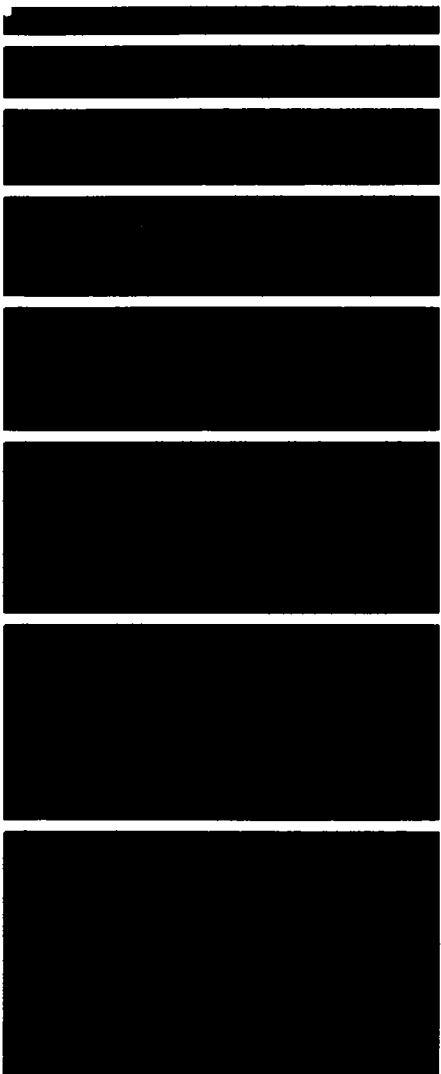

**WESTWEGO
TO
HARVEY CANAL, LA.
HURRICANE PROTECTION PROJECT**



**DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
SUPPLEMENT NO. 2**

VOLUME I

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

FEBRUARY 1990

SERIAL NO.



**US Army Corps
of Engineers**
New Orleans District

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DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

P.O. BOX 60267

NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CELMN-ED-SP (1110-2-1150a)

20 Mar 90

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

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, Design Memorandum No. 1, General Design,
Supplement No. 2

1. We are submitting the subject General Design Memorandum (GDM) for review and approval. The Advance Supplement for the Harvey Canal Floodwall and the Reduced Scope GDM for the same project were submitted previously and have been approved. The Supplement No. 2 has been prepared generally in accordance with the provisions of ER 1110-2-1150 dated November 1984.

2. The plan presented in the GDM Supplement No. 2 generally follows the authorized plan, with the addition of a new levee (Westside Closure) required to close the system in the western portion of the project.

3. A summary of the current status of the Environmental Impact Statement (EIS), endangered species and cultural resources investigation is as follows:

a. The work proposed in the subject GDM was addressed in the EIS for the West Bank of the Mississippi River in the vicinity of New Orleans, Louisiana which was filed with EPA on 23 October 1987. The EIS did not analyze the Westside Closure which has now been added to the project. This work, as well as other design changes to levees and floodwall, is addressed in Environmental Assessment dated February 1990.

b. Construction of the project will not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.

4. Section 404(b)(1) Evaluations were prepared in December 1986. Supplemental 404(b)(1) Evaluations were completed in February 1990. A Public Notice will be prepared and an application for water quality certification will be submitted to Louisiana Department of Environmental Quality in March 1990.

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane Protection Project, Design Memorandum No. 1, General Design, Supplement No. 2

5. All anticipated cultural resources investigations have been completed. The project impact area has been surveyed, and in consultation with the Louisiana State Historic Preservation Officer, found to be without significant cultural resources. Degrading of existing ground surface in the area of the V-levee segment Station 718+00 will be curtailed to avoid impact to a significant archeological site.

6. In accordance with EC-1110-2-259, Review of Cost Effectiveness of Design, 1 February 1988, and CELMV-ED-TD, multiple letter, same subject dated 24 February 1988, a cost effectiveness review of the Supplement No. 2 was performed. The estimated first cost of \$78,000,000 for the works covered by this supplement was reviewed by the Cost-Effectiveness Review Committee and considered cost effective. Accordingly, I herein certify that the subject design is the most cost effective for this design phase; however, further engineering refinements may be developed through applied value engineering principles and considered prudent and necessary to achieve a quality, cost effective and efficient end product.

7. Reference CECW-EP, multiple memorandum dated 16 February 1990, subject: GDM Review Process. No adverse issues were raised in the Administration clearing process or no known policy change has occurred subsequent to the Administration review of the feasibility report which could be expected to concern the OMB. There has been no substantial change in the proposed works since the project was authorized. Project authorization was based on the feasibility report for the West Bank of the Mississippi River in the vicinity of New Orleans, Louisiana dated December 1986, approved by ASA (CW) on 28 March 1989, in accordance with the plan recommended by the Chief of Engineers in his report dated 9 August 1988. The reduced scope GDM for the same project, approved by LMVD on 14 February 1990, has been reviewed by Washington Level Review Center. A response to their preliminary comments was furnished on 1 March 1990 by CELMV-ED-P.

8. As per LMVD-TS letter, dated 5 February 1981, this GDM has been reviewed by the District Security Office. There were no comments to be incorporated in the GDM.

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, Design Memorandum No. 1, General Design,
Supplement No. 2

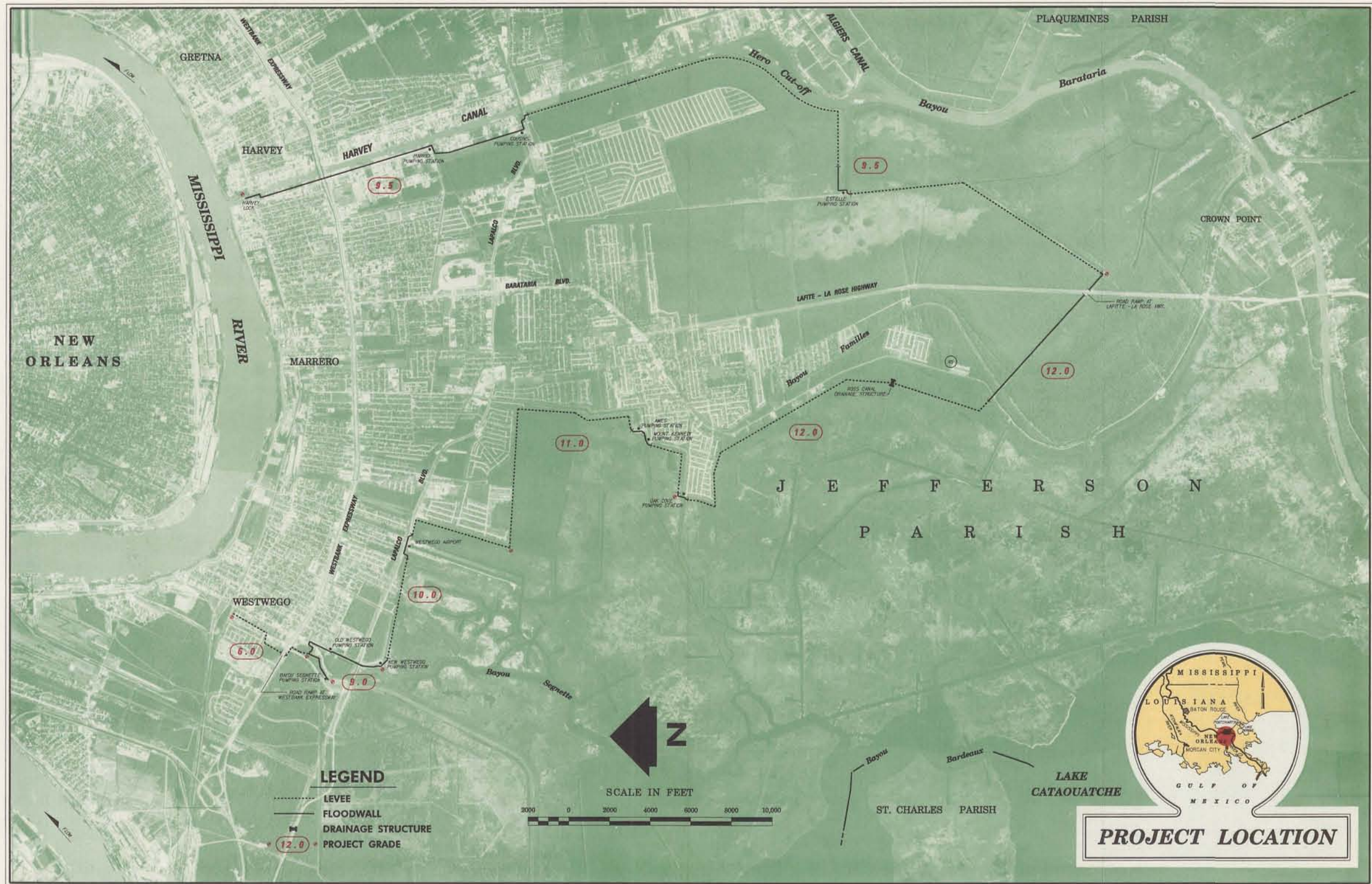
9. Approval of the GDM is recommended.

FOR THE COMMANDER:



W. EUGENE TICKNER
Acting Chief, Engineering Division

Encl
(30 cys fwd sep)



WESTWEGO TO HARVEY CANAL, LA.

HURRICANE PROTECTION PROJECT

JEFFERSON PARISH, LOUISIANA



WESTWEGO TO HARVEY CANAL, LOUISIANA HURRICANE PROTECTION PROJECT			
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN SUPPLEMENT NO. 2			
PLAN OF PROTECTION			
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS NEW ORLEANS, LOUISIANA			
DATE:	DESIGN FILE:	PLOT SCALE:	FILE NO.
FEBRUARY 1990	30685A45.DGN	1	H-2-30618

WESTWEGO TO HARVEY CANAL, LA.
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

STATUS OF DESIGN MEMORANDUMS

<u>Design Memo</u>	<u>Title</u>	<u>Actual or Scheduled Submission Date</u>
1.	ADVANCE SUPPLEMENT- HARVEY CANAL FLOODWALL	28 October 1988
1.	GENERAL DESIGN MEMORANDUM (REDUCED SCOPE)	28 July 1989
1.	SUPPLEMENT NO. 2	16 March 1990

WESTWEGO TO HARVEY CANAL, LA.
HURRICANE PROTECTION PROJECT
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EXECUTIVE SUMMARY

This General Design Memorandum (Supplement No. 2) presents the design, engineering analyses, cost estimates and updated economic analysis for the Westwego to Harvey Canal Project. The design for the Harvey Canal Floodwall portion of the project was presented in General Design Memorandum No. 1, Advance Supplement, which was approved 20 December 1988. A Reduced Scope GDM, to serve as a basis for the negotiation and execution of the Local Cooperation Agreement (ICA), was prepared for the project in Oct 1989. That GDM was approved by the Division on 6 Oct 1989. General Design Memorandum (Supplement No. 2) will serve as the basis for preparing the Plans and Specifications (P&S) for project construction.

The authorized plan provides Standard Project Hurricane (SPH) protection to the urban areas between Westwego to the Harvey Canal on the west bank of the Mississippi River. The plan consists of new and enlarged levees and floodwalls along the permitted alignment from Westwego to the V-levee, and along the existing V-levee alignment to the vicinity of Estelle Pumping Station. From the existing Estelle Pumping Station at the V-levee, the alignment follows the existing Harvey Canal - Bayou Barataria Levee to the Cousins Pumping Station.

From the Cousins Pumping Station, a new floodwall will parallel the existing 1st Avenue Canal to the existing Harvey Pumping Station. From this point, a floodwall will parallel the Harvey Canal along Destrehan Avenue and tie back into the Harvey Lock. The elevation of the SPH levees and floodwalls varies by reach from 9.0 feet NGVD to 17.0 feet NGVD.

The ongoing feasibility study for hurricane protection for the area east of the Harvey Canal will recommend the construction of a floodgate structure in Harvey Canal, south of Lapalco Blvd. bridge. The construction of the floodgate, if authorized, will alter the proposed levee alignment south of the Lapalco bridge, modify the proposed fronting protection plan and floodwall at Cousins Pumping Station and eliminate the entire proposed floodwall north of Cousins Pumping Station.

The alignment presented in this document generally follows the authorized plan except for the addition of a new levee (westside closure) required to close the system and provide protection to the western portion of the project area. The elevation of the new SPH levee in the western portion of the project is 6.0 feet NGVD. The Westside Closure alternative eliminates approximately 1326 ft of the previously proposed SPH levee/floodwall north of Bayou Segnette Pumping Station.

The final EIS for the project was filed with EPA in October 1987. The impacts of the V-levee North Alternative were fully documented in the final EIS. The EIS did not analyze the westside closure which has now been added to the project. This work, as well as other design changes to levees and floodwall are addressed in Environmental

Assessment dated Feb 1990. Direct construction impacts on significant wildlife habitat has increased from 814 acres to 849 acres since processing the final EIS.

The recommended mitigation plan involves construction of a timber pile-tire breakwater adjacent to the Netherlands marsh complex within the state-owned Salvador Wildlife Management Area (SWMA) and acquisition of 1,024 acres of wooded wetlands in the Bayou Piquant finger ridge area adjacent to the SWMA. The mitigation plan fully mitigates project induced losses.

The work adjacent to the Netherlands Marsh represents a departure from the marsh preservation measure recommended in the Feasibility Report. The State has already accomplished remedial action at the originally planned site and strongly favors the new plan for work at Netherlands.

The first cost of the project is \$78,000,000. This compares to the latest PB-3 estimate of \$78,000,000. The section 902 limit for the project is \$94,700,000. The average annual project cost is \$12,369,000 which includes annual O&M cost of \$63,000. Average annual benefits are \$27,673,000 and the B/C ratio is 2.2 to 1.

It is recommended that the plan presented in this Design Memorandum be approved as a basis for preparation of construction plans and specifications.

PERTINENT DATA

Location of Project: Urban area within Jefferson Parish between Westwego to Harvey Canal, on the west bank of the Mississippi River in the vicinity of New Orleans, Louisiana.

Datum Plane: National Geodetic Vertical Datum (NGVD)

Hydrologic Data:

Temperature (F)	
Maximum monthly	90.6
Minimum monthly	45.3
Average	69.5
Annual Precipitation (inches)	
Maximum	83.5
Minimum	40.1
Average	61.6

Hydraulic Design Criteria:

Design Hurricane: Standard Project Hurricane	
Frequency	500 years
Central Pressure Index (CPI)	27.6 inches of mercury
Maximum Wind Speed	100 MPH

Proposed Protection: (Including Harvey Canal Floodwall)

Westside Closure	6.0 N.G.V.D.
Levee:	Top Elev. 9.0 to 12.0 N.G.V.D.
Flood Wall	
I-Type	Top Elev. 9.5 to 16.5 N.G.V.D.
T-Type	Top Elev. 9.0 to 17.0 N.G.V.D.

Right of Way:

Potential Commercial/Residential	83.8 Acres
Residential	10.0 Acres
Potential Commercial	1.0 Acres
Marsh/Wetland	368.4 Acres
Wetland	635.0 Acres
Mitigation	1,024.0 Acres

PERTINENT DATA (Continued)

Estimated First Cost:

Federal	\$50,700,000
Non-Federal	\$27,300,000
Total	\$78,000,000

Justification:

Average Annual Cost	\$12,369,000
Average Annual Benefits	\$27,673,000
Benefits-to-cost Ratio @ 8-7/8%	2.2 to 1

GENERAL

1. Project Authorization. Public Law 99-662, The Water Resources Development Act of 1986, authorized the project subject to the conditions recommended in the report approved by the Secretary of the Army. The report was approved by the ASA(CW) on 28 March 1989, in accordance with the plan recommended by the Chief of Engineers in his report dated 9 August 1988.

2. Project Location and Description. The project is located in southeastern Louisiana within the urban area of Jefferson Parish on the west bank of the Mississippi River. The area is generally bounded by the Harvey Canal to the east, Lakes Cataouatche and Salvador to the west, the Mississippi River to the north and Barataria Bay to the south as shown on Plan of Protection. The project will protect the urbanized areas within Jefferson Parish between Westwego and Harvey Canal. The plan of improvement will consist of new and enlarged levees and floodwalls along the permitted alignment from the vicinity of Westwego to the V-levee, along the existing V-levee alignment to the vicinity of Estelle Pumping Station, and along the existing Harvey Canal-Bayou Barataria Levee to Harvey Pumping Station. From this point, a floodwall will parallel Harvey Canal along Destrehan Avenue, tying into Harvey Lock.

3. Purpose and Scope. The General Design Memorandum No. 1, Supplement No. 2 presents the essential data, assumptions and criteria for developing plans, designs and cost estimates for protective works from Westwego to Harvey Canal, Louisiana. The design and cost estimate for the Harvey Canal Floodwall, (a feature of the Westwego to Harvey Canal project which extends from the Harvey Lock to the Harvey Pumping Station) was presented in General Design Memorandum No. 1, Advance Supplement, approved 20 December 1988.

A reduced scope General Design Memorandum was prepared and submitted to LMVD on 28 July 1989. That GDM was approved on 6 October 1989. The primary purposes of the reduced scope GDM were (1) re-affirm the project scope, (2) present evidence to support a firm project cost estimate and (3) verify the economic soundness of the project. The reduced scope GDM is the basis for negotiations and execution of the LCA for this project. The draft LCA was agreed to by the West Jefferson Levee District on 8 December 1989, and is being reviewed by higher authority.

The level of detail in the reduced scope GDM varied between traditional GDM and the Feasibility Report. This GDM Supplement No. 2 is based on detailed design, cost estimate and economic analysis, and will serve as basis for preparing construction plans and specifications.

LOCAL COOPERATION

4. Requirements of Local Cooperation. Prior to construction, local interest must give assurance satisfactory to the Secretary of the Army that they will:

a. Provide without cost to the United States all necessary lands, easements, and rights-of-way, including borrow and excavated material disposal areas necessary for construction, operation, and maintenance of the project;

b. Accomplish, without cost to the United States, all necessary alterations and relocations to roads, railroads, pipeline, cables, and other facilities, including interior drainage, required by the construction of the the project, excluding facilities necessary to maintain the existing interception and disposal of interior drainage at the line of protection;

c. Hold and save the United States free from damages due to the construction, operation, and maintenance of the project, except where such damages are due to the fault or negligence of the United States or its Contractors;

d. Bear 35 percent of the first cost of construction.

e. Maintain and operate all features of the project in accordance with regulations prescribed by the Secretary of the Army, including levees, floodwalls, floodgates, approach channels, and all interior drainage features, including but not limited to drainage structures, drainage ditches, canals, and stoplog structures;

f. Prior to initiation of construction, prescribe and enforce regulations or other management techniques to prevent encroachment on floodplain areas, channels, rights-of-way, and levees, along with interior drainage, ponding, and sump areas, necessary for proper functioning of the project;

g. Publicize floodplain information in the areas concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the projects;

h. Provide a cash or in-kind contribution for fish and wildlife mitigation features of the project in an amount equal to the same percentage as the non-Federal share of the basic project.

i. Comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646).

j. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, Approved December 31, 1970; and

k. Comply with Section 601 of Title VI of the Civil Rights Act of 1964 (PL 88-352) that no person shall be excluded from participation in,

denied the benefits of, or subjected to discrimination in connection with the project on the grounds of race, creed, or national origin.

5. Current Status of Assurances. By letter dated 2 December 1986, the Board of Commissioners of the West Jefferson Levee District advised the Corps of Engineers that they intend to serve as local sponsor for the plan of improvement recommended in the feasibility report. Further, by letter dated 3 June 1988, the Board also advised the Corps that they will enter into an ICA for the V-Levee North Plan - an alternative alignment which avoids any 404(c) and Jean Lafitte National Park lands. The West Jefferson Levee District also stated in their 2 December 1986 letter that by law they are empowered to provide all non-Federal cooperation required for the project, and intend to enter into a binding agreement with the Corps of Engineers at the appropriate time.

6. Credit for Compatible Work by Local Sponsor. Pursuant to Section 104 of the Water Resources Development Act of 1986, a credit to the project sponsor for certain compatible work accomplished by local interests prior to 17 November 1986 was approved by the Assistant Secretary of the Army (Civil Works) in a memorandum to the Director of Civil Works dated 13 May 1988. The approved credit is for work external to the works incorporated in the project, as authorized. Hence, the value of that work, currently estimated as \$6.7 million, was added to the estimate of project costs. The actual amount of credit will be determined following a final audit of expenditures.

In addition to above, \$21.4 million in additional credit has been identified by the local sponsor for work accomplished or to be accomplished subsequent to 17 November 1986. We will audit these items of credit as the local sponsor submits documentation in support of each work item.

7. Local Cooperation Agreement. A draft ICA was furnished to the West Jefferson Levee District in April 1989. We have subsequently met with the sponsor, and reviewed the draft document. The draft ICA package was provided to the Division office by letter dated 13 December 1989. Text of the draft ICA is included in Appendix D.

DEPARTURE FROM PROJECT DOCUMENT PLAN

8. Westside Closure Alternatives. The proposed levee system as described in the Feasibility Report and authorized, ties into the existing Lake Cataouatche levee system at Bayou Segnette Pumping Station. As the Lake Cataouatche levee does not conform to SPH grade or section, the western part of the project area still remains unprotected from SPH flooding.

The following alternative alignments were investigated for closing the project area for the SPH. These alternatives are preliminary in scope and are subject to modifications pending soil investigations and field surveys. A schematic of these alternatives is shown on Plate 67.

a. Alternative No. 1. An earthen levee to commence in the vicinity of Bayou Segnette State Park, traverse west along the south shoulder of West Bank Expressway, turn in a northerly direction east of LP&L No. 1 canal, and tie into the existing railroad embankment. Under this alternative, Whiskey Bayou and Railroad Canal drainage will be diverted in a westerly direction along the northern embankment of the Southern Pacific Railroad into LP&L No. 1 Canal. A ramp will be provided at Bayou Segnette Park entrance road and West Bank Expressway. Two sluice gated structures will be provided at the existing crossings of Railroad Canal and Whiskey Bayou with the Westbank Expressway. These gates will be operated only during Hurricane condition. Two 5 cfs pumps, one at RR Canal and the other at Whiskey Bayou will provide local drainage during hurricane flooding. Estimated cost for this alternative is approximately \$9.7 million.

b. Alternative No. 2. This alternative is identical to Alternative No. 1 in the vicinity of Bayou Segnette State Park; however, at the intersection of RR Canal and Westbank Expressway, the proposed alignment will follow the east bank of the RR Canal. A combination of floodwall and a box culvert will provide hurricane protection and local drainage for the residential area east of the RR Canal. The floodwall will be tied to the existing railroad embankment. A sluice gated culvert and 25 cfs pump station will also be constructed to discharge the local drainage into the RR Canal. Westbank Expressway will be ramped around RR Canal. Estimated cost for this alternative is approximately \$15.5 million.

c. Alternative No. 3. This alternative is functionally identical to Alternative No. 2 discussed above, except a hurricane protection floodwall and a drainage ditch will be provided along the west bank of RR Canal. A 25 cfs pump and sluice gated culvert will also be provided for operation during hurricane condition. Estimated cost of this alternative is \$7.2 million.

d. Alternative No. 4. This alternative will provide an earthen levee along the east shoulder of the Bayou Segnette State Park entrance road, turn west along the south shoulder of Westbank Expressway and then turn north through the open area and existing subdivision as shown on Plate 13. Westbank Expressway will be ramped in the vicinity of the Bayou Segnette State Park entrance. An earthen channel along the eastern toe of the proposed levee will be constructed for draining the residential area on the east side of the levee. This channel will discharge into the RR Canal through an outlet channel running parallel to the north shoulder of Westbank Expressway. A sluice gated culvert and a 10 cfs pump station will be provided for operation during hurricane condition. Estimated cost of this alternative is approximately \$5.5 million.

9. Recommended Westside Closure Plan.

a. As the Lake Cataouatche levee system does not conform to SPH standards of protection, the project plan as authorized by PL 99-662,

will leave the western portion of the project area, in the vicinity of the City of Westwego susceptible to flooding. The alternative plans as presented above will close-off the project area to SPH flooding. All alternatives do not provide full SPH protection to the entire city of Westwego. Alternatives 2, 3 and 4 exclude some residential sections in the western part of the city. Alternative No. 4 is selected based on the least cost and is shown on Plate 3.

b. West Jefferson Levee District does not favor the westside closure alternatives as described above. They have expressed their desire to upgrade the Lake Cataouatche Levee to SPH level of protection and make it a part of the Westwego to Harvey Canal project. A reconnaissance scope study completed as part of Louisiana's Coastal Area Hurricane Protection, Reconnaissance Report in 1988 indicated that upgrading the levee to SPH level is not economically justified. However, since the completion of this study, West Jefferson Levee District has upgraded the levee in several locations, and has requested that a revised study based on current information be initiated. Local interests are expected to try to get Congress to appropriate funds for a feasibility study in FY 1991 to upgrade the levee to a SPH level for inclusion in the authorized Westwego to Harvey Canal project. If such a study indicates that upgrading the Lake Cataouatche Levee for SPH protection is economically justifiable, the recommended Westside Closure work will be deleted and the floodwall in the vicinity of the Bayou Segnette Pumping Station would be built under this project.

HYDROLOGY AND HYDRAULICS

10. General. The hydrology and hydraulic analyses and design for the proposed works are presented in Appendix A of this memorandum. The appendix contains detailed descriptions of the hydraulic analyses, methods and procedures used in the design of the protection features of the proposed plan.

11. Design Elevations. Due to the urban nature of the project area, the standard project hurricane (SPH) was selected as the design hurricane. Due to the transposition of the regional SPH to the smaller study area, the recurrence interval of this hurricane is about 500 years. Characteristics of this hurricane are: central pressure index (CPI) 27.6 inches of mercury; maximum wind velocity 100 mph; radius of maximum winds 30 miles from the center; and forward speed 11 knots.

Protective works exposed to wave runup will be constructed to an elevation and cross section sufficient to prevent all the overtopping from significant wave and waves smaller than the significant wave accompanying the SPH. Waves larger than the significant wave will be allowed to overtop the protective structures; however such overtopping will not endanger the integrity of the protective works or cause material flooding.

Heights of the proposed protective work along Bayou Segnette and east of V-levee apex, which are subject to only minor wave activity

generated by boat traffic or winds across a limited fetch during several hours of super elevated wind tide levels, were designed to include a freeboard allowance of 2 feet above the still water level. The height of the remaining levee from Bayou Segnette to Highway 3134 was designed to prevent overtopping from waves generated in Lakes Salvador and Cataouatche which propagate across the marsh to this reach of levee. Table 1 gives the height of protection for a typical earthen levee in the project area.

TABLE 1

REQUIRED ELEVATIONS OF PROTECTIVE WORKS

<u>Reach</u>	<u>Elevation of Protective Structure (Ft. NGVD)</u>
Westside Closure	6.0
Bayou Segnette	9.0
Bayou Segnette to Dugues Canal	10.0
Dugues Canal to Estelle Canal	11.0
Estelle Canal to Bayou Des Families	12.0
Bayou Des Families to Highway 3134	12.0
Highway 3134 to Apex of "V" Levee	12.0
Apex of "V" Levee to Harvey Canal	9.5

GEOLOGY AND SOILS

12. Physiography. The project site is located on the Deltaic Plain portion of the Mississippi River Alluvial Plain. Specifically, the project is located on the northern edge of the Barataria Basin on the western side of the Mississippi River. The Barataria Basin is an intertributary basin dominated by features which include natural levee ridges, crevasse-splay deposits, marsh, lakes, and swamps. The eastern and northern edge of the basin is defined by the natural levee ridge of the Mississippi River and the western edge of the basin is defined by the Bayou Lafourche natural levee ridge. The Gulf of Mexico constitutes the southern boundary. Elevations vary from approximately +10 to +15 feet NGVD along the natural levee of the Mississippi River to 0 feet NGVD in the back swamp and lake areas.

13. General Geology. Only the geologic history since the end of the Pleistocene Epoch is pertinent to the project. At the close of the Pleistocene, sea level was approximately 360 to 400 feet below present sea level and the Mississippi River was entrenched into the older Pleistocene sediments to the west of the project. As sea level rose to its present stand, the entrenched valley was filled with sediment by the Mississippi River, resulting in an increase in meandering and channel migration. This meandering and channel migration has resulted in a series of deltas extending into the Gulf of Mexico. Seven Holocene deltas are recognized in the lower Mississippi River Valley; however, only four are relevant to the project area. The oldest of the four

deltas in the vicinity of the project was the Cocodrie Delta whose distal edges extended across the New Orleans area from west to east. Following the Cocodrie Delta into the vicinity of the project was the St. Bernard Delta which followed the same general course as the Cocodrie Delta but extended further to the east. It was during this period that maximum sedimentation into the project area occurred via the Bayou Barataria and des Familles distributaries. A shifting of the river course upstream in response to a shorter route to the Gulf resulted in the formation of the LaFourche Delta southwest of the project. A final shift of the river brought the flow into its present course forming the Plaquemine Delta just south of New Orleans, and the present Balize Delta below the Plaquemine Delta. Development of the deltas below New Orleans coupled with the restrictions of floodwaters has resulted in the gradual degradation of the study area through subsidence and shoreline retreat.

FOUNDATION INVESTIGATION AND DESIGN

14. General. This report covers the soil investigation and design of approximately 82,000 feet of improved levees and 25,800 feet of floodwalls.

The project alignment has been divided into five design reaches due to a variation in soil strength, stratification and required protection elevations. Many of these design reaches were divided into subreaches because of varying ground elevations, levee crown transitions and soil strength variation. Area and reaches are as follows:

<u>Design Reaches</u>	<u>Base Line Stations</u>	<u>Base Line Stations</u>
Westwego and West-		
minister Levee: 5 Sub-reaches	0+00	To 256+42
Oak Cove Levee: 3 Sub-reaches	256+43	To 420+96
Hwy. 45 Levee: 1 Sub-reach	420+97	To 572+16
V-Line Levee: 3 Sub-reaches	572+17	To 804+32
Harvey Canal Levee: 3 Sub-reaches	804+33	To 1072+00

15. Field Exploration. One hundred and fifteen (115) borings were made along the proposed alignment. Of the 115 borings, 102 were obtained in 1986 by Eustis Engineering of Metairie, LA at the request and authorization of the West Jefferson Levee District, the local project sponsor. The rest of the borings (13), were obtained in 1988 and 1989 by the Corps of Engineers, the majority of which were check borings. All Eustis borings were undisturbed (5" or 3" I.D.). Eight (8) C.E. borings were 5" undisturbed borings and 5 were general type borings.

16. Laboratory Tests. Visual classifications were made on all samples and water content determinations were made on cohesive samples from all the borings.

Soil mechanics laboratory tests consisting of consolidation (C) unconfined compression (UC), unconsolidated undrained triaxial

compression (Q), consolidated-undrained triaxial compression (R), were performed on representative soil samples from the 5 and 3 inch undisturbed borings. Other related tests, such as natural water content, unit weight, and Atterberg liquid and plastic limits tests, were also performed on selected samples.

Natural water content, unit weight, Atterberg limit and unconfined compression shear tests were performed on many of the samples obtained from the 5 general type borings.

The location and results of laboratory test for the 3 and 5 inch diameter undisturbed borings and general type borings are shown on Plates F1 thru F106.

17. Foundation Condition. The subsurface conditions along the project alignment are shown on the generalized geologic profiles on Plates F106A thru F106J.

The foundation soils are predominantly fat clays (CH) varying in consistency from very soft to stiff. In many areas, organic clays (OH) and peat (PT) may be found in the top 20 feet and have a very soft consistency.

The V-Line Levee, from station 563+00 to station 588+00, is underlain by large layers of silt (ML) and sand (SM) 5 to 10 feet below the surface. Thin strata of silt and sand are encountered at various other locations in the foundation.

18. Shear Stabilities.

a. Stability of levees. Using cross-sections representative of existing conditions along the proposed alignment, the slopes and berm distances for the recommended levees were designed with borrow pits on the flood side except in the area of V-Line Levee from station 660+00 to station 800+00 where the borrow pit will be on the protected side.

The stability of the levees was determined by the "Method of Planes" using the design (Q) shear strengths as shown on the plots of soil data on Plates F107 thru F111.

A "Factor of Safety" (F.S.) of 1.3 was required for the levee stability and a F.S. of 1.5 was the minimum required for failures into borrow pits and canals.

Levee design sections developed from these analyses are shown on Plates F112 thru F129.

b. Cantilever I-Wall. I-wall stability and required penetration were determined by the "Method of Planes". A "Factor of Safety" was applied to the soil parameters. For the friction angle, the F.S. was applied as follows:

$$\phi_d = \tan^{-1} \frac{\tan \phi_a}{\text{factor of safety}}$$

where ϕ_a = available friction angle
 ϕ_d = developed friction angle

The developed friction angle was used in determining lateral earth pressure coefficients.

Using the resulting shear strengths, net horizontal water and earth pressure diagrams were determined for movement toward each side of the sheet pile. From the earth pressure diagrams, the summation of horizontal forces were equated to zero and the summation of overturning moments were determined for various tip penetrations. The depth of necessary penetration is the point of zero summation of moments.

Dynamic wave force was a design factor in the floodwalls design, from New Westwego Pumping Station (Station 69+94) to the V-Vertex of the V-Line Levee (station 660+06). The results of hydraulic analysis indicate that these walls will be subjected to the pressure and forces implanted by a "broken wave".

The following design cases were analyzed for determining required penetration:

Case I: No significant wave load on I-wall:

Q-Case

F.S. = 1.5 with static water at still water level (SWL)

F.S. = 1.0 with static water at SWL plus 2 feet

General: If the penetration of head ratio is less than 3:1, increase it to 3:1.

Case II: Significant wave load on I-wall:

Q-Case - Same as above plus

F.S. = 1.25 with static water to SWL plus wave load

S-Case

F.S. = 1.2 with water to SWL plus wave load

General: If the penetration to head ratio is less than 3:1, increase it to 3:1 or to that required by the S-case, F.S. = 1.5, whichever results in the least penetration.

19. Pile Foundation. Pile capacity curves were generated for various structures along the alignment (pumping stations, gates, T-walls, etc).

Design single pile compression and tension capacities versus tip elevations for piles were determined for various locations.

Design data were determined for the (Q) and (S) shear strength. For piles in compression, a factor of safety of 2.0 was applied to the shear strengths, and a conjugate stress ratio, K_c of 1.0 was used in the (S) case for determining the normal pressure on the pile surface. In tension, a factor of safety of 2.0 was applied to the shear strengths, and a K_t of 0.7 was used in the (S) case. In some instances the (Q) case indicates the least pile capacities, and in other instances the (S) case yields the least result. The minimum value was used for design. The results of these analyses are plotted on Plates F169 thru F187.

20. Source of fill material. The majority of proposed levees will be built of the materials obtained from adjacent borrow pits except for the Harvey Canal portion, which will be obtained from Highway 45 levee borrow area.

21. Methods of Construction.

Levee. Hwy 45 levee from BL station 425+46 to 575+89 will be constructed in one lift with semi compacted clay fill as shown on Plate 73. All other levees will be constructed in three (3) lifts with an approximate three-year interval between successive lifts. Lift 1 consists of constructing the levee and berms to full net grade and section, with construction of the berms preceding levee construction. The levees will be restored to net grade in Lift 2; in Lift 3, the levee crown will be built one (1) foot above net grade. The berms will not be rebuilt after initial placement as part of Lift 1.

22. Settlements.

a. Construction settlement. With the exception of the Hwy 45 Levee, which is located on a natural ridge, the levees will be constructed on marsh type soils (very soft and soft clays containing peat and organics). Experience in the Larose to Golden Meadow, LA area has shown that classical consolidation theories do not emulate the actual settlement of levees constructed in a marsh environment. Based on settlement data obtained from the above project, Table 2 furnishes the expected settlement of each levee reach.

TABLE 2

ESTIMATED SETTLEMENT

Levee Reach	Estimated Settlement (ft)		
	1st Lift	2nd Lift	3rd Lift
Westwego Levee Sta. 69+00 to 188+00 B/L	3.0	1.5	1.0
Westwego & Oak Cove Levee Sta. 188+00 to 377+00 B/L	3.3	1.5	1.0
Oak Cove Levee Sta. 377+00 to 418+00 B/L	3.0	1.5	1.0
Hwy 45	3.0 ¹	N/A	N/A
Harvey Canal Levee	1.5 ²	*	N/A

¹Based on 1-Lift, semi-compacted fill construction

²Based on semi-compacted fill construction

*Second Lift in areas where required

b. Borrow ratios. Based on the results of the settlement analyses, computations were made to determine the estimated ratio of borrow material to net levee section. To provide a basis for determining borrow area requirements and rights-of-way limits, it was assumed that approximately 2.6 cy of excavation will be required to produce 1 cy of usable fill.

c. Residual settlement. Long term residual settlements are estimated on the order of 0.5 to 1.0 feet after construction is completed.

d. Erosion protection. No protection is considered necessary along the levee other than seeding the levees, exclusive of stability berms. Any erosion caused by hurricane floods will be restored under normal maintenance.

e. Settlement observations. Settlement observations will be made on all structures and walls after completion of construction and annually thereafter until settlement is essentially complete. Before and upon completion of construction, profiles and sections will be obtained for each construction stage for the levees, berms and road ramps. Thereafter yearly settlement data will be obtained until settlement is essentially completed. Observations will be made on all protection features periodically thereafter.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

23. Levees. The project levee will consist of enlargement of existing levees in some areas and construction of new levees in others. The levee work will, in general, extend from the New Westwego Pumping Station to the Cousins Pumping Station. Levee work will also include construction of the new tie-in levee (westside closure) in the urbanized area of Westwego in the vicinity of Bayou Segnette State Park and the Westbank Expressway. This levee is required to close-off the hurricane protection system in the western part of Westwego. Construction of this levee will eliminate approximately 1326 feet of levee work proposed in the Reduced Scope GDM. The westside closure levee system will also eliminate fronting protection previously proposed for the Bayou Segnette Pumping Station. From the New Westwego Pumping Station to the southern side of Oak Cove Subdivision, the proposed levee will be approximately parallel to and marshward of the existing levee protection (levee baseline). From the south side of Oak Cove Subdivision to the V-Levee at Hwy 45, a new levee will be constructed approximately 500 feet parallel to and marshward of Hwy 45. Beginning at the V-Levee vertex and extending along the V-Levee to the Estelle Pumping Station, the proposed levee will be constructed on the protected side of the existing levee protection (levee baseline), so that construction will not impact the Bayou Aux Carpes 404(c) area. From Estelle Pumping Station to Cousins Pumping Station, construction will consist of straddle enlargement of the existing levee. Typical levee design sections are shown on Plates 70 through 75.

24. Recommended Levee Construction. The proposed levees, with wave berms required for the reach between the New Westwego Pumping Station and the southern side of Oak Cove Subdivision, will be constructed by uncompacted fill methods (see Plates 70 through 73). A three lift construction sequence will be required to reach the ultimate design grades, with 3 years between lifts to allow for settlement and consolidation of embankment and foundation. Uncompacted fill will be placed in horizontal layers not exceeding 3 feet in thickness. Where the levee crosses canals, shell cores will be constructed within the levee section.

The levee along the North-South reach will be constructed along the alignment of the existing geo-grid reinforced levee built by West Jefferson Levee District. Some levee crown and berm work will be required to bring the existing levee to project grade. The new levee will encapsulate the existing levee.

For the reach parallel to La Hwy 45, from Oak Cove Subdivision to Hwy 45, the proposed levee with wave berm will be constructed by semi-compacted fill method (see Plate 73). A one lift gross grade construction sequence will be required to reach the ultimate design grade. The materials of semicompacted fill shall be placed or spread in layers. The first layer will not be more than 6 inches in thickness and succeeding layers not more than 12 inches in thickness prior to compaction.

Uncompacted fill will be excavated from adjacent borrow areas for most of the project, except for the levee reach between the Estelle Pumping Station and the Cousins Pumping Station, where uncompacted fill will be excavated from a borrow area adjacent to Highway 45 levee. Shell and sand would be acquired from commercial sources.

25. Floodwalls and Gates. I-type and T-type floodwalls will be used to provide protection in congested areas, and to provide a transition between the pumping station fronting protection and the full earthen levee sections. Details of the I-walls and T-walls are shown on Plates 80, 83 and 84. I-walls will be overbuilt by a minimum of 6 inches to account for long term settlement. Aesthetic floodwall surface treatment will be provided in areas of high visibility. Swing gates and bottom roller gates will be located along the floodwall alignment to allow vehicular access to local roads and streets on both sides of the floodwall. Details of the swing gates are presented on Plates 86 through 90. Details of the bottom roller gates are presented on Plates 91 through 93. Utilities, including gas and water, crossing the floodwall alignment will be passed through a pipe sleeve as indicated on Plate 100.

26. Pumping Station Modifications. The fronting protection at each pumping station location will be raised to SPH levels by either replacement of the existing protection with pile supported T-walls, or by increasing the height of the existing fronting T-walls or sheet pile bulkheads. The structures deemed suitable for modification will require a full geotechnical and structural analysis. The analysis will be performed during the preparation of the plans and specifications for this work. Shell and riprap will be provided to fill scour holes that have developed at the discharge outlets of the pumping stations. This is required to ensure the stability of the proposed fronting protection structures. In addition, butterfly valves will be incorporated into each of the pumping station steel discharge pipes to insure a positive cutoff from the back flow of hurricane level floodwaters through the discharge pipes. Two of the pumping stations, namely Ames and Cousins, contain square concrete discharge tubes which cannot be modified with butterfly valves. Positive cutoff at these locations will be provided by constructing sluice-gated structures at the discharge tube outlets as shown on Plate 96 and 97.

The required levels of protection for the Standard Project Hurricane (SPH) for each structure location are presented in Table 3.

TABLE 3

REQUIRED LEVEL OF PROTECTION FOR STANDARD PROJECT HURRICANE

<u>LOCATION</u>	<u>WIND TIDE LEVEL</u> <u>(N.G.V.D.)</u>	<u>FLOODWALL GRADE</u> <u>(N.G.V.D.)</u>	<u>WAVE</u> <u>LOADING</u>
Bayou Segnette Pumping Station (Vic. 2+00 B/L) to New Westwego Pumping Station (Vic. 68+00 B/L)	7.0	10.0	N/A
Vic Sta. 69+20.0 B/L to Vic St. 70+00 B/L	7.0	13.5	Yes
Westwego Airport (Vic. 129+00 B/L)	7.0	13.0	Yes
Ames Pumping Station (Vic. 325+00 B/L)	8.0	15.5	Yes
Mount Kennedy Pumping Station (Vic. 335+00 B/L)	8.0	14.5	Yes
Oak Cove Pumping Station (Vic. 377+00 B/L)	9.0	16.0 to 17.0	Yes
Ross Canal Drainage Structure (Vic. 478+00 B/L)	9.0	Levee to El. 12.0	Yes
Floodwall at V-Levee Sta. 575+89 B/L to Sta. 581+75.0 B/L to Sta. 647+03 B/L	9.0	16.0 to 17.0	Yes
Sta. 647+03 B/L to Sta. 660+75.0 B/L	9.0	12.0	N/A
Estelle Pumping Station & Vicinity (Vic. 803+00 B/L)	7.5	9.5	N/A

TABLE 3 (Continued)

<u>LOCATION</u>	<u>WIND TIDE LEVEL</u> (N.G.V.D.)	<u>FLOODWALL GRADE</u> (N.G.V.D.)	<u>WAVE</u> <u>LOADING</u>
Floodwall in Vic. La. Power and Light Co. Power Lines (Vic. 959+00 B/L)	7.5	9.5	N/A
Cousins Pumping Station (Vic. 1020+00 B/L)	7.5	9.5	N/A
Floodwall Cousin Pumping Station to Harvey Pumping Station (Sta. 1025+46.00 B/L to Sta. 1066+58.0 B/L)	7.5	9.5	N/A
Harvey Pumping Station (Vic. 1070+00 B/L)	7.5	9.5	N/A

The following is a brief description of the proposed improvements at each structure location:

a. Old Westwego Pumping Station and Vicinity. The existing sheet pile bulkhead fronting protection will be modified by the addition of a concrete cap as shown on Plate 76. I-walls and T-walls will be constructed from Sta. 17+49.00 B/L at the boat staging area around Company Canal, to the Old Westwego Pumping Station as shown in Plates 4, 7 and 8. Two swing gates will allow vehicular access to the canal area.

b. Lapalco Bridge. The flood protection in this area will comprise an I-wall over an earthen levee section as shown on Plate 5. The proposed layout will cross two pipelines, a natural gas pipeline and a municipal waterline. An I-wall was chosen in this area since a full earthen levee section would add overburden to the bridge piers. This overburden could induce a settlement on the bridge piers.

c. New Westwego Pumping Station. The existing fronting T-wall will be extended to SPH levels as shown on Plate 77. The wall extension will require the addition of buttresses, concrete piles, and an extension to the base slab. The layout of the proposed floodwall is shown on Plate 6.

d. Westwego Airport. An I-wall on earthen levee section comprises the flood protection in this area as shown on Plate 14. Two 36 foot wide swing gates will allow access through the floodwall to the airport and adjacent trailer park. Rights-of-Way constraints between Lapalco Blvd. and Diques Canal justified the use of a floodwall in lieu of the full earthen section.

e. Ames Pumping Station. The layout of the proposed fronting floodwall is shown on Plate 24. The existing fronting T-wall will be extended to SPH levels as shown on Plate 77. The wall extension will require the addition of buttresses, concrete piles, and an extension to the base slab. SPH levels of protection will be provided by the addition of a concrete stub wall located on the top of the existing concrete discharge tube. A sluice-gated structure will be constructed at the outlet of the discharge tube to provide positive cutoff. A T-wall will provide flood protection between the Ames Pumping Station and the Mount Kennedy Pumping Station as shown on Plate 24.

f. Mount Kennedy and Oak Cove Pumping Stations. The existing earthen levees that serve as fronting protection at these pumping stations will be degraded and T-wall structures will be constructed as shown on Plates 78 and 80. The layout of the proposed floodwalls at Mount Kennedy and Oak Cove are shown on Plates 24 and 28 respectively.

g. Ross Canal Drainage Structure. A 60-inch diameter corrugated metal pipe drainage structure will be located through the proposed levee section to provide an outlet for water draining out through the Ross Canal as shown on Plate 2. A 60-inch x 60-inch sluice gate structure will be incorporated into the reinforced concrete pipe to provide a positive cutoff from hurricane flood waters. Details of the proposed drainage structure are shown on Plate 98.

Jefferson Parish has recently indicated that they are planning to drain the entire area between La Highway 45 and the proposed levee into a new drainage canal (60 ft bottom width). This canal will drain in a northerly direction towards the pumped drainage system. Pumping capacity of Mt. Kennedy and Oak Cove Pumping Stations will be replaced by a new pumping station to be located adjacent to Ames Pumping Station. The proposed works in the vicinity of La Highway 45 and Oak Cove Subdivision, as presented in this GDM Supplement will require modifications when Jefferson Parish finalizes its plans. These modifications will be accomplished at the P&S stage.

h. V-Levee Floodwall. The floodwall protection in this area will consist of a T-wall and I-wall on an earthen levee section as shown on Plate 81. A swing gate will allow vehicular access across Hwy 45 and a ramp will allow vehicular access across Lafitte-Larose Highway. The detail of the ramp is shown on Plate 85. The layout of the floodwall is shown on Plates 39 through 41.

i. Estelle Pumping Station. The existing sheet pile bulkhead fronting protection will be modified by the addition of a concrete cap as shown on Plate 77. An elevated walkway attached to the concrete cap will provide access for operation and maintenance of the butterfly valves at each discharge pipe. The layout of the tie-in floodwalls and fronting floodwalls is shown on Plate 48.

j. Louisiana Power & Light Co. (L.P. & L.) Power Lines. The existing sheet pile wall located in the vicinity of the L.P. & L. power

lines will be brought to SPH levels by the addition of a concrete cap. The layout of the floodwall is shown on Plate 57.

k. Cousins Pumping Station. The existing pumping station fronting protection will be modified as shown on Plate 79. The portion of the existing fronting protection provided by the pumping station building wall will be brought to SPH levels by raising a portion of the existing building structure floodwall as shown on Plate 79. Sluice-gated structures will be constructed at the outlets of the square concrete discharge tubes to provide positive cutoff. The remainder of the pumping station fronting protection comprised of a concrete-capped sheet pile wall, will be demolished and recapped to meet SPH levels. I-walls will join the areas adjacent to the pumping station and the area below Iapalco Bridge to the full earthen sections as shown on Plate 60. A 44-foot wide bottom roller gate will be provided across Destrehan Ave., and a 24-foot wide swing gate will allow access across the shell road north of the station.

l. Floodwall between Cousins Pumping Station and Harvey Pumping Station. The existing levee in this area will be degraded to elevation 6.0 and a concrete I-wall will be constructed to elevation 9.5. The existing stop log gate at Destrehan Ave. will be modified to provide protection to SPH level. The location and alignment for the proposed flood protection is presented on Plates 61, 62 and 63.

m. Harvey Pumping Station. The existing floodwall will be extended to SPH levels by the addition of stiffened steel plates anchored to the existing wall as shown on Plate 76.

n. New Westminster/Lincolnshire Pumping Station and New Estelle Pumping Station. Jefferson Parish is currently designing two new pumping stations. One will be located in the southwest corner of the Westminster Subdivision, and the other at the Harvey Canal Levee east of the existing Estelle Pumping Station. Proposed levee design at these locations will be modified to reflect tie-in to these structures during preparation of the P&S documents.

ALTERNATIVES INVESTIGATED

27. Conventional vs Geotextile Levee. There are two levee reaches on the western portion of the project area where soil conditions permit the use of geo-textile reinforced levee. One reach is the levee between New Westwego Pumping Station and Westwego Airport. The other reach is the East-West Levee. An analysis was performed to compare the cost between a conventional levee and a geotextile reinforced levee for the reach between the New Westwego Pumping Station and the Westwego Airport. This comparison reflected the following:

- | | |
|-----------------------|-------------|
| a. Conventional Levee | \$2,400,000 |
| b. Geotextile Levee | \$2,600,000 |

For the geotextile levee alternative to be equal, the right of way cost will have to be about \$12,000 per acre. Right of way in the above referenced reach is in the marsh outside of the existing protection and the cost is estimated not to exceed \$1,000 per acre.

A similar analysis was made for the East-West Levee reach, which indicated that a conventional levee was cost effective.

Consequently, conventional levee construction will be used in these two reaches.

28. Floodside vs Protected Side Borrow. Alternatives for the use of floodside vs protected side borrow on the western portion of the project (from the New Westwego Pumping Station to the Hwy 45 - V Line levee intersection) were considered.

Cost estimates for both alternatives were developed and a comparison made, which showed both plans being about the same cost. Local interest expressed concern about their exposure to increased liabilities and possible lawsuits stemming from drownings if protected side borrow pits were used. Local interest also expressed their willingness to restore borrow pit closures, as necessary, to prevent boat traffic in the borrow pits and to repair banks, if erosion occurs. In light of this, floodside borrow pits will be used.

29. Levee vs Floodwall. As a result of using detailed design data developed from additional field investigations and current rights-of-way constrictions in highly dense commercial and recreational areas, three reaches that were considered as levee reaches in the Reduced Scope GDM are now presented as floodwall reaches.

The first reach is in the Bayou Segnette area. Initially it was anticipated that a small shift of the existing levee will be adequate. After additional surveys of this area were received and new stability analysis made, the levee centerline had to be shifted about 130 feet from the edge of the Bayou. This shift to the protected side would have encroached upon the Bayou Segnette State Park and commercial establishments in the vicinity of the Bayou Segnette Pump Station area. In the area between the Old Westwego and New Westwego Pump Stations, filling a portion of the Bayou would be required to satisfy stability requirements.

The second reach is the V-Line Levee from its intersection with Hwy 45 to the V-Line Levee Vertex. New I-wall design criteria, which resulted in a reduction of sheet pile section and penetration requirements, was used.

The third reach is from Cousins Pumping Station to the Harvey Pumping Station. It was initially anticipated that the design criteria used for the Harvey Canal Levee would be applicable since soil parameters were similar. A straddle enlargement was planned in the Reduced Scope GDM. After further research it was discovered that the

draw down elevation along the canal that runs between the two pump stations was lower than what was previously known. New stability analysis were run which resulted in the levee centerline being a minimum of 175 feet from the top of the bank. This requirement would have resulted in a floodside shift encroaching upon a highly industrialized corridor. Another approach would be to keep the existing alignment. This would require partially filling the canal, enlarging the canal towards the protected side and relocating a pipeline.

30. Alternate Plan, Bayou Segnette Pumping Station and Vicinity. The existing sheet pile bulkhead fronting protection will be replaced by a pile support T-wall constructed on a shell embankment as shown on Plate S34. A floodwall will be constructed between the Bayou Segnette Pumping Station and Sta. 17+49.00 B/L. A 24' wide swing gate will be provided for access to the pumping station. This alternate plan will be incorporated for construction if the anticipated Lake Cataouatche levee upgrade is approved. The layout of the proposed alternate plan is shown in Plate 68.

STRUCTURAL DESIGN

31. Criteria for Structural Design. The structural designs to be used in preparing the final plans for construction of the structural features presented herein will comply with standard engineering practice and criteria set forth in Engineering Manuals and Engineering Technical Letters for civil works construction published by the Office, Chief of Engineers, subject to modifications indicated by engineering judgement and experience to meet local conditions.^{1/}

32. Basic Data. Basic data relevant to the design of the protective works are described in Paragraphs 23 through 26 collectively titled "Description of Proposed Structures and Improvements".

33. Design Methods.

a. Structural steel. The design of steel structures is in accordance with the requirements of the allowable working stresses recommended in "Working Stresses for Structural Design", EM 1110-1-2101 dated 1 November 1963 and amendment No. 2 dated 17 January 1972. The basic working stress for ASTM A-36 steel is 18,000 psi. Steel for steel sheet piling will meet the requirements of ASTM 328, "Standard Specifications for Steel Sheet Piling".

b. Reinforced concrete. The design of reinforced concrete structures is in accordance with the requirements of the strength design

^{1/} The floodwall design is similar to the design presented in the Lake Pontchartrain, La. & Vicinity, High Level Plan, Jefferson Parish Lakefront Levee, Design Memorandum No. 17, General Design, dated November 1987.

method of the current ACI building Code, as modified by the guidelines of "Strength Design Criteria for Reinforced Concrete Hydraulic Structures", ETL 1110-2-312 dated 10 March 1988. The basic minimum 28-day compressive strength concrete will be 3,000 psi, except for prestressed concrete piling where the minimum will be 5,000 psi. For convenient reference, pertinent stresses are tabulated below:

TABLE 4

PERTINENT STRESSES FOR REINFORCED CONCRETE DESIGN

Reinforced Concrete

f'c	3,000 psi
fy (Grade 60 Steel)	48,000 psi
Maximum Flexural Reinforcement	0.25 x Balance Ratio
Minimum Flexural Reinforcement	200/fy
f'c (For Prestressed Concrete Piles)	5,000 psi
fu (Prestressing Strands, Gr. 250)	250,000 psi
(Prestressing Strands, Gr. 270)	270,000 psi

34. I Type Floodwall.

a. General. The I-walls consist of steel sheet piling driven into the existing ground and, in some cases, into a new embankment. The design of the I-walls is based on the guidance provided in CEMRC-ED-GS letter, 24 July 1989, subject: Sheet Pile Wall Design Criteria. The upper portion of the sheet piling will be capped with concrete. The sheet piling will be driven to the required depth with 9 inches of the sheet piling extending above the finished ground elevation. The concrete portion of the floodwall will extend from 2 feet below the finished ground elevation to the required protection height.

b. Loading cases. In the design of the I-walls, the loading case to be considered will be as follows:

- Q-Case, F.S. = 1.5 with water to SWL
- Q-Case, F.S. = 1.25 with water to SWL plus waveload
- Q-Case, F.S. = 1.0 with SWL plus 2 ft freeboard
- S-Case, F.S. = 1.2 with water to SWL plus waveload
- No water, lateral soil pressure (where applicable)

c. Joints. Expansion joints in the I-wall will be spaced approximately 30 feet apart, adjusted to fall at sheet pile interlocks. To compensate for expansion, contraction, or displacement, three-bulb waterstops and premolded expansion joint fillers will be provided. Where the I-wall joins the T-wall, the deflection of the I-wall will produce a lateral displacement. To compensate for this displacement, a special sheet pile connection detail and a waterstop seal located in a notch in the I-wall have been designed to prevent water from flowing through this joint. Details of these joints are shown on Plate S51.

d. Tied-back sheet pile walls. The tied-back sheet pile walls will consist of steel sheet piling driven into existing ground and anchored with tie rods to a steel pipe, pile, or H-pile dead man. The upper portion of the sheet piling will be capped with concrete. The required sheet pile penetration and maximum bending moment will be determined by applying a factor-of-safety of 1.2 to the soil parameters. The required anchor force was determined by applying a factor-of-safety of 1.0 to the soil parameters.

35. T-Type Floodwall.

a. General. The T-wall will consist of a reinforced concrete stem on a monolithic concrete base of varying width supported on precast, prestressed concrete piles or H-Piles. The base of the T-wall will be constructed on a four-inch concrete stabilization slab. A continuous steel sheet pile wall will be provided beneath the base for seepage cutoff purposes.

b. Loading cases. These walls will be designed for the following load conditions:

Case I. Static water pressure with water to SWL, no wind, impervious sheet pile cutoff, no dynamic wave force.

Case II. Static water pressure with water to SWL, no wind, pervious sheet pile cutoff, no dynamic wave force.

Case III. Stillwater pressure with water 2 feet above SWL, dynamic wave force, impervious sheet pile cutoff (75% forces used).

Case IV. Stillwater pressure with water 2 feet above SWL, dynamic wave force, pervious sheet pile cutoff (75% forces used).

Case V. Static water pressure to SWL, dynamic waveforce, impervious sheet pile cutoff (75% forces used).

Case VI. Static water pressure to SWL, dynamic waveforce, pervious sheet pile cutoff (75% forces used).

Case VII. No water, no wind.

Case VIII. No water, wind from protected side (75% forces used).

Case IX. No water, wind from flood side (75% forces used).

c. Joints. Expansion joints in the T-wall will be spaced not more than forty feet apart except at gate monoliths. To compensate for expansion, contraction, or displacement, three-bulb waterstops and premolded expansion joint fillers will be provided.

36. Gates and Gate Monoliths.

a. General. Gate monoliths will be constructed for street crossings in lieu of I-walls. Each gate monolith will include a steel gate which will be closed by local interests when a hurricane approaches. Two types of gates will be used as described below.

b. Swing gates. To assure a proper seal, the gates will be constructed so that they can be adjusted in either the horizontal or vertical direction. The side and bottom seals can also be adjusted as alternate or supplemental means to assure that a proper seal is obtained.

c. Bottom roller gates. These gates will be constructed so that they can be adjusted in the horizontal direction, perpendicular to the tracks. The side and bottom seals can be adjusted in either the horizontal or vertical direction to assure that a proper seal is obtained.

d. Loading cases. The gate structures were designed for the following load conditions:

Case I. Gate closed, static water pressure to SWL, no wind, impervious sheet pile cutoff, no dynamic wave force.

Case II. Gate closed, static water pressure to SWL, no wind, pervious sheet pile cutoff, no dynamic wave force.

Case III. Gate closed, static water pressure with water level 2 feet above SWL, no wind, impervious sheet pile cutoff, no dynamic wave force (75% forces used).

Case IV. Gate closed, static water pressure with water level 2 feet above SWL, no wind, pervious sheet pile cutoff, no dynamic wave force (75% forces used).

Case V. Gate closed, static water pressure to SWL, dynamic wave force, impervious sheet pile cutoff (75% forces used).

Case VI. Gate closed, static water pressure to SWL, dynamic wave force, pervious sheet pile cutoff (75% forces used).

Case VII. Gate open, no wind, truck or train on protected edge of base slab.

Case VIII. Gate open, no wind, truck or train on flood side edge of base slab.

Case IX. Gate open, wind from protected side, truck or train on flood side edge of base slab (75% forces used).

Case X. Gate open, wind from flood side, truck or train on protected edge of base slab (75% forces used).

37. Cathodic Protection and Corrosion Control.

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

b. Corrosion control. The steel gates, corner plates, and all ferrous metal components which are not galvanized or stainless steel will be coated with a 7-coat vinyl paint system as required for corrosion control.

ENVIRONMENTAL EVALUATION

38. Status of EIS. The final EIS for West Bank of the Mississippi River in the vicinity of New Orleans, Louisiana (dated December 1986), was filed with EPA in October 1987. This EIS thoroughly covered the impacts of the V-North SPH alternative, which was finally approved in the Record of Decision, dated March 1989. Since the time of the original EIS, changes have occurred in project design, and these changes are covered in an Environmental Assessment (EA), dated February 1990. One change discussed in the EA is the Westwego tie-in (westside closure). This tie-in involves extending flood protection by means of a levee from the upper end of Bayou Segnette to the railroad tracks that run north of and parallel to the Westbank Expressway. A total of 13 additional acres of rights-of-way (ROW) would be required for this work. Most of the work would occur on existing residential land and, therefore, the additional environmental impact of this extension is considered to be minor. Another change that has occurred in project design involves replacing levees with floodwalls in certain reaches. The major area of floodwall construction is along the existing V-Levee from Highway 45 to the vertex. Although a floodwall is being constructed here instead of a levee, a significant reduction in the ROW did not occur. The adjacent borrow canal must be filled in and a new one dug farther north from the V-Levee. This must be done to maintain stability along the existing V-Levee. In total, direct construction impacts to wildlife habitat have increased from 814 acres to 849 acres since the processing of the final EIS.

39. Mitigation. The recommended mitigation plan as shown in the 1986 EIS involved construction of a stone dike at the mouth of Baie du Cabanage within the state-owned Salvador Wildlife Management Area (WMA) and acquisition of 1,024 acres of wooded wetlands in the Bayou Piquant finger ridge area adjacent to the WMA. The 1,024 acres of wooded

wetland acquisition would prevent logging or development, thereby preserving the area. The local sponsor proposed that lands they already own be used to mitigate woodland losses instead of lands adjacent to the WMA. The Corps has agreed to evaluate the suitability of alternative lands in conjunction with the Louisiana Department of Wildlife and Fisheries (LDWF) and the U.S. Fish and Wildlife Service. The acquired land would be licensed or deeded in-fee to an appropriate agency, such as the LDWF, for protection and management. Subsequent to the December 1986 EIS, the LDWF implemented structural measures, on their own, at Baie du Cabanage that have solved the marsh loss problems occurring within that area. It, therefore, became necessary to reinvestigate marsh management measures at the WMA. During the original investigation on Salvador, it was determined that the most desirable marsh management measure would be to construct a timber pile-tire breakwater to protect an aquatic bed and marsh complex known as the Neatherlands area. This area is adjacent to Lake Cataouatche and is being severely eroded by wind-driven wave wash. Although the benefits of doing work here far outweighed benefits of implementing measures at Baie du Cabanage, in the 1986 FEIS it was determined to be too costly. Original estimates indicated that the work would cost more than \$2 million. Subsequent investigation revealed that by redesigning the timber pile-tire breakwater, and by having it traverse a length of two-thirds the original distance, costs would be significantly reduced. The present construction cost for this new design is approximately \$527,000. Benefits to fish and wildlife habitat have been reduced by approximately one-half by reducing the length of the breakwater, but the benefits are still sufficient to fully mitigate project-induced losses associated with these habitat types including additional losses caused by the Westwego tie-in and changes in levee and floodwall design. The LDWF is in full concurrence with implementing this measure, even though they would prefer that the entire complex be afforded protection.

40. Cultural Resources. All anticipated cultural resources investigations have been completed. The westside closure alignment will affect only disturbed areas and recent structures without historic significance. Review of the westside closure will be accomplished in the course of public comment on the Environmental Assessment. All other project impact areas have been surveyed, and in consultation with the Louisiana State Historic Preservation Officer, found to be without significant cultural resources. One potentially significant archeological site (the V-Levee site) is located 120 ft. north of centerline at Sta. 718+00. Planned degrading of existing ground surface in this area will be curtailed to avoid impact to the site.

41. Recreation. Development of these levee and floodwall options will impact 800 man-days of sport hunting and 2,400 man-days of crawfishing for a combined annual loss of 3,200 man-days valued at \$14,700. Sport hunting impacts will be minor due to the linear nature of levee construction encompassing only the fringe of huntable areas. Since the V-levee borrow canal is not heavily used for sport fishing, dredging will not impact a substantial sport fishing resource. Other recreational activities such as hiking, bird-watching and nature study

would be temporarily disrupted during construction; however, after construction and once the levee areas are re-shaped and seeded these activities will return to the pre-project condition. Portions of the "V" levee reach will have a floodwall placed within the crown. This floodwall will restrict vision across the levee and provide limited open views.

REAL ESTATE REQUIREMENTS

42. General. All lands, easements, and rights-of-way required to construct the plan described in this GDM will be acquired by the local sponsor and furnished without cost to the United States. A detailed Real Estate estimate is presented in Appendix B.

PROJECT COST ESTIMATE

43. Costs. The estimated total first cost of the proposed works including the Harvey Canal Floodwall is \$78,000,000. The Federal and non-Federal shares are \$50,700,000 and \$27,300,000 respectively. Appendix F shows the detailed estimate of first cost.

44. Basis of Cost Estimate. The design and cost estimate presented in this GDM Supplement No. 2 are based on currently available engineering data and past engineering experience on projects with similar conditions.

45. Unit Price. Unit prices for this project were derived through analysis of recent past bids for the type of work involved, judgementally adjusted based on extensive experience of qualified cost estimators.

46. Project Cost Increase Limitation.

a. Section 902 of the Water Resources Development Act (WRDA) of 1986 (P.L. 99-662), as amended by Section 3(b) of the Water Resources Development Act of 1988 (P.L. 100-676), legislates the maximum total project cost. The maximum cost includes the cost cited in the authorizing legislation increased by:

- (1) Appropriate indexing to account for price level increases.
- (2) Additional costs required by the authorizing act or subsequent law.
- (3) Not more than 20% of the authorized cost (without adjustment for inflation) for modifications which do not materially alter the scope or function of the project.

b. The section 902 limit for the Westwego to Harvey Canal, Louisiana project is \$94,700,000. This figure is comprised of:

(1) \$61,500,000 - the project cost cited in the authorizing legislation; (2) \$14,200,000 - the price level increases from the date of authorized cost; (3) \$6,700,000 for the cost of credit under Section 104 of WRDA of 1986 for work accomplished by local interests for the 5 year period prior to project authorization; and (4) \$12,300,000 - 20% of the authorized cost.

c. Completion of this project within the Section 902 limit will be accomplished through appropriate management actions.

COMPARISON OF COST ESTIMATES

47. Breakdown Comparison of PB-3 and GDM No. 1, Supplement No. 2 Cost Estimates. The current total estimate of \$78,000,000 for the protection works represents no change from the cost shown in the PB-3 (effective Oct 1989). Table 5 shows a breakdown comparison of cost estimates of work items under each account for the PB-3 and the GDM, Supplement No. 2 cost estimates.

TABLE 5

BREAKDOWN COMPARISON OF PB-3 AND SUPPLEMENT No. 2 COST ESTIMATES

<u>Item</u>	<u>PB-3 (Effective Oct. 89)</u>	<u>Supplement No. 2</u>	<u>Difference</u>
01 Lands and Damages	\$ 6,772,000	\$ 6,956,000	+184,000 <u>1/</u>
02 Relocations	4,414,000	7,002,000	+2,588,000 <u>2/</u>
10 Breakwaters and Seawalls	--	527,000	+527,000 <u>3/</u>
11 Levees and Floodwalls	51,335,000	47,088,000	-4,247,000 <u>4/</u>
13 Pumping Plant	--	324,000	+324,000 <u>5/</u>
18 Cultural Resource Preservation	100,000	--	-100,000 <u>6/</u>
30 E&D	7,260,000	7,984,000	+724,000 <u>7/</u>
31 Construction Mgmt (S&I)	8,119,000	8,119,000	0
TOTAL	\$78,000,000	\$78,000,000	0

1/ This reflects a decrease in the amount of land required because of the deletion of protection works between Bayou Segnette Pumping Station and the Old Westwego Pumping Station and an increase in land costs for the westside closure.

2/ This change includes an increase in the cost for ramps at Lafitte-LaRose Hwy and Hwy 45 and an increase due to identification of more relocations during detailed designs.

3/ This is cost for a new item required for mitigation; cost for the previous mitigation measure (a dike) was included in the 11 account.

4/ This decrease is due to deletion of the protection works between Bayou Segnette and the Old Westwego Pumping Station and due to deletion of the mitigation dike.

5/ This is cost for a pumping station required for the new Westside Closure Plan.

6/ This work will not be required since the V-line levee design was changed from levee to floodwall.

7/ This increase is due to a more detailed analysis of requirements done during preparation of the supplement.

SCHEDULES FOR DESIGN AND CONSTRUCTION

48. Schedule for Design and Construction. The sequence of contracts and the schedules for design, construction, relocations, and land acquisition is shown in Table 6.

TABLE 6

SCHEDULE FOR DESIGN AND CONSTRUCTION

<u>Contracts</u>	<u>P&S</u>		<u>Construction</u>			<u>Estimated Construction Cost 1/</u>
	<u>Start</u>	<u>Complete</u>	<u>Advertise</u>	<u>Award</u>	<u>Complete</u>	
Hwy 45 Levee PI Sta. 425+45.77 to Sta. 575+88.58	AUG 89	APR 90	JUN 90	JUL 90	JUL 91	2,108,700
Mitigation Structure	FEB 90	JUN 90	SEP 90	OCT 90	APR 91	527,000
Reach I Structures*	JAN 90	NOV 90	JUN 91	JUL 91	JUL 94	4,202,500
Hwy 45 Gaps	AUG 90	APR 91	JUN 91	JUL 91	DEC 91	494,000
1st Lift V-Levee East of Vertex	FEB 91	OCT 91	DEC 91	JAN 92	MAY 93	3,910,600
Ross Canal Drainage Str.	APR 91	OCT 91	NOV 91	DEC 91	OCT 92	294,100
Reach III Structures*	JUN 91	MAR 92	OCT 92	NOV 92	JUL 95	3,016,200
1st Lift Levee- Estelle P.S. to Harvey P.S. Cousins	AUG 91	APR 92	JUN 92	JUL 92	JUL 93	1,624,300
1st Lift Levee- East West to Oak Cove	FEB 92	OCT 92	DEC 92	JAN 93	APR 94	3,748,000
1st Lift Levee- New Westwego P.S. to East West Levee	AUG 92	APR 93	JUN 93	JUL 93	JUL 94	1,456,100
Reach IV Structures*	JUL 93	MAR 94	APR 94	MAY 94	NOV 97	8,260,200
Westwego Air- port Floodwall	JAN 94	SEP 94	OCT 94	NOV 94	AUG 95	830,300
2nd Lift V- Levee, East of Vertex	MAR 94	MAR 96	MAY 96	JUN 96	MAY 97	864,500
Reach VI Structures*	MAY 94	APR 95	NOV 95	DEC 95	MAY 98	3,946,000

TABLE 6 (CONT'D)

<u>Contracts</u>	<u>P&S</u>		<u>Construction</u>			<u>Estimated Construction Cost ^{1/}</u>
	<u>Start</u>	<u>Complete</u>	<u>Advertise</u>	<u>Award</u>	<u>Complete</u>	
2nd Lift Levee- Estelle P.S. to Cousins P.S.	JUL 94	JUL 96	SEP 96	OCT 96	JUL 97	673,000
2nd Lift Levee- East-West to Oak Cove	JAN 95	JAN 97	MAR 97	APR 97	FEB 98	1,118,200
2nd Lift Levee New Westwego P.S. to East-West Levee	JUL 95	JUL 97	SEP 97	OCT 97	AUG 98	491,600
West-Side Closure	JUN 96	FEB 97	OCT 97	NOV 97	SEP 98	1,350,800
Harvey Canal Floodwal I*					SEP 98	7,149,000
3rd Lift V-Levee, East of Vertex	FEB 98	FEB 00	APR 00	MAY 00	MAY 01	495,200
3rd Lift Levee- Estelle P.S. Cousins P.S.	FEB 98	APR 00	JUN 00	JUL 00	FEB 01	541,400
3rd Lift Levee- New Westwego P.S. to Oak Cove	MAY 99	MAY 01	JUL 01	AUG 01	OCT 02	1,167,700
Miscellaneous Floodwall Capping	MAY 00	APR 01	NOV 01	DEC 01	DEC 02	573,400
					TOTAL	48,840,800

^{1/} This cost includes contingencies and Federal and non-Federal construction costs but not E&D and S&I costs.

- *Reach I - Floodwall from Station 17+49 B/L to
New Westwego P.S.
- Old Westwego Pumping Station Floodwall
- New Westwego Pumping Station Floodwall

- *Reach III - Ames Pumping Station Floodwall
- Mt. Kennedy Pumping Station Floodwall
- Oak Cove Pumping Station Floodwall

- *Reach IV - Estelle Pumping Station Floodwall
- Floodwall at Ia. Power & Light Powerlines
- V-Levee Floodwall, West of Vertex

- *Reach VI - Cousins Pumping Station Floodwall
- Harvey Pumping Station Floodwall
- Floodwall from Cousins P.S. to Harvey P.S.

*Harvey Canal Floodwall

A new control structure/pumping station alternative in the vicinity of the existing Cousins Pumping Station, as part of the existing feasibility for hurricane protection on the West Bank of the Mississippi River east of the Harvey Canal, if adopted, will negate the need for the Harvey Canal Floodwall portion of the authorized project described herein.

ECONOMIC ANALYSIS

49. General. The study area is located entirely within Jefferson Parish, which is part of the New Orleans Metropolitan Statistical Area (MSA). The protected area encompasses a portion of Jefferson Parish on the West Bank of the Mississippi River. Both residential and commercial structures occupy the area, with an industrial band centered around the Harvey Canal. Single and two-story residential structures comprise the bulk of protected properties in terms of total value and numbers of structures. Residential structural value exceeds \$1 billion and commercial structures are valued at over \$250 million in 1986 dollars. The area has been broken into seven reaches for analysis, based on hydrologic make-up. All reaches have both residential and commercial structures except Reach 3 which has only commercial properties.

50. Authorized Plan. The "V-levee north" alignment with SPH level of protection, which is the authorized plan, is the only plan being evaluated in the Economic Analysis. When the plan was originally selected the hurricane protection levee was designed to tie into the existing Lake Cataouatche levee on the western end. Since this plan is no longer feasible, a new alignment has been chosen for the western end. This new alignment encompasses approximately 4 city blocks of residential development, with approximately 100 structures. Benefits have not been adjusted to include damages prevented to that area.

51. Presentation of Average Annual Benefits and Costs.

a. Methodology. The economic justification of the plan is determined by comparing estimates of the average annual costs and average annual benefits which are expected to accrue over the life of the project. Participation in a project by the Federal Government normally requires that average annual benefits equal or exceed average annual costs.

The values estimated for benefits and costs at the time of accrual are made comparable by conversion to an equivalent time basis using an interest rate of 8-7/8 percent. The period of analysis, or project life, which is utilized in the analysis is 100 years. The benefits and costs are expressed as the average annual value of the present worth of all expenditures and all plan outputs. These expenditures and outputs are measured at a specific point in time, the base year, which is the first year complete, permanent protection is achieved.

b. Benefit Analysis. Benefits from the project result from reduction in flooding and reduction in the costs related to flooding. Benefits in the following categories were quantified; inundation reduction to structures and vehicles, flood insurance costs saved, emergency operations costs saved, and inundation reduction benefits accrued during the installation period.

52. Installation Period Benefits.

a. Installation Period Benefit Accrual. Although construction of the project requires 14 years, some benefits accrue during the installation period. During the construction period 100 percent protection is obtained at the beginning of year 11. Due to settlement, protection is subsequently reduced to 75 percent until the completion of final levee lift. One hundred percent protection is again provided when the final levee lift is completed. Since some level of protection is provided from the beginning of year 11, average annual damages prevented during the installation period can be counted as NED benefits. In order to be able to compare them at the same point in time with average annual costs, benefits accrued during installation were compounded forward to the end of the installation period. Benefits were compounded from mid-year points in order to represent the average benefit for that year. The percentage of total average annual benefits that were used to compute benefits during installation ranged from 78 percent to 97 percent.

Benefits during the installation period have been significantly reduced due to a change in the construction schedule. Based on previous construction schedules partial protection of the area would occur at the completion of the first levee lift, the beginning of year 6 of the construction period. With the existing construction sequence partial protection is not provided until the beginning of year 11. The result is a reduction in benefits during the installation period by approximately 55%, and a reduction in total benefits by over 20%. This reduction of

installation period benefits is a direct result of the delay in completing the floodwall on Harvey Canal, due to the intended tie-in with protection for the area east of Harvey Canal.

b. Summary of NED Benefits. A summary of all benefits (damages prevented) attributable to the plan is presented below.

Benefit Summary*

<u>Category</u>	<u>Average Annual Dollars (1,000)</u>
Inundation Reduction	
Structures	\$18,304
Vehicles	2,140
Benefits During Installation Period	6,804
FIA Costs Saved	347
Emergency Operations	
Costs Saved	<u>78</u>
Total Benefits	\$27,673

*October 1989 Price Level

53. Cost Analysis.

a. Installation Sequence. The proposed levee will be constructed in several sequences, or lifts. These lifts are required to bring the levee up to the approved project design level. The first lift will be complete during year 6 of the construction period, and that lift settles to 50 percent of its original height before construction of the second lift begins. During year 10, the second lift is complete and the project is at 100 percent of the approved protection level. The second lift then settles to 75 percent of its original height and construction of the third and final lift begins. Construction of the third lift is completed at the end of the 14th year and the area is then fully protected. Yearly construction costs including cost spent on Preconstruction Engineering and Design have been compounded forward to the base year, the point where construction is complete and the life of the project begins. The mid-point of each year was chosen as the point from which yearly costs were compounded forward.

b. Annual Costs. Annual costs include interest and amortization of the initial investment, average annual maintenance and operation costs, fish and wildlife mitigation and replacements. Summaries of the average annual charges for the plan are listed below.

Remaining Investment Cost and
Average Annual Charges
(October 1989 Price Levels)

<u>Item</u>	<u>Dollars (1,000)</u>
Remaining First Cost*	\$ 68,777
Interest During Construction	69,709
Gross Investment Cost At End of Installation Period	138,486
Annual Charges	
Interest and Amortization	12,239
Operation, Maintenance and Replacements	<u>76</u>
Total Average Annual Charges	12,369

*Does not include sunk cost of \$6.7 million spent by the Local Sponsor

54. Benefit-Cost Ratio. Based on the benefit and cost data presented in the two previous tables, the benefit-cost ratio and net benefits for the V-Levee north plan with SPH level of protection is shown below.

V-Levee North Alignment SPH <u>8-7/8 Percent</u>			
<u>Average Annual Benefits (\$1,000)</u>	<u>Average Annual Costs (\$1,000)</u>	<u>Net Benefits (1,000)</u>	<u>Benefit-Cost Ratio</u>
\$27,673	\$12,369	\$15,304	2.2 to 1

OPERATION AND MAINTENANCE

55. Annual Costs. The operation and maintenance of the proposed levee system, floodwalls, gates, etc. will be the responsibility of West Jefferson Levee District. The estimate of annual operations and maintenance costs are as follows:

a. Levee and Floodwall Maintenance \$48,000/yr.
(includes mowing approximately 325 acres of levee 12 times/year and minor floodwall maintenance 4 times/year).

b. Floodgate Operations (Includes \$800/yr.
operating 5 swing gates and 2 roller gates
4 times/year).

c. Floodgate Maintenance (Includes spot painting, miscellaneous routine maintenance, and complete repainting every 10 years of 7 floodgates). \$5,000/yr.

d. Sluice Gate Drainage Structure Maintenance (Includes periodic routine maintenance and complete repainting every 5 years of 10 gates). \$2,500/yr.

Subtotal \$56,300/yr.

10% - 12% contingency 6,700/yr.

Total \$63,000/yr.

RECOMMENDATIONS

56. Recommendations. The plan presented in this Supplement is recommended for approval as a basis for preparing plans and specifications for this project.

WESTWEGO TO HARVEY CANAL IA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

APPENDIX A

HYDROLOGY AND HYDRAULICS

WESTWEGO TO HARVEY CANAL, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
Appendix A

Hydrology and Hydraulics

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SECTION I - ANALYSIS

A-1. General.

This appendix presents detailed descriptions of the climatology and hydrologic regimen of the area and detailed descriptions of hydraulic analysis methods and procedures used in the design of the protection features of the plan. The overall plan of improvement is described in detail in the main body of this memorandum and reference to the main text is cited where appropriate.

A-2. Description.

The study area, located in Southeastern Louisiana, lies within Jefferson Parish on the west bank of the Mississippi River. The area is bounded by the Harvey Canal to the east, Lakes Cataouatche and Salvador to the west, the Mississippi River to the north and Barataria Bay to the south. Lakes Salvador and Cataouatche are estuary areas which connect to the Gulf of Mexico through Barataria Bay. Tidal waters can be carried into the study area through these lakes and Bayou Barataria into Bayou Segnette and the Harvey Canal. Freshwater is introduced into the study area from the Mississippi River via the Harvey and Algiers Locks, direct rainfall and pumpage from leveed areas.

The project area, is of mostly low relief and characteristic of an alluvial plain. Situated on the western bank of the Mississippi River near New Orleans, land elevations slope gently from an average elevation of about 12 feet NGVD along the natural banks of the Mississippi River to several feet below sea level in portions of the leveed areas. Natural ground elevations in the unleveed marsh areas in the southern part of the study area average 0.5 to 1.0 ft NGVD. Although leveed marshland will subside when pumped, unleveed areas are subject to natural subsidence and in the future will become increasingly vulnerable to flooding from the combined effects of this subsidence and global sea level rise. During the next 100 years subsidence in the project area will vary from as much as 1 to 2 feet in the leveed areas to 0.65 feet in the surrounding marsh. Global sea level rise is expected to be 0.5 feet within the next century.

All of the area is protected from Mississippi River overflows by the mainline levee system. Storm surge originating in the Gulf of Mexico can travel across the marsh and through the many natural and man-made channels to threaten the project area from the south and west. Storm winds blowing across Lakes Salvador and Cataouatche further raise the height of flood waters outside the leveed areas and add to required levee heights. To protect the area from this tidal and storm surge flooding, local interests have constructed a network of levees that nearly encompass the area. Along the unleveed reach, the area is afforded protection by the Bayou Des Familles Ridge, a ridge at an elevation of approximately 4.5 feet NGVD, which generally runs perpendicular to the Mississippi River in a north-south direction.

Several pumping stations drain the study area. Two stations, the Harvey and Cousins Stations discharge directly into the Harvey Canal. The Estelle Pumping Station discharges into Bayou Barataria. An additional Estelle

Pumping Station will be constructed near the existing station; it will also discharge into Bayou Barataria. On the western side of the study area six pumping stations, the new Westwego, Bayou Estates, Orleans Village, the new Ames, Mt. Kennedy and Oak Cove, drain rainfall-runoff water into the marsh. The Bayou Estates pump, will be replaced by the new Westminster/Lincolnshire Pumping Station.

The new hurricane protection levee will not interfere with the operation of these pumping stations and will protect this portion of Jefferson Parish from the standard project and lesser intensity hurricane surges emanating from Lakes Salvador and Cataouatche; the area will still be subject to periodic inundation caused by excessive rainfall. The study area is depicted on Plate H-1.

A-3. Climatology.

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

TABLE A-1
METEOROLOGIC STATIONS

LENGTH OF RECORDS (YRS.) TO 1985

<u>PRECIPITATION & TEMPERATURE STATIONS</u>	<u>Precipitation</u>	<u>Temperature</u>
NEW ORLEANS - AUDUBON PARK	97	97
NEW ORLEANS - MOISANT AIRPORT	33	33
RESERVE (NR)	85	85
SLIDELL	30	30
DONALDSONVILLE (NR)	97	98
LOUISIANA NATURE CENTER	7	7
PARADIS (NR)	72	32
HAMMOND (NR)	90	91
ST. BERNARD (NR)	21	21
COVINGTON	93	93
CARVILLE (NR)	48	47
BATON ROUGE AIRPORT	118	98

TABLE A-1 (cont'd)
METEOROLOGIC STATIONS

LENGTH OF RECORDS (YRS.) TO 1985
PRECIPITATION & TEMPERATURE STATIONS

	<u>Precipitation</u>	<u>Temperature</u>
<u>RECORDING PRECIPITATION STATIONS</u>		
NEW ORLEANS ALGIERS	87	-
NEW ORLEANS DPS 14 - CITRUS	32	-
NEW ORLEANS WATER PLANT DUBLIN	93	-
NEW ORLEANS DPS 5 - JOURDAN	53	-
NEW ORLEANS DPS 3 - LONDON	93	-
NEW ORLEANS DPS 6 - METAIRIE	38	-
GONZALES	9	-
<u>NON-RECORDING PRECIPITATION STATIONS</u>		
NEW ORLEANS CITY HALL	9	-
BATON ROUGE CENTRAL	8	-
ABITA SPRINGS FIRE TOWER	14	-

LEGEND: NR Non-Recording

b. Precipitation. Precipitation generally is heavy in two fairly definite rainy periods. Summer showers last from mid-June to mid-September, and heavy winter rains generally occur from mid-December to mid-March. The annual normal precipitation for New Orleans at Audubon Park is 61.6 inches, with annual variations of plus or minus 50 percent. Extreme monthly rainfalls exceeding 12 inches are not uncommon, and as much as 20 inches have been recorded in a single month. The greatest 24-hour amount of precipitation at this station since 1871 was 14.01 inches on 15 and 16 April 1927. At Belle Chase, 15.4 inches of rain fell on 2 October 1937. Table A-2 gives the 30-year normals for the New Orleans at Audubon Park station along with the monthly maximum and minimum totals during the 1951-1980 period. Snowfall amounts are generally insignificant, and hail of a damaging nature seldom occurs.

TABLE A-2
MONTHLY RAINFALL (INCHES)
NEW ORLEANS AT AUDUBON PARK
30-YEAR NORMALS (1951-1980)

<u>Month</u>	<u>Normal</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Month</u>	<u>Normal</u>	<u>Maximum_a</u>	<u>Minimum</u>
Jan	4.9	12.69	0.99	Jul	7.17	20.39	2.37
Feb	5.19	12.44	0.54	Aug	6.67	17.82	2.67
Mar	4.68	10.17	T	Sep	5.98	16.91	0.80

TABLE A-2 (Cont'd)
MONTHLY RAINFALL (INCHES)
NEW ORLEANS AT AUDUBON PARK
30-YEAR NORMALS (1951-1980)

<u>Month</u>	<u>Normal</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Month</u>	<u>Normal</u>	<u>Maximum_a</u>	<u>Minimum</u>
Apr	4.68	20.24	0.58	Oct	2.52	8.18	0.0 ^b
May	5.06	12.61	0.62	Nov	4.01	10.15	0.49
Jun	5.39	16.98	0.39	Dec	5.30	8.93	1.40
				ANNUAL	61.55	83.54 ^c	40.11 ^d

LEGEND: T - Trace
a - Jul 1959
b - Oct 1952, Oct 1963
c - 1961
d - 1968

c. Temperature. Temperature records at New Orleans Audubon Park show the normal annual temperature is 69.5°F. The monthly mean temperatures vary from 54°F to 83°F. Record high temperatures of 102°F occurred on 30 June 1954 and 22 August 1980. The record low temperature of 7°F occurred on 13 February 1899. Temperature normals (1951-1980) for New Orleans at Audubon Park station are shown in Table A-3.

TABLE A-3
MONTHLY TEMPERATURE (°F)
NEW ORLEANS AT AUDUBON PARK
30-YEAR NORMALS (1951-1980)

<u>Month</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Month</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>
Jan	53.6	61.8	45.3	Jul	83.0	90.6	75.3
Feb	56.1	64.6	47.6	Aug	82.8	90.3	75.3
Mar	62.6	71.0	54.1	Sep	79.8	87.0	72.6
Apr	69.8	78.3	61.2	Oct	70.8	79.5	62.1
May	76.0	84.2	67.7	Nov	61.6	70.1	53.1
Jun	81.3	89.4	73.2	Dec	56.2	64.5	47.8
				ANNUAL	69.5		

Extreme Minimum: 7°F, 13 February 1899
Extreme Maximum: 102°F, 30 June 1954 (also other dates)

d. Wind. Average wind velocity is 7.8 mph, based on anemometer records at New Orleans Moisant Airport over the period 1966-1983. The predominant wind directions are north-northeast from September through February and south-southeast from March through June. Table A-4 shows the average monthly wind speed and its resultant direction for this period.

TABLE A-4
WIND SUMMARIES, NEW ORLEANS AT MOISANT AIRPORT (1966-1983)
AVERAGE WIND SPEED (MPH)

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>ANN</u>
1966	9.6	10.5	9.5	10.7	8.7	7.3	6.2	6.4	5.7	7.6	7.4	8.6	8.2
1967	8.3	9.5	9.0	9.3	9.1	6.8	6.2	5.9	7.0	7.4	8.0	9.8	8.0
1968	9.2	10.0	9.3	9.1	8.4	5.6	5.7	5.2	6.4	6.8	8.9	9.3	7.8
1969	9.7	9.8	10.0	8.6	7.3	7.2	6.5	6.8	6.7	9.7	8.0	9.1	8.3
1970	9.5	9.2	9.8	9.9	8.5	6.8	5.4	6.0	6.7	7.7	8.0	7.4	7.9
1971	8.4	9.8	9.8	8.5	7.9	5.3	5.7	5.0	6.5	4.8	8.0	8.7	7.4
1972	8.9	8.6	9.1	10.2	7.3	9.3	7.5	6.4	7.0	8.3	9.9	9.4	8.5
1973	9.6	10.2	12.0	11.5	10.0	6.7	6.7	6.3	7.9	7.0	9.6	11.4	9.1
1974	9.2	11.0	10.8	10.7	8.2	7.4	5.0	5.2	8.6	7.4	8.5	8.5	8.4
1975	9.4	8.6	11.0	10.0	7.4	6.5	6.5	4.9	6.3	6.4	8.0	7.8	7.7
1976	9.6	8.8	10.5	7.6	8.4	6.9	5.4	5.7	6.0	8.5	7.9	8.2	7.8
1977	9.8	8.5	8.5	7.3	5.7	5.3	4.4	5.5	5.4	6.6	8.1	8.8	7.0
1978	9.1	8.9	8.5	8.6	7.9	5.9	5.5	5.3	6.3	6.1	6.7	10.0	7.4
1979	10.5	9.0	9.3	8.0	7.2	6.5	6.7	4.4	8.0	6.7	8.1	6.3	7.6
1980	7.6	8.0	9.8	8.8	7.5	7.4	5.6	5.7	5.3	5.9	6.4	5.9	7.0
1981	7.6	8.3	7.7	7.3	7.8	6.9	5.7	4.8	5.7	7.0	7.3	8.6	7.1
1982	9.8	8.3	8.9	9.4	6.5	6.2	4.6	4.4	7.1	7.5	7.6	10.0	7.5
1983	8.0	10.0	8.8	10.4	7.8	6.3	5.8	5.3	6.0	6.8	8.3	10.0	7.8
AVG	9.1	9.2	9.6	9.2	7.9	6.7	5.8	5.5	6.6	7.1	8.0	8.8	7.8

WIND SUMMARIES, NEW ORLEANS AT MOISANT AIRPORT (1966-1983)
RESULTANT DIRECTION*

	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>ANN</u>
1966	02	04	07	16	07	07	23	15	02	03	03	05	05
1967	03	02	13	15	16	11	21	02	05	06	05	08	09
1968	03	35	12	16	15	19	12	05	06	04	04	06	07
1969	07	02	02	13	09	18	24	09	04	05	36	01	05
1970	03	03	08	17	19	21	29	12	08	03	32	06	09
1971	02	12	13	15	13	23	20	01	07	04	04	12	09
1972	07	07	12	15	04	20	14	34	12	06	02	06	08
1973	02	36	16	16	20	18	24	04	10	07	13	20	12
1974	12	24	16	13	16	16	25	13	05	06	06	16	12
1975	09	21	14	11	15	18	25	17	03	05	08	04	10
1976	04	19	15	15	15	13	25	01	04	02	02	02	07
1977	01	09	13	14	13	21	20	12	15	03	10	13	11
1978	01	01	28	15	16	12	19	11	08	03	08	07	07
1979	01	04	15	14	14	15	17	13	04	11	03	03	08
1980	06	06	09	20	15	22	27	13	09	04	02	02	08
1981	02	02	21	15	13	16	22	11	05	06	10	04	09
1982	11	01	12	10	13	22	21	21	06	06	06	10	09
1983	04	05	29	18	15	12	10	11	07	05	10	03	08

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

e. Streamflow. Stage records are available at four locations within the study area. Hurricane Juan set new record highs at three of these gages. Table A-5 gives the period of record and extremes of these stations. Discharge data is not taken due to tidal influence.

TABLE A-5
GAGE DATA

<u>Station</u>	<u>Period of Record</u>	<u>Maximum</u>	<u>Stage Extremes (ft NGVD)</u>		
			<u>Date</u>	<u>Minimum</u>	<u>Date</u>
Mississippi River @ Harvey Lock	Jan 1924 - to date	19.42	24 Apr 1927	-0.68	17, 18 Dec 1953
IWW @ Harvey Lock	Jan 1925 - to date	4.74 ^a	29 Oct 1985	-1.28	26, 27 Jan 1940
Bayou Barataria @ Barataria	Jan-Sep 1950 and Nov 1951 - to date	4.25 ^a	29 Oct 1985	-0.58	9 Sep 1965
Bayou Barataria @ Lafitte	Oct 1955 to Dec 1960 and May 1963 - to date	5.05 ^a	29 Oct 1985	-0.60	12, 13 Jan 1956

^aCaused by Hurricane Juan

f. Tropical Storms and Hurricanes. Several hurricanes and tropical storms have passed through or near the study area. Some of the major storms include the 1915 hurricane, the 1947 hurricane, Hurricanes Flossy, Hilda, Betsy, Cammen, Babe, Bob, Danny, and Juan. Some major characteristics of these storms are summarized in Table A-6. Hurricane tracks are illustrated on Plate H-3.

TABLE A-6
EXPERIENCED HURRICANES

<u>STORM</u>	<u>DATE</u>	<u>CENTRAL PRESSURE (inches mercury)</u>	<u>FORWARD SPEED (Knots)</u>	<u>MAXIMUM RECORDED WINDSPEED (M.P.H.)</u>
1915	22 Sep - 2 Oct	27.87	10	106
1947	4 - 21 Sep	28.57	16	98
FLOSSY	21 - 30 Sep 1956	28.76	10	90
HILDA	28 Sep - 5 Oct 1964	28.40	7	98
BETSY	27 Aug - 10 Sep 1965	28.0	20	105
CARMEN	29 Aug - 10 Sep 1974	27.84	9	86
BABE	3 - 8 Sep 1977	29.85	--	46+
BOB	9 - 16 Jul 1979	29.58	15	58
DANNY	12 - 20 Aug 1985	29.61	13	--
JUAN	26 - 31 Oct 1985	29.13	13*	74

* Maximum reported forward speed. Several times during its traversal, the storm stalled while changing direction.

Hurricane Flossy brought torrential rains and tidal flooding to the study area. Golden Meadow, which is below the area, received 16.7 inches of rain in a 24 hour period. Hurricane Hilda raised water levels at Barataria and Lafitte to 3.6 and 4.0 feet NGVD, respectively. Hurricanes Betsy and Camen also caused flooding to some parts of the study area. Hurricane Juan broke high water records throughout the area (see Table A-5, Gage Data). On the west bank, three local levees were breached and several subdivisions were flooded by tidal inundation and the long duration of high stages. The total storm precipitation for Juan ranged from 8 to 12 inches over the area.

A-4. Stages, Tides and Salinities.

a. Stages. High stages usually result from the occurrence of a tropical storm or hurricane. However, high stages can also be caused by long duration southerly winds or westerly winds across Lakes Cataouatche and Salvador. Highest stages at the Harvey Lock at IWW and at both Barataria and Lafitte on Bayou Barataria were caused by Hurricane Juan in Oct 1985, see table A-5.

b. Tides. The normal tide has a general range of 0.35 foot in the Harvey Canal and the surrounding marsh and is diurnal in nature. However, wind effects usually mask the daily ebb and flood variations. The mean high and low tide in the area is approximately 1.6 and 1.3, respectively. The average annual high stages vary from 3.0 to 3.5 in the study area.

c. Salinities. The Barataria Bay Waterway transmits water of elevated salinity from Barataria Bay into the project area. This water is distributed throughout the area via Bayou Barataria, Bayou Segnette, Bayou Des Familles, and various other smaller waterways in the area. These waterbodies also provide drainage for freshwater runoff in the project area. This, results in variable salinity levels depending upon climate and weather conditions. Long-term data from Bayou Segnette indicate that salinities in the southern part of the project area are slightly higher than in the northern part. Salinity concentrations in Bayou Segnette near Lake Cataouatche averaged 1.6 parts per thousand (PPT) and ranged from 0.2 to 4.5 PPT. Further north on Bayou Segnette, near the Churchill Farms Canal, salinities were lower with an average of 1.4 PPT and a range of 0.4 to 3.1 (PPT). Chloride measurements made by the United States Geological Survey (USGS) during 1981 and 1982 indicate that salinities are lower in the wetlands and canals of the interior of the drainage area. In the urbanized areas that are surrounded by levees the water is fresh. The levees act as barriers to flow from outside which may contain elevated salinity levels. Interior freshwater runoff is pumped out of the leveed areas.

A-5. Description and Verification of Procedures.

a. Hurricane Memorandums. The Hydrometeorological Section (HMS), U.S. Weather Bureau, has cooperated in the development of hurricane criteria for experienced and potential hurricanes in the study area. The HMS memorandums provided isovel patterns, hurricane paths, pressure profiles, rainfall estimates, frequency data, and various other parameters required for the hydraulic computations. A reevaluation of historic meteorologic and hydrologic data was the basis for memorandums relative to experienced hurricanes. Those relative to potential hurricanes were developed through the

use of generalized estimates of hurricane parameters based on the most recent research and concepts of hurricane theory. Memorandums applicable to the study area are listed in the attached bibliography.

b. Historical Storms used for Verifications. Three observed storms, with known parameters and effects, were used to establish and verify procedures and relationships for determining surge heights, wind tide levels (WTL's), inflow into Lakes Salvador and Cataouatche and ultimately, flood elevations that result from hurricanes. The three storms used for verification occurred in September of 1915 (1)*, September of 1947 (2) and September 1956 (3). Isovel patterns for these storms are shown on Plates H-4, H-5, and H-6, respectively.

(1) The hurricane of 29 September 1915 had a central pressure index (CPI) of 27.87 inches, an average forward speed of 10 knots, and a maximum sustained wind speed of 99 mph at a radius of 29 nautical miles. This hurricane approached the mainland from the south. At Grand Isle a high water elevation of 9 feet was experienced and near Manila Village at the rear of Barataria Bay a stage of 8.0 feet was reported. Destruction was extensive. At Leesville, Louisiana, approximately 13 miles west of Grand Isle only 1 of 100 houses remained standing.

(2) The 19 September 1947 hurricane had a CPI of 28.57 inches, an average forward speed of 16 knots, and a maximum sustained windspeed of 72 mph at a radius of 33 nautical miles. The direction of approach of this hurricane was approximately from the east. A stage of 4.0 was observed at Grand Isle. The Gulf Coast from Florida to Louisiana experienced a tidal surge from the hurricane with the western end of the Mississippi Sound receiving the greatest buildup.

(3) Hurricane Flossy, which occurred on 24 September 1956, had a CPI of 28.76 inches, an average forward speed of 10 knots, and a maximum wind speed of 80 mph at a radius of 30 nautical miles. This hurricane approached the Louisiana coastline from the southwest, crossing the Mississippi River delta and reentering the Gulf of Mexico. The tide rose to 8.0 feet at Grand Isle. Tides were unusually high from 20 miles west of Grand Isle to western Florida.

c. Synthetic storms. Computed flood elevations, resulting from synthetic storms, are necessary for frequency and design computations. Parameters for certain synthetic storms and methods for derivation of others were furnished by the National Weather Service. The standard project hurricane (SPH) for the entire Louisiana coast was used for all locations in the study area with changes only in path and forward speed.

(1) SPH for the Louisiana coast was derived by the National Weather Service from a study of 42 hurricanes that occurred in the region over a period of 57 years (4). The SPH path critical to the project location and isovel patterns at critical hour are shown on Plate H-4. Based on subsequent studies of more recent hurricanes, the National Weather Service has revised

* Numbers in parenthesis indicate reference in bibliography

the SPH wind field patterns and other characteristics over the years. Wind field patterns were revised after Hurricane Betsy in 1965 to reflect the intensified wind speeds (5), (6), (7). After Hurricane Camille in 1969, the Weather Service completely revised hurricane characteristics for the SPH, including the wind speeds, central pressure and radii (8). In their latest publication (9) NOAA has expanded and generalized the latest SPH characteristics, previous SPH characteristics fit within the new generalized parameters.

(a) The SPH for the Louisiana coastal region has a frequency of once in 100 years. The CPI that corresponds to this frequency of once in 100 years is 27.6 inches. CPI probabilities are based on the following relationship (10):

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

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

(b) Radius of maximum winds is an index of hurricane size. The radius of 12 hurricanes occurring in the New Orleans area is 36 nautical miles. From relationships of CPI and radius of maximum winds of gulf coast hurricanes (10), a radius of 30 nautical miles is considered representative for an SPH having a CPI of 27.6 inches.

(c) Different forward speeds are necessary to produce SPH effects at various locations within the study area. In Lake Salvador, the forward speed is a critical factor and may be as important as the track itself. Sufficient time must elapse to allow for maximum inflow into the lake. The SPH for the east shore, has an average forward speed of 11 knots.

(d) Maximum theoretical gradient wind (10) is expressed as:

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

where V_{gx} = maximum gradient wind speed in miles per hour
 P_n = asymptotic pressure in inches
 P_o = central pressure in inches
R = radius of maximum winds in nautical miles
f = coriolis parameter in units of hour⁻¹

The estimated wind speed (30 feet above ground level) (V_x) (11) in the region of highest speeds is obtained as follows:

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

where T = forward speed in miles per hour.

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

(2) Other synthetic storms of different frequency and CPI are derived from SPH. Other CPI's for desired frequencies are obtained from the graph shown on Plate A-8. V_{gx} 's corresponding to any other CPI are determined similarly by use of the method described for the SPH. Variations in CPI's of historic storms were accomplished by the same procedure (10). Characteristics of synthetic storms and some historic storms are listed in Table A-7.

TABLE A-7
HURRICANE CHARACTERISTICS

<u>Hurricane*</u>	<u>CPI</u> inches	<u>Radius of</u> <u>Max. Winds</u> nautical miles	<u>Forward</u> <u>Speed</u> knots	<u>Vx</u> m.p.h.
Sep 1915	27.87	29	10	99
Sep 1947	28.57	33	16	72
Sep 1956	28.76	30	10	80
Sep 1965	27.79	32	20	122
SPH	27.60	30	11	100
Mod H	28.30	30	11	83

* Tracks are shown on Plate A-9.

d. Surges.

(1) Maximum hurricane surge heights along the gulf shores were determined from computations made for ranges extending from the shores out to the continental shelf by use of a general wind tide formula based on the steady state conception of water super-elevation (12) (13) (14). The average windspeed and average depth in each range were determined from isovel and hydrographic charts for each computation. The storm isovel patterns were furnished by U.S. Weather Bureau. In order to reach agreement between the computed maximum surge heights and the observed high water marks, it was necessary to introduce a surge adjustment factor or calibration coefficient into the general equation, which in its modified form, was as follows:

$$S = 1.165 \times 10^{-3} \frac{V^2 F N Z \cos O}{D}$$

where S = wind setup in feet

V = windspeed in m.p.h.

F = fetch length in statute miles

D = average depth of fetch in feet

O = angle between direction of wind and the fetch

N = planform factor, assumed equal to unity

Z = surge adjustment factor

(2) Hurricane surges at the shore were determined by summation of incremental wind setups along a range above the water surface elevation at the the gulf end of the range. A combination of the setup due to atmospheric pressure anomaly and the predicted normal tide was used to determine the

initial elevation at the gulf end of the range. Due to the variation in pressure setup between the shoreward end and gulfward end of the range, an adjustment was made at the former to compensate for the difference. This procedure for determining surge heights at the coastline was developed for the Mississippi gulf coast, where reliable data were available at several locations for more than one severe hurricane, and is used for the entire coastal Louisiana region. Due to dissimilar shoreline configurations different factors were required at different locations, but identical factors were used at each location for every hurricane. The value of the factor is apparently a function of the distance from the shoreline to deep water and varies inversely with this distance. Comparative computed surge heights and observed high water marks for the 1915 and 1947 hurricanes at the locations used to verify the respective procedures are shown in table A-8. All elevations in this appendix are in feet and are referred to National Geodetic Vertical Datum of 1929 (ngvd).

TABLE A-8

HURRICANE SURGE HEIGHTS

<u>Location</u>	<u>Surge adjustment factor (Z)</u>	<u>1915</u>		<u>1947</u>	
		<u>Observed</u>	<u>Computed</u>	<u>Observed</u>	<u>Computed</u>
		feet ngvd		feet ngvd	
Long Point, La.	0.21	9.8	9.6	10.0	10.1
Bay St. Louis, Ms.	0.46	11.8	11.8	15.2	15.1
Gulfport, Ms.	0.60	10.2(a)	9.9	14.1	14.3
Biloxi, Ms.	0.65	10.1(a)	9.8	12.2(a)	12.6

(a) Average of several high water marks.

(3) In those areas where the coastline is characterized by a coastal bay separated from the gulf by an offshore barrier island, such as Grand Isle, or by a shoal, it is necessary to inject an additional step in the normal procedure to verify experienced hurricane tides. The incremental step computation was completed to the gulf shore of the island and the water surface elevation transposed to the inland bay side of the island from whence the incremental computations were continued using a new surge adjustment factor which was considered representative of the shallower depths within the bay. This procedure resulted in a satisfactory verification of hurricane tides along other portions of the Louisiana coast.

(4) The incremental step computation was used to check elevations experienced during the hurricane of 22 September - 2 October 1915 and hurricane Flossy 21-30 September 1956. Verification of surge heights and surge adjustment factors for these hurricanes are shown in table A-9. Surge adjustment factors of 0.80 in open water and 0.48 in Barataria Bay were used for the Manila Village area.

TABLE A-9

VERIFICATION OF HURRICANE SURGE HEIGHTS

<u>Location</u>	<u>Sep. 1915</u>		<u>Sep. 1956 (Flossy)</u>		<u>Surge adjustment factor(Z)</u>
	<u>Observed</u> feet ngvd	<u>Computed</u> feet ngvd	<u>Observed</u> feet ngvd	<u>Computed</u> feet ngvd	
Grand Isle					
Flooding from front	9.0	8.8	3.9	4.1	0.80 (a)
Flooding from rear	-	-	8.0	7.8	0.80 (a) 0.48 (b)
Manila	8.0	8.5	-	5.1	0.48 (b)

(a) In Gulf of Mexico

(b) In Barataria Bay

e. Routing. Since the major hurricane damage in the study area would result from storm induced effects on Lake Salvador, it was necessary to establish a method to determine the stage in the lake at any time during the hurricane occurrence. This procedure involves the construction of a stage hydrograph for Barataria Bay by calculating simultaneously, the hourly flows and rainfall through Lake Salvador's natural inlet channels (assumed in this case to be one large channel as shown on plate H-9).

(1) Prerequisite to any routing is the choice of an actual or hypothetical hurricane of known or designated characteristics. It is then possible to develop surge heights for any point in Barataria Bay for the selected hurricane. For routing purposes, the old fishing settlement of Manila Village which is about 20 miles southeast of Lake Salvador, was selected as the critical point for a hydrograph. It would reflect stages at the mouth of the schematized inlet channel. Such a hydrograph of hourly stages was constructed by computing the incremental setup for each hour and using the maximum surge elevation as the peak of the hydrograph for the critical period. Storm surge hydrographs at Manila Village for other frequencies were determined by identical procedures.

(2) A stage-area curve was made for the schematized conveyance channel between Manila Village and the entrance to the Lake Salvador Basin which consists of Lake Salvador, Lake Cataouatche, and the adjacent marsh area. Since the width of the channel is very large, the depth of water was used as the hydraulic radius.

(3) The cumulative amount of rainfall coincident with the storm significantly affects the lake elevation and hence the routing procedure. The amount of this rainfall was calculated by the methods described in U. S. Weather Bureau memorandums (15) (16), using a moderate rainfall that would be coincident with a tropical storm. For routing purposes, a moderate rainfall of 8.50 inches in 24 hours was considered as additional inflow into the Lake

Salvador Basin. The effect of cumulative rainfall is to raise the average lake level.

(4) With the above mentioned items resolved, the routing procedure was reduced to the successive approximation type problem in which the variable factors were manipulated until a correlation between flows from the gulf through the inlet channel and the rise in the mean elevation of the Lake Salvador Basin was obtained for the incremental time intervals. The use of this method has been illustrated by Bretschneider and Collins (17). A typical routing computation is illustrated on plate A-10. For verification of the method the surge caused by Hurricane Betsy, September 1965, was routed by this procedure. The routed stage for Bayou Baratavia at Lafitte (assumed to be the representative stage of the Lake Salvador Basin), was found to be in reasonable agreement with the observed stage for the hurricane. The observed and computed peak stages for Hurricane Betsy are 3.35 and 3.05 ft., respectively. If the average stage between the Lafitte and Baratavia, Louisiana, gages was used as the representative stage, the computed and observed stages would be in very close agreement. The computed Lake Salvador Basin average water surface hydrograph for the Standard Project Hurricane and the SPH surge hydrograph at Manila Village are shown on plate H-11.

f. Wind Tides. When strong hurricane winds blow over inclosed bodies of shallow water, they tend to drive large quantities of water ahead of them; therefore, wind tide levels (WTL's) in Lakes Salvador and Cataouatche, respectively are needed to determine stage-damage curves and to design protective levee heights.

(1) Lakes Salvador and Cataouatche are located in a marsh south and west of the study area and are so situated that the volume of incoming flow from the gulf cannot be measured because the water flows over broad areas of ungedged marshland. Therefore, the extensive marshlands which surround both lakes results in an almost unlimited storage area when lake waters overflow their banks. Hourly lake elevations for the various frequencies used in computing wind tide levels for Lakes Salvador and Cataouatche were obtained from the routed hydrographs which reflect the average lake level.

(2) To compute wind tide, the lake is divided into three zones that are roughly parallel to wind directions. A nodal line is designated perpendicular to the zones and setup is calculated for the leeward segment and setdown for the windward segment. The average windspeed and average depth in each segment were determined from isovel and hydrographic charts for each computation. The storm isovel patterns were furnished by the U.S. Weather Bureau (ESSA) (5). The computation of setup or setdown along each segment was based on the segmental integration method (14) and was calculated by the use of the step method formulas (18) that were modified as follows:

$$\text{Setup} = d_t \frac{0.00266 u^2 FN + 1}{d_t^2} - 1$$

$$\text{Setdown} = d_t \left[1 - \frac{1 - 0.00266 u^2 FN}{d_t^2} \right]$$

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

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

Graphs were constructed from the above formulas to determine setup and setdown quickly about the nodal elevation for storms of varied frequencies. Volumes of water along the zones, represented by the setup and setdown with respect to a nodal elevation, were determined and the water surface profiles adjusted until setup and setdown volumes for the lake balanced within 5 percent. Then setup elevations were added to the still water level to yield the WTL. The time dependent SPH wind tide hydrograph computed for the eastern shore of Lake Salvador is shown on plate H-12.

(3) Observed wind tide elevations at the shorelines of Lakes Salvador and Cataouatche are not available. Therefore, the method of wind tide level computation could not be verified by comparing observed and computed data. However, the above described method has been used successfully for the south shore of Lake Pontchartrain at New Orleans, Louisiana. Observed data were available for this lake and the method verified. (See the series of reports on Lake Pontchartrain and Vicinity, Louisiana, Hurricane Protection Project.)

(4) In order to obtain wind tide levels at the existing back levees of Westwego, and Marrero, as well as along State of Louisiana Highway #45, it was necessary to use the relationship between the maximum wind tide level and the distance inland from the shoreline.

(5) Marshlands that fringe the shoreline in certain locations are inundated for considerable distances inland by hurricane wind tides that approach the shores. The limit of overland surge penetration is dependent upon the height of the wind tides and the duration of high stages at the lakeshore. The study of available observed high water marks at the coastline and inland indicates a fairly consistent simple relationship between the maximum surge height and the distance inland from the coast, as shown on plate H-13. This relationship exists independently of the speed of hurricane translation, wind speeds, or directions. The data indicate that the weighted mean decrease in surge heights inland is at the rate of 1.0 foot per 2.75 miles. This relationship remains true even in the western portion of Louisiana where relatively high chenieres, or wooded ridges, parallel the coast. Efforts to establish time lags between peak wind tide heights at the shoreline and at inland locations were unsuccessful because of inadequate basic data.

(6) For the purpose of surge routing procedures, the shoreline is defined as the locus of points where the maximum WTL's would be observed along fetches normal to the general shore. This synthetic shoreline is assumed to be near the extreme western tip of the proposed Lake Salvador levee as shown on plate H-2. In order to determine the maximum water surface elevations at

inland locations, it was necessary to compute maximum WTL's at the designated points mentioned above. These computed wind tide levels were then adjusted by application of the average slope of maximum surge height inland (1 foot/2.75 miles, plate H-13) to the location of interest. Hurricane stages were not available for positive verification of the procedure within the area. However, the procedure has given satisfactory results in this area and has verified the observed data in other areas of study, including the Lake Pontchartrain Basin.

A-6 Frequency Estimates.

a. Procedure.

(1) Accounts of inundation by hurricane surges do not appear in the earliest records of the study area. Information on stages is available only for the larger towns or more thickly populated locations. After about 1900 when systematic records of hurricane damages were assembled by the U. S. Weather Bureau, more details relative to flooding along the isolated coastline and vicinity are available. However, until recent years, no attempt had been made to determine accurately the maximum height of stages experienced during hurricanes. The only exception is that after the September 1915 hurricane, a thorough survey was made by Charles W. Okey, Senior Drainage Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture. In this survey, he covered the affected coastal areas which were between central Mississippi and central Texas. His report (19) is the only comprehensive record of reliable stages in the study area prior to hurricane "Audrey" of June 1957.

(2) The lack of additional data has made the establishment of dependable stage-frequency relationships impracticable. Records indicate that there is no locality along the Louisiana coast which is more prone to hurricane attack than other localities. The U. S. Weather Bureau has made a generalized study of hurricane frequencies and presented the results in a memorandum (10) (20). In a 400-mile zone along the central gulf coast from Cameron, Louisiana, to Pensacola, Florida, (Zone B), frequencies for hurricane central pressure indexes (CPI) presented in the report, shown on plate A-8, reflect the probability of hurricane recurrence in the mid-gulf coastal area. Hurricane characteristics with critical tracks and CPI's representative of the SPH and Moderate Hurricane, were then developed in cooperation with the U. S. Weather Bureau. The CPI's used were 27.6 and 28.3 inches for these two hurricanes, respectively. The SPH described in NHRP Report No. 33 (21) was the basis of development of the Design and the Moderate Hurricane used in the study. The representative hurricane path and wind pattern for the SPH critical to the study area is shown on plate H-7.

(3) Conversion of the SPH wind fields for use as the Mod-H was accomplished in the following manner. A Mod-H was assumed to have a CPI with a Zone B probability of 10 percent. Maximum gradient winds (V_{gx}) were derived for the SPH and Mod-H CPI's in accordance with procedure recommended by the U. S. Weather Bureau (10) (22). An adjustment coefficient equal to the ratio of V_{gx} of the Mod-H to V_{gx} of the SPH was then used to convert SPH wind velocities to Mod-H velocities. Thus, Mod-H winds were 83 percent of SPH winds for any given hurricane path. It was necessary to use additional

synthetic hurricanes of moderate intensity to define in more detail the stage-frequency relationship. When this was required, moderate hurricanes having CPI's of 27.8 and 29.0 inches were used. These hurricanes were of 2 and 40 percent probability, and wind speeds were 96.6 and 59.8 percent of SPH winds, respectively.

(4) Hurricane WTL's were then computed for the theoretical hurricanes in accordance with procedures described in paragraph A-5f. Isovels were rotated and the path transposed within allowable limits as necessary to produce maximum surge elevations at the proposed levee near Lake Salvador. Contours of maximum water surface elevations for the SPH that would be experienced in the study area are shown on plate H-14.

(5) A synthetic stage-frequency curve was developed by correlating stages and frequencies for corresponding CPI's, using a procedure developed for the Lake Pontchartrain study area (23). Stages for pertinent locations in the area that would accompany the SPH, and Mod H are shown in table A-10.

TABLE A-10

COMPARATIVE SURGE HEIGHTS

<u>Location</u>	<u>SPH</u>	<u>Mod H</u>
Bayou Des Familles Ridge to Estelle Canal	9.0	3.7
Estelle Canal to Dugues Canal	8.0	2.9
Dugues Canal to Bayou Segnette	7.0	2.4

The probability value used for a given CPI represents frequency of occurrence from any direction in a 400-mile zone along the central gulf coast. In order to establish frequencies for the locality under study, it was assumed that hurricanes critical to the locality would pass through a 50-mile subzone along the coast. Thus, the number of occurrences in the 50-mile subzone would be 12.5 percent of the number of occurrences in the 400-mile zone, provided that all hurricanes travel in a direction normal to the coast. A hurricane whose track is perpendicular to the coast ordinarily will cause extremely high tides and inundation for a distance of about 50 miles along the coast. However, the usual hurricane track is oblique to the shoreline, as shown in table 2 of HMS memorandum (10). The average projection along the coast of this 50-mile swath for the azimuth of 48 Zone B hurricanes is 80 miles. Since this is 1.6 times the width of the normal 50-mile strip affected by a hurricane, the probability of occurrence of any hurricane in the 50-mile subzone would be 1.6 times the 12.5 percent, or 20 percent of the probabilities for the entire midgulf Zone B. Therefore, 20 percent of the frequencies for hurricanes for Zone B, midgulf, shown in figure 4 of HMS memorandum HUR 2-4 (10), was used to represent the frequencies of hurricanes in the critical 50-mile subzone for each study locality.

(6) Since tracks having major components from the southeast create the most critical stages in the Grand Isle area, maximum hurricane surge heights were computed for synthetic hurricanes approaching the area on a track from that direction. Four-fifths (4/5) of all tracks that approached the Grand Isle area were from the southeast. Therefore, a stage-frequency curve was derived using four-fifths of the 50 mile subzone probability for all tracks. Frequencies for observed hurricane stages were then computed on the same basis as the CPI frequencies (10), and a curve plotted. The synthetic frequency curve was then adjusted to the plotted Grand Isle observed data. A frequency curve for Manila Village was then obtained by adding the additional wind tide setup across Barataria Bay to the appropriate stage-frequency value on the adjusted Grand Isle curve. A graphical presentation of this procedure is shown on Plate A-15.

(7) There is a direct relationship between the stage-frequency at Manila Village and the average lake stage-frequency in Lakes Salvador and Cataouatche. However, the critical stage-frequency at the shoreline is considerably diminished because the hurricane track required to cause critical stages at the eastern shore of Lake Salvador is unique. Only 6.4 percent of all hurricane tracks observed have followed a track similar to the unique hypothetical track used in this study. Stage-frequencies were also developed based on the remaining 93.6 percent observed hurricane tracks as described in paragraph A-6, a.(8).

(8) The azimuths of tracks observed in the vicinity of the study area were divided into quadrants corresponding to the four cardinal points. Since 1900, 73 storms have affected the Louisiana Coast; 46 had tracks from the south, 18 from the east, 8 from the west, and 1 from the north. Hurricanes with tracks having major components from the south and east generate WTL's that are near critical relative to the study area, while those tracks from the west generate WTL's most critical to the study area. The average azimuth of tracks from the south is 180°. Tracks from the east had an average azimuth of 117°. These azimuths along with the critical track from the west, were used in computing WTL's for Lake Salvador. Of all experienced tracks since 1900 affecting the Louisiana Coast, approximately 63 percent have come from a southerly direction, 24.6 percent from the east, and 11 percent have come from the west. The probabilities of equal stages for the three groups of tracks were then added arithmetically to develop a curve representing a synthetic probability of recurrence of maximum wind tide levels for hurricanes from all directions.

(9) Table A-11 illustrates the synthetic frequency computation for WTL's at the east shore of Lake Salvador.

TABLE A-11

STAGE-FREQUENCY COMPUTATION
LAKE SALVADOR

50-MILE SUBZONE

Zone B		Probability		Probability		Probability		Probability		Probability		Probability	
CPI in. (1)	years (2)	occ/100 years (3)		All Tracks occ/100 years (4)		Stage feet ngvd (5)		Probability occ/100 years (6)		Stage feet ngvd (7)		Probability occ/100 years (8)	
		occ/100	years	occ/100	years	feet	ngvd	feet	ngvd	feet	ngvd	feet	ngvd
29.0	2.5	40	8.0	2.78	4.59	4.59	5.04	4.37	1.97	4.37	5.04	4.37	1.97
28.3	10.0	10	2.0	7.08	6.47	6.47	1.26	6.04	0.49	6.04	1.26	6.04	0.49
27.8	50.0	2	0.4	8.56	7.60	7.60	0.25	7.18	0.10	7.18	0.25	7.18	0.10
27.6	100.0	1	0.2	9.04	7.93	7.93	0.13	7.48	0.05	7.48	0.13	7.48	0.05

Tracks from West Tracks from South Tracks from East

Col. 4 20 Percent of Col. 3
Col. 6 11.0 Percent of Col. 4
Col. 8 63.0 Percent of Col. 4
Col. 10 24.6 Percent of Col. 4

b. Relationships. Based on the above described procedures, stage-frequency relationships were established under existing conditions for flooding by surges from Lake Salvador for the rear areas of Westwego, and Marrero; and west of Highway #45 to the "V" Levee. The stage-frequency curve for the Lake Salvador basin was compared with those developed for the Lake Pontchartrain basin, where stage data for a partially levee rimmed lake basin is more extensive. The Lake Pontchartrain frequency relationship for the south shore was developed from analysis of available stage data and model study results (24) (25). Comparison of the two frequency curves indicates that for the south shore of Lake Pontchartrain the frequency curve is straighter in the less frequent region of the curve, i.e. between the 100-year and SPH frequencies, than the curves for Lake Salvador. Because of the similarity in the topography between the two basins and the large data base available in the Pontchartrain basin, the upper part of the Salvador frequency curve was adjusted to agree with the slope of the curve developed for the South Shore of Lake Pontchartrain. Stage-frequency curve for the east shore of Lake Salvador is shown on plate A-16.

A-7. Design Hurricane.

a. Selection of the design hurricane. The standard project hurricane was selected as the design hurricane (Des H) due to the urban nature of the study area. A design hurricane of lesser intensity which would indicate a lower levee grade and an increased frequency would expose the protected areas to hazards to life and property that would be disastrous in event of the occurrence of a hurricane of the intensity and destructive capability of the standard project hurricane.

b. Characteristics. The characteristics of the Des H for the proposed plan of protection are identical to the standard project hurricane described in detail in paragraph A-5. However, due to transposition of the regional SPH to the smaller study area the design hurricane would have a probability of recurrence of only once in about 500 years in the study area. The path of the Des H's was located to produce maximum hurricane tides along the entire length of the proposed structures. The Des H is a theoretical hurricane but ones of similar intensity have been experienced in the area. Table A-12 is a summary of the Des H characteristics. Plate A-7 illustrates the critical track.

TABLE A-12
DESIGN HURRICANE CHARACTERISTICS

<u>Location</u>	<u>CPI</u> (inches)	<u>Max.</u> <u>winds</u> (mph)	<u>Radius of</u> <u>max. winds</u> (miles)	<u>Forward</u> <u>speed</u> (knot)	<u>Direction</u> <u>of approach</u>
Lake Salvador East Shore	27.6	100	30	11	South-Southwest

c. Normal Predicted Tides. The mean tide in the study area is estimated to be approximately 0.2 foot n.g.v.d. the mean tidal range is about 0.35 foot. The difference in height of hurricane tides for occurrence of the Des H at high or low tide was only a few tenths of a foot. In determining the elevation of design surges, it was assumed that mean normal predicted tide occurs at the critical period of surges.

d. Design Rainfall. Hurricanes usually are accompanied by intense rainfalls. The mean 24-hour maximum point precipitation depth is 9.4 inches, based on data available on over 50 gulf region hurricanes (15) (16). Complete precipitation records, including but not limited to hurricane induced rainfall, indicate maximum 24-hour point depths of 21 inches for a standard project rainfall and 40 inches for the probable maximum rainfall. Estimates of point precipitation depths likely to be experienced with a standard project hurricane are 14 inches for moderately high and between 8.6 and 9.8 inches for moderate rainfalls. A moderate hurricane rainfall of 8.5 inches in 24-hours, based on observed average volume was used in the determination of residual damages for hurricanes, both under present conditions and after construction of the project.

e. Design Tide. The hurricane tide is the maximum still water surface elevation experienced at a given location during the passage of a hurricane. It reflects the combined effects of the hurricane surge, and where applicable, the overland flow of the surge, and wind tide. Design hurricane tides were computed to reflect conditions with authorized protective works or improvements in place, using the procedures described in paragraph A-5. Hurricane surges and tides usually are accompanied by violent wave action at the coastline, in unprotected bays, and in inland lakes close to the hurricane path. As the surge moves inland over marshlands and natural ridges, the waves deteriorate rapidly, and wave heights are attenuated by marsh grasses and woodland. To reach the protective works to the east of the apex of the "V" levee, the hurricane surge must traverse the heavily wooded Bayou Des Familles Ridge and the surrounding marsh, resulting in a much reduced wave climate and lower stages. Stages were reduced, as described in paragraph A-5 f., using the dropoff rate of 1 foot per 2.75 miles. These hurricane stages were incorporated into the experienced stage frequency curve at the gage on the Harvey Canal at the Harvey Lock to arrive at the combined stage frequency curve used in design of these protective works. Table A-13 gives a comparison of stages at the surge reference line on eastern side of Lake Salvador and in the Harvey Canal for the SPH and 100-year frequency Storms.

TABLE A-13
STAGE COMPARISON

<u>Frequency In Years</u>	Stage	Stage
	<u>East Side Lake Salvador feet ngvd</u>	<u>Harvey Canal feet ngvd</u>
SPH	9.0	7.5
100	7.0	5.5

The levee reach from the lower levee edge at Bayou Segnette to Highway 3134 near the apex of the "v" levee is subject to waves generated in Lakes Salvador and Cataouatche. This reach is further divided into subreaches delineated by the surge elevation within the subreach. Surge elevations at the levee will vary depending upon the distance to the surge reference line. These design storm elevations at the levee alignment are the same for existing or project conditions. Pertinent data for the design hurricane used to determine wave characteristics is given in Table A-14.

TABLE A-15
WAVE CHARACTERISTICS - DESIGN HURRICANE

	Bayou Segnette to Dugues Canal	Dugues Canal to Estelle Canal	Estelle Canal to Bayou Des Familles	Bayou Des Familles to Highway 3134
H_s - Significant wave height, feet	3.0	3.3	3.7	2.1
T - Wave period, seconds	4.0	4.0	4.1	4.1
L_0 - Deep water wave length, feet	82	82	86	86
d/L_0 - Relative depth	.067	.079	.087	.029
H_s/H_0 - Shoaling Coefficient	.977	.956	.946	1.13
H_0' - Deepwater wave height, feet	3.1	3.5	3.9	1.9
H_0'/T - Wave Steepness	.192	.216	.233	.113

g. Maximum runup and overflow.

(1) Hurricanes approaching on paths critical to the east shore of Lake Salvador can create conditions whereby protective structures along the project perimeter are overtopped. It was necessary to calculate the magnitude of the heights of wave runup and quantities of the overflow by use of established procedures in order to develop improved protective structure designs and to determine damages. This determination was divided into two significant parts for convenience of calculation, namely maximum runup and wave overtopping. Common factors which must be resolved in all types of calculations are the WTL, and the geometry and crown elevation of the protective structure.

(2) Wave runup on a protective structure depends upon the physical characteristics (i.e., configuration and surface roughness), the depth of water at the structure, and the wave characteristics. Computation of maximum runup was necessary in order to determine the heights to which existing shore protective structures would have to be raised to prevent all overflow for the significant wave accompanying the SPH. Wave runup was considered to be the ultimate height to which water in a wave ascended on the proposed slope of a

protective structure. This condition occurred when the WTL was at a maximum, and was calculated by the interpolation of model study data presented in the 1984 Shore Protection Manual (26), which relates runup (R/H_0'), wave steepness (H_0'/T^2), relative depth (d/H_0'), and structure slope.

(3) Protective structures exposed to wave runup will be constructed to an elevation and cross-section that is sufficient to prevent all overtopping from the significant wave and waves smaller than the significant wave accompanying the SPH. Waves larger than the significant wave will be allowed to overtop the protective structures; however, such overtopping will not endanger the security of the structure of cause material flooding. In the case of the levee reach from Bayou Segnette to Highway 3134, runup was computed for waves breaking on each berm to determine the required levee elevation. Wave data, runup elevation, and required elevation of the protective structures are shown in Table A-16.

Table A-16
WAVE RUNUP AND PROPOSED ELEVATION OF PROTECTIVE STRUCTURES
STANDARD PROJECT HURRICANE

<u>Location</u>	<u>H</u> (ft)	<u>T</u> (sec)	<u>WTL</u> Elevation (ft ngvd)	<u>Elevation</u> of Levee (ft ngvd)
Bayou Segnette to Dugues Canal	3.0	4.0	7.0	10.0
Dugues Canal to Estelle Canal	3.3	4.0	8.0	11.0
Estelle Canal to Bayou Des Familles	3.7	4.1	9.0	12.0
Bayou Des Familles to Highway 3134	2.1	4.1	9.0	12.0

h. Residual flooding. The procedures described in the SPM (26) are used to determine wave runup and wave overtopping for the significant wave that would be experienced during hurricane occurrences. However, 14 percent of the waves in a spectrum are higher than the significant wave and the maximum wave heights to be expected are about 1.87 times the significant wave height. Thus, a structure designed to prevent all overtopping by a significant wave would be overtopped by the portion of the spectrum that is higher than the significant wave. It was, therefore, necessary to assure that this residual overtopping would not produce flooding and subsequent damage to the extent that only partial protection was afforded to an area for the design hurricane. A determination of the residual overtopping was made for the area

and it was concluded that no material flooding results if the designed cross-section is overtopped by waves higher than the significant wave. It was, therefore, concluded that the use of the significant wave runup would result in design grades for protective structures that would permit residual flooding only to a negligible degree.

A-8. Embankment Design.

a. General. The design cross-sections presented on Plate A-17 were selected as the best choice for the project area, Bayou Segnette to the Harvey Lock. This design is an all-earthen levee with reinforcing geotechnical fabric. Foreshore protection is not required along the toe of the levee, since presently there will not be daily exposure of the new levee to wave action and along the older reaches of levee the existing toe, which has reached equilibrium with the daily wave environment, will not be disturbed.

b. Levee heights. Heights of the proposed protective work along Bayou Segnette and east of Highway 3134, which are subject to only minor wave activity generated by boat traffic or winds across a limited fetch during several hours of superelevated wind tide levels, were designed to include a freeboard allowance of 2 feet above the still water level. The height of the remaining levee from Bayou Segnette to Highway 3134 was designed to prevent overtopping from waves generated in Lakes Salvador and Cataouatche which propagate across the marsh to this reach of levee. Table A-17 gives the height of protection required in the project area.

TABLE A-17
SPH HURRICANE WINDTIDE LEVELS AND
ELEVATION OF PROTECTIVE STRUCTURES

<u>Reach</u>	<u>Windtide Levels (ft. ngvd)</u>	<u>Composite Structure Slope</u>	<u>Elevation of Protective Structure (ft. ngvd)</u>
Bayou Segnette	7.0	3	9.0
Bayou Segnette to Dugues Canal	7.0	6.0	10.0
Dugues Canal to Estelle Canal	8.0	6.1	11.0
Estelle Canal to Bayou Des Familles	9.0	6.3	12.0
Bayou Des Familles to Highway 3134	9.0	5.1	12.0
Highway 3134 to Apex of "V" Levee	9.0	3	12.0
Apex of "V" Levee to Harvey Canal	7.5	3	9.5

SECTION II - INTERIOR DRAINAGE

a. Description of Drainage Area. The only drainage area affected by the proposed hurricane protection system is the approximately 315 acres which is presently unleveed and drains naturally from the Bayou Des Familles ridge into the marsh to the west. This area will be bounded by the proposed project levee on the North, South and East and the existing high ground, Bayou Des Familles (HWY 45), on the west. The confined area is approximately 1000 ft. wide and 14000 ft. in length.

b. Proposed Drainage Improvements. The entire area will be drained into the Ross Canal via a 60 inch C.M.P. culvert 270 ft. in length with it's invert at -2.0 ft. ngvd beneath the proposed levee. A mitered entrance which conforms to the slope of the proposed drainage channel will be provided with a positive closure or flapgated exit.

A drainage channel with a 5 ft. bottom width, 4.5 ft. depth (at the culvert) and 1V on 3H side slopes will be constructed to convey rainfall runoff from the area to the culvert. The channel bottom will remain 5 ft. in width and slope upward at 0.0003 ft/ft both north & south of the structure. A 66 inch diameter C.M.P. culvert will be used under the WWL shell road.

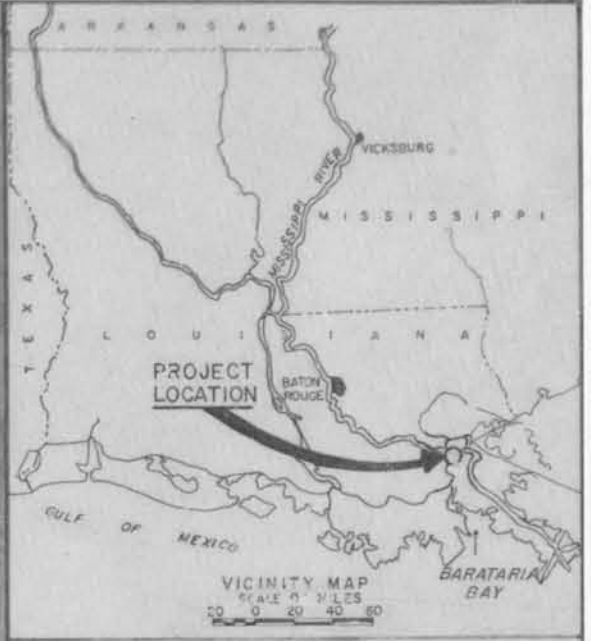
c. Hydraulic Computations. The culvert size was estimated based on the orifice equation with an inflow of $Q = CIA$. Culvert dimensions were verified later by use of a HEC-1 model. The discharge rating curve for the culvert used in the model was prepared using the Manning Equation with a roughness coefficient of 0.024. The mean daily high outside (floodside) stage used was 1.6 ft. ngvd. Rainfall runoff was calculated by the model using a 10 yr-24 hour rainfall event and a unit hydrograph developed using the inverted "v" method.

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- (22) Myers, V.A., "Characteristics of United States Hurricanes Pertinent to Levee Design for Lake Okeechobee, Florida," U.S. Weather Bureau, Hydrometeorological Report No. 32, March 1954.
- (23) Enclosure 1, Hurricane Survey Coordinating Committee, Eighth Meeting, September 29-30, 1959, subject: Synthetic Frequency Estimates of Hurricane Surge and Wind Tide Elevation in Lake Pontchartrain, La.

- (24) U.S. Army Corps of Engineers, New Orleans District, "Lake Pontchartrain, Louisiana and Vicinity, Design Memorandum No. 1 Hydrology and Hydraulic Analysis, Part 1, August 1966; Part II, August 1967, and Part III, September 1968.
- (25) U.S. Army Corps of Engineers, New Orleans District, "Lake Pontchartrain, Louisiana, and Vicinity, Design Memorandum No. 13, High Level Plan, Orleans Parish Lakefront Levee West of I.H.N.C., Volumes I and II, November 1984.
- (26) U.S. Army Coastal Engineering Research Center, Shore Protection Manual, Vols I & II, 1984.



LEGEND

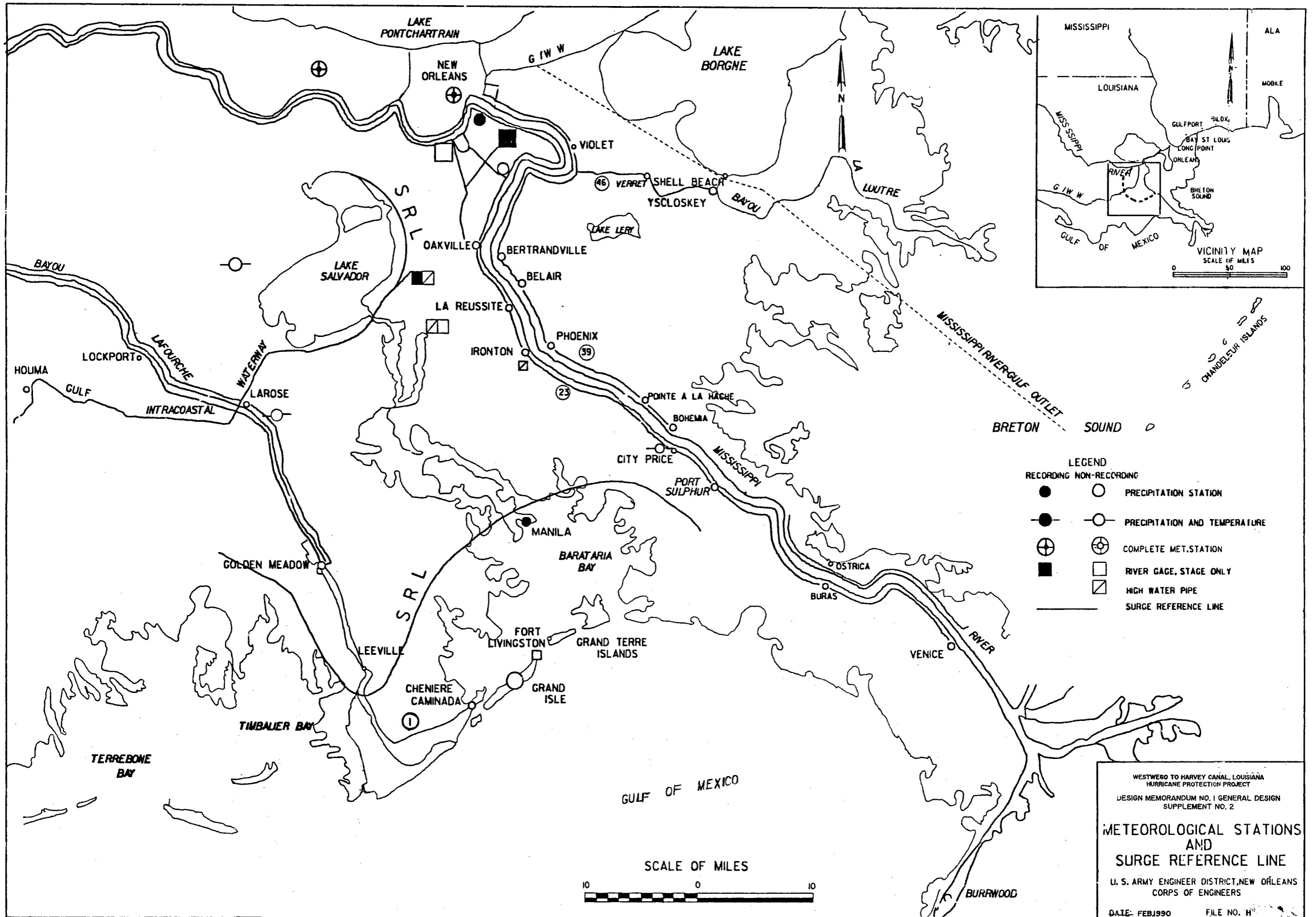


WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

STUDY AREA

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

DATE: FEB 1990 FILE NO. H-2-30618

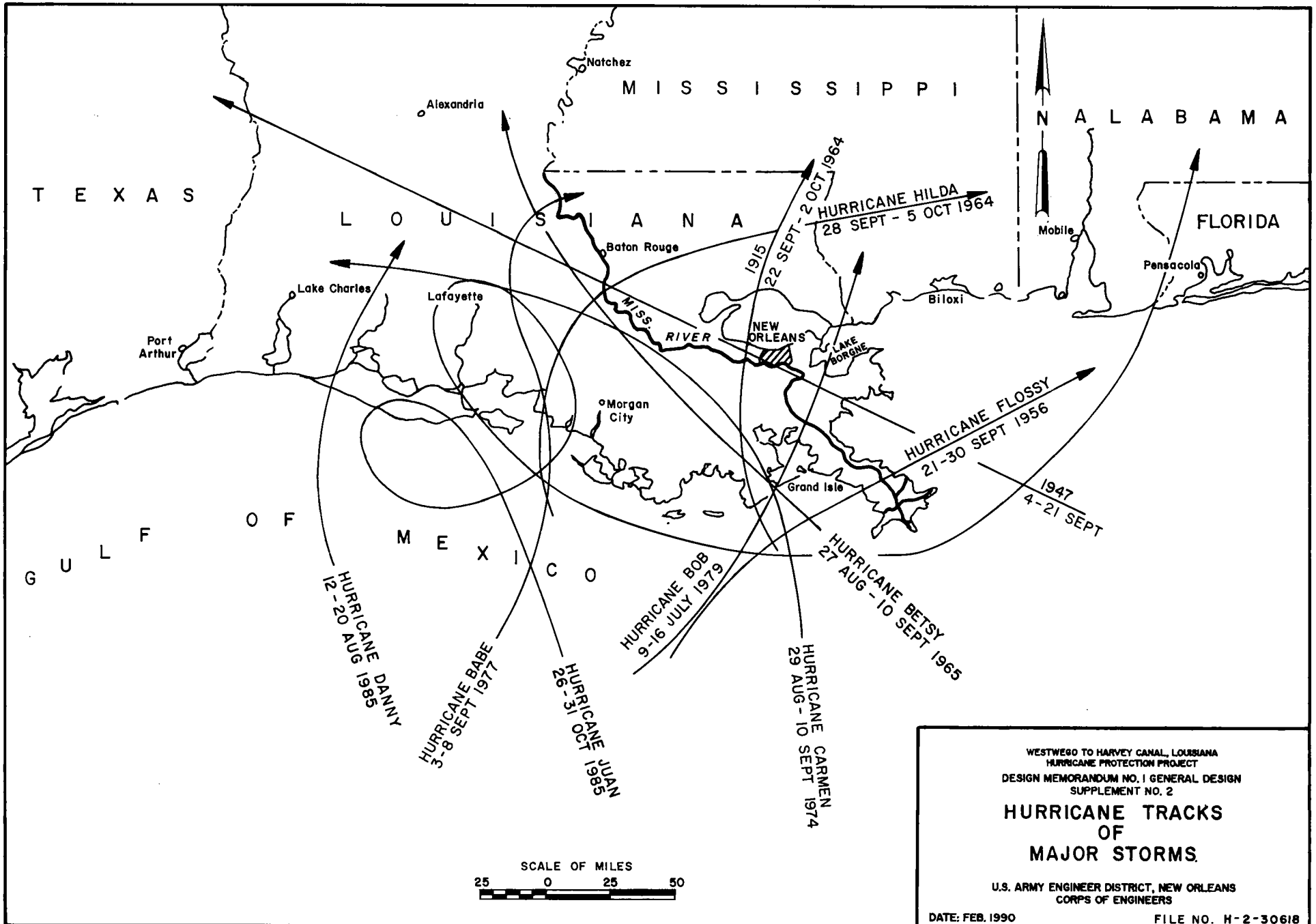


WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

**METEOROLOGICAL STATIONS
 AND
 SURGE REFERENCE LINE**

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

DATE: FEB 1990 FILE NO. H

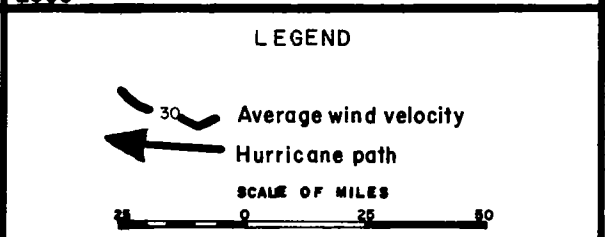
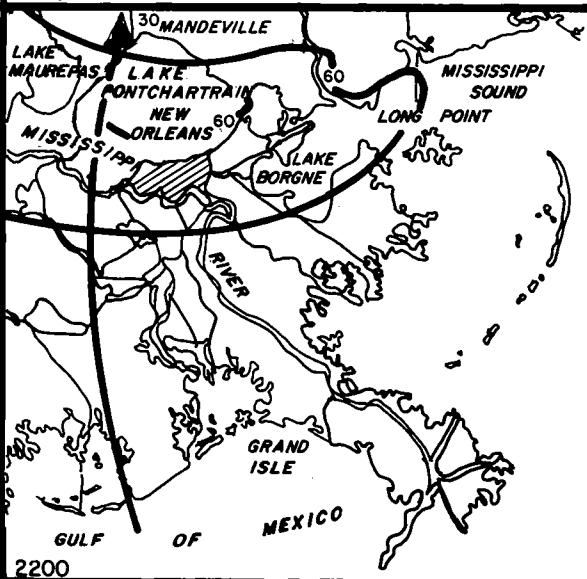
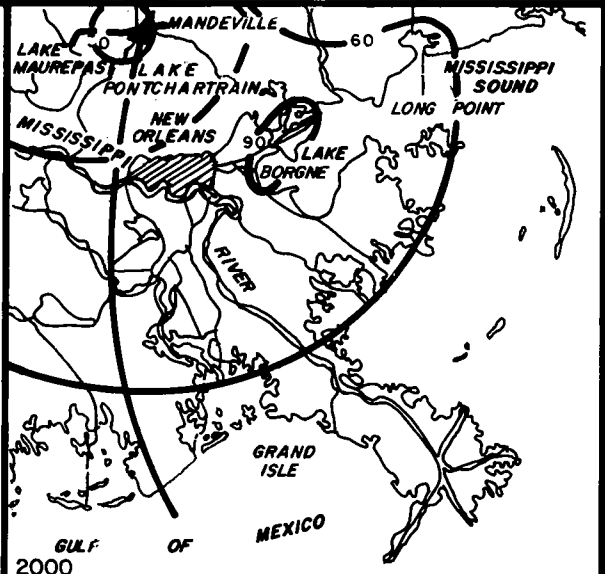
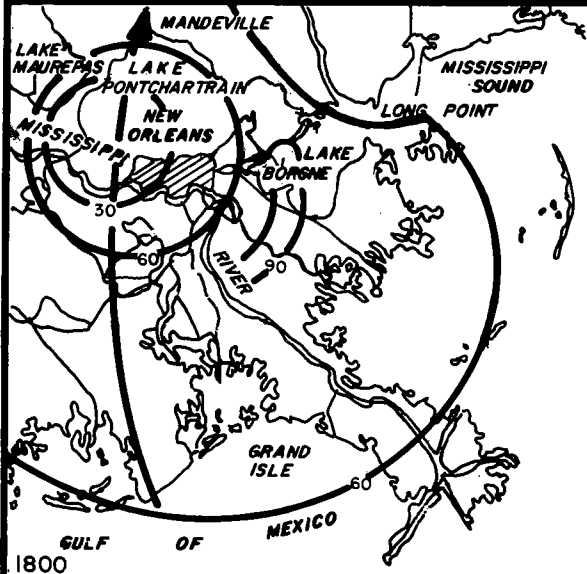
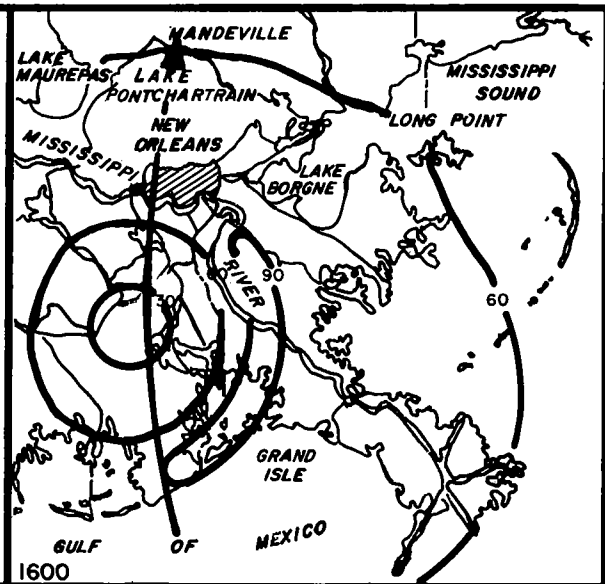
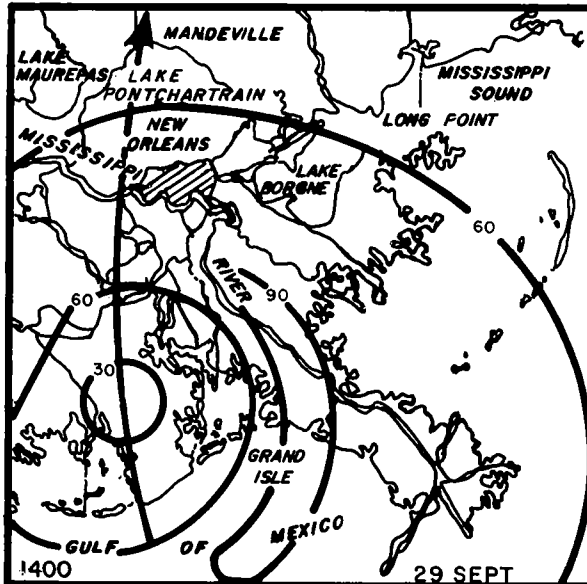


WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

**HURRICANE TRACKS
 OF
 MAJOR STORMS.**

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

DATE: FEB. 1990 FILE NO. H-2-30618



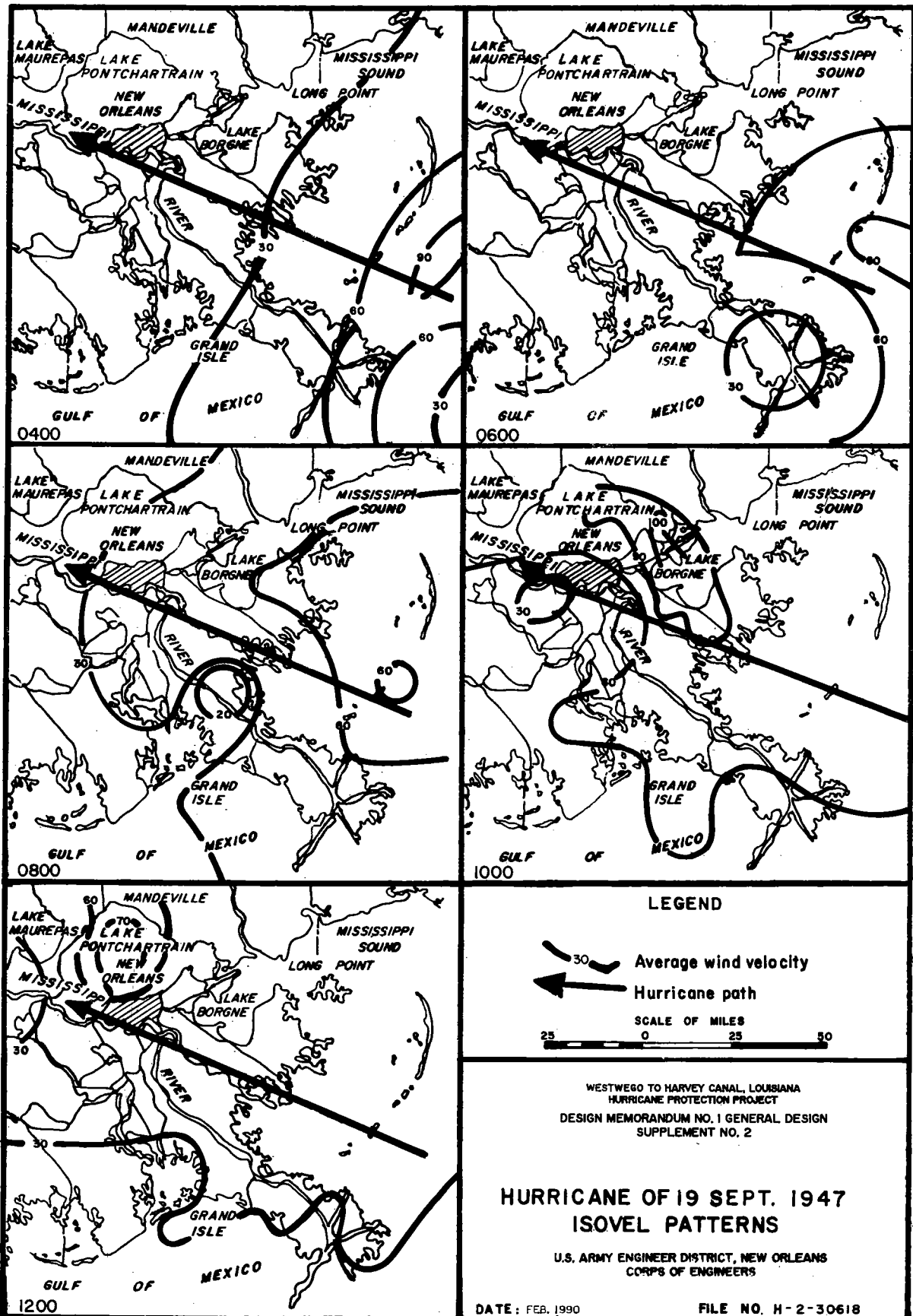
WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT

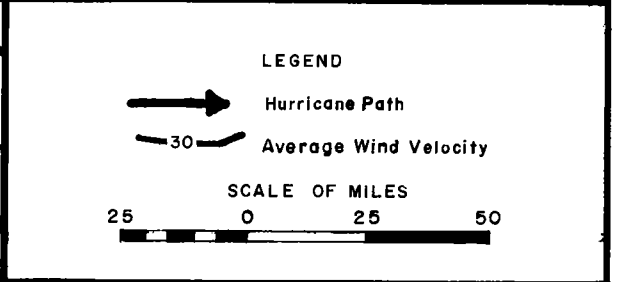
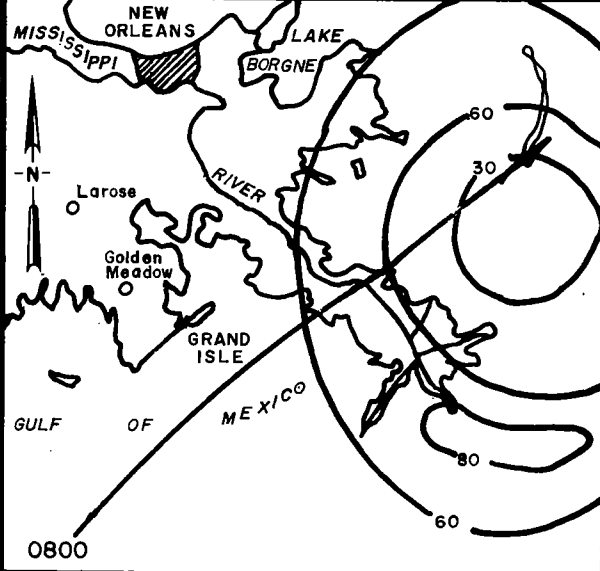
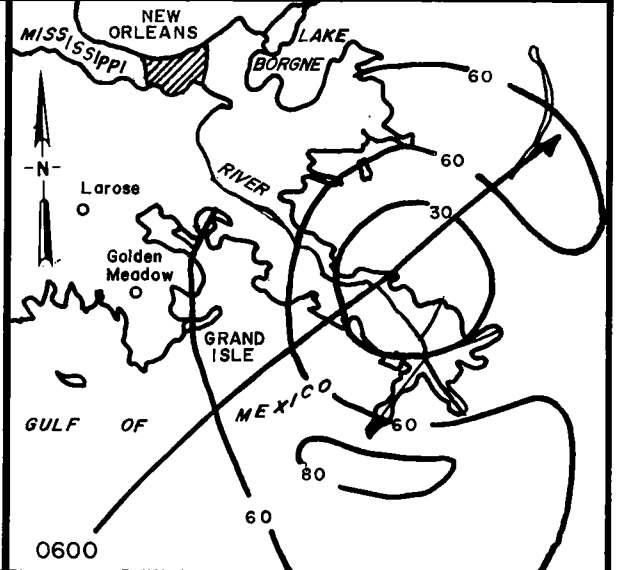
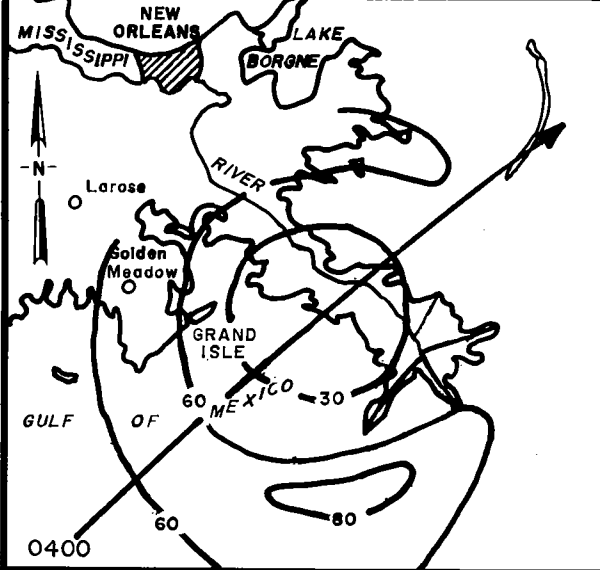
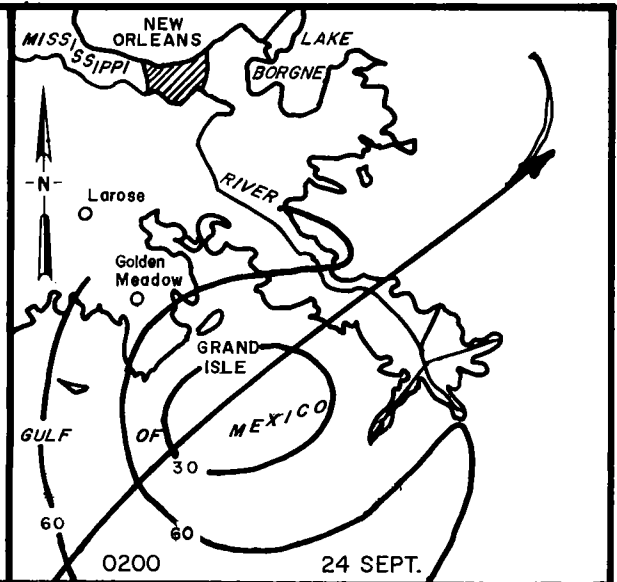
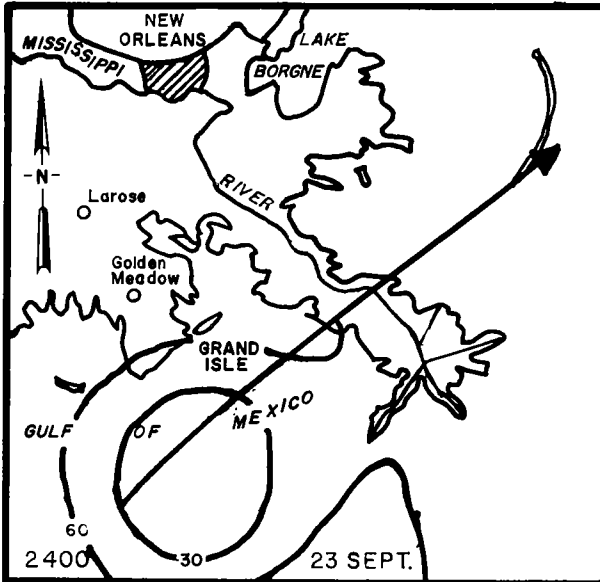
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

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

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

DATE: FEB. 1990 FILE NO. H-2-30618



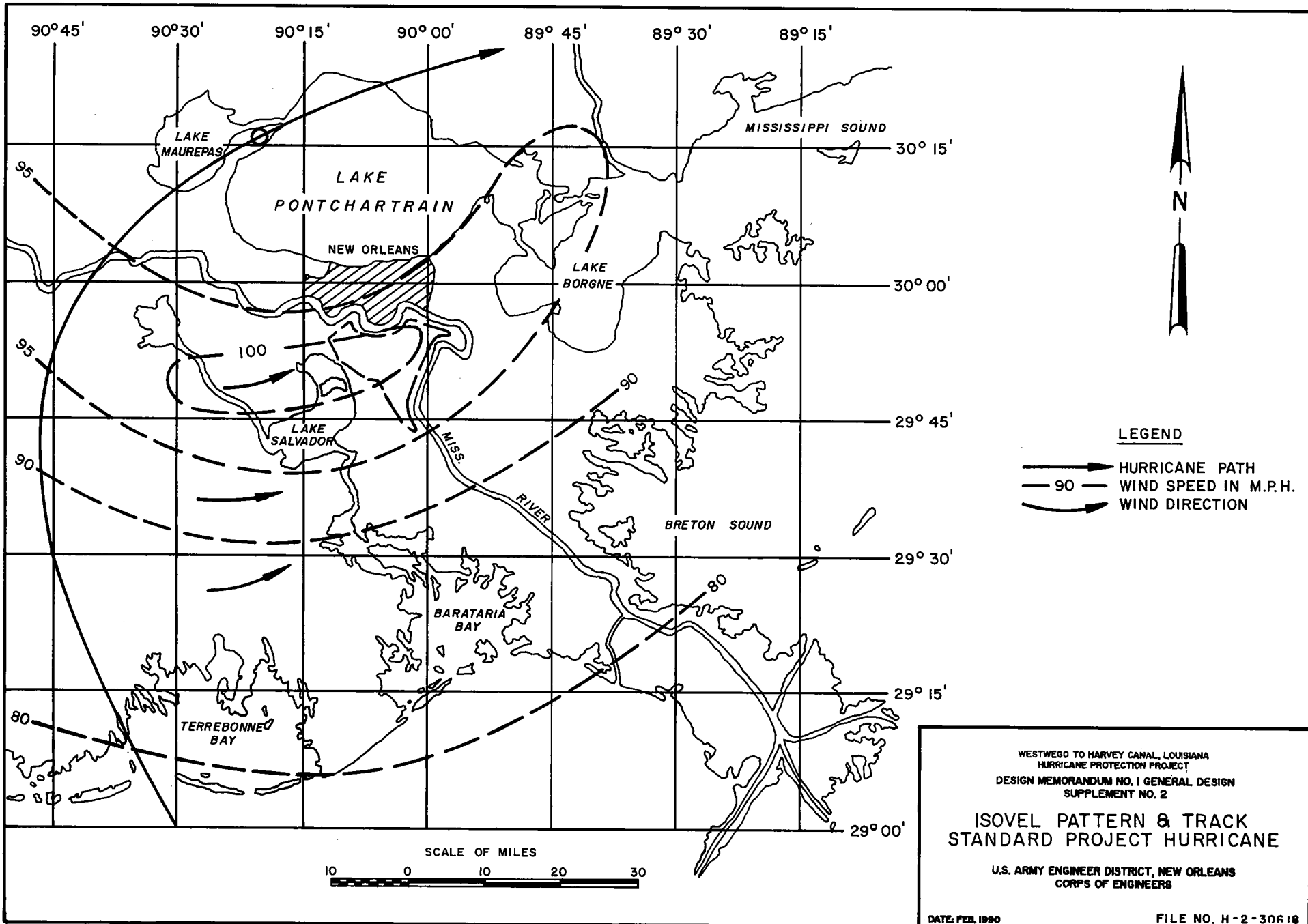


WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

HURRICANE OF 23-24 SEPT. 1956
ISOVEL PATTERNS

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

DATE: FEB. 1956 FILE NO. H-2-30618



LEGEND

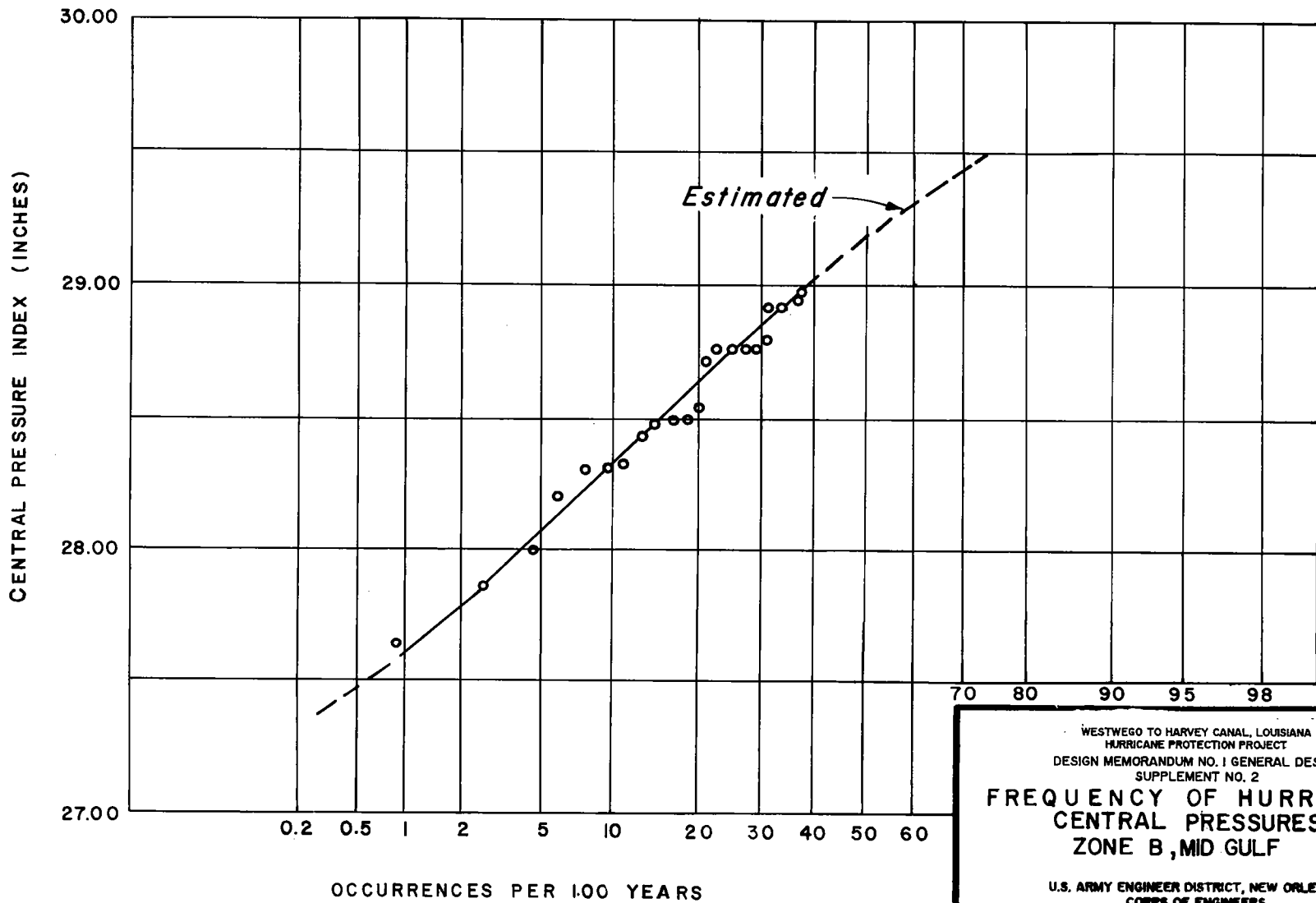
-  HURRICANE PATH
-  90 — WIND SPEED IN M.P.H.
-  WIND DIRECTION

WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

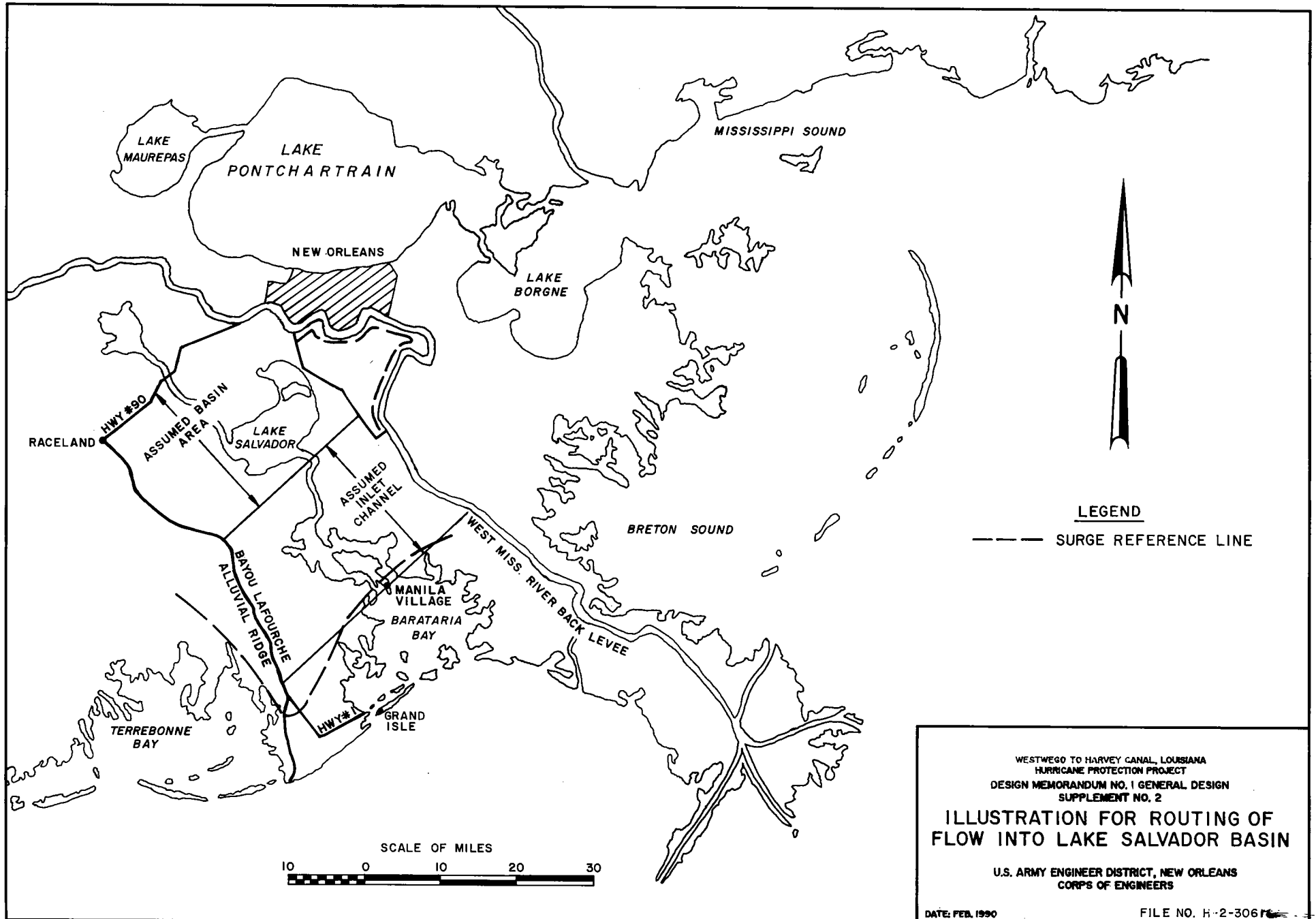
**ISOVEL PATTERN & TRACK
 STANDARD PROJECT HURRICANE**

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

DATE: FEB. 1990 FILE NO. H-2-30618



WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2
**FREQUENCY OF HURRICANE
 CENTRAL PRESSURES
 ZONE B, MID GULF**
 U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS
 DATE: FEB. 1990
 FILE NO. H-2-30618



LEGEND
 - - - SURGE REFERENCE LINE

WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2
**ILLUSTRATION FOR ROUTING OF
 FLOW INTO LAKE SALVADOR BASIN**
 U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS

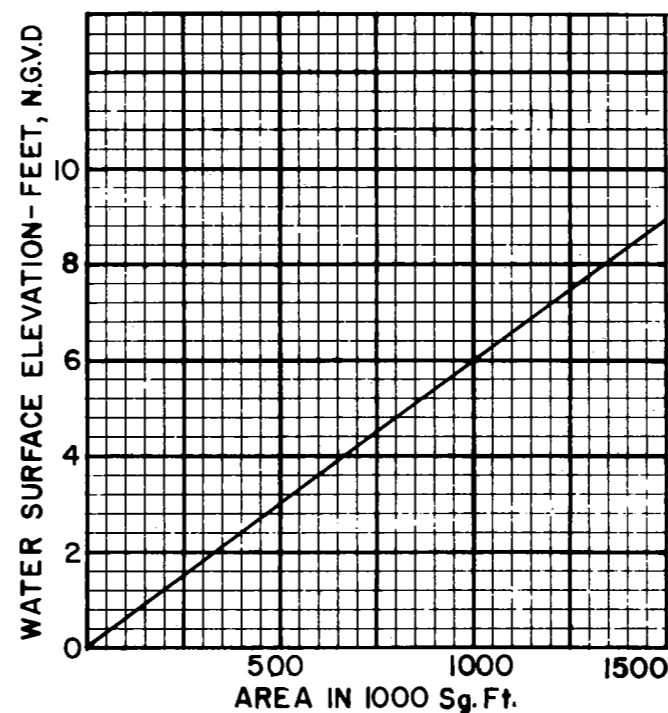
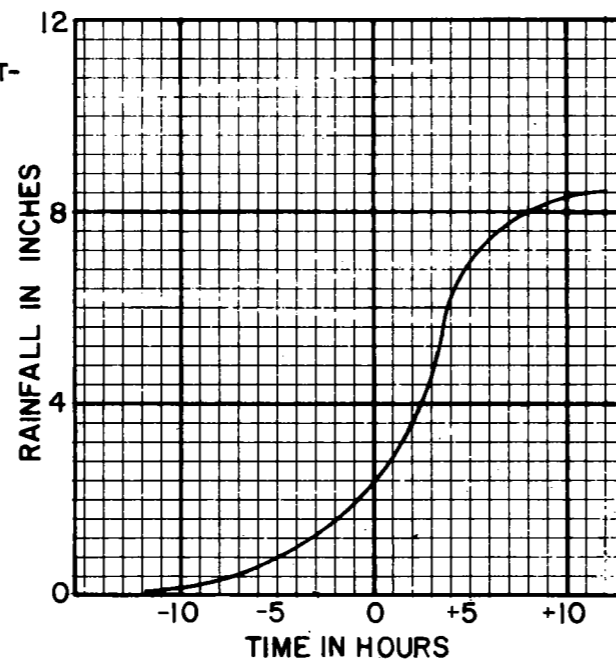
DATE: FEB. 1990 FILE NO. H-2-306

HOURS REFERENCE TO LANDFALL	AVERAGE GULF ELEVATION	AVG. LAKE SALVADOR BASIN ELEVATION	AVG. WATER SURFACE ELEVATION IN CHANNEL	ΔZ	$\frac{1.49}{NYL}$	CHANNEL AREA	R	$R^{2/3}$	ΔH	$\sqrt{\Delta H}$	Δt	($Q \Delta t$) FLOW INTO LAKE SALVADOR BASIN	Δz^*	Δ RAINFALL	MEAN BASIN ELEVATION
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	FT. N.G.V.D	FT. N.G.V.D	FT. N.G.V.D	FEET		1000 Sq. Ft.	FEET	FEET	FEET	FEET	SECONDS	C.F.S.	FEET	FEET	FT. N.G.V.D
0															1.78
	11.18	1.91	6.54	0.26	0.076	1105	6.54	3.497	9.27	3.045	3600	3,219,300	0.25	0.05	
+1															2.08
	11.02	2.20	6.61	0.24	"	1120	6.61	3.522	8.82	2.970	3600	3,205,400	0.25	0.05	
+2															2.38
	10.24	2.59	6.42	0.42	"	1080	6.42	3.451	7.65	2.766	7200	5,641,100	0.43	0.19	
+4															3.00
	8.52	3.15	5.84	0.30	"	985	5.84	3.243	5.37	2.317	7200	4,050,000	0.31	0.16	
+6															3.47
	6.30	3.56	4.93	0.17	"	830	4.93	2.877	2.74	1.655	7200	2,177,600	0.17	0.04	
+8															3.68
	3.98	3.70	3.84	0.04	"	645	3.84	2.452	0.28	0.529	7200	457,800	0.04	0.02	
+10															3.74
	1.98	3.72	2.85	(-) 0.05	0.076	480	2.85	2.010	1.74	1.319	7200	696,400	(-) 0.05	0.02	
+12															3.71

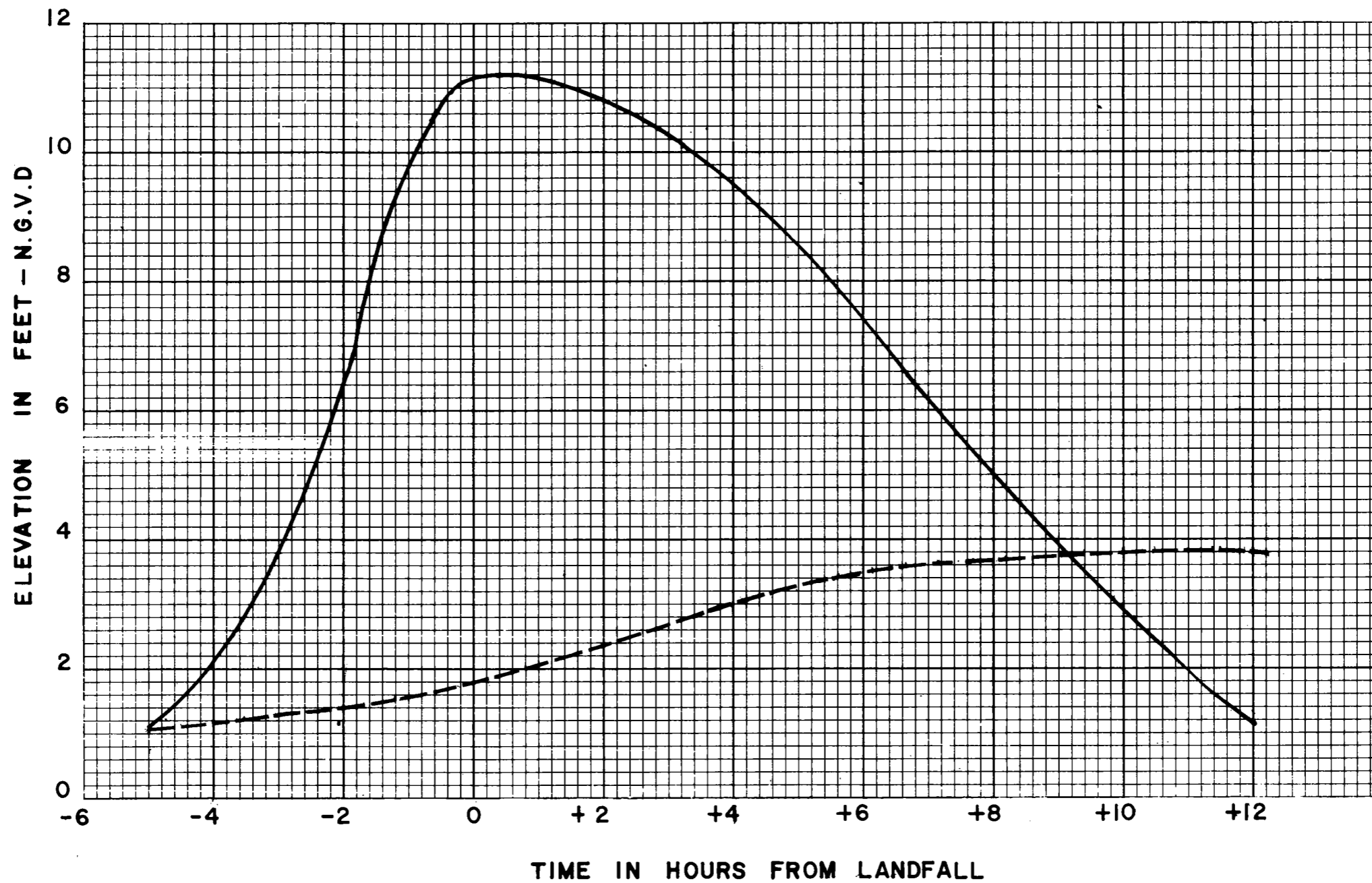
COLUMN

- (4) AVERAGE WATER SURFACE ELEVATION BETWEEN LAKE SALVADOR BASIN & MANILA VILLAGE.
- (5) ASSUMED INCREMENTAL CHANGE IN LAKE LEVEL FROM MANNING'S FORMULA ($n=0.06, L=105,600$ or ZOMI.)
- (8) HYDRAULIC RADIUS—SAME AS CHANNEL ELEVATION.
- (10) DIFFERENCE BETWEEN LAKE SALVADOR BASIN & MANILA VILLAGE WATER SURFACE.
- (13) $Q=6 \times 7 \times 9 \times 11 \times 12$
- (14) COMPUTED

$$\Delta z^* = \frac{Q}{13,034 \times 10^6 (\text{BASIN SURFACE AREA})}$$



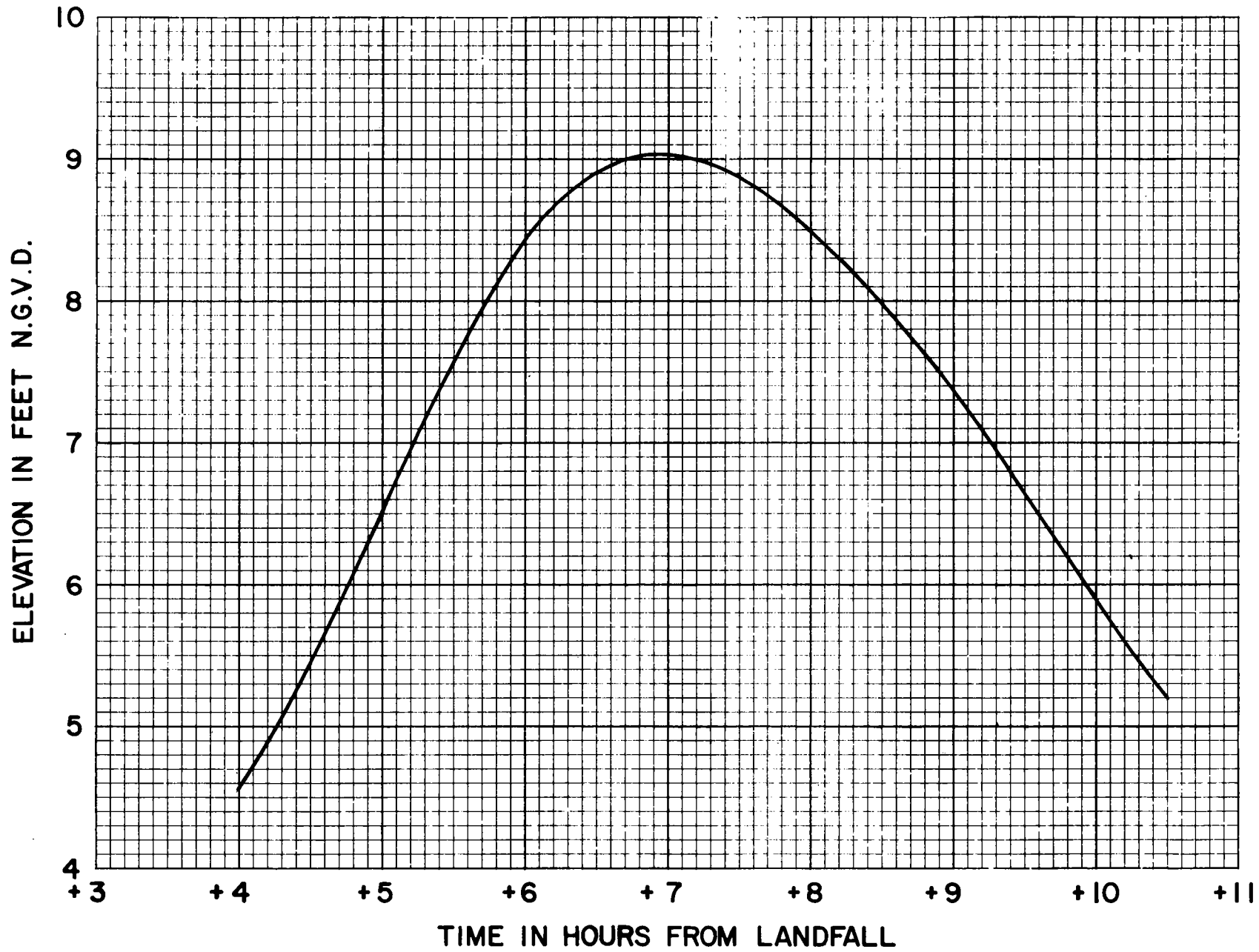
WESTGEO TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2
**ROUTING INTO LAKE
SALVADOR BASIN**
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
DATE: FEB. 1990 FILE NO. H-2-30618



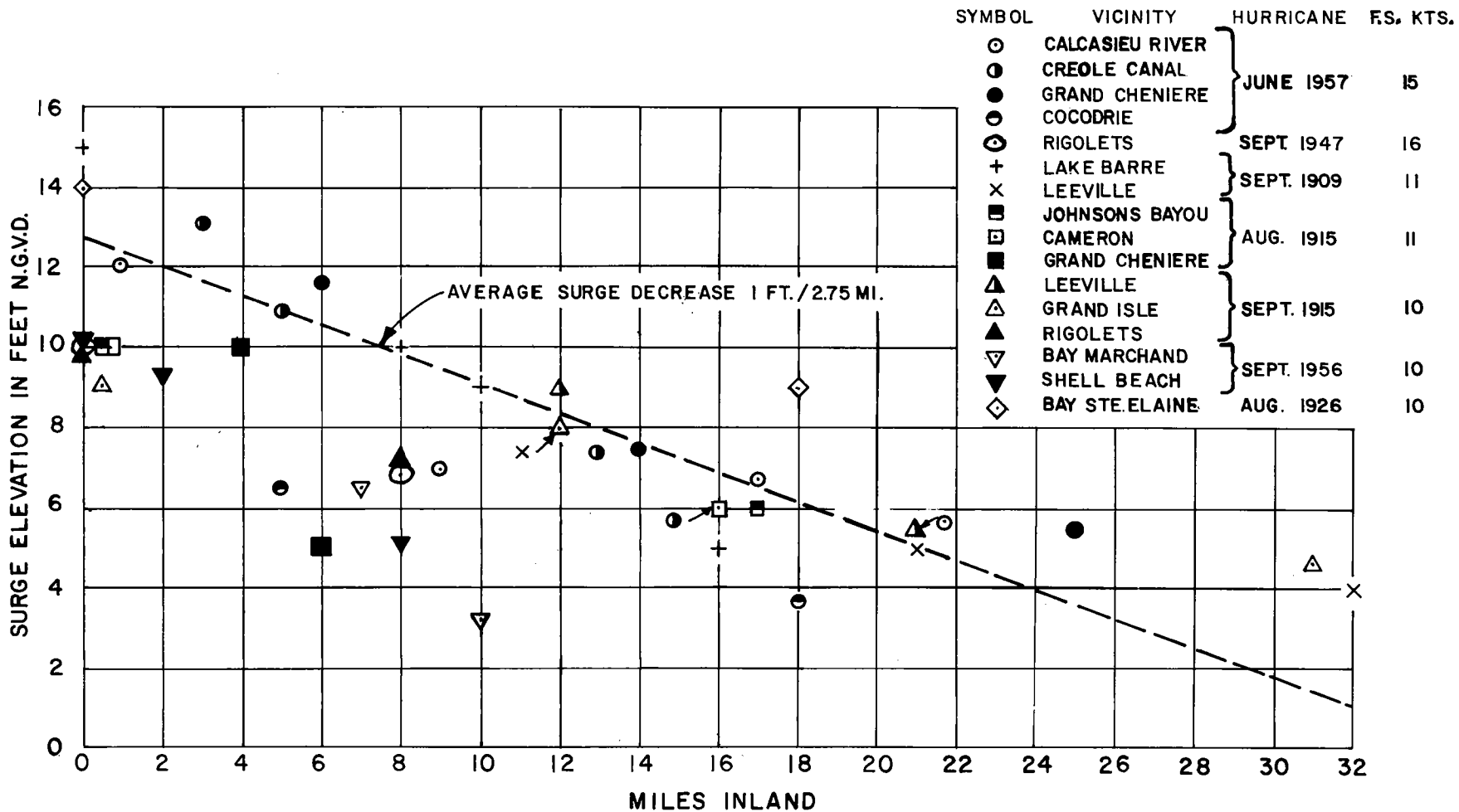
LEGEND

- MANILA VILLAGE
- - LAKE SALVADOR BASIN

WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2
**AVERAGE LAKE SALVADOR AND
 MANILA VILLAGE S PH HYDROGRAPHS**
 U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS
 DATE: FEB. 1990 FILE NO. H-2-30618



WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2
LAKE SALVADOR STAGE HYDROGRAPH
EAST SHORE
DESIGN HURRICANE
 U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS
 DATE: FEB. 1990 FILE NO. H -2 - 308 18

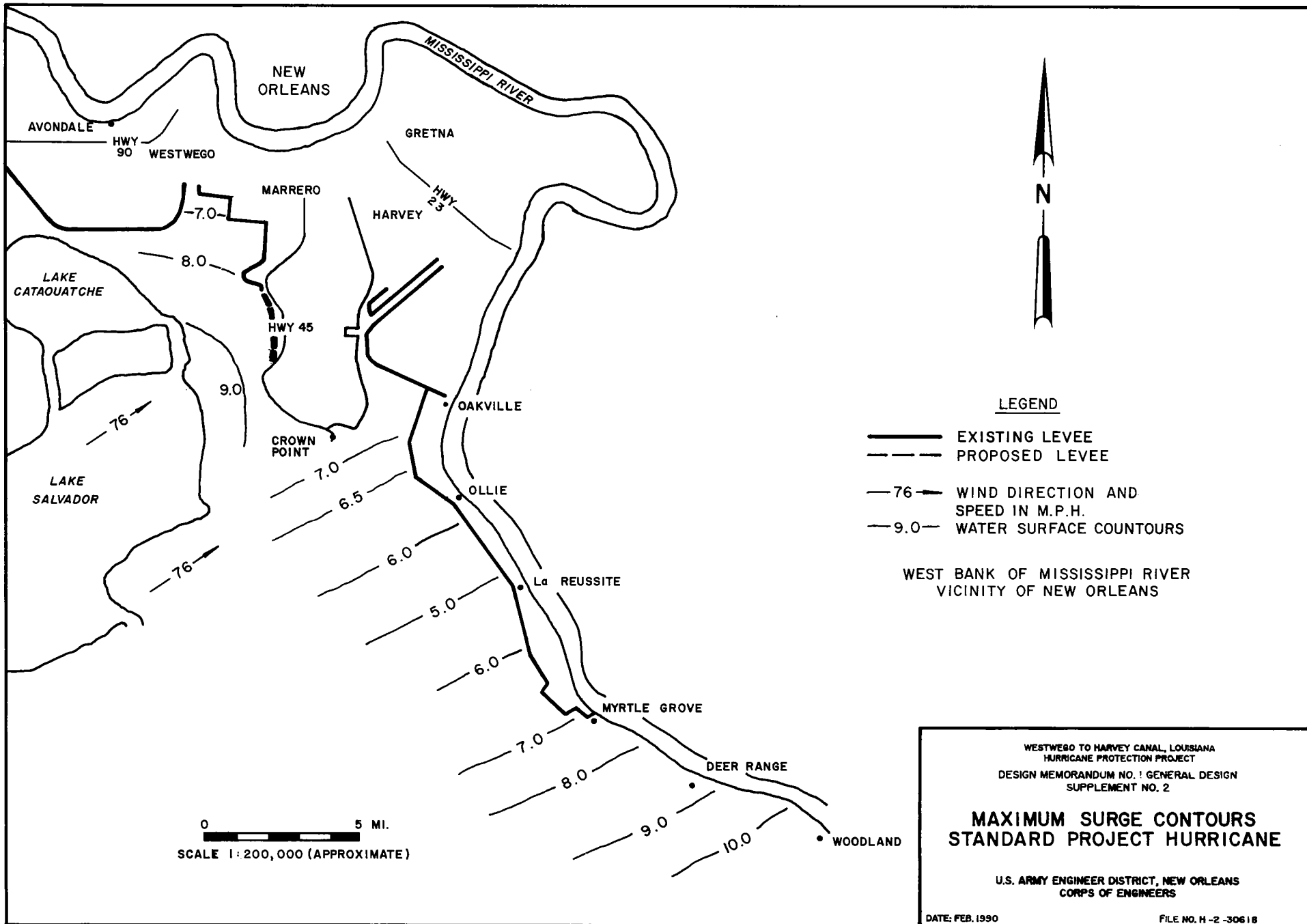


WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

**OVERLAND SURGE ELEVATIONS
 COASTAL LOUISIANA**

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

DATE: FEB. 1990 FILE NO. H-2-30618



LEGEND

— EXISTING LEVEL
 - - - PROPOSED LEVEL

76 → WIND DIRECTION AND SPEED IN M.P.H.
 — 9.0 — WATER SURFACE COUNTOURS

WEST BANK OF MISSISSIPPI RIVER
 VICINITY OF NEW ORLEANS

WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2

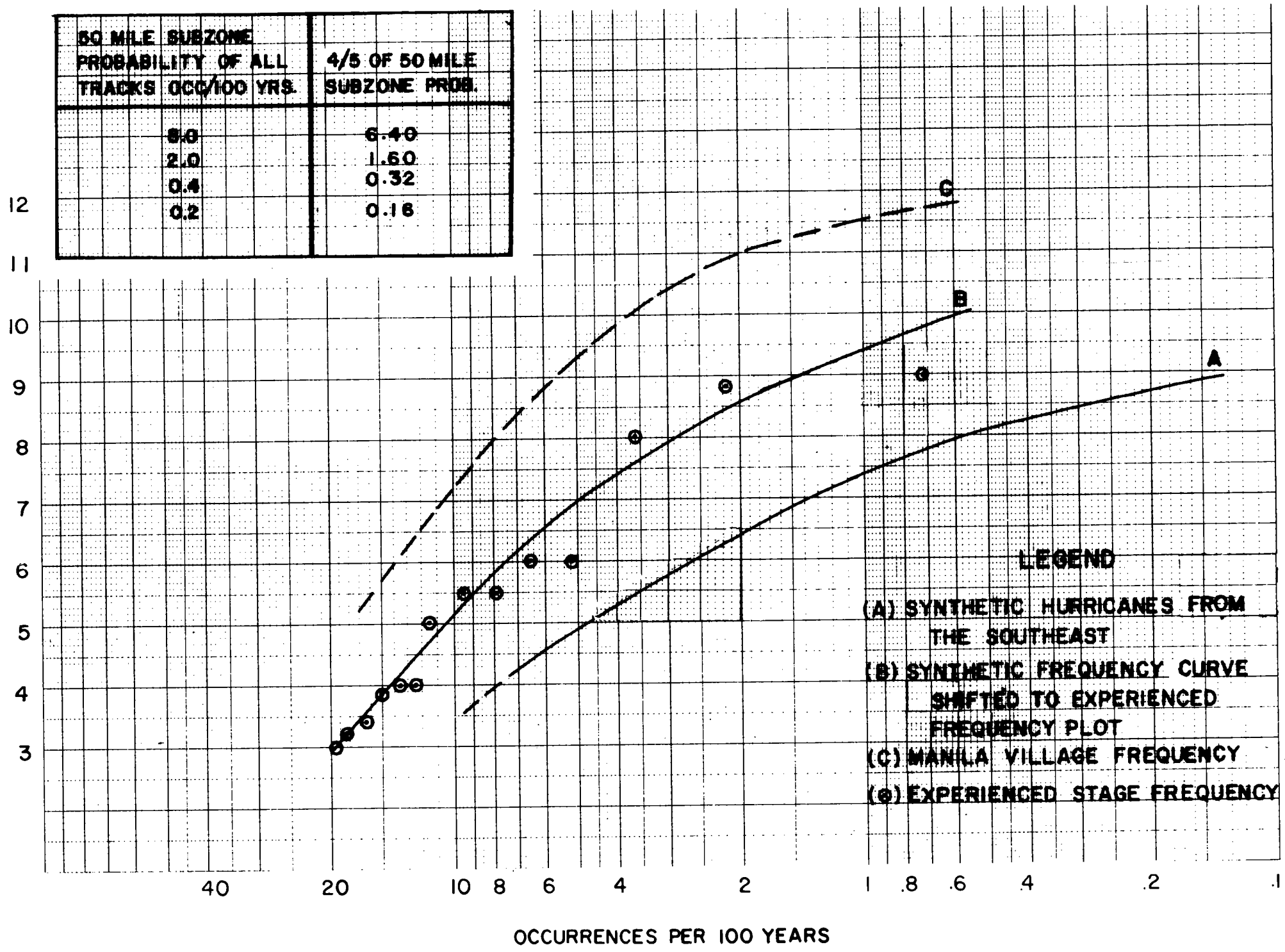
**MAXIMUM SURGE CONTOURS
 STANDARD PROJECT HURRICANE**

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

DATE: FEB. 1990 FILE NO. H-2-30618

50 MILE SUBZONE PROBABILITY OF ALL TRACKS OCC/100 YRS.	4/5 OF 50 MILE SUBZONE PROB.
8.0	6.40
2.0	1.60
0.4	0.32
0.2	0.16

ELEVATION IN FEET, N.G.V.D.



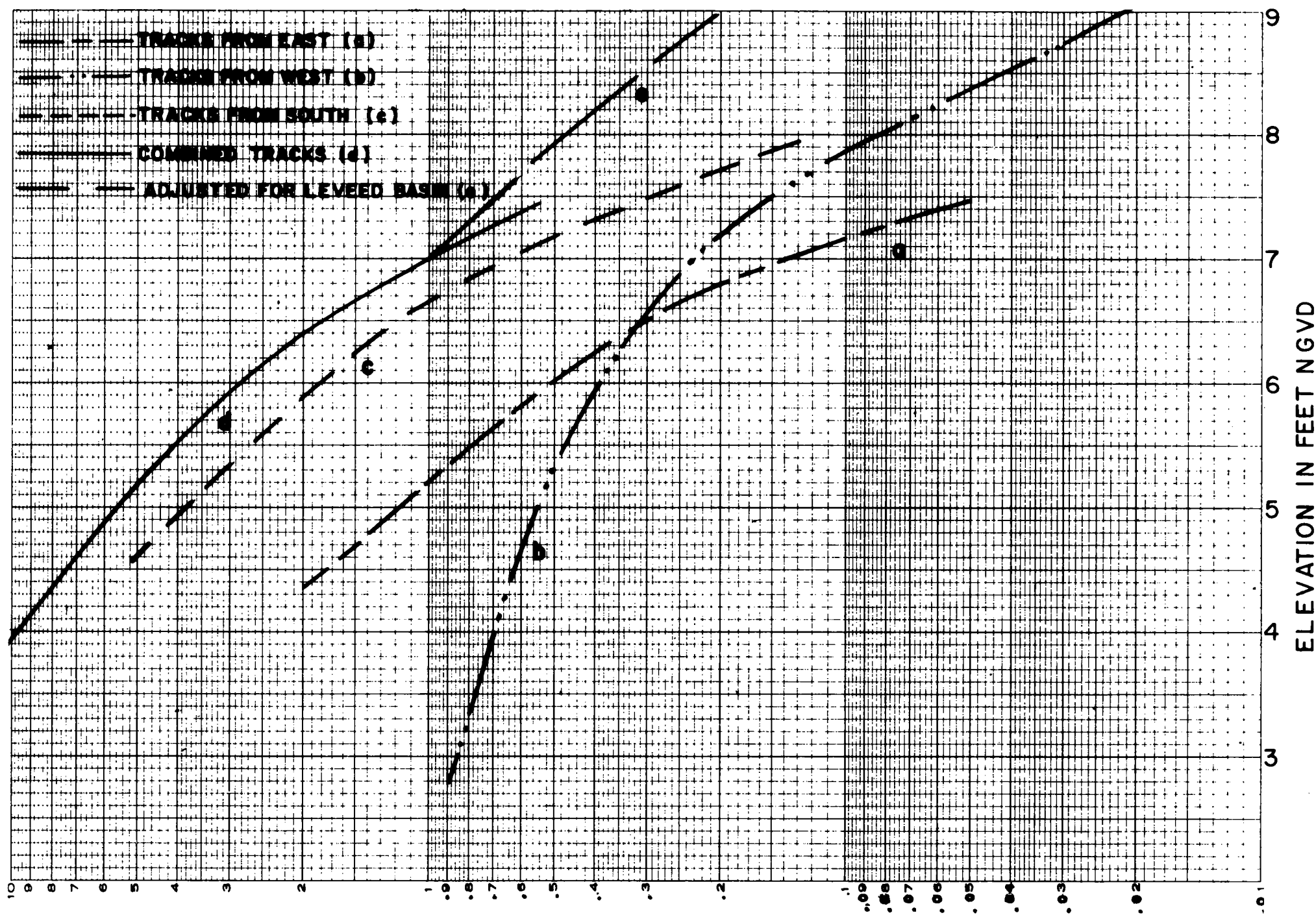
- LEGEND**
- (A) SYNTHETIC HURRICANES FROM THE SOUTHEAST
 - (B) SYNTHETIC FREQUENCY CURVE SHIFTED TO EXPERIENCED FREQUENCY PLOT
 - (C) MANILA VILLAGE FREQUENCY
 - (⊙) EXPERIENCED STAGE FREQUENCY

WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
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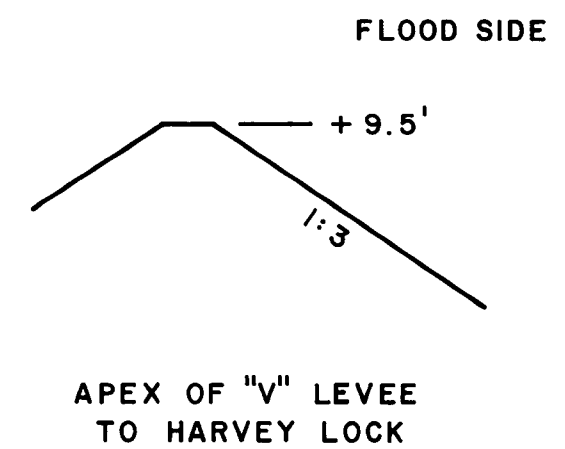
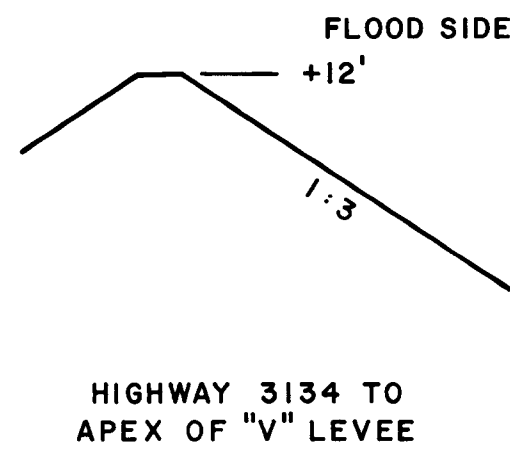
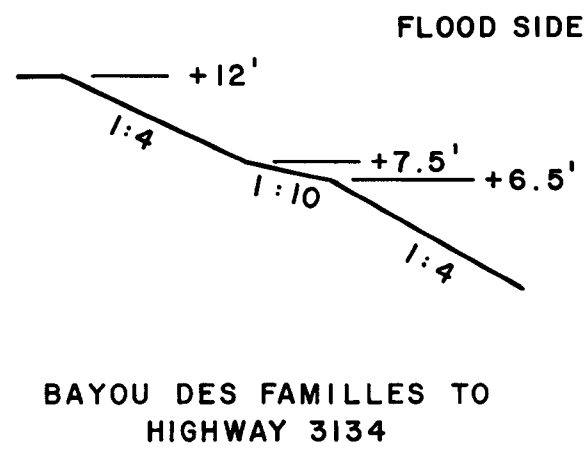
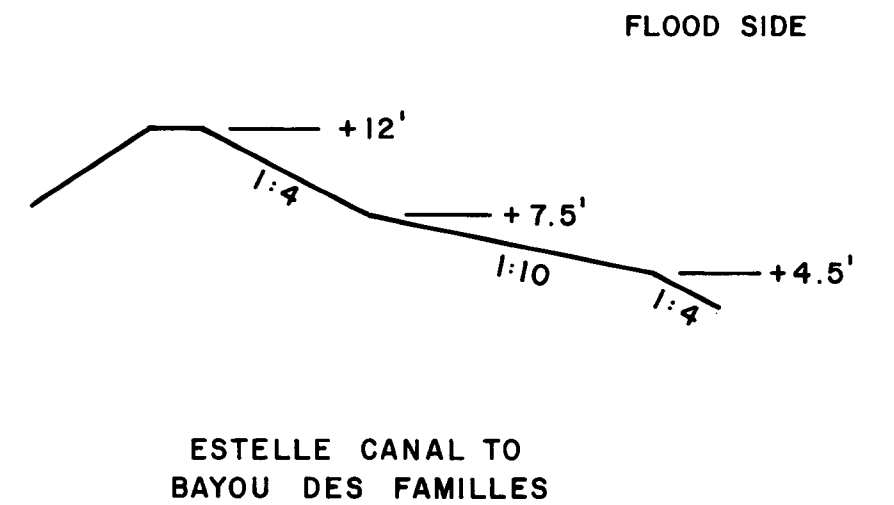
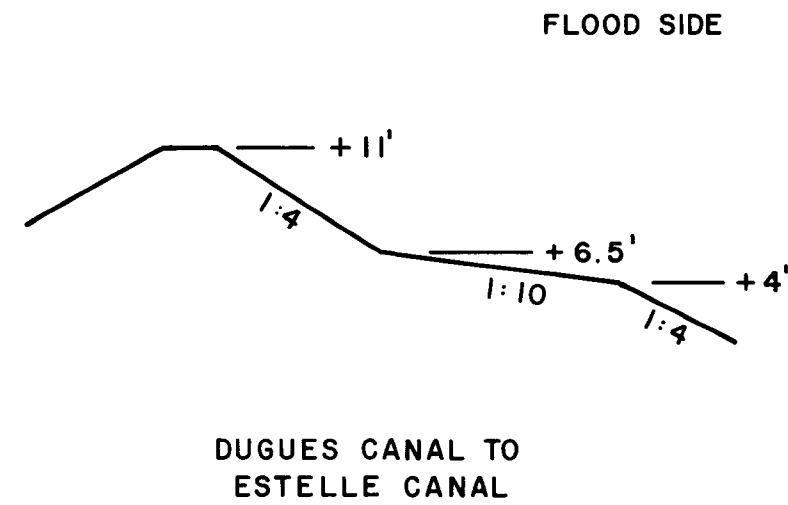
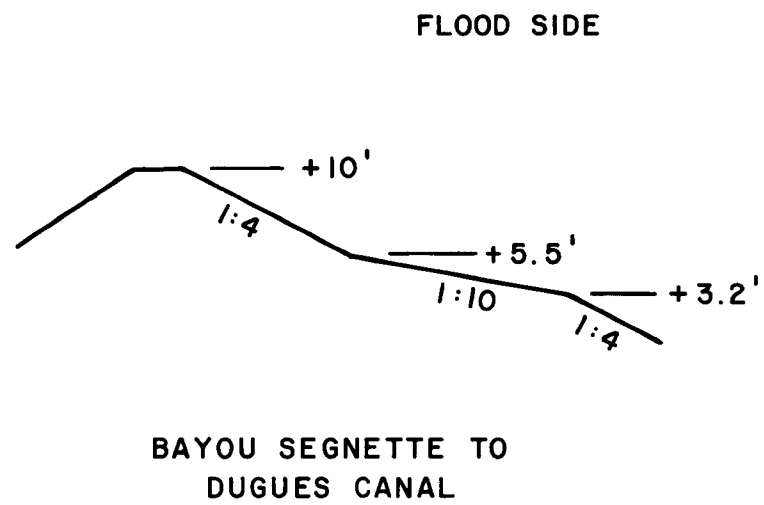
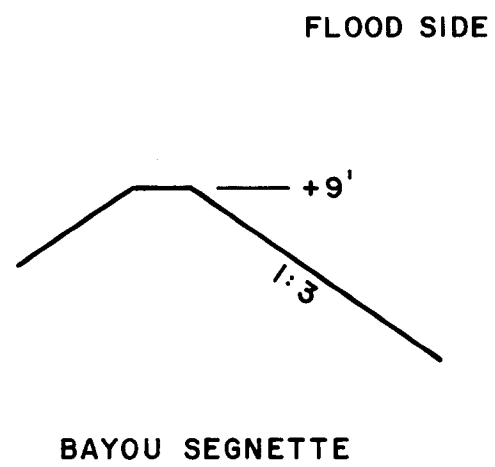
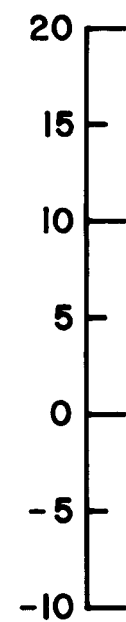
**STAGE - FREQUENCY
 MANILA VILLAGE**

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS
 DATE FEB. 1990 FILE NO. H-2-30618

OCCURRENCES PER 100 YEARS



WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
 SUPPLEMENT NO. 2
**LAKE SALVADOR
 STAGE-FREQUENCY
 EAST SHORE**
 U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
 CORPS OF ENGINEERS
 DATE: FEB, 1990 FILE NO. 4-2-3000



WESTWIND TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

**TYPICAL CROSS SECTION
EARTHEN LEVEE**

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

DATE: FEB. 1990 FILE NO. H-2-30616

WESTWEGO TO HARVEY CANAL LA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

APPENDIX B

REAL ESTATE COST ESTIMATE

IDENTIFICATION
NUMBER 00309

REAL ESTATE COST ESTIMATE
WESTWEGO TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT
JEFFERSON PARISH, LOUISIANA

Standard Protection Hurricane (SPH) Plan
Bayou Segnette Pumping Station to the Harvey Canal Pumping Station

ESTIMATE OF COSTS (Date of Value - December 1989)

(a) <u>Lands and Damages</u>	<u>Acres</u>	<u>Unit Value</u>	<u>Total Value</u>
Perpetual Levee, Floodwall and Borrow Easement			
Marsh/Wetlands	364.4	\$ 500	\$ 182,200
Wetlands	483.7	1,000	483,700
Wetlands (Over Existing Disposal Easement)	20.0	1,000 x .10	2,000
Potential Commercial/Residential	2.0	43,560	87,120
Potential Commercial/Residential **(Existing Right-of-Way Harvey Canal and Bayou Barataria Project)	75.2	35,000 x .10	263,200
Wetlands **Existing Levee Right-of-Way (V-Levee)	50.0	1,000 x .10	5,000
Perpetual Pile Tip Easement			
Marsh/Wetlands	1.4	500 x .30	210
Wetlands	1.4	1,000 x .30	420
Potential Commercial/Residential	1.4	43,560 x .30	18,295
Potential Commercial/Residential (over Existing Easement)	.3	35,000 x .10x.30	315
Temporary (3-year) Construction Easement			
Marsh/Wetlands	2.6	500 x .20	260
Wetlands	24.9	1,000 x .20	4,980
Potential Commercial/Residential	1.6	43,560 x .20	13,939
Potential Commercial/Residential (over Existing Easement)	1.3	35,000 x .10x.20	910
Improvements			0
Severance Damage			0
Total (R)			\$ 1,063,000

(b) Contingencies 25% (R)	266,000
(c) <u>Acquisition Costs</u> (Estimated 75 tracts)*	
Non-Federal (R)	555,000
Federal (R)	135,000
(d) <u>PL 91-646</u>	<u>0</u>
(e) Total Estimated Real Estate Cost	\$ 2,019,000

This estimate is a revision to Cost Estimate Identification Number 91215.

NOTE: This estimate has been prepared to exclude the 55-acre perpetual borrow easement area shown in a previous real estate cost estimate.

*Cost estimate for this item was obtained from the Code of Accounts estimate prepared by CELMN-RE-P, dated 9 March 1990.

**Cost estimates provided for existing right-of-way areage to coincides with the acquisition policy of the local sponsor (West Jefferson Levee District) on this project.

This estimate is based on mapping, acreage calculations and levee rights-of-way as provided by CELMN-ED-DL. Almost all of the land included in this appraisal report from the Bayou Segnette Pumping Station to the Harvey Canal is in an area designated as marsh/wetlands. At present, even without imposition of the easement, much of the land is classified by CELMN-OD-SS [and has been since 25 July 1975 per reference 33 CFR 330.3(A)] as wetland under Section 404 of the Clean Water Act. As such, because the appraiser was unable to obtain a yes or no answer to whether future development would be permitted in this area, the appraiser has made this estimate based on the premise no future development will be allowed. If it can be demonstrated that this premise is incorrect, this report will be modified to reflect the change in "Highest and Best Use."

It should be noted that in both the "before and after" value positions that future development of this land is contingent on the landowners' ability to obtain necessary permit from the Parish, State and Corps of Engineers.

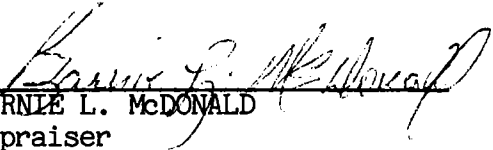
Several roads, pipelines and powerlines were observed in the proposed new right-of-way which may require relocation. Because all these utilities are thought to be public carriers, no URA costs are included for these relocations. Access to the area in the new right-of-way reportedly will be equal in the "before and after" positions.

This cost estimate is made contingent that all temporary easement areas (used for this project) will be graded when returned to the landowner

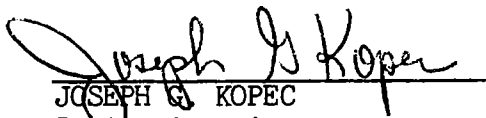
Severance Damage not estimated as maps furnished do not show the exact right-of-way lines. Sound acquisition policy should eliminate severance damages.

The tract/ownership count is subject to revision once specific property maps are provided.

NOTE: The right-of-way to be used for construction of a portion of the new levee reportedly was acquired for the Harvey Canal-Barataria Levee project in the 1960s.


BARNIE L. McDONALD
Appraiser
9 March 1990

Approved By:


JOSEPH G. KOPEC
Review Appraiser
9 March 1990

REAL ESTATE COST ESTIMATE
WESTWEGO TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT
JEFFERSON PARISH, LOUISIANA

Flood Protection Levee (West Side) Closure

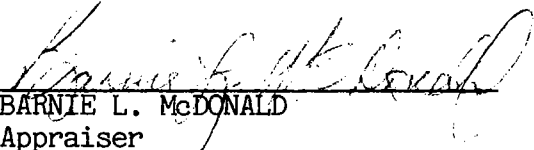
Alternative 4 - Bayou Segnette Pumping Station to Park Entrance, then North to the Southern Pacific Railroad Track

ESTIMATE OF COSTS (Date of Value - October 1989)


<u>(a) Lands and Damages</u>	<u>Acres</u>	<u>Unit Value</u>	<u>Total Value</u>
Perpetual Levee and Floodwall Easement			
Potential Commercial/Residential	2.0	\$ 15,000	\$ 30,000
Potential Commercial	1.0	130,680	130,680
Residential	10.0	87,120	871,200
Improvements			1,200,000
Severance Damage			<u>225,000</u>
Total (R)			\$2,457,000
(b) Contingencies 25% (R)			614,000
(c) <u>Acquisition Costs</u> (Estimated 25 tracts)*			
Non-Federal (R)			198,000
Federal (R)			49,000
(d) <u>PL 91-646</u> (Title II and Title III)			<u>300,000</u>
(e) Total Estimated Real Estate Cost			\$3,618,000

This estimate is a revision to Cost Estimate Identification Number 91215. This estimate is based on mapping agreeage calculations and levee rights-of-way as provided by CELMN-ED-SP. The tract/ownership count is subject to revision once specific property maps are provided.

*Cost estimate for this item was obtained from the Code of Accounts estimate prepared by CELMN-RE-P, dated 9 March 1990.


BARRIE L. McDONALD
Appraiser
9 March 1990

Approved By:


JOSEPH G. KOPEC
Review Appraiser
9 March 1990

REAL ESTATE COST ESTIMATE
 WESTWEGO TO HARVEY CANAL, LOUISIANA
 HURRICANE PROTECTION PROJECT
 MITIGATION ALTERNATIVES
 ST. CHARLES PARISH, LOUISIANA

IDENTIFICATION
 NUMBER 00309

Area in Vicinity of Davis Pond

ESTIMATE OF COSTS (Date of Value - December 1989)

	<u>Acres</u>	<u>Unit Value</u>	<u>Total Value</u>
(a) <u>Lands and Damages</u>			
Fee Simple Excluding Mineral Rights			
Wooded Wetlands	1,024	\$ 800	\$ 819,200
Improvements			0
Severance Damage			0
Total (R)			\$ 819,000
(b) Contingencies 25% (R)			205,000
(c) <u>Acquisition Costs</u> (Estimated 2 tracts)*			
Non-Federal (R)			111,000
Federal (R)			28,000
(d) <u>PL 91-646</u>			0
(e) Total Estimated Real Estate Cost			\$1,163,000


*Cost estimate for this item was obtained from the Code of Accounts estimate prepared by CELMN-RE-P, dated 9 March 1990.

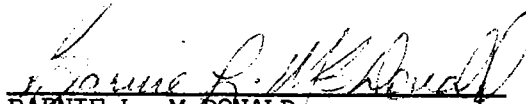
This estimate is based on acreage calculations as contained in the EIS. The mitigation land will be located near the Salvador Wildlife Management Area in the vicinity of Davis Pond.

The tract/ownership count is subject to revision once specific property maps are provided. For purposes of this estimate and due to the large size of the ownerships in this area, this appraisal is made contingent that all right-of-way can be acquired from two landowners.

NOTE: All of the mitigation land appraised herein reportedly is now classified as wetland under Section 404 of the Clean Water Act.

Approved By:


 JOSEPH G. KOPEC
 Review Appraiser
 9 March 1990


 BARNIE L. McDONALD
 Appraiser
 9 March 1990

WESTWEGO TO HARVEY CANAL LA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

APPENDIX C

CORRESPONDENCE

BUDDY ROEMER
GOVERNOR

COMMISSIONERS

THOMAS ALARIO
FRANCIS BOFFONE
ALEX "DICK" GUIDRY
FRANK L. MUSCARELLO
REV. FRANKLIN R. PRICE
WILLIAM J. SCHEFFLER, III
ROGER D. STACK

VICE PRESIDENT
PHILIP J. LOYACANO



PRESIDENT
RONALD R. BESSON

DIRECTOR / PRINCIPAL ENGINEER
LEO N. DUETT

GENERAL COUNSEL
OWEN J. BORDELON, JR.

BOARD SECRETARY
EVELYN DUFRENE

403 BARATARIA BLVD.
MARRERO, LA 70072
TEL: (504) 340-0318

December 8, 1989

Colonel Richard V. Gorski
Department of the Army
Corps of Engineers
P.O. Box 60267
New Orleans, La. 70160


Re: West Bank Hurricane Protection Levee
(Westwego to Harvey Canal)

Dear Colonel Gorski:

The West Jefferson Levee District, Board of Commissioners, is empowered by law and has the financial capability to provide the non-federal project requirements for the above referenced project.

The District is prepared to execute the Local Cooperative Agreement as per the enclosed draft and fulfill its monetary obligations as shown in the enclosed financial plan.

Sincerely,


Ronald R. Besson
President

RRB/ed
encl.

cc: Mr. Bordelon
Mrs. Grille
Commissioners

Encl 2

In a telephone poll conducted on December 5, 1989, the following resolution was adopted:

R E S O L U T I O N

RESOLVED, that the final draft of the Local Cooperation Agreement to be entered into by and between the United States and the West Jefferson Levee District be approved as written, and,

FURTHER RESOLVED, that the President or Vice- President be authorized to execute said agreement in the name of the West Jefferson Levee District.

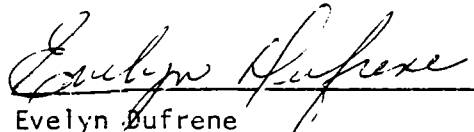
The voting was as follows:

YEAS: Mr. Boffone, Mr. Guidry, Mr. Loyacano, Mr. Muscarello,
Mr. Scheffler, Mr. Stack

NAYS: None

NOT AVAILABLE: Rev. Price

The resolution was adopted, and will be ratified at the Board meeting to be held on Thursday, December 21, 1989.


Evelyn Dufrene
Board Secretary

CELMN-LC

13 December 1989

MEMORANDUM FOR Commander, Lower Mississippi Valley,
ATTN: CELMV-BD-PG

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, Draft Local Cooperation
Agreement (LCA) Package

1. The subject LCA package is submitted in accordance with ER 1165-2-131 and includes the following:

a. Draft LCA and exhibits.

b. The local sponsor's financial plan and our analysis of the sponsor's financial capability to participate in the project.

c. Project Milestone Schedule.

d. General Design Memorandum (GDM) (Reduced Scope) for the project, approved 6 October 1989. This GDM confirms the project scope and costs, and provides the basis for negotiation and execution of the LCA.

e. Detailed Project Schedule (PB-2a) supporting the draft LCA and Federal and non-Federal allocation of funds.

f. Federal and non-Federal funding schedules.

g. Project Fact Sheet.

2. Deviations from the model LCA follow:

a. Model LCA, Page A-5, Article II.c. The requirement for a cash contribution by the local sponsor of 5 percent of the total project cost does not apply to the subject project. Refer to CELMN-PD-F Memorandum of 2 November 1987, and CECW-PS Memorandum of 21 December 1987 and CELMV-PD-F 1st Endorsement thereto attached to the financial analysis.

CELMN-LC

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, Draft Local Cooperation
Agreement (LCA) Package

b. Draft LCA, Page A-5, Article II.d. The basic cost sharing percentage for the local sponsor is 35 percent for hurricane protection projects.

e. Draft LCA, Page 4, Article II.e. This Article was added to document the credits approved in accordance with Section 104 of the WRDA of 1986.

f. Model LCA, Page A-7, Article IV.a.4. The first sentence was revised to stipulate a "four-year period" preceding the date the LCA is signed to accommodate the time frame during which the Local Sponsor has in fact acquired lands, easements and rights-of-way through involuntary acquisitions.

3. We recognize that HQUSACE made a recent decision to include an additional Article in all LCA's concerning Federal/non-Federal responsibilities related to hazardous and toxic waste sites on lands necessary for project construction, operation, and maintenance. We received an advance copy of this Article on 7 December 1989. In the interest of time we will apprise the Local Sponsor of this new requirement, and provide you with the agreed to language under separate cover and at the earliest practicable date.

4. The subject project is an FY 1990 new construction start. The first construction contract is scheduled for award in July 1990.

5. Recommend your expeditious review and approval of the draft LCA package.

Encls

RICHARD V. GORSKI
COL, CE
Commanding

CELMV-ED-PG (CELMN-ED-SP/28 Jul 89) (1105-2-10c) 3d End Bardwell/caf/5925
SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane Protection Project,
General Design Memorandum No. 1 (Reduced Scope)

CDR, Lower Mississippi Valley Division, Vicksburg, MS 39181-0080

14 FEB '90

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

The resolution of the 1st End comments is satisfactory.

FOR THE COMMANDER:

2 Encls
nc


FRED H. BAYLEY III
Chief, Engineering Division

CF (10 cys 2d End):
CECW-EP

CELMV-ED-PG (CELMN-ED-SP/28 Jul 89) (1105-2-10c) 1st End Bardwell/caf/5925
SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane Protection Project,
General Design Memorandum No. 1 (Reduced Scope)

CDR Lower Mississippi Valley Division, Vicksburg, MS 39181-0080

06 OCT '89

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

The subject DM is approved subject to resolution of the comments contained in enclosure 2.

FOR THE COMMANDER:

2 Encls
wd encl 1
Added 1 encl
2. LMVD Tech Cmts

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

Rec-90
ED-90
2A-1



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

P.O. BOX 60267

NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CELMN-ED-SP

28 July 1989

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

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, General Design Memorandum No. 1
(Reduced Scope)

1. The subject General Design Memorandum (GDM) is submitted for review and approval. The GDM has been prepared generally in accordance with the guidance provided in the 31 March 1989 briefing held for ASA (CW) and the HQ U.S. Army Corps of Engineers, letter dated 10 May 1989. This letter provided clarifying comments for preparing the reduced scope GDM.
2. A summary of the current status of the Environmental Impact Statement (EIS), endangered species and cultural resources investigation is as follows:
 - a. The work proposed in the subject GDM was addressed in the EIS for West Bank of the Mississippi River in the Vicinity of New Orleans, Louisiana, which was filed with EPA on 23 October 1987. The EIS did not include the Westside closure which was proposed subsequent to the original authorization. This will be addressed in an Environmental Assessment to be prepared upon final selection of the Westside closure alternate.
 - b. The construction of the project will not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.
 - c. A detailed plan for a program of mitigative data recovery at the V-levee Archaeological Site is currently under review. Completing the required investigations at this site, which is eligible for National Register, should fully discharge all project cultural resource commitments.
3. The plan presented in the GDM generally follows the authorized plan, with the addition of a new levee/floodwall combination required to close the system and provide protection to the western portion of the project area.

CELMN-ED-SP

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, General Design Memorandum No. 1
(Reduced Scope)

4. As the final Design for the project work is not completed, the level of design detail for the GDM varies between traditional GDM and feasibility scope.
5. The subject GDM is being submitted on schedule.
6. As per LMVED-TS letter, dated 5 February 1981, this GDM has been reviewed by the District Security Office. There were no comments to be incorporated in the GDM.
7. Approval of the GDM is recommended.

FOR THE COMMANDER:



Encl (16 copies fwd sep)

FREDERIC M. CHATRY
Chief, Engineering Division

LOWER MISSISSIPPI VALLEY DIVISION
VICKSBURG, MISSISSIPPI 39181-0080

Technical Comments
Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, General Design Memorandum No. 1
(Reduced Scope)

1. General.

a. The "Typical Sections" for the levee work in this document show an all earth uncompacted fill levee with berms ranging from small to very large. The text indicates that by using such a design, three lifts with three years between lifts will be necessary. It is our understanding that alternative levee designs using geotextiles, geogrids, semicompacked fill, I-wall in levee sections, etc., have been investigated. The levee sections presented are considered acceptable as a basis for a GDM scope cost estimate, however, the GDM supplement should present sufficient details of alternatives investigated to determine the best overall design.

b. The criteria shown for cantilever I-wall design are based on CEMRC-ED-GS letter, 23 December 1987, subject: Sheet Pile Wall Design Criteria. These criteria were correct at the time of preparation of this document. However, the final guidance summarized in CEMRC-ED-GS letter, 24 July 1989, subject: Sheet Pile Wall Design Criteria, should be cited and used in the design to be presented in the forthcoming GDM supplement.

c. In the GDM supplement, the levee centerline should be shown on Plates 1 through 16, in addition to the baseline and wall line. The levee stationing should also be related to the baseline and wall line stationing on these plates.

2. Para 7h. This paragraph should be reworded to express current policy with reference to local interest responsibility for furnishing mitigation lands and participating in the cost of other mitigation features.

3. Para 30c, page 16, and plate 38. The I-wall to T-wall joints should be in accordance with the details shown on plates 18 and 25 of the West Esplanade to Lakefront Floodwall plans and specifications, Lake Pontchartrain, Louisiana and Vicinity, Hurricane Protection Project, Jefferson Parish/St. Charles Parish Return Levee.

4. Para 33b, page 18. This paragraph should be revised as follows: ". . . stainless steel shall be painted with a vinyl coating 7 mils thick. The vinyl shall be supplemented by a cathodic protection system utilizing sacrificial anodes."

5. Para 43, page 48. The PB-3 should be revised to reflect the GDM cost estimate upon approval of the GDM.

Enc/2

6. Table 7, page 51. This table should be revised to include data on fish and wildlife mitigation measures to be constructed and on land acquired for mitigation. The Baie du Cabanage mitigation dike could be listed for early completion to be followed shortly by acquisition of separable mitigation lands. This would meet the requirement that the mitigation be accomplished concurrent with other project construction.

7. Plate 35. On the Gate Monolith section, "Protected Side" and "Flood Side," labels appear to be reversed. The J-bulb seal arrangement pointed out this discrepancy.

8. Appendix A, Section II, page A-26.

a. The 60" CMP will provide an outlet through the hurricane protection levee. Plate 3 indicates that the landside area which will convey flow to this culvert is essentially marsh with an elevation varying between 0.5 to 1.0 ft NGVD. Section II states that the CMP's invert will be placed at -2.0 ft NGVD. With this invert elevation, the 60" CMP culvert will not flow full. To ensure that full culvert capacity is available, the circular culvert invert must be lowered (and the connecting channel modified) or an equivalent elliptical/arch pipe utilized.

b. A drawing showing the details of the interior drainage structure should be included in the GDM supplement.

9. Appendix D, Article IIc, page D-4. In the last sentence, the reference to Article VI.f should be changed to Article VI.e.

CELMN-ED-SP (CRLMN-ED-SP/28 Jul 89) (1110-2-1150a) 2d End
Mr. Tufail/mn/2613
SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, General Design Memorandum No. 1 (Reduced
Scope)

DA, New Orleans District, Corps of Engineers, P. O. Box 60267,
New Orleans, LA 70160-0267 9 Nov 89

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

1. Our proposed disposition of comments contained in the 1st endorsement is as follows:
2. Paragraph 1.a. Concur. We will include a detailed discussion of various alternatives in the GDM Supplement.
3. Paragraph 1.b. Concur.
4. Paragraph 1.c. Concur.
5. Paragraph 2. Paragraph 7.h. is correctly written. This is identical to the corresponding paragraph in the approved Feasibility Report.
6. Paragraph 3. Concur.
7. Paragraph 4. Do not concur. Use of sacrificial anodes is generally required for structures which remain submerged or are subject to tidal fluctuations. In our judgement floodwalls do not fall in this category.
8. Paragraph 5. Concur. We have revised the PB-3.
9. Paragraph 6. Concur. We are reanalyzing the mitigation measures. The schedule for design and construction for the GDM Supplement will include mitigation measures to be constructed for the project.
10. Paragraph 7. Concur.
11. Paragraph 8.a. Concur. Since the design outside stage used is 1.6 ft NGVD, we will set the culvert invert at -3.5 ft NGVD so that the culvert is submerged for the design conditions.

CELMN-ED-SP

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane Protection Project, General Design Memorandum No. 1 (Reduced Scope)

12. Paragraph 8.b. Concur.

13. Paragraph 9. Concur.

14. Approval of the proposed disposition of comments as presented herein, is recommended.

FOR THE COMMANDER:

2 Encls
nc

FREDERIC M. CHATRY
Chief, Engineering Division



DEPARTMENT OF THE ARMY
LOWER MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS

P. O. BOX 80
VICKSBURG, MISSISSIPPI 39180-0080

REPLY TO
ATTENTION OF:

CELMV-ED-PG (1105-2-10c)

18 OCT '89

MEMORANDUM FOR HQUSACE (CEEC-EP) WASH DC 20314-1000

SUBJECT: Westwego to Harvey Canal, Louisiana Hurricane Protection Project,
General Design Memorandum No. 1 (Reduced Scope)

1. Pursuant to ER 1110-2-1150, dated 24 June 1985, paragraph 15c, the subject DM is furnished for your use (enclosure 1). LMVD technical comments on the subject DM are provided at enclosure 2. The reduced scope DM complies with the requirements set forth in 4th endorsement, CEEC-EP, 10 May 1989, subject: West Bank of Mississippi River in the Vicinity of New Orleans, Louisiana (Westwego to Harvey Canal, Louisiana Hurricane Protection Project). A copy of the referenced 4th endorsement is contained in Appendix C, Correspondence.


2. As indicated in the Project Cost Estimate section of the subject DM, paragraph 42, the current project cost estimate is \$78 million (October 1989 price level). The Division approval limit is \$75.5(R) million (\$61,500,000 plus \$7.3(R) million for inflation from October 1985 to October, 1989, plus \$6,700,000 credit for previous work accomplished by local interests for the five-year period prior to authorization). In accordance with paragraph 6e, ER 5-2-1, it is recommended that a management ceiling of \$78 million be established for this project based on the cost estimate presented in the cost estimate section paragraphs 39-41 and Table 5. The contingencies included in the cost estimate are considered appropriate for the current level of planning, engineering, and design. Appropriate management action will be applied to complete the project within the management ceiling.

3. The section 902 limit for the Westwego to Harvey Canal project is \$94,700,000. The current fully funded cost estimate based on the cost presented in the subject DM with cost inflated to the midpoint of the contract construction period is \$85,800,000. This fully funded cost compares to the PB-3 (effective 1 Oct 89) cost of \$84,900,000, which includes inflation projected to the contract award date. The EC 1105-2-176, Figure B-4, Maximum Cost Including Inflation through Construction, and Appendix C, Project Cost Increase Fact Sheet, are enclosed (encl 3).

FOR THE COMMANDER:

3 Encls (10 cys)

CF (w/encl 3):
CELMN-ED-SP
CELMN-LC


FRED H. BAYLEY III
Chief, Engineering Division

LOWER MISSISSIPPI VALLEY DIVISION
VICKSBURG, MISSISSIPPI 39181-0080

Technical Comments
Westwego to Harvey Canal, Louisiana Hurricane
Protection Project, General Design Memorandum No. 1
(Reduced Scope)

1. General.

a. The "Typical Sections" for the levee work in this document show an all earth uncompacted fill levee with berms ranging from small to very large. The text indicates that by using such a design, three lifts with three years between lifts will be necessary. It is our understanding that alternative levee designs using geotextiles, geogrids, semicompacted fill, I-wall in levee sections, etc., have been investigated but were not available for use in this document. We have no objection to the levee sections presented, provided the GDM supplement presents detailed alternatives investigated. The plans and specifications for any segment of this work should not be submitted for review until after the GDM supplement is approved.

b. The criteria shown for cantilever I-wall design are based on CEMRC-ED-GS letter, 23 December 1987, subject: Sheet Pile Wall Design Criteria. These criteria were correct at the time of preparation of this document. However, the final guidance summarized in CEMRC-ED-GS letter, 24 July 1989, subject: Sheet Pile Wall Design Criteria, should be cited and used in the design to be presented in the forthcoming GDM supplement.

c. In the GDM supplement, the levee centerline should be shown on Plates 1 through 16, in addition to the baseline and wall line. The levee stationing should also be related to the baseline and wall line stationing on these plates.

2. Para 7h. This paragraph should be reworded to express current policy with reference to local interest responsibility for furnishing mitigation lands and participating in the cost of other mitigation features.

3. Para 30c, page 16, and plate 38. The I-wall to T-wall joints should be in accordance with the details shown on plates 18 and 25 of the West Esplanade to Lakefront Floodwall plans and specifications. Lake Pontchartrain, Louisiana and Vicinity, Hurricane Protection Project, Jefferson Parish/St. Charles Parish Return Levee.

4. Para 33b, page 18. This paragraph should be revised as follows: ". . . stainless steel shall be painted with a vinyl coating 7 mils thick. The vinyl shall be supplemented by a cathodic protection system utilizing sacrificial anodes."

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6. Table 7, page 51. This table should be revised to include data on fish and wildlife mitigation measures to be constructed and on land acquired for mitigation. The Baie du Cabanage mitigation dike could be listed for early completion to be followed shortly by acquisition of separable mitigation lands. This would meet the requirement that the mitigation be accomplished concurrent with other project construction.

7. Plate 35. On the Gate Monolith section, "Protected Side" and "Flood Side," labels appear to be reversed. The J-bulb seal arrangement pointed out this discrepancy.

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b. A drawing showing the details of the interior drainage structure should be included in the GDM supplement.

9. Appendix D, Article IIc, page D-4. In the last sentence, the reference to Article VI.f should be changed to Article VI.e.

MAXIMUM COST INCLUDING INFLATION THROUGH CONSTRUCTION

Line 1:		
a.	Current project estimate at current price levels	\$78,000,000
b.	Project cost estimate, inflated through construction	\$85,800,000 <u>1/</u>
c.	Ratio, b/a	1.100
d.	Authorized cost at current price levels, Columns h plus i from Figure B-1	\$68,798,517
e.	Authorized cost, inflated through construction, c x d	\$75,678,368
Line 2:	Cost of modifications required by law	\$6,700,000
Line 3:	20 percent of authorized cost (.2 x Fig. B-1, Col. f + g)	\$12,300,000
Line 4:	Maximum cost limited by Section 902 (1.e + 2 + 3)	\$94,678,368

Figure B-4

1/ Inflation projected through midpoint of contract construction period. Compares to PB-3 (eff. 1 Oct 89) cost of \$84,900,000 which is projected to contract award date.

APPENDIX C

PROJECT COST INCREASE FACT SHEET

1. Westwego to Harvey Canal, La. Hurricane Protection Project
 2. Authorized by the Water Resources Development Act of 1986 (PL 99-662) dated 17 November 1986.
 3. Section 902 limit on project cost:
 - a. Authorized Project Cost: (W/ Price level) \$61,500,000
 - b. Price level increases from date of authorized cost: \$14,178,368
 - c. Current cost of modifications required by law: \$6,700,000
 - d. 20% of line 3.a.: \$12,300,000
 - e. Maximum project cost limited by Section 902: \$94,678,368
 4. Current Project Cost including inflation through construction: \$85,800,000 1/
 5. Computation of percentage increase:
 - a. Current estimate (Line 4) \$85,800,000 1/
 - b. Less total of lines 3.a., b, and c. \$82,378,368
 - c. Subtotal \$3,421,632
 - d. Percent increase (line 5.c./3.a.) 6%
 6. Indexes for Real Estate are National, and indexes for Construction are 1-State (Louisiana).
 7. Authorizing legislation (WRDA 1986) provides for credit to Local Interests for work done up to 5 years prior to authorization.
 8. Cost changes since authorization include a switch to the V-Levee North Alignment as recommended by the Chief of Engineers, and the addition of Mitigation.
 9. Current BCR is 2.6 to 1.
 10. A new construction start has been approved for FY 90. The first item of work (levee construction) will be awarded in July 1990. Remaining construction items will be awarded according to the schedule shown in the Reduced Scope GDM. A final GDM is scheduled to be completed in Feb 90, and the Local Cooperation Agreement is scheduled to be signed in Dec 1989.
- 1/ Inflation projected through midpoint of contract construction period. Compares to PB-3 (eff. 1 Oct 89) cost of \$84,900,000 which is projected to contract award date.

Encl 3² (5)

CELMV-ED-PG (CELMN-ED-SP/20 Oct 88) (1105-2-10c) 5th End Mr. Bardwell/jm
601-634-5925
SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane Protection Project -
General Design Conference

CDR, Lower Mississippi Valley Division, CE, Vicksburg, MS 39181-0080

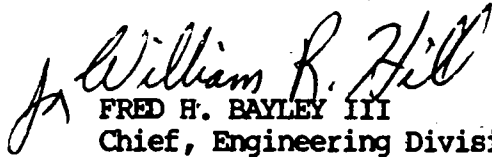
19 MAY '89

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

Referred for action.

FOR THE COMMANDER:

3 Encls
nc


FRED H. BAYLEY III
Chief, Engineering Division



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT, CORPS OF ENGINEERS

P.O. BOX 60267

NEW ORLEANS, LOUISIANA 70160-0267

REPLY TO
ATTENTION OF:

CELMN-ED-SP

20 Oct 88

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

SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane
Protection Project - General Design Conference

1. Reference ER 1110-2-1150, para. 8.b. concerning the requirements for the General Design Conference (GDC). In accordance with the above referenced ER, the enclosed MFR is furnished for your review and approval to complete the requirements for the GDC for the subject project.
2. Approval is recommended.

A handwritten signature in black ink, appearing to read "Frederic M. Chatry", with a long horizontal line extending to the right.

FREDERIC M. CHATRY
Chief, Engineering Division

Encl

CELMV-ED-PG (CELMN-ED-SP/20 Oct 88) (1105-2-10c) 1st End. Mr. Bardwell/caf/5925
SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane Protection Project -
General Design Conference

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39181-0080

80 DEC '88

FOR: CDR USACE (CEEC-EB) WASH DC 20314-1000

The Memorandum for Record for the subject General Design Conference is forwarded for your review. Approval is recommended subject to the satisfactory resolution of the following comments:

a. Paragraph B, page 1. The local interests' deadline of March 1990 for a construction start to avoid forfeiture of the State-provided funds requires deviating from our current procedure of having an approved General Design Memorandum (GDM) as the basis for the Local Cooperation Agreement (LCA). My staff discussed this problem with Messrs. Ed Nutter and Rob Vining of your office and the following was agreed to:

(1) The LCA will reflect the project features presented in the Feasibility Report, including the V-Levee North alternative. An additional change in the recommended plan will be an extension of the west side levee from the Bayou Segnette pumping station northwesterly to high ground to complete the required protection.


(2) The LCA will be based on the current available information and will include data from the feasibility report, the advance GDM supplement for the Harvey Canal Floodwall and the GDM currently under development.

b. Paragraph B, page 2. In the third sentence of the penultimate paragraph, the word "freeboard" should be replaced with the word "height" since the levee crest elevation will be established based on wave runup computations. Freeboard is selected so that it includes factors which cannot be accurately calculated.

FOR THE COMMANDER:

Encl (quad)
nc

CF:
CELMN-ED-SP (wo/encl)
CELMN-DD-P (wo/encl)


FRED H. BAYLEY III
Chief, Engineering Division

CEEC-EP (CELMV-ED-PG/20 Oct 88) (335-2-5c) 2nd End WALLACE/272-8890
SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane Protection
Project - General Design Conference


HQ, U.S. Army Corps of Engineers, Washington, DC 20314-1000 9 March 1989

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

1. Reference CECW-RN Memorandum dated 23 November 1987, Subject: Guidance Letter No. 4, New Start Construction Projects--Draft LCA Submission Requirements and Status of General Design Memorandum (GDM).
2. The Memorandum for Record (MFR) for the subject design conference accurately reflects the conclusions reached at the conference. However, there are several issues raised in the MFR and the 1st Endorsement that need clarification.
3. Based on conversations between our staffs, we understand that an LCA package which reflects GDM scope costs will be available by October 1989. The LCA package should be consistent with EC 1165-2-144 and submitted to CECW-RN for review and approval. In accordance with the referenced memorandum, the LCA will not be executed until the GDM is approved and funds have been appropriated for the project. At the time the GDM is submitted to your office for approval, information copies should be provided concurrently to CEEC-EP for review. It is imperative that the October 1989 submission date be met in order to be in a position to initiate construction by March 1990.
4. The position that the project plan signed by the Secretary of the Army should serve as the basis for Section 902 cost computations is incorrect. The baseline project cost is the cost contained in the authorizing language for the project (\$61,500,000). Section 104 credit approved for external but compatible work is additive to the total project costs but is not counted against the 20% limit. If it is determined that the project costs will exceed the Section 902 limit, a post-authorization change report should be prepared and submitted to CECW-P. ER 1105-2-10 and EC 1105-2-176 (draft) should be reviewed in consultation with CECW-PS staff in this regard.
5. We are also uncertain as to the significance of the statement in the MFR that if the project is not under construction by March 1990, the State of Louisiana will withdraw its financial support for the project. Therefore, please furnish written documentation on the conditions surrounding the State's level of financial commitment to the project.

FOR THE DIRECTOR OF ENGINEERING AND CONSTRUCTION:

Encl
nc


HERBERT H. KENNON
Chief, Engineering Division
Directorate of Engineering
and Construction

CELMV-ED-PG (CELMN-ED-SP/20 Oct 88) (1105-2-10c) 3d End Mr. Miskelley/ts/5922
SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane Protection Project -
General Design Conference

DA, Lower Mississippi Valley Division, CE, Vicksburg, MS 39181-0080

24 APR '89

FOR CDR USACE (CEEC-EP), WASH DC 20314-1000

1. As discussed informally on several occasions with members of the HQUSACE staff the plan of action outlined in the enclosed CELMN-LC memorandum, 13 Apr 89, subject: Westwego to Harvey Canal, Louisiana, Hurricane Protection Project, (encl 2), is proposed. Basically the plan includes submission of an Engineering Supplement to the Feasibility Report. The cost estimates will be prepared using detailed estimating procedures similar to procedures used in preparation of Fair and Reasonable estimates used in evaluating bids on construction contracts. The recently formulated code of accounts, required by EC 1110-2-538, will be used to identify cost items.

2. The documentation requested in paragraph 5 of your 2d Endorsement is enclosed (encl 3).

3. Expeditious approval of the proposed plan of action and outline for the Engineering Supplement is recommended.

FOR THE COMMANDER:



FRED H. BAYLEY III
Chief, Engineering Division

3 Encls
1. nc
added 2 encls
2-3. as

CF:
CELMN-LC
CELMN-ED-SP

CEEC-EP (CELMN-ED-SP/20 Oct 88) (1105-2-10c) 4th End
KAMIEN/vs/272-8894
SUBJECT: West Bank of the Mississippi River in the Vicinity of
New Orleans, LA. (Westwego to Harvey Canal, Louisiana Hurricane
Protection Project)

HQ, U.S. Army Corps of Engineers, Washington, DC 20314-1000
10 May 1989

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

1. Background.

a. On 31 March 1989, a briefing was held for ASA(CW) concerning the status of the Westwego to Harvey Canal, LA Hurricane Protection Project. Participating in the briefing were the New Orleans Deputy District Engineer for Project Management and the Life Cycle Project Manager for the Westwego to Harvey Canal Project. The purpose of the briefing was to evaluate options available for initiating Federal construction on the project by March 1990, as desired by the local sponsor.

b. Because of the uncertainty of funding, it is necessary to have a GDM suitable as a decision document for two potential funding scenarios:

1) Qualifying the project as an FY91 New Construction Start. The decision document will be needed by July-August 1989.

2) If Congress adds construction funds in FY90, a decision document is needed by October 1989 to allow for initiation of construction by March 1990.

c. It is understood that engineering and design through Plans and Specifications is underway for the Harvey Canal Floodwall feature of the project, which will be the first feature under construction.

2. In order to accelerate the schedule, the GDM must be of a reduced scope and detail compared with the GDM presently scheduled for approval in February 1990. However, it must be of sufficient scope to determine a firm forecast final cost estimate that would serve as the basis to execute the LCA. This concept was endorsed by ASA(CW).

3. The proposed plan of action and outline is approved subject to the following clarifying comments:

a. Affirm the authorized plan.

CEEC-EP

SUBJECT: West Bank of the Mississippi River in the Vicinity of New Orleans, L.A. (Westwego to Harvey Canal, Louisiana Hurricane Protection Project)

b. Contain a discussion of cost sharing (including the appropriate sections of the law) and Section 104 credits.

c. Include a draft LCA (See ER 1165-2-131) and a FEIS and if necessary, an SEIS.

d. Discuss the similarities and contrasts between the current plan and the authorized plan (i.e., to insure that the plan we build is still the authorized plan). This presentation will include a comparison of the estimated total project costs to the Section 902 cost limit.

e. If applicable, discuss induced damage mitigation costs.

f. Discuss real estate requirements and OMRR&R costs.

4. The cost estimate display and discussion should include the following:

a. Cost estimates in a Reduced Scope GDM must be the traditional GDM scope cost estimate using the new code of accounts.

b. Display first costs for construction and LERRD's for each project purpose (e.g. recreation structural flood control and nonstructural flood control).

c. Display environmental mitigation and environmental enhancement costs.

d. Display and discuss cost sharing separately for construction and LERRD's. If land enhancement benefits occur (unless incidental), display, the land enhancement cost sharing as a separate line item according to the applicable policy.

e. The costs of the Lands, Easements, Rights-of-Way, Relocations, and Dredged Material Disposal Areas will be displayed individually (e.g., utilities).

f. Operation, Maintenance, Repair, Replacement, and Rehabilitation will be displayed individually for each project purpose and environmental enhancement, if included.

5. EC 1105-2-176 (31 March 1989) provides guidance on computing the Section 902 limit for a project.

6. Your document should more appropriately be titled General Design Memorandum (Reduced Scope).

7. Please provide milestone schedule based on the above guidance.

CEEC-EP

SUBJECT: West Bank of the Mississippi River in the Vicinity of
New Orleans, L.A. (Westwego to Harvey Canal, Louisiana Hurricane
Protection Project)

8. Questions can be directed to Douglas J. Kamien, (202)
272-8894.

FOR THE DIRECTOR OF ENGINEERING AND CONSTRUCTION:



HERBERT H. KENNON
Chief, Engineering Division
Directorate of Engineering
and Construction

3 Encls
nc

CF: CECW-RN
CECW-BC

15 Sep 88

MEMORANDUM FOR RECORD

SUBJECT: Westwego to Harvey, LA - General Design Conference

Dates of Conference: 13 & 14 September 1988Place of Conference: New Orleans District Office
New Orleans, LAAttendance: List of attendants is enclosed (Encl 1)

Conference Purpose: The purpose of the General Design Conference was to discuss the current project plan, background, objectives, schedules, costs, design options, major issues or problem areas and types of documents to be submitted.

Conference SummaryA. Field Trip

On 13 Sep 1988, a field trip was arranged for the conference participants. The existing conditions, the work currently being done by the local sponsor and the salient features to be proposed in the GDM, were described at key locations along the project alignment.

B. Design Conference

The design conference was held on 14 Sep 88. Participation generally followed the agenda shown on Encl 2 with attendants participating in the form of comments or questions invited at anytime during the course of the presentations and discussions. A brief history of the project including the status of local cooperation was given. The reasoning behind preparing the design of floodwall along Harvey Canal in the form of an advance supplement was discussed at length. The local sponsor of the project has already had funds appropriated by the State of Louisiana and has to start construction by March 1990 to avoid forfeiture of these funds. Mention was made of the fact that \$4.5 million in state funds and \$1.2 million in levee district funds are available for the construction of the floodwall along Harvey Canal. It was also mentioned that the local sponsor has submitted a letter indicating their willingness to enter into an LCA for the V-levee north plan. Regarding the current status of the project, the participants were advised that the advance supplement is scheduled to be submitted to LMVD on 31 Oct 88 and is currently on schedule. A draft LCA will not be sent with the supplement.

CELMN-ED-SP

SUBJECT: Westwego to Harvey, LA - General Design Conference

The LCA is scheduled to be completed and signed prior to the start of construction of the floodwall along Harvey Canal. It was mentioned by LMVD that approval of the Advance Supplement will be subject to signing of the Record of Decision. A new construction start will be needed for FY 90 but no federal funds will be needed for the first year of construction as local contributions will be used. The GDM is scheduled for submission to LMVD in Feb 1990. Some delay is being experienced in obtaining the right of entry for the field surveys, which in turn, may affect the GDM completion schedule.

The current project plan as contained in the Feasibility Report of Dec 1986 does not tie the proposed levee at Bayou Segnette Pumping Station to SPH protection. Alternatives to provide SPH protection in this area were discussed. The participants were advised that further investigations of these alternatives will be done to select the proposed plan and the result of these investigations presented in the GDM. Detailed designs for this area will be included in a supplement to the GDM.

The 20 percent project cost exceedence limit referred in the Water Resources Development Act of 1986 (PL99-662) section 902, was discussed in light of additional work. New Orleans District position is that the project plan signed by the Secretary of Army, should become the basic project to which the 20% exceedence limit will be applicable. (For further discussion, please refer to Encl 3)

Status of the study for hurricane protection for areas east of Harvey Canal and feasibility of a floodgate at Harvey Canal was given. The preliminary report is scheduled for completion in Feb 1989.

Discussion was held on H&H considerations for the project design. It was explained that the finished grade of the levee reach on the western side of the "V" levee is 3 feet above the still water level. This freeboard is based on existence of wave runup. Two feet of freeboard was used on the east side because no significant wave activity is expected on that side of the project. It was agreed that a discussion of the effect of relative sea level change on the project should be included in the GDM.

Status of the F&M designs for the project was provided. Some confusion over the relationship of the work the locals are doing now and our designs was evident. It was explained that the work the locals are doing, is generally for interim protection and the extent of any credit due for their work

CELMN-ED-SP

SUBJECT: Westwego to Harvey, LA - General Design Conference

will depend on the compatibility of the work with the Corps recommended Plan. It was clarified that the selection of the recommended plan presented in the GDM will be based upon the cost-effectiveness evaluations of various alternative plans. The recommended plan will be used as a basis to determine the credit due to the local sponsor for their design and construction effort.

Status of structural design for the project was discussed. It was agreed that the possibility of higher uplift pressures on the pumping stations as a result of higher head on the pump station walls will be investigated in the GDM. Architectural treatment for the floodwalls was also discussed. Areas to be considered for treatment are around Bayou Segnette in the vicinity of Westbank Expressway, the floodwall along Harvey Canal, the Ames pumping station, and the Harvey pumping station.

It was agreed that safety issues for the area around the airport should be coordinated with the FAA. The possibility of a folding floodwall will be investigated.

Status of the levee designs was provided. Alternatives being considered were discussed. It was stated, that the levees adjacent to Jean Lafitte National Historic Park area and the EPA designated 404 (c) area will be designed to conform to V-Levee North Plan as recommended in the Chief of Engineers report.

A handout providing the status of the mitigation plan for the project was provided. A short discussion of the mitigation plan followed. It was suggested and agreed that there should be coordination with the National Park Service during the GDM process.

Summary of Recommendations by OCE and LMVD Participants:

The following is a summary of concerns and suggestions expressed during the GDC.

a. The following design documents will be submitted for this project.

REPORT	SCHEDULED SUBMITTAL
Advance Supplement	OCT 88
GDM	FEB 90
Supplement #1 (SPH protection for the Western side of Project)	To be determined
REDM (Mitigation)	To be determined

CELMN-ED-SP

SUBJECT: Westwego to Harvey, LA - General Design Conference

- b. A new construction start will be needed in FY 90 for the floodwall along Harvey Canal but no federal funds for construction work will be needed in that year.
- c. The completed LCA will be forwarded to LMVD no later than Oct 89. The LCA will include provisions for creditable items.
- d. Further research is needed to determine whether the 20% exceedence for project cost, (PL99-662, section 902), refers to the cost given in the WRDA or the cost of the project plan as approved by the Secretary of the Army. (Refer to Encl 3).
- e. Discussion of the effect of relative sea level change on the project will be included in the GDM.
- f. The possibility of higher uplift pressure on the pumping stations as a result of higher head on the walls will be investigated in the GDM.
- g. Architectural treatment for the floodwalls will be considered for areas around Bayou Segnette, Harvey Canal floodwall, the Ames pumping station and the Harvey Pumping stations.
- h. A folding floodwall will be investigated for the area around the airport.
- i. There will be coordination with National Park Service during the GDM process.
- j. The advance supplement, GDM and other reports will be reviewed by the cost-effectiveness review team.

PAM DELOACH
Project Engineering Section
Design Services Branch



ATTENDANCE RECORD



DATE(S) 14 Sept, 88	SPONSORING ORGANIZATION New Orleans District Corps of Engineers.	LOCATION New Orleans Dist. Office
------------------------	--	---

PURPOSE *General Design Conference
Westwego to Harvey Canal, Louisiana*

PARTICIPANT REGISTER *

NAME	ORGANIZATION	TELEPHONE NUMBER
Victor M. Agostinelli	CELMV-ED-TS	601-634-5932
Jim Miskelley	CELMV-ED-PG	601-634-5922
Fred Cover	CELMV-ED-P	601-634-5904
J.H. Lockhart, Jr.	CEEC-EH-D	202-272-8503
Bruce Wallace	CEEC-EB (General Engr)	202-234-3757
RON BURKHARD	CELMV-ED-TC	601-634-5930
JOE McCORMICK	CELMV-ED-WH	601-634-5919
Frank J. Hegler	CELMV-ED-G	601-634-5896
ASHLEY	CELMV-BC-D	601-634-5800
Pamela A. DeLoach	CELMN-ED-SP	504-862-2621
RAUL VELEZ	CELMN-ED-DL	504-862-1944
Larry L. Weed	CELMN-ED-DD	504-862-2668
Jack Bardwell	CELMV-ED-PG	601-634-5925
ERNEST BARTON	CELMN-ED-SP	504-862-2608
Harry Walton	CELMV-PD-F	601-634-5833
Tom Pallen	CELMV-PD-R	601-634-5857
LESLIE S. WAGUESPACK	CELMV-PD-FG	504-862-2503
Steve Finnegan	CELMNPD-RA	504 862-2553
Ed Nutter	CECW-PS	202 272-1974
Rich Jackson	CELMV-ED-G	601 634-5878
John Grieshaber	CELMN-ED-FS	
Trey Rossbr	CELMV-VE	601 634 5936
Dan Macdonald	CEMNFED-D	504 862 2140

LMV FORM 583-R
(replaces LMN 906)

* If you wish to be furnished a copy of the attendance record,
please indicate so next to your name.

Encl 1

Westwego to Harvey Canal, Louisiana
Hurricane Protection Project
General Design Conference
13 - 14 September 1988

New Orleans District, Corps of Engineers

AGENDA

13 September 1988

0900 - 1500 Field Trip

14 September 1988

Welcome - Introduction

Mr. Tufail

Project History/Current Status
Existing Conditions/Local Cooperation

Mr. Broussard

Status of GDM
Alternative Plans/Schedule
Heights of Protection
Westside Closure

Mr. Tufail

Floodgate Considerations for Harvey Canal

Mr. Wagaspack

Break

H&H Considerations

Development of SPH Stages
Hydraulic Sections (With/Without Wave Berm)
Interior Drainage

Lunch

Foundation Design

Investigations-(Borings/Testing)
Soil Conditions
Alternatives Considered

Break

Structural Design

Flood Wall
Levees
Alternative Plans

Break

Recommendations by OCE/LMVD participants
Wrap-up Discussions
End of Conference

Encl 2
6/12



DEPARTMENT OF THE ARMY

NEW ORLEANS DISTRICT CORPS OF ENGINEERS

P.O. BOX 60267

NEW ORLEANS, LOUISIANA 70160-0267

13 April 1989

REPLY TO
ATTENTION OF:

Executive Office

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

SUBJECT: Westwego to Harvey Canal, Louisiana, Hurricane
Protection Project

1. References:

a. CELMN-ED-SP memorandum dated 20 October 1988 and endorsements 1 and 2, subject: Westwego to Harvey Canal, Louisiana, Hurricane Protection Project - General Design Conference.

b. Briefing, 31 March 1989, by Mr. Bory Steinberg (CECW-R) for Mr. Robert Page, ASA(CW), concerning the subject project.

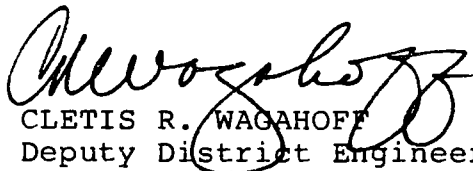
c. Draft ER 1110-2-XXXX, dated 31 March 1989, Engineering and Design for Civil Works Projects.

2. In accordance with reference 1a, 2nd endorsement, paragraph 3, the LCA for the subject project will not be executed until the GDM is approved. The GDM is scheduled for completion in February 1990. However, in order to initiate Federal construction by March 1990, assuming approval of an FY90 new construction start, the LCA must be executed by October 1989.

3. In an effort to decrease the time and effort between the approved project feasibility report and the start of construction, we propose to submit a report in accordance with the enclosed outline which will: (1) reaffirm the project scope, (2) present evidence to support a firm project cost estimate, and (3) verify the economic soundness of the project. This report will be the basis for negotiation and execution of the LCA. We will submit the report within 60 days of approval of the enclosed outline.

4. Recommend approval of the enclosed outline.

Enclosures


CLETIS R. WAGONHOFF
Deputy District Engineer
for Project Management

WESTWEGO TO HARVEY CANAL, LA
HURRICANE PROTECTION PROJECT
ENGINEERING SUPPLEMENT TO
FEASIBILITY REPORT-OUTLINE
=====

- I. Executive Summary.
- II. Project Authorization, Status and Description.
- III. Purpose and Scope.
 - A. Present project alignment and general project parameters based on current data.
 - B. Present current project cost estimate.
 - C. Present updated economic analysis.
- IV. Background.
 - A. General.
 - B. Inclusion of Harvey Canal Floodwall in Louisiana State Flood Control Program.
 - C. Original Plan of Action and Milestones to effect Floodwall contract award by March 1990.
 - D. Current Plan of Action and Milestones to effect Floodwall contract award by March 1990.
- V. Discussion of Design Data Currently Available.
- VI. Presentation of Designs based on Current Data.
 - A. Design criteria, methods and assumptions.
 - B. Plan and Profile sheets.
 - C. Typical design sections (see attachments numbered 1 and 2 for examples of level of detail).

VII. Project Cost Estimate.

- A. Estimates for contract items shown on attachment numbered 3.
- B. Discussion of level of confidence in design and cost estimates for each project Reach.
- C. Discussion of 20% cost increase limitation (Section 902, P.L. 99-662).

VIII. Schedule for Design and Construction.

IX. Update of Project Benefits.

- A. Project benefits.
- B. Benefit - cost ratio based on updated benefits and current project cost estimate.

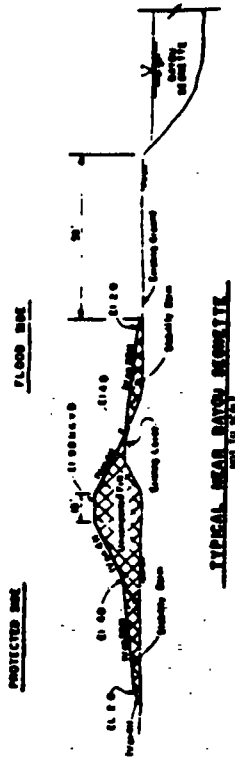
X. Environmental Information.

- A. Status of EIS.
- B. Mitigation.

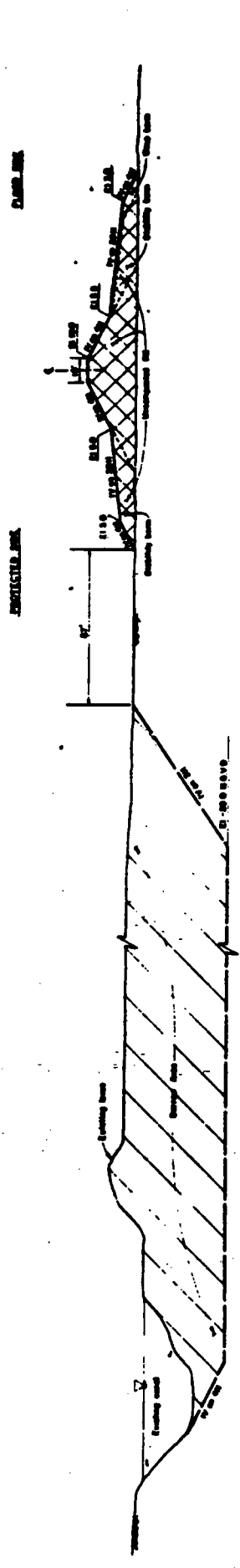
XI. Views of Local Cost Sharing Sponsor.

XII. Recommendation.

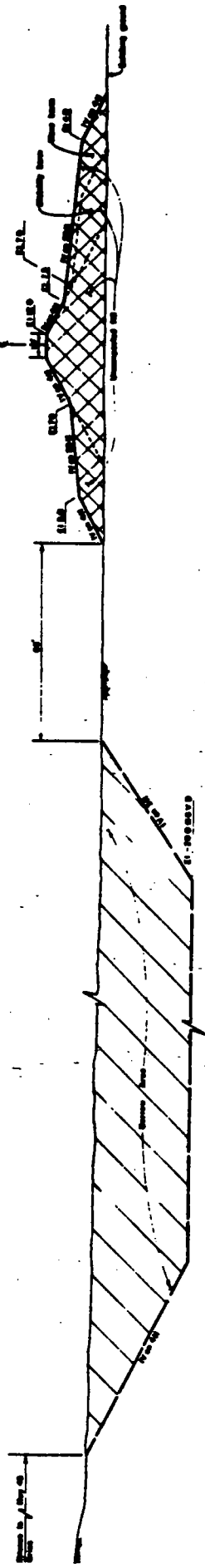
- A. Based on Engineering Supplement to Feasibility Report, proceed with execution of LCA in October 1989.



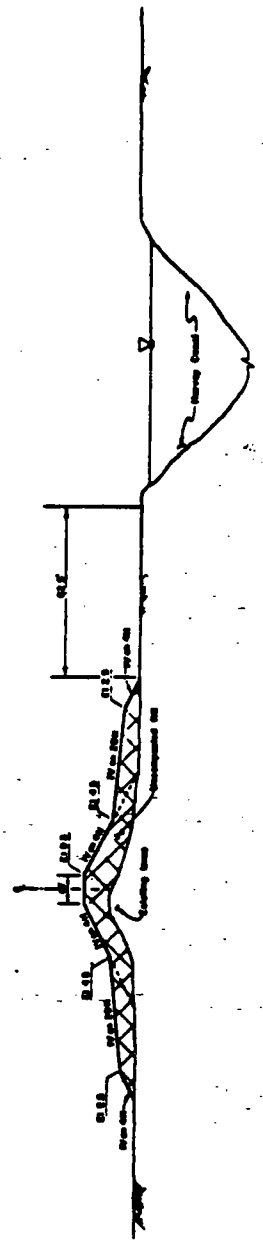
TYPICAL NEAR BAYOU NOUVELLE
NOT TO SCALE



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NOT TO SCALE

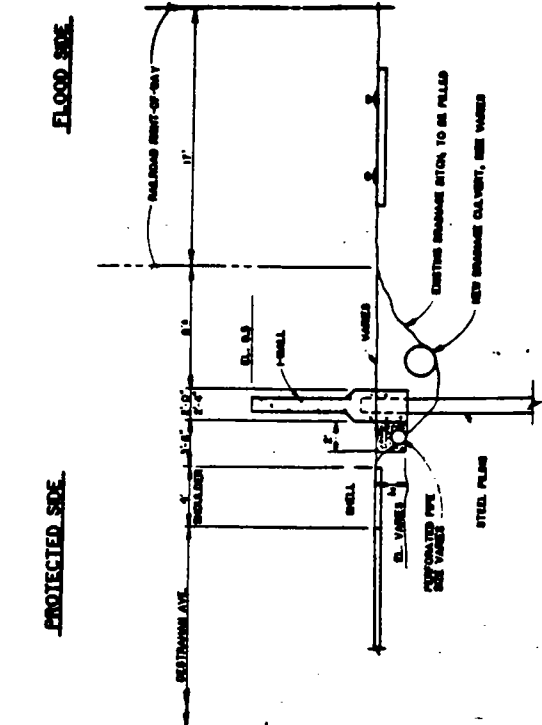


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NOT TO SCALE

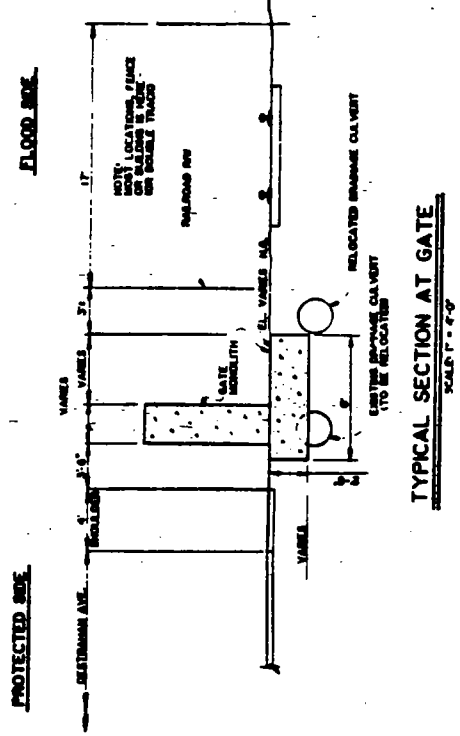


TYPICAL OF HARVEY CANAL
NOT TO SCALE

ATTCH 1



TYPICAL SECTION -1 WALL
SCALE: 1" = 4'-0"



TYPICAL SECTION AT GATE
SCALE: 1" = 4'-0"

WESTWEGO TO HARVEY CANAL, LA
HURRICANE PROTECTION PROJECT
CONTRACT ITEMS

(1ST LIFT)

BAYOU SEGNETTE P.S. TO OAK COVE
OAK COVE TO HWY 45
HWY 45 TO ESTELLE P.S.
ESTELLE P.S. TO HARVEY P.S.

(2ND LIFT)

BAYOU SEGNETTE P.S. TO OAK COVE
OAK COVE TO HWY 45
HWY 45 TO ESTELLE P.S.
ESTELLE P.S. TO HARVEY P.S.

(3RD LIFT)

BAYOU SEGNETTE TO HWY 45
HWY 45 TO HARVEY P.S.

(STRUCTURES/FLOODWALLS)

OAK COVE TO HWY 45-DRAIN STRUCT
HARVEY LOCK TO HARVEY P.S.-FLDWL
WESTWEGO P.S. FLDWL
ESTELLE P.S. FLDWL
HARVEY P.S. FLDWL
BAYOU SEGNETTE P.S. FLDWL
WESTWEGO AIRPORT FLDWL
AMES MT. KENNEDY-OAK COVE FLDWL
COUSINS P.S. FLDWL
HWY 45 & LAFITTE HWY-GATES
WEST SIDE TIE-IN WALL
EAST SIDE TIE-IN WALL

(PUMPING STATIONS)

WESTWEGO P.S.
ESTELLE P.S.
HARVEY P.S.
BAYOU SEGNETTE P.S.
AMES MT. KENNEDY & OAK COVE P.S.
COUSINS P.S.



LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
P.O. Box 94245, Baton Rouge, Louisiana 70804-9245

NEIL L. WAGONER, P.E.
SECRETARY

BUDDY ROEMER
GOVERNOR

FAX Ph. 379-1393

Office Ph. 379- 1473

F A X L E T T E R

TO: CELMN-LC-Terral Broussard

FROM: Dot McConnell

DATE: 01-30-89

Total of pages including cover sheet 9

MESSAGE: _____



Robert G. Graves
Secretary

Department of Transportation and Development

P. O. BOX 94245
BATON ROUGE, LA. 70804-9245



Edwin W. Edwards
Governor

March 5, 1986

Mr. Ernest J. Tassin, Exec. Director
West Jefferson Levee District
403 Barataria Blvd.
Marrero, Louisiana 70072

Dear Mr. Tassin:

The 1985 Regular Session of the Louisiana Legislature has provided funding for the Statewide Flood Control Program in accordance with the prioritized list of projects presented by the Joint Legislative Committee on Transportation, Highways, and Public Works. The authorized level of funding is sufficient to allow for the construction of the Destrehan Ave./Harvey Canal project. Funding scheduled is as follows:

<u>Sponsor</u>	<u>Project Name</u>	<u>S.P. No.</u>	<u>Estimated Const. Cost</u>	<u>LA Funding Share</u>
West Jefferson Levee District	Destrehan Ave. Floodgate/Harvey Canal Floodwall	576-26-02	\$ 6,493,018	\$ 2,457,807

The amount indicated as Louisiana's Funding Share does not reflect adjustments which may be made pursuant to RS38:90.12(c).

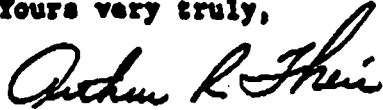
Please note the state project number that has been assigned to your project and use it for reference in all future correspondence.

Before we can proceed with the project, you will be required to enter into an agreement with DOTD. We are currently preparing an agreement for your signature and will forward it to you as soon as possible. In accordance with this agreement, the Office of Public Works will develop plans and specifications, prepare rights-of-way drawings, assist you in obtaining permits and assist you in developing any utility relocation information. Specific instructions for advertising, bidding, awarding of the contract, administration of the contract and payment release will be defined in the "Statewide Flood Control Procedural Manual". A copy of this manual will be forwarded to you at a later date.

①

We are looking forward to working with you toward reduction of flood damages in your area. If we can provide you with additional information, members of my staff can be reached at (504) 379-1473.

Yours very truly,



ARTHUR R. THEIS, CHAIRMAN
FLOOD CONTROL EVALUATION COMMITTEE

ART/DMc:clw

Enclosure

cc: Ms. Mona George
Ms. Delmar Fulmer
Dr. Charles Groat
Mr. Glen Daigre
Mr. J. C. McGrew
Attn: Geneva Grille
Senator Elwyn Nicholson
Senator Fritz Windhorst
Representative N. J. Damico
Representative J. Chris Uilo



Robert G. Graves
Secretary

Department of Transportation and Development

P. O. BOX 94245
BATON ROUGE, LA. 70804-9245

(504) 379-1473
August 29, 1986



Edwin W. Edwards
Governor

Mr. Ernest J. Tassin, Executive Director
West Jefferson Levee District
403 Barataria Blvd.
Marrero, LA 70072

Dear Mr. Tassin:

The 1986 Regular Session of the Louisiana Legislature has provided funding for the Statewide Flood Control Program in accordance with the prioritized list of projects presented by the Joint Legislative Committee on Transportation, Highways and Public Works. The authorized level of funding is sufficient to allow commitment of the balance necessary to complete the State's 70% share for the Destrehan Ave. Floodgate/Harvey Canal Floodwall project.

Our letter of March 5, 1986 indicated that \$2,457,807 was being made available from Fiscal Year 85-86 funds. At this time we are able to supplement that amount by an additional \$2,087,306. Therefore the total state funding made available to the project is \$4,545,113. In accordance with the Statewide Flood Control Program's guidelines, this represents 70% of the project's estimated construction cost. Funding scheduled is as follows:

<u>Sponsor</u>	<u>Project</u>	<u>State Project No.</u>	<u>Estimated Const. Cost</u>	<u>LA Funding Share</u>
West Jefferson Levee District	Destrehan Ave. Floodgate/ Harvey Canal Floodwall	576-26-02	\$6,493,018	\$4,545,113

Please do not hesitate to contact this office if you require additional information.

Yours very truly,

Arthur R. Theis
ARTHUR R. THEIS, CHAIRMAN
FLOOD CONTROL EVALUATION COMMITTEE

ART/DMc:bl

Mr. Ernest J. Tassin, Executive Director
West Jefferson Levee District
August 29, 1986
Page 3

cc: Senator Elwyn Nicholson
Senator Frits Windhorst
Representative N. J. Damico
Representative J. Chris Ulio
Ms. Mona George
Ms. Delmar Fulmer
Dr. Charles Groat
Mr. Glen Daigre
Mr. John Evanco
Attn: Ms. Geneva Grille



Robert G. Graves
Secretary

Department of Transportation and Development

P. O. BOX 94245
BATON ROUGE, LA. 70804-9245

(504) 379-1473
September 16, 1986



Edwin W. Edwards
Governor

Mr. Ronald R. Besson
President
West Jefferson Levee District
403 Barataria Blvd.
Marrero, LA 70072

Dear Mr. Besson:

I have received your letter concerning the Destrehan Avenue Floodgate/Harvey Canal Floodwall project (State Project Number 576-26-02). This project was approved and funded through the Statewide Flood Control Program. You received notification of that funding in our letter of March 5, 1986. Under the regulations governing the Statewide Flood Control Program at the time your project was funded, the money will remain dedicated for four (4) years from the date of that letter. Funding will not be jeopardized as long as a construction contract is awarded within that time period.

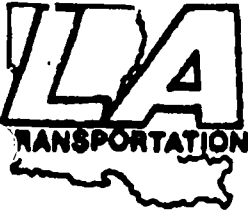
The project addresses a serious flooding problem and I understand your concern that it be accomplished in a timely manner. Since DOTD is handling all engineering aspects of the project on your behalf, I can assure you they will be completed within the time frame required by the Statewide Flood Control Program.

Thank you for your inquiry and do not hesitate to call if I can be of further assistance.

Sincerely,

ROBERT G. GRAVES
SECRETARY

RGG/DMc:bl



LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
P.O. Box 94245, Baton Rouge, Louisiana 70804-9245

NEIL L. WAGONER, P.E.
SECRETARY

BUDDY ROEMER
GOVERNOR

(504) 379-1435

October 24, 1988

STATE PROJECT NO. 576-26-02
FLOOD CONTROL IMPROVEMENTS TO
HARVEY CANAL (WEST BANK) FLOODWALL
JEFFERSON PARISH

Mr. Ronald R. Besson, President
West Jefferson Levee District
403 Baratavia Boulevard
Marrero, LA 70072

Dear Mr. Besson:

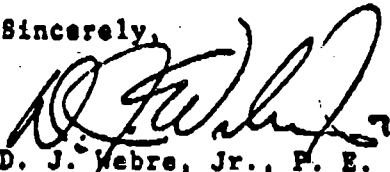
We have received your letter, dated October 13, 1988, requesting the U. S. Army, Corps of Engineers provide engineering services for the captioned project.

The Department has no objections to the Corps providing engineering services provided the project is developed in accordance with the Statewide Flood Control Program "Procedural Manual for Funded Projects" and a construction contract is awarded prior to March 5, 1990.

We will supplement our agreement so that DOTD will not provide the engineering services, but West Jefferson Levee District will be responsible for engineering services, so that you may contract with the Corps.

If we may be of additional service, please advise.

Sincerely,


D. J. Webre, Jr., P. E.
Project Support Chief

DJW/jfh

cc: Mr. Dempsey D. White
Mr. Ed Breckwoldt
Mr. Curtis G. Patterson
Mr. Fred Chatry, Corps of Engineers

STATE PROJECT NO. 576-26-02
FLOOD CONTROL IMPROVEMENTS TO
HARVEY CANAL (WEST BANK) FLOODWALL
JEFFERSON PARISH

THIS AGREEMENT, made and executed in three (3) original copies on this 1 day of January, 1991, by and between the Department of Transportation and Development, Office of Public Works, hereinafter referred to as "DOTD", and the West Jefferson Levee District, a political subdivision of the State of Louisiana, hereinafter referred to as "Sponsor";

WITNESSETH: That;

WHEREAS, under the provisions of Title 38, Louisiana Revised Statutes, "Public Contracts, Works and Improvements", as amended, funds have been appropriated to finance improvement projects on the approved Statewide Flood Control Construction Program under the direct administration of the DOTD; and

WHEREAS, the Sponsor has requested and has received an appropriation of State funds to finance a portion of the flood control project as described herein; and

WHEREAS, the Sponsor has self-generated funds available for its share of participation in the flood control project; and

WHEREAS, the Sponsor agrees to furnish all lands, easements, rights-of-way and spoil disposal areas necessary to construct and maintain the project without cost to the State; and

WHEREAS, the Sponsor agrees to operate and maintain the project in accordance with the "Operation and Maintenance Manual" approved by the DOTD; and

WHEREAS, the Sponsor agrees to assume all maintenance and operation costs for the project and all future alterations as may be required without cost to the State; and

WHEREAS, the Sponsor agrees to accomplish all necessary utility and any other facility relocations, alterations and maintenance without cost to the State; and

WHEREAS, the Sponsor agrees to provide at least thirty percent (30%) local participation for cost of constructing the project; and

WHEREAS, the DOTD agrees to provide no more than seventy percent (70%) participation for the cost of constructing the project or as modified by RS 38:90.12(c);

NOW, THEREFORE, in consideration of the premises and mutual dependent covenants herein contained, the parties hereto agree as follows:

WESTWEGO TO HARVEY CANAL LA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

APPENDIX D

DRAFT LOCAL COOPERATION AGREEMENT

LOCAL COOPERATION AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
WEST JEFFERSON LEVEE DISTRICT
FOR CONSTRUCTION OF THE
WEST BANK HURRICANE PROTECTION LEVEE
(Westwego to the Harvey Canal)
JEFFERSON PARISH, LOUISIANA

THIS AGREEMENT, entered into this _____ day of _____ 1989, by and between the DEPARTMENT OF THE ARMY (hereinafter referred to as the "Government"), acting by and through the Assistant Secretary of the Army (Civil Works), and the WEST JEFFERSON LEVEE DISTRICT (hereinafter referred to as the "Local Sponsor"), acting by and through Ronald R. Besson

WITNESSETH, THAT:

WHEREAS, construction of the West Bank Hurricane Protection Levee at Westwego to the Harvey Canal, Jefferson Parish, Louisiana (hereinafter referred to as the "Project", as defined in Article I.a. of this Agreement), was authorized by Section 401 of the Water Resource Development Act of 1986, Public Law 99-662; and,

WHEREAS, Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, specifies the cost-sharing requirements applicable to the Project; and,

WHEREAS, Section 221 of the Flood Control Act of 1970, Public Law 91-611, as amended, provides that the construction of any water resource project by the Secretary of the Army shall not be commenced until non-Federal interest has entered into a written agreement to furnish its required cooperation for the project; and,

WHEREAS, on 13 May 1988, the Assistant Secretary of the Army, Civil Works, approved a credit, subject to audit, with an estimated value of \$6,700,000 for West Jefferson Levee District towards West Jefferson District's share of the project cost for external work done during the 5-year period prior to enactment of the Water Resources Development Act of 1986. Hence, the value of this work is additive to the reporting officer's estimate of the

Encl 1

project cost. Furthermore, on 28 March 1989 the Assistant Secretary of the Army, Civil Works, approved a credit subject to audit, with an estimated value of \$21,400,000 for West Jefferson Levee District towards West Jefferson Levee District's share of the project cost for work accomplished or to be accomplished subsequent to enactment of the Water Resources Development Act of 1986, 17 November 1986. This credit is in accordance with Section 104 of this Act;

WHEREAS, the Local Sponsor does not qualify for a reduction of the maximum non-Federal cost share pursuant to the guidelines which implement Section 103(m) of the Water Resources Development Act of 1986, Public Law 99-662, published in 33 C.F.R., sections 241.1 - 6, entitled "Flood Control Cost-Sharing Requirements Under the Ability to Pay Provision"; and

WHEREAS, the Local Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in cost-sharing and financing in accordance with the terms of this Agreement;

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS AND GENERAL PROVISIONS

For purposes of this Agreement:

a. The term "Project" shall mean the provision of standard project hurricane protection to the areas between Westwego and the Harvey Canal on the west bank of the Mississippi River in the vicinity of New Orleans, Louisiana and consisting of approximately 22 miles of Levee and 2 miles of floodwalls in accordance with the plan delineated in the reduced scope General Design Memorandum.

b. The term "total project costs" shall mean all costs incurred by the Local Sponsor and the Government directly related to construction of the Project. Such costs shall include, but not necessarily be limited to, continuing planning and engineering costs incurred after October 1, 1985, costs of applicable engineering and design; actual construction costs; supervision and administration costs; costs of contract dispute settlements or awards, mitigation and the value of lands, easements, rights-of-way, utility and facility alterations or relocations, and dredged material disposal areas provided for the Project by the Local Sponsor, but shall not include any costs for betterments, operation, repair, maintenance, replacement, or rehabilitation.

c. The term "period of construction" shall mean the time from the advertisement of the first construction contract to the time of acceptance of the Project by the Contracting Officer.

d. The term "Contracting Officer" shall mean the U.S. Army Engineer for the New Orleans District, or his designee.

e. The term "highway" shall mean any highway, thoroughfare, roadway, street, or other public or private road or way.

f. The term "relocations" shall mean alterations, modifications, lowering or raised in place, and/or new construction related to, but not limited to, existing: railroads, highways, bridges, railroad bridges and approaches thereto, buildings, pipelines, public utilities (such as municipal water and sanitary sewer lines, telephone lines, and storm drains), aerial utilities, cemeteries, and other facilities, structures, and improvements determined by the Government to be necessary for the construction, operation and maintenance of the Project.

g. The term "fiscal year" shall mean one fiscal year of the United States Government unless otherwise specifically indicated. The Government fiscal year begins on October 1 and ends on September 30.

h. The term "involuntary acquisitions" shall mean the acquisition of lands, easements and rights-of-way by eminent domain.

i. The term "functional portion of the Project" shall mean a completed portion of the Project as determined by the Contracting Officer to be suitable for tender to the Local Sponsor to operate and maintain in advance of completion of construction of the entire Project.

ARTICLE II - OBLIGATIONS OF THE PARTIES

a. The Government, subject to and using funds provided by the Local Sponsor and appropriated by the Congress of the United States, shall expeditiously construct the Project (including relocations of railroad bridges and approaches thereto), applying those procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations and policies. The Local Sponsor shall be afforded the opportunity to review and comment on all contracts, including relevant plans and specifications, prior to the issuance of invitations for bid. The Local Sponsor will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. The Government will consider the comments of the Local Sponsor, but award of contracts, modifications or change orders, and performance of all work on the Project (whether the work is performed under contract or by Government personnel), shall be exclusively within the control of the Government. In those cases

where notification of the Local Sponsor of a required contract modification or change order is not practicable prior to the issuance of Notice to Proceed such modification will be provided at the earliest day possible.

b. When the Government determines that the Project, or a functional portion of the Project is complete, the Government shall turn the completed Project or functional portion over to the Local Sponsor, which shall accept the Project or functional portion and be solely responsible for operating, repairing, maintaining, replacing, and rehabilitating the Project, or functional portion in accordance with Article VIII hereof.

c. As further specified in Article III hereof, the Local Sponsor shall provide all lands, easements, rights-of-way, to include any separable fish and wildlife mitigation lands, and dredged material disposal areas, and perform all relocations (excluding railroad bridges and approaches thereto, and excluding facilities necessary to maintain the existing interception and disposal of interior drainage at the line of protection) determined by the Government to be necessary for construction of the Project. At its sole discretion, the Government may perform relocations in cases where it appears that the Local Sponsor's contributions will exceed the maximum non-Federal cost share set out in Article VI.e.

d. If the value of the contributions provided under paragraph c. of this Article and the referenced credits approved by the Assistant Secretary of the Army (Civil Works) and verified by audit represent less than 35 percent of total project costs, the Local Sponsor shall provide, during the period of construction, an additional cash contribution in the amount necessary to make its total contribution equal to 35 percent of total project costs.

e. The government shall apply credit, as verified by audit, for external compatible work performed prior to enactment of the Water Resources Development Act of 1986, 17 November 1986, by the Local Sponsor and work performed or to be performed subsequent to enactment of the Act in accordance with Section 104 of the Act. The credit shall be applied against the Local Sponsor's cost-sharing requirements for the project. The Local Sponsor's total cost-sharing requirements are presently estimated to be \$29,700,000.

f. No Federal funds may be used to meet the Local Sponsor share of project costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified in writing by the granting agency.

g. The Local Sponsor agrees to participate in and comply with applicable Federal flood plain management and flood insurance programs.

h. No less than once each year the Local Sponsor shall inform affected interests of the limitations of the protection afforded by the Project.

1. The Local Sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

**ARTICLE III - LANDS, FACILITIES, AND PUBLIC LAW 91-646
RELOCATION ASSISTANCE**

a. Prior to the advertisement for any construction contract, the Local Sponsor shall furnish without cost to the Government all lands, easements, and rights-of-way, including suitable borrow and dredged material disposal areas, as may be determined by the Government to be necessary for construction, operation and maintenance of the Project, and shall furnish to the Government evidence supporting the Local Sponsor's legal authority to grant rights-of-entry to such lands.

b. The Local Sponsor shall provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged material disposal areas necessary for construction of the Project.

c. Upon notification from the Government, the Local Sponsor shall accomplish or arrange for accomplishment at no cost to the Government all relocations (excluding railroad bridges and approaches thereto, and excluding facilities necessary to maintain the existing interception and disposal of interior drainage at the line of protection) determined by the Government to be necessary for construction of the Project.

d. The Local Sponsor shall comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way for construction and subsequent operation and maintenance of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

ARTICLE IV - VALUE OF LANDS AND FACILITIES

a. The value of the lands, easements, and rights-of-way to be included in total project costs and credited towards the Local Sponsor's share of total project costs will be determined in accordance with the following procedures:

1. If the lands, easements or rights-of-way are owned by the Local Sponsor as of the date the first construction contract for the Project is awarded, the credit shall be the fair market value of the interest provided to the Government by the Local Sponsor at the time of such award. The fair market value shall be determined by an appraisal, to be obtained by the Local Sponsor, which has been prepared by a qualified appraiser who is acceptable to both the Local Sponsor and the Government. The appraisal shall be reviewed and approved by the Government.

2. If the lands, easements, or rights-of-way are to be acquired by the Local Sponsor after the date of award of the first construction contract for the Project, the credit shall be the fair market value of the interest at the time such interest is acquired. The fair market value shall be determined as specified in Article IV.a.1. of this Agreement. If the Local Sponsor pays an amount in excess of the appraised fair market value, it may be entitled to a credit for the excess if the Local Sponsor has secured prior written approval from the Government of its offer to purchase such interest.

3. If the Local Sponsor acquires more lands, easements, or rights-of-way than are necessary for project purposes, as determined by the Government, then only the value of such portions of those acquisitions as are necessary for project purposes shall be included in total project costs and credited towards the Local Sponsor's share.

4. Credit for lands, easements and rights-of-way in the case of involuntary acquisitions which occur within a four-year period preceding the date this Agreement is signed or which occur after the date this Agreement is signed will be based on court awards, or on stipulated settlements that have received prior Government approval.

5. Credit for lands, easements, or rights-of-way acquired by the Local Sponsor within a five-year period preceding the date this Agreement is signed, or at any time after this Agreement is signed, will also include the actual incidental costs of acquiring the interest, e.g., closing and title costs, appraisal costs, survey costs, attorney's fees, plat maps, and mapping costs, as well as the actual amounts expended for payment of any Public Law 91-646 relocation assistance benefits provided in accordance with the obligations under this Agreement.

b. The costs of relocations which will be included in total project costs and credited towards the Local Sponsor's share of total project costs shall be that portion of the actual costs as set forth below, and approved by the Government:

1. Highways and Highway Bridges: Only that portion of the cost as would be necessary to construct substitute bridges and highways to the design standard that the State of Louisiana would use in constructing a new bridge or highway under similar conditions of geography and traffic loads.

2. Utilities and Facilities (including railroads): Actual relocation costs, less depreciation, less salvage value, plus the cost of removal, less the cost of betterments. With respect to betterments, new materials shall not be used in any alteration or relocation if materials of value and usability equal to those in the existing facility are available or can be obtained as salvage from the existing facility or otherwise, unless the provision of new material is more economical. If, despite the availability of used material, new material is used, where the use of such new material represents an additional cost, such cost will not be included in total project costs.

ARTICLE V - CONSTRUCTION PHASING AND MANAGEMENT

a. To provide for consistent and effective communication between the Local Sponsor and the Government during the period of construction, the Local Sponsor and the Government shall appoint representatives to coordinate on scheduling, plans, specifications, modifications, contract costs, and other matters relating to construction of the Project. The Local Sponsor will be informed of any changes in cost estimates.

b. The representatives appointed above shall meet as necessary during the period of construction and shall make such recommendations as they deem warranted to the Contracting Officer.

c. The Contracting Officer shall consider the recommendations of the representatives in all matters relating to construction of the Project, but the Contracting Officer, having ultimate responsibility for construction of the Project, has complete discretion to accept, reject, or modify the recommendations.

ARTICLE VI - METHOD OF PAYMENT

a. The Local Sponsor shall provide, during the period of construction, its required share of total project costs as stated under Article II of this Agreement. Total project costs are presently estimated to be \$84,900,000. In order to meet its share, the Local Sponsor must provide a total contribution presently estimated to be \$29,700,000. The dollar amounts set forth in this Article are based upon the Government's best estimates which will reflect projection of costs, price level changes, and anticipated inflation and credits provided by the Local Sponsor. Such cost estimates are subject to adjustments based upon cost actually incurred and are not to be construed as the total financial responsibilities of the Government and the Local Sponsor.

b. The Local Sponsor shall provide its required contribution in proportion to the rate of Federal expenditures during the period of construction in accordance with the following provisions:

1. For purposes of budget planning, the Government shall notify the Local Sponsor by 31 July of each year of the estimated funds that will be required from the Local Sponsor to meet its share of total project costs for the upcoming fiscal year.

2. No later than 60 calendar days prior to the award of the first construction contract, the Government shall notify the Local Sponsor of the Local Sponsor's share of total project costs, including its share of costs attributable to the Project incurred prior to the initiation of construction, for the first fiscal year of construction. No later than 30 calendar days thereafter, the Local Sponsor shall verify to the satisfaction of the Government that it has deposited the requisite amount in an escrow account acceptable to the Government, with interest accruing to the Local Sponsor.

3. For the second and subsequent fiscal years of project construction, the Government shall, no later than 60 calendar days prior to the beginning of the fiscal year, notify the Local Sponsor of the Local Sponsor's share of total project costs for that fiscal year. No later than 30 calendar days prior to the beginning of the fiscal year, the Local Sponsor shall make the necessary funds available to the Government through the funding mechanism specified in Article VI.b.2. of this Agreement. As construction of the project proceeds, the Government shall adjust the amounts required to be provided under this paragraph to reflect actual costs.

4. If at any time during the period of construction the Government determines that additional funds will be needed from the Local Sponsor, the Government shall so notify the Local Sponsor, and the Local Sponsor, no later than 45 calendar days from receipt of such notice, shall make the necessary funds available through the funding mechanism specified in Article VI.b.2. of this Agreement.

c. The Government will draw on the escrow account provided by the Local Sponsor such sums as the Government deems necessary to cover contractual and in-house fiscal obligations attributable to the Project as they are incurred, as well as incurred by the Government prior to the initiation of construction.

d. Upon completion of the Project and resolution of all relevant contract claims and appeals, the Government shall compute the total project costs and tender to the Local Sponsor a final accounting of the Local Sponsor's share of total project costs. In the event the total contribution by the Local Sponsor is less than its minimum required share of total project costs, the Local Sponsor shall, no later than 90 calendar days after receipt of written notice, make a cash payment to the Government of whatever sum is required to meet its minimum required share of total project costs.

e. If the Local Sponsor's total contribution under this Agreement including lands, easements, rights-of-way, and relocations, and dredged material disposal areas provided by the Local Sponsor exceeds 50 percent of total project costs, the Government shall, subject to the availability of appropriations for that purpose, refund the excess to the Local Sponsor no later than 90 calendar days after the final accounting is complete.

ARTICLE VII - DISPUTES

Before any party to this Agreement may bring suit in any court concerning an issue relating to this Agreement, such party must first seek in good faith to resolve the issue through negotiation or other forms of nonbinding alternative dispute resolution mutually acceptable to the parties.

ARTICLE VIII - OPERATION AND MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION.

a. After the Government has turned the completed Project, or functional portion of the Project, over to the Local Sponsor, the Local Sponsor shall operate, maintain, repair, replace, and rehabilitate the completed Project, or functional portion of the Project, in accordance with regulations or directions prescribed by the Government.

b. The Local Sponsor hereby gives the Government a right to enter, at reasonable times and in a reasonable manner, upon land which it owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. If an inspection shows that the Local Sponsor for any reason is failing to fulfill its obligations under this Agreement without receiving prior written approval from the Government, the Government will send a written notice to the Local Sponsor. If the Local Sponsor persists in such failure for 30 calendar days after receipt of the notice, then the Government shall have a right to enter, at reasonable times and in a reasonable manner, upon lands the Local Sponsor owns or controls for access to the Project for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Government shall operate to relieve the Local Sponsor of responsibility to meet its obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy at law or equity to assure faithful performance pursuant to this Agreement.

ARTICLE IX - RELEASE OF CLAIMS

The Local Sponsor shall hold and save the Government free from all damages arising from the construction, operation, and maintenance of the Project, except for damages due to the fault or negligence of the Government or its contractors.

ARTICLE X - MAINTENANCE OF RECORDS

The Government and the Local Sponsor shall keep books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total project costs. The Government and the Local Sponsor shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the Project and resolution of all relevant claims arising therefrom, and shall make available at their offices at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the parties to this Agreement.

ARTICLE XI - GOVERNMENT AUDIT

The Government shall conduct an audit when appropriate of the Local Sponsor's records for the Project to ascertain the allowability, reasonableness, and allocability of its costs for inclusion as credit against the non-Federal share of project costs.

ARTICLE XII - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Local Sponsor agrees to comply with all applicable Federal and State laws and regulations, including section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XIII - RELATIONSHIP OF PARTIES

The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

ARTICLE XIV - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or resident commissioner, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE XV - COVENANT AGAINST CONTINGENT FEES

The Local Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Local Sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XVI - TERMINATION OR SUSPENSION

a. If at any time the Local Sponsor fails to make the payments required under this Agreement, the Secretary of the Army shall terminate or suspend work on the Project until the Local Sponsor is no longer in arrears, unless the Secretary of the Army determines that continuation of work on the Project is in the interest of the United States or is necessary in order to satisfy agreements with any other non-Federal interests in connection with the Project. Any delinquent payment shall be charged interest at a rate, to be determined by the Secretary of the Treasury, equal to 150 per centum of the average bond equivalent

rate of the 13-week Treasury bills auctioned immediately prior to the date on which such payment became delinquent, or auctioned immediately prior to the beginning of each additional 3-month period if the period of delinquency exceeds 3 months.

b. If the Government fails to receive annual appropriations for the Project in the amounts sufficient to meet project expenditures for the then-current or upcoming fiscal year, the Government shall so notify the Local Sponsor. After 60 calendar days either party may elect without penalty to terminate this Agreement pursuant to that Article or to defer future performance hereunder; however, deferral of future performance under this Agreement shall not affect existing obligations or relieve the parties of liability for any obligation previously incurred. In the event that either party elects to terminate this Agreement pursuant to this Article, both parties shall conclude their activities relating to the Project and proceed to a final accounting in accordance with Article VI. of this Agreement. In the event that either party elects to defer future performance under this Agreement pursuant to this Article, such deferral shall remain in effect until such time as the Government receives sufficient appropriations or until either party elects to terminate this Agreement.

ARTICLE XVII - NOTICES

a. All notices, requests, demands, and other communications required or permitted to be given this Agreement shall be deemed to have been duly given if in writing and delivered personally, given by prepaid telegram, or mailed by first-class (postage pre-paid), registered, or certified mail, as follows:

If to the local sponsor: West Jefferson Levee District
403 Barataria Boulevard
Marrero, Louisiana 70072

If to the Government: Department of the Army
U.S. Army Engineer District,
New Orleans
Corps of Engineers
ATTN: CELMN-DD-P
P.O. Box 60267
New Orleans, Louisiana 70160

b. A party may change the address to which such communications are to be directed by giving written notice to the other party in the manner provided in this Article.

c. Any notice, request, demand, or other communication made pursuant to this Article shall be deemed to have been received by the addressee at such time as it is personally delivered or seven calendar days after it is mailed, as the case may be.

ARTICLE XVIII - CONFIDENTIALITY

To the extent permitted by the law governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE XIX - SECTION 902 PROJECT COST LIMITS

The W.J. Levee Board has reviewed the provisions set forth in Section 902 of P.L. 99-662, as amended, and understands that Section 902 establishes a maximum construction cost for the project. For purposes of this Agreement, the Section 902 cost limit is \$ 94,700,000 as calculated on October 1, 1989.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the Assistant Secretary of the Army (Civil Works).

THE DEPARTMENT OF THE ARMY

WEST JEFFERSON LEVEE DISTRICT

BY:

ROBERT W. PAGE
Assistant Secretary
of the Army (Civil Works)

BY:

Ronald R. Besson
RONALD R. BESSON
President
Board of Commissioners
West Jefferson Levee
District

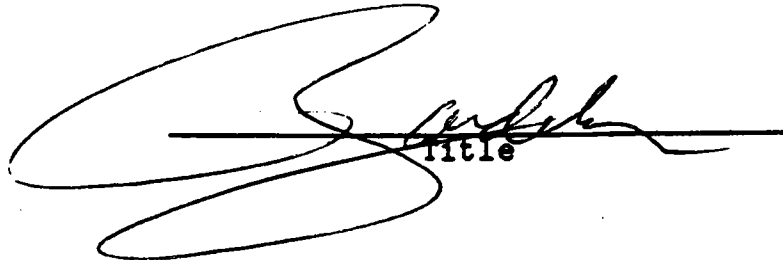
DATE: _____

DATE: 12/8/89

CERTIFICATE OF AUTHORITY

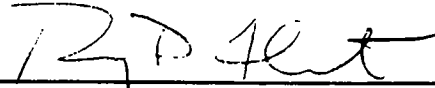
I, Owen Boudreau, do hereby certify that I am the principal legal officer of the WJLD, that the WJLD is a legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the Department of the Army and the WJLD in connection with the Project, and to pay damages, if necessary, in the event of the failure to perform, in accordance with Section 221 of Public Law 91-611, and that the persons who have executed this Agreement on behalf of the WJLD have acted within their statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 8th day of December 1989.


title

CERTIFICATION OF LEGAL REVIEW

The draft Local Cooperation Agreement for Westwego to Harvey Canal, Louisiana Hurricane Protection Project has been fully reviewed by this Office of Chief, Counsel, USAED, New Orleans.



JOSEPH A. TOWERS
District Counsel

WESTWEGO TO HARVEY CANAL LA
HURRICANE PROTECTION PROJECT
DESIGN MEMORANDUM NO. 1 GENERAL DESIGN
SUPPLEMENT NO. 2

APPENDIX E

DETAILED COST ESTIMATE

DETAILED ESTIMATE OF FIRST COST
(Oct 89 Price Levels)

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
01.-.-.-	LANDS AND DAMAGES					
01.-.-.-	LANDS AND DAMAGES, Bayou Segnette to Harvey Canal Pumping Station					
	Federal					
01.B.-.-	Post-Authorization Planning					
01.B.1.-	Cost Estimate	800		800	200	1,000
01.B.2.-	Acquisition Schedule	800		800	200	1,000
01.B.4.-	Sponsor Capability Evaluations	800		800	200	1,000
01.B.8.-	All Other					
01.C.-.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA	800		800	200	1,000
01.C.2.-	Final LCA	800		800	200	1,000
01.C.3.-	LCA Negotiations	2400		2400	620	3,020
01.C.8.-	All Other	1840		1840	470	2,310
01.D.-.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation	1120		1120	280	1,400
01.D.1.2	Document Review	800		800	200	1,000
01.D.1.3	LCA Compliance Reviews	800		800	200	1,000
01.D.2.-	Mapping, Survey and Tract Ownership					
01.D.2.1	Document Preparation	1120		1120	280	1,400
01.D.2.2	Document Review	800		800	200	1,000
01.D.2.3	LCA Compliance Reviews	800		800	200	1,000
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation	800		800	200	1,000
01.D.3.2	Document Review	800		800	200	1,000
01.D.3.3	LCA Compliance Reviews	960		960	240	1,200
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation	23200		23200	5910	29,110
01.D.4.2	Document Review	12000		12000	3050	15,050
01.D.4.3	LCA Compliance Reviews	1120		1120	280	1,400
01.D.5.-	Condemnations (Pre-DT Filing)					
01.D.5.1	Document Preparation	800		800	200	1,000
01.D.5.2	Document Review	800		800	200	1,000
01.D.5.3	LCA Compliance Reviews	800		800	200	1,000
01.E.-.-	Condemnation (Post-DT Filing)					
01.E.0.1	Document Preparation	1120		1120	280	1,400
01.E.0.2	Document Review	800		800	200	1,000

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
01.F.-.-	Appraisals					
01.F.1.-	Staff Appraisals			2000	510	2,510
01.F.1.1	Document Preparation			40000	10160	50,160
01.F.1.2	Document Review			960	240	1,200
01.F.1.3	LCA Compliance Reviews			2400	620	3,020
01.F.1.8	All Other					
01.H.-.-	Relocation Assistance					
01.H.1.-	PL 91-646					
01.H.1.1	Document Preparation			3600	920	4,520
01.H.1.2	Document Review			1040	260	1,300
	SUBTOTAL: Federal					107,680
	Contingencies					27,320
	SUBTOTAL: Federal					135,000
	Non-Federal					
01.B.-.-	Post-Authorization Planning					
01.B.1.-	Acquisition Schedule			1840	460	2,300
01.B.8.-	All Other			800	200	1,000
01.C.-.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA			1120	280	1,400
01.C.3.-	LCA Negotiations			2480	620	3,100
01.C.8.-	All Other			800	200	1,000
01.D.-.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation			2240	560	2,800
01.D.1.2	Document Review			800	200	1,000
01.D.1.3	LCA Compliance Reviews			800	200	1,000
01.D.2.-	Mapping, Survey and Tract Ownership					
01.D.2.1	Document Preparation			4320	1100	5,420
01.D.2.2	Document Review			4960	1260	6,220
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation			5040	1280	6,320
01.D.3.2	Document Review			2320	580	2,900
01.D.3.3	LCA Compliance Reviews			1600	400	2,000
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation			112800	28300	141,100
01.D.4.2	Document Review			56800	14270	71,070
01.D.4.3	LCA Compliance Reviews			1840	460	2,300
01.D.5.-	Condemnation (Pre-DT Filing)					
01.D.5.1	Document Preparation			7200	1800	9,000
01.D.5.2	Document Review			4000	1000	5,000
01.D.5.3	LCA Compliance Reviews			1840	460	2,300
01.E.-.-	Condemnation (Post-DT Filing)					
01.E.0.1	Document Preparation			12800	3220	16,020
01.E.0.2	Document Review			5600	1400	7,000

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
01.E.O.3	LCA Compliance Reviews			1840	460	2,300
01.F.-.-	Appraisals					
01.F.1.-	Staff Appraisals					
01.F.1.1	Document Preparation			150000	37620	187,620
01.F.1.8	All Other			50400	12710	63,110
01.H.-.-	Relocation Assistance					
01.H.1.-	PL 91-646					
01.H.1.1	Document Preparation			7200	1820	9,020
01.H.1.2	Document Review			2160	540	2,700
01.M.-.-	Real Estate Payments					
01.M.3.-	Land Payments			1,063,200	265,800	1,329,000 *
*From Real Estate Estimate No. 00309 (See Appendix B for copy of estimate)						
	SUBTOTAL: Non-Federal Contingencies					1,506,800
	SUBTOTAL: Non-Federal					377,200
	TOTAL: Bayou Segnette to Harvey Canal Pumping Station					1,884,000
	TOTAL: Bayou Segnette to Harvey Canal Pumping Station					2,019,000
01.-.-.-	LANDS AND DAMAGES, Westside Closure					
	Federal					
01.B.-.-	Post-Authorization Planning					
01.B.1.-	Cost Estimate			264	66	330
01.B.2.-	Acquisition Schedule			45	15	60
01.B.3.-	Real Estate Design Memorandum			45	10	55
01.B.4.-	Sponsor Capability Evaluations			180	45	225
01.B.8.-	All Other			45	10	55
01.C.-.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA			180	45	225
01.C.2.-	Final LCA			180	45	225
01.C.3.-	LCA Negotiations			136	34	170
01.C.8.-	All Other			45	10	55
01.D.-.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation			90	20	110
01.D.1.2	Document Review			90	20	110
01.D.1.3	LCA Compliance Reviews			45	10	55
01.D.1.8	All Other			136	34	170
01.D.2.-	Mapping, Survey and Tract Ownership					
01.D.2.1	Document Preparation			136	34	170
01.D.2.2	Document Review			45	10	55
01.D.2.3	LCA Compliance Reviews			45	10	55

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
			\$	\$	\$	\$
01.D.2.8	All Other			136	34	170
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation			907	223	1,130
01.D.3.2	Document Review			545	135	680
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation			8,776	2,184	10,960
01.D.4.2	Document Review			4,088	1,022	5,110
01.D.4.8	All Other			977	243	1,220
01.D.5.-	Condemnations (Pre-DT Filing)					
01.D.5.2	Document Review			271	69	340
01.D.5.3	LCA Compliance Reviews			271	69	340
01.D.5.8	All Other			180	45	225
01.E.-.-	Condemnation (Post-DT Filing)					
01.E.0.1	Document Preparation			701	179	880
01.E.0.2	Document Review			622	158	780
01.E.0.3	LCA Compliance Review			271	69	340
01.E.0.8	All Other			180	45	225
01.F.-.-	Appraisals					
01.F.1.-	Staff Appraisals					
01.F.1.1	Document Preparation			1,000	250	1,250
01.F.1.2	Document Review			5,000	1,250	6,250
01.F.1.3	LCA Compliance Reviews			1,000	250	1,250
01.F.1.8	All Other			1,000	250	1,250
01.H.-.-	Relocation Assistance					
01.H.1.-	PL 91-646					
01.H.1.1	Document Preparation			8,760	2,175	10,935
01.H.1.2	Document Review			2,114	526	2,640
01.H.1.3	LCA Compliance Reviews			180	45	225
01.H.1.4	Appeals			362	88	450
01.H.1.8	All Other			180	45	225
	SUBTOTAL: Federal					39,228
	Contingencies					9,772
	SUBTOTAL: Federal					49,000
	Non-Federal					
01.B.-.-	Post-Authorization Planning					
01.B.1.-	Cost Estimate			46	9	55
01.B.2.-	Acquisition Schedule			46	9	55
01.B.3.-	Real Estate Design Memorandum			46	9	55
01.B.4.-	Sponsor Capability Evaluations			180	40	220
01.B.8.-	All Other			46	9	55
01.C.-.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA			180	45	225
01.C.2.-	Final LCA			180	45	225
01.C.3.-	LCA Negotiations			136	34	170

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE \$	AMOUNT \$	CONTINGENCIES \$	PROJECT COST \$
01.C.6.-	All Other			46	9	55
01.D.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation			90	20	110
01.D.1.2	Document Review			90	20	110
01.D.1.3	LCA Compliance Reviews			90	20	110
01.D.1.8	All Other			90	20	110
01.D.2.-	Mapping, Survey and Tract Ownership					
01.D.2.1	Document Preparation			1,808	452	2,260
01.D.2.2	Document Review			90	20	110
01.D.2.3	LCA Compliance Review			46	9	55
01.D.2.8	All Other			317	83	400
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation			12,264	3,056	15,320
01.D.3.2	Document Review			3,504	866	4,370
01.D.3.3	LCA Compliance Reviews			362	88	450
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation			14,116	3,519	17,635
01.D.4.2	Document Review			13,030	3,250	16,280
01.D.4.3	LCA Compliance Reviews			90	20	110
01.D.4.8	All Other			1,366	344	1,710
01.D.5.-	Condemnations (Pre-DT Filing)					
01.D.5.1	Document Preparation			1,808	442	2,250
01.D.5.2	Document Review			904	226	1,130
01.D.5.3	LCA Compliance Reviews			362	88	450
01.D.5.8	All Other			542	138	680
01.E.-	Condemnation (Post-DT Filing)					
01.E.0.1	Document Preparation			10,478	2,612	13,090
01.E.0.2	Document Review			1,933	482	2,415
01.E.0.3	LCA Compliance Reviews			90	20	110
				180	50	230
01.F.-	Appraisals					
01.F.1.-	Contract Appraisals					
01.F.1.1	Document Preparation			50,000	12,490	62,490
01.F.1.8	All Other			10,000	2,490	12,490
01.H.-	Relocation Assistance					
01.H.1.-	PL 91-646					
01.H.1.1	Document Preparation			1,627	403	2,030
01.H.1.2	Document Review			24,800	6,190	30,990
01.H.1.3	LCA Compliance Reviews			7,189	1,801	8,990
01.H.1.4	Appeals			362	88	450
01.H.1.8	All Other			90	20	110
01.M.-	Real Estate Payments					
01.M.3.-	Land Payments			2,696,800	674,200	3,371,000 *

*From Real Estate Estimate No. 91215 (See Appendix B for copy of estimate)

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
	SUBTOTAL: Non-Federal Contingencies					2,855,424
	SUBTOTAL: Non-Federal					713,736
						3,569,160
01.-.-.-	TOTAL: West Side Closure					3,618,160
01.-.-.-	LANDS AND DAMAGES, Mitigation					
	Federal					
01.B.-.-	Post-Authorization Planning					
01.B.1.-	Cost Estimate			310	80	390
01.B.2.-	Acquisition Schedule			90	20	110
01.B.3.-	Real Estate Design Memorandum			90	20	110
01.B.4.-	Sponsor Capability Evaluations			90	20	110
01.B.8.-	All Other			90	20	110
01.C.-.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA			180	45	225
01.C.2.-	Final LCA			180	45	225
01.C.3.-	LCA Negotiations			180	45	225
01.C.8.-	All Other			180	45	225
01.D.-.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation			271	69	340
01.D.1.2	Document Review			45	10	55
01.D.1.8	All Other			45	10	55
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation			700	180	880
01.D.3.2	Document Review			350	90	440
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation					
01.D.4.2	Document Review					
01.D.4.3	LCA Compliance Reviews			4,316	1,084	5,400
01.D.5.-	Condemnations (Pre-DT Filing)			2,843	707	3,550
01.D.5.1	Document Preparation			180	50	230
01.D.5.2	Document Review			362	88	450
01.D.5.3	LCA Compliance Reviews			362	88	450
01.D.5.8	All Other			226	54	280
01.E.-.-	Condemnation (Post-DT Filing)					
01.E.0.1	Document Preparation			1,062	268	1,330
01.E.0.2	Document Review			178	178	890
01.E.0.3	LCA Compliance Review			180	50	230
01.E.0.8	All Other			180	50	230
01.F.-.-	Appraisals					
01.F.1.-	Staff Appraisals					

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
01.F.1.1	Document Preparation			1,000	250	1,250
01.F.1.2	Document Review			5,000	1,250	6,250
01.F.1.3	LCA Compliance Reviews			1,000	250	1,250
01.F.1.8	All Other			1,000	250	1,250
01.H.-	Relocation Assistance					
01.H.1.-	PL 91-646					
01.H.1.1	Document Preparation			350	90	440
01.H.1.2	Document Review			350	90	440
	SUBTOTAL: Federal					22,150
	Contingencies					5,550
	SUBTOTAL: Federal					27,700
	<u>Non-Federal</u>					
01.B.-	Post-Authorization Planning					
01.B.1.-	Cost Estimate			90	20	110
01.B.2.-	Acquisition Schedule			90	20	110
01.B.3.-	Real Estate Design Memorandum			90	20	110
01.B.4.-	Sponsor Capability Evaluations			90	20	110
01.B.8.-	All Other			90	20	110
01.C.-	Local Cooperation Agreement					
01.C.1.-	Draft LCA			180	50	230
01.C.2.-	Final LCA			180	50	230
01.C.3.-	LCA Negotiations			180	50	230
01.C.8.-	All Other			180	50	230
01.D.-	Acquisition					
01.D.1.-	Attorney's Opinion of Compensability					
01.D.1.1	Document Preparation			271	69	340
01.D.1.2	Document Review			45	10	55
01.D.2.-	Mapping, Survey and Tract Ownership					
01.D.2.1	Document Preparation			1,983	497	2,480
01.D.2.2	Document Review			691	169	860
01.D.2.3	LCA Compliance Review			45	10	55
01.D.2.8	All Other			45	10	55
01.D.3.-	Title Evidence					
01.D.3.1	Document Preparation			10,122	2,528	12,650
01.D.3.2	Document Review			3,494	876	4,370
01.D.3.3	LCA Compliance Reviews			180	50	230
01.D.3.8	All Other			180	50	230
01.D.4.-	Negotiations and Closings					
01.D.4.1	Document Preparation			10,660	2,675	13,335
01.D.4.2	Document Review			5,556	1,389	6,945
01.D.4.3	LCA Compliance Reviews			452	113	565
01.D.4.8	All Other			452	113	565
01.D.5.-	Condemnations (Pre-DT Filing)					
01.D.5.1	Document Preparation			1,808	452	2,260
01.D.5.2	Document Review			452	113	565

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
01.D.5.3	LCA Compliance Reviews				226	54	280
01.D.5.8	All Other				226	54	280
01.E.--	Condemnation (Post-DT Filing)						
01.E.O.1	Document Preparation				10,218	2,552	12,770
01.E.O.2	Document Review				3,255	815	4,070
01.E.O.3	LCA Compliance Reviews				180	50	230
01.E.O.8	All Other				180	50	230
01.F.--	Appraisals						
01.F.1.-	Contract Appraisals						
01.F.1.1	Document Preparation				20,000	5,000	25,000
01.F.1.8	All Other				5,000	1,250	6,250
01.J.--	Disposals						
01.J.1.-	Predisposal Activities				6,400	1,600	8,000
01.J.4.-	LCA Compliance Reviews				1,600	400	2,000
01.L.--	Encroachment and Trespass						
01.L.1.-	Prevention/Detection				4,000	1,000	5,000
01.M.--	Real Estate Payments						
01.M.3.-	Land Payments				819,000	205,000	1,024,000 *
*From Real Estate Estimate No. 91212 (See Appendix B for copy of estimate)							
	SUBTOTAL: Non-Federal						907,891
	Contingencies						227,249
	SUBTOTAL: Non-Federal						1,135,140
01.--	TOTAL: Mitigation						1,162,840
01.--	LANDS AND DAMAGES, Harvey Canal Floodwall						156,000
01.--	TOTAL: LANDS AND DAMAGES						6,956,000
02.--	RELOCATIONS						
02.1.--	ROADS, Floodwall and Floodgate at V-Levee						
02.1.1.-	CARE OF TRAFFIC						
02.2.1.B	Detour road at Lafitte -		LS	168,000.00	168,000	32,580	200,580
02.2.1.B	Detour road at Hwy 45		LS	53,000.00	53,000	10,270	63,270
	const. & removal						
	Lump Sum						
	Lump Sum						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
02.1.2.-	DRAINAGE						
02.1.2.B	Demolition & removal of existing culvert	Lump Sum	LS	75,000.00	75,000	14,550	89,550
02.1.2.B	Construction of replacement culvert and headwalls	Lump Sum	LS	700,000.00	700,000	135,790	835,790
02.1.3.-	ROAD SURFACING						
02.1.3.B	Construction of asphaltic concrete ramp and subgrade for Lafitte/Larose Hwy	Lump Sum	LS	1,160,000.00	1,160,000	213,020	1,373,020
02.1.3.B	Construction of asphaltic concrete ramp at Hwy 45	Lump Sum	LS	21,000.00	21,000	4,070	25,070
	SUBTOTAL: Floodwall and Floodgates at the V-Levee						2,177,000
	CONTINGENCIES						410,280
	SUBTOTAL: Floodwall and Floodgates at the V-Levee						2,587,280
02.0.2.-	ROADS, Oak Cove (PI Sta 425+45.77) to Vic HWY 45 (Sta 575+88.58)						
02.1.-.-	Ramp Construction	Lump Sum	LS	7,500.00	7,500	1,500	9,000
02.1.2.-	DRAINAGE						
02.1.2.B	66" CMP Culvert	Lump Sum	LS	20,000.00	20,000	3,900	23,900
	SUBTOTAL: Oak Cove to Vic HWY 45						27,500
	CONTINGENCIES						5,400
	SUBTOTAL: Oak Cove to Vic HWY 45						32,900
02.1.-.-	ROADS, Westside Closure						
02.1.-.-	Ramp construction; West Bank expressway (2), Park Ramp	3	EA	100,000.00	300,000	87,990	387,990
	SUBTOTAL: Westside Closure						300,000
	CONTINGENCIES						87,990
	SUBTOTAL: Westside Closure						387,990
02.3.2.-	UTILITIES, Floodwall between Bayou Segnette & New Westwego Pumping Stations						
02.3.2.Q	16" Dia H.P. gas pipeline (Louisiana Gas Service Co.) thru "I"-Wall with sleeve	1	EA	56,000.00	56,000	10,860	66,860
02.3.2.Q	24" Dia H.P. gas pipeline (United Gas Pipeline) thru "I"-Wall with sleeve	1	EA	127,000.00	127,000	24,650	151,650
02.3.2.Q	36" Dia municipal watermain thru "I"-Wall with sleeve	1	EA	35,300.00	35,300	6,850	42,150
02.3.2.Q	8" Dia waterline	1	EA	10,000.00	10,000	1,940	11,940

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
02.3.2.Q	6" Dia PVC Sewerline	1	EA	9,000.00	9,000	1,750	10,750
02.3.2.R	Relocate powerline pole	Lump Sum	LS	10,000.00	10,000	1,950	11,950
02.0.2.-	SUBTOTAL: Floodwall between Bayou Segnette & New Westwego Pumping Stations						247,300
	CONTINGENCIES						48,000
	SUBTOTAL: Floodwall between Bayou Segnette & New Westwego Pumping Stations						295,300
02.3.2.-	UTILITIES, Floodwalls at Ames, Mt. Kennedy, and Oak Cove Pumping Stations						
02.3.2.Q	22" Dia H.P. gas pipeline (Bridgeline Gas Dist. Co.)						
	Thru 1"-Wall with sleeve	1	EA	90,100.00	90,100	17,600	107,700
02.0.2.-	SUBTOTAL: Floodwalls at Ames, Mt. Kennedy, and Oak Cove Pumping Stations						90,100
	CONTINGENCIES						17,600
	SUBTOTAL: Floodwalls at Ames, Mt. Kennedy, and Oak Cove Pumping Stations						107,700
02.3.2.-	UTILITIES, Floodwall and Floodgates at V-Levee						
02.3.2.Q	10" Dia H.P. gas pipeline (Louisiana Gas Service Co.)						
	thru 1"-Wall with sleeve	1	EA	96,000.00	96,000	18,620	114,620
02.3.2.Q	8" dia H.P. gas pipeline (United Gas Pipeline)						
	thru 1"-Wall with sleeve	1	EA	85,700.00	85,700	16,620	102,320
02.3.2.Q	30" Dia municipal watermain						
	thru 1"-Wall with sleeve	1	EA	157,000.00	157,000	30,440	187,440
02.0.2.-	SUBTOTAL: Floodwall and Floodgates at V-Levee						338,700
	CONTINGENCIES						65,680
	SUBTOTAL: Floodwall and Floodgates at V-Levee						404,380
02.3.2.-	UTILITIES, Floodwalls at Cousins and Harvey Pumping Stations						
02.3.2.Q	36" Dia water line						
	thru 1"-Wall with sleeve	1	EA	35,300.00	35,300	6,670	41,970
02.3.2.Q	8" Dia water line						
	thru 1"-Wall with sleeve	1	EA	10,000.00	10,000	1,970	11,970
02.3.2.Q	16" Dia gas line						
	thru 1"-Wall with sleeve	2	EA	54,500.00	109,000	21,160	130,160
02.0.2.-	SUBTOTAL: Floodwalls at Cousins and Harvey Pumping Stations						154,300
	CONTINGENCIES						29,800
	SUBTOTAL: Floodwalls at Cousins and Harvey Pumping Stations						184,100
02.3.2.-	UTILITIES, Levees						
02.3.2.Q	H.V. Powerlines	Lump Sum	LS	270,000.00	270,000	52,360	322,360
02.3.2.Q	1-20" United Gas	Lump Sum	LS	182,000.00	182,000	35,320	217,320
02.3.2.Q	1-20" United Gas	Lump Sum	LS	182,000.00	182,000	35,310	217,310

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
02.3.2.Q	2000' Section 20" United Gas	Lump Sum	LS	100,000.00	100,000	19,400	119,400
02.3.2.Q	1-22" Texaco H.P. Gas	Lump Sum	LS	209,300.00	209,300	40,600	249,900
02.3.2.Q	1-10" Shell Products	Lump Sum	LS	70,200.00	70,200	13,620	83,820
02.3.2.Q	1-6" Southern Natural Gas	Lump Sum	LS	204,100.00	204,100	39,600	243,700
02.3.2.Q	1-22" Texaco H.P. Gas	Lump Sum	LS	209,000.00	209,000	40,540	249,540
	SUBTOTAL: Levees						1,426,600
02.0.2.-	CONTINGENCIES						276,750
	SUBTOTAL: Levees						1,703,350
02.-.-.-	RELOCATIONS, Harvey Canal Floodwall						1,299,000
02.-.-.-	TOTAL: RELOCATIONS						7,002,000
10.-.-.-	BREAKWATERS AND SEAWALLS						
10.0.1.-	BREAKWATERS, Mitigation Breakwater	Lump Sum	LS	25,000.00	25,000	1,500	26,500
10.0.A.-	Mob & Demob						
10.0.1.-	Segmented breakwater (3490' gross length)	3,000	FT	145.00	435,000	65,500	500,500
	SUBTOTAL: Mitigation Breakwater						460,000
10.0.2.-	CONTINGENCIES						67,000
	SUBTOTAL: Mitigation Breakwater						527,000
10.-.-.-	TOTAL: BREAKWATERS AND SEAWALLS						527,000
11.-.-.-	LEVEES AND FLOODWALLS						
11.0.1.-	LEVEES, New Westwego P.S. to East-West Levee (Sta. 186+73.12)						
	<u>1st Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	11,650	71,650
11.0.1.B	Clearing	95	AC	1,500.00	142,500	27,650	170,150
11.0.1.B	Uncompacted fill	257,200	CY	2.50	643,000	124,740	767,740
11.0.1.B	Fert & Seeding	28	AC	500.00	14,000	2,720	16,720
11.0.1.B	Plug	Lump Sum	LS	90,000.00	90,000	17,460	107,460
	<u>2nd Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	57	AC	500.00	28,500	5,550	34,050

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE \$	AMOUNT \$	CONTINGENCIES \$	PROJECT COST \$
11.0.1.B	Uncompacted fill	136,600	CY	2.00	273,200	53,000	326,200
11.0.1.B	Fert & Seeding	40	AC	500.00	20,000	3,880	23,880
11.0.1.B	Pulling & driving plug sheeting		LS	40,000.00	40,000	7,760	47,760
	<u>3rd Lift</u>						
11.0.A.-	Mob & Demob		LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	40	AC	500.00	20,000	3,880	23,880
11.0.1.B	Uncompacted fill	129,800	CY	1.60	207,680	40,290	247,970
11.0.1.B	Fert & Seeding	40	AC	500.00	20,000	3,880	23,880
11.0.1.B	Pulling & driving plug sheeting		LS	40,000.00	40,000	7,760	47,760
	<u>11.0.2.-</u>						
	SUBTOTAL: New Westwego P.S. to East-West Levee						1,698,880
	CONTINGENCIES						329,620
	SUBTOTAL: New Westwego P.S. to East-West Levee						2,028,500
11.0.1.-	LEVEES, East-West Levee (Sta. 188+73.12) to Oak Cove (PI Sta. 425+45.77)						
	<u>1st Lift</u>						
11.0.A.-	Mob & Demob		LS	60,000.00	60,000	11,630	71,630
11.0.1.B	Clearing	260	AC	1,500.00	390,000	75,640	465,640
11.0.1.B	Uncompacted fill	769,000	CY	2.50	1,922,500	353,350	2,275,850
11.0.1.B	Fert & Seeding	78	AC	500.00	39,000	7,570	46,570
11.0.1.B	Shell closure	10,000	CY	16.00	160,000	31,030	191,030
11.0.1.B	Plug		LS	90,000.00	90,000	17,460	107,460
11.0.1.B	Flotation Access		LS	30,000.00	30,000	5,820	35,820
	<u>2nd Lift</u>						
11.0.A.-	Mob & Demob		LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	78	AC	500.00	39,000	7,570	46,570
11.0.1.B	Uncompacted fill	384,500	CY	2.00	769,000	149,170	918,170
11.0.1.B	Fert & Seeding	78	AC	500.00	39,000	6,980	45,980
11.0.1.B	Pulling & Driving plug sheeting		LS	40,000.00	40,000	7,760	47,760
	<u>3rd Lift</u>						
11.0.A.-	Mob & Demob		LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	78	AC	500.00	39,000	7,570	46,570
11.0.1.B	Uncompacted fill	295,200	CY	1.60	472,320	91,610	563,930
11.0.1.B	Fert & Seeding	78	AC	500.00	39,000	7,570	46,570
11.0.1.B	Pulling & Driving plug sheeting		LS	40,000.00	40,000	7,750	47,750
	<u>11.0.2.-</u>						
	SUBTOTAL: East-West Levee to Oak Cove						4,268,820
	CONTINGENCIES						807,880
	SUBTOTAL: East-West Levee to Oak Cove						5,076,700

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
11.0.1.-	LEVEES, Oak Cove (PI Sta. 425+45.77) to Vic. Hwy 45 (Sta. 575+88.58)						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	11,660	71,660
11.0.1.B	Clearing	132	AC	1,500.00	198,000	38,420	236,420
11.0.1.B	Semi-compacted fill	397,600	CY	3.00	1,192,800	219,720	1,412,520
11.0.1.B	Fert & Seeding	36	AC	500.00	18,000	3,500	21,500
	SUBTOTAL: Oak Cove to Vic Hwy 45						1,468,800
	CONTINGENCIES						273,300
	SUBTOTAL: Oak Cove to Vic Hwy 45						1,742,100
11.0.1.-	LEVEES, Gap Closures						
11.0.A.-	Mob & Demob	Lump sum	LS	60,000.00	60,000	11,670	71,670
11.0.1.B	Clearing	34	AC	1,500.00	51,000	9,900	60,900
11.0.1.B	Semi-compacted fill	99,400	CY	3.00	298,200	57,860	356,060
11.0.1.B	Fert & Seeding	9	AC	500.00	4,500	870	5,370
	SUBTOTAL: Gap Closures						413,700
	CONTINGENCIES						80,300
	SUBTOTAL: Gap Closures						494,000
11.0.1.-	LEVEES, V-Line Levee, East of Vertex						
	<u>1st Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	80,000.00	80,000	15,500	95,500
11.0.1.B	Clearing	178	AC	1,500.00	267,000	51,800	318,800
11.0.1.B	Uncompacted fill	519,300	CY	2.50	1,298,250	238,960	1,537,210
11.0.1.B	Stripping	143,000	CY	1.50	214,500	41,610	256,110
11.0.1.B	Sand	242,200	CY	5.00	1,211,000	222,030	1,433,030
11.0.1.B	Fert & Seeding	44	AC	500.00	22,000	4,270	26,270
	<u>2nd Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	44	AC	500.00	22,000	4,270	26,270
11.0.1.B	Uncompacted fill	259,700	CY	1.60	415,520	80,610	496,130
11.0.1.B	Stripping	143,000	CY	1.50	214,500	41,630	256,130
11.0.1.B	Fert & Seeding	44	AC	500.00	22,000	4,270	26,270
	<u>3rd Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	50,000.00	50,000	9,700	59,700
11.0.1.B	Clearing	44	AC	500.00	22,000	4,270	26,270
11.0.1.B	Uncompacted fill	199,400	CY	1.60	319,040	61,890	380,930
11.0.1.B	Fert & Seeding	44	AC	500.00	22,000	4,280	26,280
	SUBTOTAL: V-Line Levee, East of Vertex						4,229,810
	CONTINGENCIES						794,790
	SUBTOTAL: V-Line Levee, East of Vertex						5,024,600

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
11.0.1.-	LEVEES, Estelle P.S. to Cousins P.S.						
	<u>1st Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	25,000.00	25,000	4,860	29,860
11.0.1.B	Clearing	78	AC	1,500.00	117,000	22,700	139,700
11.0.1.B	Uncompacted fill	248,800	CY	4.00	995,200	182,570	1,177,770
11.0.1.B	Fert & Seeding	46	AC	500.00	23,000	4,460	27,460
	<u>2nd Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	20,000.00	20,000	3,880	23,880
11.0.1.B	Clearing	46	AC	500.00	23,000	4,460	27,460
11.0.1.B	Uncompacted fill	124,400	CY	4.00	497,600	96,550	594,150
11.0.1.B	Fert & Seeding	46	AC	500.00	23,000	4,460	27,460
	<u>3rd Lift</u>						
11.0.A.-	Mob & Demob	Lump Sum	LS	25,000.00	25,000	4,850	29,850
11.0.1.B	Clearing	46	AC	500.00	23,000	4,460	27,460
11.0.1.B	Uncompacted fill	95,600	CY	4.00	382,400	74,190	456,590
11.0.1.B	Fert & Seeding	46	AC	500.00	23,000	4,460	27,460
11.0.2.-	SUBTOTAL: Estelle P.S. to Cousins P.S.						2,177,200
	CONTINGENCIES						411,900
	SUBTOTAL: Estelle P.S. to Cousins P.S.						2,589,100
11.0.1.-	LEVEES AND FLOODWALLS, Floodwall and Floodgates at Westwego Airport						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	8,640	68,640
11.0.1.-	LEVEES						
11.0.1.B	Clearing and Grubbing	1	AC	1,500.00	1,500	150	1,650
11.0.1.B	Semiconpacted fill levee (6 mile haul dist.)	2,900	CY	8.00	23,200	4,500	27,700
11.0.1.B	Seeding, fertilizing and mulching	1	AC	500.00	500	50	550
11.0.2.-	FLOODWALLS						
11.0.2.B	Structural excavation	590	CY	8.00	4,720	930	5,650
11.0.2.B	Structural backfill	160	CY	10.00	1,600	320	1,920
11.0.2.B	Steel sheet pile type P2-22	17,810	SF	12.00	213,720	20,080	233,800
11.0.2.B	Cold tar epoxy sheet piling	Lump Sum	LS	4,100.00	4,100	410	4,510
11.0.2.B	Prstd. Conc. Piles, 12"x12"	7,880	LF	18.00	141,840	20,430	162,270
11.0.2.C	T-Wall stab. slab	30	CY	70.00	2,100	210	2,310
11.0.2.C	T-Wall base slab	206	CY	200.00	41,200	3,880	45,080
11.0.2.C	T-Wall stem	202	CY	330.00	66,660	6,280	72,940
11.0.2.C	I-Wall stab. slab	30	CY	70.00	2,100	210	2,310
11.0.2.C	I-Wall stem	350	CY	330.00	115,500	10,850	126,350
11.0.2.C	Waterproof finish	22,200	SF	1.00	22,200	2,090	24,290
11.0.2.E	Swing gate						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
	(15,200#) size 36'x10'	2	EA	23,000.00	46,000	4,330	50,330
	SUBTOTAL: Floodwall and Floodgates at Westwego Airport						
	CONTINGENCIES						
	SUBTOTAL: Floodwall and Floodgates at Westwego Airport						
	746,940						
	83,360						
	830,300						
	LEEVES AND FLOODWALLS, Ross Canal Drainage Structure						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	8,630	68,630
11.0.1.-	LEEVES						
11.0.1.B	Clearing & Grubbing	1	AC	1,500.00	1,500	215	1,715
11.0.1.B	Excavation, common	3,000	CY	2.00	6,000	1,170	7,170
11.0.1.B	Semicompacted fill (Adjacent borrow)	610	CY	4.00	2,440	480	2,920
11.0.1.B	Steel sheet pile, P2-22	1,530	SF	12.00	18,360	2,640	21,000
11.0.1.B	Riprap	95	TN	20.00	1,900	370	2,270
11.0.1.B	Seeding, fertilizing and mulching	1	AC	500.00	500	75	575
11.0.G.-	DRAINAGE						
11.0.G.B	Geotextile separator Fabric	90	SY	2.00	180	30	210
11.0.G.B	Concrete sand	80	CY	20.00	1,600	310	1,910
11.0.G.B	68" Dia CMP culvert	226	LF	400.00	90,400	22,050	112,450
11.0.G.C	Conc. in base slabs	50	CY	200.00	10,000	940	10,940
11.0.G.C	Conc. in headwalls & wingwalls	35	CY	330.00	11,550	1,090	12,640
11.0.G.C	Conc. in sluice gate chamber	10	CY	330.00	3,300	330	3,630
11.0.G.E	(5'x5') sluice gate incl. electrical	1	EA	35,000.00	35,000	5,030	40,030
11.0.G.E	Misc. metals (hand rails & trash rack)	Lump Sum	LS	7,000.00	7,000	1,010	8,010
	SUBTOTAL: Ross Canal Drainage Structure						
	CONTINGENCIES						
	SUBTOTAL: Ross Canal Drainage Structure						
	249,730						
	44,370						
	294,100						
	LEEVES AND FLOODWALLS, Estelle Pump Sta. & LP&L Powerlines						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	8,640	68,640
11.0.1.-	LEEVES						
11.0.1.B	Clearing and Grubbing	5	AC	1,500.00	7,500	750	8,250
11.0.1.B	Semicompacted fill (adjacent borrow)	3,000	CY	1.75	5,250	1,020	6,270
11.0.1.B	Semicompacted fill						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE \$	AMOUNT \$	CONTINGENCIES \$	PROJECT COST \$
11.0.1.B	(haul from borrow, 1 mile) Seeding, fertilizing and mulching	13,900	CY	3.00	41,700	8,040	49,740
11.0.2.-	FLOODWALLS						
11.0.2.B	Structural excavation	280	CY	8.00	2,240	430	2,670
11.0.2.B	Structural backfill	150	CY	10.00	1,500	300	1,800
11.0.2.B	Steel sheet pile, PZ-22	24,430	SF	12.00	293,160	27,840	321,000
11.0.2.B	Cold tar epoxy sheet piling	Lump Sum	LS	18,800.00	18,800	1,790	20,590
11.0.2.B	Prstd. conc. piles, 12"x12"	4,480	LF	18.00	80,640	11,620	92,260
11.0.2.C	T-Wall stab. slab	10	CY	70.00	700	70	770
11.0.2.C	T-Wall base slab	85	CY	200.00	17,000	1,600	18,600
11.0.2.C	T-Wall stem	45	CY	330.00	14,850	1,420	16,270
11.0.2.C	I-Wall stem	90	CY	330.00	29,700	2,820	32,520
11.0.2.C	Waterproof finish	17,500	SF	1.00	17,500	1,670	19,170
11.0.2.-	SUBTOTAL: Estelle Pump Sta. & LP&L Powerlines CONTINGENCIES						593,040
11.0.2.-	SUBTOTAL: Estelle Pump Sta. & LP&L Powerlines						68,260
							661,300
11.-.-	LEVEES AND FLOODWALLS, 2nd Lift Floodwalls at Various Locations						
11.0.A.-	Mob & Demob	Lump Sum	LS	60,000.00	60,000	8,640	68,640
11.0.1.-	LEVEES						
11.0.1.B	Clearing and grubbing	10	AC	1,000.00	10,000	950	10,950
11.0.1.B	Semiconpacted fill	22,600	CY	8.00	180,800	35,070	215,870
11.0.1.B	Seeding, fertilizing and mulching	10	AC	500.00	5,000	480	5,480
11.0.2.-	FLOODWALLS						
11.0.2.B	Structural excavation	545	CY	8.00	4,360	850	5,210
11.0.2.B	Structural backfill	340	CY	10.00	3,400	670	4,070
11.0.2.C	I-Wall stab. slab	50	CY	70.00	3,500	340	3,840
11.0.2.C	I-Wall stem	655	CY	390.00	216,150	20,320	236,470
11.0.2.C	Waterproof finish	20,900	SF	1.00	20,900	1,970	22,870
11.0.2.-	SUBTOTAL: 2nd Lift Floodwalls CONTINGENCIES						504,110
11.0.2.-	SUBTOTAL: 2nd Lift Floodwalls						69,290
							573,400
11.-.-	LEVEES AND FLOODWALLS, Floodwalls at Cousins & Harvey Pumping Stations						
11.0.A.-	Mob & Demob	Lump Sum	LS	150,000.00	150,000	21,600	171,600
11.0.1.-	LEVEES						
11.0.1.B	Clearing and grubbing	9	AC	1,000.00	9,000	860	9,860
11.0.1.B	Semiconpacted fill						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
11.0.1.B	(adj. borrow) Degrade existing levee (haul to levee along Harvey Canal)	5,000	CY	1.75	8,750	1,700	10,450
11.0.1.B	Seeding, fertilizing and mulching	10,000	CY	2.50	25,000	4,850	29,850
		9	AC	500.00	4,500	430	4,930
11.0.2.-	FLOODWALLS						
11.0.2.B	Structural excavation	1,900	CY	8.00	15,200	2,940	18,140
11.0.2.B	Structural backfill	960	CY	10.00	9,600	1,860	11,460
11.0.2.B	Steel sheet piling, P2-22	58,990	SF	12.00	707,880	59,545	767,425
11.0.2.B	Pull & redrive Frodingham SNA	3,150	SF	4.50	14,175	2,750	16,925
11.0.2.B	Prstd. conc. piles, 14"x14"	2,790	LF	20.00	55,800	8,035	63,835
11.0.2.B	12" treated timber piles	1,000	LF	10.00	10,000	1,440	11,440
11.0.2.C	T-Wall stab. slab	30	CY	70.00	2,100	200	2,300
11.0.2.C	T-Wall base slab	90	CY	200.00	18,000	1,690	19,690
11.0.2.C	T-Wall stem	10	CY	330.00	3,300	320	3,620
11.0.2.C	I-Wall stab. slab	15	CY	70.00	1,050	105	1,155
11.0.2.C	I-Wall stem	1,900	CY	330.00	627,000	58,940	685,940
11.0.2.C	Waterproof finish	54,000	SF	1.00	54,000	5,080	59,080
11.0.2.E	Bottom roller gate (17600#) size 44'x4' Swing gate (5000#) size 24'x5.5'	Lump Sum	LS	27,000.00	27,000	2,540	29,540
		Lump Sum	LS	8,000.00	8,000	760	8,760
	SUBTOTAL: Floodwalls at Cousins & Harvey Pumping Stations						1,750,355
	CONTINGENCIES						175,645
	SUBTOTAL: Floodwalls at Cousins & Harvey Pumping Stations						1,926,000
11.-.-	LEVEES AND FLOODWALLS, Floodwall and Floodgates at the V-Levee						
11.0.A.-	Mob & Demob	Lump Sum	LS	150,000.00	150,000	21,600	171,600
11.0.1.-	LEVEES						
11.0.1.B	Clearing and grubbing	52	AC	1,500.00	78,000	11,230	89,230
11.0.1.B	Shaping & dressing	24	AC	500.00	12,000	1,740	13,740
11.0.1.B	Sand haul road	8,000	LF	38.85	310,800	60,300	371,100
11.0.1.B	Degrade existing levee & excavate new channel for semicompacted fill berm	275,500	CY	1.85	509,675	98,875	608,550
11.0.1.B	Seeding, fertilizing and mulching	27	AC	500.00	13,500	1,965	15,465
11.0.2.-	FLOODWALLS						
11.0.2.B	Structural excavation	3,730	CY	8.00	29,840	5,795	35,635
11.0.2.B	Structural backfill	2,050	CY	10.00	20,500	3,980	24,480
11.0.2.B	Steel sheet pile, P2-22	108,120	SF	12.00	1,297,440	110,260	1,407,700
11.0.2.B	Cold tar epoxy sheet piling	Lump Sum	LS	1,200.00	1,200	120	1,320

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
11.0.2.B	Prstd. conc. piles, 12"x12"	10,830	LF	18.00	194,940	28,070	223,010
11.0.2.B	Compression pile test	1	EA	18,000.00	18,000	2,600	20,600
11.0.2.B	Additional comp. pile test	1	EA	14,000.00	14,000	2,000	16,000
11.0.2.C	T-Wall stab slab	60	CY	70.00	4,200	400	4,600
11.0.2.C	T-Wall base slab	460	CY	200.00	92,000	8,660	100,660
11.0.2.C	T-Wall stem	200	CY	330.00	66,000	6,200	72,200
11.0.2.C	I-Wall stab. slab	280	CY	70.00	19,600	1,840	21,440
11.0.2.C	I-Wall stem	2,890	CY	330.00	953,700	80,250	1,033,950
11.0.2.C	Waterproof finish	101,610	SF	1.00	101,610	9,550	111,160
11.0.2.E	Swing gate @ Hwy 45 (15,200#) size 36'x10'	Lump Sum	LS	23,000.00	23,000	2,160	25,160
SUBTOTAL: Floodwall and Floodgates at V-Levee							
CONTINGENCIES							
SUBTOTAL: Floodwall and Floodgates at V-Levee							
LEVEES AND FLOODWALLS, Floodwalls at Ames, Mt. Kennedy & Oak Cove Pumping Stations							
11.0.A.-	Mob. & Demob.	Lump Sum	LS	150,000.00	150,000	21,600	171,600
LEVEES							
11.0.1.-	Clearing and Grubbing	2	AC	1,500.00	3,000	280	3,280
11.0.1.B	Semiconpacted fill (adj. borrow)	1,500	CY	1.75	2,625	515	3,140
11.0.1.B	Semiconpacted fill (haul from borrow, 3 mile)	1,250	CY	5.00	6,250	1,210	7,460
11.0.1.B	Seeding, fertilizing and mulching	2	AC	500.00	1,000	100	1,100
FLOODWALLS							
11.0.2.-	Structural excavation	1,470	CY	8.00	11,760	2,285	14,045
11.0.2.B	Structural backfill	740	CY	10.00	7,400	1,440	8,840
11.0.2.B	Steel sheet pile, PZ-22	9,400	SF	12.00	112,800	10,600	123,400
11.0.2.B	Cold tar epoxy sheet piling	Lump Sum	LS	6,500.00	6,500	610	7,110
11.0.2.B	Prstd. conc. piles, 14"x14"	20,540	LF	20.00	410,800	79,700	490,500
11.0.2.B	Compression pile test	1	EA	18,000.00	18,000	2,600	20,600
11.0.2.B	Adttl. comp. pile test	1	EA	14,000.00	14,000	2,000	16,000
11.0.2.B	Tension pile test	1	EA	19,000.00	19,000	2,740	21,740
11.0.2.B	Adttl. tension pile test	1	EA	14,000.00	14,000	2,000	16,000
11.0.2.C	T-Wall stab. slab	90	CY	70.00	6,300	600	6,900
11.0.2.C	T-Wall base slab	680	CY	200.00	136,000	12,780	148,780
11.0.2.C	T-Wall stem	525	CY	330.00	173,250	16,285	189,535
11.0.2.C	Waterproof finish	8,200	SF	1.00	8,200	770	8,970
SUBTOTAL: Floodwalls at Ames, Mt. Kennedy & Oak Cove Pumping Stations							
CONTINGENCIES							
SUBTOTAL: Floodwalls at Ames, Mt. Kennedy & Oak Cove Pumping Stations							

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
11.-.-.- LEVEES AND FLOODWALLS, Floodwall bwt. Bayou Segnette & New Westwego Pumping Stations							
11.0.A.-	Mob & Demob	Lump Sum	LS	150,000.00	150,000	21,600	171,600
11.0.1.- LEVEES							
11.0.1.B	Clearing and grubbing	12	AC	1,500.00	18,000	1,690	19,690
11.0.1.B	Degrade existing levee & haul to stockpile area	22,000	CY	2.50	55,000	10,670	65,670
11.0.1.B	Semiconpacted fill (adjacent borrow)	9,800	CY	1.75	17,150	3,330	20,480
11.0.1.B	Seeding, fertilizing and mulching	12	AC	500.00	6,000	580	6,580
11.0.2.- FLOODWALLS							
11.0.2.B	Structural excavation	3,190	CY	8.00	25,520	4,950	30,470
11.0.2.B	Structural backfill	1,735	CY	10.00	17,350	3,370	20,720
11.0.2.B	Pull & redrive existing sheet piling, (1N-RU3)	7,070	SF	4.25	30,048	5,830	35,878
11.0.2.B	Steel sheet pile, P2-22	84,014	SF	12.00	1,008,168	85,470	1,093,638
11.0.2.B	Steel sheet pile, P2-27	3,560	SF	13.00	46,280	4,350	50,630
11.0.2.B	Cold tar epoxy sheet piling	Lump Sum	LS	4,500.00	4,500	440	4,940
11.0.2.B	Prstd. conc. piles, 12"x12"	10,100	LF	18.00	181,800	26,180	207,980
11.0.2.B	Prstd. conc. piles, 14"x14"	9,625	LF	20.00	192,500	29,475	221,975
11.0.2.C	T-Wall stab. slab	75	CY	70.00	5,250	505	5,755
11.0.2.C	T-Wall base slab	440	CY	200.00	88,000	8,270	96,270
11.0.2.C	T-Wall stem	280	CY	330.00	92,400	8,690	101,090
11.0.2.C	I-Wall stab. slab	140	CY	70.00	9,800	920	10,720
11.0.2.C	I-Wall stem	1,880	CY	330.00	620,400	58,320	678,720
11.0.2.C	Waterproof finish	86,660	LF	1.00	86,660	8,144	94,804
11.0.2.E	Swing gate no. 2 (5700#) size 26'x6'	Lump Sum	LS	9,000.00	9,000	860	9,860
11.0.2.E	Swing gate no. 3 (7500#) size 26'x8'	Lump Sum	LS	12,000.00	12,000	1,140	13,140
11.0.2.E	Pedestrian swing gates (6'x6') 1680#	4	EA	5,000.00	20,000	2,880	22,880
11.0.G.- DRAINAGE							
11.0.G.B	Storm drainage system (18" RCP, catch basins, & gate valves)	Lump Sum	LS	33,000.00	33,000	6,400	39,400
11.0.R.- ASSOCIATED GENERAL ITEMS							
11.0.R.B	Timber walkway	Lump Sum	LS	32,000.00	32,000	6,210	38,210
SUBTOTAL: Floodwall between Bayou Segnette & New Westwego Pumping Stations							
CONTINGENCIES							
SUBTOTAL: Floodwall between Bayou Segnette & New Westwego Pumping Stations							
2,760,826							
300,274							
3,061,100							

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE \$	AMOUNT \$	CONTINGENCIES \$	PROJECT COST \$
11.0.1.-	LEVEES, Westside Closure						
11.0.A.-	Mob. & Demob	Lump Sum	LS	50,000.00	50,000	14,700	64,700
11.0.1.-	LEVEES						
11.0.1.B	Clearing & Grubbing	14	AC	1,000.00	14,000	4,110	18,110
11.0.1.B	Uncompacted fill (Canal exc.)	14,000	CY	3.00	42,000	12,340	54,340
11.0.1.B	Uncompacted fill (Bonnet Carre, 25 miles one way)	16,600	CY	9.50	157,700	46,340	204,040
11.0.1.B	Fertilizing & seeding	10	AC	500.00	5,000	1,460	6,460
11.0.G.-	DRAINAGE						
11.0.G.B	7' dia concrete culvert & sluice gate machinery	150	FT	1,500.00	225,000	66,150	291,150
	SUBTOTAL: Westside Closure CONTINGENCIES						493,700
	SUBTOTAL: Westside Closure						145,100
							638,800
11.0.2.-	FLOODWALLS, Fronting Protection at Estelle Pumping Station						
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Structural excavation	80	CY	8.00	640	128	768
11.0.2.B	Structural backfill	40	CY	10.00	400	80	480
11.0.2.B	12"x12" prstd. conc piles	1,760	LF	18.00	31,680	6,136	37,816
11.0.2.-	PUMPING PLANT FRONTING STRUCTURE						
11.0.2.C	T-Wall slab	5	CY	70.00	350	35	385
11.0.2.C	T-Wall base slab	35	CY	200.00	7,000	660	7,660
11.0.2.C	T-Wall stem	10	CY	330.00	3,300	310	3,610
11.0.2.C	Cap existing sheet pile wall	90	CY	330.00	29,700	4,275	33,975
11.0.2.C	Waterproof finish	4,560	SF	1.00	4,560	426	4,986
11.0.R.-	Elevated walkway	Lump Sum	LS	17,000.00	17,000	2,450	19,450
11.0.G.-	GATES AND VALVES						
11.0.G.B	Butterfly valves	3	EA	38,000.00	114,000	16,470	130,470
	54" dia valve						
	SUBTOTAL: Fronting Protection at Estelle Pumping Station CONTINGENCIES						208,630
	SUBTOTAL: Fronting Protection at Estelle Pumping Station						30,970
							239,600
11.0.2.-	FLOODWALLS, Fronting Protection at Cousins Pumping Station						
11.0.B.-	CARE AND DIVERSION OF WATER						
11.0.B.B	Cofferdam for sluice gate structure incl. dewatering	Lump Sum	LS	156,000.00	156,000	38,060	194,060
	a. First structure	Lump Sum	LS	126,000.00	126,000	30,740	156,740
	b. Second structure						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				↓	↓	↓	↓
11.0.2.-	EARTHWORK FOR STRUCTURES						
11.0.2.B	Structural excavation	70	CY	8.00	560	115	675
11.0.2.B	Structural backfill	40	CY	10.00	400	80	480
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Steel sheet piling, P2-22	1,700	SF	12.00	20,400	3,960	24,360
11.0.2.B	Steel sheet piling, P2-35	2,800	SF	18.00	50,400	9,780	60,180
11.0.2.B	14"x14" prst conc piles in sluice gate structure	1,380	LF	20.00	27,600	5,350	32,950
11.0.2.-	PUMPING PLANT FRONTING STRUC. & SLUICE GATE STRUC.						
11.0.2.C	Sluice gate structure						
	a. Stab slab	10	CY	70.00	700	70	770
	b. Base slab	80	CY	200.00	16,000	2,300	18,300
	c. Floors and walls	220	CY	330.00	72,600	10,450	83,050
11.0.2.C	Conc. in I-Wall stem	100	CY	330.00	33,000	4,750	37,750
11.0.2.C	Demolition of existing T-Wall	85	CY	130.00	11,050	2,120	13,170
11.0.2.C	Waterproof finish	2,150	SF	1.00	2,150	205	2,355
11.0.R.-	Pedestrian walkway bridge	Lump Sum	LS	15,000.00	15,000	2,910	17,910
11.0.G.-	GATES AND VALVES						
11.0.G.B	Butterfly valves						
	72" dia valves	3	EA	58,500.00	175,500	34,050	209,550
	36" dia valves	1	EA	14,000.00	14,000	2,020	16,020
11.0.G.E	7'x10' sluice gates & machinery incl. electrical	6	EA	95,000.00	570,000	110,580	680,580
	SUBTOTAL: Fronting Protection at Cousins Pumping Station						1,291,360
	CONTINGENCIES						257,540
	SUBTOTAL: Fronting Protection at Cousins Pumping Station						1,548,900
11.0.2.-	FLOODWALLS, Fronting Protection at Harvey Pumping Station						
11.0.2.-	FOUNDATION WORK						
11.0.2.B	14"x14" prstd conc piles	1,300	LF	20.00	26,000	5,040	31,040
11.0.2.-	PUMPING PLANT FRONTING STRUC.						
11.0.2.C	Base slabs	60	CY	200.00	12,000	2,340	14,340
11.0.2.C	Floodwall extension, 3/8" PL (including painting)	Lump Sum	LS	22,000.00	22,000	3,180	25,180
11.0.G.F	Modification of existing stoplogs	Lump Sum	LS	6,000.00	6,000	1,180	7,180
11.0.G.-	GATES AND VALVES						
11.0.G.B	Butterfly valves 72" dia	3	EA	58,500.00	175,500	34,060	209,560
	SUBTOTAL: Fronting Protection at Harvey Pumping Station						241,500
	CONTINGENCIES						45,800

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE \$	AMOUNT \$	CONTINGENCIES \$	PROJECT COST \$
	SUBTOTAL: Fronting Protection at Harvey Pumping Station						
		Lump Sum	LS	88,000.00	88,000	21,470	109,470
11.0.2.-	FLOODWALLS, Fronting Protection at Ames Pumping Station						
11.0.B.-	CARE AND DIVERSION OF WATER						
11.0.B.B	Cofferdam for sluice gate structure incl. dewatering						
		Lump Sum	LS	88,000.00	88,000	21,470	109,470
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Struc. excavation	315	CY	8.00	2,520	490	3,010
11.0.2.B	Struc. backfill	80	CY	10.00	800	160	960
11.0.2.B	Raise piling, steel sheet type PMA-22 (33' long)	850	SF	3.00	2,550	500	3,050
11.0.2.B	Steel sheet pile, P2-22	920	SF	12.00	11,040	2,145	13,185
11.0.2.B	Pull 46' timber piles	86	EA	100.00	8,600	1,680	10,280
11.0.2.B	14"x14" prstd conc piles						
	a. Floodwall	5,790	LF	20.00	115,800	22,470	138,270
	b. Sluice gate struc.	1,620	LF	20.00	32,400	4,670	37,070
11.0.2.-	PUMPING PLANT FRONTING STRUC. & SLUICE GATE STRUC.						
11.0.2.C	Floodwall stem extension	20	CY	330.00	6,600	960	7,560
11.0.2.C	Floodwall buttress	5	CY	330.00	1,650	240	1,890
11.0.2.C	Floodwall buttress base slab	50	CY	200.00	10,000	1,440	11,440
11.0.2.C	Stab slabs	30	CY	70.00	2,100	200	2,300
11.0.2.C	T-Wall base slabs	160	CY	200.00	32,000	4,620	36,620
11.0.2.C	T-Wall stem	135	CY	330.00	44,550	6,420	50,970
11.0.2.C	Waterproof finish	2,400	SF	1.00	2,400	230	2,630
11.0.2.C	Sluice gate struc.						
	a. Stab slab	5	CY	70.00	350	35	385
	b. Base slab	45	CY	200.00	9,000	1,300	10,300
	c. Floors and walls	100	CY	330.00	33,000	4,760	37,760
11.0.2.C	Demolition of existing T-Wall	180	CY	130.00	23,400	4,540	27,940
11.0.R.-	Pedestrian walkway bridge						
		Lump sum	LS	11,000.00	11,000	2,130	13,130
11.0.R.-	Pedestrian swing gate						
		Lump Sum	LS	6,000.00	6,000	870	6,870
11.0.G.-	GATES AND VALVES						
11.-G.B	84" dia butterfly valves	2	EA	142,000.00	284,000	55,100	339,100
11.0.G.E	8'x9' sluice gates & machinery incl. electrical	2	EA	110,000.00	220,000	42,680	262,680
11.0.G.E	8'x9' sluice gates & machinery incl. electrical	1	EA	95,000.00	95,000	18,430	113,430
11.0.2.-	SUBTOTAL: Fronting Protection at Ames Pumping Station						
	CONTINGENCIES						1,042,760
	SUBTOTAL: Fronting Protection at Ames Pumping Station						
							197,540
	SUBTOTAL: Fronting Protection at Mt. Kennedy Pumping Station						
							1,240,300

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Struc. excavation	100	CY	8.00	800	160	960
11.0.2.B	Struc backfill	25	CY	10.00	250	50	300
11.0.2.B	Steel sheet piling, P2-22	635	SF	12.00	7,620	1,155	8,775
11.0.2.B	14"x14" prstd conc piles	1,670	LF	20.00	33,400	6,500	39,900
11.0.2.-	PUMPING PLANT FRONTING STRUCTURE						
11.0.2.C	T-Wall stab slab	10	CY	70.00	700	70	770
11.0.2.C	T-Wall base slab	70	CY	200.00	14,000	2,100	16,100
11.0.2.C	T-Wall stem	40	CY	330.00	13,200	2,000	15,200
11.0.2.C	Waterproof finish	630	SF	1.00	630	65	695
11.0.G.-	GATES AND VALVES						
11.0.G.B	48" dia butterfly valve	2	EA	26,500.00	53,000	7,600	60,600
11.0.G.B	30" dia butterfly valve	2	EA	16,000.00	32,000	4,700	36,700
11.0.2.-	SUBTOTAL: Fronting Protection at Mt. Kennedy Pumping Station						155,600
11.0.2.-	CONTINGENCIES						24,400
11.0.2.-	SUBTOTAL: Fronting Protection at Mt. Kennedy Pumping Station						180,000
11.0.2.-	FLOODWALLS, Fronting Protection at Oak Cove Pumping Station						
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Structural excavation	220	CY	8.00	1,760	350	2,110
11.0.2.B	Structural backfill	110	CY	10.00	1,100	220	1,320
11.0.2.B	Steel sheet piling, P2-22	1,290	SF	12.00	15,480	2,230	17,710
11.0.2.B	Piling, prstd. conc. 14"x14"	4,920	LF	18.00	88,560	12,760	101,320
11.0.2.-	PUMPING PLANT FRONTING STRUCTURE						
11.0.2.C	T-Wall stab slab	20	CY	70.00	1,400	140	1,540
11.0.2.C	T-Wall base slab	125	CY	200.00	25,000	3,600	28,600
11.0.2.C	T-Wall stem	115	CY	330.00	37,950	5,460	43,410
11.0.2.C	Waterproof finish	3,120	SF	1.00	3,120	310	3,430
11.0.G.-	GATES AND VALVES						
11.0.G.B	24" dia butterfly valve	2	EA	13,000.00	26,000	3,760	29,760
11.0.2.-	SUBTOTAL: Fronting Protection at Oak Cove Pumping Station						200,370
11.0.2.-	CONTINGENCIES						28,830
11.0.2.-	SUBTOTAL: Fronting Protection at Oak Cove Pumping Station						229,200
11.0.2.-	FLOODWALLS, Fronting Protection at Old Westwego Pumping Station on						
11.0.2.-	EARTHWORK FOR STRUCTURES						
11.0.2.B	Shell embankment fill	1,300	CY	20.00	26,000	6,340	32,340
11.0.2.B	Riprap	300	TN	20.00	6,000	1,160	7,160

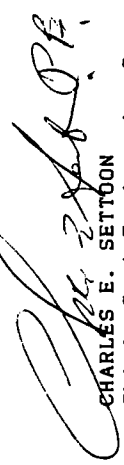
ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
				\$	\$	\$	\$
11.0.2.-	PUMPING PLANT FRONTING STRUCTURE						
11.0.2.C	Sheet pile capping	60	CY	330.00	19,800	2,930	22,730
11.0.2.C	Waterproof finish	1,950	SF	1.00	1,950	200	2,150
11.0.G.-	GATES AND VALVES						
11.0.G.B	84" dia butterfly valve	1	EA	142,000.00	142,000	27,550	169,550
11.0.G.B	54" dia butterfly valve	1	EA	38,000.00	38,000	7,370	45,370
	SUBTOTAL: Fronting Protection at Old Westwego Pumping Station						239,750
	CONTINGENCIES						45,550
	SUBTOTAL: Fronting Protection at Old Westwego Pumping Station						279,300
11.0.2.-	FLOODWALLS, Fronting Protection at New Westwego Pumping Station						
11.0.2.-	EARTHWORK FOR STRUCTURES						
11.0.2.B	Demolition of conc. slabs	Lump sum	LS	800.00	800	160	960
11.0.2.-	FOUNDATION WORK						
11.0.2.B	Piling, prst conc. 14"x14"	1,420	LF	20.00	28,400	5,540	33,940
11.0.2.-	PUMPING PLANT FRONTING STRUCTURE						
11.0.2.C	Conc in base slab extension	40	CY	200.00	8,000	1,160	9,160
11.0.2.C	Conc in T-Wall stem & buttresses	30	CY	330.00	9,900	1,450	11,350
11.0.2.C	Waterproof finish	2,500	SF	1.00	2,500	240	2,740
11.0.G.-	GATES AND VALVES						
11.0.G.B	84" dia butterfly valves	3	EA	142,000.00	426,000	82,650	508,650
	SUBTOTAL: Fronting Protection at New Westwego Pumping Station						475,600
	CONTINGENCIES						91,200
	SUBTOTAL: Fronting Protection at New Westwego Pumping Station						566,800
11.-.-.-	LEVEES AND FLOODWALLS, Harvey Canal Floodwall						5,850,000
11.-.-.-	LEVEES AND FLOODWALLS, Credit For External Work						6,100,000
11.-.-.-	TOTAL: LEVEES AND FLOODWALLS						47,088,000
13.-.-.-	PUMPING PLANT						
13.-.-.-	PUMPING PLANT, Westside Closure						

ACCT. NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
13.-.-.-	5 CFS pump station, 13' head	Lump Sum	LS	200,000.00	200,000	59,200	259,200
13.-.-.-	Misc. Metals; trash rack, hand rails, grating, etc.	Lump Sum	LS	50,000.00	50,000	14,800	64,800
	SUBTOTAL: Westside Closure						250,000
13.0.2.-	CONTINGENCIES						74,000
	SUBTOTAL: Westside Closure						324,000
13.-.-.-	TOTAL: PUMPING PLANT						324,000
30.-.-.-	PLANNING, ENGINEERING AND DESIGN						
30.F.-.-	General Design Memorandum						1,765,000
30.H.-.-	PLANS AND SPECIFICATIONS						
30.H.Y.-	Hwy 45 Levee				185,000	35,000	220,000
30.H.Y.-	Reach I Structures				320,000	59,000	379,000
30.H.Y.-	Hwy 45 Gaps				45,000	8,000	53,000
30.H.Y.-	1st Lift - V-Levee, East of Vertex				385,000	73,000	458,000
30.H.Y.-	Ross Canal Drainage Structure				28,000	5,000	33,000
30.H.Y.-	Reach III Structures				230,000	42,000	272,000
30.H.Y.-	1st Lift Levee - Estelle P.S. to Cousins P.S.				145,000	26,000	171,000
30.H.Y.-	1st Lift Levee - East-West to Oak Cove				335,000	65,000	400,000
30.H.Y.-	1st Lift Levee - New Westwego P.S. to East-West Levee				120,000	21,000	141,000
30.H.Y.-	Reach IV Structures				625,000	123,000	748,000
30.H.Y.-	Westwego Airport Floodwall				50,000	8,000	58,000
30.H.Y.-	2nd Lift - V-Levee, East of Vertex				75,000	17,000	92,000
30.H.Y.-	Reach VI Structures				300,000	56,000	356,000
30.H.Y.-	2nd Lift Levee - Estelle P.S. to Cousins P.S.				60,000	12,000	72,000
30.H.Y.-	2nd Lift Levee - East-West to Oak Cove				100,000	19,000	119,000
30.H.Y.-	2nd Lift - New Westwego to East-West Levee				45,000	8,000	53,000
30.H.Y.-	West Side Closure				125,000	21,000	146,000
30.H.Y.-	3rd Lift - V-Levee, East of Vertex				45,000	8,000	53,000
30.H.Y.-	3rd Lift Levee - Estelle P.S. to Cousins P.S.				50,000	8,000	58,000
30.H.Y.-	3rd Lift Levee - New Westwego P.S. to Oak Cove				105,000	20,000	125,000
30.H.Y.-	Misc. Floodwall Capping				45,000	7,000	52,000
30.H.Y.-	Mitigation Dike				40,000	8,000	48,000
	SUBTOTAL: PLANS AND SPECIFICATIONS						3,458,000
30.0.2.-	CONTINGENCIES						649,000
	SUBTOTAL: PLANS AND SPECIFICATIONS						4,107,000
30.J.-.-	ENGINEERING DURING CONSTRUCTION						
30.J.Y.-	Hwy 45 Levee				20,000	3,000	23,000

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
			\$	\$	\$	\$
30.J.Y.-	Reach I Structures			35,000	7,000	42,000
30.J.Y.-	Hwy 45 Gaps			5,000	1,000	6,000
30.J.Y.-	1st Lift - V-Levee, East of Vertex			45,000	7,000	52,000
30.J.Y.-	Ross Canal Drainage Structure			3,000	1,000	4,000
30.J.Y.-	Reach III Structures			25,000	5,000	30,000
30.J.Y.-	1st Lift Levee - Estelle P.S. to Cousins P.S.			15,000	5,000	20,000
30.J.Y.-	1st Lift Levee - East-West to Oak Cove			35,000	10,000	45,000
30.J.Y.-	1st Lift Levee - New Westwego P.S. to East-West Levee			13,000	3,000	16,000
30.J.Y.-	Reach IV Structures			70,000	12,000	82,000
30.J.Y.-	Westwego Airport Floodwall			5,000	1,000	6,000
30.J.Y.-	2nd Lift - V-Levee, East of Vertex			8,000	2,000	10,000
30.J.Y.-	Reach VI Structures			35,000	5,000	40,000
30.J.Y.-	2nd Lift Levee - Estelle P.S. to Cousins P.S.			7,000	1,000	8,000
30.J.Y.-	2nd Lift Levee - East-West to Oak Cove			10,000	3,000	13,000
30.J.Y.-	2nd Lift - New Westwego to East-West Levee			5,000	1,000	6,000
30.J.Y.-	West Side Closure			13,000	3,000	16,000
30.J.Y.-	3rd Lift - V-Levee, East of Vertex			5,000	1,000	6,000
30.J.Y.-	3rd Lift Levee - Estelle P.S. to Cousins P.S.			6,000	1,000	7,000
30.J.Y.-	3rd Lift Levee - New Westwego P.S. to Oak Cove			10,000	3,000	13,000
30.J.Y.-	Misc. Floodwall Capping			5,000	1,000	6,000
30.J.Y.-	Mitigation Dike			4,000	1,000	5,000
SUBTOTAL: ENGINEERING DURING CONSTRUCTION 379,000						
CONTINGENCIES 77,000						
SUBTOTAL: ENGINEERING DURING CONSTRUCTION 456,000						
30.2.-.-	Credit for External Work					600,000
30.-.-.-	E&D, Harvey Canal Floodwall					1,056,000
30.-.-.-	TOTAL: PLANNING, ENGINEERING AND DESIGN					7,984,000
31.-.-.-	CONSTRUCTION MANAGEMENT (S&I)					
31.B.-.-	Contract Administration					368,000
31.B.4.-	Contract Modification					1,073,000
31.B.9.-	All Other					
31.E.-.-	Inspection And Quality Assurance					552,000
31.E.9.-	All Other					
31.F.-.-	Project Office Operation					5,276,000

ACCT. NO.	ITEM	QUANTITY	UNIT PRICE	AMOUNT	CONTINGENCIES	PROJECT COST
31.-.-.-	Construction Management, Harvey Canal Floodwall					850,000
31.-.-.-	TOTAL: CONSTRUCTION MANAGEMENT (S&I)					8,119,000
	TOTAL PROJECT					78,000,000

The above cost estimate was prepared by Cost Engineering Branch


 CHARLES E. SETTOON
 Chief, Cost Engineering Branch
 Date: 9/16/48

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