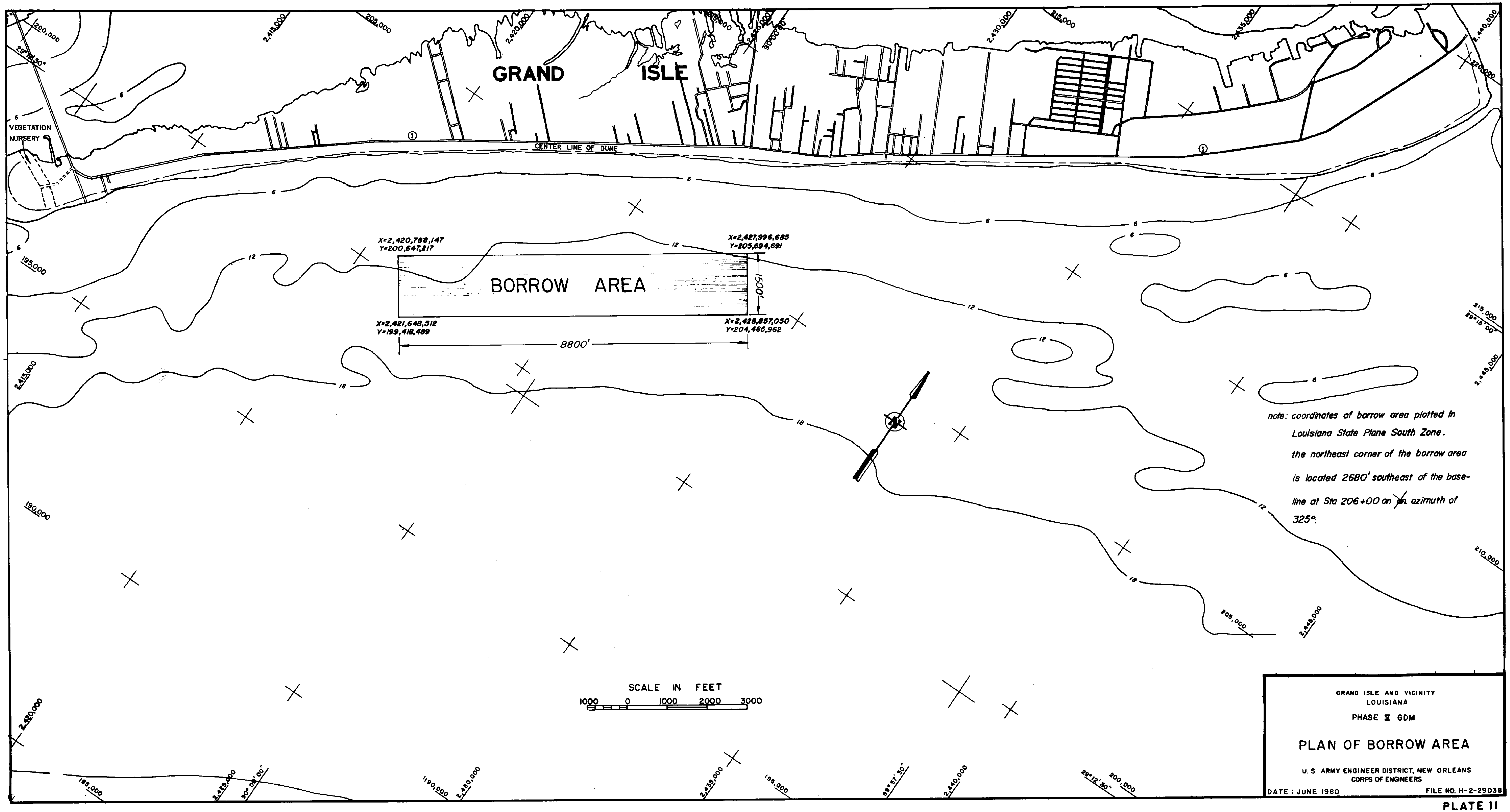
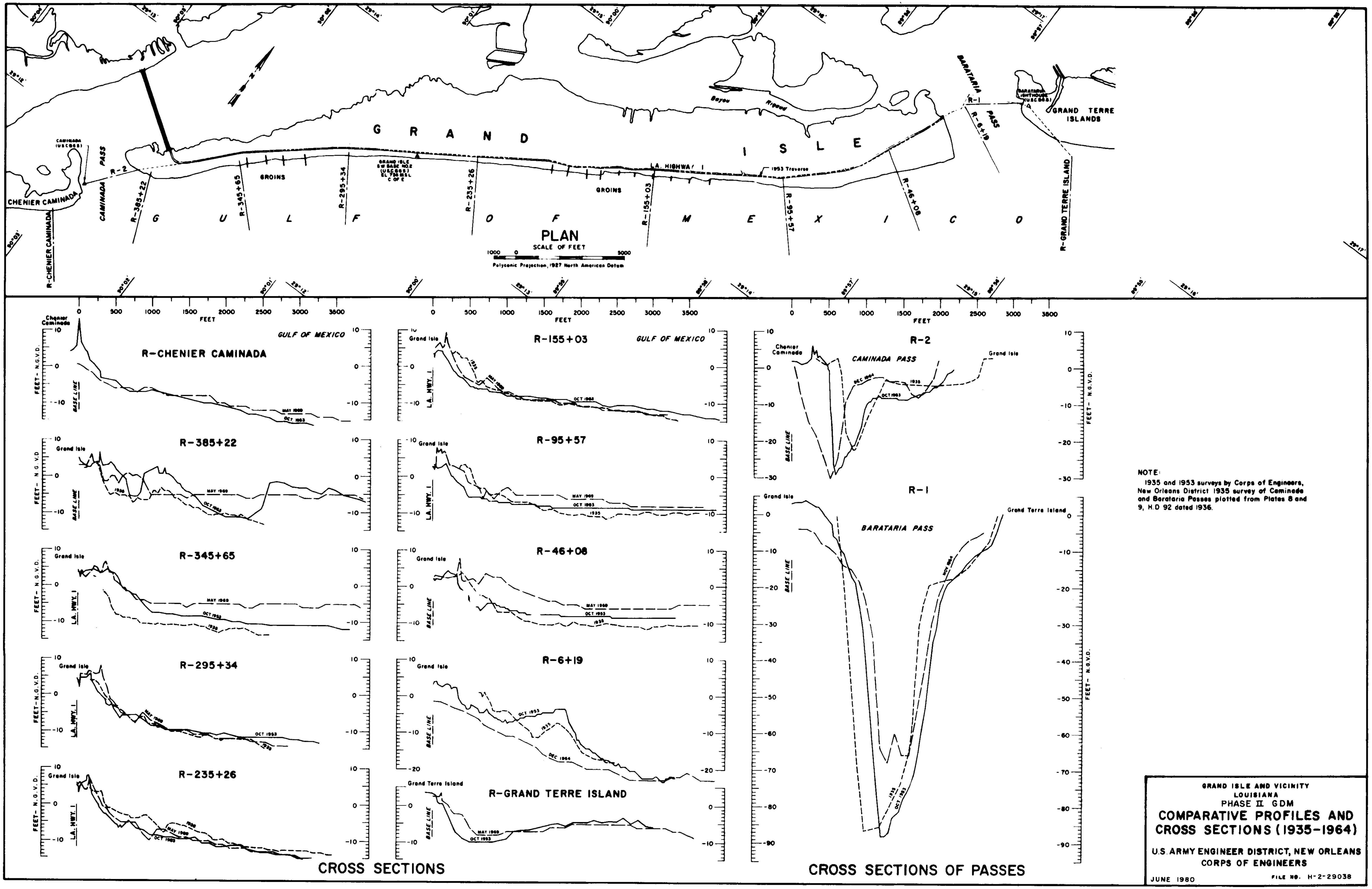

GRAND ISLE
VEGETATION NURSERY
CENTER LINE OF DUNE
BORROW AREA
X=2,420,788,147
Y=200,647,217
X=2,427,996,685
Y=205,894,691
X=2,421,648,512
Y=199,418,489
X=2,428,857,050
Y=204,465,962
8800'
1500'
note: coordinates of borrow area plotted in Louisiana State Plane South Zone.
the northeast corner of the borrow area is located 2680' southeast of the base-line at Sta 206+00 on an azimuth of 325°.
SCALE IN FEET
1000 0 1000 2000 3000
GRAND ISLE AND VICINITY
LOUISIANA
PHASE II GDM
PLAN OF BORROW AREA
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: JUNE 1980
FILE NO. H-2-29038

PLATE 11



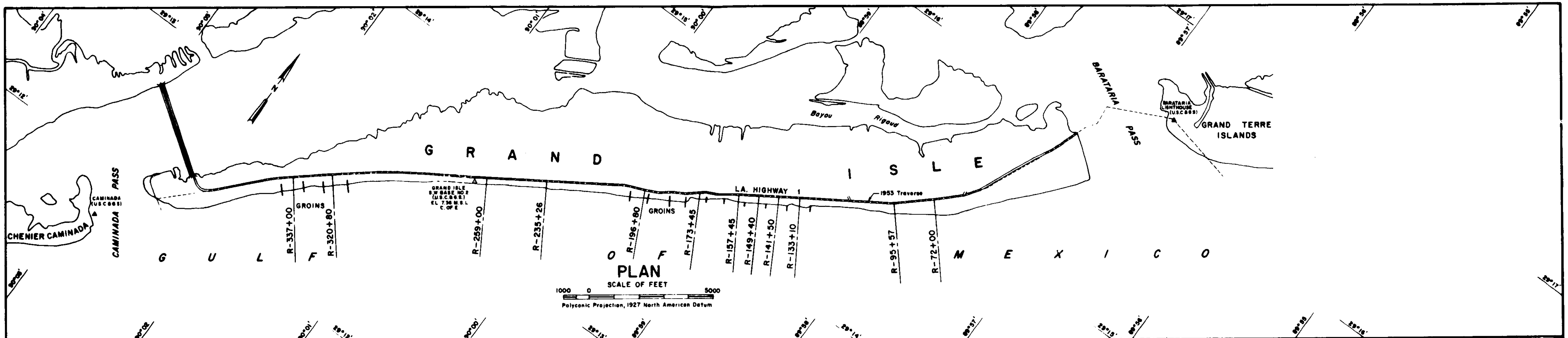
GRAND ISLE AND VICINITY
LOUISIANA
PHASE II GDM

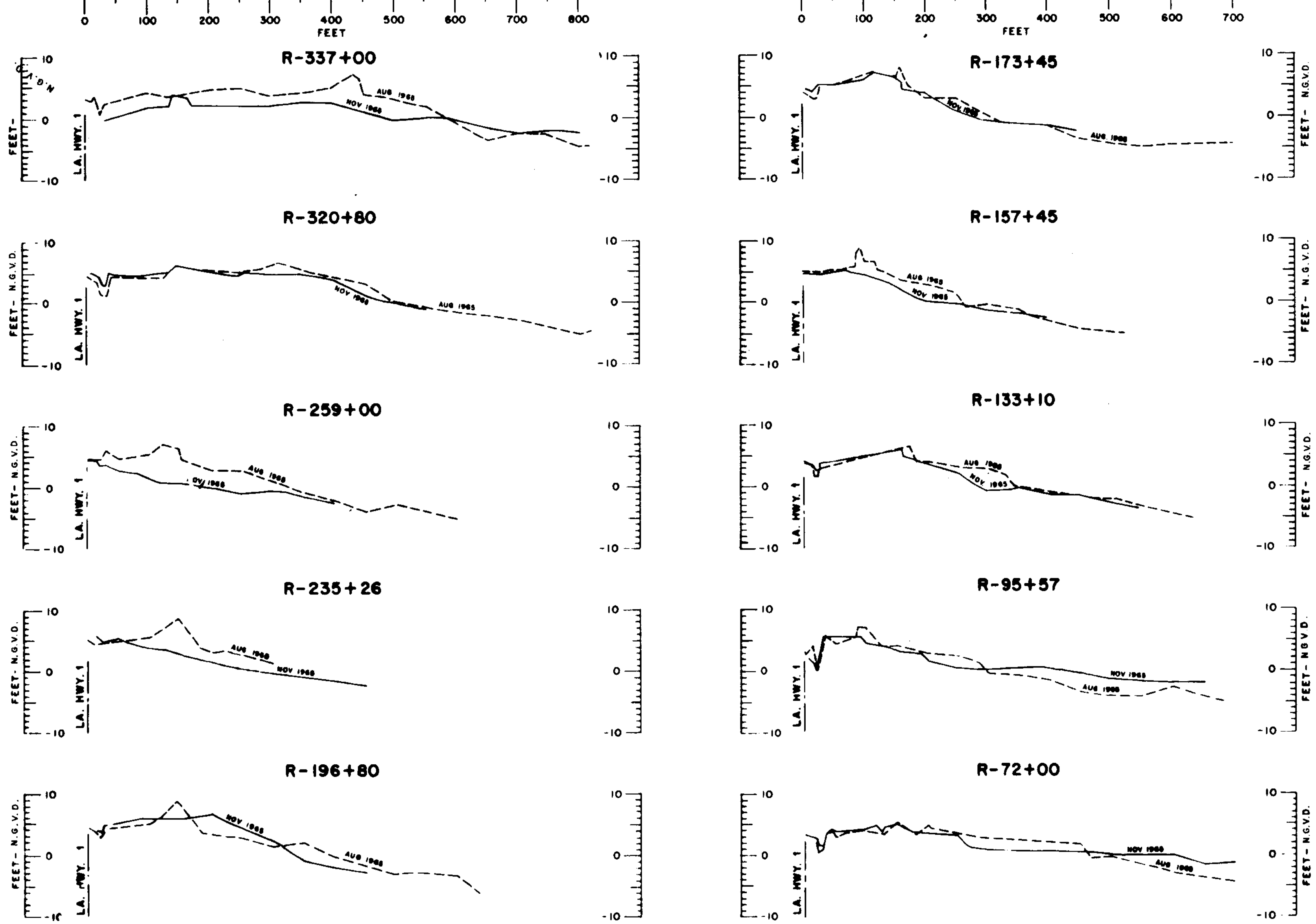
COMPARATIVE PROFILES AND CROSS SECTIONS (1935-1964)

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

JUNE 1980 FILE NO. H-2-29038

PLATE 12





BEFORE & AFTER CROSS SECTIONS — HURRICANE "BETSY"

GRAND ISLE AND VICINITY
LOUISIANA
PHASE II GDM

COMPARATIVE PROFILES AND CROSS SECTIONS (1965-1970)

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

JUNE 1980 FILE NO. H- 2-29038

PLATE 13

APPENDIX A

Geology and Soils

APPENDIX A

GRAND ISLE AND VICINITY, LOUISIANA
PHASE II GENERAL DESIGN MEMORANDUM

GEOLOGY AND SOILS

1. PHYSIOGRAPHY

The study area is located on the deltaic plain of the Mississippi River, a region of extremely low relief. Specifically, the area is situated on the northeast side of the distal end of the remnants of an ancient lobate delta of the Mississippi River known as the Lafourche delta. The principal physiographic features of the delta are the ancient course of the Lafourche stage Mississippi River; delta margin islands flanking the ancient delta; beaches along the gulfward margin of the mainland and islands facing the gulf; marshlands and inland bodies of water that lie landward of the shoreline beaches; and sand ridges--called chenieres--which locally parallel the coastline on the mainland.

Elevations range from 4 to 6 feet National Geodetic Vertical Datum (NGVD) along the crests of the chenieres and beach ridges to about 1 or 2 feet above sea level in the marshlands. The inland bays and lakes are very shallow.

2. GENERAL GEOLOGY

Only the geologic history in the last 4,000 to 5,000 years is significant for this study. During that time, the rise in sea level ceased, many lobate deltas were formed, and a gulfward growth of the land mass began. As the land mass advanced seaward, the course of the Mississippi River, and its associated deltas, shifted many times, depositing a front of fine-grained alluvium over the entire area. After each change in the course of the Mississippi and its corresponding delta, the effects of subsidence and erosion became the dominant process within the abandoned delta. The gulfward edge of the abandoned delta began a landward retreat forming accurate sandy delta margin islands with well developed beaches consisting primarily of the coarser sediments of the reworked distributary deposits. Grand Isle, which flanks the gulfward end of the abandoned Lafourche delta, is an example of these delta margin islands.

3. INVESTIGATIONS PERFORMED

One-hundred sixteen subsurface borings extending in depths between 6.5 and 60 feet were made in the general vicinity of Grand Isle, La., between March 1964 and October 1979. Thirty-eight of these borings were made between March 1964 and April 1970 on the island proper, on the mainland, on Grand Terre Island, in some of the shallow inland bays, and several were made in the offshore area immediately south of Grand Isle.

Locations of these borings are shown on Plate A-1. Three undisturbed borings and thirty shallow general-type borings were made between July 1975 and August 1978. The locations of these borings are shown on Plates A-4, A-13, and A-14. Forty-two vibra-core borings were made offshore in July 1979, and three more were made at the eastern end of the island in October 1979. Their locations are shown on Plate A-4. In addition to the subsurface borings, 77 surface samples were taken. In 1964, 52 surface samples were taken at various ranges on the front (south) side of Grand Isle and at several ranges on the mainland and on the inland bays. The samples were taken at the shoreline, at the 6-foot depth, and at the 12-foot depths. Location of these ranges is shown on Plate A-I. In 1979, 25 surface samples were taken at five different ranges (95+57; 155+03; 235+26; 295+4; and 345+46) along the front of Grand Isle. The samples were taken at the +6, +3, 0, -3, and -6 elevation points on the ranges. Tests performed on all the samples included visual classification, water content, and mechanical sieve analyses. Boring logs and test results are shown on Plates A-1, A-2, A-3, A-5, A-7, A-8, A-9, A-10, and A-11. In addition, the samples taken in 1979 (both surface and subsurface) were resieved using a sieve size interval of ¼ Ø. Finally, in July 1979 an acoustic subbottom profile survey was conducted by WES in the offshore area south of Grand Isle. The profile was run in several lines which extended from the eastern to western ends of the island, and southward to a distance of about 2 miles offshore.

4. SUBSURFACE CONDITIONS

As indicated by the acoustic subbottom profile, boring data and other information, the subsurface at Grand Isle consists of Holocene deposits approximately 450 feet thick, underlain by very stiff to stiff Pleistocene materials. Generally, the Holocene consists of an upper sequence, 8 to 10 feet thick, of horizontally bedded sands and silty sands underlain by a 10 to 25-foot thick sequence of interbedded sandy silts, silts and clays. Underlying these two sequences is a thick wedge of medium prodelta clays. As indicated on the isopach map (Plate A-6), the upper sequence, which would yield the most suitable borrow material for beach replenishment, reaches its maximum thickness near the midway point of the island and thins markedly towards the east and west. An exception to this is in the general vicinity of Caminada Pass where thickness of 12 feet of silty sand and sand are encountered.

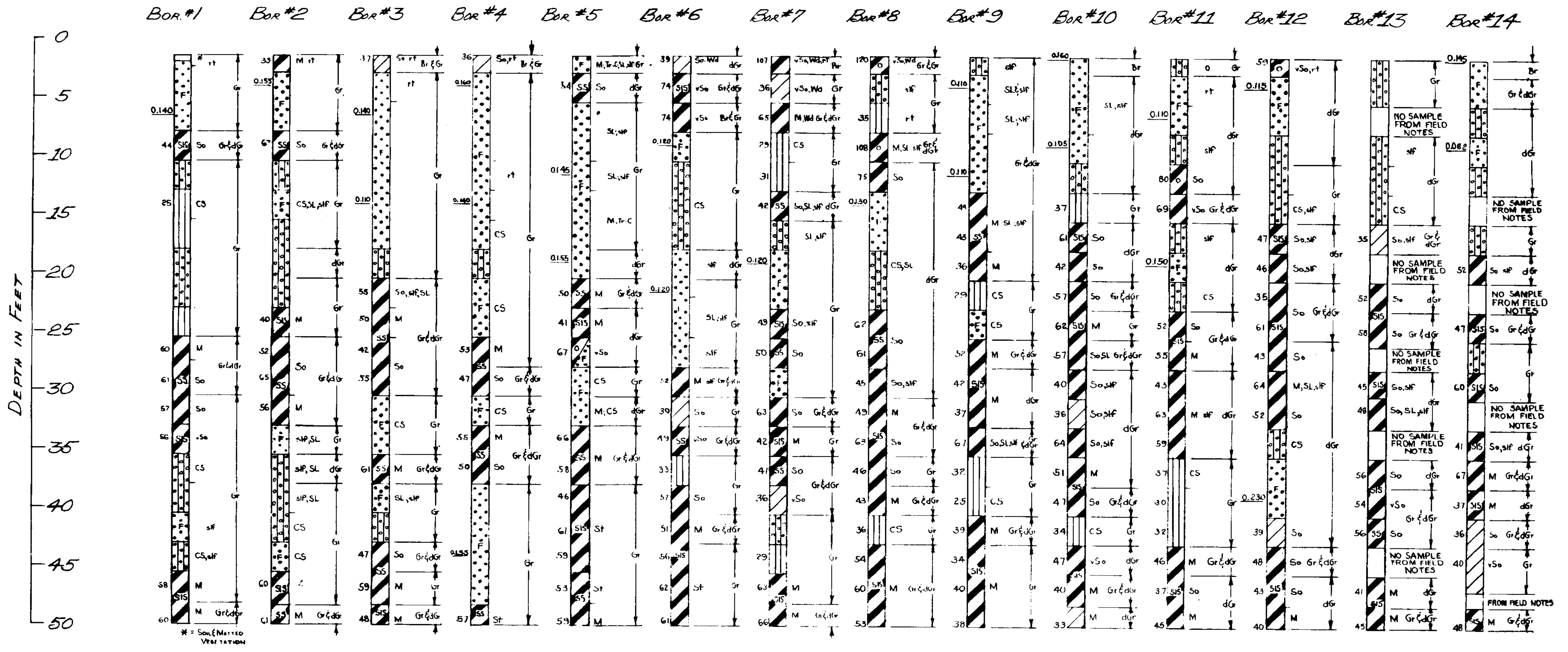
5. CONCLUSIONS AND RECOMMENDATIONS

Based on available geologic and subsurface data, at least 11 areas, both on and offshore appear to have sand of sufficient quality and quantity to warrant consideration as sources of material for dune construction and beach replenishment. (shaded areas on Plates A-1, A-6, A-13 and A-14). Other considerations, including existance of pipelines, oyster reefs, and difficulty of acquiring property indicate that an area approximately 3,000 feet off the gulfside of Grand Isle is the most favorable of all the feasible sites. The recommended offshore borrow area measures 8,700 X 1,500 feet in aerial extent and ranges from 6 to 9 feet thick and is indicated on Plate A-6. Assuming dredging the available material to an average depth of 8 feet, approximately 3.9 million cubic yards of sand are available for dune construction. A study of the longshore currents off Grand Isle indicates that usable sand deposits may also occur to the east of the sampled area within the area of pipelines which are located on Plate A-6. These deposits possibly extend farther seaward than the 3,000-6,000 feet in the western and central portions of the study area.

6. SOILS

Based upon undisturbed borings (Plates A-9 through A-11) and a stability analysis (Plate A-12), no soil stability problems exist in building the proposed dune even with wave berms omitted.

Therefore, no unusual problems should be encountered in constructing a sand dune to an elevation of 11.5 with the wave berm.



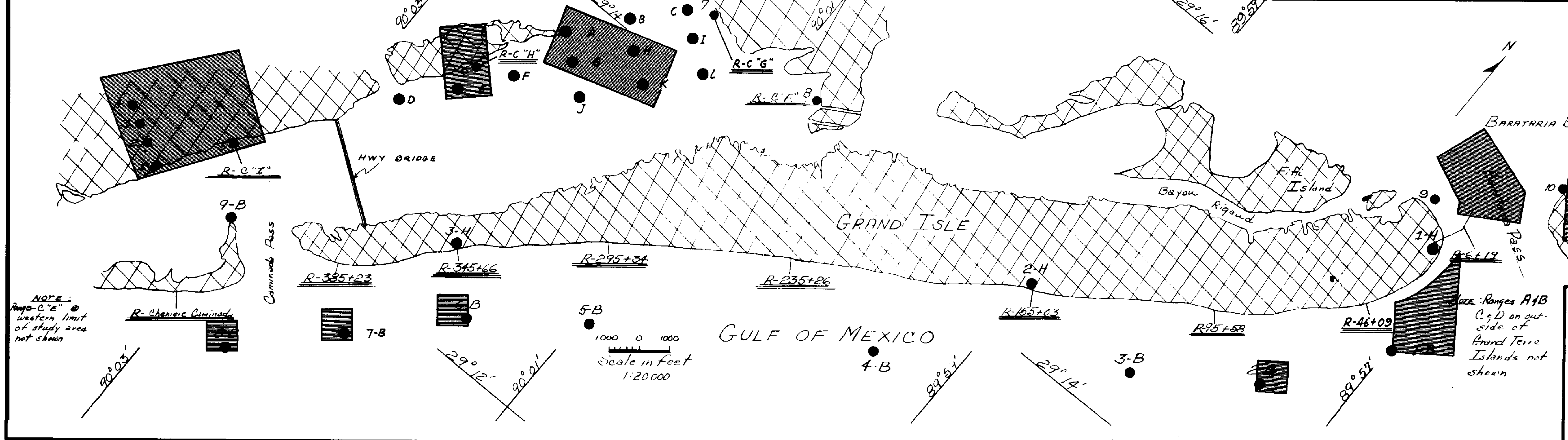
ANALYSIS OF BEACH SAMPLES

LOCATION	CLASS	D-50(mm)
R-C "F" @ beach	SM-1-S	0.1250
R-C "F" 250' off	SM-1	0.1150
R-C "G" @ beach	Matt Veg.	No NA.
R-C "G" 200' off	SP	0.1400
R-C "G" 350' off	SM-1-S	0.1600
R-C "H" @ beach	ML-1	0.0605
R-C "H" 150' off	ML-1	0.0490
R-C "I" @ beach	SM-1	0.1250
R-C "I" 150' off	SP	0.1500
R-C "I" 300' off	SP	0.1300
R-A @ beach	SP	0.1650
R-A 6' depth	SP	0.1250
R-A 12' depth	ML-1	0.0740
R-B @ beach	SP	0.1700
R-B 6' depth	SM-1	0.0740
R-B 12' depth	SM-1-S	0.1200
R-C @ beach	SP	0.1750
R-C 6' depth	ML-2-S	0.0620
R-C 12' depth	ML-2-S	0.0640
R-D @ beach	SP	0.1750
R-D 6' depth	SM-1-S	0.1005
R-D 12' depth	ML-2	0.0350
R-6+19 @ beach	SP	0.1300
R-6+19 6' depth	SM-1-S	0.0970
R-6+19 12' depth	SP	0.1250
R-46+09 @ beach	SP	0.1400
R-46+09 6' depth	SP	0.1255
R-46+09 12' depth	ML-1	0.0670

LOCATION	CLASS	D-50(mm)
R-95+48 @ beach	SP	0.1750
R-95+48 6' depth	SP	0.1050
R-95+48 12' depth	SM-1-S	0.1200
R-155+03 @ beach	SP	0.1900
R-155+03 6' depth	SP	0.1200
R-155+03 12' depth	SM-1	0.1050
R-235+26 @ beach	SP	0.1250
R-235+26 6' depth	SP	0.1300
R-235+26 12' depth	SM-1-S	0.1050
R-295+34 @ beach	SP	0.1700
R-295+34 6' depth	SP	0.1350
R-295+34 12' depth	SM-1	0.0890
R-345+66 @ beach	SP	0.1800
R-345+66 6' depth	SP	0.1400
R-345+66 12' depth	ML-1	0.0790
R-385+23 @ beach	SP	0.1800
R-385+23 6' depth	SP	0.1800
R-385+23 12' depth	ML-1	0.0780
R-Chen Cam. @ beach	SP	0.1800
R-Chen Cam. 6' depth	SP	0.1250
R-Chen Cam. 12' depth	SM-1-S	0.0750
R-C "E" @ beach	SP	0.1750
R-C "E" 6' depth	SP	0.1700
R-C "E" 12' depth	SM-1-S	0.0940

CLASS	% Sand
SP	90-100
SM-1-S	80-90
SM-1	60-80
ML-1	45-60
ML-2-S	20-45

Bor. 1 - 14 were made in March, 1964 using an open bottom sampler
Under-lined figures to left of boring indicate D50 size in mm.
Bor. 1-B - 9-B were made in November, 1965 See Plate 2 for logs
Bor. 1-H - 3-H were made in April, 1970 See Plate 2 for logs



GRAND ISLE AND VICINITY, LOUISIANA

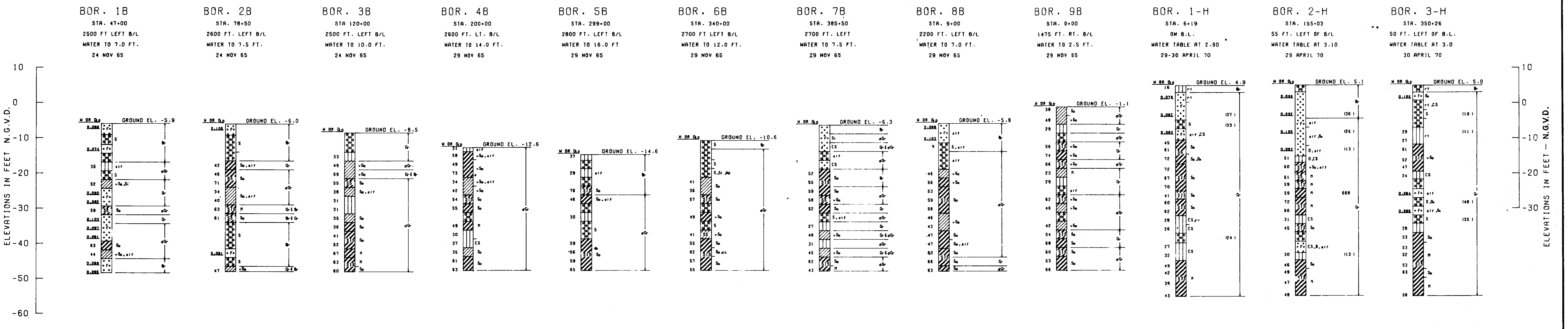
PHASE II GDM

BORING LOCATIONS (1964, 1965, 1970)
PLOTTED BORING LOGS (1964)
INVESTIGATED BORROW AREAS

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

JUNE 1980 FILE NO. H-2-29038

PLATE A-1



NOTE:

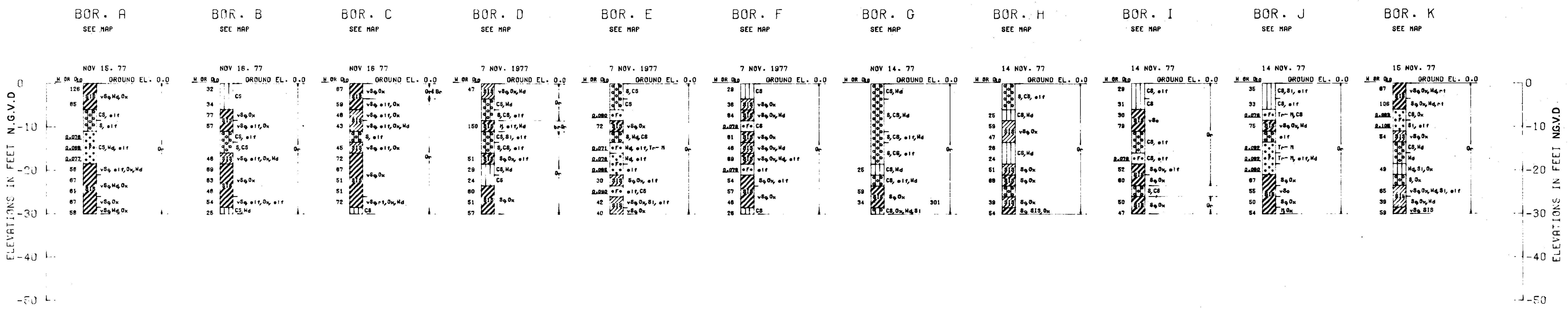
1. Borings 1-B thru 9-B made in Nov. 1965 with a $1\frac{7}{8}$" I.D. Core Barrel Sampler.
2. Borings 1-H thru 3-H made in Apr. 1970 with a $1\frac{7}{8}$" I.D. Core Barrel Sampler & a $1\frac{3}{8}$" Split Spoon Sampler.
3. See Plate A-1 For Boring Locations.

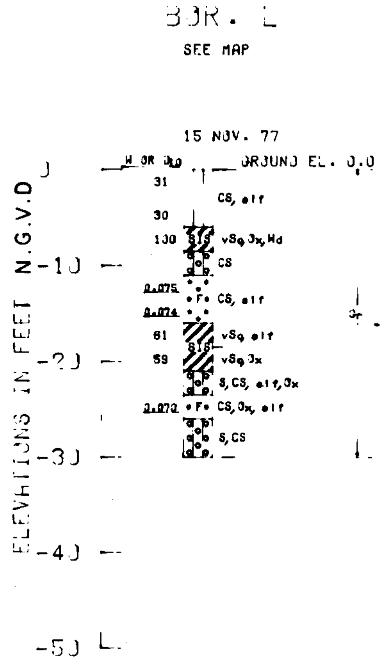
GRAND ISLE AND VICINITY
LOUISIANA
PHASE II GDM

SOIL BORING DATA

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

JUNE 1980 FILE NO. H-2-29038





NOTE:

1. See Plate A-1 For Boring Locations.

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

SOIL BORING DATA

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

JUNE 1980 FILE NO. H-2-29038

GRAND ISLE AND VICINITY, LOUISIANA

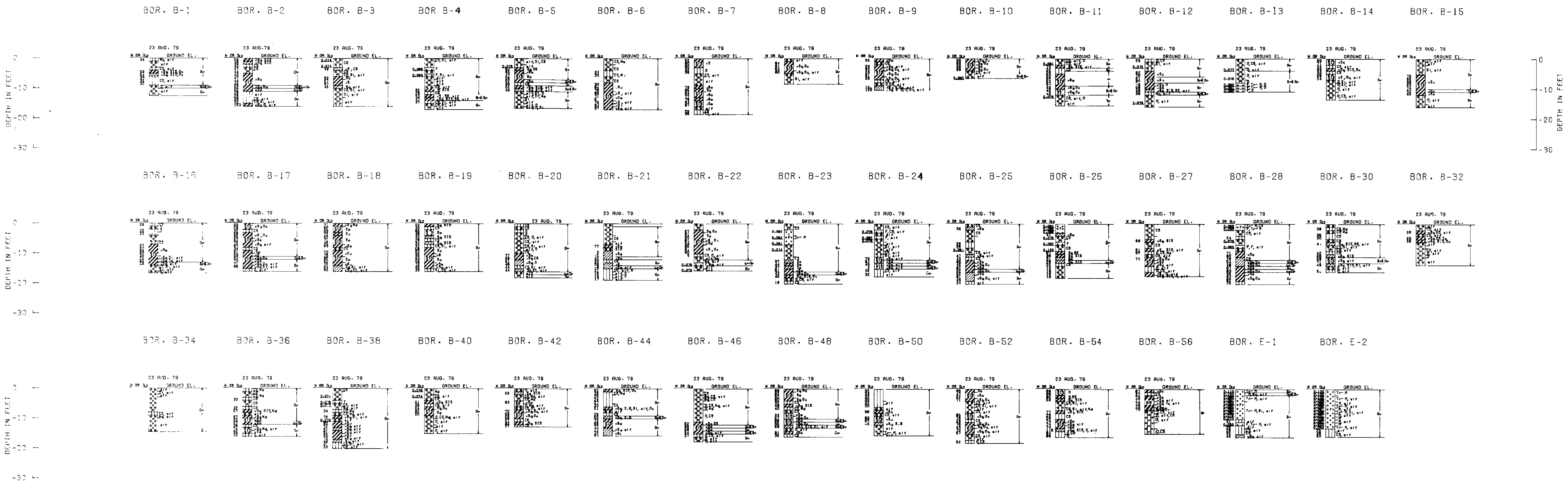
PHASE II GDM

BORING LOCATION (OFFSHORE 1979)

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

JUNE 1980 FILE NO. H-2-29038

PLATE A-4



NOTE:
1. See plate A-4 for Boring Locations.

GRAND ISLE AND VICINITY, LOUISIANA

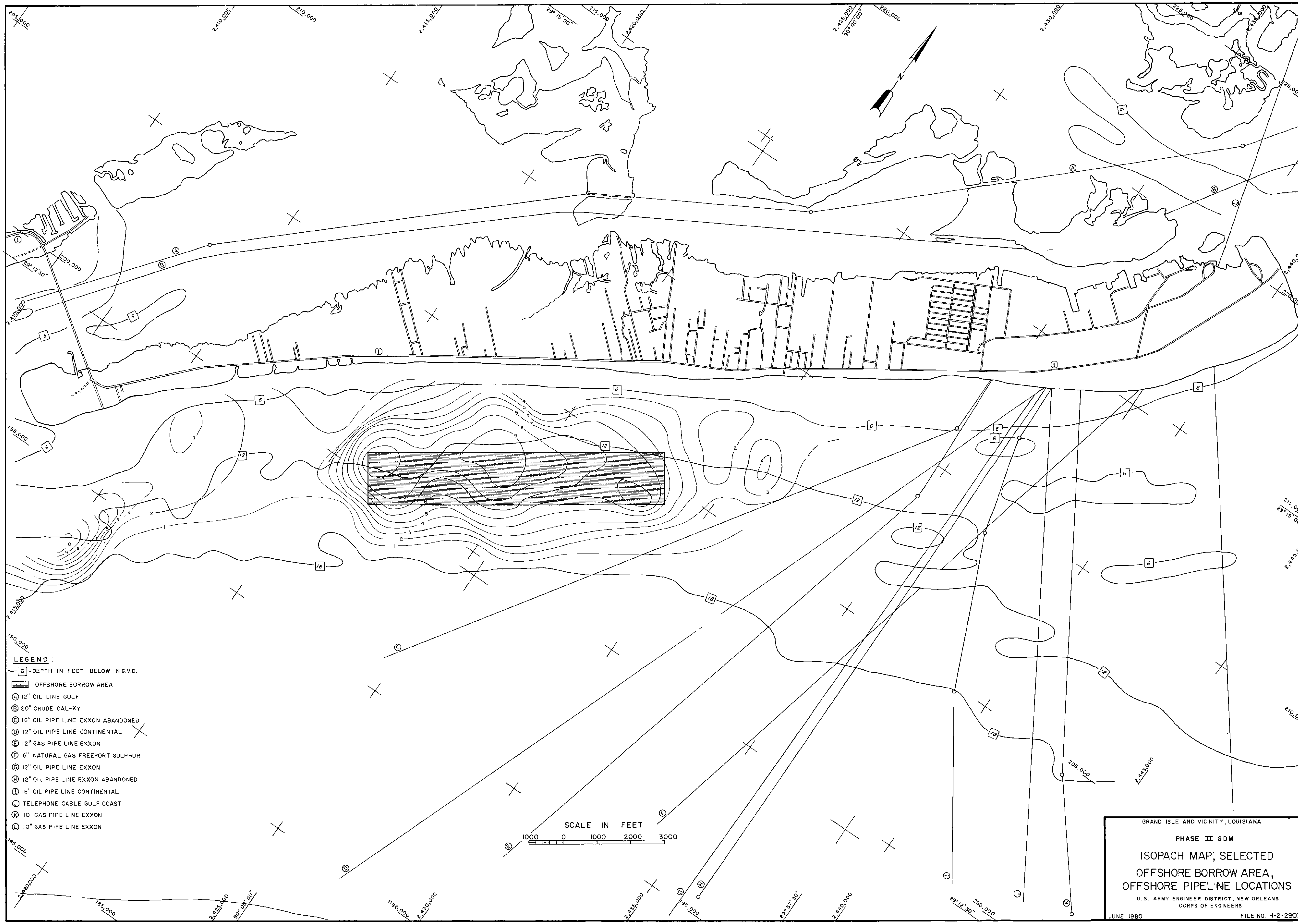
PHASE II GDM

SOIL BORINGS (OFFSHORE 1979)

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

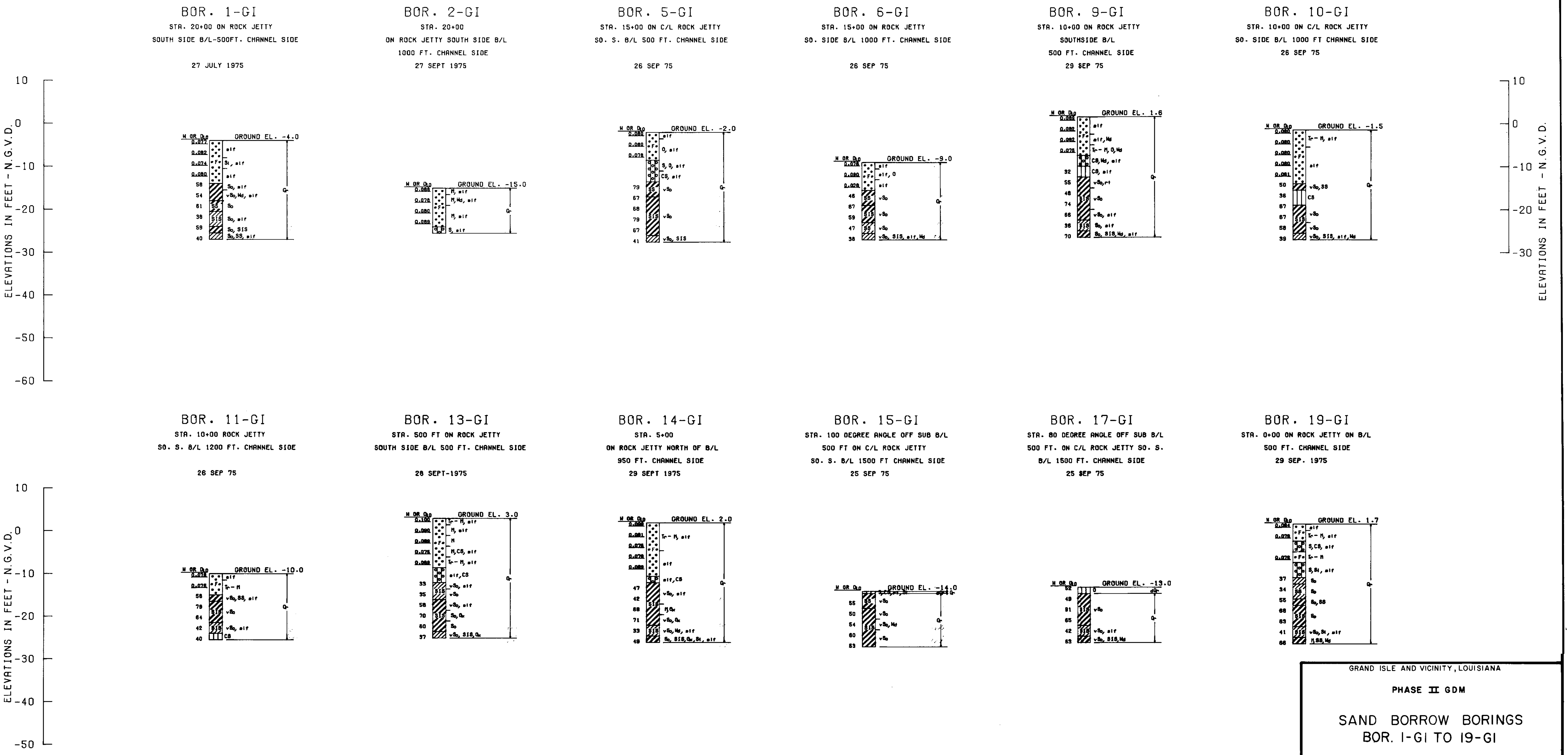
JUNE 1980 FILE NO. H-2-29038

PLATE A-5



LEGEND:
6 DEPTH IN FEET BELOW N.G.V.D.
OFFSHORE BORROW AREA
Ⓐ 12" OIL LINE GULF
Ⓑ 20" CRUDE CAL-KY
Ⓒ 16" OIL PIPE LINE EXXON ABANDONED
Ⓓ 12" OIL PIPE LINE CONTINENTAL
Ⓔ 12" GAS PIPE LINE EXXON
Ⓕ 6" NATURAL GAS FREEPORT SULPHUR
Ⓖ 12" OIL PIPE LINE EXXON
Ⓗ 12" OIL PIPE LINE EXXON ABANDONED
Ⓘ 16" OIL PIPE LINE CONTINENTAL
Ⓙ TELEPHONE CABLE GULF COAST
Ⓚ 10" GAS PIPE LINE EXXON
Ⓛ 10" GAS PIPE LINE EXXON
SCALE IN FEET
1000 0 1000 2000 3000
GRAND ISLE AND VICINITY, LOUISIANA
PHASE II GDM
ISOPACH MAP; SELECTED
OFFSHORE BORROW AREA,
OFFSHORE PIPELINE LOCATIONS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
JUNE 1980
FILE NO. H-2-29038

PLATE A-6



GRAND ISLE AND VICINITY, LOUISIANA

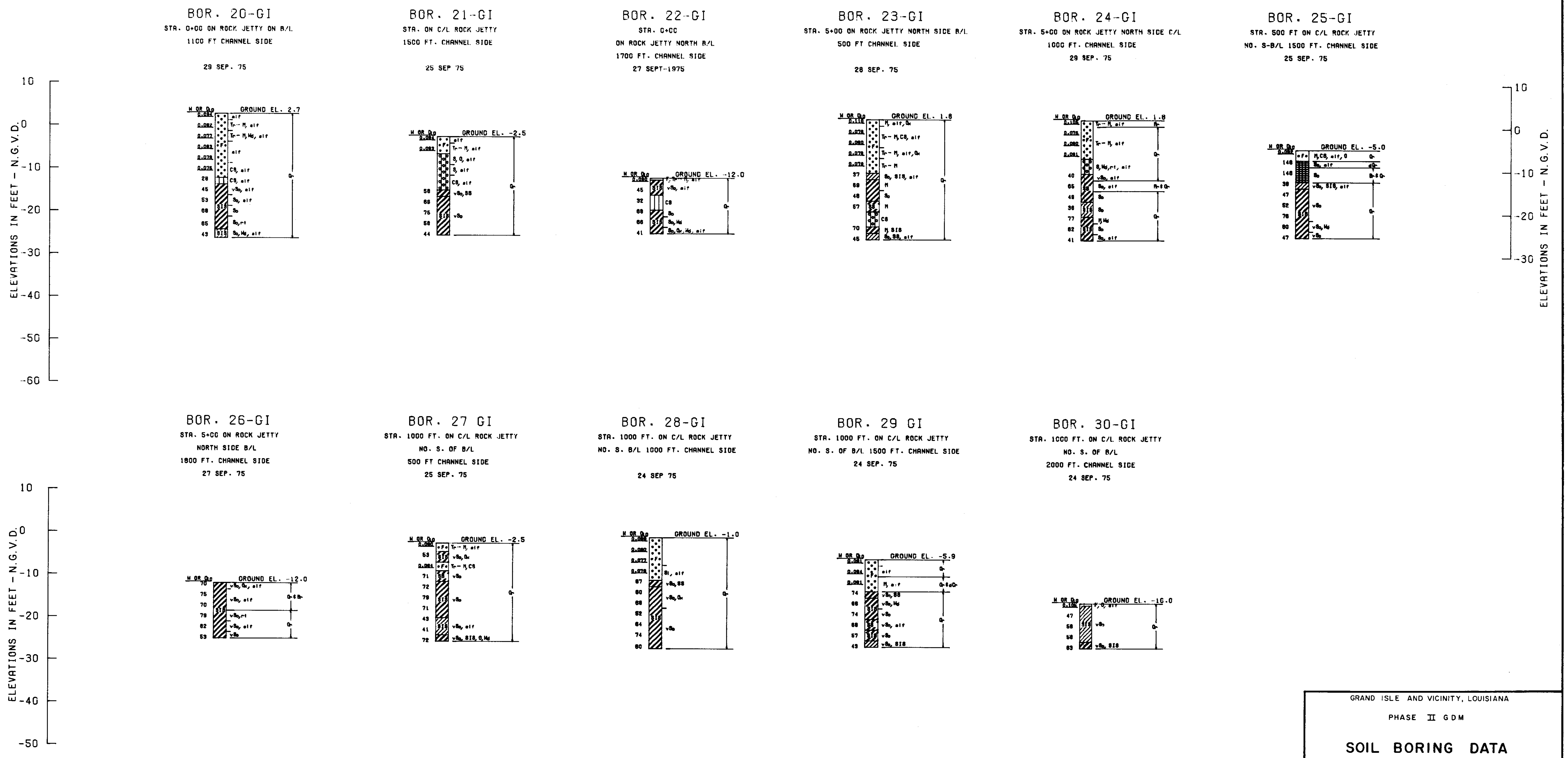
PHASE II GDM

SAND BORROW BORINGS
BOR. I-GI TO 19-GI

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

JUNE 1980 FILE NO. H-2-29038

PLATE A-7



GRAND ISLE AND VICINITY, LOUISIANA

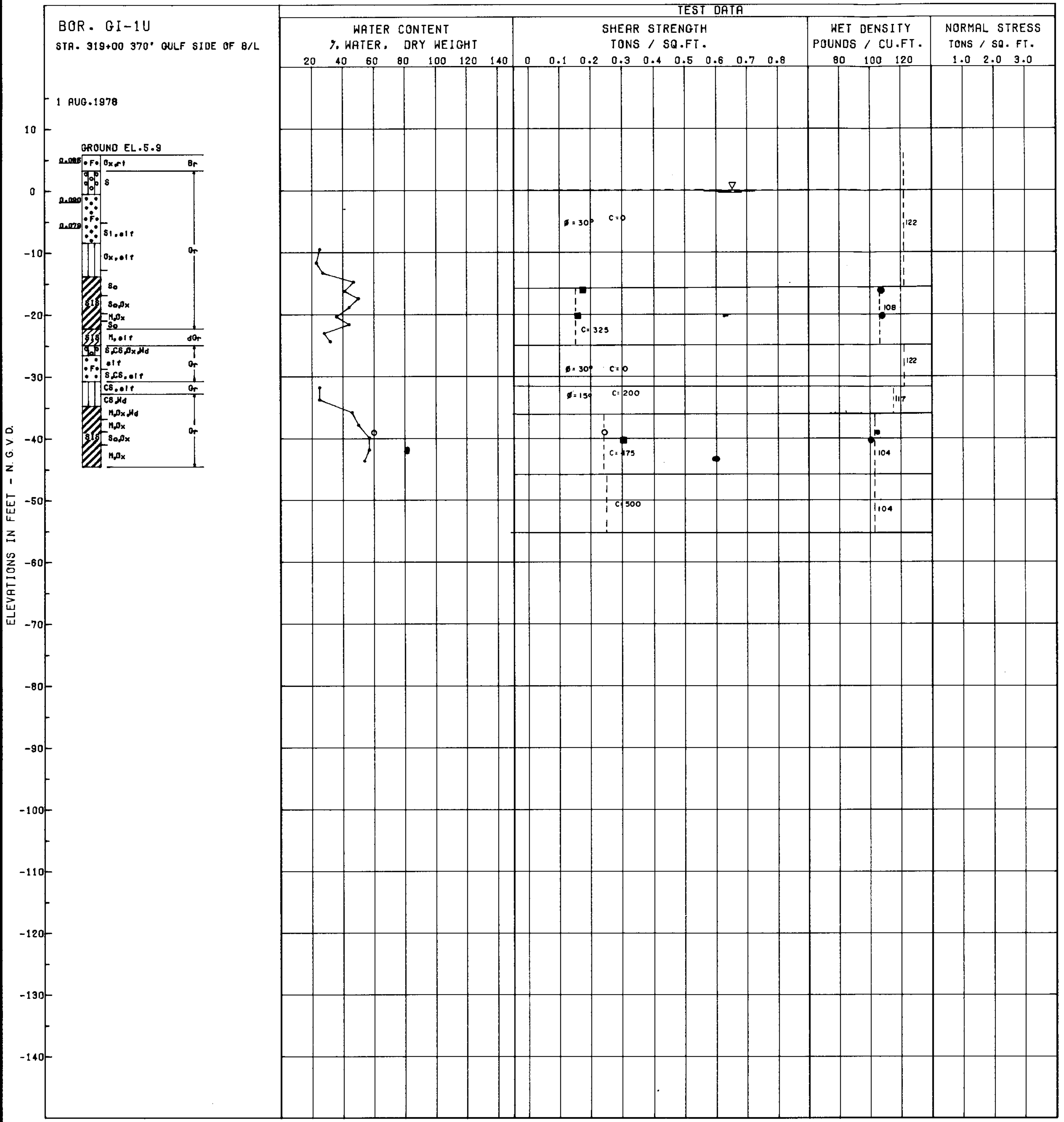
PHASE II GDM

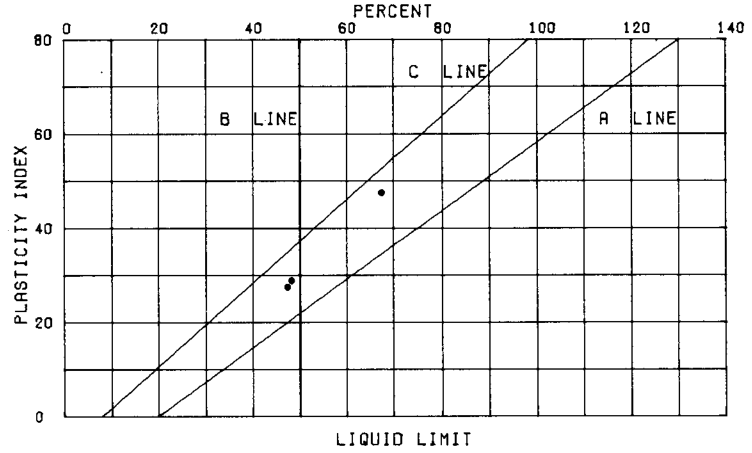
SOIL BORING DATA

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

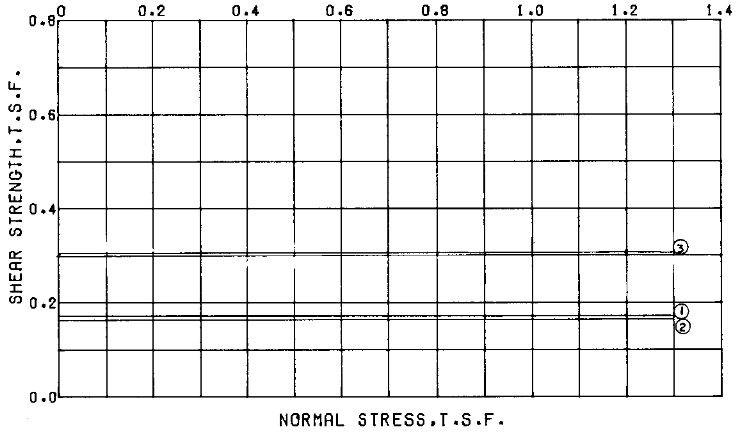
JUNE 1980

FILE NO. H-2-29038



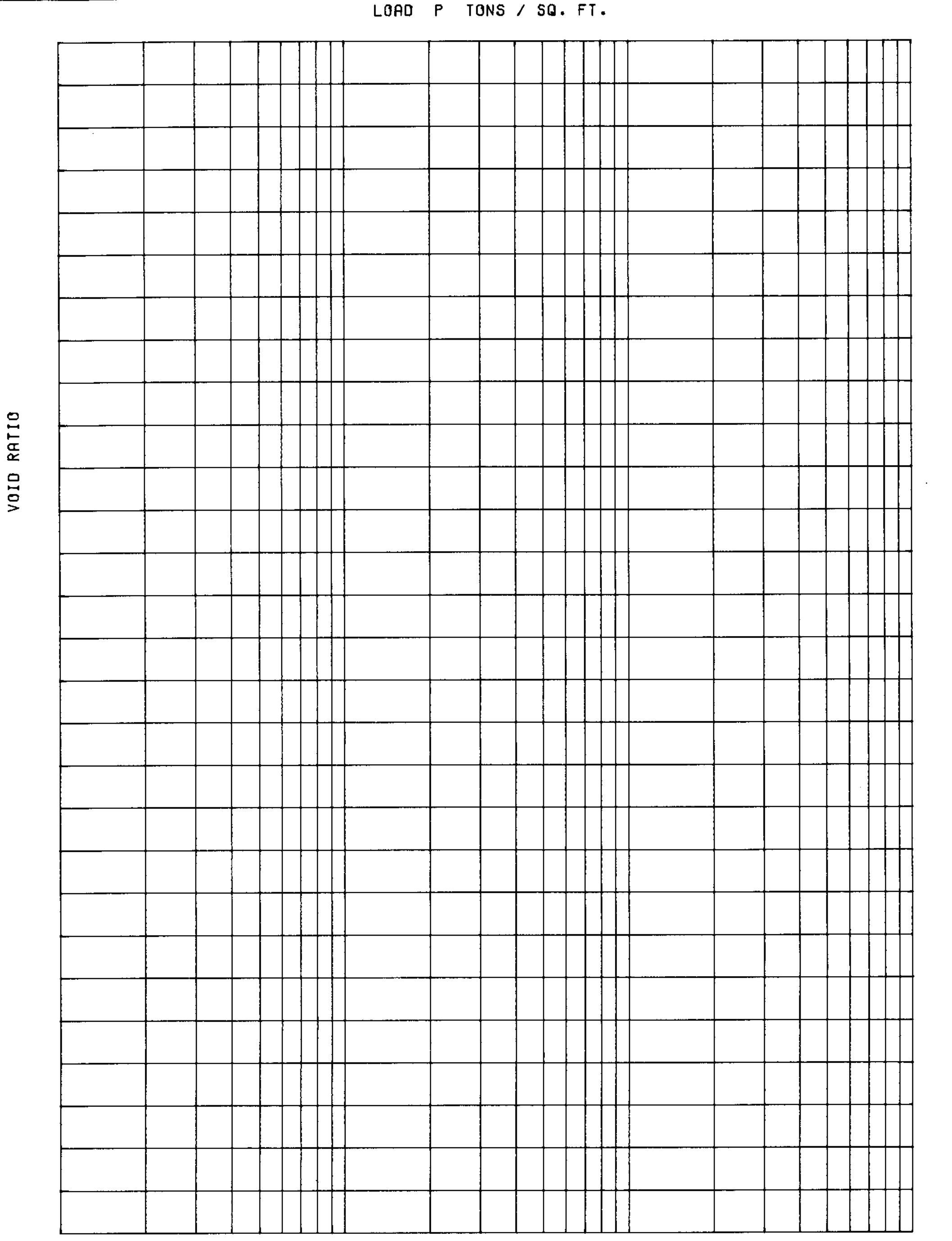


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
①	-15.0	Q	0	0.177	CH
②	-20.1	Q	0	0.160	CH
③	-40.1	Q	0	0.303	CH



CONSOLIDATION DATA

- (UC) UNCONFINED COMPRESSION TEST
- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
- (S) CONSOLIDATED - DRAINED SHEAR TEST

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

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE

GRAND ISLE AND VICINITY, LOUISIANA

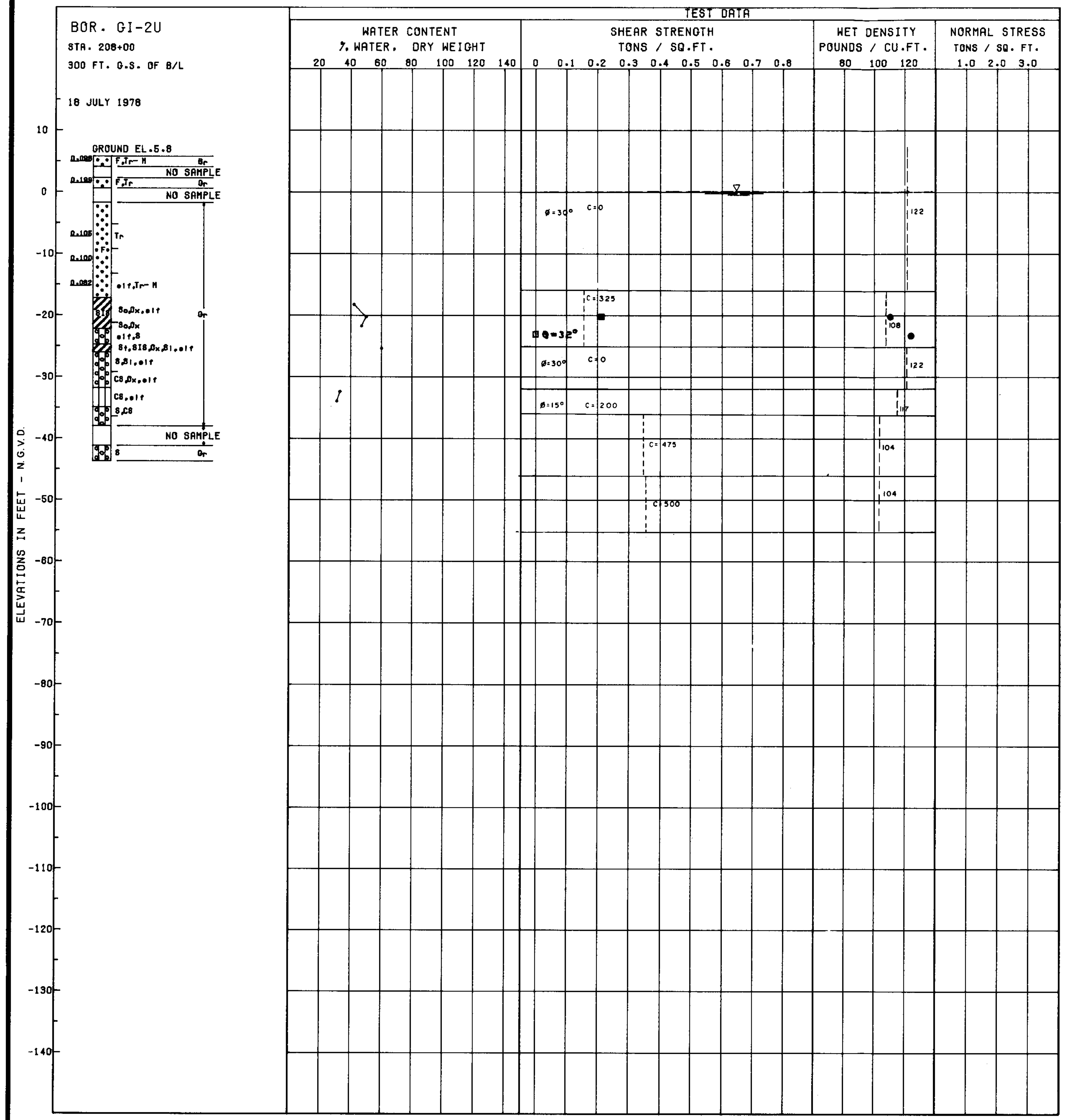
PHASE II GDM

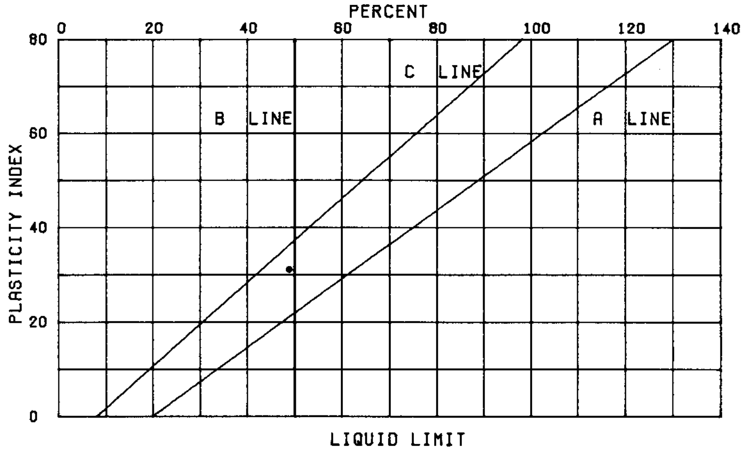
UNDISTURBED BORING GI-IU

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

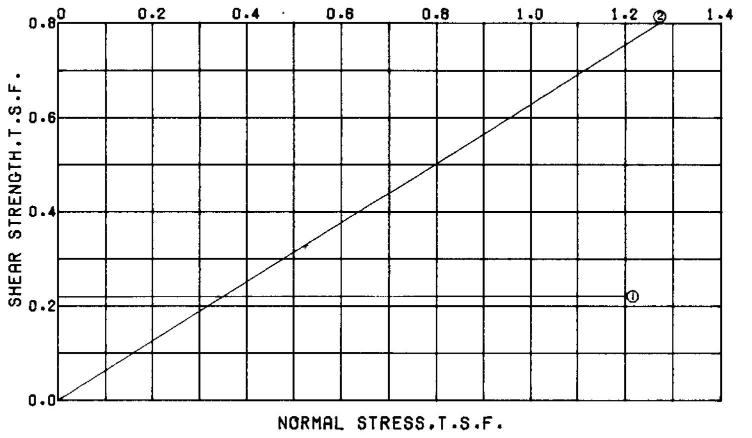
JUNE 1980 FILE NO. H-2-29038

PLATE A-9



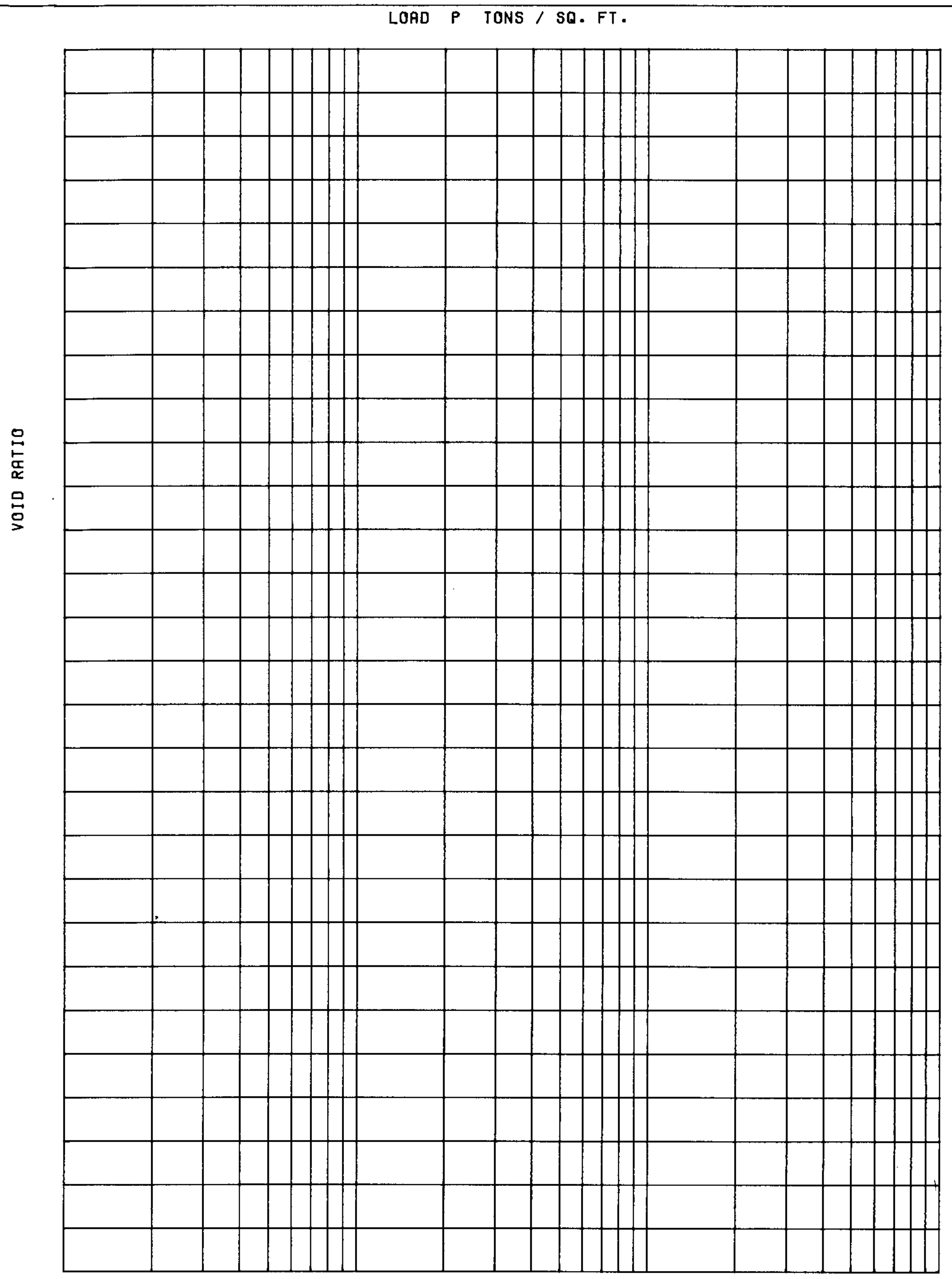


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Φ	C - TSF	
1	-20.2	Q	0	0.215	CH
2	-23.0	S	32	0	CH



CONSOLIDATION DATA

- (UC) UNCONFINED COMPRESSION TEST
- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
- (S) CONSOLIDATED - DRAINED SHEAR TEST

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

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE

GRAND ISLE AND VICINITY, LOUISIANA

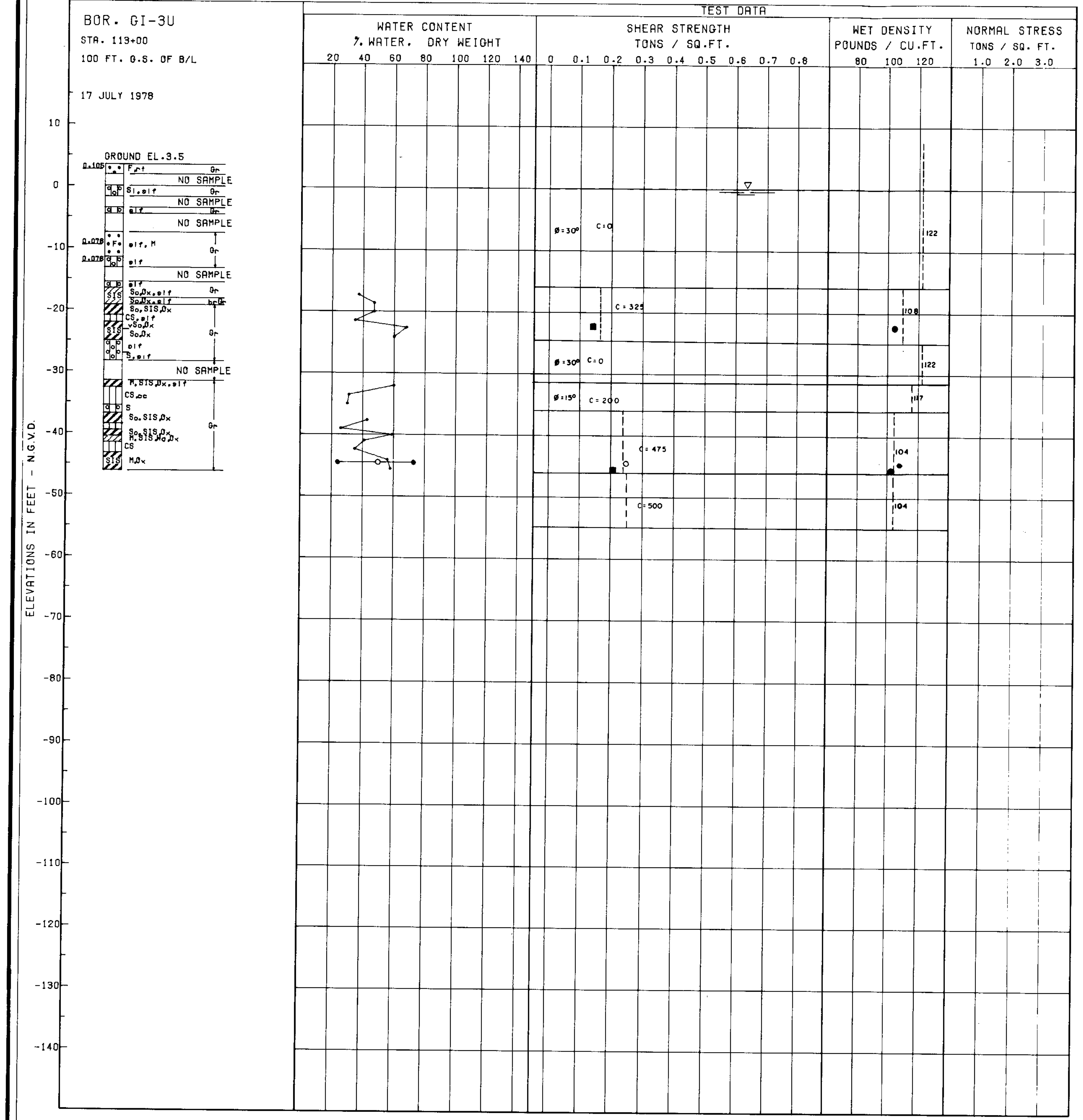
PHASE II GDM

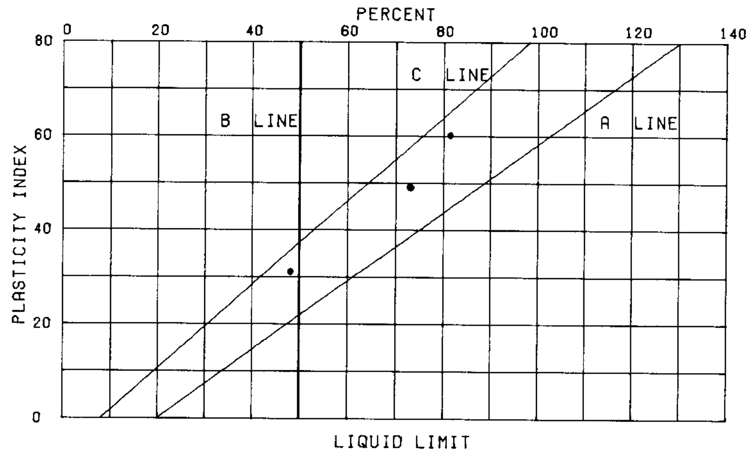
UNDISTURBED BORINGS GI-2U

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

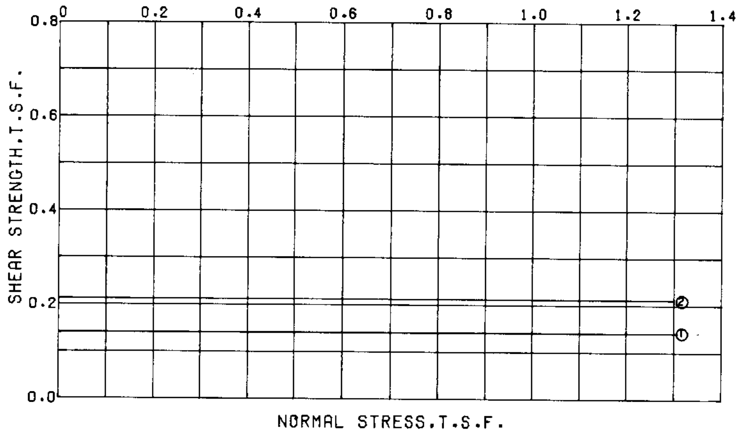
JUNE 1980

FILE NO. H-2-29038



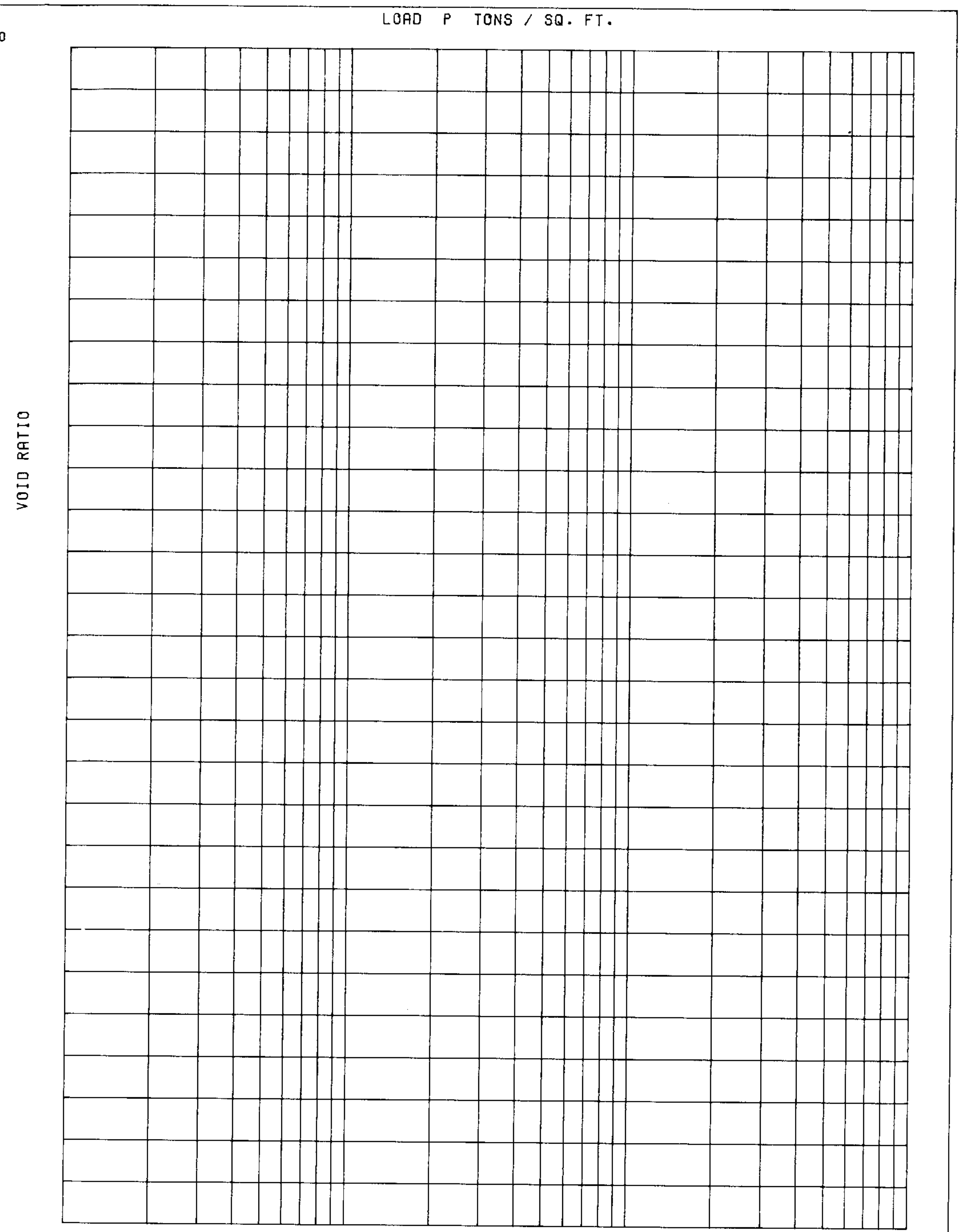


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
1	-25.9	Q	0	0.142	CH
2	-45.9	Q	0	0.208	CH



CONSOLIDATION DATA

- (UC) UNCONFINED COMPRESSION TEST
- (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
- (R) CONSOLIDATED - UNDRAINED SHEAR TEST
- (S) CONSOLIDATED - DRAINED SHEAR TEST

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

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATE

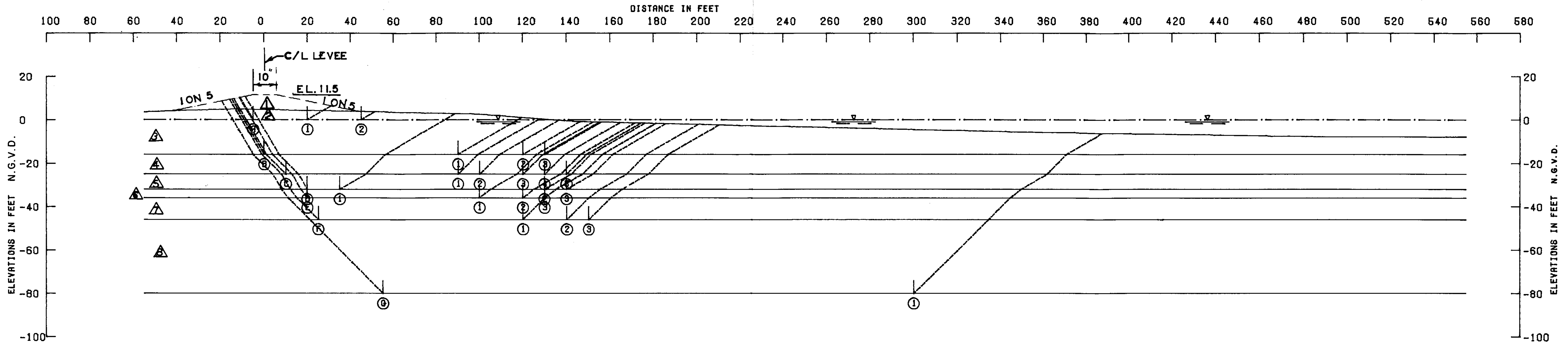
GRAND ISLE AND VICINITY, LOUISIANA

PHASE II GDM

UNDISTURBED BORING GI-3U

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

JUNE 1980 FILE NO. H-2-29038



GENERAL NOTES

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

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

EXISTING GROUND ELEVATIONS SCALED FROM PLATE 4 OF PHASE I GDM

STRATUM NO.	SOIL TYPE	EFFECTIVE UNIT WT. P.C.F.		C - UNIT COHESION - P.S.F.				FRICTION ANGLE DEGREES
				CENTER OF STRATUM		BOTTOM OF STRATUM		
		VERT. 1	VERT. 2	VERT. 1	VERT. 2	VERT. 1	VERT. 2	
1	SP	122.0	122.0	0.0	0.0	0.0	0.0	30.0
2	SP	122.0	122.0	0.0	0.0	0.0	0.0	30.0
3	SP	60.0	60.0	0.0	0.0	0.0	0.0	30.0
4	CH	46.0	46.0	325.0	325.0	325.0	325.0	0.0
5	SM	60.0	60.0	0.0	0.0	0.0	0.0	30.0
6	ML	55.0	55.0	200.0	200.0	200.0	200.0	15.0
7	CH	42.0	42.0	475.0	475.0	475.0	475.0	0.0
8	CH	42.0	42.0	500.0	500.0	500.0	500.0	0.0

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	RESISTING FORCES			DRIVING FORCES		SUMMATION OF FORCES		FACTOR OF SAFETY
			R_A	R_B	R_P	D_A	$-D_P$	RESISTING	DRIVING	
A	1	0.00	4829	18666	6541	7243	3271	30036	3973	7.561
A	2	0.00	4829	29256	1733	7243	867	35818	6377	5.617
B	1	-16.00	23982	29250	23817	35973	11908	77049	24065	3.202
B	2	-16.00	23982	39000	15951	35973	7976	78933	27997	2.819
B	3	-16.00	23982	42250	14365	35973	7182	80597	28791	2.799
C	1	-25.00	30094	26000	27301	59193	24120	83395	35073	2.378
C	2	-25.00	30094	29250	24424	59193	22170	83709	37022	2.263
C	3	-25.00	30094	35750	20334	59193	18510	86178	40683	2.118
C	4	-25.00	30094	39000	19469	59193	17328	88563	41865	2.115
C	5	-25.00	30094	42250	18987	59193	16681	91331	42512	2.148
D	1	-32.00	43541	14527	64530	78249	43891	122598	34359	3.568
D	2	-32.00	43541	93356	40989	78249	27630	177886	50620	3.514
D	3	-32.00	43541	100750	40009	78249	26998	184300	51252	3.596
E	1	-36.00	49649	38000	53912	90795	40161	141561	50634	2.796
E	2	-36.00	49649	47500	49333	90795	36117	146482	54678	2.679
E	3	-36.00	49649	52250	47861	90795	34934	149761	55861	2.681
F	1	-46.00	58721	45125	57361	123608	57979	161208	65629	2.456
F	2	-46.00	58721	54625	55783	123608	55493	169129	68115	2.483
F	3	-46.00	58721	59375	55145	123608	54827	173241	68782	2.519
G	1	-80.00	91907	122500	79043	252517	141210	293450	111307	2.696

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

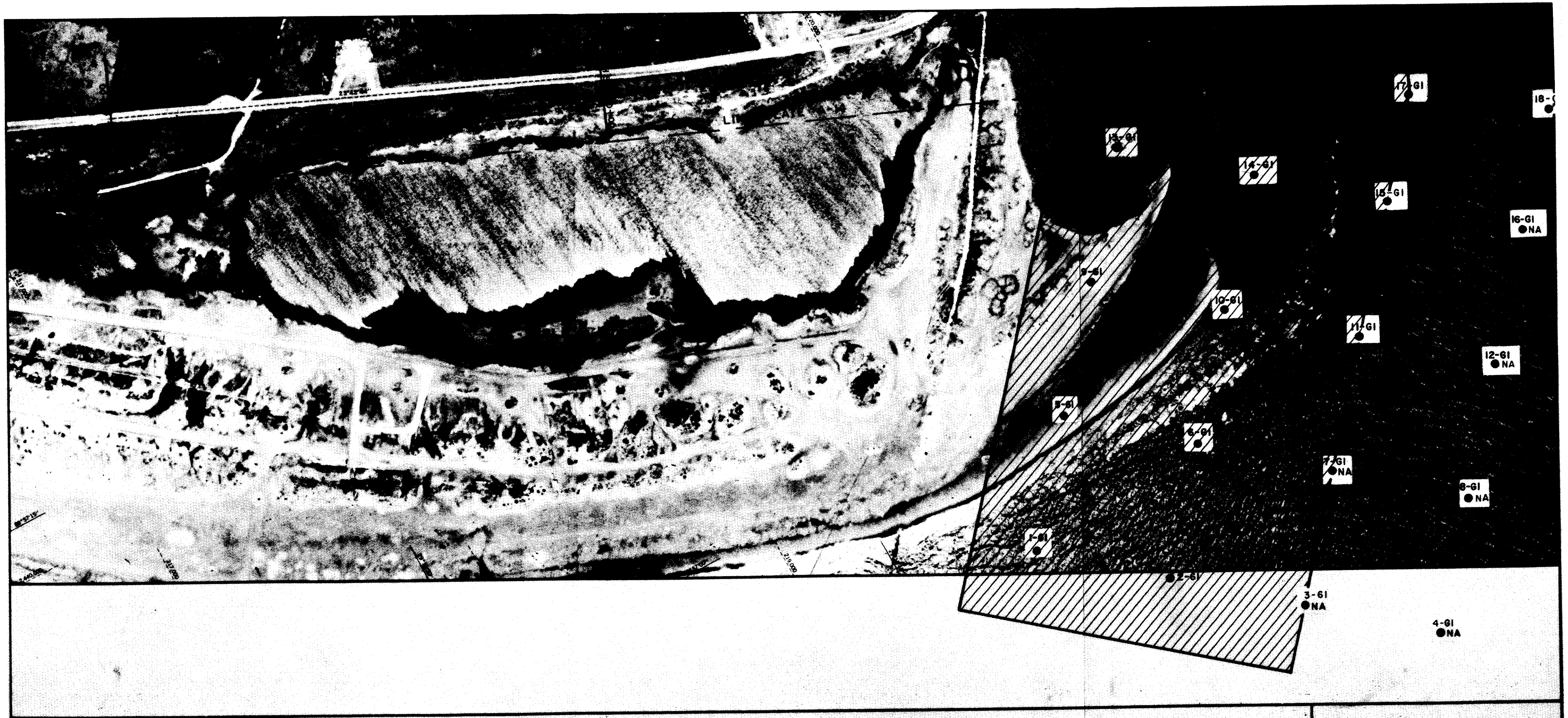
$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

GRAND ISLE AND VICINITY, LA.
PHASE II GDM
STATION 14+30 TO 390+09
COMBINED BEACH EROSION AND HURRICANE PROTECTION

STABILITY ANALYSIS

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

CORPS OF ENGINEERS JUNE 1980 FILE NO. H-2-29038



SCALE IN FEET

150 0 150 300 450

LEGEND

BORROW AREA

NOTES:

INSIDE THE PLAN AREA. POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS

PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

NOTE:

SEE PLATE A-7 FOR LOGS OF BORINGS LOCATED ON THIS PLATE.

GRAND ISLE AND VICINITY
LOUISIANA

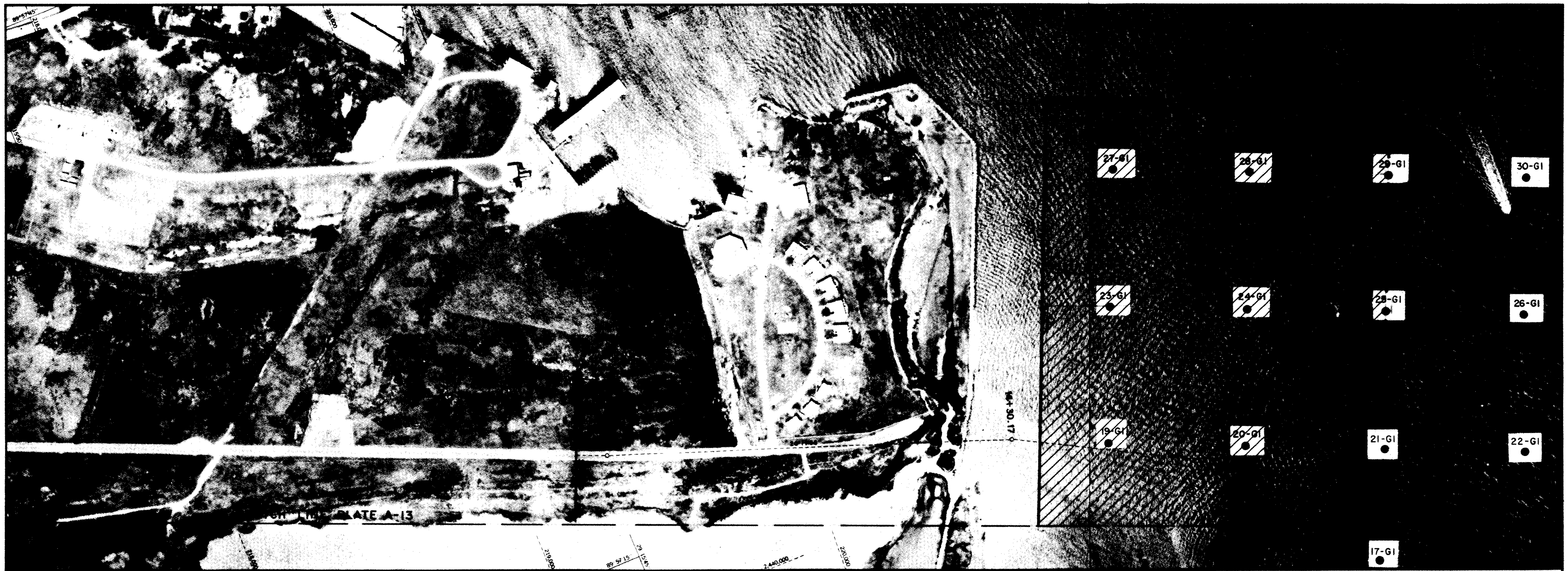
PHASE II GDM

BORING LOCATIONS

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

JUNE 1980

FILE NO. H-2-29038



LEGEND

BORROW AREA

SCALE IN FEET

150 0 150 300 450

NOTES:
INSIDE THE PLAN AREA, POLYCONIC PROJECTION-1927 NORTH AMERICAN DATUM IS SHOWN BY SOLID TICKS AND LAMBERT CONFORMAL CONIC PROJECTION IS SHOWN BY DASHED TICKS.
PREPARED FROM AERIAL PHOTOS FLOWN MAY 1978.

NOTE:
SEE PLATE A-7 & A-8 FOR LOGS OF BORINGS LOCATED ON THIS PLATE.

GRAND ISLE AND VICINITY
LOUISIANA

PHASE II GDM

BORING LOCATIONS

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

JUNE 1980

FILE NO. H-2-29038

APPENDIX B

Report on Grand Isle Vegetation Plan

by

W. W. Woodhouse, Jr.

APPENDIX B

Report on Grand Isle Vegetation Plan

W. W. Woodhouse, Jr.

I. Introduction

Planting of the new dune will be essential to prevent loss of sand by wind and to slow losses by wave action during storm tides. Vegetation can be extremely effective in stabilizing sand against wind erosion. The proposed planting will, when fully established, be capable of trapping essentially all windblown sand that enters it. Vegetative dune cover offers significant protection against short-term storm activity and tends to be self-healing. It is less effective against wave erosion, particularly undercutting by long-term beach recession.

Since speed of coverage will be critical the best adapted plants and the most advanced establishment procedures should be used. Planting should be by sections as rapidly as areas of significant size can be completed and made ready for planting.

II. Plant Selection

A. Species present on site

The usual range of beach, dune and swale species found along the Alabama, Mississippi and Texas coasts occur on Grand Isle. Among these are Andropogon spp., Distichlis spicata, Croton sp., Hydrocotyle sp., Ipomoea spp., Erigeron sp., Panicum amarum, Panicum repens, Iva sp., Spartina patens, Sporobulus sp., and Uniola paniculata. Of these, bitter panicum (P. amarum[1]) and sea oats (U. paniculata) constitute the principal pioneer foredune species of this region. They are capable of establishment on freshly deposited, unstabilized sand thereby initiating the development of foredunes. Most of the other species tend to act in a secondary role, invading and contributing to stability after initial stabilization by the pioneer species. It is not usually necessary to plant them although several can be planted successfully, if necessary.

B. Principal species for planting

Primary emphasis should be placed on planting bitter panicum and sea oats. Between them they constitute the primary dune builders of the region. Techniques for propagation, use and management of both have been developed.

Bitter panicum should be the major planted species as it is easy to multiply under nursery conditions and quick to stabilize bare areas. Sea oats is more difficult to produce and slower to develop. However, once established it is a more effective sand trapper and is often more persistent than bitter panicum. Unlike bitter panicum, sea oats is a good seed producer and these seed enhance regenerative capacity of the dune cover. Also, sea oats is much more pleasing, aesthetically, than bitter panicum and, therefore, would have more public appeal. In view of these differences in species characteristics, it is proposed that bitter panicum make up the major part of the planting but that sufficient sea oats be included throughout to insure the presence and future spread of this species. The species ratio should be about 10 bitter panicum to 1 sea oats but this may be adjusted to fit the plant supply.

III. Obtaining plant materials

Planting must be with vegetative material. Seeds of these species are not available and even if they were, seeding of exposed, unstabilized dune sand is usually impractical. Sand movement will usually uncover seeds and seedlings or bury them too deeply before establishment can take place.

A. Wild harvest

Limited quantities of satisfactory planting stock of these species can often be obtained from the wild. However, this will not be feasible in this case. There are substantial amounts of bitter panicum on the site that would make suitable planting material but most of it is in the zone to be covered by the new dune. Therefore, this material must be transferred to a nursery prior to construction if it is to serve as a plant source. Sea oats is present on Grand Isle in very limited amounts, insufficient for nursery establishment. Wild stock of these species would not, to my knowledge, be available in sufficient quanties elsewhere.

B. Commercial sources

Pot-grown plants (seedlings of sea oats and sprigs of bitter panicum) are available from one commercial source (Horticultural Systems, Parrish, Florida). Reliance on this single source for the entire planting would have certain distinct disadvantages.

1. High cost; probably in excess of $100/1,000 plants, F.O.B. Parrish, Florida. 2. The small size of the plants and the resultant time lag in the development of effective cover. 3. Probable difficulties in coordinating and scheduling plant production and delivery to fit planting schedules. Plants must be ordered at least 90 days in advance of delivery while planting should be done by sections as construction is completed. This kind of arrangement seems likely to result in costly delays in planting, in reduced plant viability, and in added costs incurred in holding plants in anticipation of planting. These problems could easily raise the real cost of these plants by 50%. Therefore, I feel that there are sound reasons for considering the production of a large part of the planting stock required in a field nursery located as close to the project site as feasible. Plant requirements for this project is substantial, estimated to be about 594,000 for the initial planting. An allowance of 35% to cover plants for repairs to storm-damaged areas and replanting of weather-related failures and other contingencies would run the total to nearly 800,000 plants.

Production costs for field nursery plans would depend a great deal on the site and on the effort and quality of supervision devoted to it. However, based on experience elsewhere, total plant costs should easily be reduced by 60 to 75% compared with pot-grown plants. There would also be a significant reduction in planting costs. Pot-grown plants are considerably more difficult to handle and transplant than are field-grown plants. Probably more important, local production would assure the availability of plants as needed. Plants could be harvested and replanted almost immediately, eliminating transportation and storage costs as well as risks of deterioration in transit and storage. This should result in more timely planting and more rapid and effective development of vegetative cover. It is, therefore, recommended that the feasibility of the development of a field nursery for this project be fully explored.

C. Field nursery

1. Location. A Grand Isle site would be preferable. This would be most convenient for planting purposes and on leaving Grand Isle suitable sites appear to be some distance away at best. The most promising locations seen on Grand Isle are on State parks property. As I understand it, there is a good possibility that one of these (preferably on the west end of the island) can be made available. It would not be difficult to develop this area into a suitable nursery site. Present vegetation is sparse and should not be difficult to control.

Ample quantities of bitter panicum are present on the proposed dune site to serve as planting-stock for the initial nursery planting. It would be highly desirable to multiply and use this panicum type which is doing well here, rather than bringing in other material that might not be as well adapted. Sea oats for nursery establishment would have to come from elsewhere in any case. Distribution of this plant is very limited on Grand Isle and it is apparently not plentiful anywhere in Louisiana.

2. Timing. There is ample lead time available (2 growing seasons) to develop a nursery and give the people involved experience in handling these plants. It will be important to get a nursery started on at least a limited scale in 1979 to provide experience and some basis for determining the area needed to produce in 1980 the plants that will be required beginning in 1981.

3. Operation. If for no other reason the relative isolation of Grand Isle would strongly suggest consideration of assigning responsibility for day-to-day operation of the nursery to someone nearby. It would be difficult for persons headquartered elsewhere to give it the required attention. The key to economical operation of a nursery of this type is frequent inspection and timely execution of the essentials. After preparation and planting most of the effort needed will be in weed control and this will not require much time or expense if carried out as needed. Frequent inspection and prompt follow-up is essential. There is some indication that the local Soil and Water Conservation District interested in taking this on. If so, this could work out to the advantage of all concerned. They already own tractors, cultivator frames, tools, and plows. Preparation and planting of the nursery could come at a slack time in the beach year and might utilize labor not heavily occupied otherwise.

If this arrangement should work out satisfactorily, consideration should be given to having the dune planting done by the same people who tended the nursery. By that time they would have developed an understanding of the plants and their requirements. A locally based planting crew should expedite timely planting of sections as they are completed and cut costs well below a crew brought in from a distance. Again much of the planting could come in slack season on the farm.

Whether the dune planting is handled locally or by an outside contractor would in no way affect the desirability of a local nursery operation. Plant supply will be the most serious unknown for a prospective bidder if he must find the plants elsewhere.

(a) Problems. (1) Training someone to plant and care for this type of nursery. This will be an essential step as it is highly unlikely that any of the local people will be acquainted with these plants or will have had experience with anything quite like this. It should not be difficult if an individual with some feel for growing things can assume local responsibility. I can provide rather detailed instructions and these can be interpreted on the ground by SCS and NOD personnel. (2) Overall supervision and guidance. Again, this could be provided by the SCS or the District. Regular visits for this purpose would be advisable.

(b) Alternatives. If local responsibility for the day-to-day operation cannot be worked out, the question of moving to a more accessible location will arise. This would probably mean moving inland and to a finer textured soil. Bitter panicum grows well inland and it can be grown on heavier soils. Planting, harvesting, and weed control would be more difficult. Sea oats would present a much more serious problem. This plant has had history of pest problems when grown away from the salt spray zone. These can usually be controlled by close attention to the timely application of pesticides. In view of the relatively small proportion of sea oats required, it might be preferable to purchase pot-grown seedlings rather than undertake field nursery production at an inland location.

4. Nursery establishment

(a) Scale. A relatively small nursery area will suffice for the 1979 season. This is due to the fact that bitter panicum tends to become over crowded in the nursery the second year, causing transplant quality to decline. Consequently, the objective with this species in 1979 is to grow enough to plant a full-scale nursery in 1980 and, equally important, give personnel experience with this plant and provide production estimates on which to base the size of the 1980 planting. Half an acre of bitter panicum will probably be ample for these purposes. If project planting is done over a two-year period a total of two acres of bitter panicum should provide ample planting stock.

A full size sea oat planting should be established in 1979. In contrast to bitter panicum, the slower initial development of this species requires that a nursery planting be left in place through a second growing season in order to obtain full production of the best quality plants. It is suggested that at least two acres of this species be established in 1979. This should supply sufficient plants over the two-year planting period.

(b) Equipment. Acquire a transplanter and a cultivator frame suited to the tractor. A small 1-row tractor will be adequate. It will be more maneuverable than a larger machine and the power requirement is not large. The most satisfactory transplanter we have seen is the Model 15 made by Powell Manufacturing Company, Bennetsville, South Carolina, 29512. It is light weight, has few moving parts and is adaptable to different plants.

(c) Preparation. Area should be leveled and the present vegetation removed as completely as possible. Do not disturb or bring up sand from beneath any more than necessary to get the surface level enough to permit operation of planter and cultivator.

Fumigate with methyl bromide following carefully the directions on the label. (Material may be obtained from any dealer in agricultural chemicals. This step is not mandatory but if properly carried out, it will probably save several times the cost in hand weeding and increase production.)

If fumigation is done apply 500 lbs/acre of 10-10-10 fertilizer (or the equivalent) after cover is removed. In absence of fumigation, delay fertilization until after planting.

(d) Planting.

(1) Bitter Panicum. Transplant freshly pulled stems when the sand is moist. Space rows to fit cultivating equipment, usually 36 to 42 inches. Stems are pulled from the clumps by hand. Some may come up with roots, most will break off at the surface. Either are satisfactory. They may be planted upright, 5 to 8 inches deep, 18 to 24 inches apart, but first year production will be higher if they are buried end to end, 4 to 6 inches deep in furrows with the top 3 to 6 inches left exposed. This way, a new plant will emerge at nearly every node. Furrow planting can be accomplished with the transplanter or by placing stems by hand in furrows opened by a small plow and covered by another furrow slice. Lacking a plow, the furrow may be opened by the planter with the covering wheels raised and the stems covered by hand. For upright planting most mature stems will have to be broken in half. The upper and lower halves are equally viable. It may be necessary to break long stems in order to feed them through the planter into a furrow.

Later in the season new tillers will emerge. These make better planting stock than the mature stems during the spring and summer. These should be planted upright 5 to 8 inches deep.

(2) Sea Oats. Planting stock will be peat-pot or liner-grown seedlings. They should be placed upright in rows the same width as the bitter panicum - 2 feet apart in the row and 2 to 3 inches below the top of the pot. Sand should be moist. Plants may be planted by transplanter or by hand.

(e) Maintenance

(1) Weed control. These plants do not do well in competition with weeds and weed infestation interferes with harvesting. It is essential that weeds (all plants other than the species in production) be controlled. If done properly, fumigation should largely eliminate weeds the first growing season. Cultivation, tractor drawn and hand weeding, will have to be used the second year and in the absence of fumigation, the first year.

Cultivation should be shallow to avoid damage to roots and rhizomes. Soil should be thrown to the rows but as plants develop, it will be necessary to keep at a distance to avoid damage to spreading plants. Later, hand weeding may become the only method.

In any case, weeding should not become a major task provided it is done promptly, as required. A delay of a few days will often increase the labor requirement 5 to 10 fold or more. Therefore, the importance of frequent inspection and prompt action cannot be over emphasized.

(2) Fertilization. This will be very important on the dune sand of the proposed site. Nutrient content is very low and this sand has little ability to retain nutrients. Overfertilization which will stimulate weeds should be avoided. Frequent application of low rates will be best. Apply 250-300 lbs. per acre of 10-10-10 (or equivalent) beside the row as soon as new shoots begin to emerge (in the case of bitter panicum) or about 2 to 3 weeks after transplanting for sea oats. Afterward, change to ammonium nitrate, 100 lbs. per acre per application probably at about 6-week intervals. However, continued fertilization should be adjusted to rainfall and plant vigor. Heavy rains will deplete nutrients and require refertilization. Fertilizers should be frequent enough to maintain growth and good color but should not be overdone. Exececssive fertilization will encourage weeds and may lower the viability of transplants.

(3) Harvesting and processing.

Bitter panicum. Two distinct types of planting stock (primary stems and tillers) of bitter panicum are available in late spring and early summer. Primary stems represent mature growth from the previous year which has flowered and is generally dry and brittle. Such stems are usually 1 or more meters long and most lower leaves are dead (giving the plant a somewhat unsightly appearance) with the terminal leaves still green. These are available and preferred for planting from early winter through early spring. Regrowth from this material is somewhat erratic. Some transplants start growth almost immediately while others may remain dormant for extended periods of time.

Tillers are young, succulent growing stems and are usually smaller than primary stems. These make the best planting stock from late spring through summer because they become established and grow quickly.

Primary stem size is important because small stems do not do well. These are usually found only in old crowded stands, a major reason for using first-year material for dune planting.

In upright planting, stems longer than 50 to 60 cm should not be used. Primary stems from vigorous stock are usually more than 1 meter long and may be cut or broken into two pieces for planting with little difference in survival between top and bottom pieces.

Planting stock is usually pulled by hand (or mowed). Some stems will come up with roots attached while others will break off at the surface. Presence or absence of roots appears not to affect survival and regrowth.

Planting stock may be heeled-in in moist sand for short periods and has been stored up to a month by emersing the lower half in fresh water. Plants may be stacked in tubs or baskets for transplanting.

Sea Oats. It is necessary to loosen the sand around sea oats clumps with a shovel or other tool before lifting them. It is usually not possible to pull unloosened plants without excessive damage. Clumps are shaken free of excess sand and hand-separated into transplanting units of one or more healthy, vigorous stems. Transplants may be stacked upright in tubs or baskets for transport. Drying of the base of the plant should be carefully avoided. Dipping the lower 10-15 cm of sea oats plants in a clay slurry can be helpful in this regard and is good insurance under unfavorable planting conditions. When plants are not to be transplanted immediately, they may be held for a week or so by heeling-in in moist sand. Sea oats plants do not store well in water.

The stem-size range is greater in sea oats than in bitter panicum. The larger and intermediate size stems survive best, one reason for using second-year field nursery stock. There is little advantage in planting more than one good stem per hill.

IV. Planting

A. Width

The proposed width of planting is a compromise. It allows for maximum recreational use of the beach consistent with reasonable protection of the dune. A seaward extension of the planting of another 50 to 100 feet would be highly desirable from the standpoint of protection.

B. Spacing

A graduated rather than uniform spacing pattern is planned. This allows windblown sand to filter through the seaward edge for the first year or two (likely the period of greatest movement) and become trapped near the center of the planting. This delays the formation of a ridge at the seaward edge, typical of a uniform spaced plantings, and makes for a smoother, more stable slope. It requires fewer plants and, therefore, is considerably cheaper than a uniform pattern of the same width dense enough to be as effective.

The planting pattern is shown in the following diagram. Planting begins with the 8 rows on top of the dune and proceeds seaward and landward in sequence as shown.

Location	Spacing (on centers)	No. rows	Width
seaward slope	3.5 ft	2	7.0 ft
seaward slope	3.0 ft	3	9.0 ft
seaward slope	2.5 ft	4	10.0 ft
seaward slope	2.0 ft	4	8.0 ft
top of dune	1.5 ft	4	6.0 ft
top of dune	1.5 ft	4	6.0 ft
landward slope	2.0 ft	4	8.0 ft
landward slope	3.0 ft	7	21.0 ft
		32	65.0 ft

If the planting is extended further seaward, the addition should be spaced 3.5 ft. for the first half and 4.0 ft. for the remainder.

This pattern is for bitter panicum planted upright. Two rows of sea oats are to be fitted in with their spacing somewhat dependent upon the supply of plants. Preference would be to use sea oats in the second row (from the front) on top of the dune and in one of the 2.5 ft. rows on the seaward slope. In case of inadequate sea oats planting stock, sea oats could be planted in alternate hills with bitter panicum in these rows. One primary purpose is to develop a sea oats seed supply, well distributed along the dune.

C. Plant Requirements

Based on the proposed planting plan, total plant requirements will be about 600,000 hills for the initial planting plus a reserve of 150,000 to 200,000 plants for replanting and repair. About 45,000 to 50,000 of the total would be sea oats; the remainder, bitter panicum. Estimates of the field nursery size required to produce these plants are given in the nursery section. These estimates should be revised later based on 1979 nursery experience.

D. Planting Season

Sand must be moist but the salt content low enough to not interfere with dune plant survival. Moisture and low salt are much more important than time of year in this case. It has been observed that sand dredged and deposited under conditions similar to this requires the action of about 1 to 1.5 inches of rainfall to eliminate salinity as a factor in dune plan establishment.

Bitter panicum and sea oats have been transplanted in the gulf coast region with some success almost year round. However, the preferred period is late winter to early summer with fall and early winter being least desirable due to the extended period of dormancy at that time. In summary, planting should proceed on completed sections during the late winter through mid-summer as soon as 1.0 to 1.5 inches of rain has fallen (following dredging) and provided the sand is moist. Fall and early winter planting is risky although not completely out of the question.

Sand fence can be used for temporary stabilization during this period.

E. Equipment

Transplanting on the completed sections will require the same equipment as suggested for the nursery, a Powell Model 15 (or equivalent) transplanter and a small farm tractor with hydraulic controls. If desired, a larger tractor may be used with 2 Model 15 transplanters mounted on the tool bar to plant 2 rows at a time. A crew of 4 (1 driver, 2 on the planter and 1 to supply plants to the planter) are required to operate a single-row unit efficiently and a crew of 6 for a 2-row operation. Either should work satisfactorily on the slopes planned on Grand Isle.

F. Planting Procedure

For machine planting it will be necessary to trim excess top growth from some planting stock to allow it to be easily handled and facilitate passage through the planter. Stock must be supplied to the planting trays in an untangled condition with all tops aligned in the same direction.

Planting depth is important both in order to keep the base of the plant in moist sand as well as to anchor it against wind action. The base of the plant should be placed at least 6 and preferably 8 to 10 inches deep and care taken to see that the sand is pressed firmly around it. Deep planting is more critical for sea oats than for bitter panicum due to the slow starting of sea oats.

Planting is more efficient on long rows than short but this probably becomes insignificant beyond about 1/8 to 1/4 mile, except as it will decrease the frequency of machine adjustments to alter spacing.

The need and value of fertilization of dune planting varies and is not always predictable. Fertilizer addition will, however, usually be helpful in speeding plant establishment and rate of spread thereby markedly reducing the time during which the plants and dune are most vulnerable to storm damage. Since fertilization involves a relatively minor cost, it is usually considered to be cheap insurance in cases like Grand Isle.

Fertilizer response will be primarily to nitrogen and possibly to phosphate and is unlikely in the salt-spray zone to potassium or the trace elements. Broadcast 50 lbs./acre of nitrogen (N) and Phosphate (P_2O_5) in pelleted or granular form about a month after transplanting, or as soon as new growth appears. Follow at 6-week intervals with two applications of 50 lbs./acre of N (from ammonium nitrate or equivalent).

Fertilizer may be applied by hand (with whirlwind type, knapsack seeder), with ground equipment, or by air helicopter or fixed wing). Care must be taken with ground equipment to avoid damage to the cover. After establishment, walkways may make ground equipment impractical.

Note. Sometimes it is cheaper and more convenient to obtain the N and P_2O_5 in the first application from a mixed fertilizer such as 10-10-10. The potash in this mixture is wasted on dune vegetation, but it will do no harm.

V. Maintenance

A. Protection

This is the most critical aspect of dune maintenance. Sand dunes are fragile structures requiring vegetative cover in order to maintain stability. Dune plants are well adapted to the harsh environment, (heat, drought, sand blast, salt, etc.) found on dunes. Most of them are ill adapted to disturbance by foot and vehicular traffic or to mowing and grazing. It is particularly essential that sand dunes constructed along developed beaches such as Grand Isle be protected by well-planned, regularly enforced ordinances. Public access over the dunes should be provided at appropriate locations by way of elevated walkways[2] constructed for this purpose. Access from private property should be provided in like manner. This is critical because footpaths through dunes encourage blow-outs and provide pathways for washouts during storm tides. Foot or vehicular traffic on the vegetated dune should be prohibited. Disturbance or removal of dune plants, such as sea oats heads should be prohibited.

B. Fertilization

Maintenance fertilization is not usually needed on established vegetation growing on dunes undergoing active sand accumulation. However, when fresh sand supply is absent, dune plants tend to lose vigor and thin out. Where this occurs, periodic fertilization can be very helpful in maintaining protective cover. It appears to me that much of the new dune on Grand Isle, particularly the western half, will receive little new sand after construction. If this is the case, it will be advisable to carry out a maintenance fertilizer program geared to the growth and appearance of the dune cover. This might consist of a single application of 50 to 75 lbs. of N per acre at 1 to 3 year intervals. This should be kept clearly in the plan and decisions made as to areas to be treated and frequency of fertilization as the need develops. Unneeded fertilization is wasteful and may be detrimental. Therefore, fertilizer use should be carefully adjusted to the growth and appearance of the dune cover.

C. Repairs

1. Sand fence. Fences are very effective in trapping windblown sand but fence-built sand dunes must be vegetated for stability. Sand fences will be helpful on this project primarily for temporary use (fall and winter) and in blowouts and washovers while vegetation is being planted and becoming established. The slat-type fence will be much better than the fabric-type due to the susceptability of the latter to vandalism.

2. Mulch. Mulches are not too effective in dune stabilization. Transplants tend to lift rather than grow through most types. All mulches ravel badly on dunes unless the edges are well protected. Their use may be justified on small critical sites under repair. The net type over straw is probably the best for this purpose.

3. Replanting. Replanting of damaged areas (blowouts, washouts, trampled areas) should be done with the same species (bitter panicum and sea oats) under as near optimum conditions as possible. Protection in the form of fences or mulches should be used where appropriate.

4. Traffic Areas. Traffic areas that cannot be handled by walks or hard surfacing should be planted to turf-type grasses. The best species are bermuda and St. Augustine. The bermuda hybrid, "coastal", grows well on dune sand but has a higher fertilizer requirement than the normal dune species.

5. Other Species. It has been suggested that torpedo grass (Panicum repens) be included. If desired, it could be overseeded on the landward slope of the transplanted dune. I do not believe it is enough of a sand trapper to substitute for the pioneer foredune species. It is present on the island and will in time invade the planted dune.

6. Irrigation. Dune species are equipped to tolerate drought conditions and irrigation is seldom warranted on them in humid climates. In replanting small critical areas irrigation could be useful at times.

VI. References.

Supporting data for much of the recommendations in this report are to be found in the following publications:

Dahl, B. E., et. al., "Construction and stabilization of coastal foredunes with vegetation: Padre Island, Texas" MP 9-75, U. S. Army Corps of Engineers. CERC, Ft. Belvoir, Virginia, Sept. 1975.

Woodhouse, W. W. Jr., "Dune building and stabilization with vegetation", SP 3, U. S. Army Corps of Engineers, CERC, Ft. Belvoir, Virginia, Sept. 1978.

1 Classification of the seashore panicums is somewhat confused. The plant referred to here is a large, rhizomatous, spreading type that seldom, if ever, produces viable seeds. It is commonly called bitter panicum and is probably P. amarum.

2 Walton, T. L. Jr. & T. C. Skinner "Beach Dune Walkover Structures." See Appendix E of this report.

APPENDIX C

Hydrology and Hydraulics Calculations and Other Plans Investigated

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Hydrology and Hydraulics Calculations and Other Plans Investigated

1. Hydraulic Design Calculations.

Overfill Ratio and Renourishment Factor Calculations. The following sample calculations illustrate the method used in determining the overfill ratio and renourishment factor for the Grand Isle & Vicinity project. This procedure is outlined in Volume I of the Coastal Engineering Research Shore Protection Manual and Technical Paper No. 77-6, Review of Design Elements for Beach-Fill Evaluation, dated June 1977.

COMPUTATION OF OVERFILL AND RENOURISHMENT RATIOS

Composite of Offshore Borrow Samples (Model 2)

AND

Adjusted Beach and Nearshore Samples (Model 1)

	NATURAL BEACH	BORROW AREA
Φ_{84}	= 3.47	= 3.78
Φ_{16}	= 2.64	= 2.60

$$M_{\phi n} = \frac{\Phi_{84} + \Phi_{16}}{2} = \frac{3.47 + 2.64}{2} = 3.06 \quad \text{MODEL 1}$$

$$M_{\phi B} = \frac{\Phi_{84} + \Phi_{16}}{2} = \frac{3.78 + 2.60}{2} = 3.19 \quad \text{MODEL 2}$$

$$\sigma_{\phi n} = \frac{\Phi_{84} - \Phi_{16}}{2} = \frac{3.47 - 2.64}{2} = 0.42 \quad \text{MODEL 1}$$

$$\sigma_{\phi B} = \frac{\Phi_{84} - \Phi_{16}}{2} = \frac{3.78 - 2.60}{2} = 0.59 \quad \text{MODEL 2}$$

$$\frac{\sigma_{\Phi B}}{\sigma_{\Phi n}} = \frac{0.59}{0.42} = 1.40$$

$$\frac{M_{\Phi B} - M_{\Phi n}}{\sigma_{\phi n}} = \frac{3.19 - 3.06}{0.42} = 0.31$$

FROM FIG. 5-3, $R_A = 1.40$

FROM FIG. 5-4, $R_J = 0.90$

COMPUTATION OF OVERFILL AND RENOURISHMENT RATIOS

Composite of Offshore Borrow Samples (Model 3)

AND

Adjusted Beach and Nearshore Samples (Model 1)

	NATURAL BEACH	BORROW AREA
Φ_{84}	= 3.47	= 3.35
Φ_{16}	= 2.64	= 2.64

$$M_{\phi n} = \frac{\Phi_{84} + \Phi_{16}}{2} = \frac{3.47 + 2.64}{2} = 3.06 \quad \text{MODEL 1}$$

$$M_{\phi B} = \frac{\Phi_{84} + \Phi_{16}}{2} = \frac{3.35 + 2.64}{2} = 3.00 \quad \text{MODEL 3}$$

$$\sigma_{\phi n} = \frac{\Phi_{84} - \Phi_{16}}{2} = \frac{3.47 - 2.64}{2} = 0.42 \quad \text{MODEL 1}$$

$$\sigma_{\phi B} = \frac{\Phi_{84} - \Phi_{16}}{2} = \frac{3.35 - 2.64}{2} = 0.36 \quad \text{MODEL 3}$$

$$\frac{\sigma_{\Phi B}}{\sigma_{\Phi n}} = \frac{0.36}{0.42} = 0.86$$

$$\frac{M_{\Phi B} - M_{\Phi n}}{\sigma_{\phi n}} = \frac{3.00 - 3.06}{0.42} = -0.143$$

FROM FIG. 5-3, **$R_A = 1.02$**

FROM FIG 5-4, **$R_J = 1.00$**

GRAND ISLE

Composite Lines I→V (Beach Samples) ÷6 Weighted Ave.

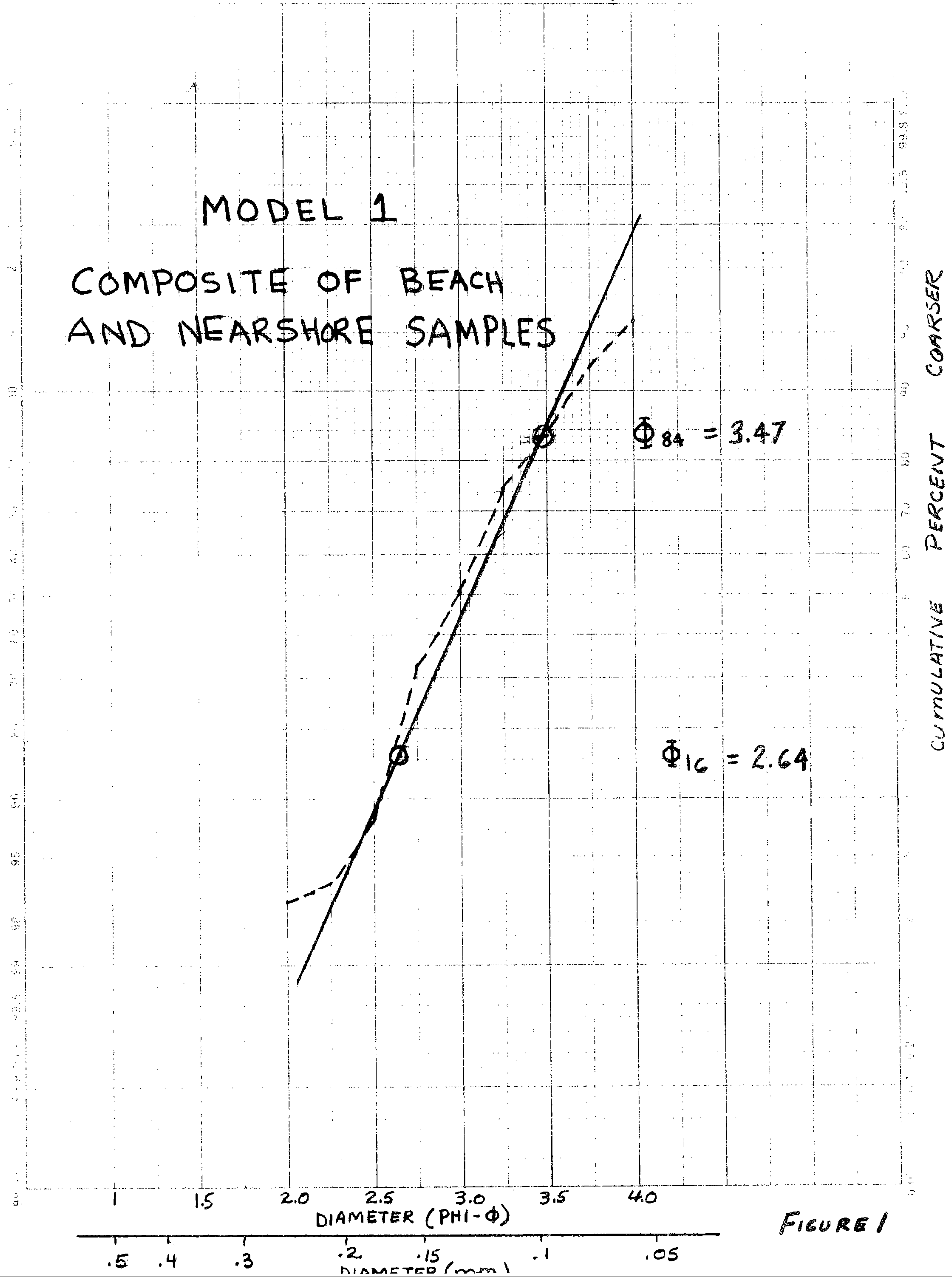


FIGURE 1

GRAND ISLE

Composite B4 → B46 (BORROW SAMPLES)

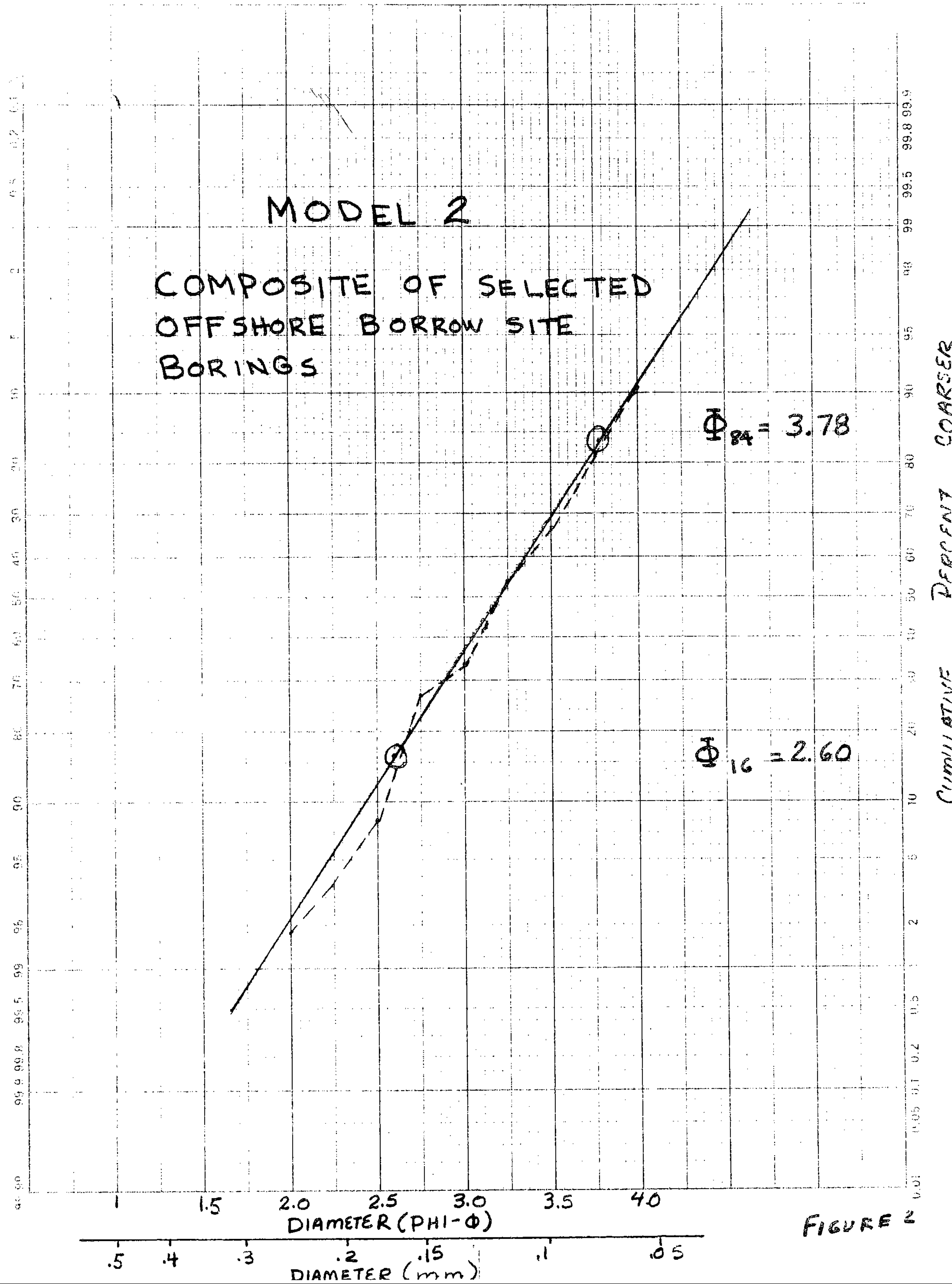


FIGURE 2

GRAND ISLE
Composite E1→E3

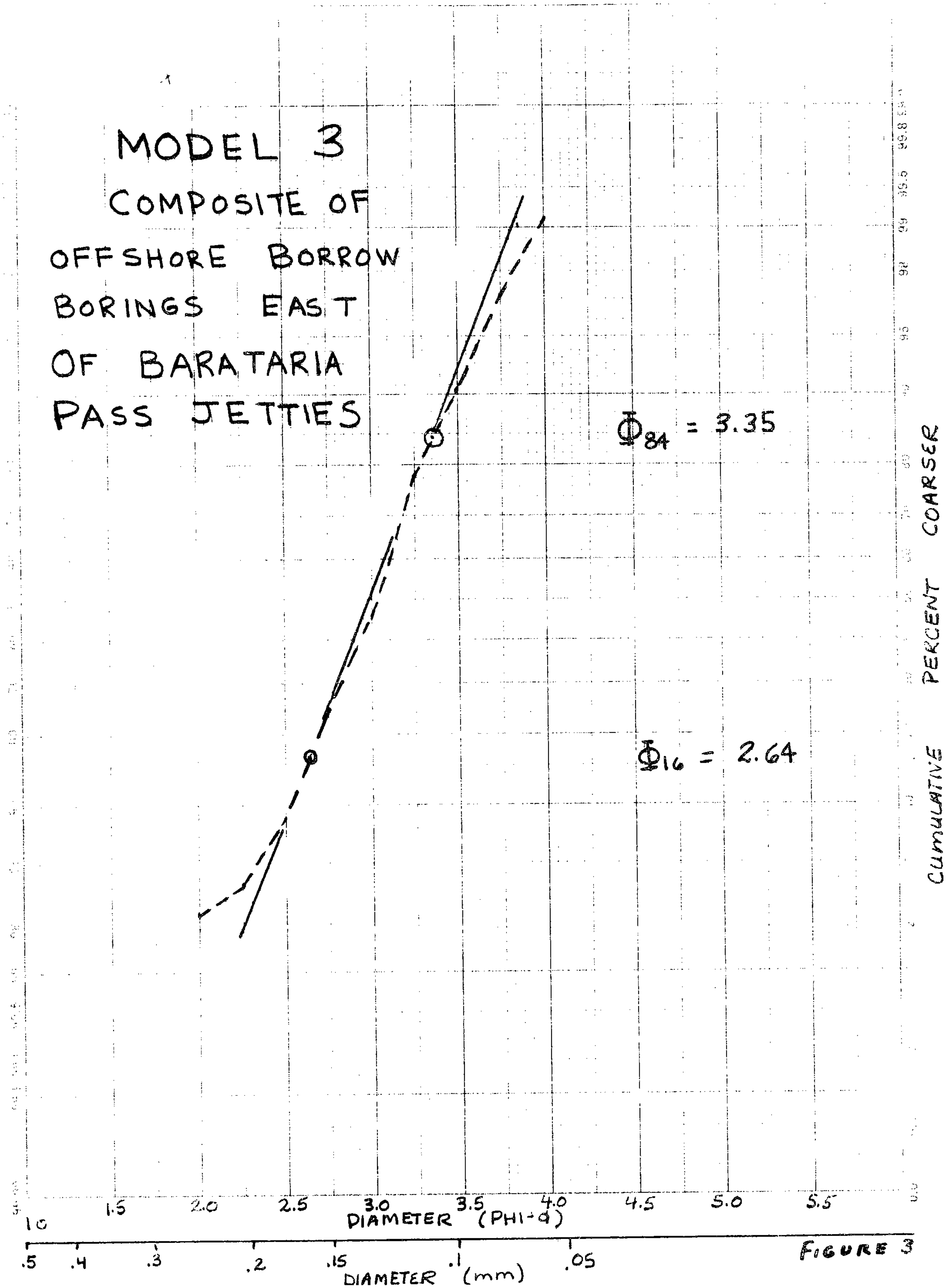


FIGURE 3

⊙ COMPARISON OF MODEL 1 AND MODEL 2, $R_A = 1.4$

△ COMPARISON OF MODEL 1 AND MODEL 3, $R_A = 1.02$

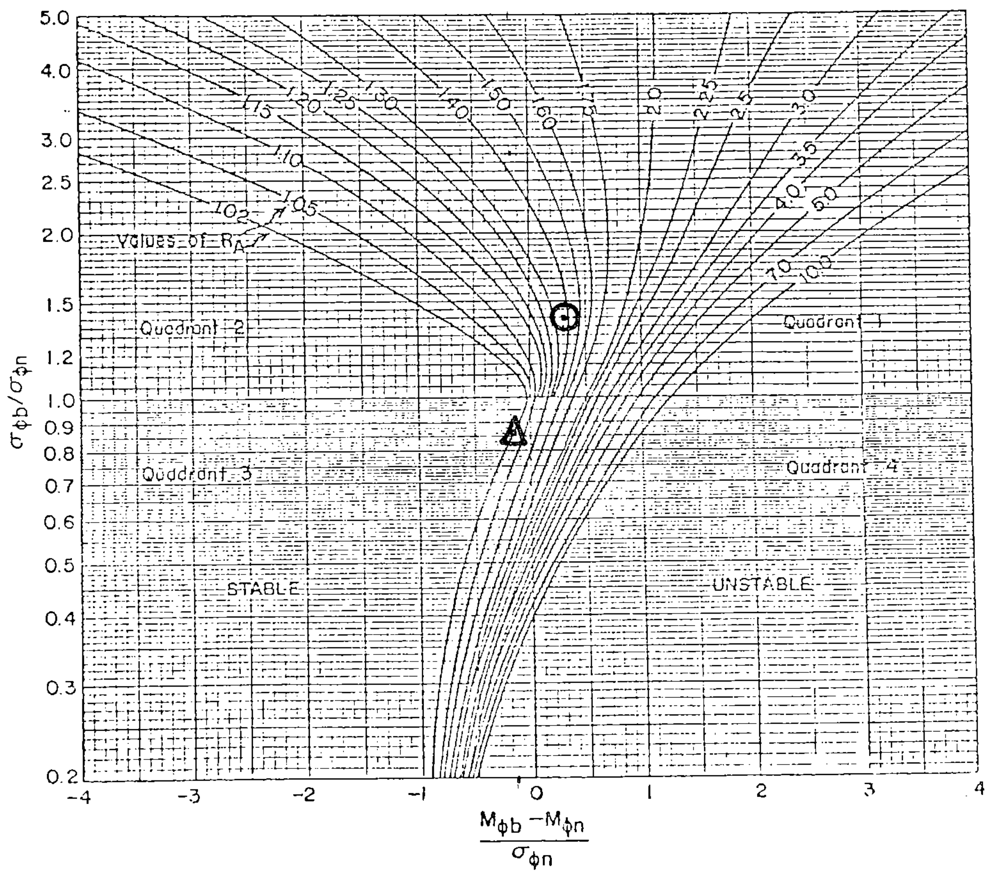


Figure 5-3. Isolines of the Adjusted Fill Factor, R_A, for values of Phi Mean Difference and Phi Sorting Ratio (from James, 1975)

FIGURE 4

⊙ COMPARISON OF MODEL 1 AND MODEL 2, RJ = 0.90

△ COMPARISON OF MODEL 1 AND MODEL 3, RJ = 1.0

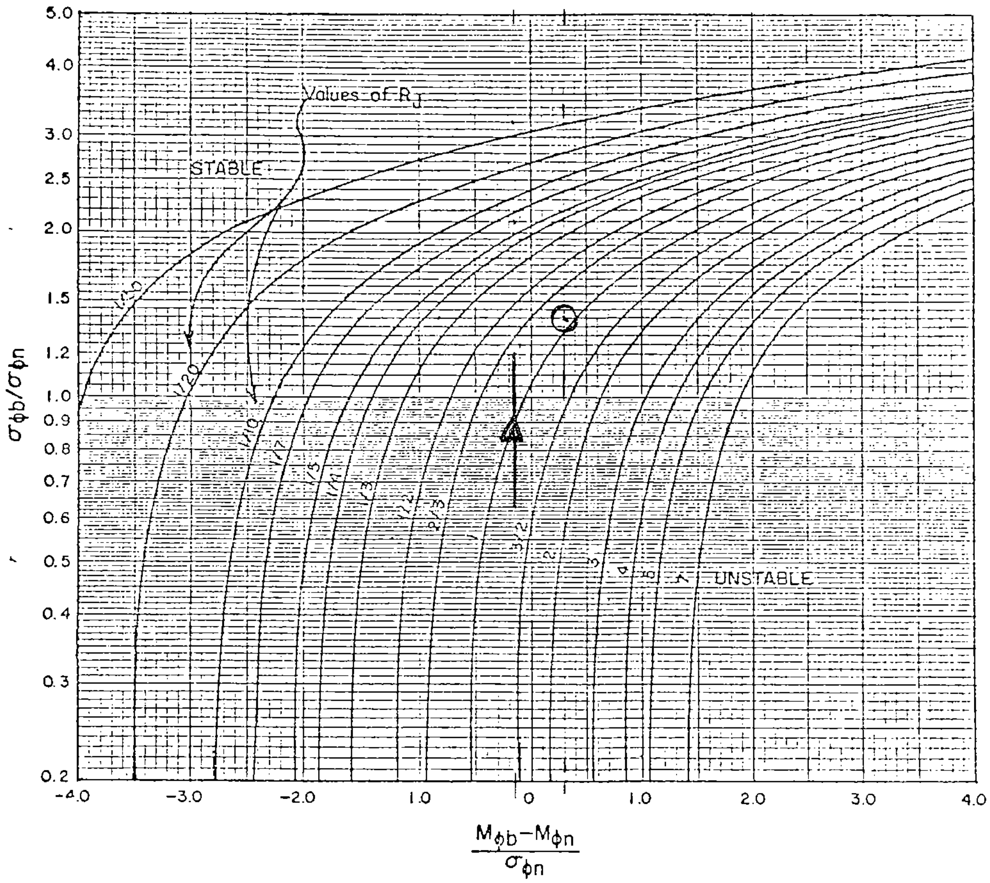


Figure 5-4. Isolines of the Renourishment Factor, R_A, for Values of Phi Mean Difference and Phi Sorting Ratio, Δ = 1.0 (James, 1975)

FIGURE 5

Table 5–1. Relationships of Phi Means and Phi Standard Deviations of Native Material and Borrow Material.

Category		Relationship of Phi Means	Relationship of Phi Standard Deviations
Case	Quadrant in Fig. 5-3		
I	1	$M_{\phi b} > M_{\phi n}$ Borrow material is finer than native material	$\sigma_{\phi b} > \sigma_{\phi n}$ Borrow material is more poorly sorted than native material
II	2	$M_{\phi b} < M_{\phi n}$ Borrow material is coarser than native material	
III	3	$M_{\phi b} < M_{\phi n}$ Borrow material is coarser than native material	$\sigma_{\phi b} < \sigma_{\phi n}$ Borrow material is better sorted than native material
IV	4	$M_{\phi b} > M_{\phi n}$ Borrow material is finer than native material	

FIGURE 6

2. Others Plans Investigated

a. Revetment for Dune Protection.

The crest of the project dune will be built to 11.5 feet NGVD and will intersect the beach berm at elevation 8.5 NGVD. A vegetation plan that calls for stabilizing the dune from wind action and minor wave action is described in this report. The use of sea oats and bitter panicum along with an agressive maintenance program will stabilize the upper dune for the entire project. It is recognized that there will be segments or reaches where the beach berm may experience critical erosion. After completion of the initial project it may be necessary to protect the dune with cellular concrete blocks or pocket filter cloth. These plans are to be used in limited areas or only as an emergency contingency. See figures 7, 8, and 9 for typical cross sections of these structural methods. The cost of the cellular concrete block revetment is estimated to be $130 per linear foot. The cost of the pocket filter cloth revetment is approximately $65 per linear foot. It should be noted that the pocket filter cloth is considerably cheaper, however, it does not offer the same degree of protection. The estimated life of the pocket filter cloth is 2 years and the life of the concrete block revetment is 20 years.

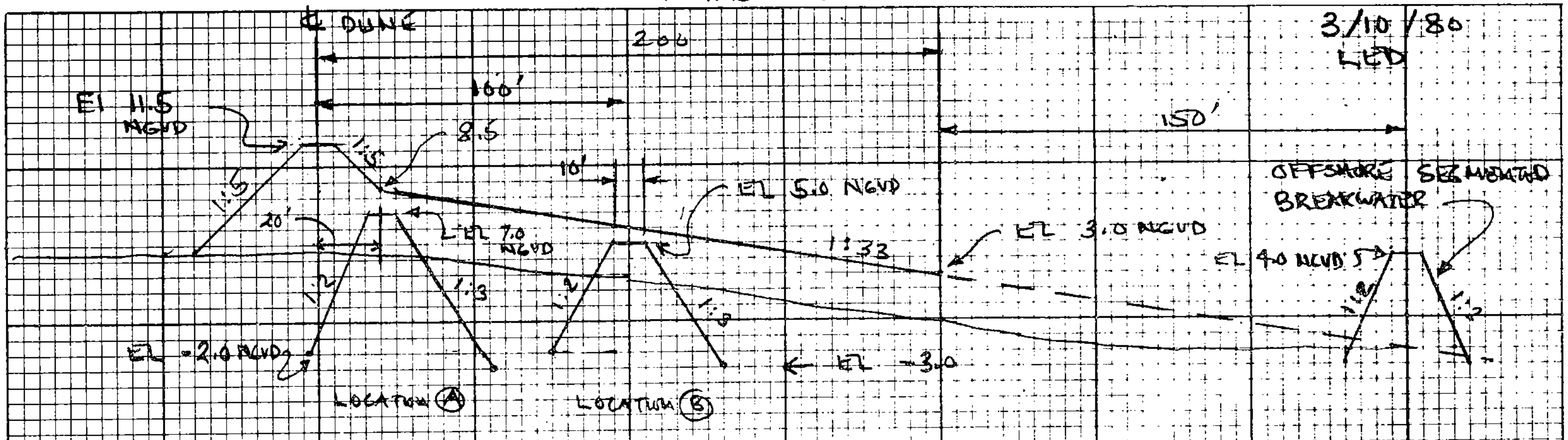
Two specific areas along the project limits have experienced critical erosion during the past. The first one is located at the western end between baseline stations 350+00 to 370+00. The second critical area is just beyond the last groin field and is located between baseline stations 100+00 to 112+00. During the dune restoration project built under the authority of Public Law 93-288 in 1975-1976, structural methods using Longard Tubes were used in these two areas. This restoration project was essentially confined to restoring only the dune existing prior to Hurricane Carmen which crossed the island in September 1974. These two areas experienced frequent overtopping and caused flooding of LA Highway 1.

Phase II plans do not call for additional structural alternatives within these two areas during the construction of the combined beach nourishment and hurricane dune protection project. With the use of large capacity offshore dredges, sufficient sand will be pumped into these offshore areas to offset local erosion effects. With a continuous wide beach on both sides of these two critical areas structural methods should not be necessary.

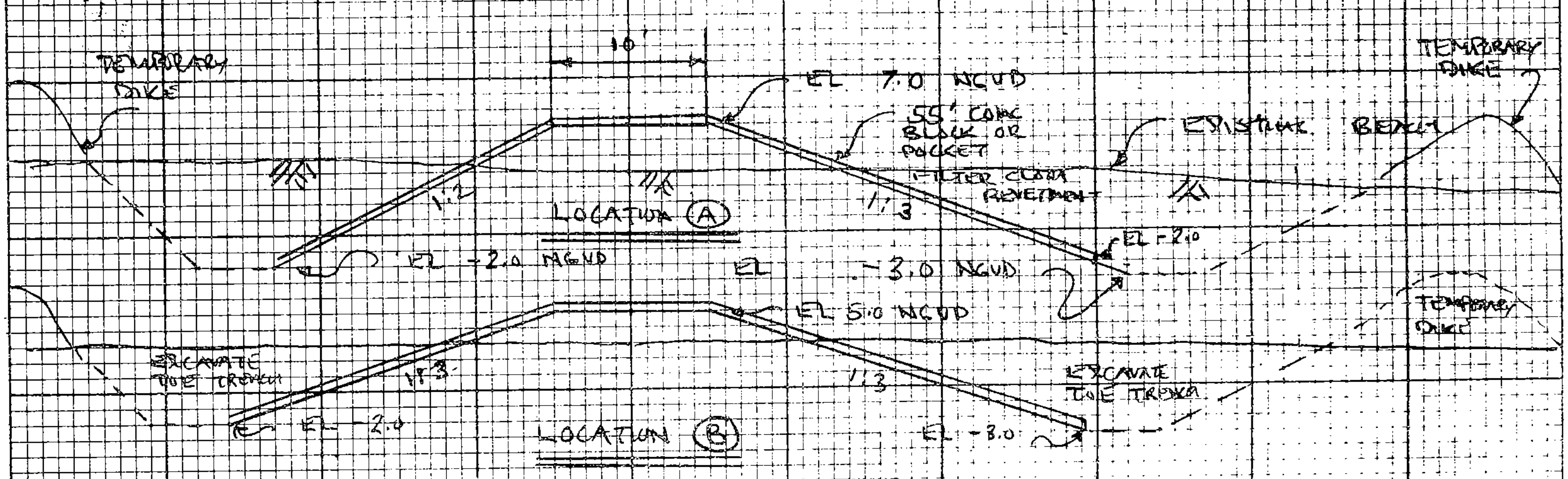
After completion of construction of this project, beach profiles will be monitored on a regular basis as described in section 13.b. in the main body of this report. If experience dictates, the plan using these additional structural methods could be incorporated into the project during future nourishment.

PHASE II - GRAND ISLE

3/10/80
LED



TYPICAL REVETMENTS AND ALTERNATE LOCATIONS FOR DUNE PROTECTION IN CRITICAL REACHES



TYPICAL X-SECTIONS OF
CELLULAR CONCRETE BLOCK
OR
POCKET FILTER CLOTH REVETMENTS

ESTIMATED QUANTITIES FOR EACH LOCATION 55 SQFT / LINEAR FT
FOR POCKET FILTER CLOTH ADD 10 FT + 55 = 65 SQFT / LINEAR FT

BEE 10x10

FIGURE 9

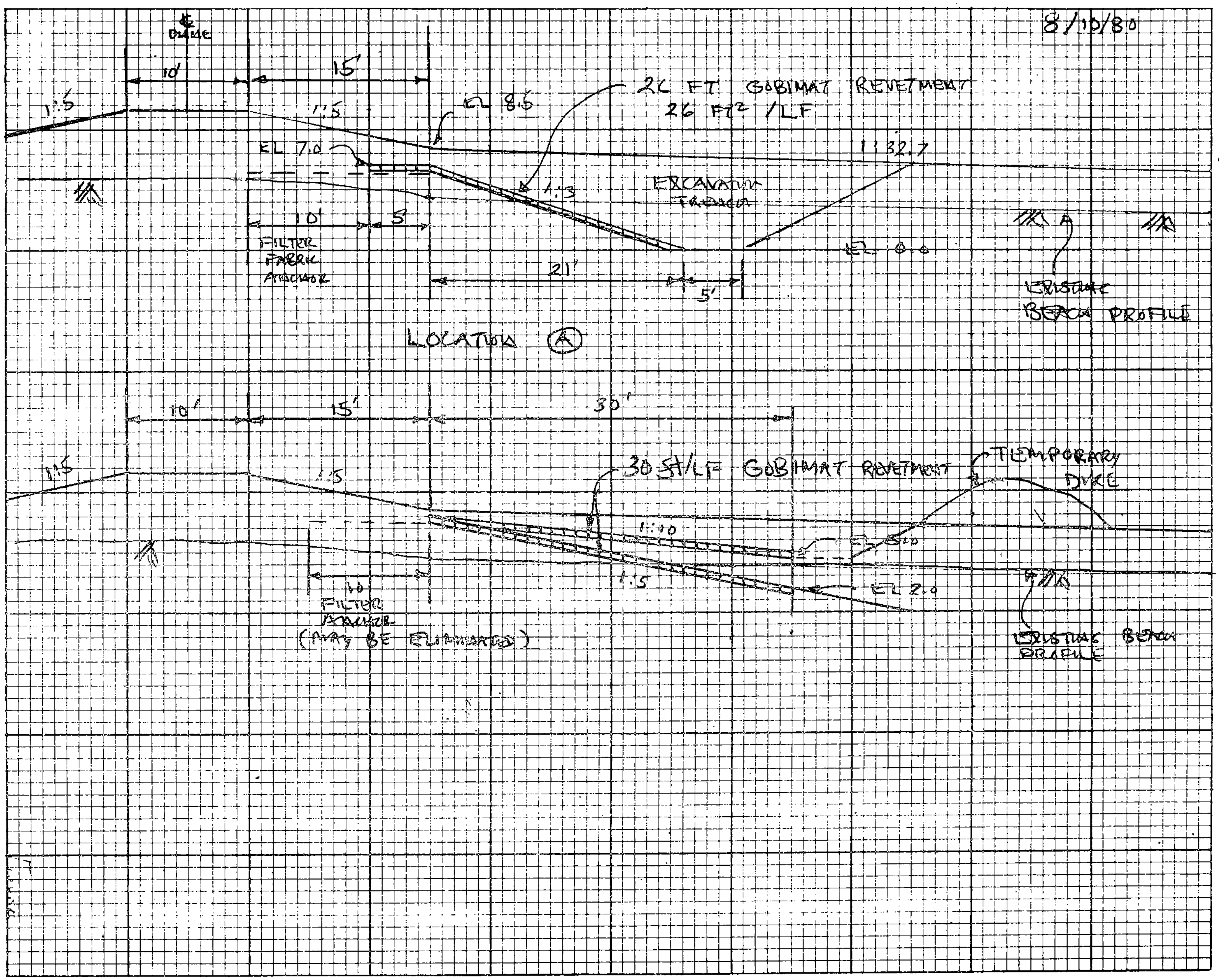

8/10/80
℄ DIKE
10'
15'
1:5
1:5
EL 8.5
26 FT GOBIMAT REVETMENT
26 FT² /LF
1:32.7
EL 7.0
1:3
EXCAVATION TRENCH
10'
5'
FILTER FABRIC ANCHOR
21'
5'
EL 0.0
EXISTING BEACH PROFILE
LOCATION (A)
10'
15'
30'
1:5
1:5
30 SY/LF GOBIMAT REVETMENT
TEMPORARY DIKE
1:10
1:5
EL 2.0
10'
FILTER ANCHOR
(MAY BE ELIMINATED)
EXISTING BEACH PROFILE

FIGURE 8

PHASE II - GRAND ISLE

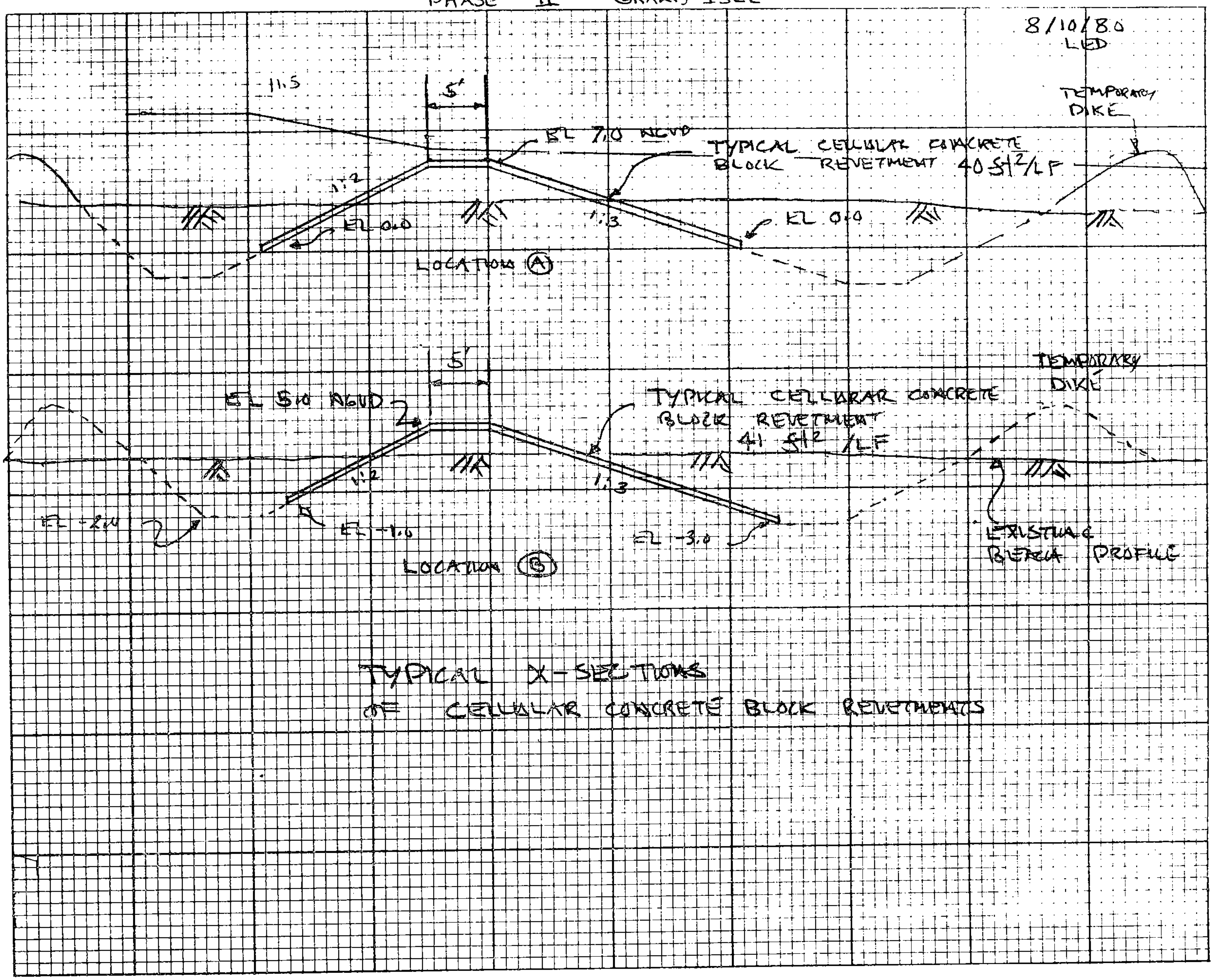


FIGURE 9

b. <u>Offshore Segmented Breakwater</u>. The Coastal Engineering Research Center was consulted for the design of this concept which has been installed at other locations. After a field visit with NOD and CERC personnel a prototype test structure was suggested for the two critical areas. These breakwaters are not designed for prevention of erosion or attenuation of wave action during major storms. Their purpose is to stabilize or reduce renourishment maintenance requirements that are caused by normal long term erosive effects. The suggested prototype test section consists of five offshore rock breakwaters each 150 feet in length and oriented parallel to the beach. The distance offshore that the offshore breakwater will be located is 150 feet from the low water shoreline. The gap distance between segmented breakwaters is dependent upon factors such as wave height, wave length, littoral transport, erosion rate, etc. These factors are not fixed but are constantly changing throughout the year. For the prototype test section four gap distances are proposed and they are as follows: 600 feet, 400 feet, 300 feet, and 200 feet. The total length of the segmented breakwater including gaps is 2,250 feet. See figures 10, 11, 12 and 13 for a plan view and typical cross section of the breakwaters. The design wave height and wave period for the breakwater is 4.0 feet and 5.0 seconds. The crest elevation is 4.0 feet NGVD and the crest width is 10 feet. The estimated cost of this segmented offshore breakwater is $230 per linear foot. Typical design calculations follow:

DESIGN WAVE = 4.0' (ASSUMED MAXIMUM BREAKING WAVE)
T = 5.0 SEC

CALCULATE ARMOR SIZE:

ROUGH, ANGULAR QUARRYSTONE (n = 2)
RANDOM PLACEMENT

SPM, TABLE 7-7, $K_D = 3.5$ (TRUNK SECTION)

$$W = \frac{w_r H^3}{K_D (S_r - 1)^3 \cot\theta}$$

$$= \frac{(155)(4)^3}{3.5(1.42)^3(2.0)}$$

$\cot\theta = 2.0$
$K_D = 3.5$
$H = 4.0$
$w_r = 155$
$S_r = 2.42$

W = 495 # ~ 500 #

GRADATION: 625# - 375# WITH 75% > 500#

CALCULATE CREST WIDTH:

$$B = n K_\Delta \left(\frac{W}{w_r}\right)^{1/3} \quad ; \quad K_\Delta = 1.15$$

$$= 2(1.15)(500/155)^{1/3} = 3.39' \quad \text{USE } B = 10'$$

CALCULATE ARMOR LAYER THICKNESS:

$$r = n K_\Delta \left(\frac{W}{w_r}\right)^{1/3} = 3.4' \quad \text{SAY } 3.5'$$

FIGURE 10

PROJECT Grand Isle, LA	Page 2 of	COMPUTED BY JRL	DATE 10/31/79
SUBJECT		CHECKED BY	DATE

ESTIMATED DAMAGES FOR WAVES EXCEEDING $H_D = 4.0'$

H	% DAMAGE
4.0	0 - 5
4.3	5 - 10
4.8	10 - 15
5.1	15 - 20
5.5	20 - 30
5.9	30 - 40
6.2	40 - 50

STRUCTURE LAYOUT

LOCAL WAVELENGTH @ $d = 6'$

$L_o = 5.12\,T^2 = 128'$

$d/L_o = 0.046875$

SPM TABLE C-1 ; $d/L = 0.09084$ ∴ $L = 66'$

∴ MAKE EA. STRUCTURE $= 1.5\,L = 99'$ SAY $100'$

IF OFFSHORE DISTANCE IS LIMITED TO STRUCTURE LENGTH, THAT MAY BE TOO CLOSE ∴ USE $\ell = 150'$

USE GAP BETWEEN STRUCTURES $\cong 4\,L = 264'$ SAY $275'$

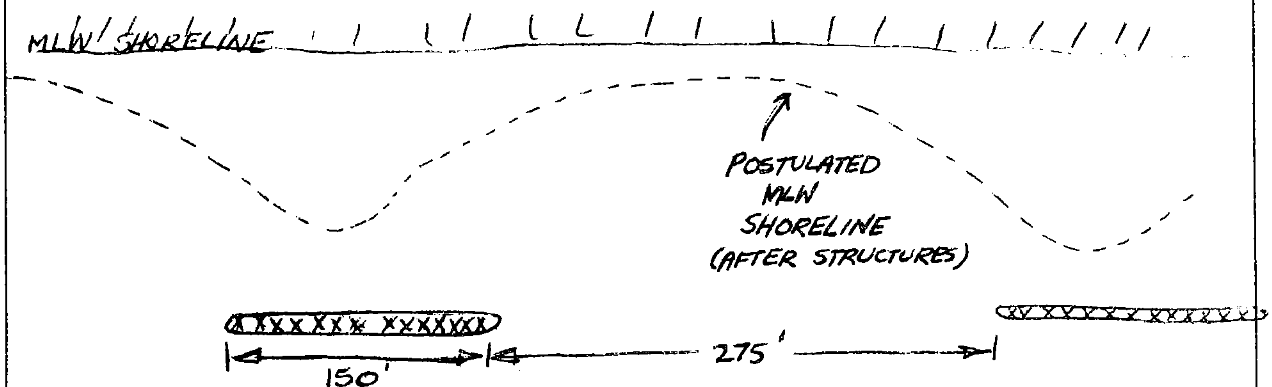


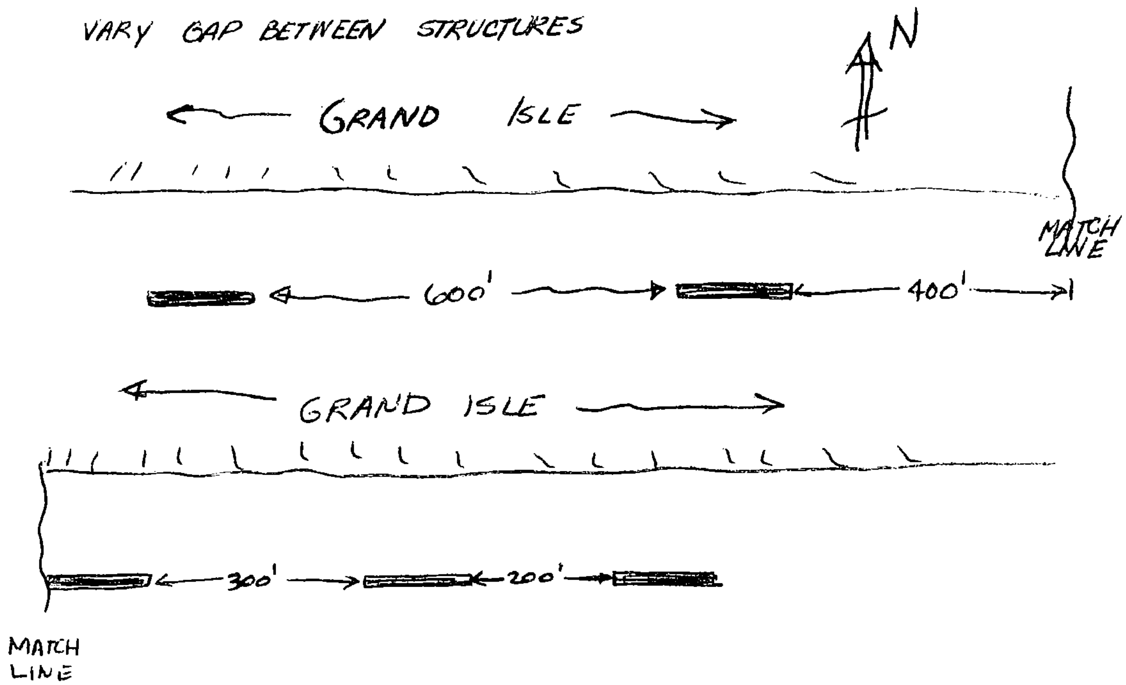
FIGURE 11

PROJECT GRAND ISLE, LA	Page 3 of __	COMPUTED BY JRL	DATE 10/31/79
SUBJECT		CHECKED BY	DATE

POSSIBLE PROTOTYPE TEST STRUCTURES

MAINTAIN STRUCTURE LENGTH AND OFFSHORE DISTANCE @150'

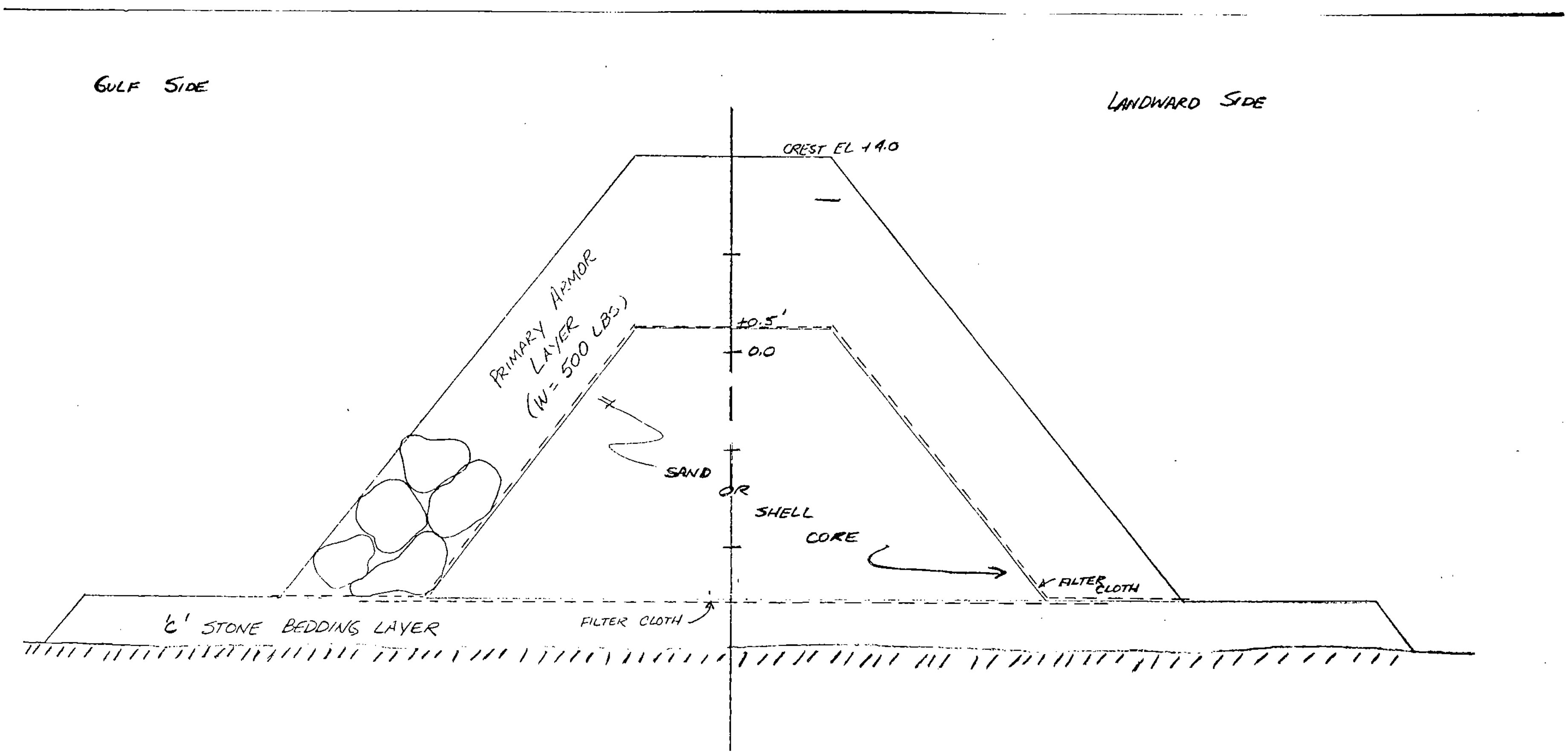
VARY GAP BETWEEN STRUCTURES



5 STRUCTURES

TOTAL BEACH LENGTH = 2250'

FIGURE 12



SEGMENTED OFFSHORE BREAKWATER

FIGURE 13

c. Sand Fencing. The use of standard slat fencing was also investigated as a back-up to the proposed vegetation plan. In the event that plants are not available in the quantities necessary to stabilize the dune from wind borne transport, sand fencing would be employed. Figures 16 and 17 which were reproduced from "Dune Building and Stabilization with Vegetation" by W. W. Woodhouse, Special Report No. 3, dated Sep 78, published for the Coastal Engineering Research Center, illustrates the slat fence. A single row of fence could be erected where vegetation is inadequate to prevent sand from blowing from the dune onto private property. This problem was brought up at the public meeting held 24 February 1979 at Grand Isle, Louisiana. Some meeting attendants indicated that emergency restoration projects built previously at Grand Isle had caused problems because sand from the dune had blown under their camps, thus creating a nuisance and inconvenience to the owners. The estimated cost per meter for installed sand fence is $8.50 based on Oct 80 price levels. Fencing will only be used as an alternative to the vegetation plan outlined in Appendix B of this report.

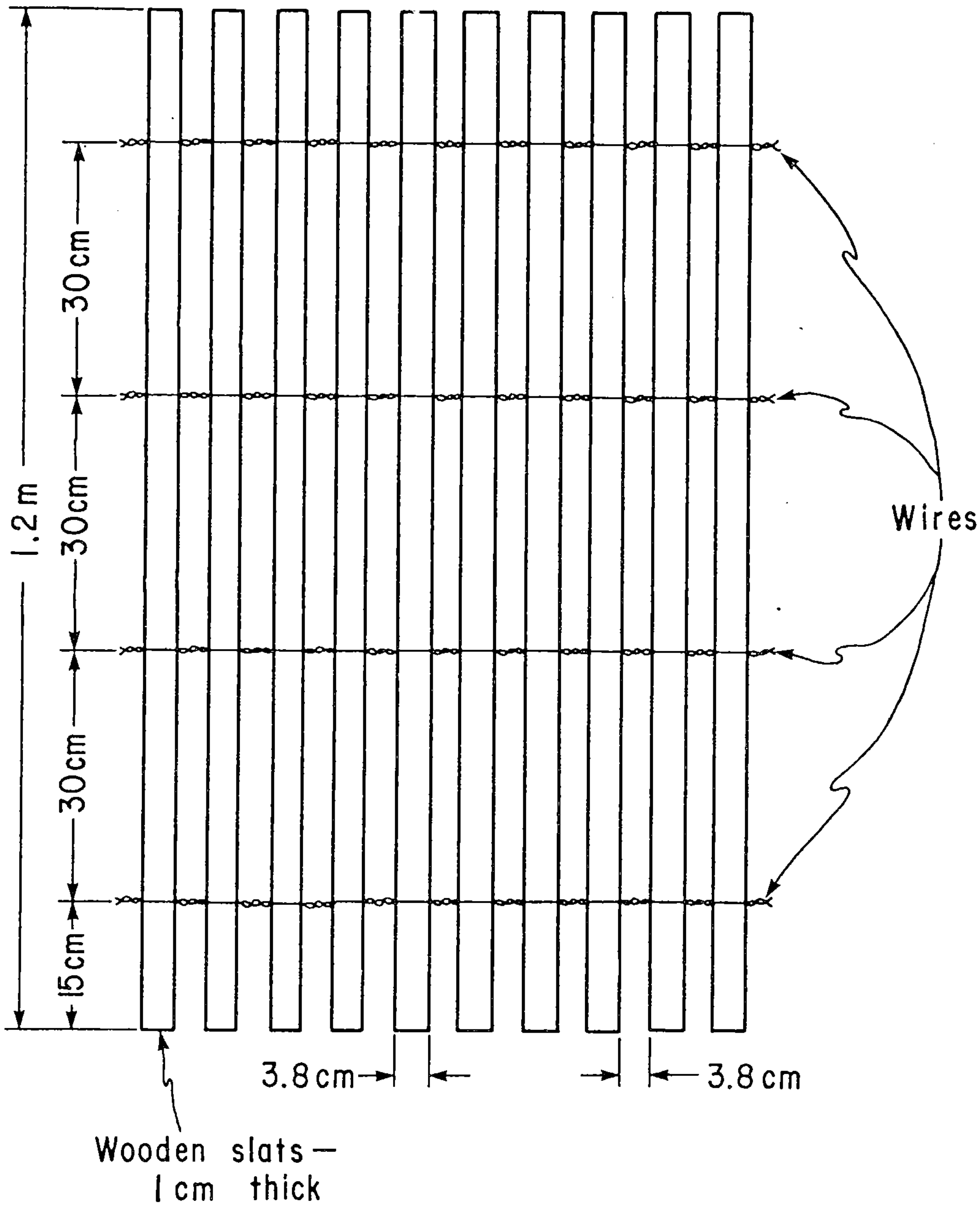


Figure 14. Typical wooden slat fence.

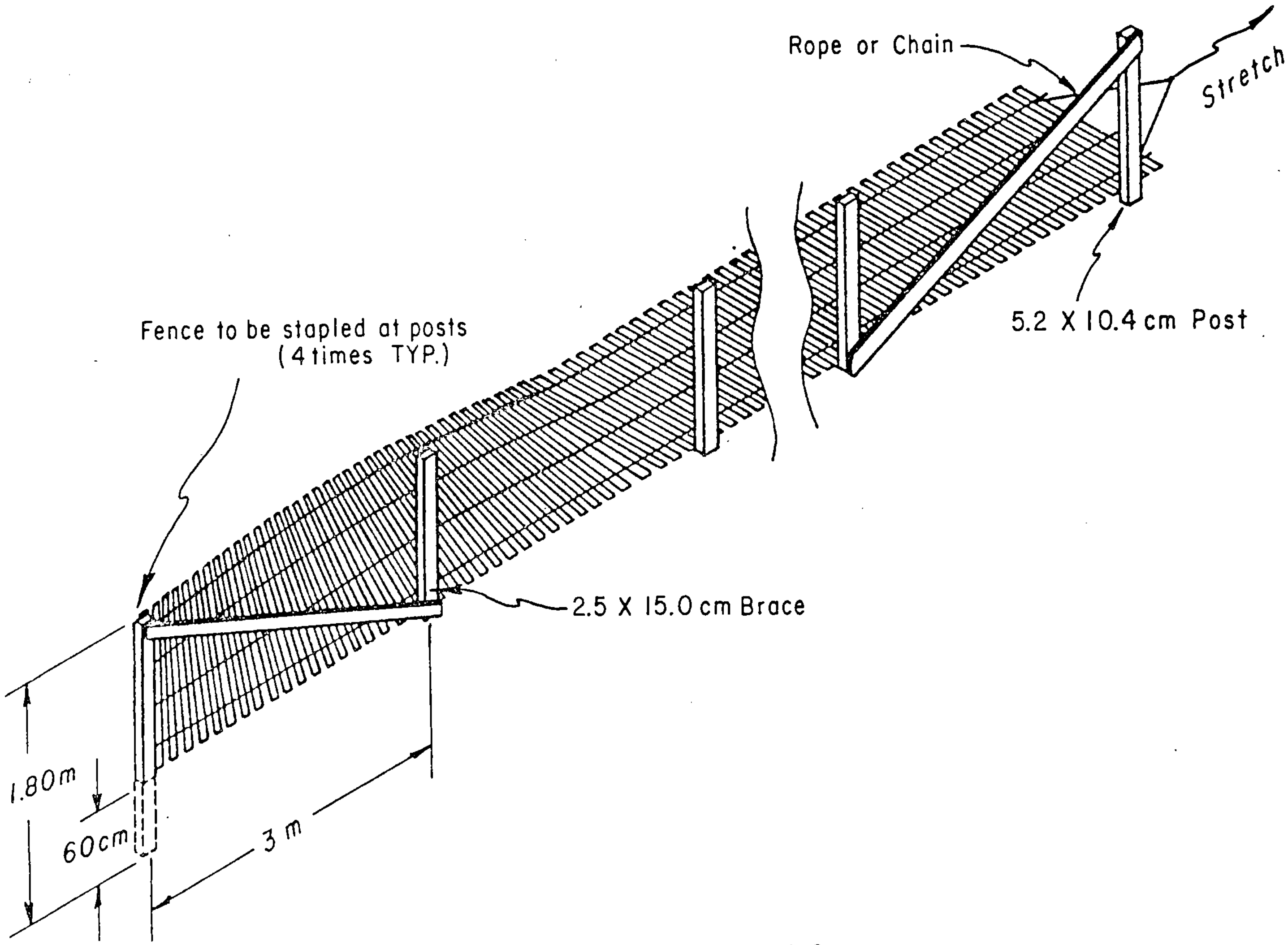


Figure 15. Diagram of a sand fence.

FIGURE 15

APPENDIX D

1. Approved MFR for Milestone 41 Design Conference.

2. OCE Comments on Phase I GDM.

LMVED-TD (NOD 28 Nov 79) 1st Ind
SUBJECT: Grand Isle and Vicinity, Louisiana

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 18 DEC 79

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

The Memorandum for Record is approved.

FOR THE DIVISION ENGINEER:

1 Incl
wd 5 cy (wd incl 3 to incl 1)

for Robert J Kaufman
R. H. RESTA
Chief, Engineering Division

CF:
DAEN-CWE-B (4 cy)
w 4 cy bsc ltr & Incl 1

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

REPLY TO
ATTENTION OF:

LMNED-MP

28 November 1979

SUBJECT: Grand Isle and Vicinity, Louisiana

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. Reference ER 18-2-2, Intensive Milestones System (RCS-DAEN-CWP-16) 21 August 1978.

2. In accordance with the referenced ER, the inclosed MFR is furnished for your review and approval to complete milestone 41 requirements for the subject project.

3. Approval is recommended.

FOR THE DISTRICT ENGINEER:

1 Incl
as

FREDERIC M. CHATRY
Chief, Engineering Division

LMNED-MP

27 November 1979

MEMORANDUM FOR RECORD

SUBJECT: Grand Isle & Vicinity, La., Milestone 41 Design Conference

Date of Conference. 30 August 1979

Place of Conference. New Orleans District Office New Orleans, LA

Attendance. List of attendants is attached (Incl 1).

Conference Purpose. The purpose of the Milestone 41 Design Conference was to brief higher authority on the design considerations that would be addressed in the Phase II GDM and to solicit recommendations regarding methods and/or additional treatment required in the GDM.

Brief Summary of Conference.

Conference participation followed the agenda shown on Incl 2 with attendants participation in the form of comments or questions invited at anytime during the course of the meeting. Because most participants attending the conference had not been afforded the opportunity to see the project site, a rather extensive slide presentation and project briefing was presented. A summary of all known previous shore protection efforts and beach nourishment activities at Grand Isle, La. was presented. The history was compiled to help stress the chronic nature of the problem at Grand Isle and to point out examples of both successful shoreline protection efforts as well as those efforts that achieved only limited success or none at all. The status of the current design activities was given along with an explanation of the future work items which are shown on the inclosed Phase II schedule. (See Attachment 1 of Incl 3.)

The status of the sand resources survey being conducted by the Waterways Experiment Station (W.E.S.) was given. A number of potential sources for sand borrow to construct the beach and dune had been previously identified in the Phase I GDM. However, these borrow sites were located principally adjacent to or on the bayside of the Island and their use would inevitably cause more disruption to the environment than would an offshore site. Hence, the WES study had been initiated to find a more desirable source of sand. The study area had been limited to a rectangular area extending from the nearshore area from approximately 1/2 mile to 2 miles offshore and fronting the entire length of the island. The WES study is proceeding on schedule but no quantitative results have been received as of the conference date.

A discussion of the selected plan constructability was entertained. This discussion centered on the design template outlined in the Phase I GDM and the "more realistic" design or construction section being considered in the Phase II GDM. This section is shown on plate 4 of Incl 3. The extension shown in red for the authorized plan is considerably more realistic in terms of constructability. Conferees agreed that the construction section should be used in computing quantity take-offs for the Phase II designs. The concept and purpose of computing overfill ratios directly relates to the active zone of the beach profile and the natural sorting that is expected to occur following construction. NOD agreed to address the overfill ratios in the Phase II GDM in accordance with procedure outlined in the Shore Protection Manual.

A slide presentation showing methods employed in the emergency dune restoration performed by the District during the month of August 1975 through May 1976 was given. This presentation showed the construction sequence along with follow-up slides showing the effectiveness of the restoration efforts.

The Phase I GDM outlined a vegetation plan for the dune in which a seeding and asphalt mulch preparation would be employed. Prior restoration efforts at Grand Isle, using a similar approach had achieved only limited success in stabilizing the dune. The primary reason for the partial success was that the grass species used in the restoration effort were not tolerant to the saltwater environment and required considerable upkeep. The conference attendants were briefed on the vegetation plan being developed for the Phase II GDM and the status of the beach grass species field nursery at Grand Isle was given. The vegetation plan calls for planting the dune with seedling size plants of Sea Oats (Uniola paniculata) and Panic Grass (Panicum amarum). These plants are to be grown in the field nursery located at the West End State Park area.

Following the vegetation plan, a discussion of miscellaneous construction items ensued. Topics discussed are listed in the conference agenda, Incl 2. In regards to these topics, one item concerning the need for a culvert to be located at the East End State Park was questioned. This construction item was outlined in the Phase I GDM and its conception and designs came as a result of a request by the State Park to keep the "tidal lagoon" open to tidal interchange. The location of the proposed culvert and lagoon is shown on plate 4 of Incl 3. NOD stated that they would investigate alternative approaches to keeping the lagoon open to tidal flow in the Phase II GDM.

The final topic for NOD presentation on the agenda concerned the proposed monitoring plan to be included in the Phase II GDM. Preliminary plans would call for selected beach profiles to be run on a quarterly basis the first year after construction with adjustments to this profiling schedule to be made pending the results of the first years findings. The primary purpose of the monitoring would be to verify erosion rates for the new beach fill material and to use this information to verify the maintenance schedule for the project.

Summary of Recommendation by OCE & LMVD Participants.

The following comments were received after the formal presentation had been concluded:

a. An Operation and Maintenance Manual should be prepared for the project. Such items as care and inspection of the dune should be addressed. A limit on the amount of erosion should be established so that timely action can be taken to insure that maintenance dredging is performed.

b. During construction, the use of temporary dikes to retain dredge effluent should not be employed to obtain the design profile berm width and slopes. Rather, dredge effluent should be allowed to run back into foreshore zone so that the active beach profile builds progressively outward under the influence of the existing wave activity.

c. Specification of construction slopes and elevations should be avoided because the natural angle of repose of material may not conform to those specified. Therefore, it might be more appropriate to specify berm width and berm elevation instead of slopes.

d. Low pocket areas on the protected side of the dune should be filled during construction.

e. Dredge certification by U.S.C.G. will probably be required. Availability of certified dredges for construction should be investigated.

f. The depth of water from which borrow is obtained will place an additional constraint upon dredge selection. Designers should investigate draft requirements for the dredge sizes that are contemplated for this job.

g. Public access to the beach should be provided at a minimum of 1/2 mile intervals.

h. The use of pocket filter cloth to protect the dune face should be investigated as a possible means of stabilization.

Vann Stutts

VANN STUTTS

3 Incl
as

LIST OF ATTENDANTS

D. Vann Stutts	LMNED-MP
L. F. Cook	LMVED-WH
J. H. Lockhart, Jr.	DAEN-CWE-HD
A. J. Combe, III	LMNED-HC
L. E. DeMent	LMNED-HC
H. L. Bracey	LMNED-DG
H. R. Varner	LMVED-DG
J. M. Carlton	LMNPD-RE
Ed Watford	LMNPD-F
Ernest E. Barton	LMNED-MP
Bob Louque	LMVED-W
E. B. Kemp	LMNED-FG
Gerry Satterlee	LMNED-FD
Tom Harrington	LMNED-M
Frank J. Weaver	LMVED-G
Charles Pigott	LMVCO-C
Dan Cooper	LMNCD-CD
Frederic M. Chatry	LMNED
Rodney P. Picciola	LMNED-F

Incl 1

AGENDA

Grand Isle & Vicinity, LA
Design Conference Meeting
30 August 1979
New Orleans District
Corps of Engineers

Time		
0830	Welcoming	Mr. Chatry
0835	Briefing - History of Projects & Current Status of Designs	Mr. Stutts
0850	Sand Resource Survey - Source of Construction & Annual Nourishment Materials	Mr. Kemp
0945	Coffee Break	
1000	Selected Plan Design Sections & Overfill Ratios - Previous Emergency Restorations	Mr. Dement
1100	Vegetation Plan & Field Nursery	Mr. Carlton
1200	Lunch	
1245	Construction Methods	Mr. Dement
1330	Miscellaneous Construction Items Localized Protection East End State Park Culvert Beach Access (Public & Private) Sand Fencing	Mr. Dement & others
1430	Monitoring Plan	Mr. Comb
1445	Break	
1500	Summary of Recommendation by OCE & LMVD Participants	--
1530	End of Conference	

LMVED-TD (OCE 5 Nov 79) 1st Ind
SUBJECT: Grand Isle and Vicinity, Louisiana - Comments for Consideration During Phase II GDM Studies

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 29 NOV 79

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

Referred for appropriate action.

FOR THE DIVISION ENGINEER:

Frank J. Weaver
for R. H. RESTA
Chief, Engineering Division

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON. 20314

REPLY TO
ATTENTION OF:

DAEN-CWE-BB

5 November 1979

SUBJECT: Grand Isle and Vicinity, Louisiana - Comments for Consideration During Phase II GDM Studies

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. Reference 1st Indorsement LMVPD-F, 24 September 1979, on letter LMNPD-F, 18 May 1979, subject: "Grand Isle and Vicinity, Louisiana - Phase I GDM."

2. The technical comments furnished in the following paragraphs on the Phase I GDM transmitted to DAEN-CWE-BB with the above referenced correspondence should be considered during the preparation of the Phase II GDM.

3. Run Up Analysis. The run up analysis makes use of the empirical relationships found by Saville and presented in the SPM; however, only one wave condition appears to have been investigated. The assumption that the design wave will result in the maximum runup is not necessarily correct. Various heights and periods need to be investigated since a broad range of wave frequencies (periods) are present in hurricanes and sometimes smaller waves that break closer to shore will result in higher run up. A more comprehensive analysis should be made since the run up analysis determines the dune crest elevation which is a critical factor in establishing project benefits and costs.

4. Design Profiles.

a. The report states that "the hurricane protection profile was determined from an estimate of the quantity of material likely to be eroded .....". No information is provided on how this estimate was made. Since the overall performance of the project depends upon the adequacy of the hurricane protection profile, the erosion analysis should be presented.

b. No critical assessment of the expected performance of the nourishment material is presented. Data are available on the grain size distributions of both the native sand and the sand from several proposed borrow areas; however, their comparison to determine the suitability of the borrow is not made. Some recent work (James, N. R., "Techniques for Evaluating Suitability of Borrow Material for Beach Nourishment", CERC Technical Memorandum 60, December 1975) will allow the determination of a "renourishment factor" through comparison of the native sand and fill sand size distributions. The renourishment factor will provide some indication of the required frequency of renourishment given present erosion rates.

5. Miscellaneous.

a. Houses constructed on Grand Isle have their first floors at approximately elevation +8.0 feet to meet the local building code. If this is correct, the stage-damage curves probably should show a marked increase in damage as water stages approach and exceed this level; the curves do not indicate this.

b. The report should indicate that there is a very high probability (64 percent) that the 50-year design hurricane water level will occur sometime during the 50-year lifetime of the project.

c. The design criteria for the jetty at Caminada Pass suggest that that jetty is permeable and that overtopping will occur. No explanation is provided for the permeability and low-crest elevation; it is assumed that the economics justify the low-crest. The design criteria should be provided for the existing structure and a statement made as to whether it meets the Corps design standards.

FOR THE CHIEF OF ENGINEERS:

LLOYD A. DUSCHA
Chief, Engineering Division
Directorate of Civil Works

APPENDIX E

Proposed

"Beach Dune Walkover Structures"

For Grand Isle & Vicinity project

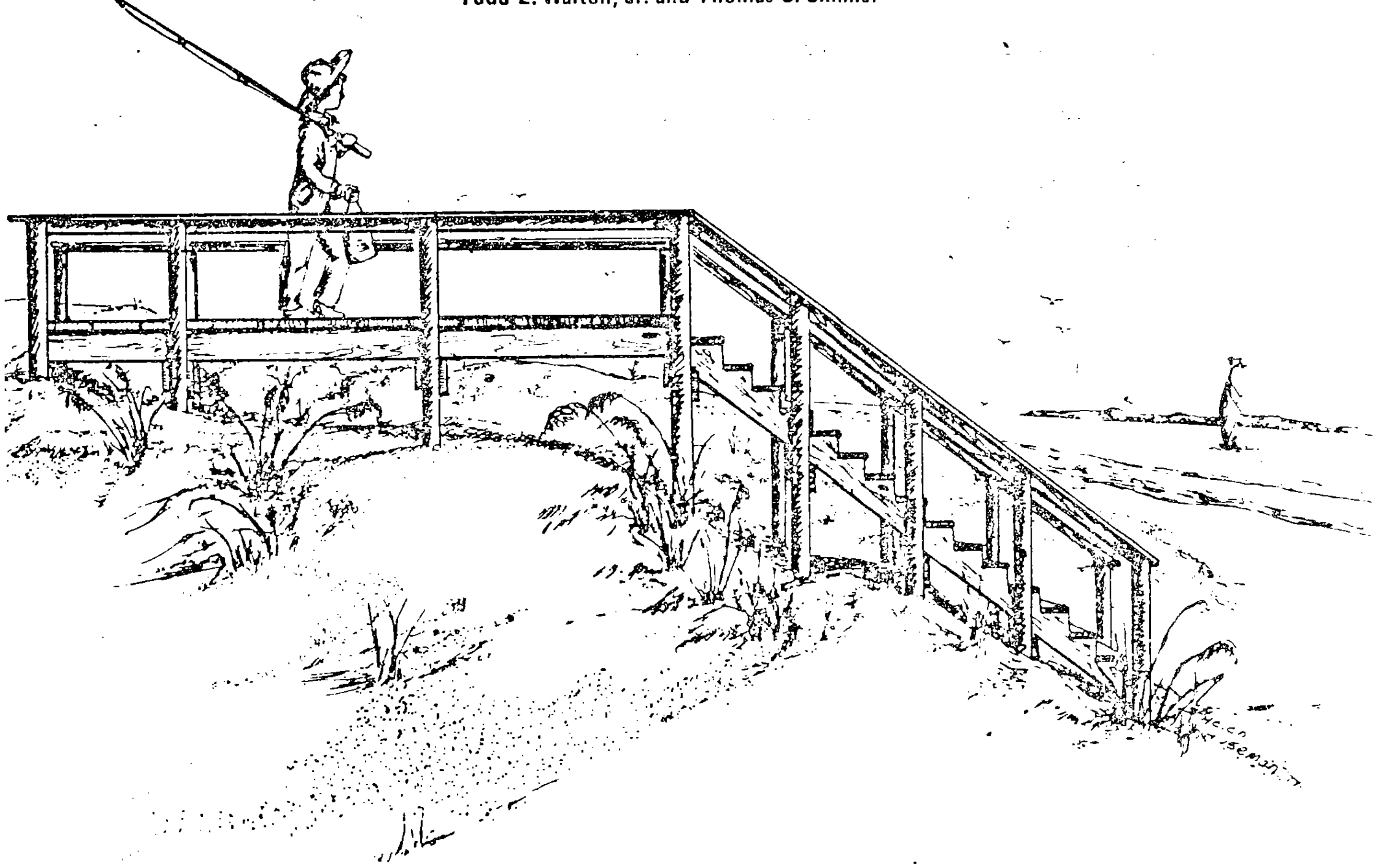
FLORIDA COOPERATIVE EXTENSION SERVICE

Marine Advisory Program

ORIDA SEA GRANT PUBLICATION DECEMBER 1976 SUSF - SG - 76 - 006

Beach Dune Walkover Structures

Todd L. Walton, Jr. and Thomas C. Skinner



The Florida Sea Grant Program is supported by award of the Office of Sea Grant, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, contract number 04-6-158-44055, under provisions of the National Sea Grant College and Programs Act of 1966. The Florida Sea Grant Program was initiated in 1972 with three major components: applied marine research, education, and advisory services.

This public document was promulgated at a cost of $242.79 or 8 cents per copy, to provide information on construction of a beach dune walkover structure.

The Marine Advisory Program functions as a component of the Florida Cooperative Extension Service, John T. Woeste, dean, in conducting Cooperative Extension work in Agriculture, Home Economics, and Marine Sciences, State of Florida, U.S. Department of Agriculture, U.S. Department of Commerce, and Boards of County Commissioners, cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 14, 1914.

12/3M/76

This is the last of six Marine Advisory Program Bulletins published in 1976.

BEACH DUNE WALKOVER STRUCTURES

by

Todd L. Walton, Jr.[1] and Thomas C. Skinner[2]

INTRODUCTION

The idea behind this publication originally came from the Bureau of Beaches and Shores, Department of Natural Resources, State of Florida. It was recognized that numerous dune systems within our state were undergoing destruction due to the loss of vegetation caused by unrestricted access to the beach over the dune systems. As the vegetation was lost, the wind became capable of eroding the dune and caused a progressive deterioration of the entire dune system.

In areas of high human traffic, a beach walkover structure is needed to save this vegetation. Two structure designs are presented in this publication. Figures 1 through 7 give details of a structure for use in areas of heavy foot traffic. A good example of such use might be for a condominium or a community public access ramp. The depths of pilings account for both depth necessary for structure stability and added depth to account for possible dune deflation losses.

Figures 8 and 9 give details of a smaller structure more suitable for the typical coastal land owner where only light foot traffic is expected. The depth of pilings in sand is correspondingly less which should minimize interference with the dune system in construction of the walkway. It should be noted that any construction seaward of the State Coastal Construction

---

1 Coastal Engineering Advisory Specialist, Marine Advisory Program, with the Coastal and Oceanographic Engineering Laboratory, University of Florida.

2 Extension Agricultural Engineer, Florida Cooperative Extension Service, IFAS University of Florida.

Setback Line (Reference 1) must be permitted by the Bureau of Beaches and Shores, Department of Natural Resources.

The designs are basic enough such that various alternatives can be added to the designs without altering the structures to a great degree. One such alteration would be a transverse extension of the deck section with benches for people to sit on overlooking the beach area. The addition of properly spaced skid resistant materials to the decking of the ramp section of the large walkover structure would make the deck and the deck extension accessible to handicapped people in wheelchairs. Additional features which could also be added are limited only by the planner's imagination.

The authors would like to thank both Mr. Gill Hill and Mr. William Sensabaugh of the Bureau of Beaches and Shores, Department of Natural Resources, for the ideas and suggestions used in these plans. The authors hope that this publication will lead to the building of more walkover structures in areas where dune systems are threatened by human traffic. The authors also hope to hear any suggestions, comments, or criticism which might be included in a future revision of this publication.

MATERIALS SPECIFICATION SHEET

(1) Wood

All wood to be pressure treated in accordance with American Wood Preservers Association Standard C-2. The preservative used should be a waterborne preservative such as Type B or C or equivalent as covered in Federal Specification TT-W-535 and AWPA Standards P5, C2, and C-14. The type wood to be used depends on the quality of the construction desired. A suitable inexpensive wood for construction would be southern pine. Higher grade and more expensive woods would be the heartwood of Bald Cypress, Redwood, or Eastern Red Cedar. Very expensive but extremely durable and decay resistant woods would be Greenheart or Basra Locus. "Rough cut" lumber can be used on all lumber in the substructure while "dressed" (i.e. surfaced) lumber should be used on the flooring and hand-rails. Further information on the specifications for buying lumber can be found in Reference 2.

(2) Hardware

All bolts and other hardware to be hot dipped galvanized.

(3) Nails

All nails to be galvanized.

GENERAL NOTES

(1) Bolts in handrails shall have nut end toward post. Countersink so that bolt does not project beyond post. Trim excess of projecting bolts after fastening.

(2) All connections to posts to be by bolts.

(3) Do not encase bottoms of pilings in concrete. This would be termed objectionable construction in obtaining a permit from the Bureau of Beaches and Shores.

1. Coastal Construction Setback Line by J.A. Purpura and W.M. Sensabaugh, Marine Advisory Bulletin, SUSF-SG-74-002, Florida Cooperative Extension Service, 197-

2. Wood Handbook: Wood as an Engineering Material, U.S.D.A., Forest Products Laboratory, 1974

3. Timber Design and Construction Handbook, McGraw Hill Publishing Co., 1956

4. Wood Engineering, G. Gurfinkel, Southern Forest Products Association, 1973

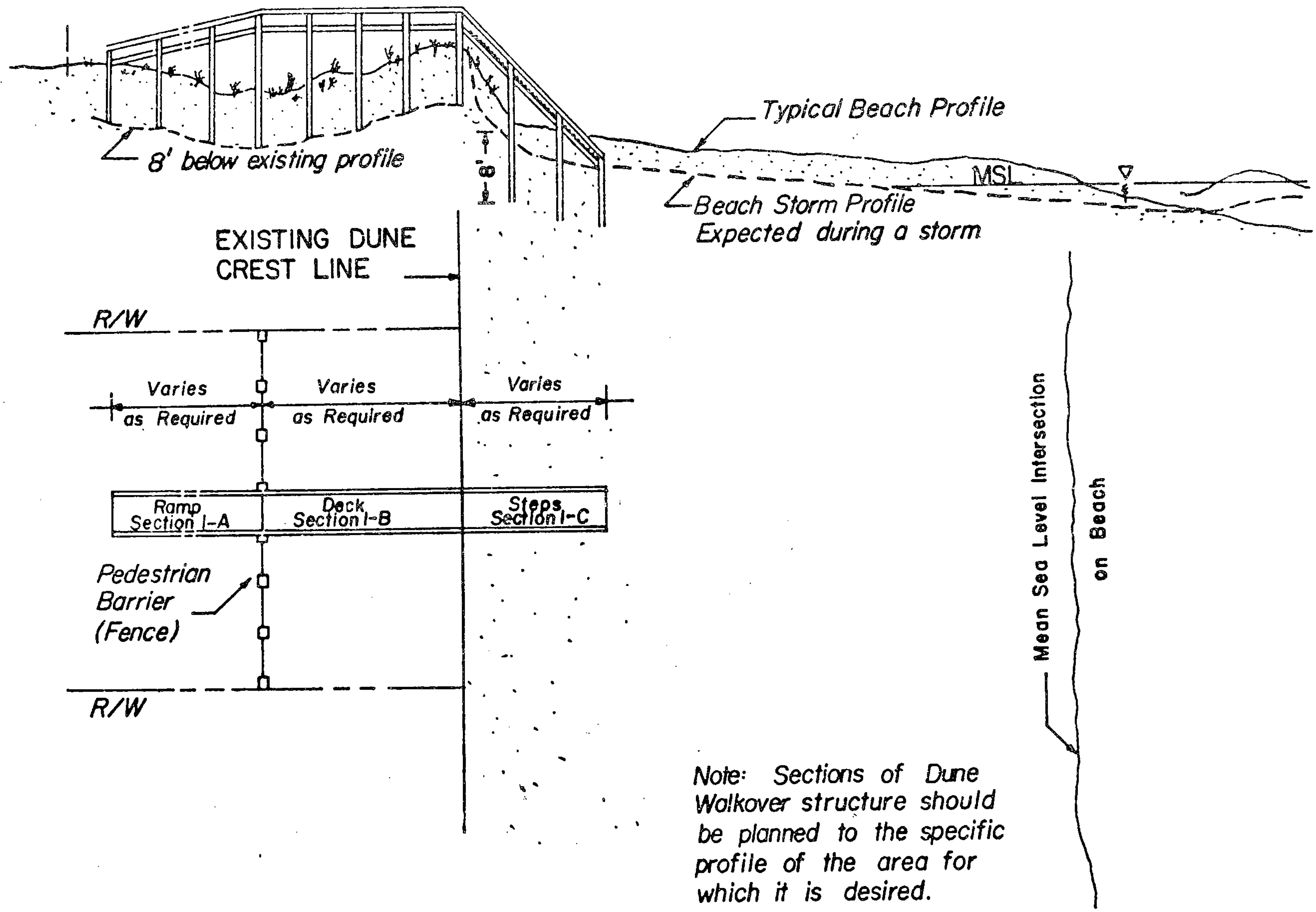


Fig. I TYPICAL PLAN and ELEVATION VIEW
Scale: 1" = 20'

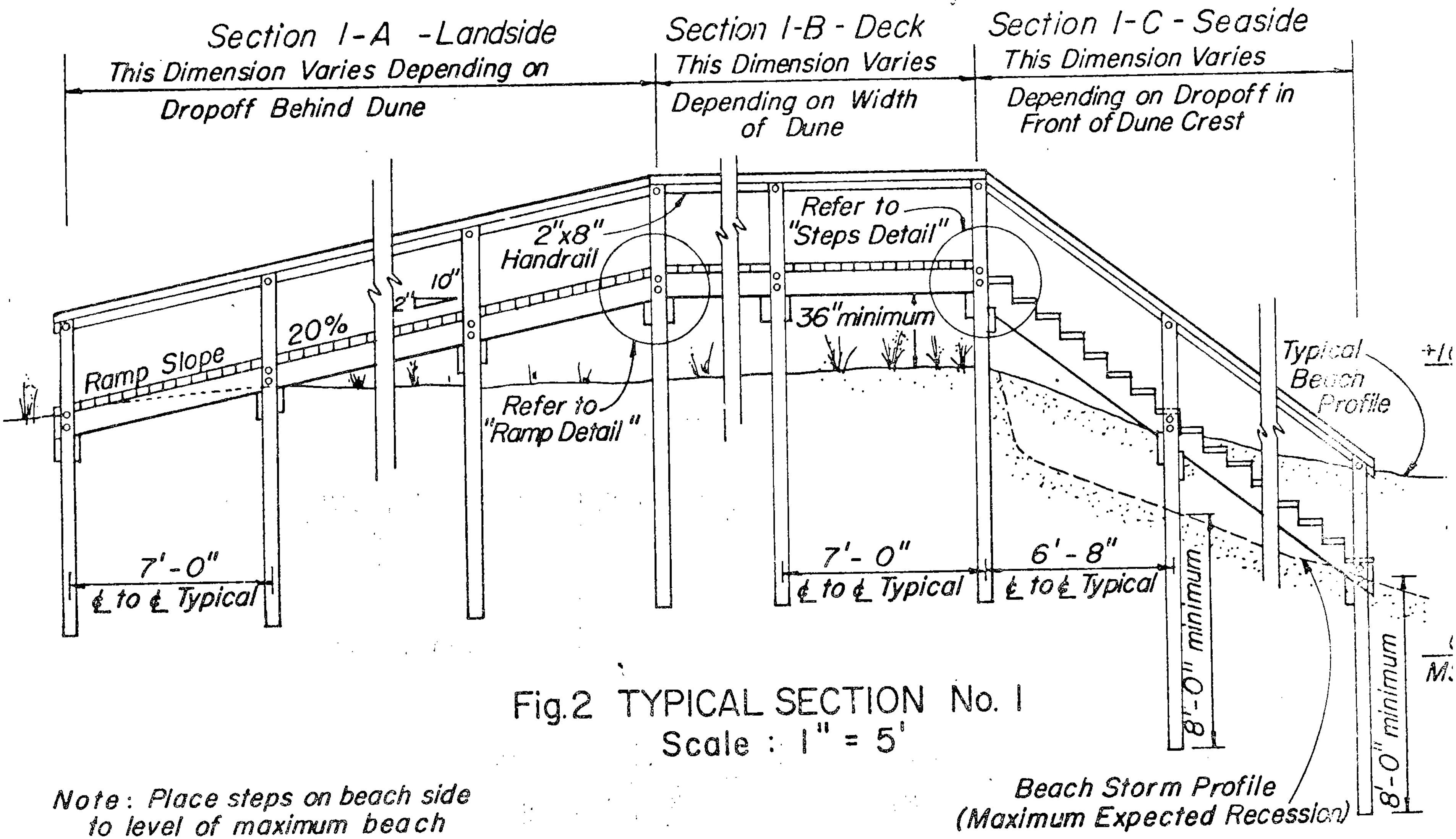


Fig.2 TYPICAL SECTION No. 1
Scale : 1" = 5'

Note: Place steps on beach side to level of maximum beach recession during a severe storm or tropical hurricane

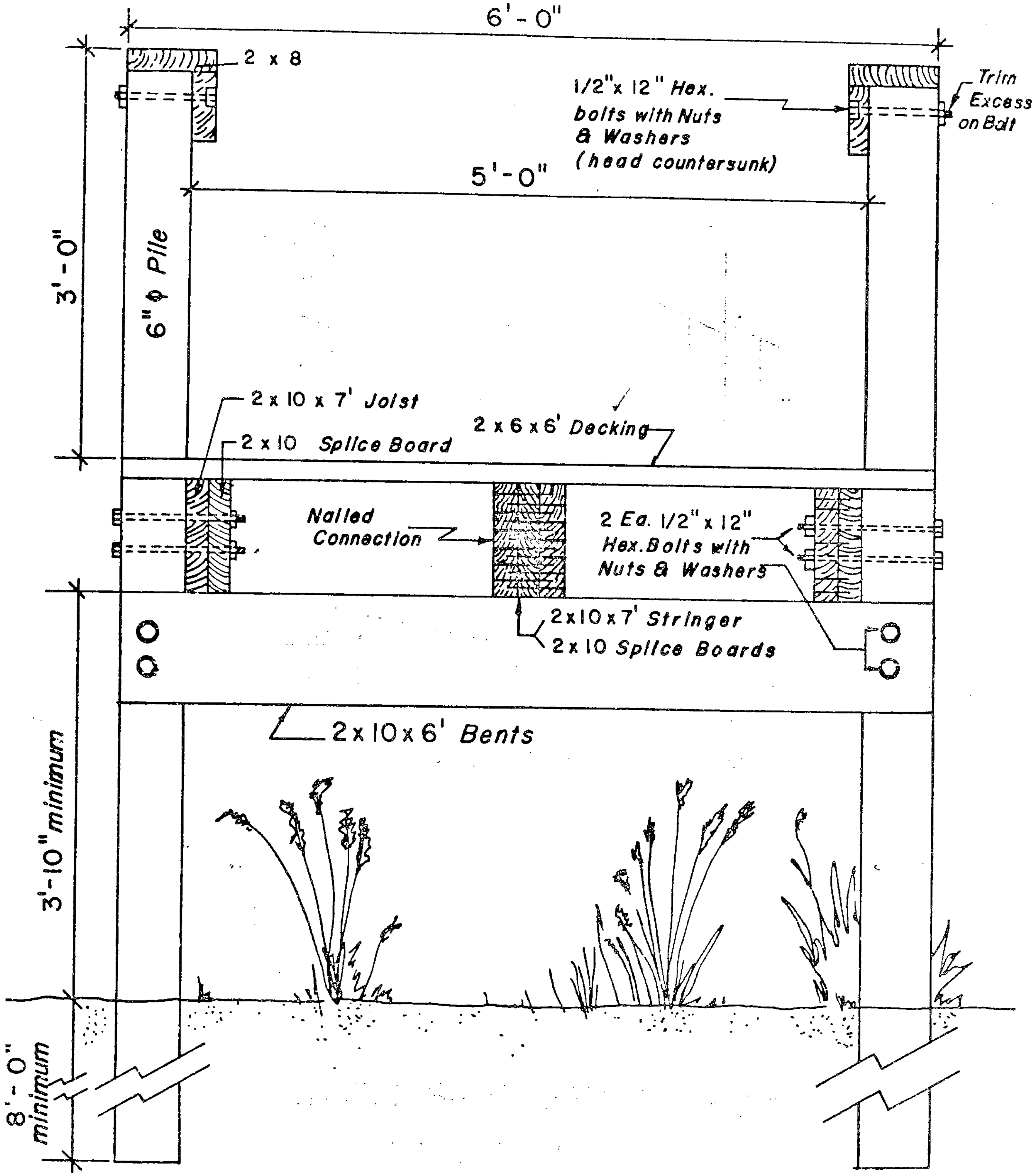


Fig. 3 TYPICAL SECTION I-B DECK
Scale: 1" = 1'-0"

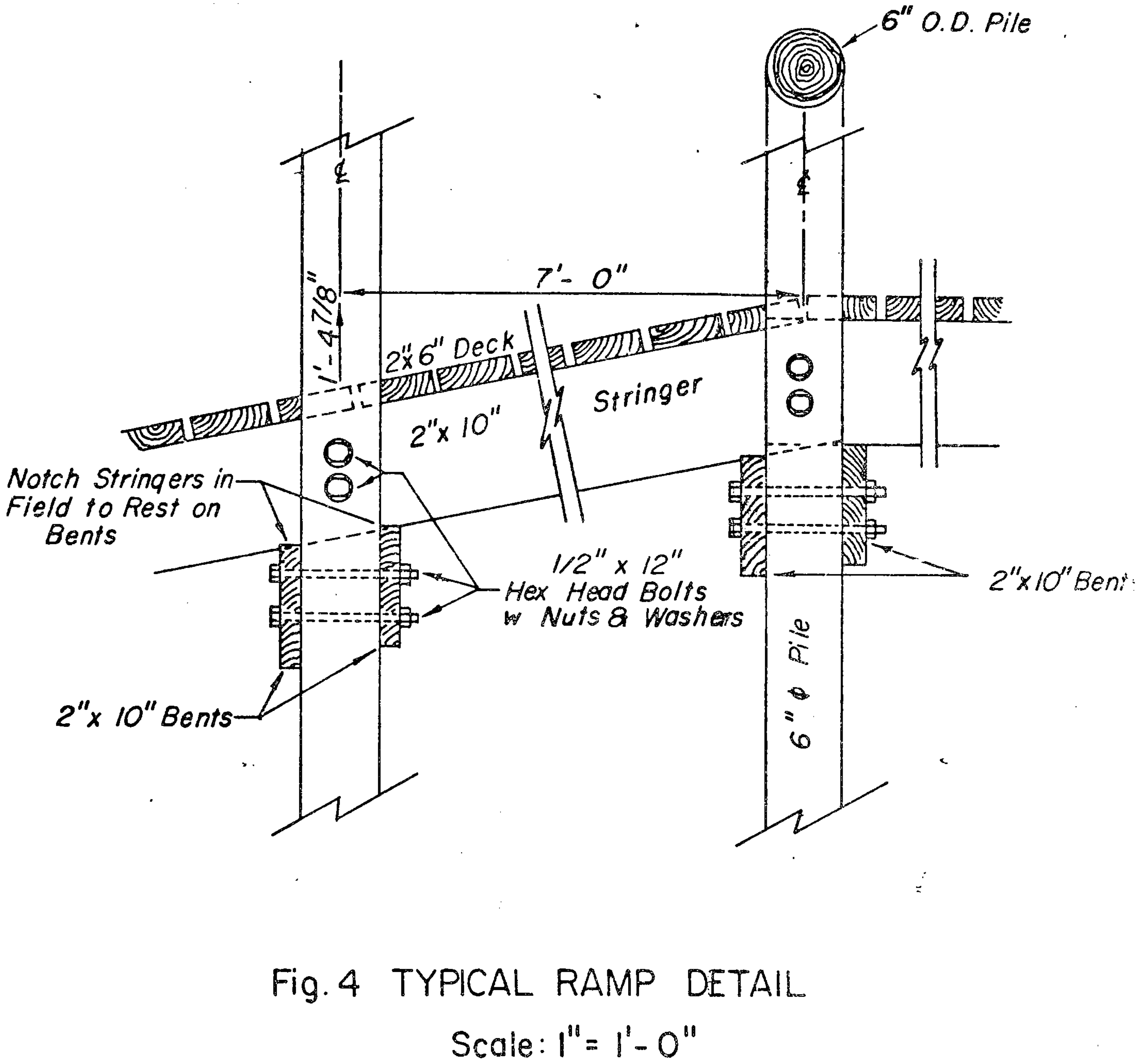


Fig. 4 TYPICAL RAMP DETAIL

Scale: 1" = 1'- 0"

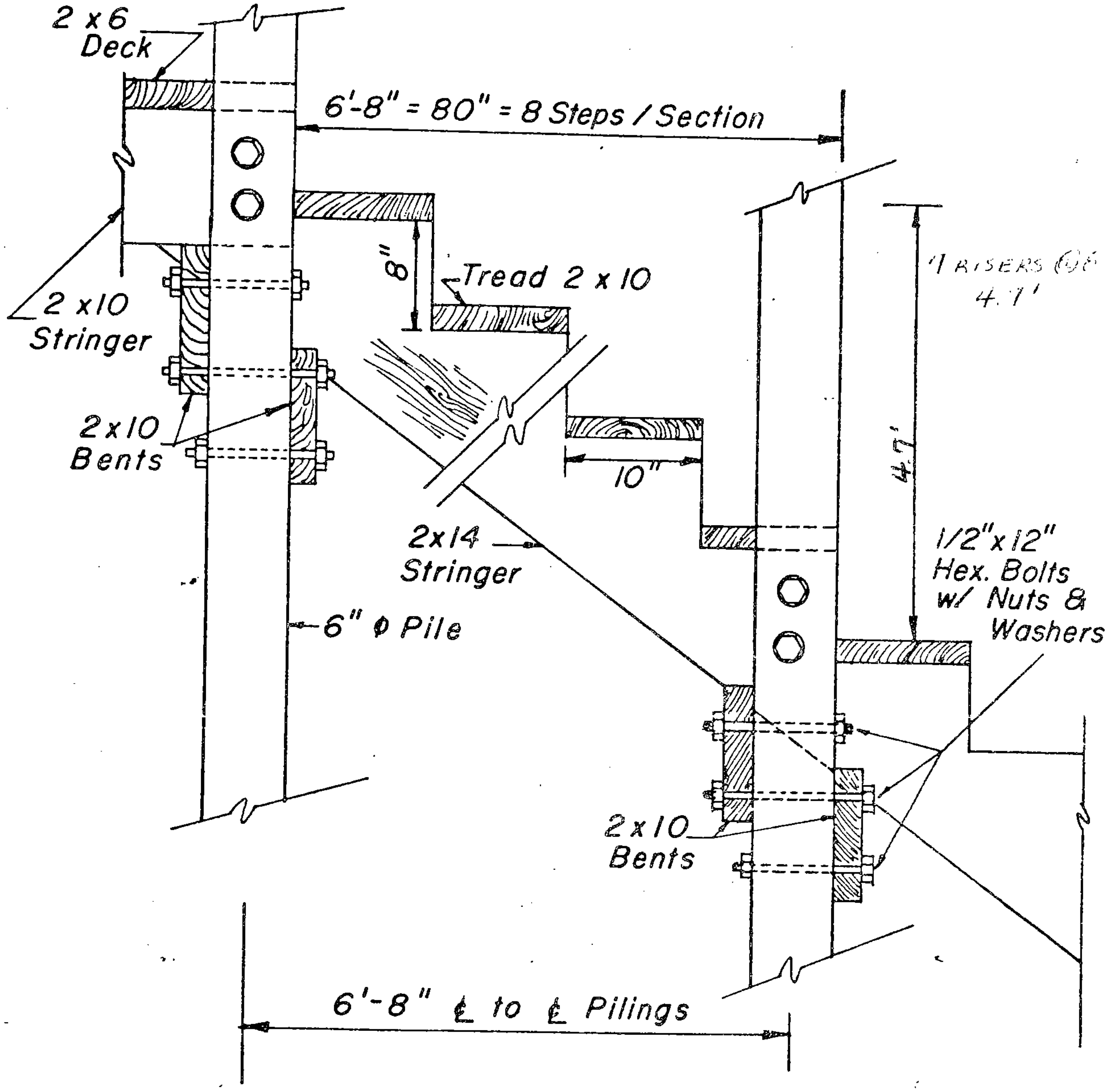
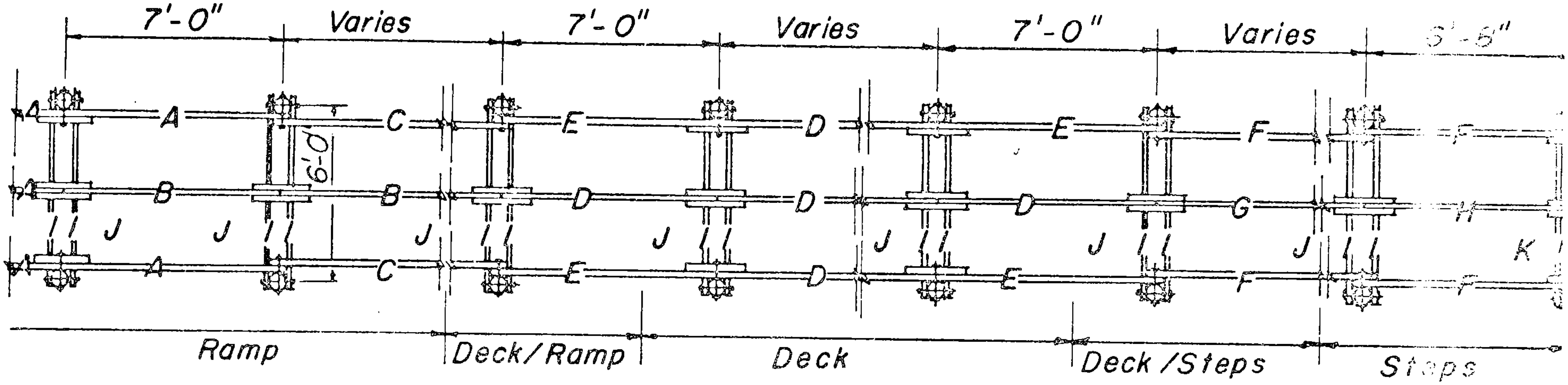


Fig. 5 TYPICAL STEPS DETAIL

Scale : 1" = 1'- 0"



Stringer Dimensions		
A	2 x 10 x 7'-9"	
B	2 x 10 x 7'-6"	
C	2 x 10 x 8'-4"	
D	2 x 10 x 7'-0"	
E	2 x 10 x 7'-3"	
F	2 x 14 x 9'-0"	notched for steps
G	2 x 14 x 8'-6"	notched for steps
H	2 x 14 x 8'-9"	notched for steps
Bent Dimension		
I	2 x 10 x 6'-6"	
Splice Dimension		
J	2 x 10 x 2'-0"	
K	2 x 10 x 1'-6"	

Note: Bill of Materials based on ramp length of 21', deck length of 28' and 2 stair sections of 6'-8" each.

Note: All splice blocks to be nailed to stringers to provide both lateral support at joints and bearing support. All pile bolted connections to be 1/2" x 12" hex. bolt with nut and washers.

Bill of Materials		
Quan.	Item - Description	
44	2 x 6 x 20'	dressed
9	2 x 8 x 20'	dressed
5	2 x 10 x 20'	dressed
19	2 x 10 x 20'	rough
3	2 x 14 x 20'	rough
20	6" ⌀ Piles @ 16'	
100	1/2" x 12" hex. bolt with nut and washers	

Fig. 6 TYPICAL STRINGER LAYOUT DETAIL

Scale: 1" = 5'-0"

Include as many step sections as necessary to grade from top of dune + 3 feet to base of rear dune.

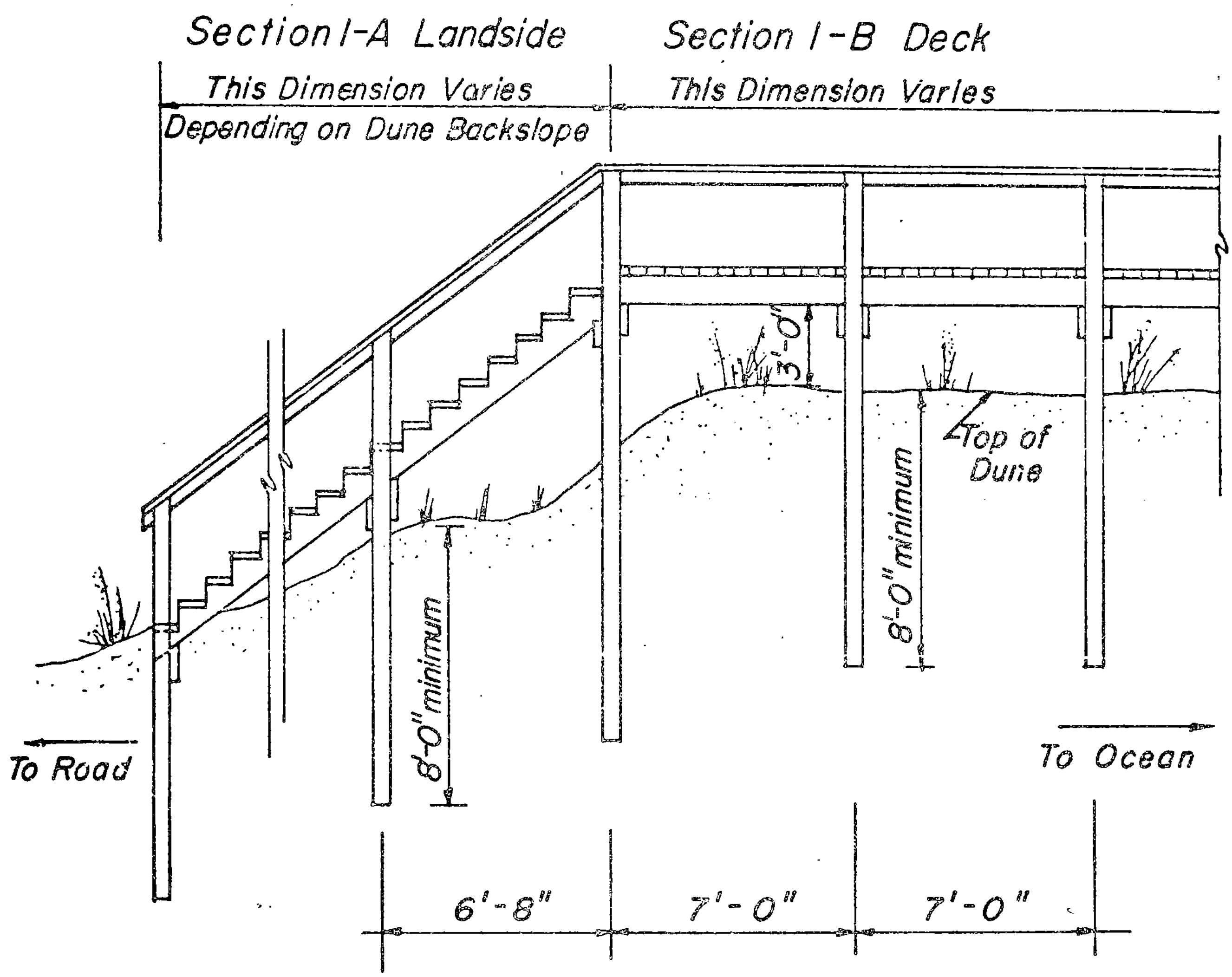


Fig.7 ALTERNATE SECTION No.1
Scale : 1" = 5'-0"
(Refer to details as per Figure 2)

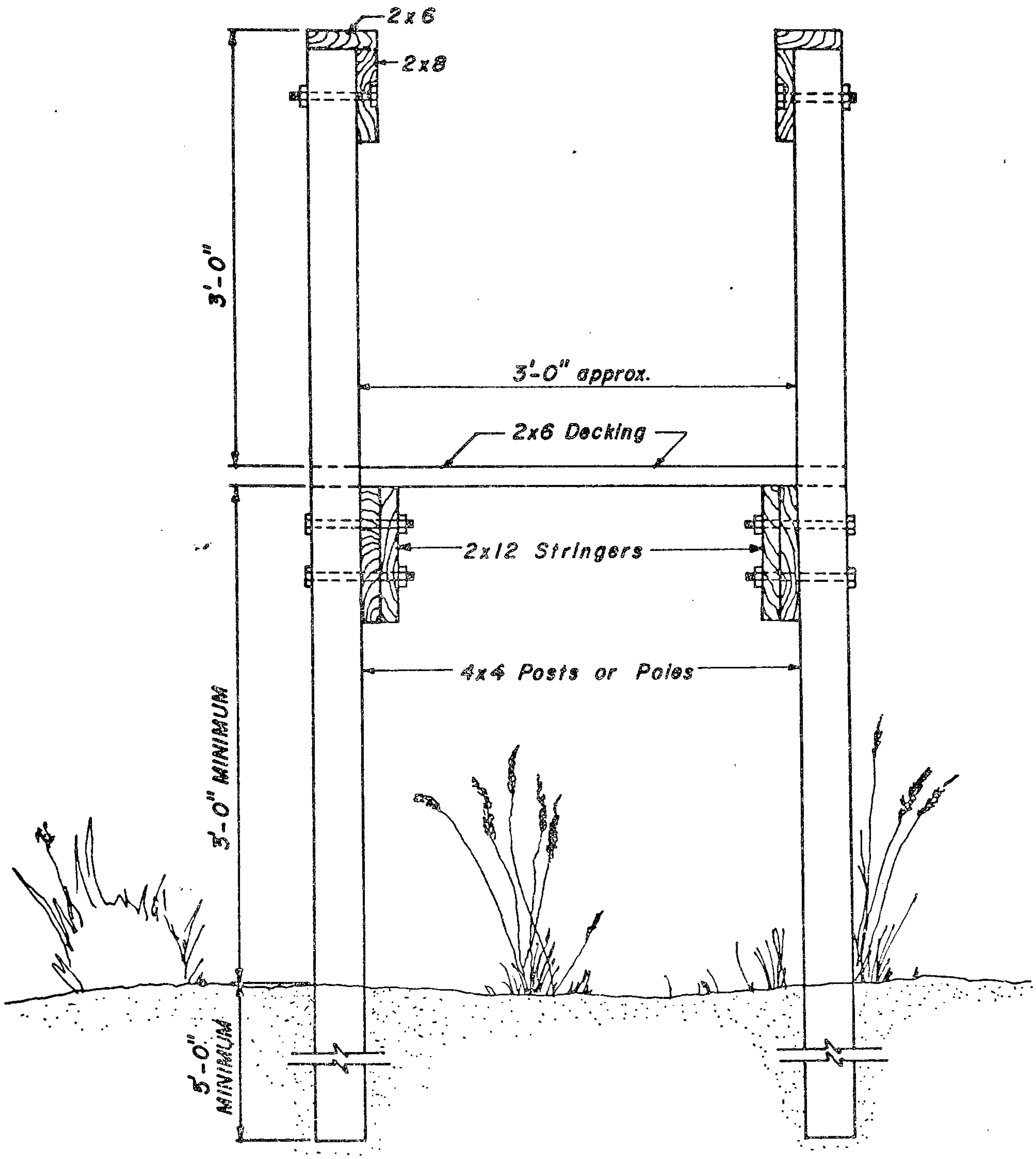
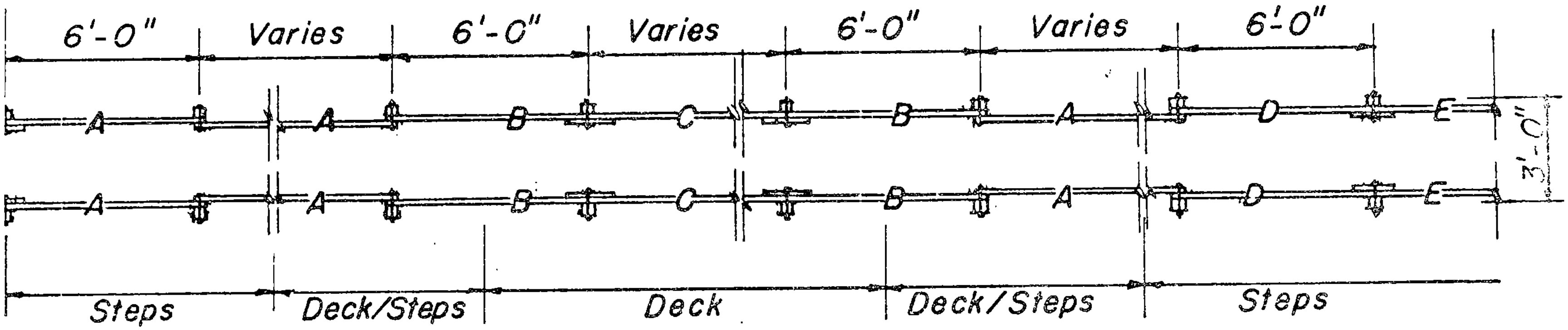


FIG. 8 TYPICAL SECTION scale: 1"=1'-0"



STRINGER DIMENSION		
A	2 x 12 x 8'	notched for steps
B	2 x 12 x 7'-9"	
C	2 x 12 x 6'	
D	2 x 12 x 7'-8"	notched for steps
E	2 x 12 x 7'-6	notched for steps
SPLICE BLOCK DIMESION		
F	2 x 12 x 1'-6"	

BILL OF MATERIALS	
QUANT.	ITEM DESCRIPTION
108'	2x12 Stringers & Splice blocks
16	4"x4" Posts or Poles
66	1/2"x 12" Hex bolt w/ nut and washers
36	2x6x 20' dressed
28	2x 8x 20' dressed
4	2x10x 20' dressed

Note: *All splice blocks to be nailed to stringers to provide both lateral and bearing support at joints. All pile bolted connections to be 1/2"x 12" hex bolt with nut and washers.*

Bill of Materials based on 24' deck and step lengths, 6' and 12'.

FIG.9 TYPICAL STRINGER LAYOUT
scale: 1" = 5'

APPENDIX F

1. Supplemental Information Report Grand Isle, Louisiana

SUPPLEMENTAL INFORMATION REPORT

GRAND ISLE AND VICINITY, LOUISIANA

Changes in the Construction and Maintenance Plan

Borrow Area

Sandfill for construction of the dune and beach berm will now be dredged and pumped from a single borrow area in the Gulf of Mexico (see Plate 1). This represents a change from the plan outlined in the Environmental Impact Statement which is also shown on Plate 1. Original borrow areas are shown at the eastern and western ends of the island. The new borrow area will occupy 300 acres, is approximately 1,500 feet wide and 8,700 feet long, and is located approximately ½ mile offshore in a water depth of 12 feet. There will be 113 acres more available for borrow than was originally reported. The new borrow area will reduce pumping distances required by the previous plan. Analysis of boring logs taken in the borrow area indicates the upper 10 feet of sand is suitable for placement on the Grand Isle Beach. Boring log analysis also revealed a few layers of fines that, under the action of normal wave wash and littoral currents, would be subject to suspension and thus removal from the beach. The quantity of fines in the borrow area is estimated to be about 10 percent of the total borrow material that will be used. However, it is expected that only a very small percentage of these fines will be subject to wave action. A large majority of fines will be covered by the more suitable sand material and not be subjected to the action of currents and waves.

Dune and Beach Building

The new dune and beach area will occupy approximately 365 acres, of which 275 acres will be below the mean high water line. An additional 150 acres of water bottoms will be covered to a depth of 1 foot or less, due to material lost from the project area. These figures represent a total increase of 25 acres in the amount of water bottoms covered. The entire construction process, estimated to take approximately 1 year from the date initiated, represents a reduction of 1½ years in construction time as originally specified in the EIS. Although estimated total quantities of material for beach and dune construction have increased, construction time for similar jobs conducted by the Jacksonville District, US Army Corps of Engineers, indicate the 1-year period will be sufficient for this project. Replacement of an estimated greater. Approximately 70 acres would be covered during each of the maintenance dredgings below the mean high water line, and an additional 40 acres would be returned to the gulf.

Changes in Impact

There should be only minor changes regarding impacts concerning actual dune and beach building. It is estimated that only an additional 25 acres will be covered and, thus, impacts should be increased accordingly. Initial dredging from the borrow pit could disrupt the entire 300-acre borrow area. This is 113 additional acres of borrow as compared to the original EIS. Maintenance borrow, as previously stated, will come from a small area within the large borrow area. The short-term impacts of dredging should be less than reported in the EIS, since the borrow areas have been moved away from the tidal passes. The attached Table shows acres and months of productivity lost because of the project.

Cultural Resources Survey

A magnetometer survey, conducted 25 February to 1 March 1980, for cultural resources within the 300-acre borrow area was performed by Texas A&M Anthropology Research Laboratory. In the course of their survey, two magnetic anomalies were located just outside of the borrow area and six magnetic anomalies were located within. The final survey report with evaluations of the magnetic data will be coordinated with the State Historic Preservation Officer for comment. Further evaluation of the magnetic anomalies will be performed by divers in order to identify and assess significance of the findings. This will be accomplished before dredging in the borrow area begins.

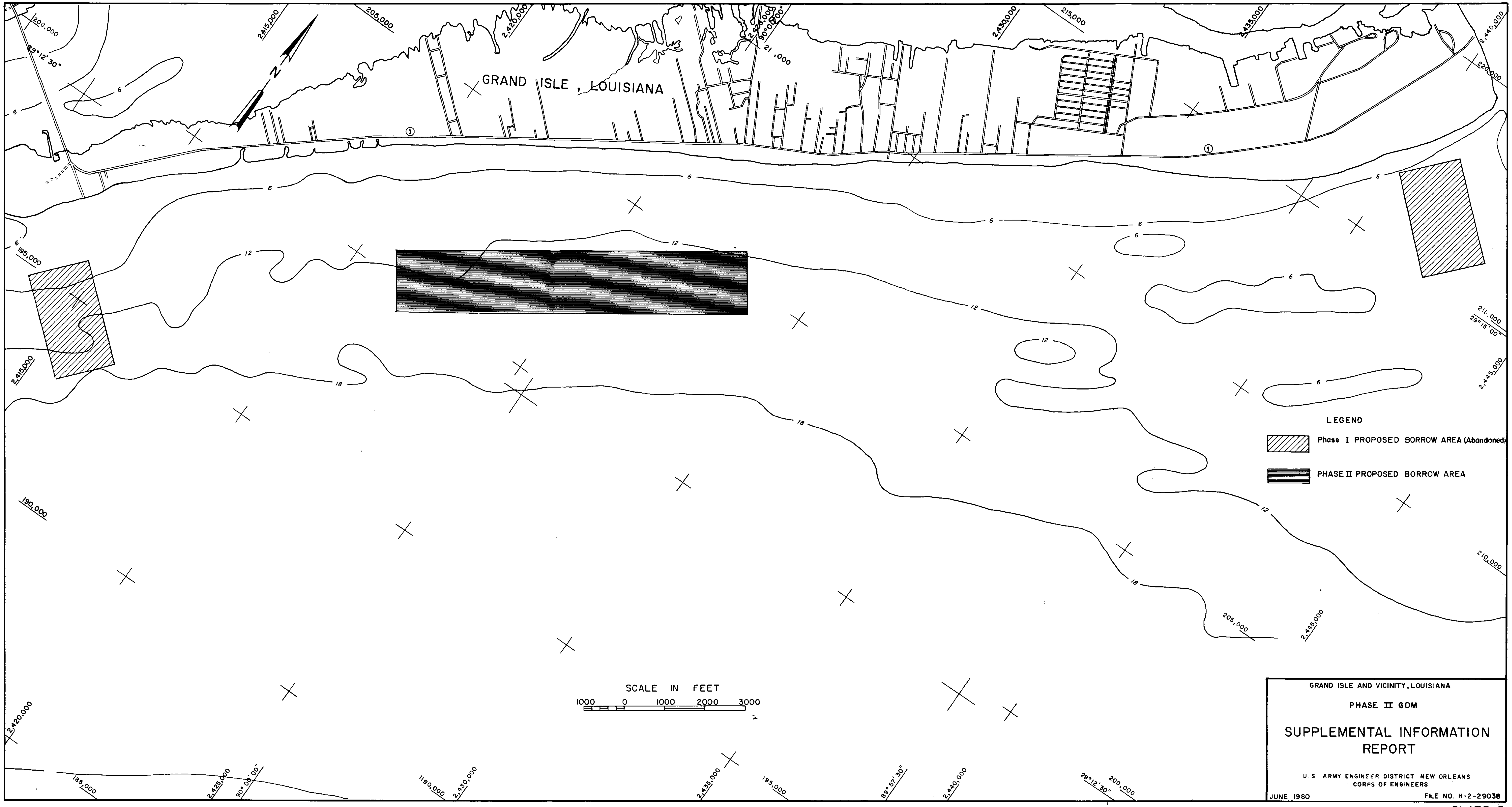
404(b)(1) Evaluation

The Section 404 regulations deal with the discharge of dredged or fill material into navigable waters. The changes as discussed in the aforementioned paragraphs do not cause a change to the method, location, or type of discharge. Therefore, a revision to the 404(b)(1) Evaluation was not considered necessary.

ACRES AND MONTHS OF PRODUCTIVITY
LOST OR DIMINISHED DUE TO PROJECT

SITE	ACRES	ACTIVITY	TIME AND PRIMARY IMPACT	TOTAL TIME
Borrow Area	300	Construction	12 months and 6 months recovery time for benthos	18 months
	35	Maintenance	3 months dredging plus 6 months recovery time X 11	99 months
Dune berm*	90	Construction	12 months dredge material disposal and 12 months recovery time for supra-tidal species**	24 months
	30	Maintenance***	6 months recovery X 11	66 months
Beach****	275	Construction	12 months of disposal operation	12 months
	70	Maintenance	6 months recovery time X 11	66 months
Sand returned to Gulf	150	Construction	6 months recovery time	6 months
	40	Maintenance	6 months recovery time X 11	66 months
				357 months
				381 months***

*Above mean high water line
**Recovery of dune will be enhanced by vegetation transplants
***One maintenance operation of the dune is anticipated with the same timing and impacts as initial construction
****Below mean high water line



GRAND ISLE AND VICINITY, LOUISIANA

PHASE II GDM

SUPPLEMENTAL INFORMATION REPORT

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

JUNE 1980

FILE NO. H-2-29038

PLATE I