ST. GERMAIN

US Army Corps of Engineers
New Orleans District

Tangipahoa, Tchefuncte, and Tickfaw Rivers, Louisiana

Reconnaissance Report

June 1991

SYLLABUS

This report presents the results of a reconnaissance-level study of hurricane and riverine flooding in the Tangipahoa, Tchefuncte, and Tickfaw River drainage basins on the north shore of Lakes Pontchartrain and Maurepas.

The study area encompasses 2,400 square miles in southeast Louisiana and south Mississippi. It includes portions of St. Tammany, Tangipahoa, Washington, St. Helena, and Livingston Parishes in Louisiana and a small part of Pike and Amite Counties in Mississippi. Major streams include the Tangipahoa, Tchefuncte, and Tickfaw Rivers and Bayous Lacombe and Bonfouca. Major urban areas include the cities of Hammond, Slidell, Covington, Ponchatoula, Mandeville, and the community of Lacombe.

Portions of the study area are vulnerable to flooding from heavy rainfalls, overflowing streams, and hurricane surges, or combinations of these events. In our analysis, we considered the preliminary feasibility of constructing hurricane protection and flood control projects in selected urbanized areas. For the hurricane protection analysis, these areas included: Mandeville, Slidell, Madisonville, and Lacombe. For the flood control analysis, the areas included: Hammond (Ponchatoula Creek-Yellow Water River), Covington (Mile Branch), northern Mandeville (Bayou Chinchuba), and the Lower Tchefuncte-Bogue Falaya River. Three of these areas yielded potentially feasible plans under Federal criteria: Hammond (Ponchatoula Creek-Yellow Water River), Covington (Mile Branch), and Mandeville (hurricane protection). The table below is a summary of costs and benefits associated with the most economical plans presented in the report.

From the analysis of these plans, we concluded that sufficient justification exists to warrant further investigations. However, no potential non-Federal sponsors have indicated their intent to share in the cost of feasibility studies.

For the Mandeville Hurricane Protection plan, it is unlikely that a non-Federal sponsor will cost share in the feasibility phase, due to the negative aesthetic impacts of this plan on the Mandeville area. For this reason, we recommended that processing of the report be suspended until a sponsor is identified.

The report also contains a recommendation to continue feasibility studies of Mile Branch and Ponchatoula Creek under Section 205 of the Flood Control Act of 1948, as amended. The anticipated Federal costs of each of these plans is less than the $5,000,000 program limit.

Summary of Costs and Benefits
of the Most Economical Plans Considered
(1991 Price Level, 8 3/4 Interest Rate)

Plan	First Costs	Avg. Annual Costs	Avg. Annual Benefits	Benefit-to-Cost Ratio
Covington (Mile Branch Channel)	$4,201,000	$389,000	$772,000	1.98
Hammond (Ponchatoula Creek Channel)	$995,000	$102,000	$1,678,000	16.45
Mandeville (Hurricane Protection)	$15,685,000	$1,615,000	$1,992,000	1.23

TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS, LOUISIANA

RECONNAISSANCE REPORT

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INTRODUCTION

STUDY AUTHORITY

We conducted this study under the authority provided by a resolution adopted August 8, 1984, by the Committee on Public Works and Transportation of the United State House of Representatives and under the authority of Section 401(c) of the Water Resources Development Act of 1986 (Public Law 99-662). The resolution and the act are quoted below.

> Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers published as House Document Numbered 231, 89th Congress, 1st Session, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to the advisability of improvements for hurricane protection, flood control, and related purposes along the north shores of Lakes Pontchartrain and Maurepas and along their tributaries, including, but not limited to, the Tangipahoa, Tchefuncte, and Tickfaw Rivers, Louisiana.
>
> SEC. 401. AUTHORIZATION OF PROJECTS
>
> * * * *
>
> (c) PRE-CONSTRUCTION AUTHORIZATION. -- The Secretary is authorized to carry out planning, engineering, and design for the following projects:
>
> * * * *
>
> A project to provide a level of protection sufficient to prevent recurring flood damages along the following rivers, at a total cost of $10,000,000:
> (1) Amite River, Louisiana; (2) Comite River, Louisiana; (3) Tangipahoa River, Louisiana; (4) Tchefuncte River, Louisiana; (5) Tickfaw River, Louisiana; (6) Bogue Chitto River, Louisiana; and (7) Natalbany River, Louisiana.
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STUDY PURPOSE

The purpose of this reconnaissance study is to determine the feasibility of plans for flood control and hurricane protection along the north shores of Lakes Pontchartrain and Maurepas and along their tributaries. The reconnaissance study is the first phase of the two-phase process for Corps of Engineers implementation studies of water resource projects. The purpose of the reconnaissance phase of the study is to develop and present sufficient information to determine if at least one potential solution to the problems,

needs, and opportunities in the study area (1) will likely be in the Federal interest to implement, (2) will be in accordance with current policies and budgetary guidance, (3) can be implemented in accordance with environmental laws and statutes, and (4) will be supported by a non-Federal sponsor. If these conditions are met, the study will proceed into detailed feasibility phase investigations. If these conditions are not met, no further studies will be conducted under this authority unless there is a change in conditions upon which the study conclusions were based.

GEOGRAPHICAL STUDY AREA

The study area covers about 2,400 square miles in southeast Louisiana and southwest Mississippi (see Plate 1). It includes portions of Tangipahoa, St. Tammany, Washington, Livingston, and St. Helena Parishes, as well as parts of Pike and Amite Counties (see Plate 2). The study area is primarily rural with numerous small population centers. The Louisiana portion includes six communities with a population exceeding 5,000 (Slidell, Hammond, Covington, Mandeville, Ponchatoula, and Lacombe, 1980 Census) and an additional six with populations exceeding 1,000 (Amite, Abita Springs, Independence, Kentwood, Livingston, and Roseland). Over 30 other smaller population centers are located in the area.

Principal rivers include the Tangipahoa, Tchefuncte, Tickfaw, Bogue Falaya, and Natalbany. Other major streams are Bayou Bonfouca, Bayou Liberty, Abita River, Bayou Lacombe, Ponchatoula River (Creek), Blind River, Yellow Water River, Bayou Castine, and Bayou Chinchuba.

The study area is a portion of the Lake Pontchartrain (and Lake Maurepas) basin of southeastern Louisiana. It is also part of what are known as the "Florida Parishes", so-called because at one time they were part of the Florida territory claimed by Spain.

SCOPE OF THE STUDY

This reconnaissance study included an investigation of the preliminary feasibility of flood control and hurricane protection projects along the north shores of Lakes Pontchartrain and Maurepas and in the Tangipahoa, Tchefuncte, and Tickfaw River basins. Although the authorities cite the Amite, Comite, Bogue Chitto, Natalbany, Tangipahoa, Tickfaw, and Tchefuncte

Rivers basins, flooding problems Amite, Comite, and Bogue Chitto Rivers basins are being addressed in other authorized studies.

Flooding problems in the Amite and Comite River basins are being addressed under the authority of the Amite River and Tributaries, Louisiana, study. A number of flood control plans are being developed, including diversion of the Comite River; channel modifications on Jones Creek, Ward Creek, Bayou Fountain, Beaver Bayou, and Black Water Bayou in East Baton Rouge Parish; Miller Canal Diversion and Grays Creek enlargement in Livingston Parish; and the Darlington Reservoir.

Problems, needs, and opportunities related to flooding problems in the Bogue Chitto River basin are being addressed under the authority of the Pearl River Basin, Mississippi and Louisiana, study. Reconnaissance-scope studies of problems in the Bogue Chitto River basin have not identified any potential Federal projects, and no feasibility phase studies are being conducted at this time.

This reconnaissance study included investigations to identify problems, needs, and opportunities related to flood and hurricane protection throughout the study area. Specific problems, needs and opportunities related to hurricane and flood protection were identified for eight subareas within the overall study boundaries. These subareas are delineated on Plate 3. For the hurricane protection plans, these subareas are: Slidell, Mandeville-Lewisburg, Lacombe, and Madisonville. For the riverine flood protection plans, the subareas are Bayou Chinchuba, Ponchatoula Creek, Mile Branch-Lateral "A", and the Lower Tchefuncte-Bogue Falaya River basins. General information on the overall study area is presented in this report. More detailed information is presented for each of the subareas.

The study focuses on establishing whether there is a feasible plan that warrants detailed study. Only potentially feasible plans were studied in detail. The engineering analysis in this report consists of developing preliminary designs and cost estimates of hurricane and flood protection plans. The economic analysis is an estimate of the reduction in residential and commercial flood damages that may result from the plans. The environmental analysis lists environmental habitats in the area and the possible project-related environmental impacts.

ECONOMIC ANALYSIS

This analysis was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance. The National Economic Development Procedures Manual-Urban Flood Damage prepared by the Water Resources Support Center, Institute for Water Resources was also used as a reference.

The report presents an economic evaluation of water resource improvements considered and is sectioned into subareas. The evaluation consists of a description of the methodology used to determine economic damages and benefits under existing conditions, project costs, and benefit-to-cost analysis. The evaluation uses 1991 price levels. The proposed improvements (see Plan Descriptions) were evaluated by comparing estimated average annual benefits that would accrue to the study area with estimated average annual project costs. Benefits were converted to average annual values by use of the current Federal discount rate of 8-3/4 percent and a project life of either fifty or one hundred years depending on whether it was a channel modification or a hurricane protection project. The estimated project base year (the year in which significant benefits will accrue as a result of project construction) differs for each subarea and type of project analyzed.

National Economic development Benefits Considered. The National Economic Development Procedures Manual for Urban Flood Damage recognizes four primary categories of benefits for urban flood control plans: inundation reduction, intensification, location, and employment benefits. Location benefits occur when a reduction in the level of flood risk makes it profitable for new activities to locate in the floodplain. Inundation reduction is the only primary category of NED benefits considered.

Inundation Reduction Benefits. Most benefits from a flood protection project result from the reduction of actual or potential damages due to inundation. Physical inundation reduction damages include structural damages to buildings and losses to contents. Since this is a reconnaissance level report, only inundation reduction benefits on existing development were considered for project justification.

Unquantified Benefits. Unquantified benefits are those benefits generated by flood protection plans that have not been assigned a precise dollar value. These benefits include the following:

1. Savings to the community from reduced emergency costs;
2. Reduction of business losses resulting from the inability to open

business or to have customers reach a business during flood events;
3. Reduction of floodproofing costs by contractors that are ultimately passed on to the homeowner;
4. Flood Insurance Administration (FIA) cost savings from having to write fewer homeowner policies;
5. Reductions of flood damages to streets, roads, sewerage lift stations, communication cables and splicing stands, gas and electrical transmission systems.

These benefits would be considered in the feasibility phase study.

ENGINEERING ANALYSIS

Reconnaissance-Scope Design and Cost Estimates. Preliminary designs and cost estimates were prepared based on existing data and field investigations of the area, professional judgment, and designs and cost estimates of similar projects.

Hydraulic and Hydrologic Analysis. The stage-frequency curves developed for this study are based on existing data on file or published by the U.S. Army Corps of Engineers, Federal Emergency Management Agency, A/E consulting firms, and state or parish agencies. The stage-frequency curves are a preliminary estimate of the probabilities associated with attaining floodwater elevations at selected locations in the study area. For the channel modification plans, no attempt was made to estimate induced flooding downstream of the study areas due to the preliminary nature of the analyses. This affect would be considered in the feasibility phase.

ENVIRONMENTAL ANALYSIS

The preliminary environmental analysis is based on existing information and field investigations of the study area. Preliminary mitigation costs are based on information developed by the U.S. Fish and Wildlife Service.

REAL ESTATE INVESTIGATIONS

Real estate investigations were limited to preliminary appraisals of the lands, easements, and rights-of-way necessary for the construction, operation, and

maintenance of the plans addressed in this study. Due to time and funding constraints, we did not comply with the information required by draft of Chapter 12 of the regulation, ER 405-2-12, Real Estate Handbook. Some plans with benefit-to-cost ratios found to be well below unity do not include real estate costs when this information was known prior to the appraisal.

EXISTING PROJECTS AND PRIOR STUDIES

A report on the Lake Pontchartrain, Louisiana and Vicinity hurricane protection project was completed in 1954. The report, which was published as House Document 231, 89th Congress, included the improvement of the Mandeville seawall. The Lake Pontchartrain, Louisiana, and Vicinity Hurricane Protection Project, was authorized by Public Law 89-298, October 27, 1965. The project, as originally formulated, involved the construction of low-level levees and barrier structures in Lake Pontchartrain to provide hurricane protection in the Lake Pontchartrain Basin. A project reevaluation was initiated in 1977 to determine whether the originally proposed plan was the most feasible method of achieving hurricane protection. In the reevaluation (completed in 1984), the most feasible plan was determined to be a high-level levee plan for the Metropolitan New Orleans Area. The high-level plan, unlike the barrier structure and low-level levee plan, does not afford hurricane protection to the north shore area.

The Lake Pontchartrain North Shore study was completed in November 1977. In this study, a variety of hurricane protection plans were developed for the north shore of Lake Pontchartrain, including the Slidell and Mandeville areas. No economically feasible flood control plans were developed for the City of Mandeville. An economically feasible plan was identified for the Howze Beach area, involving the construction of a levee from Highway 11 to Salt Bayou. However, this plan was opposed locally and was dropped from further consideration. Three levee plans were developed for the City of Slidell, but none of these plans was found to be economically feasible. It should be noted that the benefits for this study were calculated assuming the barrier project would be in place to moderate stages in the lake. Because the barrier project will not be constructed, the north shore of Lake Pontchartrain currently has a higher potential for hurricane flooding than reflected in the 1977 study's economic analysis.

A report recommending clearing and snagging of 53.5 miles of the Tangipahoa River above its mouth was completed in 1879. It was published

in House Document No. 98, 45th Congress, 3rd Session. The recommended improvements were completed in 1884.

A detailed project report recommending construction of an 8- by 100- foot entrance channel at the mouth of the Tangipahoa River was completed and approved on 28 July 1967 under Section 107 of the River and Harbor Act of 1960, as amended. The recommended improvements were completed in January 1971.

A draft reconnaissance report was prepared in May 1990 on hurricane protection for the Schneider Canal portion of Slidell, Louisiana. A economically feasible hurricane protection plan was identified for the area, but the study was suspended in August 1990 due to the lack of a non-Federal sponsor.

A report prepared in July 1970 on the Tangipahoa River and tributaries recommended no modifications or flood control improvements. This report considered small retention reservoirs on the river's tributaries and diversion channels on the lower river. Neither of these plans was found to be economically feasible.

A report prepared in 1880 recommended dredging and removal of navigation obstructions in the Tchefuncte and Bogue Falaya Rivers to Covington, Louisiana. The project was authorized in 1881. A second report on these streams was completed in 1927 recommending modification of the authorized improvements to provide a depth of 8 feet between Lake Pontchartrain and Washington Street in Covington, Louisiana. The project was completed in 1929 as maintenance on the former project. A third report on the Tchefuncte and Bogue Falaya Rivers, completed in 1957, favored construction of a 10-foot-deep by 125-foot-wide channel from Lake Pontchartrain to mile 3.5 (mile 0 is at the mouth of the stream) of the Tchefuncte River and a channel 8 feet deep over an unspecified bottom width from that point to Washington Street in Covington, Louisiana. The project was completed in 1959.

A report completed in 1924 resulted in authorization of 9 miles of navigation improvements on Bayou Bonfouca. The improvements were completed in 1931 and consisted of a channel 10 feet deep and 60 feet wide between Slidell and deep water in Lake Pontchartrain.

The Slidell, Louisiana, and Pearlington, Mississippi, flood control study evaluated the feasibility of various alternatives that would provide relief in Slidell from Pearl River flooding. A feasibility report, which was approved by the Board of Engineers for Rivers and Harbors in April 1986, recommended a 15-mile levee system for the Slidell area in the Pearl River Basin. The plan was authorized in 1985. Engineering and design studies are underway, with construction scheduled to begin in fiscal year 1993.

In 1933, a report recommended navigation improvements on Bayou Lacombe through the bar at the mouth of the stream, and removal of snags and overhanging trees from the mouth to about mile 8.2. The project was completed in 1938.

The River and Harbor Act of 3 March 1881, provided for removal of obstructions in the Tickfaw River from its mouth to mile 26; in the Blood River from its mouth to mile 4; and in the Natalbany and Ponchatoula Rivers for a distance of 15.5 miles. Total length of the improvement is 45.5 miles.

A number of clearing and snagging projects for flood control were completed in the study area under Section 2 of the Flood Control Act of 1937, as amended. The affected streams and work completion dates are as follows: Bayou Vincent (for a distance of 1.4 miles, December 1947), Little Tangipahoa River (approximately 8 miles in the vicinity of Magnolia, Mississippi, May 1956), Natalbany River (mile 12.5 to mile 15, March 1953), Natalbany River (mile 15 to mile 16.9, October 1954), Ponchatoula Creek (May 1949), Selser's Creek (July 1950), Tickfaw River (mile 17.8 to mile 34.1, June 1958), and Yellow Water River (October 1950).

A multi-purpose study of water resources problems and needs in the New Orleans-Baton Rouge Metropolitan area was completed in September 1981 (New Orleans-Baton Rouge Metropolitan Area Water Resources Study). Part of the study area included St. Tammany, Tangipahoa, St. Helena, and Livingston Parishes. Flood control improvements were considered for Ponchatoula Creek in Hammond and for the drainage canals in Slidell. None of these improvements was found to be economically feasible.

PROBLEM IDENTIFICATION

NATIONAL OBJECTIVES

The objective of Federal water resources planning is to contribute to national economic development in a manner consistent with protecting the nation's environment. Contributions to national economic development are increases in the net value of the national output of goods and services, expressed in monetary units, that occur in the planning area and the rest of the nation. In addition, planning should be in accordance with national environmental statutes, applicable Executive Orders, and other Federal planning requirements.

PHYSICAL SETTING

DRAINAGE IN THE STUDY AREA

The primary riverine drainage basins in the study area are the Tangipahoa, Tchefuncte, and Tickfaw rivers and their associated branches. A number of smaller bayous also drain this area. These include Bayou Chinchuba, Bayou Lacombe, Bayou Liberty, and Bayou Bonfouca. All of these bayous drain into Lake Pontchartrain.

The Tangipahoa River rises in southwest Mississippi near McComb and flows in a southerly direction about 110 miles through a portion of southeastern Louisiana and enters Lake Pontchartrain near the western end of the lake. Its watershed includes portions of Amite and Pike Counties in Mississippi and Tangipahoa Parish in Louisiana. The river has a drainage area of approximately 790 square miles varying in elevation from about 220 feet National Geodetic Vertical Datum (NGVD) in the headwaters to near mean sea level in the marshlands adjacent to the river at the lake. The width of the stream varies from a few feet in the upper reaches to about 200 feet near its mouth. The channel is very tortuous throughout its length. Streamflow is fairly rapid in the upper reaches but becomes tidal in the lowlands adjacent to the lake.

The Tchefuncte River rises in the upper portion of Tangipahoa and Washington Parishes, and flows in a southerly direction into Lake

Pontchartrain, opposite New Orleans, Louisiana. The distance by stream from the mouth to the source is approximately 70 miles. The drainage area is about 390 square miles. The Bogue Falaya, a major tributary of the Tchefuncte River, rises in the lower portion of Washington Parish and flows south, generally parallel to and about 6 miles east of the Tchefuncte River. It passes by the city of Covington in St. Tammany Parish and empties into the Tchefuncte River approximately 10.5 miles above its mouth. The Tchefuncte River is tidal for a distance of approximately 14 miles. The Bogue Falaya is tidal to the city of Covington. Above these points both rivers have the characteristics of hill streams, flowing through a low, gently sloping country.

The Tickfaw rises in southwestern Mississippi (Amite County) and flows approximately 80 miles in a southerly direction through St. Helena and Livingston Parishes in southeastern Louisiana to Lake Maurepas. The Tickfaw and its tributaries (including the Blind, Natalbany, and Ponchatoula Rivers) have a drainage area of about 650 square miles. Much like the other major rivers in the area, streamflow is fairly rapid in the upper reaches but becomes tidal in the lowlands adjacent to the lake.

DESCRIPTION OF STUDY SUBAREAS

The 8 subareas within the overall study boundaries for which specific problems, needs, and opportunities were addressed in the study are described below and shown on Plate 3.

Mile Branch-Lateral "A". Mile Branch originates in south-central St. Tammany Parish north of the city of Covington and flows through the city into the Tchefuncte River near river mile 14 (see Plate 4). The watershed encompasses 4.1 square miles. The predominate land use within the watershed is agricultural, primarily pasture, accounting for about 70 percent of the total watershed. The remaining 30 percent is mostly residential and commercial development located within the corporate limits in the southeastern portion of the watershed.

Lower Tchefuncte-Bogue Falaya River. This area includes the portion of the Tchefuncte and Bogue Falaya River basins south of Highway 190 (see Plate 5). It includes the cities of Madisonville and Covington as well as scattered residential development between the cities along the Tchefuncte River. The

Tchefuncte River drains some 147 square miles above the Highway 190 bridge crossing.

Mandeville-Lewisburg. This area is located in southwestern St. Tammany Parish along the north shore of Lake Pontchartrain (see Plates 6-8). It includes the city of Mandeville and the adjacent community of Lewisburg, which are separated by the Lake Pontchartrain Causeway Boulevard. The area is bounded by Highway 190 to the north, Little Bayou Castine to the east, Lake Pontchartrain to the south, and Bayou Chinchuba to the west. Both Mandeville and Lewisburg are mostly urban and include residential development and small commercial establishments.

The majority of each area drains directly into Lake Pontchartrain and through man-made culverts and natural streams. The east and west side of the Mandeville-Lewisburg area, however, drains into Little Bayou Castine and Bayou Chinchuba, respectively.

Bayou Chinchuba. Bayou Chinchuba originates in southwestern St. Tammany Parish northeast of the town of Mandeville and flows some 6 miles into Lake Pontchartrain (see Plate 9). The bayou has a drainage area of 11.1 square miles. The drainage basin and surrounding areas are undergoing rapid residential development, especially in the area east of Causeway Boulevard.

Slidell. This area is located in St. Tammany Parish near the northeastern shore of Lake Pontchartrain. It includes the portion of the City of Slidell and surrounding communities bounded by U. S. Highway 190 (Gause Boulevard) to the north, Interstate 10 to the east, Schneider Canal and the Lake Pontchartrain marshes to the south, and a pipeline crossing to the west (see Plate 10). The Southern Railroad divides this area into two parts. The portion east of the Southern Railroad is mostly urban and includes residential development, shopping centers, and a number of other small commercial establishments. In the west portion, most of the development is situated along Bayou Bonfouca, Bayou Liberty, and Highway 433.

Major drainage outlets include Bayou Bonfouca, Bayou Liberty (and Bayou Vincent), Schneider Canal, and the W14 and W15 canals to the east. All of these channels drain into Lake Pontchartrain, which is located from one to three miles from the study area.

Lacombe. This area is located in southern St. Tammany Parish along the north shore of Lake Pontchartrain (see Plate 11). It includes the

unincorporated communities of Lacombe and Oak Lawn. The area includes a 6-mile band of residential and commercial development on both the east and west side of Bayou Lacombe extending south of Highway 190 for some 3 miles. In the west portion, most of the development is concentrated along Bayou Lacombe, Highway 434, and Cypress Bayou.

The area drains into Lake Pontchartrain through Bayou Lacombe which has a drainage area of 96.2 square miles.

Madisonville. This area is located in southwestern St. Tammany Parish some 2 miles from Lake Pontchartrain on the east bank of the Tchefuncte River (see Plate 12). It includes the immediate town of Madisonville. The area drains into the Tchefuncte River and to the marshy area on the west of town.

Ponchatoula Creek-Yellow Water River. Ponchatoula Creek, with a drainage area of 69 square miles at its mouth, begins approximately 10 miles north of the City of Hammond in Tangipahoa Parish (see Plate 13). It flows in a southern direction, entering the Natalbany River approximately 4 miles southwest of Ponchatoula. Yellow Water River Canal, with a drainage area of 18.1 square miles at its mouth, begins approximately 10 miles north of Hammond and flows in a southerly direction, connecting with and crossing Ponchatoula creek approximately 0.5 miles north of the northern corporate limits of Hammond. After interconnecting with Ponchatoula Creek, Yellow Water River Canal flows in a southerly direction, entering Ponchatoula Creek again approximately 4.5 miles south of Hammond. Land use on either side of Yellow Water River Canal, between U.S. Route 51 and Highway 190 consists primarily of pasture, woodland, and scattered residential development. Land use along Ponchatoula Creek between the northern confluence of Yellow Water River Canal and Highway 190 consists mostly of residential areas and the Southeastern Louisiana University campus.

CLIMATE

The climate of the area is humid subtropical, but is subject to significant polar influences during winter, as cold air masses periodically move southward over the area displacing warm moist air. Prevailing southerly winds create a strong maritime character. This movement from the Gulf of Mexico helps to decrease the range between hot and cold temperatures and provides a source of abundant moisture and rainfall.

Temperature. Records of temperatures are available from "Climatological Data" for Louisiana, published by the National Climatic Center. The study area can be described by using the average normal temperature data observed at four climatological stations located within or near the study area. These stations are listed in Table 1 along with their monthly and annual mean normals which are based on the period 1951-1980. The annual mean normal temperature is 66.4 °F, with monthly mean temperature normal varying from 81.3 °F in July to 49.7 °F in January. A maximum extreme temperature of 105 °F was recorded at Amite and Covington during June 1988 and August 1909, respectively. A minimum extreme of 1 °F was recorded at Hammond during February 1899.

Precipitation. Records of precipitation are also available in publication by the National Climatic Center. Fifteen stations were used to show the rainfall data for the study area. Table 2 gives a list of the stations with their period of record, and available extremes. Nine of these stations have precipitation normals. The average annual normal is 61.8 inches based over the period 1951-1980. Table 3 lists the monthly and annual normals of these stations. The wettest month is July with an average monthly normal of 7.07 inches. October is the driest month averaging 2.63 inches. The average annual rainfall since 1980 is 65.1 inches. This average accounts for fourteen stations with current records and is shown in Table 4 with the monthly and annual averages of each station.

Wind. The average velocity of winds in the study area is 7.3 mph. This is based on 18 years of record (1973-1990) taken at Baton Rouge at Ryan Airport. Prevailing wind flow is from a southerly direction during much of the year. The maximum wind speed observed at this station since 1963 was 58 mph during September 1965 and was caused by Hurricane Betsy. Table 5 gives the monthly and annual wind speeds for Baton Rouge.

STREAM GAGING DATA

Streamflow data is available from major gaging stations in the study area. Many of these stations are maintained through cooperative agreement between the U.S. Army Corps of Engineers and the U.S. Geological Survey. Maximum records were set at 5 of the 12 stations in the study area from the

TABLE 1
MEAN MONTHLY AND ANNUAL TEMPERATURE (^{O}F)
30 Year Normals (1951-1980)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
AMITE	49.4	52.4	59.5	67.4	74.0	79.7	81.8	81.3	77.6	67.4	57.9	51.6	66.70
COVINGTON	51.3	53.7	60.1	67.4	73.8	79.3	81.3	80.9	77.5	67.7	58.5	53.2	67.10
HAMMOND	51.0	53.6	60.2	67.6	73.6	79.3	81.4	80.9	77.4	67.3	58.3	52.7	66.90
LIBERTY	47.1	50.1	57.3	65.6	72.2	78.3	80.6	80.0	76.1	65.4	55.7	49.3	64.80
AVERAGE	49.7	52.5	59.3	67.0	73.4	79.2	81.3	80.8	77.2	67.0	57.6	51.7	66.40

Source: National Climatic Center

TABLE 2
PRECIPITATION STATIONS

Station	Map No.	Period of Record	Maximum Monthly (in.)[a]	Date	Minimum Monthly (in.)[a]	Date	Greatest 1-Day (in.)[a]	Date
Louisiana Normals								
Amite	1	1885-1990	18.95	4/83	0.0	10/52	8.77	4/6/83
Covington	2	1894-1990	18.02	12/53	0.0	10/52	6.67	12/4/82
Hammond	3	1887-1990	17.15	2/66	0.0	10/52	12.77	9/28/64
Kentwood	4	1941-1990	17.08	5/74	0.0	10/78[b]	9.80	5/22/74
Pearl River Lock	5	1947-1985	15.61	3/80	0.0	10/78	8.15	5/19/58
Pine Grove	6	1907-1990	19.33	8/77	0.0	10/52	8.65	4/6/83
Oaknolia	7	1942-1990	16.17	8/77	0.01	4/65	7.98	4/6/83
Mississippi Normals								
Liberty	8	1949-1988	16.25	3/80	0.0	10/63	7.85	4/21/77
Tylertown	9	1938-1988	18.21	4/83	0.0	10/52	8.91	6/14/63
Without Normals								
Abita Springs	10	1973-1990	15.93	3/80	0.0	10/78	8.23	5/3/78
Denham Springs	11	1978-1990	19.24	8/83	T	10/78	13.80	8/2/83
Franklinton	12	1956-1990	18.03	4/83	0.0	10/78	10.50	4/6/83
Greenwell Springs	13	1967-1990	17.05	4/80	0.11	6/79	11.42	8/2/83
Livingston	14	1979-1990	15.18	4/80	0.13	11/85	6.16	12/4/82
Slidell	15	1956-1990	17.74	5/58	0.0	10/78	13.2	5/18/58
Springville	16	1955-1987	17.37	2/66	0.0	10/78	7.00	7/11/79

a From 1951 b And other dates T Trace
Source: National Climatic Center

TABLE 3
MONTHLY AND ANNUAL PRECIPITATION (inches)
30 Year Normals (1951-1980)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
						LOUISIANA STATIONS							
AMITE	5.44	5.90	5.66	6.46	5.48	4.51	7.33	4.86	5.18	2.68	4.58	5.82	63.90
COVINGTON	4.87	5.32	5.71	5.33	5.24	4.64	6.65	5.16	5.39	2.96	4.12	5.89	61.28
HAMMOND	4.81	5.65	5.67	6.15	5.68	3.82	7.53	4.82	5.74	2.94	4.44	5.99	63.24
KENTWOOD	5.39	5.18	5.78	6.17	6.14	4.49	7.15	5.03	4.74	2.79	4.78	5.91	63.55
OAKNOLIA	5.33	5.39	5.33	5.95	5.64	3.80	6.20	4.77	4.24	3.02	4.27	5.44	59.38
PEARL RIVER	4.92	5.07	5.85	5.46	5.20	4.16	6.64	5.20	5.53	2.72	4.41	5.78	60.94
PINE GROVE	5.88	5.86	6.08	6.52	6.11	4.26	7.78	5.57	4.94	3.20	4.83	6.46	67.49
						MISSISSIPPI STATIONS							
LIBERTY	5.04	4.81	5.93	5.38	5.31	4.53	5.85	4.43	4.29	2.48	4.38	6.04	58.47
TYLERTOWN	5.00	5.23	5.48	5.53	5.56	4.17	5.78	4.45	3.60	2.67	4.16	5.93	57.56
AVG. NORMAL	5.19	5.38	5.72	5.88	5.60	4.26	6.77	4.92	4.85	2.83	4.44	5.92	61.76

SOURCE: National Climatic Center

TABLE 4
Average Precipitation(inches)
(1980-1990)

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
LOUISIANA													
ABITA SPRINGS	4.44	6.68	6.34	4.46	4.19	5.73	4.84	7.84	4.76	3.17	4.10	5.12	61.67
AMITE	4.97	6.84	6.20	5.44	4.65	5.40	5.42	6.70	4.59	4.22	4.38	6.32	65.12
COVINGTON	4.32	7.03	6.45	4.50	4.86	5.39	6.21	6.33	4.66	3.36	4.52	5.80	63.26
DENHAM SPRINGS	4.66	6.20	5.73	4.83	4.94	6.59	6.36	7.12	3.65	4.11	4.10	5.32	63.63
FRANKLINTON	4.65	6.95	6.77	5.70	5.49	5.06	5.05	5.45	3.44	3.14	5.14	5.43	61.72
GREENWELL SPRINGS	5.05	6.53	5.83	5.44	5.57	6.99	4.49	6.65	4.49	4.98	4.95	6.18	67.15
HAMMOND	4.90	7.55	5.93	5.22	4.54	6.31	5.96	6.98	4.27	3.94	4.32	5.69	65.64
KENTWOOD	5.84	7.29	6.85	5.98	4.58	6.04	4.97	5.97	3.97	4.27	4.40	6.20	65.09
LIVINGSTON	4.64	6.66	5.53	4.88	4.98	6.18	5.61	6.06	4.33	3.89	4.03	5.72	69.32
OAKNOLIA	5.64	6.52	5.52	5.06	5.65	6.08	4.83	6.61	4.68	4.87	4.77	6.55	66.77
PINE GROVE	5.48	7.34	6.52	5.64	6.19	6.87	6.47	8.04	5.97	5.12	4.86	7.40	75.88
SLIDELL	4.36	6.17	6.04	4.49	4.83	4.26	5.80	5.94	5.03	3.38	3.74	4.57	58.60
MISSISSIPPI													
LIBERTY	5.35	6.65	4.46	4.11	3.90	5.73	4.63	6.04	4.13	3.95	4.42	5.53[a]	61.35[b]
TYLERTOWN	5.33	6.55	5.44	5.01	5.88	7.01	4.80	5.92	3.96	5.33	4.08	6.49[a]	66.10[b]
AVERAGE	4.97	6.78	5.97	5.05	5.02	5.97	5.39	6.55	4.42	4.12	4.42	5.88	65.09

a Not Available - used normal b Estimated

TABLE 5
AVERAGE MONTHLY AND ANNUAL WIND SPEEDS
1973 - 1990 (MPH)
BATON ROUGE AT RYAN AIRPORT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
AVG	8.3	8.8	9.0	8.3	7.5	6.4	5.6	5.3	6.4	6.5	7.5	8.0	7.3

SOURCE: National Climatic Center

TABLE 6
STREAM GAGING DATA

MAP NO.	STATION	PERIOD OF RECORD	MAXIMUM STAGE FT (NGVD)	MAXIMUM STAGE DATE	MAXIMUM DISCHARGE CFS	MAXIMUM DISCHARGE DATE	MINIMUM STAGE FT (NGVD)	MINIMUM STAGE DATE	MINIMUM DISCHARGE CFS	MINIMUM DISCHARGE DATE
1	LAKE PONTCHARTRAIN MANDEVILLE	1931-89	7.6	10/85[a]	-	-	-2.25	1/38	-	-
2	BAYOU BONFOUCA nr SLIDELL	1962-89	6.8	8/69[a]	-	-	-0.60	2/63	-	-
3	TICKFAW RIVER nr SPRINGFIELD	1947-89	6.46	10/85[a]	-	-	-1.43	12/54	-	-
4	@ HOLDEN	1940-89	40.19[b]	4/83	22470	4/83	20.08	10/76	65	10/69
5	@ LIVERPOOL	1956-89[d]	217.74	4/83	32000	4/83	206.20	10/68	29	9/68
6	NATALBANY RIVER @ BAPTIST	1943-89	32.08	4/83	9810	4/83	14.06	10/80	1.8	11/63
7	YELLOW WATER RIVER nr HAMMOND	1948-89	36.99	9/64	-	-	0	dry[c]	-	-
8	TANGIPAHOA RIVER @ ROBERT	1938-89	32.74[b]	4/83	85000	4/83	9.82	10/39	245	10/68
9	PONCHATOULA CREEK @ HAMMOND	1948-89	39.11	4/77	-	-	0	dry[c]	-	-
10	nr PONCHATOULA	1948-89	17.37	6/50	-	-	-0.93	6/77	-	-
11	TCHEFUNCTE RIVER @FOLSOM	1943-89	86.23	4/83	29800	4/83	66.86	10/86	26	9/68
12	PASS MANCHAC nr PONCHATOULA	1955-89	5.40	10/85	-	-	-2.00	1/61	-	-

a Caused by Hurricane
b From Highwater Mark
c Dry on several occasions
d Records: 1956-68,79-81,81-89
Source: U.S. Geological Survey Water-Date Report LA-88
U.S. Army Engineers District, New Orleans

April 1983 flood and 3 from Hurricane Juan in October 1985. The stations with their maximum and minimum stages and discharges are shown in Tables 6 and 7.

STORMS AND FLOODS OF RECORD

High stages from hurricanes have occurred in the lower portion of the study area in 1909, 1947, 1956, 1961, 1964, 1965, 1969, 1974, and 1985. Hurricane Juan in October 1985 was the last storm to affect the area. Maximum stages from Hurricane Juan were 7.6 feet on Lake Pontchartrain at Mandeville, 5.4 feet at Pass Manchac near Ponchatoula, and 6.46 feet on the Tickfaw River at Springfield (all stages NGVD).

Stream flooding which resulted from intense rainfall has occurred on occasion in the area. The most severe flood events occurred in May 1953 and April 1983. These two floods are described below.

May 1953 The flood of May 1953 was caused by unusually heavy rains beginning at the end of April. During the period 22 April-9 May 1953 heavy rainfall produced generally high stages on most streams in the area and set the stage for additional flooding following a second storm period between 10-21 May 1953. At the Tangipahoa River at Robert, a peak discharge of 50,500 cubic feet per second (cfs) occurred on May 3 and had a maximum stage of 30 ft., NGVD. At the Natalbany River at Baptist, a peak discharge of 9,550 cubic feet per second also occurred on May 3 and had a maximum stage of 31 ft., NGVD. The highest stage on the Tchefuncte River near Covington was 29.9 ft., NGVD.

April 1983 Heavy rains produced the flood in April of 1983. During 5-8 April, severe thunderstorms produced more than 10 inches of rain over the study area with several of the stations receiving over 8 inches on April 6. Several stage and discharge records were exceeded during this flood. The Tangipahoa River at Robert recorded a peak discharge of 85,000 cfs with a highwater mark of 32.74 ft., NGVD. Other records were set on the Tickfaw

TABLE 7
HYDROLOGIC STATIONS

PERIODS OF RECORD

Station	Level Gage	Record Available	STAGE EXTREMES (NGVD) Maximum	Date	Minimum	Date
Tickfaw River nr Springfield	Auto Recorder and Staff	Gage Heights, May 47 to 1989 Discharge, last observation -7 in 1977	6.51*	Oct 85	-1.43	Dec 54
Pass Manchac nr Ponchatoula	Staff	Gage Heights, July 55 to 1989	5.4*	Oct 85	-2.0	Jan 61
Lake Pontchartrain at Frenier	Auto Recorder and Staff	Gage Heights, Sep 31 to Sep 65 Jan 69 to 1988	12.09* (watermark)	Sep 65	-2.71	Dec 88
Lake Pontchartrain at Mandeville	Auto Recorder and Wire Weights	Gage Heights, Aug 57 to 1989	6.95*	Sep 47	-2.25	Jan 38
Lake Pontchartrain at Midlake nr New Orleans	Auto Recorder and Wire Weights	Gage Heights, Aug 57 to 1989	6.14*	Oct 85	-1.28	Mar 65

* Caused by hurricane

River at Holden with a peak discharge of 22,470 cfs and a highwater mark of 40.19 ft., NGVD, and on the Natalbany River at Baptist with a peak discharge of 9,810 cfs and maximum stage of 32.08 ft., NGVD.

Other large floods on the Tangipahoa River at Robert occurred in 1961, with 38,200 cfs; 1966, with 30,800 cfs; 1973, with 37,900 cfs; and 1974, with 39, 500 cfs. Other large floods on the Natalbany River at Baptist occurred in 1964, with 8,140 cfs; 1967, with 6,390 cfs; and 1974, with 7,080 cfs.

The January 1990 flood was the latest flood of record. Rainfall from 3 to 6 inches fell over the the southeastern portion of the state during 23-25 January, producing flooding and high water throughout the study area, though damages to structures were low. Very wet soil condition and elevated water tables intensified flooding problems despite low storm-rainfall totals. The upper reaches of the Tickfaw River were above flood stage from the 25th to 28th with the Holden gage peaking on the 26th, with a reading of 38.15 ft, NGVD.

GEOLOGY

The study area lies on the Pleistocene Coastal Terraces Belt (Pine Meadows) within the Eastern Gulf Coastal Plain. This belt is a narrow strip of coastal lowland situated between the Southern Pine Hills and Lakes Pontchartrain and Maurepas. Elevations in the area range from about sea level to 350 feet.

Three geological features, Pleistocene Terrace (Central Coastal Plain), Prairie Terrace (Gulf Coast Flatwoods) and Deltaic Plain (Southern Mississippi Valley Alluvium), predominate. The Pleistocene Terrace is located in the upper half of the study area and is characterized by gently rolling hills, steep streambanks, and narrow floodplains. The Pleistocene terraces, generally, are comprised of fine-grained sediments at and near the surface. Sediments vary from clays to silts with some sand present. The clays consist of lean clays and fat clays, which are known to be expansive in some areas. Soils are loamy and moderately well drained. The Prairie Terrace is found in the lower half, and the terrain becomes relatively flatter, although the floodplains are still narrow. These terraces have faint relief and low seaward-facing scarps. The loamy and poorly drained soils are often nutrient poor and acidic. A narrow band of alluvial, Deltaic Plain is found near the shore of Lake Pontchartrain, and the land becomes much flatter and the floodplain widens. Holocene marsh and swamp areas are present here

which vary in thickness. Generally, these marsh and swamp deposits consist of highly organic clays and silts with some peat and sand layers. The mucky and clayey soils found here are often saturated.

ENVIRONMENTAL RESOURCES

BIOLOGICAL

The physiographic areas of the study area are similar to the geological features. The forested terrace uplands of the Pleistocene Terrace are composed primarily of woodland and pastureland; the broad terraces of the Prairie Terrace are largely woodland, pastureland, and truck crops; the alluvial floodplain of the Deltaic Plain is predominately marshes and swamps; and the river flood plains are almost all woodlands.

Historically, the forested terrace uplands supported vast stands of longleaf and slash pine, however most of this area was cleared by the early 1900's. Much of the area has been replanted with loblolly and slash pine. Along rivers, mixed pine-hardwoods and bottomland hardwoods are present. Cleared areas are farmed for dairy products, cattle, and truck crops. The broad terraces support vegetation similar to the terraced uplands in the drier sites and with pine flatwoods on saturated soils. Historically, these flatwoods burned regularly, resulting in longleaf pine savannahs. Plant diversity in the flatwoods is very high. Much of the vegetation is unique, including insectivorous plants and orchids.

The alluvial floodplains are mostly wetlands, primarily marsh and forested wetlands. The marshes are of a fresh to brackish type while the forested wetlands, most of which are swamp, are composed of bald cypress and water tupelo. These areas are found along the fringes of major lakes and bayous.

The narrow flood plains of the streams are largely wooded with bottomland hardwood species capable of withstanding frequent, but short duration, flooding.

Lake Pontchartrain is the most obvious physiographic feature of the area. The shallow, flat bottomed lake encompasses about 640 square miles and drains a 4,700 square mile area. The lake's salinity, which varies from fresh to brackish, is dependent upon the quantity of fresh water supplied by its tributaries and wind-driven tides.

Because of the geological and physiographic features of the area, a diversity of habitats are present. The majority of these areas are wetlands. The habitat types potentially to be impacted by the various alternatives are described below:

Fresh/Intermediate Marsh. Fresh and intermediate marshes are non-forested communities found in nearly permanently saturated soils with interspersed small ponds. The fresh marsh is generally found in areas with salinities of less than 2 parts per thousand (ppt) and the intermediate marsh ranges from 1 to 5 ppt. This productive community acts as a nursery area for estuarine species.

The floristic composition of fresh/intermediate marsh is quite heterogeneous and is dependent on the frequency and duration of flooding as well as substrate, flow and salinity. The fresh marsh is frequently dominated by maidencane while in the intermediate marsh, marsh-hay cordgrass predominates. Vegetation common in the fresh marsh includes spikesedge, bulltongue, alligatorweed, cordgrass, pickerelweed, pennyworts, waterlillies and cattail; and in the intermediate marsh includes reed, bulltongue, hyssop, spikesedge, three-cornered grass, bulrush, threesquare, and switch grass.

These marshes act as important nursery areas for juveniles of many estuarine organisms, including flounder, black drum, seatrout, and croaker. Fish found here include mosquitofish, killifishes, gar, shad, buffalo, catfish, bass, and drum. Amphibians and reptiles seen would include tree frogs, alligators, anoles and various water snakes. Long-legged wading birds, such as herons, egrets, and ibis; waterfowl, like teal, gadwalls, widgeons, and scaup; and other water birds such as stilts, rails, and bitterns are present. Mammals would include deer, rabbits, nutria, otter, raccoon, and mink.

Cypress Swamps. Cypress swamps are forested communities found on nearly permanently saturated soils and frequently occur along bayou edges. These swamps are important in improving water quality and serve as nursery area for many freshwater and some estuarine dependent fish and shellfish. High productivity of the system is increased by periodic flooding and increased water flow. Floristic diversity is relatively low, and undergrowth is generally sparse as a result of low light and long periods of inundation.

The predominate vegetative species in these swamps are cypress and tupelo gum. Common associates with these trees are red maple, black willow, pumpkin ash, water elm and button bush.

Important detritivores are crawfish and aquatic insect larvae. Reptiles and amphibians are especially abundant in this community. Waterfowl, primarily wood ducks and mallards, are common. Typical mammals found here are raccoons, opossums, white-tailed deer, and squirrels.

Bottomland Hardwood Forests. Bottomland hardwood forests are wooded communities found on frequently flooded soils and generally occur between the swamp and adjacent uplands. These communities are very productive due to the periodic flooding, and deposition of organic matter and nutrients. The vegetative associations found in this habitat type are quite diverse, and are dependent upon many factors including hydro-period, climate, soils, and water quality.

Most of the non-riparian bottomland hardwood forests in the project area are a sweet gum-water oak community. Major associates of this community include green ash and American elm. Other species typical here are red maple, greenbriers, deciduous holly, and trumpet-creeper. The soils are saturated or inundated for one to two months during the growing season.

Riparian bottomland hardwood forests are narrow, linear forests occurring along small rivers. The soils are generally silt/sand loams, and are annually flooded for a week or two a year, but seldom more than a couple of days at a time. The species composition is quite variable, and is dependent on the slope, soil type, and frequency and duration of flooding. Common trees include magnolia, beech, sweet gum, black gum, red maple, birch, ash, spruce pine and cypress.

Abundant food and cover results in high productivity for fish and wildlife species. Flooded bottomlands produces many shallow, warm water sites where many aquatic organisms spawn and/or feed on decaying plant material. The seasonally flooded areas provide nursery areas for many fish. Reptiles and amphibians are abundant in this community. Wintering waterfowl are common during winter flood periods. Typical animals found here are herons, egrets, otters, raccoons, opossums, white-tailed deer, and squirrels.

Pine Flatwoods. Pine flatwoods are found on flat, low relief areas with a high water table or along the edges of moderate to large streams. The soils are generally saturated during the late winter/early spring rainy season and periodically during the summer growing season. This community is maintained by fire, and the mid- to under- story present is dependent on the frequency of burning. In the absence of fire, the community generally transitions to a hardwood forest.

Longleaf, slash, loblolly and spruce pine are typically found mixed in various percent of composition, although spruce pine tends to be found near sandy, flowing streams. Other trees found in association with the pines include water oak, sweetbay, red maple, sweet gum and black gum. In damper areas, cypress is often seen. Understory species include palmetto, gallberry, cyrilla, wax-myrtles and blueberries.

These communities have a moderate animal population. Species, such as deer, squirrel, turkey, rabbit, dove, quail, and woodcock are common as are raccoons, coyotes, foxes, minks, opossums, and bobcats. The endangered red-cockaded woodpecker is found in this habitat type.

Pine Savannah. The pine savannah is an open, herbaceous area with scattered trees throughout. The savannahs are found on seasonally flooded, flat area with very poor drainage. The soils are very acid and often underlain with an impervious layer of clay. The water table is near the surface most of the year. The community is maintained by frequent fires, especially during the spring and early summer.

The sparse overstory is typified by longleaf and slash pines with an occasional sweet bay, black gum or live oak. Cypress may be found in the lower sites. The herbaceous vegetation is very diverse, and dominated by grasses such as broomsedge, bluestem, panic grass, toothache grass jointgrass, yellow-eyed grass, and umbrella grass. Insectivorous plants are typical in this community and include pitcher plants, sundews, butterworts, and bladderworts. Numerous orchard species are found throughout. Club and sphagnum mosses are abundant. Flatwood ponds, or "bogs", are wet depressions in the savannah dominated by taller grasses and sedges. This community is unique to the "Florida Parishes" and are classified as rare within the state.

These communities have a moderate animal population. Species, such as deer, turkey, rabbit, dove, quail, and woodcock are common as are sparrows,

raccoons, minks, skunks and opossums. The endangered red-cockaded woodpecker is also found here.

Mixed Hardwood-Pine Forest. The mixed hardwood-pine forest community is found in the upland, drier sites. The community is quite variable in the ratio of evergreen and deciduous vegetation as well as the species composition. The plant species present are dependent largely on soil moisture and fire. Without fire, the community tends to be dominated by hardwoods.

Loblolly pine is often the dominate species, comprising 20 percent or more of the overstory trees. Other pine trees include longleaf, slash and shortleaf. Hardwood trees in damper areas include sweet gum; beech; and water, cherrybark, swamp and white oak, and in dryer sites includes hickory; sassafras; and red, post, water, and blackjack oak.

The live oak - pine - magnolia community is a mixed hardwood/pine forest found throughout the dryer areas within two miles of Lake Pontchartrain. These forests are quite variable in species composition, and the community type is dependent on a number of factors including slope, soil moisture, age, drainage and fire. Overstory species include live oak, southern magnolia, and longleaf, slash and loblolly pine. Other significant trees include red maple; sweet gum; sweet bay; black gum; and water, white, laurel and cherrybark oak. The area serves as important resting and foraging habitat for trans-gulf migrating birds.

These communities have a moderate animal population. Species, such as deer, squirrel, turkey, rabbit, dove, quail, and woodcock are common as are raccoons, coyotes, foxes, opossums, and bobcats.

Riverine. A number of sandy-bottomed, meandering streams or bayous flow through the study area and into Lake Pontchartrain. These aquatic sites vary from shallow sand/gravel riffles in the upper reach to slow, relatively deep water near the lake. Water quality is good to poor for primary and secondary contact recreation as well as fish and wildlife production.

Invertebrate species found in these systems include mayflies, caddisfly, damselfly, dragonfly, and various mussels. Fish found include bass, sunfishs, madtoms, topminnow, shiners, and darters. Species diversity of fish tends to diminish in the upper reaches as does the size of the fish.

Lake Pontchartrain. Lake Pontchartrain is a flat-bottomed water body about 640 square miles in area and averaging about 12 feet deep. Normal tidal ranges are less than one foot, and the lake's salinity varies from fresh to brackish depending on the location. The lake receives runoff from a 4,700 square mile drainage area, primarily via the Tangipahoa and Tchefuncte Rivers and Bayous Lacombe and Bonfouca. The lake serves as a primary nursery area and supports a commercial and sport fishery.

Commercially and recreationally important invertebrates in the lake include the blue crab, and white and brown shrimp. Sport fishery includes the largemouth bass, sunfishes, catfishes, seatrout, drum, flounder, and croaker, and commercial fishery includes catfish, seatrout, black drum and flounder. Nongame fish include shad, bowfin, mullet, menhaden and anchovy. Non-aquatic species using the lake are seabirds, wading birds and diving ducks.

ENDANGERED AND THREATENED SPECIES

Endangered and threatened species resident in the general study area are the Gulf of Mexico sturgeon, gopher tortoise, ringed sawbacked turtle and red-cockaded woodpecker. The anadromous sturgeon could be found in any of the freshwater streams and bayous flowing into Lake Pontchartrain, and they may spawn in these streams. The gopher tortoise is found in dry, open sandy areas while the ringed sawbacked turtle is found in the slower moving waters of the adjacent Pearl River basin. The redcockaded woodpecker is found in pine woodlands, and nest in old pine trees with red heart disease. Transient species would include the brown pelican and peregrine falcon. The American alligator is listed as endangered due to similarity of appearance to other crocodilian species. The Bachmans Warbler was common in lower St. Tammany Parish in the 1800's, but has not been seen in years.

NATURAL AND SCENIC RIVERS

Louisiana's Natural and Scenic Rivers System was established in 1988 to protect, preserve, develop, reclaim, and enhance the wild and scenic beauty of designated free-flowing rivers, streams, bayous, or segments of them. To be designated as such, the stream must not have been channelized, cleared, nor snagged within the past 25 years, not realigned, inundated, or otherwise altered. The shoreline must be covered by native vegetation and have no, or few, man-made structures.

A number of the study area's rivers, streams and bayous are included in the Louisiana Natural and Scenic Rivers System. These include portions of the Bogue Chitto River, Tangipahoa River, Tchefuncte River, Bayou Cane, and Bayou Lacombe. The Bogue Falaya and Bayou Chinchuba are currently being evaluated for inclusion into the system.

RECREATION RESOURCES

Many of the rivers, streams, and bayous located in the study area are aesthetically pleasing with their lush wooded banks and clear flowing waters. It is the moderate pollution problems from agricultural, industrial, and municipal sources which detract most from their beauty. Terrestrial and boating access to the lower reaches of these waterbodies is quite good. Several boat launching facilities are available as well as numerous bridge crossings. Much of the recreational activity is therefore water oriented. Most of these rivers' upper reaches can be easily floated by canoe. Their lower portions are suitable for motorboating. Fishing is good but swimming is somewhat limited because of pollution, although the water quality does not seem to deter swimmers and waterskiers on hot summer days. Fishing hunting and recreation camps have been established along the streambanks especially in the lower reaches. Moderate access exists at highway crossings, but most of the streambanks are privately owned. Several picnicking and camping areas, both public and private, are spotted along the banks. Two State Parks, Fairview-Riverside on the Tchefuncte River and Fontainebleau on Lake Pontchartrain's north shore, are located within the study area. These offer camping, fishing, picnicking and boating.

CULTURAL RESOURCES

The study area, locally known as the North Shore, is culturally and geographically distinct from the rest of southern Louisiana. The way people live on the rolling terrain of the Pleistocene terraces, the rivers which dissect it, and the marshes which edge Lake Pontchartrain contrasts with the bayou and river bank adaptation of the South Shore. This is true for both the historic and prehistoric periods.

The "Florida Parishes" of the North Shore are part of the Upland South cultural tradition. European pioneers were generally yeoman farmers of

small holdings, Scotch-Irish or English, Protestant, and antifederal. This culture contrasts sharply with the Plantation based economy of the Creole, Catholic south. Timber and pitch were abundantly available from the forests of the uplands. The major corridor of maritime commerce from Mobile and the Gulf of Mexico to New Orleans was through Lake Pontchartrain. These factors made Madisonville and the lower Tchefuncte River a center of shipbuilding activity from before the War of 1812 to the present time. Communities along the lakefront and the rivers flowing into it were fostered by the water connection to New Orleans and by New Orleanians escaping the oppressive summer heat of the low lying city.

As the first Europeans moved into the region, Indian groups living along the Pearl River (Acolapissa, Choctaw, and Pensacola) were displaced and resettled along the shore of Lake Pontchartrain. The poorly known archeological sites created by these Indian groups are virtually our sole source of information on the final chapter of these tribes autonomous existence.

Hundreds of prehistoric archeological sites are known in the study area, in spite of the absence of thorough local investigations. Only a few of the oldest (Paleo-Indian) type of sites are known. However, the dissected Pleistocene terraces which are the locally dominant landform should contain more of these kinds of sites. Most prehistoric archeological sites are simple lithic scatters, many of them associated with gravel deposits. A few mound sites are known. Artifacts found at Archaic period sites indicate that these groups appear to share traits with Archaic peoples to the southeast rather than those from west of the Mississippi. Archeological sites which yield pottery are rare. The Late Prehistoric agricultural villages which are typical of the alluvial valleys are not prominant in the uplands.

NATIONAL REGISTER OF HISTORIC PLACES

There are 42 National Register of Historic Places entities recorded in Tangipahoa and St. Tammany Parishes. All of these are historic structures. The Tchefuncte River was a center of shipbuilding through the War of 1812, Civil War, World War II and up to the present. Artifacts of this maritime industry as well as the wrecks of ships and boats themselves are potentially cultural resources.

WATER QUALITY

A discussion of existing water quality in the study area is given in Appendix A.

DEVELOPMENT AND ECONOMY

ST. TAMMANY PARISH

St. Tammany covers approximately 873 square miles and in 1990 had a population of about 143,561, a 30 percent increase over the 1980 census figure. Forty-one percent of the population was urban in 1980. There were about 3.06 persons per household in 1980 and 35,695 owner occupied housing units, and 7,383 renter occupied units. Ten percent of the families lived below the poverty level in 1980. Located within the parish were 12 private and public schools, one railroad, and one airport. A 1983 breakdown of the number of workers employed within the parish gives the following distribution:

Agricultural, Forestry & Fisheries	313
Mining	147
Contract Construction	1,921
Manufacturing	1,547
Transportation, & other Public Utilities	1,262
Wholesale Trade	889
Retail Trade	6,675
Finance, Insurance, and Real Estate	1,300
Services	8,778
Public Administration	1,075

The Louisiana Department of Labor's "Labor Market Information" for 1990 indicated that the civilian labor force in the St. Tammany Parish area increased from 63,800 to 64,500 during the past 12-month period. The unemployment rate appears to be dropping significantly from 9.0 percent to 6.7 percent, with total unemployment decreasing from 5,700 to 4,300. Several of the communities within the parish are within daily commuting distance of employment opportunities in the New Orleans central business district. Forty two percent of the population works outside of the parish.

Mile Branch-Lateral "A" Area. The community of Covington is situated 30 miles north of New Orleans, eight miles north of the Lake Pontchartrain Causeway. It lies just north of the convergence of the Tchefuncte and Bogue Falaya Rivers; Mile Branch cuts through the northwestern half of the city. Covington is the parish seat and covers approximately 6.7 square miles of the study area.

The 1980 population of Covington was 7,892, an increase of 10 percent from 1970; however, the population appears to have declined according to census data reported in the Times-Picayune which placed the current number at 7,647. The median household income was $14,201, and 23 percent of the population lived below the poverty level in 1980. There were 3,127 total housing units in the town with a median value of $56,500 each in 1980.

Development within the Mile Branch overflow basin consists of 754 single-family residential structures; 8 mobile homes; 49 apartment buildings; and 62 commercial structures. The average value of a home in this area, excluding land, is $37,075. Apartment and other commercial buildings averaged $101,081 and $155,903 in value per structure, respectively.

The area is composed of a mix of property ranging from very low valued, located in the northern most reaches of the basin, to middle and upper middle class properties located in the lower reaches of the basin.

Lower Tchefuncte-Bogue Falaya Area. The Lower Tchefuncte-Bogue Falaya area consists primarily of residential structures located along the Tchefuncte and Bogue Falaya Rivers in the unincorporated area of Mandeville and in the city of Covington. The area includes such upscale subdivisions south of Interstate 12, as Beau Chene, Country Club Estates, Riverwood, Riverwood East, and Tchefuncte Country Club. It also includes the Three Rivers Subdivision north of Interstate 12, the portions of the city of Covington south of Highway 21, and the River Forest Subdivision south of Highway 190.

During the Spring of 1991 field surveys were conducted to determine the number of structures in the study area south of Interstate 12. The 1990 Census Block Statistics were used to determine the number of structures in the study area north of Interstate 12. The development in the area was found to consist of 1,841 residential structures.

The structures in the area below Interstate 12 were assigned values based past sales in the area as recorded by Deed Fax. Approximately 20 percent of the selling price was then subtracted out as the cost of the lot. Finally, these values were verified by the Marshall and Swift Valuation System. The average depreciated value of a single structure in this area, including contents, was $175,946.

Average home values from the 1980 Census Block Statistics were used for the structures in the study area north of Interstate 12. These values were updated to current levels by the Marshall and Swift Price Index. The cost of the land was then subtracted out. The average depreciated value of a single structure in this area, including contents, was $135,793. The average depreciated value of a single structure, including contents, in the total Tchefuncte River overflow basin was $157,887.

Mandeville-Lewisburg, Bayou Chinchuba, and Bayou Castine Areas. The city of Mandeville, one of the fastest growing communities in Louisiana, is located on the north shore of Lake Pontchartrain. Less than an hour's drive from downtown New Orleans, it has become a haven for both commuters and retirees. The area is well known for its abundant trees, its excellent school system, and its many recreational and water activities.

Mandeville, as well as the other areas of St. Tammany Parish, suffered only minor effects from the oil bust of the 1980's. Business activity, which is primarily service oriented, has continued to thrive and easily meets the demands of the city's expanding population. Many new shopping centers, banks, and professional office building have been constructed in recent years. The area is also known for its many restaurants, art stores and antique shops.

With a total population of 7,083, Mandeville is the third largest city in St. Tammany Parish. The area has experienced tremendous population growth during the past 30 years. Its number of residents increased 48 percent between 1960 and 1970, 136 percent between 1970 and 1980, and 17 percent between 1980 and 1990. Population growth in the area is expected to continue in future decades. However, the future growth rate will depend on whether or not contractors can build on land previously designated as "wetlands". This environmental issue is currently being analyzed by the U.S. Army Corps of Engineers.

During the Spring of 1990, field surveys were conducted to determine the number, value, and first floor elevation of the structures in the study area. A breakdown of this development is shown in the Tables 8 and 9.

The Marshall and Swift Valuation Program was used to determine the depreciated values of the structures in all of the study areas except in the Greenleaves subdivision. Valuation was based on square footage, quality of construction, age, and use of the structure. Structures in the Greenleaves subdivision, were assigned values based on the current prices of homes in the area less the cost of the lot. Tables 10 and 11 show the average depreciated value of the structures, including contents, in the study area.

Slidell Area. The economic study area is the area located in St. Tammany Parish near the northeastern shore of Lake Pontchartrain. The study area comprises a portion of the community of Slidell, Louisiana, which is within daily commuting distance of employment opportunities in the New Orleans central business district (CBD). Most of the study area consists of urban development which includes mobile homes, commercial, and residential structures. Slidell, as a whole, had a population of 6,400 in 1960 that increased to 16,100 in 1970, and to 26,700 in 1980. The 1990 preliminary census states that the population has dropped by 10 percent to 24,000. The study area, as of the 1990 Census, contributed approximately 7,000 to the total population. There are several sparsely developed areas within the immediate study area, but for the most part it can be assumed that the population will remain fairly constant for the near future.

Development within the study area consists of approximately 2,600 residential structures, 50 small commercial structures, 180 mobile homes and several small apartment complexes. Field surveys determined that there is little residential or commercial development at elevations below 2.0 feet NGVD. A survey in the area appraising the value for the residential structures yielded an average depreciated value of $57,000 per structure based on the Marshall & Swift Valuation Program with a wide variety of ranges ($10,000 to $245,000). Mobile homes were assigned an average depreciated value of $8,000 each. Total value of all residential improvements within the area was $31,700,000 (1990 price levels).

TABLE 8
DEVELOPMENT IN MANDEVILLE AND LEWISBURG HURRICANE PROTECTION STUDY

	Lewisburg	Mandeville (East of Causeway Blvd.)	Total
Residential	378	1,342	1,720
Apartments	1	65	66
Commercial	30	183	213
Automobiles	388	1,636	2,022

TABLE 9
DEVELOPMENT IN BAYOU CASTINE, LITTLE BAYOU CASTINE, AND BAYOU CHINCHUBA STUDY AREAS

	Bayou Castine Overflow Basin (1)	Little Bayou Castine Overflow Basin	Bayou Chinchuba Overflow Basin
Residential	0	32	843
Apartments	0	1	0
Mobile Homes	0	0	47
Commercial	0	8	4
Automobiles	0	41	890

(1) No structures in the overflow basin.

TABLE 10
AVERAGE DEPRECIATED VALUE OF STRUCTURES
INCLUDING CONTENTS IN MANDEVILLE AND LEWISBURG STUDY AREA

	Lewisburg	Mandeville (East of Causeway Blvd.)	Total
Residential	$102,560	$73,111	$79,582
Apartments	$260,000	$114,245	$116,453
Commercial	$321,675	$191,805	$210,094

TABLE 11
AVERAGE DEPRECIATED VALUE OF STRUCTURES INCLUDING CONTENTS
IN BAYOU CASTINE, LITTLE BAYOU CASTINE, AND BAYOU CHINCHUBA

	Bayou Castine Overflow Basin (1)	Little Bayou Castine Overflow Basin	Bayou Chinchuba Overflow Basin
Residential	$0	$42,190	$175,390
Apartments	$0	$414,500	$0
Mobile Homes	$0	$0	$14,000
Commercial	$0	$209,800	$479,000

(1) No structures in the overflow basin.

Lacombe Area. Most of the Lacombe study area consists of undeveloped areas with scattered areas of urban development which includes mobile homes, commercial and residential structures. Lacombe, as a whole, has a population of 6,523 as of the 1990 census with the population remaining fairly constant over the years. The study area, as of the 1990 Census, contributed less than one-third of the total population. There are many sparsely developed areas within the immediate study area, but for the most part it can be assumed that the population will continue to remain constant in the near future.

Development within the study area consists of approximately 800 residential structures, 20 small commercial structures, 30 mobile homes. The total housing units for the community of Lacombe is 2,637 as per the 1990 Census Information.

All residential compilation was collected from census block information. Information using current contour maps of the area indicates that there is little residential or commercial development at elevations below 5.0 feet NGVD. Census block information showed the value of the residential structures yielded an average depreciated value of approximately $55,000-$60,000 per structure. Total value of all residential improvements within the area was $45,098,000 (1991 price levels).

Madisonville Area. The town of Madisonville is located on the west bank of the Tchefuncte River about 2 miles north of Lake Pontchartrain in the southwest portion of St. Tammany Parish. While the neighboring cities of Covington and Mandeville have experienced rapid population expansion and commercial development during the past 30 years, this small rural community has maintained its turn-of-the-century charm. Madisonville primarily consists of wood-frame houses that are shaded by large oak trees. Many of these homes overlook the Tchefuncte River. Shipping interests and several restaurants along the riverfront provide the core of the area's business activity.

The population of Madisonville has declined from 801 residents in 1970 to 659 residents in 1990, which is a 17.7 percent decrease. The town lacks the new subdivision development of the other cities in St. Tammany Parish, possibly because of its distance from the Causeway Bridge.

During the Summer of 1990, field surveys were conducted to determine the number, value, and first floor elevation of the structures in Madisonville. There were 265 residential structures in the area with a depreciated average value, including contents, of $68,676. The houses were predominantly pier construction with the first floor heights of one to two feet above the ground. There were 25 commercial structures with a depreciated average value, including contents, of $187,972, and 1 apartment complex valued at $125,200. The area also included 71 mobile homes that were assigned structure values ranging from $8,000 to $10,000.

TANGIPAHOA PARISH

Tangipahoa Parish, one of the "Florida Parishes", was established in 1869 and derived its name from the Tangipahoa Indians. The topography of the parish, about 50 miles long and 20 miles wide, is composed of flat lands to the south and rolling hills in the north. It covers 783 square miles of land. The major cities within the parish are Ponchatoula and Hammond.

The primary agricultural crops are strawberries, peppers, cucumbers, and tomatoes. A 1983 breakdown of the number of workers employed within the parish gives the following distribution:

Agricultural, Forestry & Fisheries	166
Mining	74
Contract Construction	1,103
Manufacturing	2,137
Transportation, & other Public Utilities	812
Wholesale Trade	924
Retail Trade	4,984
Finance, Insurance, and Real Estate	879
Services	7,107
Public Administration	883

Ponchatoula Creek-Yellow Water River Area. The community of Hammond is situated 35 miles northwest of New Orleans, at the crossroads of I-12 and I-55. It lies just south of the divergence of the Yellow Water River Canal and Ponchatoula Creek. Yellow Water River Canal flows to the west of the city and Ponchatoula Creek to the east of the city. It is the 24th largest standard metropolitan area in the state with a 1980 population of 15,043. Hammond is

the home of Southeastern Louisiana University, and a large part of the campus is within the study area.

The Yellow Water River Canal (YWRC) area is composed of a mix of property ranging from very low valued to distinctly upper middle class neighborhoods, and a substantial amount of commercial and public property. The Ponchatoula Creek area is composed of very low valued neighborhoods with pockets of lower to upper middle class at the fringes. Therefore, there is substantially more valuable property in the YWRC basin than in the Ponchatoula Creek basin. Development within the Yellow Water River Canal basin consists of 930 single-family residential structures; 76 mobile homes; 183 apartment buildings; and 169 commercial structures. The average value of a home in this area, excluding land, is $62,000. The average mobile home was valued at $6,263. Apartment and other commercial buildings averaged $100,000 and $183,000 in value respectively.

Development with the Ponchatoula basin consists of 634 single-family residential structures; 150 mobile homes; 65 apartment buildings; and 44 commercial structures. The average value of a home in this area, excluding land, is $29,936. The average mobile home was valued at $7,306. Apartment and other commercial buildings average $52,815 and $66,863 in value respectively.

CONDITIONS IF NO FEDERAL ACTION IS TAKEN

If no Federal action is taken, the study area will continue to experience flooding from riverine flooding and from high tides in Lake Pontchartrain due to storms and hurricanes. Flood damage to new development should be moderated by the area's participation in the National Flood Insurance Program, which requires that new development be constructed above the 100-year base flood elevation.

STATUS OF EXISTING PLANS AND IMPROVEMENTS

Local interests have planned or are constructing many drainage improvements in the study area. Those improvements that are related to this study are listed below.

The Louisiana Department of Transportation and Development enlarged portions of Yellow Water River and Ponchatoula Creek between the town of Independence and the City of Ponchatoula in 1988. As a result of these improvements, more water is diverted down the Yellow Water River during flood flows.

J.J. Krebs and Sons, Inc., Consulting Engineers, prepared a drainage study for St. Tammany Parish in 1989 which included an analysis of planned flood control improvements to Bayou Chinchuba, Bayou Castine, and Bayou Little Castine. The parish is currently considering these proposals.

Professional Engineering Consultants Corporation prepared a preliminary report on drainage improvements for the City of Covington in 1985. The report includes recommendations for improvements to Mile Branch and Lateral "A".

In 1915, local interests built a concrete seawall 1.5 miles long in front of the town of Mandeville. Between 1938 and 1940, forty concrete groins and several sets of concrete steps were added to the seawall. The seawall is in disrepair. An authorized Federal project to improve the seawall has never been constructed because the required local assurances were not obtained.

In December 1988, the St. Tammany parish Drainage District No. 2 applied for a permit to construct flood control improvements immediately south of the study area in the Eden Isles development. The improvements involve enlarging Schneider Canal to improve its drainage capacity and upgrading the existing pump station to increase its discharge capacity.

The Landmark Land Company of Louisiana, Inc. has constructed a ring levee system around an area in Eden Isles that will be used for residential development. The purpose of this levee is to provide hurricane protection against the 100-year frequency hurricane.

The City of Slidell has plans to construct an 835 cfs pumping station in Schneider Canal immediately east of U.S. Highway 11. The pumping station would provide additional drainage for the area north of Schneider Canal in the study area. The purpose of the project is to maintain a lower water surface elevation on the upstream side of the pumping station during high lake levels and storm events. Other interior drainage improvements in the City of Slidell are also planned or underway.

PROBLEMS, NEEDS, AND OPPORTUNITIES

INTRODUCTION

The study area is vulnerable to flooding from a variety of sources. The low-lying areas within approximately 5 miles of Lakes Pontchartrain and Maurepas can be flooded by intense rainfall, abnormally high tides in the lakes, hurricanes or lesser tropical storms, and combinations of these events. In the areas not adjacent to the lakes, flooding would result from periodic intense rainfall causing overflow of rivers and streams.

A majority of the population in the study area is located in the lower, downstream portion where flooding is potentially most severe. This area is especially vulnerable to the combination of high stages in Lake Pontchartrain and intense rainfall.

The upper portion of the study area (which includes parts of northern St. Tammany and Tangipahoa Parishes, Pike and Amite Counties, and Washington, and St. Helena Parishes) is less vulnerable to severe flooding. The area is sparcely populated and the slope of the land aids drainage. Much of the agricultural land that floods is pasture.

Numerous state and local channel improvements have been made in the study area during the last 50 years. Local interests are taking steps to improve drainage in low-lying, floodprone areas adjacent to the lakes. None of these plans, however, will provide significant hurricane protection. The communities and surrounding areas of Slidell, Lacombe, Mandeville, and Madisonville fall within this category.

FLOOD OF APRIL 1983

Public concern over damages resulting from the flood of April 1983 led to the eventual authorization of this study in August 1984. Rainfall from this event was widespread, resulting in record or near record flooding in the Amite, Tickfaw, Tangipahoa, Tchefuncte, and Pearl River Basins. Records as old as 30 years were exceeded.

Heavy rainfall in the first week of December 1982 caused high stages throughout East Central Louisiana. Throughout the remaining winter, river

stages and soil saturation remained relatively high from continuing excessive precipitation. When the rains of 5-8 April 1983 fell, the flooding potential was great. The total storm rainfall for this four-day period in East Central Louisiana ranged from 4.38 inches at LSU Ben-Hur Exp. Sta. in Baton Rouge to 13.59 inches at Franklinton. Two-thirds of the thirty gaging stations in East Central Louisiana reported 10 inches or more. This four-day rainfall has a 10-year return period, although 50- to 100-year frequency stages were experienced in some areas. All major streams in East Central Louisiana experienced moderate to extensive head water flooding as well as backwater overflow along their tributaries. Flow into Lake Pontchartrain from area streams elevated the lake level about 1.5 feet.

Although a precise breakdown is not available, the New Orleans District prepared a post-flood report in September 1983 showing the widespread nature of damages in the study area and in the Amite River basin from this event. Damage estimates are given for the entire northern Lake Pontchartrain Basin within the New Orleans District boundaries, not by individual river basin. While the majority of the acreage overflowed consisted of woods and swampland, extensive flooding occurred in the vicinity of the cities of Ponchatoula, Hammond, Amite City, Covington and along the Tangipahoa-Tchefuncte-Tickfaw Rivers system. Total estimated acres flooded (including the Amite River Basin) are shown below. The portion of the study area inundated by the April 1983 flood is shown on Plate 14.

Estimate of Areas Inundated--Northern Lake Pontchartrain Basin
April 1983 Flood

Land Use	Area Inundated (Acres)
Urban	4,000
Rural Developed	1,000
Agricultural	15,000
Wooded	65,000
Other (includes marsh)	85,000
TOTAL	170,000

The heaviest urban damages were experienced by residential, commercial, and light industrial developments in the vicinity of Baton Rouge in East Baton Rouge Parish and Denham Springs in Livingston Parish (both of which are in the Amite River basin). Substantial monetary losses occurred as a result of both headwater and backwater overflows. A combination of

inadequate drainage facilities, overtaxed drainage pumps, and surrounding high water levels hampered efforts to reduce damage. In the overall northern Lake Pontchartrain basin, an estimated 5,300 residences in urban areas sustained damage (mostly in the Amite River basin). Additionally, it is estimated that well over 100 commercial establishments suffered business losses as well as physical damages. Inundated structures generally were flooded over their first floors from a few inches in depth to eight feet. While the results of headwater overflow were felt in low-lying areas along the banks of the Tangipahoa, Tchefuncte, and Tickfaw Rivers, other tributary streams produced a combination of backwater and headwater overflow--namely Ponchatoula Creek and Chappepeela Creek. Although the inundation of structures generally lasted from only a few hours to several days, water often stood in streets and on lawns for a considerably longer period. Rural developed areas sustained moderate to heavy flood damages from a combination of headwater and backwater overflows. During the April 1983 flood, nearly 85,000 acres of marsh and wooded swamp were inundated in the north Lake Pontchartrain basin as were a like number of cleared and wooded acres. However, due to the sparseness of development, the total damages to residential and commercial development did not approach that witnessed in urban areas. In all, an estimated 1,400 rural residences, many of which were camp-like dwellings, were flooded to depths of from a few inches to eight feet for a duration of 1 day to several weeks.

In St. Tammany, Tangipahoa, Livingston, St. Helena, and East Baton Rouge Parishes, some 15,000 cleared agricultural areas were subject to moderate flooding. Generally, corn, pasture, strawberry, and truck crops experienced the greatest damage, although the total monetary damage was relatively modest. Within the tidal zone, agricultural losses were light as only marshy pastures and livestock operations were adversely affected. Total agricultural losses in the northern Lake Pontchartrain Basin were an estimated $800,000.

DESCRIPTION OF FLOOD POTENTIAL IN THE STUDY AREA

Mandeville, Slidell, Madisonville, and Lacombe Areas. Due to their close proximity to Lake Pontchartrain, these cities are vulnerable to flooding from hurricane surges. Flooding due to a combination of heavy rainfalls and high tides is also a threat. These areas have not recently sustained devastating flood damages from hurricane surges, but the damages from a powerful

hurricane tracking across Lake Pontchartrain on a critical path are potentially severe. A review of hurricane-induced stages and hydrologists' predictions for the area illustrate the flooding potential. During Hurricane Betsy in 1965, a maximum stage of 6.5 feet NGVD was recorded at Mandeville. For the same event, the stage at Frenier Beach on the western shore of Lake Pontchartrain was 12.1 foot NGVD. The highest stage recorded at Mandeville was 9.0 feet in 1909. Hydrologists predict that the maximum stage associated with a 100-year frequency hurricane to be 12.0 feet (still water level) at Mandeville, 10.2 feet at Highway 433 in Slidell, 10.0 feet at the Gulf Mobile and Ohio Railroad in Lacombe, and 11.0 feet in the town of Madisonville at the Tchefuncte River bridge (all stages in NGVD). In these areas, some homes begin flooding when water elevations reach 4.0 to 5.0 feet NGVD. The city of Mandeville is especially vulnerable, due to potential damages from waves as high as 4 feet added to the still-water elevation. The existing seawall offers little protection against hurricanes greater than the 10-year frequency storm. The force of crashing waves could cause substantial damage within the first few blocks from the lake.

Slidell and Lacombe are also vulnerable to flooding from overflowing streams (Bayou Bonfouca and its tributaries in Slidell and Bayou Lacombe in Lacombe). Because these streams run through the middle of these cities, construction of hurricane protection is difficult. Ring levees following the banks of the streams are not practicable because much development is located close to the waterfront. Thus, large navigable floodgates in the hurricane protection system are necessary to protect the area and preserve navigation on these streams.

Lower Tchefuncte-Bogue Falaya River, Mile Branch and Lateral "A" Areas.
Flooding in these subareas is relatively frequent. It is caused by headwater flooding due to intense rainfall in the upper reaches of the Tchefuncte and Bogue Falaya Rivers. The principal causes of flooding are the inadequacy of the existing channel system to convey the storm runoff. The primary flood seasons for the Covington area are winter and spring. Most of the higher floods have resulted in generally heavy rains during these times. However, floods due to intense local thunderstorms and hurricanes may occur during the summer and fall months. The greatest flood of record in the Covington area occurred on May 8, 1953, when rainfall was concentrated in the upper basins of the Tchefuncte and Bogue Falaya Rivers. Newspaper accounts describe severe flooding to crops, highways, businesses and residences along these two rivers. Other floods have occurred in April 1947, December 1947,

November 1948, April 1954, November 1961, February 1966, February 1967, April 1967, and April 1983.

An application by the City of Covington for funding of improvements to the Mile Branch area under the Statewide Flood Control program was completed in November 1984. This application states that approximately 1,068 people (305 single family residences) and 15 commercial business could be affected by the flooding of Mile Branch.

Bayous Chinchuba and Castine Areas. Prior to many of the current ordinances regulating new land uses in St. Tammany Parish, portions of developments in these drainage basins were constructed with little regard to controlling rainfall runoff (reference: J.J Krebs and Sons, Inc.-- West St. Tammany Drainage Study). In some instances, development took place within the floodplain of the bayou. During intense storm events these developments not only become inundated by the rising stream level, but also impede the drainage for upstream communities. A number of recent rainfall events have caused flooding in these areas. Of particular note is a storm event which occurred on the weekend of August 12, 1988. Rainfall intensity information compiled from the records of the Mandeville city engineer suggests intermittent rain for a period of three days prior to a very heavy rain. The one-hour intensity experienced during this storm of 4.75 inches corresponds to approximately a 75-year return event. At the time of the storm, the lake level was being affected by continuous south east winds and a high tide to produce a water level of almost 4.0 feet NGVD. The combination of saturated soils, swollen streams, a high lake level and the intense rainfall event joined to inundate roads and homes which do not normally experience flooding.

Ponchatoula Creek-Yellow Water River Area. In April 1977, severe flooding occurred in the City of Hammond. During a three day period from April 20 to 22, 12.54 inches of rain were recorded in the Hammond area. This flood was caused by intense rainfall, aggravated by partially clogged drainage mains and laterals. Growth of vegetation in and along Ponchatoula Creek and Yellow Water River Canal also restricted flow. The most severe flooding occurred along Ponchatoula Creek in the vicinity of Southeastern Louisiana University. Morris Road from Orange Street of the Dande Food Store was blocked by water, as were segments of Range Road, Oak Street, and General Pershing Drive. Water damaged 75 to 80 homes in Whitmar Acres. Up to 4 feet of water covered parts of the SLU campus. University Cinema and the Book Nook at SLU were inundated to a depth of 18 inches.

There was approximately $527,000 in flood damage in Hammond during this flood. The last severe flooding in the City of Hammond occurred in April 1983. During a three day period from April 6 to April 8, 13.89 inches of rain were recorded in the Hammond area. Newspaper accounts show that numerous residences were flooded and many streets were closed.

A crest-stage gage in operation since 1948 on Yellow Water River Canal at the Illinois Gulf Central Railroad Bridge recorded a peak of 36.99 feet on September 27, 1964, and 35.46 feet on April 6, 1983. A crest-stage gage located on Ponchatoula Creek at the U. S. Route 190 bridge recorded a peak of 39.11 feet on April 21, 1977, and 38.22 feet on April 7, 1983. Both of these peaks represent maximums for the period of record. Based on the flood frequencies computed in a FEMA flood insurance study dated February 1987, the flood in 1964 on Yellow River Canal has a recurrence interval of approximately 11 years, and the flood of 1977 on Ponchatoula Creek has a recurrence interval of approximately 22 years. It should be stressed that the computed frequencies for these floods are based on the combined discharges of Ponchatoula Creek and Yellow Water River Canal. Thus, different combinations of stage may produce the same recurrence interval. Also, following the publication of the flood insurance study in 1987, the City of Hammond and the Louisiana Department of Transportation and Development constructed channel improvements in the system that give the Yellow Water River more capacity to carry flood flows.

SUMMARY

There is a need to reduce or alleviate flood problems in the study area. Partial or full flood protection would reduce the financial risk involved to home owners, businesses, and agricultural enterprises. A range of opportunities are available to address the problem. These opportunities could be realized by constructing, channel modifications, diversions, levees, floodgates, pumping stations, floodplain management, and nonstructural measures.

Other needs include improving water quality in the Tangipahoa, Tchefuncte, and Tickfaw Rivers and in Lake Pontchartrain and Lake Maurepas; restoring or maintaining the lakes' and river's uses as recreation resources; and slowing the trend of habitat and habitat quality reduction for both terrestrial and aquatic species. Mitigation opportunities for both terrestrial and aquatic species would be considered an essential part of any Federal action plan developed.

An opportunity exists to augment local interests' plans for interior drainage improvements with a Federal hurricane protection project. Environmental impacts could be minimized by constructing the hurricane protection alignment to minimize impacts to marsh or to include developmental easements that would prevent drainage and development of marsh.

PLANNING OBJECTIVE

The objective of this study is to identify hurricane and flood protection plans for the study area that will contribute to the Nation's economic development by reducing flood damages while minimizing adverse impacts to the environment.

PLAN FORMULATION

DEVELOPMENT OF PRELIMINARY PLANS

PLAN DESCRIPTIONS

Four hurricane protection plans and four flood control plans were developed for the study, in response to problems, needs, and opportunities in the study area. A description of these plans and their variations are described below.

Mile Branch and Lateral "A". These plans are enlargements of drainage channels in Covington, Louisiana (see Plate 4). The first plan involves enlarging the lower two miles of Mile Branch. Reinforced concrete paving and gabion lining of the channel were considered as variations. Dredged material would be placed on adjacent banks. Enlargement of Lateral "A" is similar, but includes only about 1 mile of channel on the lower end of the stream. The improved channels would provide flood protection for events up to the 25-year frequency storm.

Lower Tchefuncte-Bogue Falaya River. This plan involves diverting the Tchefuncte River by constructing a 6-mile channel from Highway 190 to the 1-foot contour on the Black River (see Plate 5). A diversion structure at Highway 190 would be operated so that the 25-year frequency stage would not be exceeded along the Tchefuncte River. The diversion system will also include levees and 2 drop structures. The levees would be constructed on the lower 3 miles of the diversion to help contain the flow. The drop structures would help control erosion in the streams that are intercepted by the diversion. The structures provide for the abrupt change in the streams' channel gradient by means of a vertical drop.

Mandeville and Lewisburg. Three hurricane protection alignments were developed for this area: 1.) Mandeville and Lewisburg, 2.) Mandeville only, and 3.) Lewisburg only (see Plates 6-8). Each of these plans has six variations (100-year vs. Standard Project Hurricane (SPH) protection, gravity vs. forced drainage, construction of the lakefront levee with material hauled in by truck vs. material obtained from an adjacent borrow pit) for a total of 18 plans.

• Mandeville and Lewisburg Hurricane Protection Project
This alignment involves the construction of 6 miles of levee, 3 swing gates, two 60" concrete pipes, and several culverts. The levee would enclose both the Mandeville and Lewisburg areas. The levee would border Bayou Castine, Lake Pontchartrain, and Bayou Chinchuba and tie into high ground near Highway 190 at both bayous. The alternative that provides 100-year protection has a levee crest elevation of 16 feet NGVD, while the SPH levee has an elevation of 18 feet NGVD. The levees would be constructed with semicompacted fill in a single lift to gross elevations of 18 feet (100 year) and 20.0 feet (SPH). They are projected to settle to the design elevations. For the forced drainage option, a 125 cfs pump station would be located in Mandeville and a 50 cfs pump station would serve the Lewisburg area in place of the concrete pipes.

• Mandeville Hurricane Protection Project
This alignment involves the construction of 3 miles of levee, 4,000 feet of floodwall, 5 swing gates, and several culverts. The levee would enclose only the Mandeville area east of Causeway Boulevard. The levee would border Bayou Castine and Lake Pontchartrain and tie into high ground near Highway 190 at Bayou Castine. The floodwall would be parallel to the Causeway Boulevard and also tie into high ground at Highway 190. The alternative that provides 100-year protection has a levee with a crest elevation of 16 feet NGVD, while the SPH levee has an elevation of 18 feet NGVD. For the forced drainage option, a 125 cfs pump station would be provided in place of the concrete pipes.

• Lewisburg Hurricane Protection Project
This alignment encloses only the Lewisburg area and involves the construction of 2.6 miles of levee, 4,000 feet of floodwall, 4 swing gates, six 60" concrete pipes, and several culverts. The levee would border Lake Pontchartrain and Bayou Chinchuba and tie into high ground near Highway 190 at the bayou. The alternative that provides 100-year protection has a levee with a crest elevation of 16 feet NGVD, while the SPH levee has an elevation of 18 feet NGVD. For the forced drainage option, a 59 cfs pump station would be provided in place of the concrete pipes.

Bayou Chinchuba. This plan involves diverting Bayou Chinchuba through culverts along Causeway Boulevard into Lake Pontchartrain (see Plate 9). Approximately 20 to 30 percent of the flow could be diverted. The diversion conduit would consist of either two side-by-side 77- by 22- inch

reinforced arch concrete pipes or two 7- by 11-ft. box culverts. The length of the diversion would be 6,000 feet. The basis for this design is a similar proposal developed by J. J. Krebs, Consulting Engineers in 1989 for St. Tammany Parish.

Slidell Area

•Slidell Hurricane Protection Project, Gravity Drainage.

There are two alignments under consideration for this study area called Plan A and Plan B (see Plate 10). Plan A is considered more economical while Plan B is based more on environmental concerns. Both plans share the same levee and navigational control criteria. In both cases, the preliminary design for the portion of the levee east of the Southern Railroad was taken from the Schneider Canal, Slidell, Louisiana reconnaissance report completed in May 1990.

Plan A involves the construction of some 10 miles of levee, two navigable floodgates with 84-foot openings, two major drainage structures, 27 concrete culverts with double 60-inch pipes, three double 5- by 5-ft. box culverts, a sluice-gated culvert, and two bottom roller gates. Starting at high ground near the intersection of Highway 190 and Interstate 10, the levee would follow the Interstate 10 median and the north bank of Schneider Canal, cross the Southern Railroad and continue west for 4.5 miles, at which point it would turn north at the pipeline canal and tie into high ground again near Highway 190. The 27 concrete culverts with double 60-inch pipes would be located on the western side of the Southern Railroad. Their purpose would be to nourish the marsh south of the levee. The levee system has an average elevation of 14 feet NGVD and would protect against the 100-year frequency hurricane. The levees west of Southern Railroad would be constructed with uncompacted fill in a single lift to a gross elevation that accounts for projected settlement. (A gross elevation of 17.0 feet NGVD is projected to settle to the design elevation.) In general, most of the levee would be situated on Holocene marsh swamp deposits, with the remainder on the Pleistocene surface. Borrow pits will parallel the levees on the protected side which will also serve to provide interior drainage for the area. Levees east of the Southern Railroad would be constructed in two lifts, with 5 years between lifts. Beneficial completion of the project would be reached in year 2, because the 2nd lift is for shaping only.

Plan B is similar, except that it encloses less marsh. See map, Plate 10.

•Slidell Hurricane Protection Project, Forced Drainage.
This plan is similar to the gravity drainage plans above, except that it includes the following variations which would be substituted for the two major drainage structures and the three double 5- by 5-foot box culverts:

a. 2 pump stations (1,200 and 100 cfs)
b. 5 pump stations (1,200 cfs, 100 cfs, and three 1,700 cfs)
c. 6 pump stations (1,200 cfs, 100 cfs, 1000 cfs, and three 1,700 cfs)
d. 7 pump stations (1,200 cfs, 100 cfs, two 1,000 cfs, and three 1,700 cfs)
e. 8 pump stations (1,200 cfs, 100, cfs, three 1,000 cfs, and three 1,700 cfs)

Lacombe. This alignment encloses the Lacombe area below Highway 190 that is susceptible to hurricane flooding (see Plate 11). It involves the construction of 8.3 miles of levee, two 84-foot navigable flood gates, twelve 5- by 5-ft. reinforced concrete culverts, and 27 double 60" reinforced concrete pipes. At each end, the levee would tie into high ground at the Gulf Mobile and Ohio Railroad. The alternative that provides 100-year protection has a levee with a crest elevation of 14 feet NGVD, while the SPH levee has an elevation of 16 feet NGVD. The levees would be constructed with uncompacted fill in a single lift to a gross elevation that accounts for projected settlement. Gross elevations of 17 feet (100 year) and 19 feet (SPH) are projected to settle to the design elevations. For the forced drainage option, three 1,500 cfs pump stations would be provided in place of the concrete pipes and concrete box culverts.

Madisonville. This hurricane protection alignment encircles most of the developed portions of the town of Madisonville (see Plate 12). It involves the construction of 2.3 miles of levee, 4,700 feet of floodwall, a floodgate, and eight 36-inch reinforced concrete pipes. The alternative that provides 100-year protection has a levee with a crest elevation of 15 feet NGVD, while the SPH levee has an elevation of 17 feet NGVD. The levee would be constructed with uncompacted fill in two lifts to a gross elevation that accounts for settlement after each lift. For the forced drainage option, a 40 cfs pump station would be provided in place of the concrete pipes.

Ponchatoula Creek-Yellow Water River. This plan we developed for this area involves enlarging Ponchatoula Creek over a distance of 2.6 miles, from its northernmost confluence with Yellow Water River to just below Highway 190 (see Plate 13). The improved channel would follow the existing creek.

The channel would have bottom widths of from 10 to 20 feet with 1 on 3 side slopes. Dredged material would be placed on the adjacent banks.

OTHER AREAS CONSIDERED

Other floodprone areas were considered in the preliminary analysis, but were dropped when it became apparent that there was a low probability of developing a feasible plan. A description of these areas is listed below.

Tangipahoa River. A clearing and snagging plan on the Tangipahoa River between I-12 and Lake Pontchartrain was considered. The plan was similar to the existing authorized project, except that alternative disposal methods were investigated. This reevaluation was undertaken because of the difficulties experienced in maintaining the existing project. The local sponsor, the Tangipahoa Parish Police Jury, has had difficulty obtaining right-of-entry for some of the authorized disposal sites. Consequently, Federal maintenance has been incomplete. The purpose of considering alternative disposal methods was to attempt to restore some of the flood protection that the original clearing and snagging project provides. However, preliminary investigations of the problem revealed that clearing and snagging would likely prevent a negligible amount of damages in the river basin. Thus, the plan was dropped from further consideration.

Bayou Castine and Little Bayou Castine. Channel modifications to improve drainage in these areas were considered. Potential improvements included dredging, clearing and snagging, and bridge enlargements. An investigation of residential and commercial structures in these basins revealed that very few were vulnerable to flooding from the 100-year frequency rainfall event. Consequently, total expected average annual flood damages in each basin are not sufficient to support a Federal channel modification project.

PRELIMINARY COST ESTIMATES

Preliminary cost estimates are provided in Appendix B. Real estate cost estimates are provided in Appendix C.

ECONOMIC ANALYSIS

INTRODUCTION

Data Collection and Structure Valuation. Based on data prepared by the study team's hydrologic engineers, the overflow and reaches for each subarea were delineated on current street maps. During May 1990 to May 1991, field surveys were taken to determine the number, value, and elevation of all structures within the 100-year frequency base flood overflow. Data regarding square footage, type, use, location, and elevation were recorded. Residential and commercial structure values were calculated using the Marshall and Swift Residential and Commercial Program. The continuously price adjusted computer program uses costs per square foot which are geographically localized by zip code to calculate replacement cost and depreciated cost for each structure. Mobile homes were assigned an average depreciated value of $8,000 each. For most of the study area, the average value of a used automobile was determined to be $6,320 based on a 1985 survey by the Hertz Corporation that has been price adjusted by the Survey of Current Business' used car price index. The average value for automobiles in the Hammond area was determined to be $5,511 which is slightly lower than the 1991 national average. It was assumed that each automobile was parked one half foot below the first floor elevation of slab houses and parked at the ground floor level of houses built on piers. One automobile was assigned to each residential structure, apartment unit, or mobile home.

Procedures for Estimating Damages. Stage-frequency curves for existing conditions and for each plan were provided by the study team's hydrologists. Either freshwater or salt-water depth damage curves, developed by CH2M Hill, Inc., were used for the study subareas, depending on the source of flooding. These curves were used to indicate the percentage of the total structure value that would be damaged from flooding at and above the first floor elevation.

The Hydrologic Engineering Center--Flood Damage Analysis Package, which includes the Structure Inventory for Damage Analysis (SID) and the Expected Annual Flood Damage Computation (EAD) interactive computer programs, was used to calculate property damage. Inputs to these programs include flood

plain structure inventory, depth damage relationships, and stage probabilities obtained from stage-frequency curves for each hydrologic reach.

The SID computer program was used to generate an elevation-damage curve for the existing condition and for the flood protection plan in each section of the study area. These results were then input into the EAD program in order to weight the damage corresponding to each magnitude of flooding by the percentage chance of exceedance. From these weighted damages the program determines the expected annual damage. Damages were calculated for residential structures, apartment complexes, mobile homes, and commercial structures, as well as their contents. Damages to automobiles were also calculated. A summary of the expected annual damages and damages prevented, or benefits, attributable to each project is shown in the following sections.

Presentation of Average Annual Benefits and Costs. The economic justification of the plans given detailed consideration 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 a designated interest rate. The interest rate used in this analysis is 8 3/4 percent. The periods of analysis, or project life, used were 100 years for the hurricane protection plans and 50 years for the channel modification plans. 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 (base year). The base year is the year in which the project becomes operational or when significant benefits start to accrue.

MILE BRANCH-LATERAL "A" AREA

The purpose of this section is to determine the economic feasibility of providing flood protection for the city of Covington in St. Tammany Parish, Louisiana. The preliminary results of the analysis for Lateral "A" did not yield sufficient damages to support a Federal project.

Presentation of Average Annual Damages, Benefits, and Costs. An analysis of the stage-frequency and elevation-damage curves for Covington revealed that both plans produced substantial lowerings in the hydrologic reaches designated as 1 through 6. A summary of the expected annual damage and the damage reductions is displayed in Table 12.

TABLE 12

Mile Branch Area
Expected Annual Damages and Damages Prevented (Benefits)
(In $1000's)

DAMAGE CATEGORY	DAMAGE W/O PROJ	DAMAGE W/PROJ	DAMAGE REDUCED
RESIDENTIAL	435.10	8.02	427.08
COMMERCIAL	177.61	0.55	177.06
APARTMENTS	103.87	1.55	102.32
AUTOMOBILES	66.98	1.54	65.44
TOTAL	792.59	11.66	771.90
% DAMAGE PREVENTED		98.5%	

The only induced flooding occurred in reach 6 for the 100-year and lower frequency storms. The total effect of this is to move 26 automobiles from above the 500-year flood zone to within the 100- to 500-year flood zone, thus adding $195,000 to the damage within that zone. However, the net effect on expected annual damage is negligible because of the low frequencies of the storms involved with induced damage. The economic justification of the plans given detailed consideration 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. Table 13 displays average annual benefits and costs, net benefits, first costs, and benefit-to-cost ratios.

Table 13

Mile Branch Area Channel Improvements
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)
Base Year = 1997, Project Life = 50 Years

	25-Yr Project Concrete Lining	25-Project Gabion Lining
First Cost	$4,201,000	$5,011,000
Average Annual Benefits	$771,900	$771,900
Average Annual Costs	$389,000	$464,000
B/C Ratio	1.98	1.66
Net Benefits	$382,900	$307,900

LOWER TCHEFUNCTE RIVER-BOGUE FALAYA RIVER AREA

The section addresses the economic feasibility of building a diversion structure on the Tchefuncte River. The plan will lower the stages on the Tchefuncte River and on the Bogue Falaya River below Highway 21 and thereby reduce flooding in the area.

Contour maps obtained from the developers of the subdivisions south of Interstate 12 were used to determine the ground elevation in those areas. For the areas above Interstate 12, survey data provided by the city contractor and supplemented by the U.S. Geological Survey quad maps, for the lesser developed areas, were used.

Presentation of Average Annual Benefits and Costs. A summary of the expected annual damages and damages prevented, or benefits, attributable to the Tchefuncte River Diversion Project is shown in Table 14.

TABLE 14
LOWER TCHEFUNCTE - BOGUE FALAYA RIVER AREA
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

Damage Category	Existing Condition	Damage W/Plan	Damage Prevented
Residential	$982.37	$280.13	$702.24
Commercial	7.56	0.06	7.5
Autos	88.3	18.8	69.5
Total	$1,078.23	$298.99	$779.24
%Damage Prevented			72.27%

Table 15 displays average annual benefits and costs, net benefits, first cost and benefit-to-cost ratios. Although the project prevents 72 percent of the existing damages, the benefit-to-cost ratio is only 0.18.

Table 15

Lower Tchefuncte River-Bogue Falaya River Area
Channel Diversion
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)
(Base Year = 1998, Project Life = 50 years)

First Cost	$30,227,000
Average Annual Benefits	$779,240
Average Annual Costs	$4,265,025
B/C Ratio	0.18
Net Benefits	($3,485,785)

MANDEVILLE-LEWISBURG AREA
BAYOU CHINCHUBA AREA
BAYOU CASTINE AND LITTLE BAYOU CASTINE AREAS

The focus of this section is twofold: to discuss the need for hurricane protection and the need for channel modification in the study area.

Because the city of Mandeville borders the north shore of Lake Pontchartrain, there exists the threat of major flood damage caused by the wave action of

hurricanes. Hurricane protection for the Lewisburg section of the city (which includes Historic Lewisburg, Old Golden Shores, Weldon Park, and the southern part of Beau Rivage) is discussed separately in this analysis from the area of the city east of Causeway Boulevard (which includes Old Mandeville, New Golden Shores, Mariners Village, and the southern part of Golden Glen). The two segments are also discussed jointly.

Heavy rainfalls and inadequate drainage, coupled with the low, flat terrain of the area could result in flood damage from area bayous. The over-flowing of Bayou Castine and Little Bayou Castine poses a threat to the older sections of the city near Fontainebleau State Park. However, only a small area with relatively little development would be affected. Bayou Chinchuba poses a threat to the unincorporated areas of Mandeville north of Florida Boulevard. The overflow basin includes such prominent subdivisions as Greenleaves, Glendale Heights, Audubon Lakes, and Rosedown, as well as lower income areas to the east of Abita Road.

Presentation of Average Annual Damages, Benefits, and Costs. A summary of the expected annual damages and damages prevented, or benefits, attributable to each hurricane protection plan is shown in Tables 16-18.

Because the property damages in the overflow basins of Bayou Castine and Little Bayou Castine were negligible, benefits were not calculated for the flood protection plans in these areas. A summary of the expected annual damages and damages prevented, or benefits, attributable to the flood protection plan in the Bayou Chinchuba area is shown in Table 19.

The 100-year frequency hurricane protection plan for the Mandeville subarea yields the highest net benefits and prevents 98 percent of the damage. Based on the construction costs developed for this study, the Lewisburg area does not experience enough existing damages to justify a hurricane protection project.

Table 16

MANDEVILLE AND LEWISBURG AREA
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

		100 YEAR PROTECTION		SPH PROTECTION		100 YEARS WITH PUMPS		SPH WITH PUMPS	
DAMAGE CATEGORY	EXISTING CONDITION	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED
RESIDENTIAL	1749.63	206.56	1543.07	162.30	1587.33	33.64	1715.99	7.14	1742.49
COMMERCIAL	247.06	35.04	212.02	28.38	218.68	3.96	243.10	0.00	247.06
APARTMENTS	60.93	0.00	60.93	0.00	60.93	0.00	60.93	0.00	60.93
AUTOS	472.69	84.12	388.57	69.85	402.84	14.38	458.31	4.48	468.18
TOTAL	$2,530.31	$325.72	$2,204.59	$260.53	$2,269.78	$51.98	$2,478.33	$11.62	$2,518.66
% DAMAGE PREVENTED			87.13%		89.70%		97.95%		99.54%

Table 17

MANDEVILLE AREA (EAST OF CAUSEWAY BLVD.)
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

		100 YEAR PROTECTION		SPH PROTECTION		100 YEARS WITH PUMPS		SPH WITH PUMPS	
DAMAGE CATEGORY	EXISTING CONDITION	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED
RESIDENTIAL	1354.66	201.66	1153.00	161.09	1193.57	30.23	1324.43	6.64	1348.02
COMMERCIAL	230.12	35.04	195.08	28.38	201.74	3.96	226.16	0.00	230.12
APARTMENTS	60.26	0.00	60.26	0.00	60.26	0.00	60.26	0.00	60.26
AUTOS	394.98	81.49	313.49	68.88	326.10	12.89	382.09	4.42	390.56
TOTAL	$2,040.02	$318.19	$1,721.83	$258.35	$1,781.67	$47.08	$1,992.94	$11.06	$2,028.96
% DAMAGE PREVENTED			84.40%		87.34%		97.69%		99.46%

Table 18

LEWISBURG AREA
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

DAMAGE CATEGORY	EXISTING CONDITION	100 YEAR PROTECTION		SPH PROTECTION		100 YEARS WITH PUMPS		SPH WITH PUMPS	
		DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED
RESIDENTIAL	394.97	4.9	390.07	1.21	393.76	3.41	391.56	0.5	394.47
COMMERCIAL	16.94	0	16.94	0	16.94	0	16.94	0	16.94
APARTMENTS	0.67	0	0.67	0	0.67	0	0.67	0	0.67
AUTOS	77.71	2.63	75.08	0.97	76.74	1.49	76.22	0.06	77.65
TOTAL	$490.29	$7.53	$482.76	$2.18	$488.11	$4.90	$485.39	$0.56	$489.73
% DAMAGE PREVENTED			98.46%		99.56%		99.00%		99.89%

TABLE 19
BAYOU CHINCHUBA AREA
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

Damage Category	Existing Condition	Damage W/Plan	Damage Prevented
Residential	$735.40	$340.99	$394.41
Commercial	0.01	0.00	0.01
Mobile Homes	1.65	0.32	1.33
Autos	48.19	25.28	22.91
Total	$785.25	$366.59	$418.66
%Damage Prevented			53.32%

Tables 20 and 21 display average annual benefits and costs, net benefits, first costs, and benefit-to-cost ratios.

Table 20

Bayou Chinchuba Area
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)
(Base Year = 1997, Project Life = 50 Years)

	Concrete Culvert	Arch Pipe Culvert
First Cost	$21,713,000	$12,385,000
Average Annual Benefits	$418,660	$418,660
Average Annual Costs	$2,022,000	$1,157,000
B/C Ratio	0.21	0.36
Net Benefits	(1,603,340)	($738,340)

TABLE 21

MANDEVILLE AND LEWISBURG AREA HURRICANE PROTECTION PLANS

SUMMARY OF COSTS AND BENEFITS

1991 PRICE LEVEL: 8 3/4 INTEREST RATE, BASE YEAR = 1998, PROJECT LIFE = 100 YEARS

	100 YR-ADJ CAST FORCED DRAINAGE	100 YR-ADJ CAST GRAVITY DRAINAGE	SPH-ADJ CAST FORCED DRAINAGE	SPH-ADJ CAST GRAVITY DRAINAGE	100 YR-TRUCK HAUL FORCED DRAINAGED	100 YR -TRUCK HAUL GRAVITY DRAINAGE	SPH-TRUCK HAUL FORCED DRAINAGE	SPH-TRUCK HAUL GRAVITY DRAINAGE
First Cost	$27,556,000	$25,299,000	$33,999,000	$31,719,000	$23,781,000	$21,558,000	$29,135,000	$26,776,000
Average Annual Benefits	$2,478,330	$2,204,590	$2,518,660	$2,269,780	$2,478,330	$2,204,590	$2,518,660	$2,269,780
Average Annual Cost	$2,747,400	$2,532,400	$3,361,600	$3,144,600	$2,387,400	$2,175,400	$2,897,500	$2,668,500
B/C Ratio	0.90	0.87	0.75	0.72	1.04	1.01	0.87	.85
Net Benefits	($269,070)	($327,810)	($842,940)	($874,820)	$90,930	$29,190	($378,840)	($398,720)
MANDEVILLE								
First Cost	$18,323,000	$16,646,000	$20,801,000	$16,755,000	$15,685,000	$14,008,000	$18,860,000	$17,144,000
Average Annual Benefits	$1,192,940	$1,721,830	$2,028,960	$1,781,670	$1,992,940	$1,721,830	$2,028,960	$1,781,670
Average Annual Cost	$1,867,400	$1,707,400	$2,103,600	$1,717,600	$1,615,400	$1,345,400	$1,917,500	$1,754,500
B/C Ratio	1.07	1.01	.96	1.04	1.23	1.28	1.06	1.02
Net Benefits	$125,540	$14,430	($74,640)	$64,070	$377,540	$376,430	$111,460	$27,170
LEWISBURG								
First Cost	$16,770,000	$16,190,000	$20,112,000	$19,502,000	$15,427,000	$14,848,000	$18,388,000	$19,877,000
Average Annual Benefits	$485,390	$482,760	$489,730	$488,110	$485,390	$482,760	$489,730	$488,110
Average Annual Cost	$1,718,000	$1,663,000	$2,037,000	$20,550,000	$1,590,000	$1,427,000	$1,872,000	$2,014,000
B/C Ratio	0.28	0.29	0.24	.24	0.31	0.34	0.26	0.24
Net Benefits	($1,232,610)	($1,180,240)	($1,547,270)	($1,565,270)	($1,104,610)	($944,240)	($1,382,270)	($1,525,890)

SLIDELL AREA

The focus of this section is the need for hurricane protection for the city of Slidell and surrounding areas. Flood problems within the affected area are primarily caused by inadequate drainage of storm runoff, low, flat flood plain areas which are easily inundated, locally heavy rainfalls, and high stages in Lake Pontchartrain from hurricanes. Some damages can be attributed to the overflow of various bayous in the study area due to heavy rainfall.

Presentation of Average Annual Damages, Costs, and Benefits. With the project in place, estimated damages would be limited to the effects of rainfall. The total benefits are equal to the damages experienced under existing conditions minus the estimated damage due to rainfall with the proposed project in place. Table 22 shows average annual damages prevented in the area. Table 23 displays average annual benefits and costs, net benefits and benefit-to-cost ratios. The plan with the most pumping capacity only prevents 50 percent of the damages. The gravity drainage plans induce substantial damage.

LACOMBE AREA

The focus of this study is the need for hurricane protection in the community of Lacombe. Flooding problems within the affected area are primarily caused by inadequate drainage of storm runoff, low, flat flood plain areas which are easily inundated, locally heavy rainfalls, and high stages in Lake Pontchartrain from hurricanes. Some damages can be attributed to wave action and the overflow of several bayous in the study area due to heavy rainfall.

Presentation of Average Annual Damages, Costs, and Benefits. With the project in place, estimated damages would be limited to the effects of rainfall. Table 24 shows average annual damages prevented in the area. None of the alternatives considered in the analysis are economically justified. The two gravity drainage plans induce more damages than they prevent, while the forced drainage plans only prevent $14,000 of the $6,012,000 in total average annual damages. More damages could be prevented by adding more pumping capacity. However, even if all damages could be prevented at no additional cost, the benefit-to-cost for a 100-year hurricane protection system would be less than 0.75 ($8,003,000/$6,012,000 = 0.75). Thus, a hurricane protection system for the area is not economically feasible.

TABLE 22

SLIDELL AREA HURRICANE PROTECTION PLANS

COMPARISON OF EXPECTED ANNUAL DAMAGES

UNDER WITH AND WITHOUT PROJECT CONDITIONS

Category	Without Project	100-Year Forced Drainage		SPH Forced Drainage		100-Year Gravity Drainage		SPH Gravity Drainage	
	Total Damages	Damage W/Plan	Damages Prevented	Damage W/Plan	Damages Prevented	Damage W/Plan	Damages Prevented	Damage W/Plan	Damges Prevented
Residential	$5,289,000	$2,978,000	$2,311,000	$2,700,000	$2,589,000	$9,725,000	($4,436,000)	$9,468,000	($4,179,000)
Commercial	146,000	76,000	70,000	67,000	79,000	295,000	(149,000)	288,000	(142,000)
Mobile Homes	115,000	48,000	67,000	39,000	76,000	250,000	(135,000)	242,000	(127,000)
Automibles	774,000	377,000	397,000	332,000	442,000	1,436,000	(662,000)	1,401,000	(627,000)
Totals	$6,324,000	$3,479,000	$2,845,000	$3,138,000	$3,186,000	$11,706,000	($5,382,000)	$11,399,000	($5,075,000)

TABLE 23
SLIDELL AREA HURRICANE PROTECTION PLANS
SUMMARY OF COSTS AND BENEFITS
BASE YEAR = 1998, PROJECT LIFE = 100 YEARS

ALIGNMENT "A"

	Forced 9,400 CFS	Forced 8,400 CFS	Forced 7,400 CFS	Forced 6,400 CFS
Average Annual Benefits	$5,881,000	$5,881,000	$5,881,000	$5,881,000
Average Annual Costs	$14,404,000	$13,292,000	$12,180,000	$11,068,000
Net Benefits	($8,523,000)	($7,411,000)	($6,299,000)	($5,187,000)
B/C Ratio	0.41	0.44	0.48	0.53

	Forced 7,100 CFS	Forced 6,100 CFS	Forced 5,100 CFS	Gravity Drainage
Average Annual Benefits	$5,881,000	$5,881,000	$5,881,000	($2,966,000)
Average Annual Costs	$12,132,000	$11,020,000	$9,908.000	$4,874,000
Net Benefits	($6,251,000)	($5,139,000)	($4,027,000)	($7,840,000)
B/C Ratio	0.48	0.53	0.59	-0.61

ALIGNMENT "B"

	Forced 9,400 CFS	Forced 8,400 CFS	Forced 7,400 CFS	Forced 6,400 CFS
Average Annual Benefits	$5,881,000	$5,881,000	$5,881,000	$5,881,000
Average Annual Costs	$14,416,000	$13,304,000	$12,192,000	$11,080,000
Net Benefits	($8,535,000)	($7,423,000)	($6,311,000)	($5,199,000)
B/C Ratio	0.41	0.44	0.48	0.53

	Forced 7,100 CFS	Forced 6,100 CFS	Forced 5,100 CFS	Gravity Drainage
Average Annual Benefits	$5,881,000	$5,881,000	$5,881,000	($2,966,000)
Average Annual Costs	$12,144,000	$11,032,000	$9,920,000	$4,886,000
Net Benefits	($6,263,000)	($5,151,000)	($4,039,000)	($7,852,000)
B/C Ratio	0.48	0.53	0.59	-0.61

TABLE 24

LACOMBE AREA

COMPARISON OF ANNUAL DAMAGES

UNDER WITH AND WITHOUT PROJECT CONDITIONS

Category	Without Project Total Damages	100-Year Forced Drainage Damage W/Plan	100-Year Forced Drainage Damages Prevented	SPH Forced Drainage Damage W/Plan	SPH Forced Drainage Damages Prevented	100-Year Gravity Drainage Damage W/Plan	100-Year Gravity Drainage Damages Prevented	SPH Gravity Drainage Damage W/Plan	SPH Gravity Drainage Damges Prevented
Residential	$5,399,000	$5,386,000	$13,000	$5,386,000	$13,000	$5,971,000	($572,000)	$5,971,000	($572,000)
Commercial	0	0	0	0	0	0	0	0	0
Mobile Homes	0	0	0	0	0	0	0	0	0
Automibles	613,000	612,000	1,000	612,000	1,000	633,000	(20,000)	633,000	(20,000)
Totals	$6,012,000	$5,998,000	$14,000	$5,998,000	$14,000	$6,604,000	($592,000)	$6,604,000	($592,000)

Table 25 displays average annual benefits and costs, net benefits and benefit-to-cost ratios.

Table 25

Lacombe Area
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)

	100-Yr Project With Pumps	SPH-Project With Pumps
First Cost	$82,749,000	$90,051,000
Average Annual Benefits	$14,000	$14,000
Average Annual Costs	$8,003,000	$8,698,000
B/C Ratio	0.0017	0.0016
Net Benefits	($7,989,000)	($8,684,000)

MADISONVILLE AREA

Because the town of Madisonville is located on the Tchefuncte River and is only 2 miles north of Lake Pontchartrain, it is vulnerable to hurricane flooding. SPH protection and 100-year protection were analyzed as means to eliminate the potential flood damage.

Presentation of Average Annual Damages, Benefits, and Costs. Damages were calculated for residential structures, mobile homes, and commercial structures as well as their contents. Damages to automobiles were also calculated. A

summary of the expected annual damages and damages prevented, or benefits, attributable to the Hurricane Protection Project is shown in Table 2. Table 27 displays average annual benefits and costs, net benefits and benefit-to-cost ratios. Even though the projects prevent 100 percent of the damages, they were not economically feasbile.

Table 26

MADISONVILLE AREA
COMPARISON OF AVERAGE ANNUAL DAMAGES
UNDER WITH AND WITHOUT PROJECT CONDITIONS
(1000'S)

		100 YEAR PROTECTION		SPH PROTECTION		100 YEARS WITH PUMPS		SPH WITH PUMPS	
DAMAGE CATEGORY	EXISTING CONDITION	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED	DAMAGE W/PLAN	DAMAGE PREVENTED
RESIDENTIAL	$591.00	$0.19	$590.81	$0.00	$591.00	$0.05	$590.95	$0.00	$591.00
COMMERCIAL	120.36	0.00	120.36	0.00	120.36	0.00	120.36	0.00	120.36
MOBILE HOMES	2.77	0.00	2.77	0.00	2.77	0.00	2.77	0.00	2.77
APARTMENTS	15.97	0.00	15.97	0.00	15.97	0.00	15.97	0.00	15.97
AUTOS	135.66	0.00	135.66	0.00	135.66	0.00	135.66	0.00	135.66
TOTAL	$865.76	$0.19	$865.57	$0.00	$865.76	$0.05	$865.71	$0.00	$865.76
% DAMAGE PREVENTED			99.98%		100.00%		99.99%		100.00%

Table 27

Madisonville Area
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)
(Base Year = 2001, Project Life = 100 Years)

	100-Yr Project Without Pumps	100-Yr Project With Pumps	SPH-Project Without Pumps	SPH-Project With Pumps
First Cost	$14,330,000	$14,910,000	$16,800,000	$17,410,000
Average Annual Benefits	$865,710	$865,570	$865,760	$865,760
Average Annual Costs	$1,741,000	$1,678,000	$2,012,000	$1,946,000
B/C Ratio	0.50	0.52	0.43	0.44
Net Benefits	($875,290)	($812,430)	($1,146,240)	($1,080,340)

PONCHATOULA CREEK-YELLOW WATER AREA

The purpose of this section is to determine the economic feasibility of providing flood protection for the city of Hammond in Tangipahoa Parish, Louisiana.

The value of a used automobile was determined as a function of the value of the homes in the area. The function used was developed from a cross section sample of subdivisions within the study area, and it has a correlation coefficient greater than 80 percent.

The average value for automobiles in the Hammond area was determined to be $5,511 which is slightly lower than the 1991 national average of just above $6,000. The total value of 3,687 automobiles within the study area

was $20,319,200. Average values for each reach ranged from a low of $1,950 to a high of $8,302 per automobile which reflects the variance of property values within the study area.

In addition to residential automobiles, one automobile was added for each of the 1,118 apartment units within the study area and 620 used and 170 new automobiles were added to represent the auto population of certain businesses such as new car dealerships, the SLU campus, and the Louisiana Department of Transportation facility. The average new car price used was $15,395. In all, there were 2,549 autos within the Yellow River basin and 1138 autos within the Ponchatoula Creek basin.

Presentation of Average Annual Damage, Costs, and Benefits. Damages were calculated for single family one and two story homes; mobile homes; commercial structures; apartments; and the contents of each. Damages to automobiles were also calculated. A summary of the expected annual damage and the damage reductions attributable to the plan is displayed in Table 28.

An analysis of the stage-frequency and elevation-damage curves for Hammond revealed significant variation in lowerings generated by the proposed projects. The lowerings produced for YWRC by plan 2 were not nearly as substantial as those produced for Ponchatoula Creek. Virtually all of the property in the Ponchatoula Creek basin is above the 500 year storm overflow with the project in place which provides a 99.9 percent level of protection, which in contrast to the YWRC area only receives a 74.3 percent level of protection because most property is only above the 20 year storm overflow with the project in place. Residential is the damage category which produced the most benefits in both basins. No induced flooding could be detected within the immediate study area. Induced flooding downstream of the study area was not considered due to the preliminary natures of the analysis. This affect will be evaluated in the feasibility phase study.

TABLE 28

Hammond - Yellow Water River Canal
Expected Annual Damages and Damages Prevented (Benefits)
(In $1000's)

DAMAGE CATEGORY	DAMAGE W/O PROJ	DAMAGE W/PROJ	DAMAGE REDUCED
RESIDENTIAL	702.32	182.15	520.17
COMMERCIAL	143.62	31.55	112.07
APARTMENTS	193.29	54.63	138.66
AUTOMOBILES	151.85	37.32	114.53
TOTAL	1191.08	305.65	885.43
% DAMAGE PREVENTED			74.3%

Hammond - Ponchatoula Creek
Expected Annual Damages and Damages Prevented (Benefits)
(In $1000's)

DAMAGE CATEGORY	DAMAGE W/O PROJ	DAMAGE W/PROJ	DAMAGE REDUCED
RESIDENTIAL	522.87	.16	522.71
COMMERCIAL	90.29	.00	90.29
APARTMENTS	88.43	.00	88.43
AUTOMOBILES	91.00	.01	90.99
TOTAL	792.59	.17	792.42
% DAMAGE PREVENTED			99.9%

Table 29 displays average annual benefits and costs, first costs, net benefits and benefit-to-cost ratios.

Table 29

Ponchatoula Creek Area Channel Improvements
Summary of Costs and Benefits
(1991 Price Level, 8 3/4 Interest Rate)
(Base Year = 1997, Project Life = 50 years)

First Costs	$995,000
Average Annual Benefits	$1,677,850
Average Annual Costs	$102,000
B/C Ratio	16.45
Net Benefits	$1,575,850

PRELIMINARY ENVIRONMENTAL ANALYSIS

Below is a description of environmental impacts associated with selected plans considered in this study.

BIOLOGICAL

Mile Branch and Lateral "A" Channel Improvements. Enlargement of Mile Branch and Lateral "A" would impact both wet and non-wet habitats. Most of these channels pass though developed lands, primarily residential, of

Covington, LA, and have been previously channelized. The habitat types impacted is displayed in Tables 30 and 31.

Most of the channelization work would be along mixed hardwoods and pine habitats in or near urban development. The lower segments of Mile Branch and Lateral "A" are bottomland hardwoods and swamp, with the swamp located in the flood plain of the Tchefuncte River.

Tchefuncte River Diversion. The Tchefuncte River Diversion would result in losses to just about all the major habitat types in the study area as a result of it's north-south orientation and length. Most of the area is in a natural state. Habitats to be impacted include fresh to intermediate marsh, riparian and non-riparian bottomland hardwoods, cypress swamp, pine flatwoods, pine savannas, and possibly live oak-pine-magnolia forest. In addition to the direct impacts displayed in Table 32, the project has potential for severe indirect impacts as the channel could dewater wetlands along its entire length.

At the diversion channel origin, sandy-bottomed stream, cypress swamp, riparian bottomland hardwood forests, and non- riparian bottomland hardwood forests would be impacted in the Tchefuncte River floodplain. South of river floodplain and north of the I-12 Interstate, pine savannas and flatwoods predominate with bisecting creeks and channels of bottomland hardwoods. South of the I-12, the area is a mixture of hardwoods and pines, and becomes an oak-pine-magnolia community near the Black River. Along the River the habitats transition from bottomland hardwoods, to swamp, and finally fresh/intermediate marsh before flowing across brackish marsh into Lake Pontchartrain.

The reduction in bank overflow during flooding events could result in slight reduction in productivity, but this is not expected to be significant. Flood reduction could result in significant secondary impacts, such as increased developmental pressure along the river and associated environmental degradation.

Mandeville and/or Lewisburg Hurricane Protection Project. Work on the Mandeville portion would result in impacts to Little Bayou Castine and the shoreline of Lake Pontchartrain, and construction of the Lewisburg segment would impact the Lake's edge and Bayou Chinchuba. The total area

TABLE 30
MILE BRANCH
Habitats Impacted
(in acres)

SITE	HABITATS					TOTAL AREA
	Swamp	Bottom-land Hardwood	Riverine Open Water	Wooded Residen-tial	Upland Developed	
Channel	2.8	23.2	4.9	0	0	30.9
Disposal	2.7	10.1	0	7.8	6.9	27.5
Total	5.5	33.3	4.9	7.8	58.4	58.4

TABLE 31
LATERAL "A"
Habitats Impacted
(in acres)

SITE	HABITATS					TOTAL AREA
	Swamp	Bottom-Upland Hardwood	Riverine Open Water	Wooded Residen-tial	Upland Developed	
Channel	0.8	3.4	1.4	4.9	0	10.5
Disposal	0	5.6	0	4.4	0	10.0
Total	0.8	9	1.4	9.3	0	20.5

TABLE 32
TCHEFUNCTE RIVER DIVERSION
Habitats Impacted
(in acres)

SITE	HABITATS							TOTAL AREA
	Pine Savannas	Swamp	Bottom-land Hardwood	Pine Flat-woods	Mixed Pine Hardwood	Upland Developed	Riverine Open Water	
Channel	39.1	1.3	9.5	38.3	12.5	7.8	3.2	117.7
Levee	0.0	0.0	71.7	0.0	72.4	0.0	0.0	144.1
Disposal	95.9	2.1	76.7	93.4	186.7	19.2	0.0	474.0
TOTAL	135.0	3.4	158.0	131.7	271.6	27.0	3.2	729.8

impacted, by habitat type, for each alternative is displayed in Table 33. The impacts for just the Mandeville segment can be found in Table 34, and impacts to the Lewisburg area in Table 35.

Little Bayou Castine is small bayou about 2 miles in length that drains the eastern edge of the city of Mandeville. The bayou transitions upstream through wooded swamp, bottomland hardwoods, and mixed pine/hardwoods. The levee alignment through little Bayou Castine would impact swamp and bottomland hardwoods habitats.

Most of the lakefront of Mandeville is developed as green space with a concrete bulkhead at the lake and grassland behind. A small remnant area of cypress swamp and upland hardwood forest is present. The remaining levee in Mandeville has been developed for commercial or residential uses.

The Lewisburg area is composed primarily of live oak-magnolia forest which extends to the lakefront. Although most of this area is in residential use many of the trees remain. Bayou Chinchuba is composed of cypress swamp with a transition of sweet gum, water oak, red maple bottomland hardwood.

Bayou Chinchuba Drainage Improvements. The proposed diversion of floodwaters along the Causeway Boulevard would have minimal environmental impacts. The rights- of-way for this work is currently existing roadways or commercial properties.

Slidell Hurricane Protection. Most of the impacts associated with the construction of a hurricane protection levee in the Slidell, Louisiana area would be in wetlands, primarily marsh, swamp or pine flatwoods. The alignment would cross Bayou Liberty and Bayou Bonfouca as well as several smaller tributaries of these Bayous.

Mixed pine-hardwood forests are located at both ends of the proposed levee alignment and are located in areas in elevation of slightly less than 5 feet to 15 feet NGVD. These forests are saturated during periods of heavy rain, and the wood on the eastern portion of the alignment may have a foot of water flowing through them during very heavy rain. These areas may have been pine flatwoods at one time, but the repression of fire appears to have encouraged the growth of hardwoods.

TABLE 33
HURRICANE PROTECTION, MANDEVILLE AND LEWISBURG AREA
Habitats Impacted
(in acres)

SITE	HABITATS						TOTAL AREA
	Lake Bottom	Bottom-land Hardwood	Mixed Pine Hardwood	Mixed Pine	Wooded Residen-tial[1/]	Upland Developed	
				100-YEAR			
Cast							
Levee	17	28.5	10.7	0	17.7	14.1	88
Borrow	38	47.8	18.2	3.1	28.8	8.4	144.3
Total	55	76.3	28.9	3.1	46.5	22.5	232.3
Haul							
Levee	17	28.5	10.7	0	17.7	14.1	88
Borrow		41.7	18.2	33		8.4	101.3
Total	17	70.2	28.9	33	17.7	22.5	189.3
				SPH			
Cast							
Levee	19.6	33.5	13.1	0	19.6	13.2	99
Borrow	4.3	58.5	16.6	4	32.7	6.5	161.3
Total	62.6	92	29.7	4	52.3	19.7	260.3
Haul							
Levee	19.7	31.4	13.1	0	19.6	15	98.8
Borrow		45.5	21.6	42		7.2	116.3
Total	19.7	76.9	34.7	42	19.6	22.2	215.1

1/ Area primarily a live oak-pine-magnolia type of mixed hardwood-pine forest in the Lewisburg area.

TABLE 34
HURRICANE PROTECTION, MANDEVILLE AREA ONLY
Habitats Impacted
(in acres)

SITE	HABITATS						TOTAL AREA
	Lake Bottom	Bottom-land Hardwood	Mixed Pine Hardwood	Mixed Pine	Wooded Residen-tial	Upland Developed	
				100-YEAR			
Cast							
Levee	17	15	1.6	0	0	18.1	51.7
Borrow	38	24.8	2.5	3.7		8.4	77.4
Total	55	39.8	4.1	3.7	0	26.5	129.1
Haul							
Levee	17	15	1.6	0	0	18.1	51.7
Borrow		18.7	2.5	23.1		8.4	52.7
Total	17	33.7	4.1	23.1	0	26.5	104.4
				SPH			
Cast							
Levee	19.6	18.4	2.7	0	0	17.2	57.9
Borrow	4.3	28	4.6	4		6.5	86.1
Total	62.6	46.4	7.3	4	0	23.7	144
Haul							
Levee	19.7	16.3	2.7	0	0	19	57.7
Borrow		20	4.6	27.9		7.2	59.7
Total	19.7	36.3	7.3	27.9	0	26.2	117.4

TABLE 35
HURRICANE PROTECTION, LEWISBURG AREA ONLY
Habitats Impacted
(in acres)

SITE	HABITATS						TOTAL AREA
	Lake Bottom	Bottom-land Hardwood	Mixed Pine Hardwood	Mixed Pine	Wooded Residen-tial[1/]	Upland Developed	
				100-YEAR			
Cast							
Levee		13.5	9.1	0	17.7	4	44.3
Borrow		2.3	15.7	1	28.8		68.5
Total	0	36.5	24.8	1	46.5	4	112.8
Haul							
Levee		13.5	9.1	0	17.7	4	44.3
Borrow		23	15.7	15			53.7
Total	0	36.5	24.8	15	17.7	4	98
				SPH			
Cast							
Levee		15.1	10.4	0	19.6	4	49.1
Borrow		30.5	12	1	32.7		76.2
Total	0	45.6	22.4	1	52.3	4	125.3
Haul							
Levee		15.1	10.4	0	19.6	4	49.1
Borrow		25.5	17	19			76.2
Total	0	40.6	27.4	19	19.6	4	110.6

1/ Area primarily a live oak-pine-magnolia type of mixed hardwood-pine forest.

The fresh to intermediate marshes are found at elevations near sea-level. The marsh type is dependent on the head-differential of the inflowing streams and bayous, as affected by rainfall and tidal stage in Lake Pontchartrain.

Swamps are found interspersed in the mixed pine/hardwoods and the marshes, and are associated with tributaries of the major bayous. Cypress trees predominate these swamps.

Bayous Liberty and Bonfouca are the dominate waterways in the area although numerous natural bayous and streams meander throughout the area. Both bayous have been dredged to maintain them as navigable. Although some commercial use is made of Bayou Bonfouca, the dominate traffic in these waterways is recreational. Bayou Bonfouca upstream of the project area has been designated by the EPA as a Superfund site.

Direct impacts would be associated with the construction of the levee and control structures. The area, by habitat type, impacted for Plan A and B, by level of protection, is displayed in Table 36.

Indirect impacts would be related to the construction of the an interior borrow canal and potential induced development. An estimated 54 5-foot diameter concrete pipes in 27 locations, and six 5-foot box culverts in three sites would be used to maintain existing hydraulic regimes during non-hurricane periods.

Ponchatoula Creek. The enlargement of Ponchatoula Creek would result in impacts to stream bottoms, riparian bottomland hardwoods, and mixed upland, pine/hardwoods. Although much of the area adjacent to the banks of Ponchatoula Creek has been cleared for both commercial and residential urban uses, most of the channel sides are wooded. The creek has been previously channelized. The area of habitats impacted for channel enlargement and associated disposal areas is displayed in Table 37.

Channel enlargement would result in the loss of all riparian bottomland hardwoods between the existing channel banks. These woodlands area growing on very steep sides, and are approximately 30 years old. Vegetation

TABLE 36
HURRICANE PROTECTION, WEST SLIDELL
Habitats Impacted
(in acres)

PLAN	HABITATS								TOTAL AREA
	Intermed/ Brackish Marsh	Shallow Open Water	Fresh Marsh	Bottom-land Hardwood	Riverine Open Water	Upland Developed	Mixed Pine Hardwood	Scrub Shrub	
PLAN A									
100-YEAR									
Levee	47.2	4.0	1.9	1.2	1.1	1.6	43.3	0.0	100.2
Borrow	67.4	5.7	2.7	1.7	1.6	2.6	63.6	0.0	145.3
Total	114.6	9.8	4.5	2.9	2.7	4.2	106.9	0.0	245.5
PLAN B									
100 YEAR									
Levee	20.9	0.0	1.4	1.1	0.6	1.6	78.4	1.1	105.1
Borrow	29.9	0.0	2.0	1.6	0.8	2.6	114.1	1.6	1[illegible]
Total	50.9	0.0	3.4	2.7	1.4	4.2	192.4	2.7	2[illegible]

TABLE 37
PONCHATOULA CREEK
Habitats Impacted
(in acres)

SITE	HABITATS				TOTAL AREA
	Bottom-land Hardwood	Riverine Open Water	Upland Developed	Mixed Pine Hardwood	
Channel	17.2	9.5	0	23.9	50.6
Disposal	0	0	12.9	31.7	44.6
Total	17.2	9.5	12.9	55.6	95.2

along the channel bottom tends to be younger and more recent secondary growth species. The channel woodlands are heavily utilized by passerine birds.

The channel bottom would be destroyed during construction; however, some partial recovery would be expected over time. The general productivity of the creek would be substantially reduced as a result of the removal of adjacent stream-side vegetation and overhanging trees. The stream bottom was cleared and snagged about 5 years ago, and vegetation immediately adjacent possibly was herbicided.

Lands adjacent to the creek bank would be used for disposal of material excavated from the channel. Much of this adjacent land is currently being used for commercial, agricultural, or residential purposes, and some has been previously disposed upon. The areas previously not impacted, are vegetated with upland species, primarily pines and oaks.

ENDANGERED AND THREATENED SPECIES

The Gulf of Mexico sturgeon would probably not be impacted by diversion projects; however, channelization projects on streams or bayous terminating in Lake Pontchartrain could have a negative impact. The removal of sandy/gravel/rock area used for spawning could impact this fish species. Construction of any of these projects through pine dominated habitats, especially flatwoods, has the potential to impact red-cockaded woodpecker colonies. Surveys would be necessary to locate colony sites of this avian species. The mobile alligator would be expected to move from any construction areas. The gopher tortoise and ringed sawbacked turtle are not expected to be found in the proposed work areas.

NATURAL AND SCENIC RIVERS

The environmental quality of the Tchefuncte River could potentially be impacted by the Tchefuncte River Diversion Project. The reduction in bank overflow during flooding events could result in slight reduction in productivity, but this is not expected to be significant. Direct project construction is not expected to have any impact on the scenic qualities of the stream except at the diversion site. Flood reduction, however, could result

in increased developmental pressure along the river, and thus degrade its scenic quality as well as contribute to other secondary impacts. Bayou Chinchuba is being evaluated for inclusion into the system. The impacts on this bayou due to the Bayou Chinchuba Diversion Project would be similar to that described above for the Tchefuncte River. The Mandeville-Lewisburg Hurricane Protection plans, which involve the construction of levees along the lower portion of Bayou Chinchuba, could impact the flow characteristics of the bayou. None of the other plans would significantly impact scenic streams in the study area.

Permits are required by the Louisiana Department of Wildlife and Fisheries to perform work on scenic rivers.

RECREATIONAL RESOURCES

Mile Branch and Lateral "A" Channel Improvements. The enlargement of Mile Branch and Lateral "A" would have minimal impacts on recreation resources. Approximately 40 acres of mixed bottomland hardwoods having some hunting potential would be lost to the project. Channelization would temporarily curtail fishing activity in those work areas.

Tchefuncte River Diversion. The loss of approximately 730 acres of habitat caused by cutting a flood flow diversion channel would result in the reduction of sport fishing and hunting potential. Secondary impacts of the project, such as induced draining of wetlands or increased development and associated environmental degradation would cause additional reductions in fishing and hunting potential.

Mandeville and Lewisburg Hurricane Protection Project. Project construction along the shoreline areas of Lake Pontchartrain within the linear City Park would result in the loss of existing parkland which is used for a variety of outdoor activities including fishing, picnicking, and sightseeing. The aesthetic and visual attractiveness of the lake view and adjacent green space would be severely disrupted by construction of levees and/or floodwalls. Construction outside the City Park would result in 100 acres of habitat loss and a subsequent reduction in both fishing and hunting potential.

Bayou Chinchuba Drainage Improvements. The proposed floodwater diversion would not impact recreation resources.

Slidell Hurricane Protection Project. The loss of 240 acres of marshland habitat associated with the construction of a hurricane protection levee west of Slidell would result in losses to both fishing and hunting potential

Ponchatoula Creek. The enlargement of Ponchatoula Creek would have minimal impacts on recreation resources. Approximately 20 acres of mixed bottomland hardwoods having some hunting potential would be lost to the project.

CULTURAL RESOURCES

Most of the study alternatives would require a field survey to determine if presently unknown properties of National Register significance were in their way. Were such properties identified, appropriate procedures to avoid and/or mitigate impact to them would be developed in consultation with the Louisiana State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Mile Branch and Lateral "A". Bank clearing to allow access for dredging equipment may damage presently unknown archeological sites located along the creek banks.

Tchefuncte River Diversion. An archeological and historical site survey will be required to identify any potentially significant sites in construction areas.

Mandeville and Lewisburg. Primary concerns relate to cutting off historically significant houses from their view of the lake. Archeological and historical site survey will be required to identify any potentially significant sites in construction areas.

Bayou Chinchuba. The location of the proposed structure follows the course of an existing culvert along the shoulder of the highway. It is unlikely that any significant undisturbed cultural resources exist in this context.

Slidell. An archeological and historical site survey will be required to identify any potentially significant sites in construction areas.

Ponchatoula Creek. Bank clearing to allow access for dredging equipment may damage presently unknown archeological sites located along the creek bank.

MITIGATION

The following section contains a preliminary estimate of mitigation features that will likely be required for construction of selected plans evaluated in this study. An estimate of mitigation costs is provided for the potentially economical plans, as well as for certain uneconomical plans to illustrate the range of costs involved. Most of the areas impacted by the alternatives evaluated are wetlands. These wetland habitats are primarily marsh, bottomland hardwoods, and pine flatwoods/savannas and each would require in-kind mitigation.

Mitigation could be accomplished by either management of existing public lands, acquisition of additional lands, or a combination of these two. Additional mitigation by avoidance and minimization would be performed during the Feasibility Stage of project development. The Bogue Chitto National Wildlife Refuge, Pearl River State Wildlife Management Area, Fontainebleau State Park, Fairview Riverside State Park, and a number of local parks are located within the project area. The Louisiana Department of Wildlife and Fisheries is evaluating purchase of pine flatwoods and savannas in the Lake Ramsey area.

For the purposes of preliminary mitigation analysis, terrestrial habitats and lake bottoms were grouped into three dominate habitat types; bottomland hardwoods, marsh and pine savannas. Habitats that were not one of these types were consolidated with the most similar type, and considered equal in habitat value to them, or determined to be of a lessor value and converted to equivalent area. The area of equivalent habitats is displayed in Table 38. All mitigation plans consisted of the purchase of degraded habitats and passive or active management of the area, as necessary. No specific locations were identified, but sufficient land exist adjacent to Federal or state lands that these areas could be incorporated into public lands. For bottomland hardwoods, previously impacted lands would be purchased and planted with mast-producing vegetation. For marsh, degraded wetlands would be purchased, water control capability installed, and the area managed. For pine savannas, the area would be purchased and intensively managed. Much of the cost information was provided by the U.S. Fish and Wildlife Service. The first costs for mitigation of each plan can be found in Table 39 and the maintenance costs in Table 40. These costs were added to the project costs shown in Appendix B.

TABLE 38
EQUIVALENT AREA OF VARIOUS MITIGATION HABITATS
(base area in acres)

PLAN	HABITAT		
	Bottom-land Hardwoods (Note 1)	Fresh water Marsh (Note 2)	Pine Savannas (Note 3)
Mile Branch	41.1	0	0
Lateral "A"	12.9	0	0
Tchefuncte River Division	270	0	266.7
Mandeville/Lewisburg H.P.			
100-year			
cast	94.3	18.3	0
haul	100.9	5.7	0
SPH			
cast	122.9	20.9	0
haul	114	6.6	0
Mandeville H.P.			
100-year			
cast	42.9	18.3	0
haul	44.6	5.7	0
SPH			
cast	50.9	20.9	0
haul	50.4	6.6	0
Lewisburg H.P.			
100-year			
cast	62.3	0	0
haul	58.3	0	0
SPH			
cast	72.4	0	0
haul	65.7	0	0
West Slidell H.P.			
Plan A (100-year)	45.7	119.1	0
Plan B (100-year)	80.3	54.3	0
Ponchatoula Creek	39.4	0	0

Note 1: Equivalent bottomland hardwood habitats for impacts to swamp, bottomland hardwoods, upland hardwood forest, mixed pine and hardwoods, and low density residential.

Note 2: Equivalent fresh marsh habitats for impacts to fresh, intermediate and brackish marsh.

Note 3: Equivalent pine savanna habitats for impacts to pine savanna and flatwoods.

TABLE 39
FIRST COST OF MITIGATION
(in 1990 dollars, X $1,000)

PLAN	MITIGATION SITE HABITAT			TOTAL
	Bottom-land Hardwoods	Fresh water Marsh	Pine Savannas	
Mile Branch	112	0	0	112
Lateral "A"	35	0	0	35
Tchefuncte River Division	737	0	400	1,137
Mandeville/Lewisburg H.P.				
100-year				
cast	257	50	0	307
haul	275	16	0	291
SPH				
cast	336	57	0	393
haul	311	18	0	329
Mandeville H.P.				
100-year				
cast	117	50	0	167
haul	122	16	0	137
SPH				
cast	139	57	0	196
haul	138	18	0	156
Lewisburg H.P.				
100-year				
cast	170	0	0	170
haul	159	0	0	159
SPH				
cast	198	0	0	198
haul	179	0	0	179
West Slidell H.P.				
Plan A				
100-year	125	324	0	449
Plan B				
100-year	219	148	0	441
Ponchatoula Creek	108	0	0	108

The first cost of mitigation per acre is $910 for bottomland hardwoods, $908 for marsh, and $1,000 for pine savannas. These costs were developed with information provided by the U.S. Fish and Wildlife Service, the Louisiana Department of Wildlife and Fisheries, and the Nature Conservancy and are based on actual costs in the study area. The mitigation requirement for the loss of bottomland hardwoods and freshwater marsh is to purchase 3 acres of like habitat for every acre destroyed. For Pine Savannas, the requirement is 1.5 acres for every acre destroyed. Sample calculation: Mile Branch---41.1 acres Bottomland Hardwoods (from Table 38) X $910/acre X 3 = $112,203. Note: First costs in the table above are rounded to the nearest $1,000.

TABLE 40
MAINTENANCE COST OF MITIGATION
(in 1990 dollars, X $1,000)

PLAN	MITIGATION SITE HABITAT			TOTAL
	Bottom-land Hardwoods	Fresh water Marsh	Pine Savannas	
Mile Branch	0.0	0.0	0.0	0.0
Lateral "A"	0.0	0.0	0.0	0.0
Tchefuncte River Division	0.0	0.0	200.0	200.0
Mandeville/Lewisburg H.P.				
100-year				
cast	0.0	1.4	0.0	1.4
haul	0.0	0.4	0.0	0.4
SPH				
cast	0.0	1.6	0.0	1.6
haul	0.0	0.5	0.0	0.5
Mandeville H.P.				
100-year				
cast	0.0	1.4	0.0	1.4
haul	0.0	0.4	0.0	0.4
SPH				
cast	0.0	1.6	0.0	1.5
haul	0.0	0.5	0.0	0.5
Lewisburg H.P.				
100-year				
cast	0.0	0.0	0.0	0.0
haul	0.0	0.0	0.0	0.0
SPH				
cast	0.0	0.0	0.0	0.0
haul	0.0	0.0	0.0	0.0
West Slidell H.P.				
Plan A				
100-year	0.0	8.9	0.0	8.9
Plan B				
100-year	0.0	4.1	0.0	4.1
Ponchatoula Creek	0.0	0.0	0.0	0.0

Amount maintenance cost of savannas is estimated to be $500 per acre, and for marsh is estimated to be $25 per acre.

Replacement cost of $5,000 is required in year 25 for marsh mitigation plans.

REQUIREMENTS FOR FURTHER STUDIES

In the feasibility study, additional alternatives should be considered to minimize environmental impacts. An appropriate environmental document (Environmental Assessment or Environmental Impact Statement) will be prepared. A Section 404(b) (1) Evaluation, Coastal Zone Consistency Determination, and other required environmental documents will also be prepared. An application will be made for a state Water Quality Certificate. Mitigation requirements will be calculated and a mitigation plan formulated for each alternative considered in detail. Development induced by the project will be estimated.

WATER QUALITY

A discussion of water quality impacts is given in Appendix A.

STUDY PARTICIPANTS AND COORDINATION

This study was coordinated with the Louisiana Department of Transportation and Development, the U.S. Fish and Wildlife Service, and numerous city and parish officials. In January 1990, the New Orleans District issued a public notice to solicit the views and concerns of local interests concerning flooding problems in the study area. Several property owners responded with information on flooding in their area. We investigated these sites to determine whether Federal flood control plans could be developed. In most cases, these flooding problems were localized or in sparcely populated areas where the development of feasible structural measures was determined to be highly unlikely. No public officials responded to the public notice with specific requests or concerns. As a result, the study manager arranged meetings with parish and city officials to discuss flooding problems in areas where the likelihood of developing a Federal project seemed highest. These sites were selected on the basis of population and an assessment of flooding potential derived from flood insurance studies and floodplain maps in the study area. The study manager met with Tangipahoa Parish Police Jurors concerning Tangipahoa Parish and the Tangipahoa River; with Livingston Parish Police Jury concerning the Tickfaw River and its tributaries; with St.

Tammany Parish Police Jury officials concerning the Tchefuncte River and surrounding areas. In addition, he contacted several parish engineers, city engineers, and county agents throughout the study area. As a result of these investigations, the study team developed a list of "problem" areas to analyze. While these potential sponsors have indicated an interest in reducing flood damages in their areas, they have not indicated a willingness or capability to share in the cost of feasibility-level studies.

PROJECT COST SHARING

HURRICANE PROTECTION

Non-Federal. If a hurricane protection project is implemented, the local sponsor would incur at least 35 percent of the total cost of construction (including mitigation), which includes all lands, easements, relocations, and rights-of-way (LERR's) required for the project. However, at least 5 percent of the total non-Federal share must be a cash contribution. If the LERR's amount to more than 20 percent of the total project cost, the minimum cash contribution of 5 percent would still be required. If the LERR's amount to less than 35 percent of the total project cost, then a cash contribution of the remainder is required. The local sponsor would also be responsible for operating and maintaining the project.

Federal. The maximum Federal share of the hurricane protection project is 65 percent of the total project first cost, including engineering and design and construction management. No Federal maintenance would be provided.

FLOOD PROTECTION

Non-Federal. If a flood protection project is implemented, the local sponsor would incur at least 25 percent of the total cost of construction (including mitigation), which includes all lands, easements, relocations, and rights-of-way (LERR's) required for the project. However, at least 5 percent of the total non-Federal share must be a cash contribution. If the LERR's amount to more than 20 percent of the total project cost, the minimum cash contribution of 5 percent would still be required. The local sponsor would also be responsible for operating and maintaining the project.

Federal. The maximum Federal share of the flood protection project is 75 percent of the total project first cost, including engineering and design and construction management. No Federal maintenance would be provided.

CONCLUSIONS

Analysis of the national economic development benefits associated with the plans presented herein indicates that there is a Federal interest in continuing the study into the feasibility phase. We identified three subareas within the overall study area which have at least one potentially feasible plan under Federal criteria. These subareas are designated as Mandeville, Mile Branch (Covington), and Ponchatoula Creek-Yellow Water River (Hammond). For the Mandeville area, we investigated the feasibility of constructing a hurricane protection system around a portion of the city. For the Mile Branch and Ponchatoula Creek-Yellow Water River areas, we investigated the feasibility of constructing channel improvements for flood control.

Table 41 summarizes the costs and benefits associated with the most economical plans in these areas. Due to the preliminary nature of this analysis, however, additional detailed studies are necessary to verify these findings.

Continuation into the feasibility phase will be advisable if non-Federal sponsors agree to share in the cost of the study. At the present time, no non-Federal sponsor has indicated an intent to participate. Separate feasibility studies would be appropriate for each area because their boundaries are mutually exclusive. Potential non-Federal sponsors include the State of Louisiana, St. Tammany Parish, and the cities of Hammond, Mandeville, and Covington.

The feasibility studies of Ponchatoula Creek-Yellow Water River and Mile Branch could be pursued under the Section 205 Program, if non-Federal sponsorship is forthcoming. The anticipated Federal costs of each of these plans is less than the $5,000,000 program limit.

Due to the aesthetic impacts of the Mandeville Hurricane Protection Plan, it is unlikely that a non-Federal sponsor will cost share in the feasibility phase study at this time. For this reason, processing this reconnaissance report to continue studies under the General Investigations program is not advisable.

TABLE 41

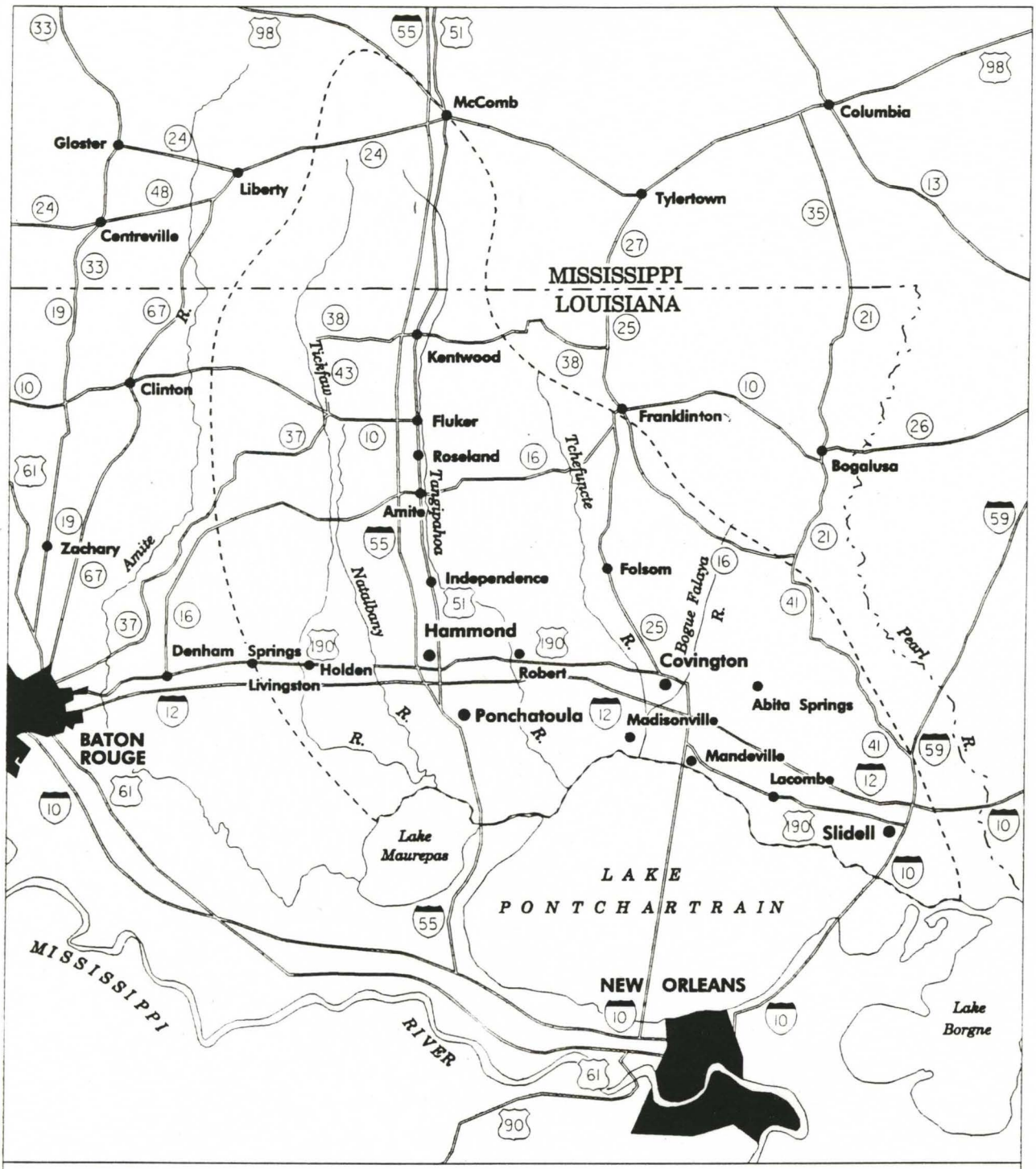
Summary of Costs and Benefits
of the Most Economical Plans Considered
(1991 Price Level, 8 3/4 Interest Rate)

Plan	First Costs	Avg. Annual Costs	Avg. Annual Benefits	Benefit-to-Cost Ratio
Covington (Mile Branch Channel)	$4,201,000	$389,000	$772,000	1.98
Hammond (Ponchatoula Creek Channel)	$995,000	$102,000	$1,678,000	16.45
Mandeville (Hurricane Protection)	$15,685,000	$1,615,000	$1,992,000	1.23

RECOMMENDATIONS

I recommend continuing the study of Ponchatoula Creek-Yellow Water River and Mile Branch under Section 205 of the Flood Control Act of 1948, as amended. I further recommend that you suspend processing of this reconnaissance report until a non-Federal sponsor is identified for the Mandeville area hurricane protection plan.

Michael Diffley
Colonel, U. S. Army
District Engineer



LEGEND

---- STUDY AREA LIMITS

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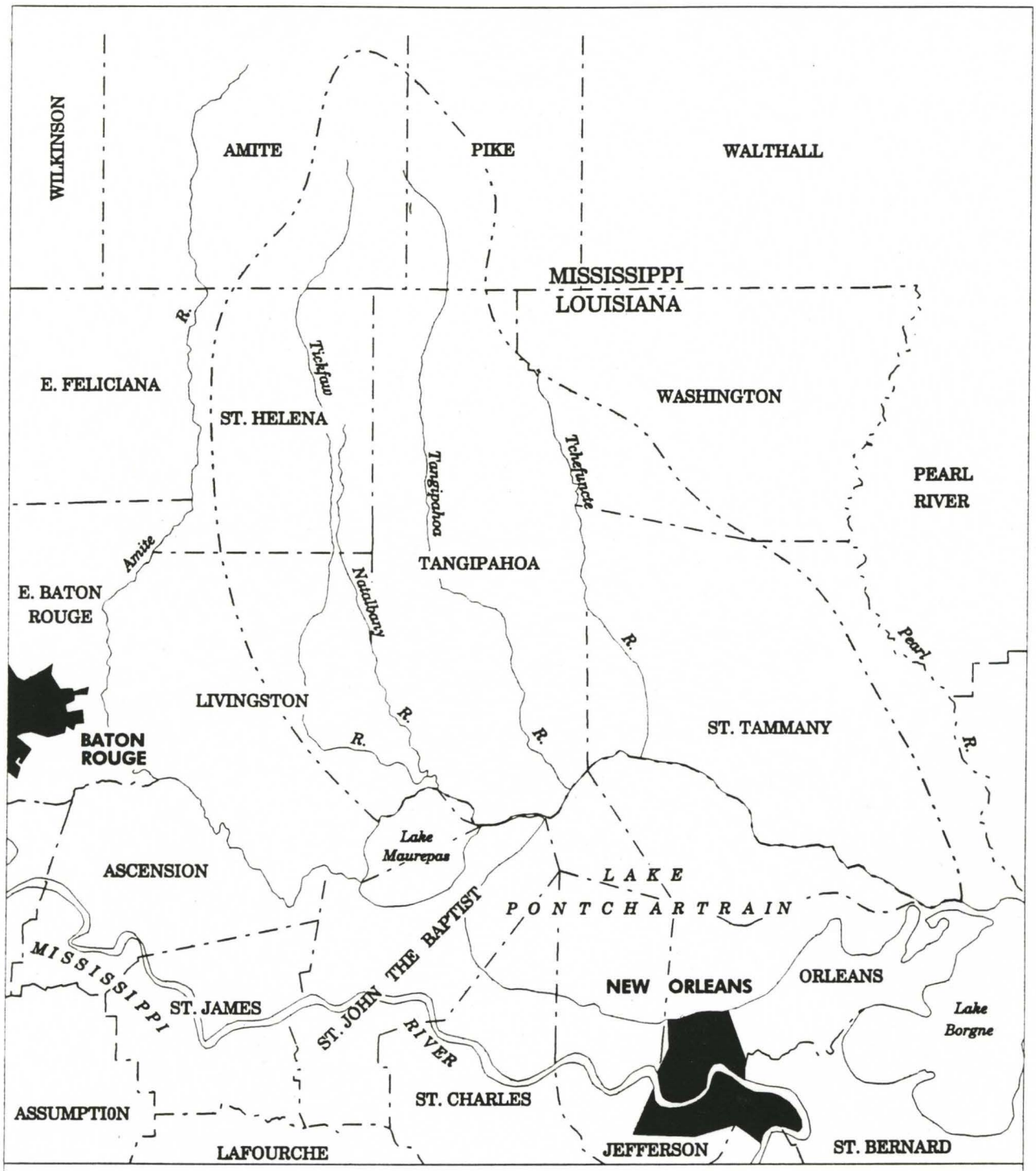
N

0 5 10 15 20 Miles

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

STUDY AREA

PLATE 1



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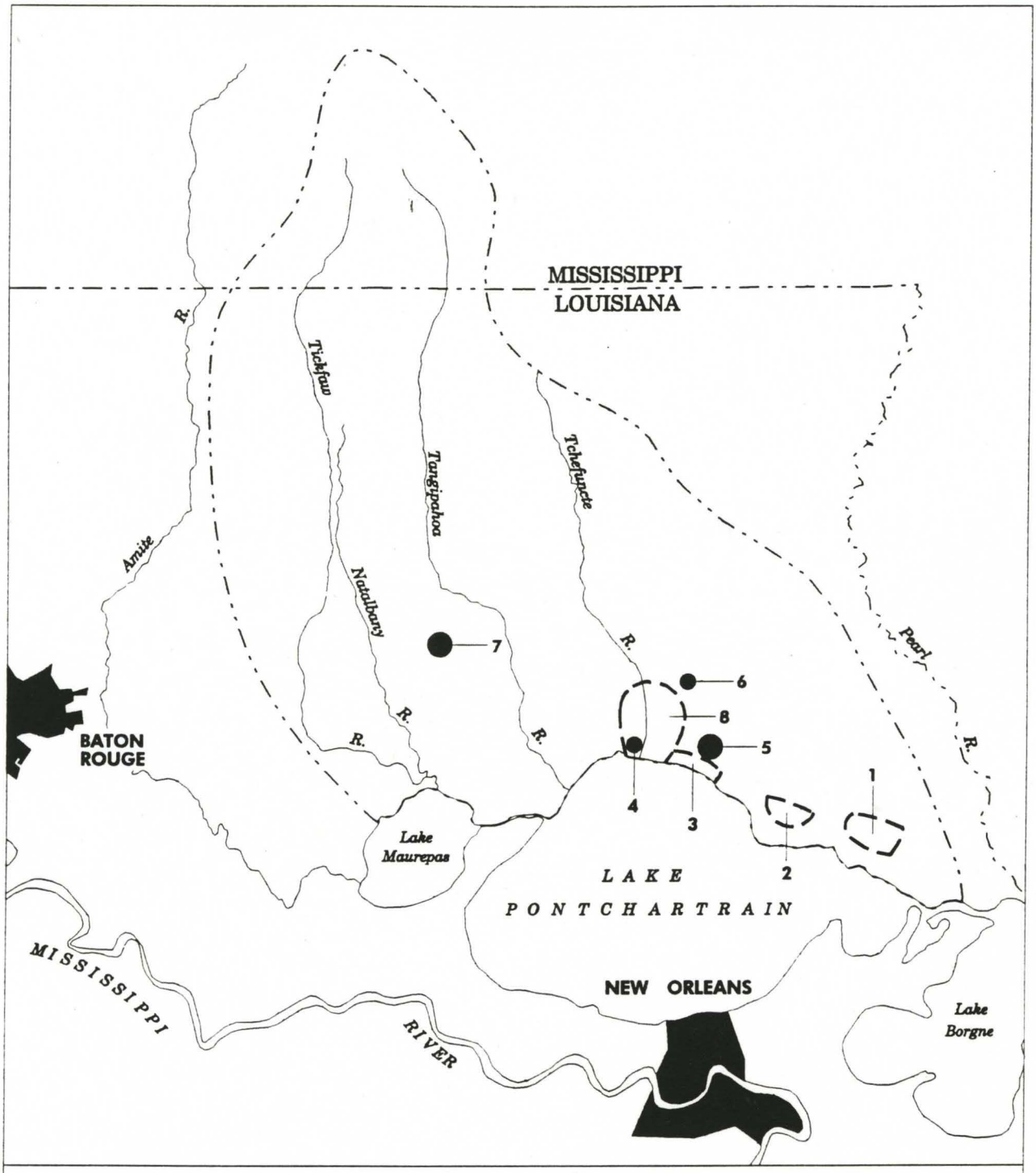
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PARISH BOUNDARIES

PLATE 2



LEGEND

1 — SLIDELL AREA
2 — LACOMBE AREA
3 — MANDEVILLE - LEWISBURG AREA
4 — MADISONVILLE AREA
5 — BAYOU CHINCHUBA AREA
6 — MILE BRANCH - LATERAL "A" AREA
7 — PONCHATOULA CREEK - YELLOW WATER RIVER AREA
8 — LOWER TCHEFUNCTE - BOGUE FALAYA RIVER AREA

— - · STUDY AREA LIMIT

2 — STUDY SUBAREAS — 7

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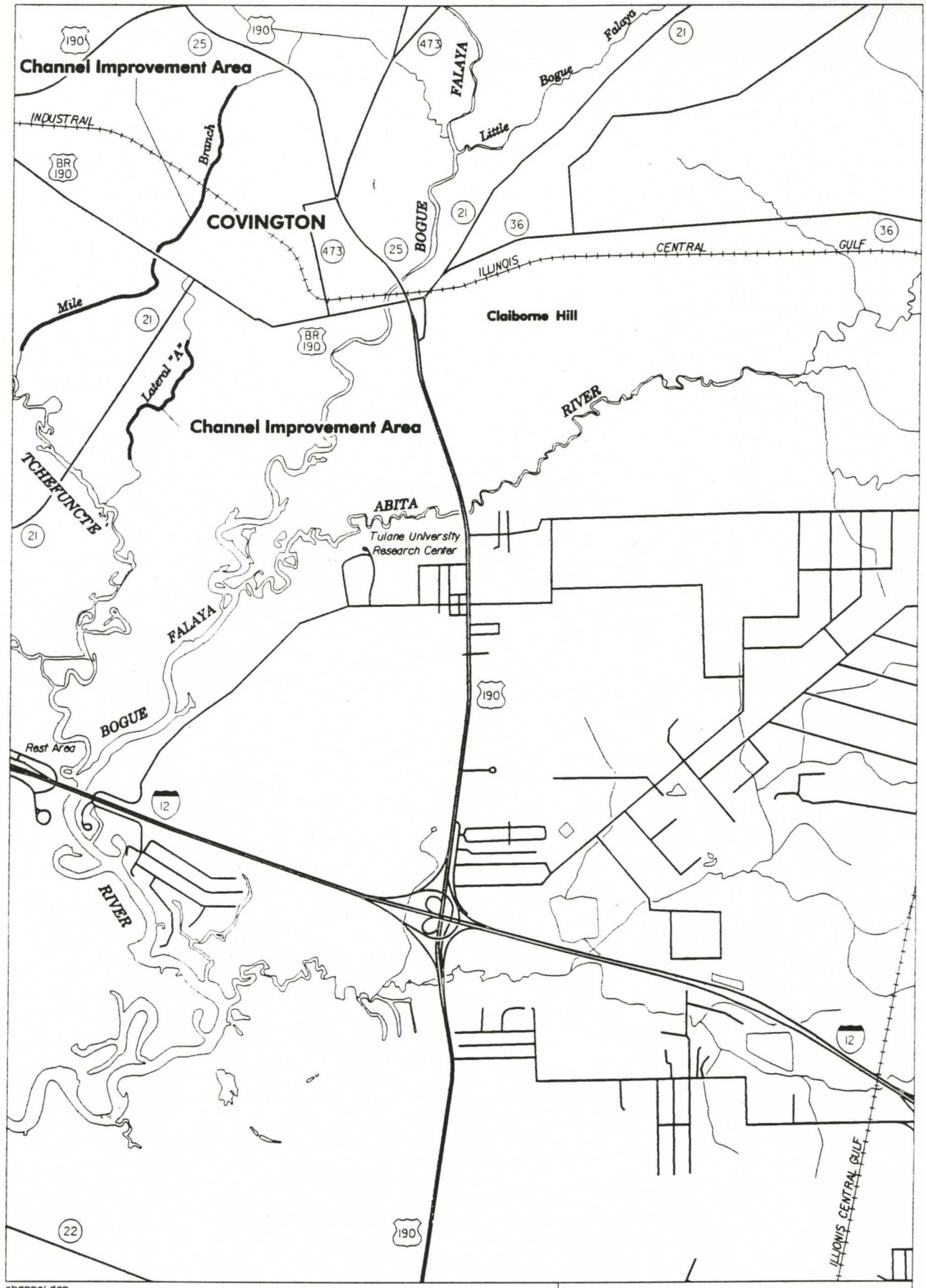
0 5 10 15 20 Miles

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

STUDY SUBAREAS

PLATE 3



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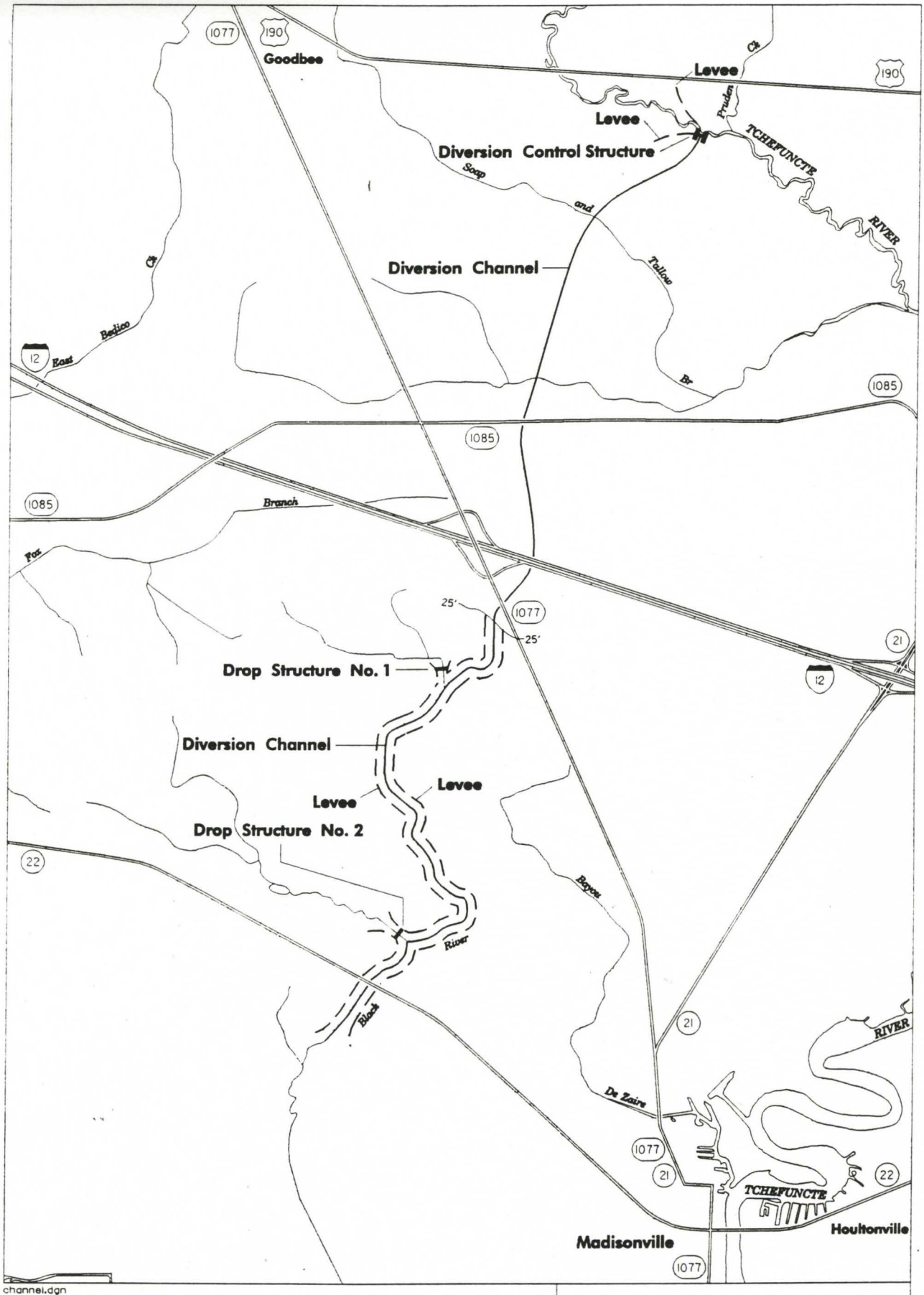
N

0 ½ Mile

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

**MILE BRANCH AND LATERAL "A"
CHANNEL IMPROVEMENTS**

PLATE 4



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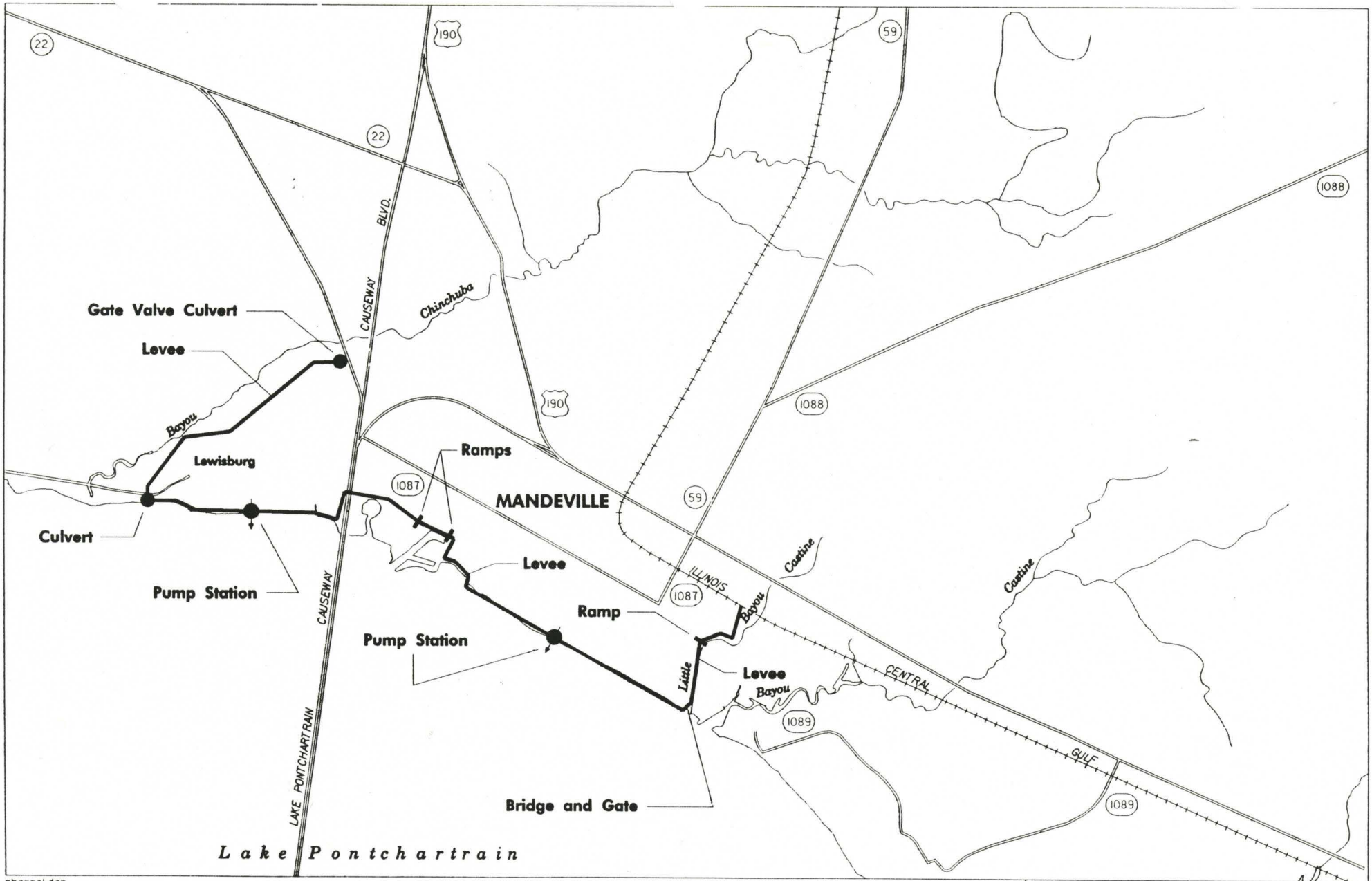
N

0 ½ 1 Mile

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

TCHEFUNCTE RIVER DIVERSION

PLATE 5



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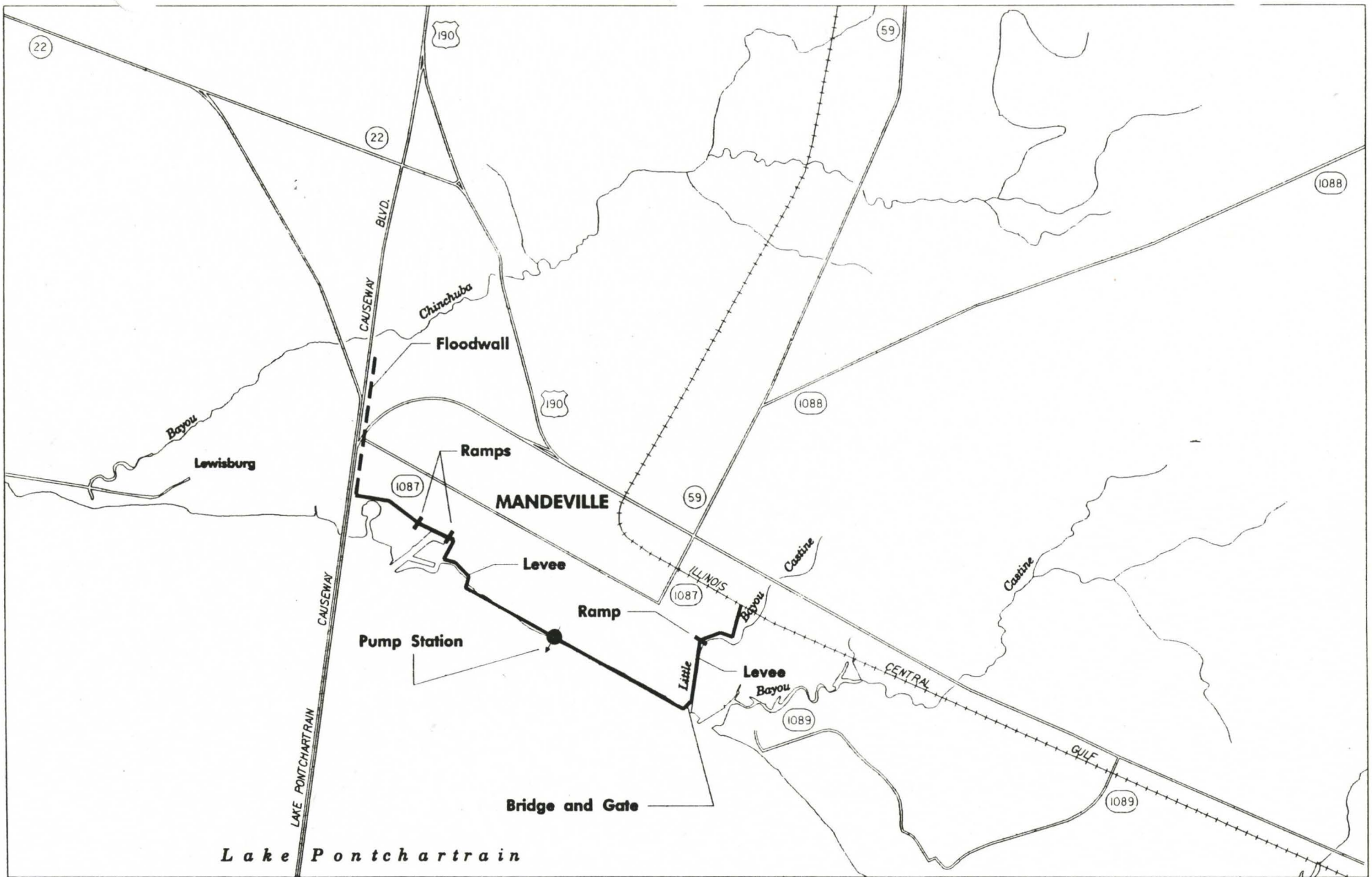
0 ½ 1 Mile

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

MANDEVILLE AND LEWISBURG HURRICANE PROTECTION ALIGNMENT 100 – YEAR AND SPH PLANS

PLATE 6



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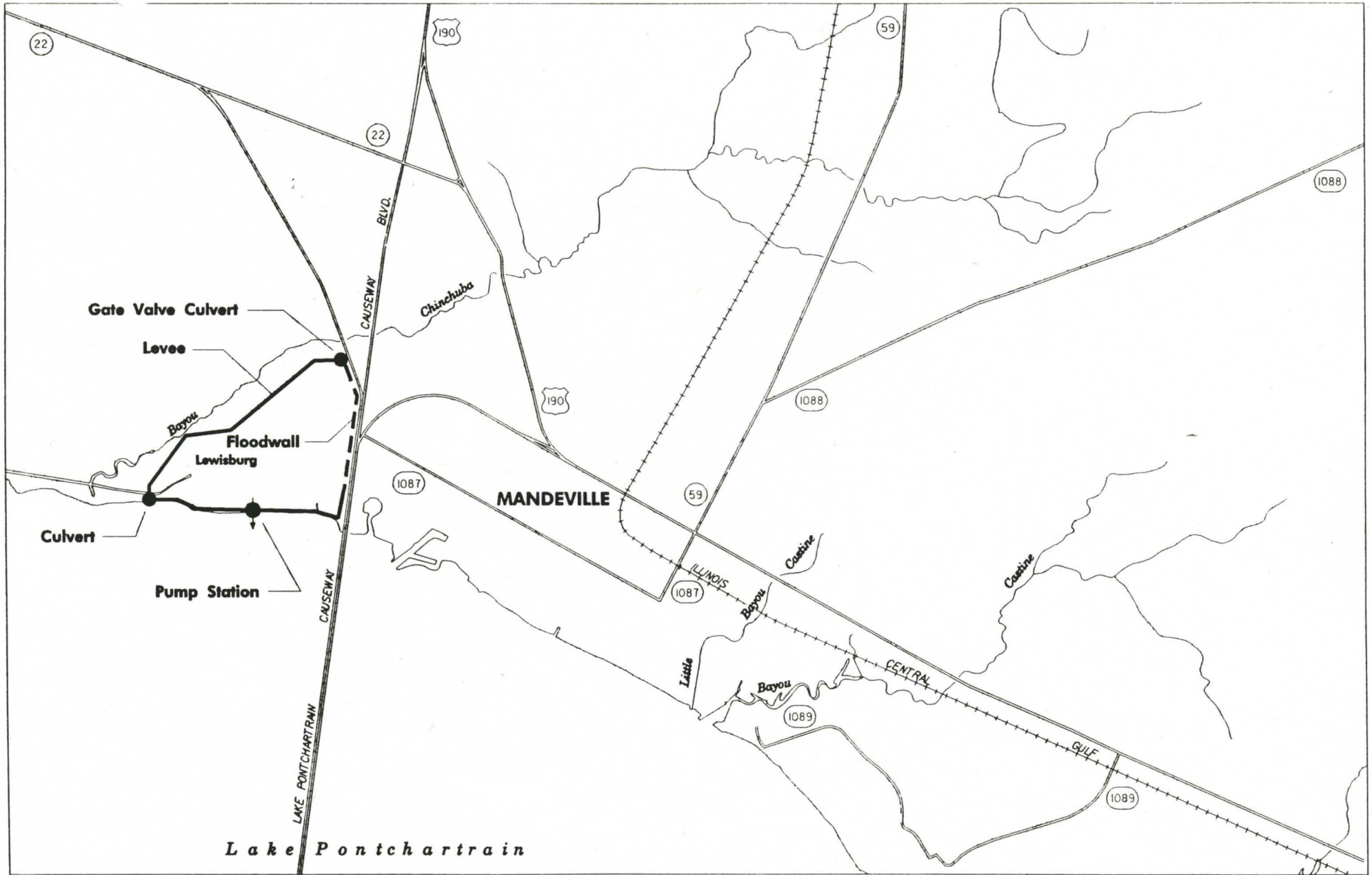
N

0 ½ 1 Mile

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

MANDEVILLE HURRICANE PROTECTION ALIGNMENT 100 – YEAR AND SPH PLANS

PLATE 7



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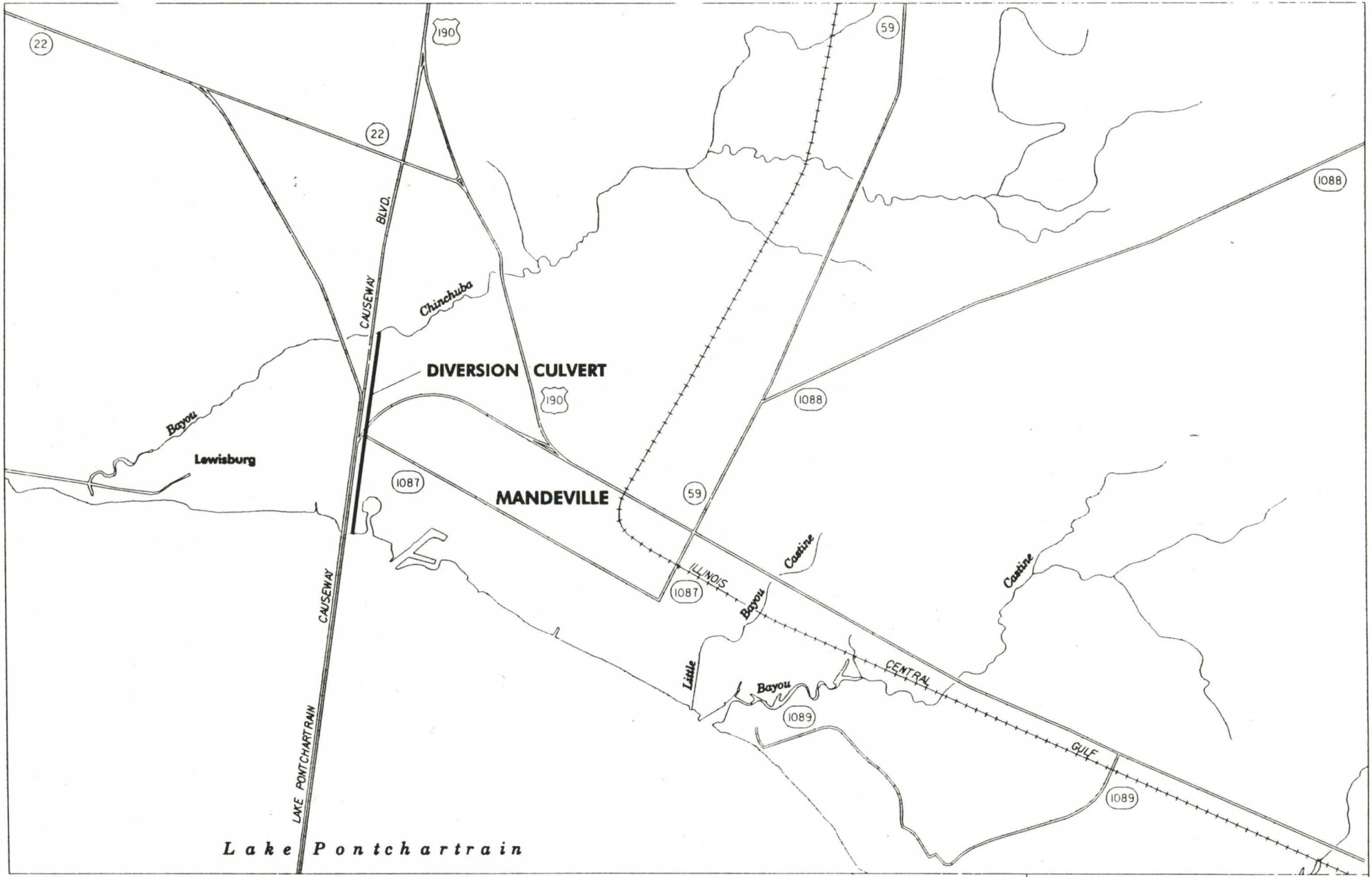
N

0 ½ Mile

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

LEWISBURG HURRICANE PROTECTION ALIGNMENT 100 – YEAR AND SPH PLANS

PLATE 2



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N

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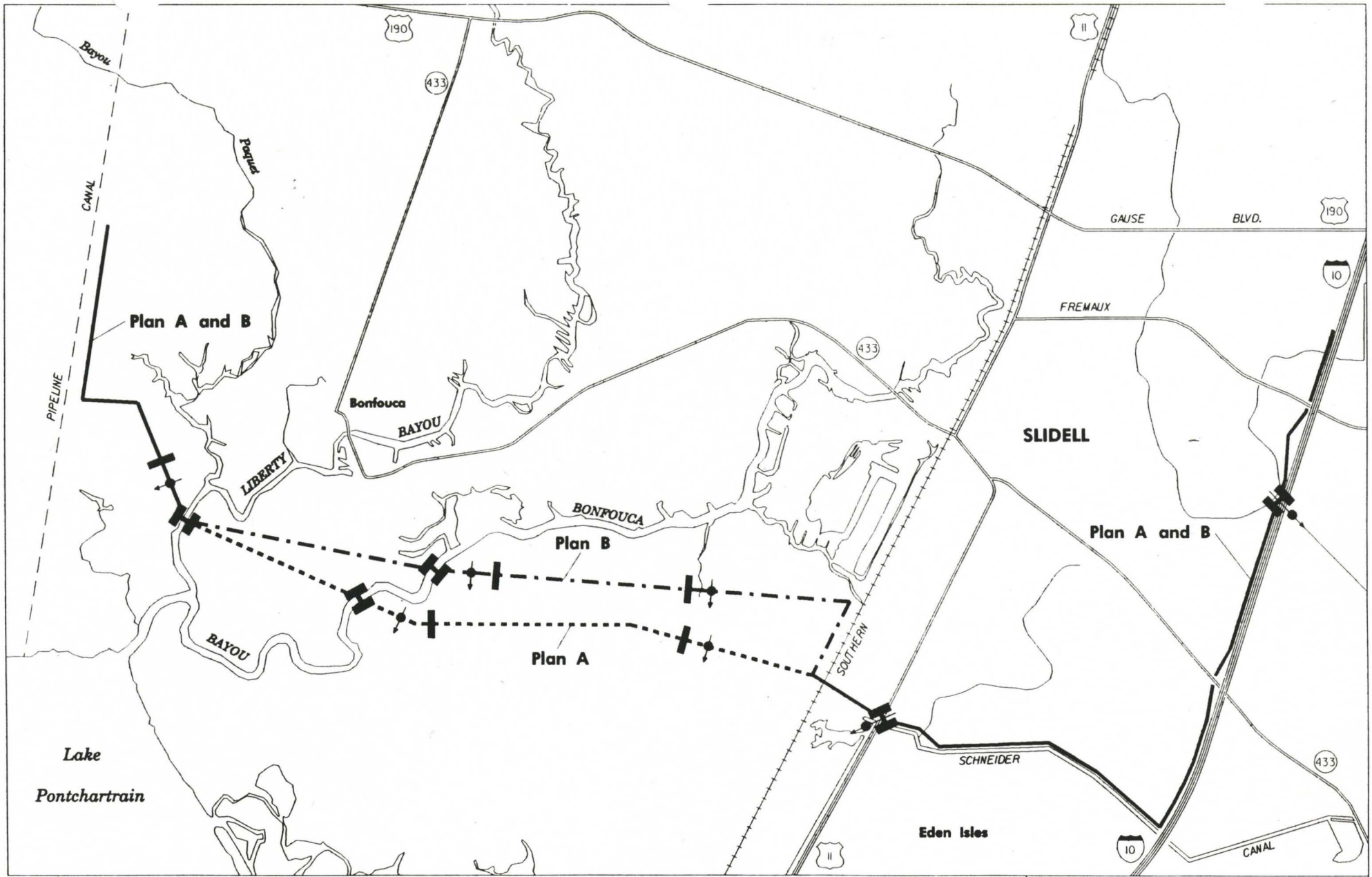
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

BAYOU CHINCHUBA CHANNEL DIVERSION

PLATE 9



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LEGEND

- NAVIGABLE FLOODGATE
- FLOODGATE OR PUMPING STATION
- PUMP STATION(S)
- CULVERT

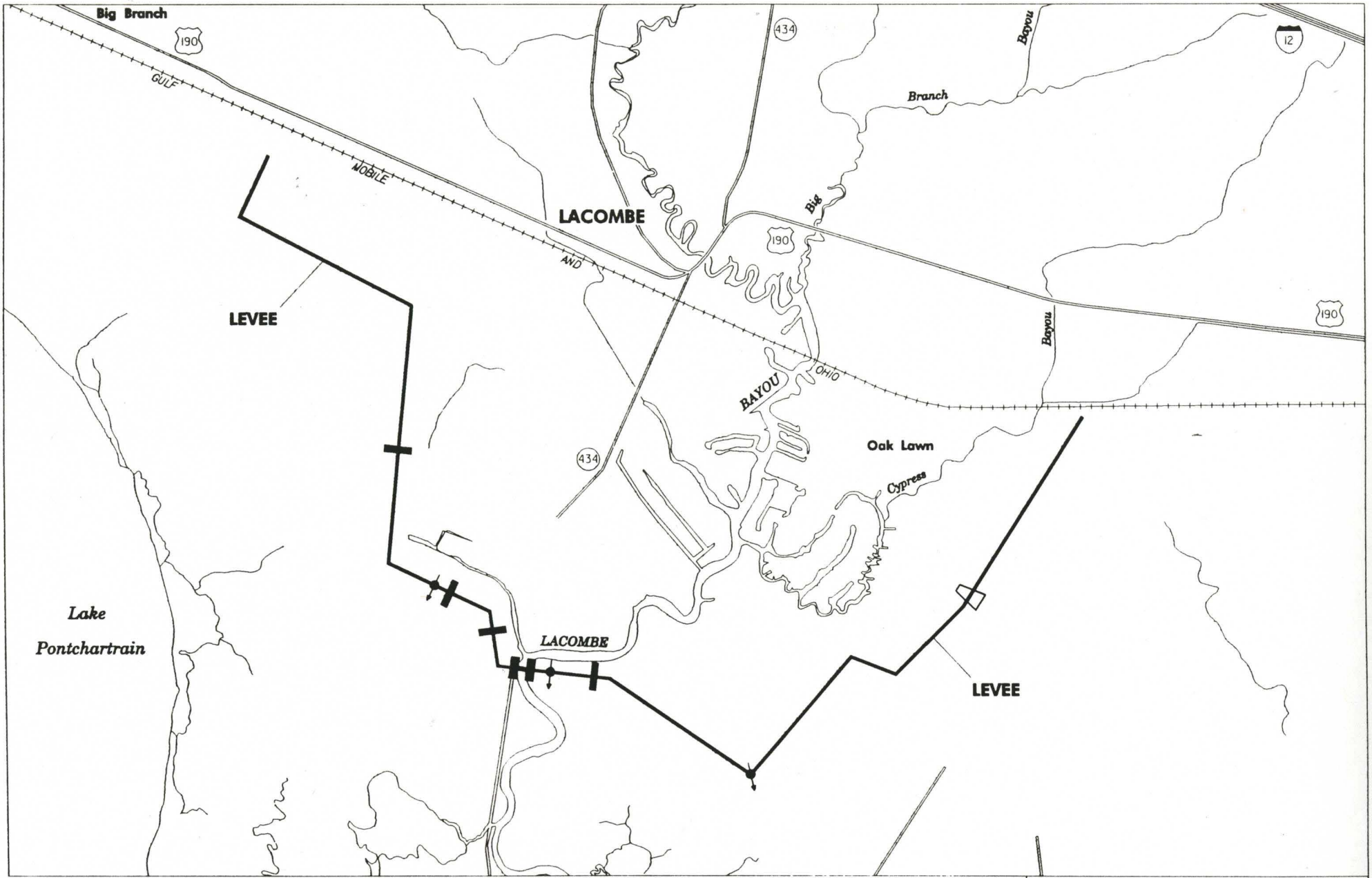
N

0 ½ Mile

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

WESTERN SLIDELL HURRICANE PROTECTION ALIGNMENTS A AND B, 100 – YEAR AND SPH PLANS

PLATE 10



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LEGEND

— NAVIGABLE FLOODGATE

— RAMP OR GATE

— PUMP STATION(S)

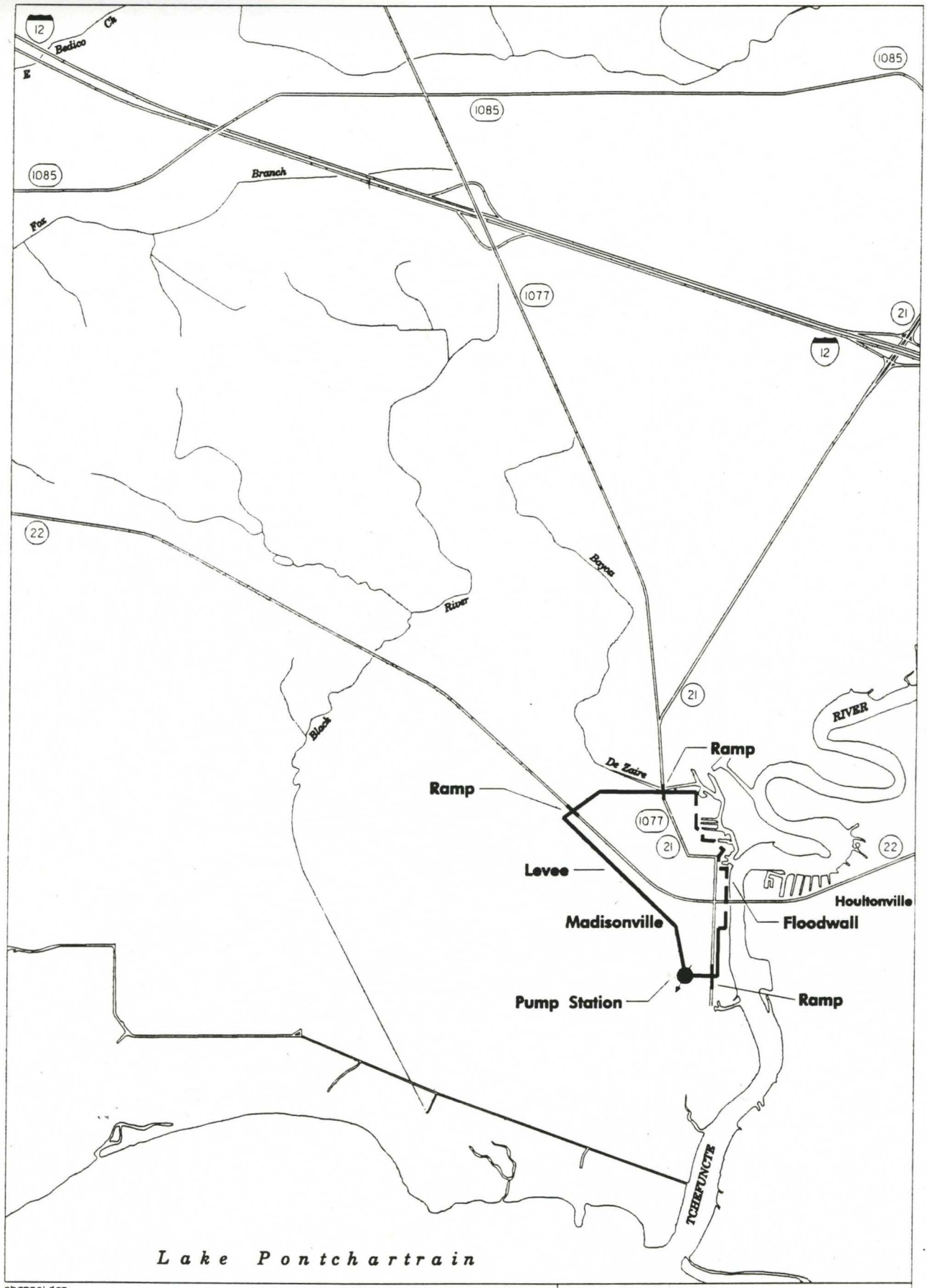
— CULVERT

N

0 ½ 1 Mile

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

LACOMBE HURRICANE PROTECTION
ALIGNMENT – 100 YEAR AND SPH PLANS



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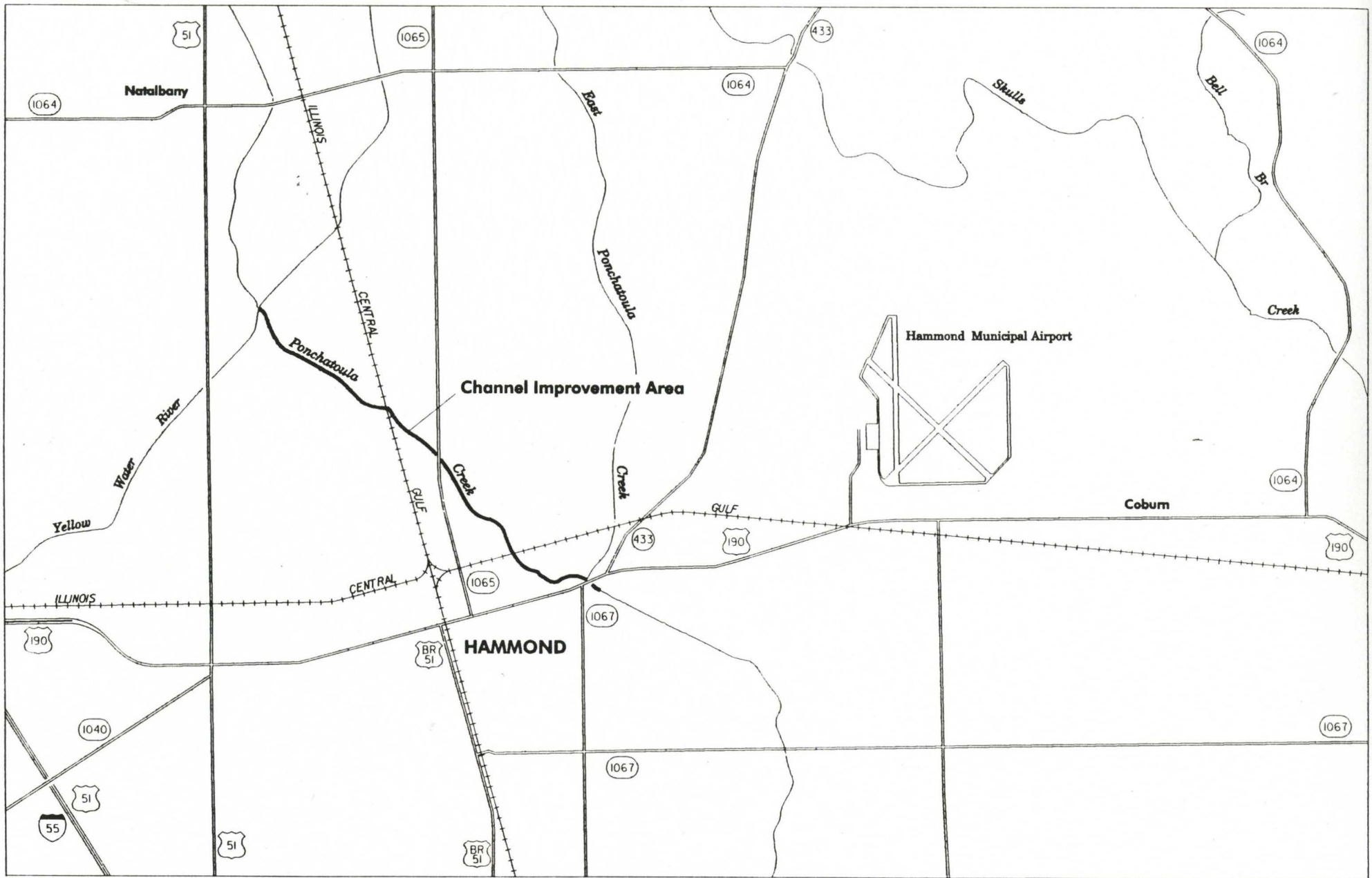
N

0 ½ Mile

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

MADISONVILLE HURRICANE PROTECTION ALIGNMENT 100 - YEAR AND SPH PLANS

PLATE 12



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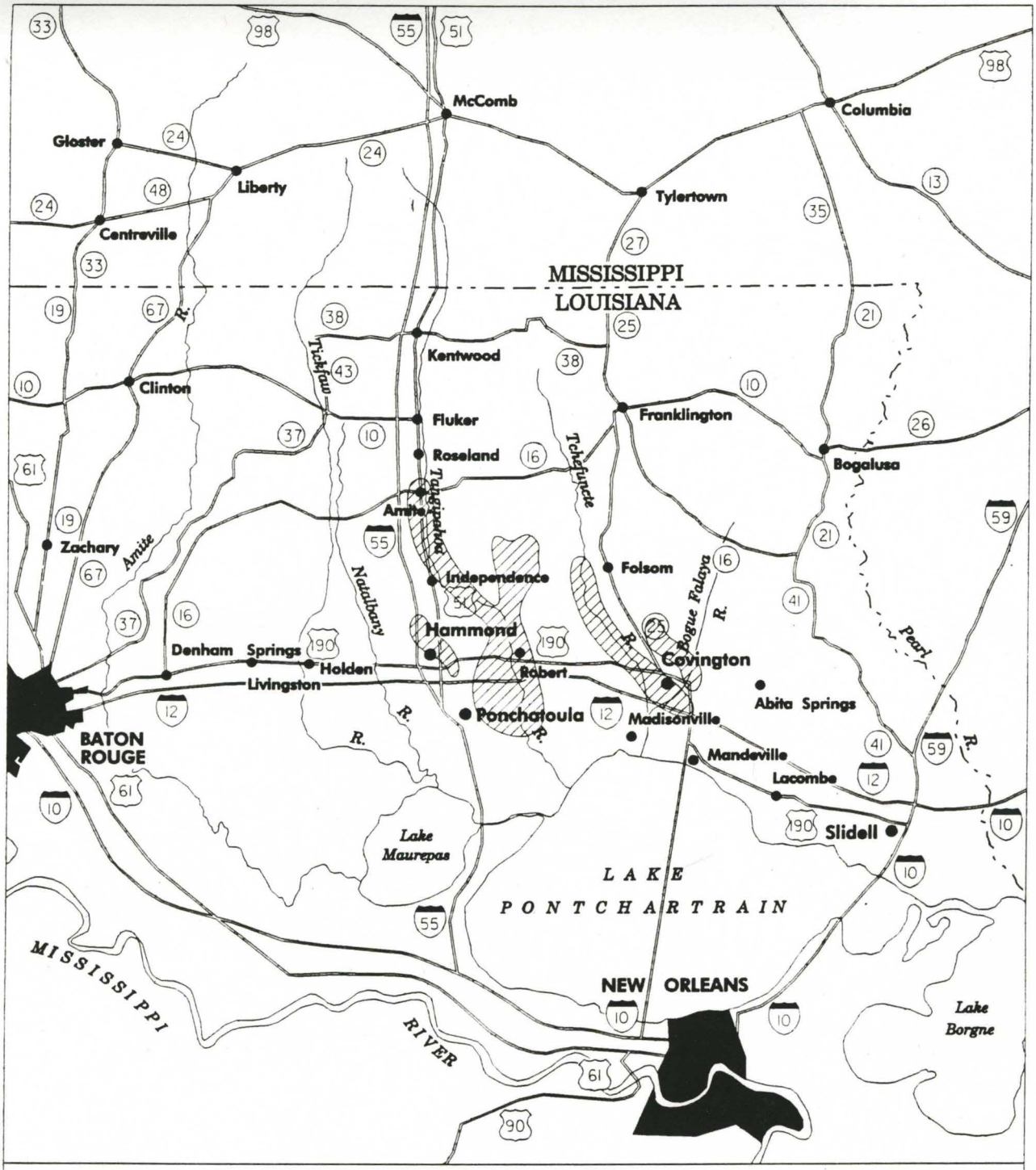
N

0 ½ 1 Mile

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

PONCHATOULA CREEK CHANNEL IMPROVEMENTS



LEGEND

OVERFLOW AREA

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N

0 5 10 15 20 Miles

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

APRIL 1983 FLOOD LIMITS

PLATE 14

Appendix A
Water Quality

TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS

RECONNAISSANCE STUDY

March 1991

TABLE OF CONTENTS

APPENDIX

WATER QUALITY

1. General. This section describes existing water quality and identifies the potential water quality impacts associated with the alternatives considered in the Tangipahoa, Tchefuncte and Tickfaw Rivers reconnaissance study.

2. Water Quality Standards and Criteria. Both the Louisiana Department of Environmental Quality (LDEQ) and the US Environmental Protection Agency (EPA) have established ambient water quality criteria applicable to surface waters in the State of Louisiana. These criteria are briefly iscussed in the following paragraphs.

a. Applicable Louisiana state standards. The LDEQ has established general written water quality criteria which are applicable to all waters of the State of Louisiana. The general written standards relate to the condition of the water as affected by waste discharges or human activity as opposed to purely natural phenomena. The general standards written encompass aesthetics; color; floating, suspended, and settleable solids taste and odor; toxic substances; oil and grease; foaming or froting materials; nutirents; turbity; flows; radioactive materials; and limits on other materials which must be in accordance with recommendations of LDEQ and the Louisiana Department of Health and Human Resources Administration.

Additionally, LDEQ has established numerical criteria which apply to specified waterbodies, and to their tributaries, distributaries, and interconnected streams and waterbodies if they are not specifically named therein, unless it can be shown through a use attainability analysis that unique chemical, physical, and/or biological conditions preclude the attainment of the criteria. In those cases, natural background levels of these conditions may be used to establish site-specific water quality criteria. Those waterbodies officially approved and designated by the state and EPA as intermittent streams, man-made watercourses, or naturally dystrophic waters may be excluded from some or all numerical criteria during specified seasonal periods. The numerical criteria apply specifically with respect to substances or conditions attributed to waste discharges or activities of man as opposed to purely natural phenomena. A list of surface waters in the study area for which numerical criteria are included in the published tables is shown in Table 1. Table 1 also includes designated use categories for the surface waters listed. Designated water uses for each stream are represented as follows:

A = Primary Contact Recreation

B = Secondary Contact Recreation
C = Propagation of Fish and Wildlife
D = Drinking Water Supply
E = Oyster Propagation
F = Agriculture
G = Outstanding Natural Resource Waters

Table 1, which contains applicable criteria for each water body, designates one of the following four standards as applicable according to present and anticipated usage of the waters.

Standard #1. PRIMARY CONTACT RECREATION - Based on a minimum of not less than five samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 200/100 mL nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected annually exceed 400/100 mL.

Standard #2. SECONDARY CONTACT RECREATION - Based on a minimum of not less than 5 samples taken over not more than a 30-day period, the fecal coliform content shall not exceed a log mean of 1,000/100 mL nor shall more than 10 percent of the total samples during any 30-day period or 25 percent of the total samples collected exceed 2,000/100 mL.

Standard #3. DRINKING WATER SUPPLY - The monthly arithmetic mean of total coliform MPN shall not exceed 10,000/100 mL, nor shall the monthly arithmetic mean of fecal coliforms exceed 2,000/100 mL.

Standard #4. OYSTER PROPAGATION - The fecal coliform median MPN shall not exceed 14 fecal coliforms per 100 mL, and not more than 10 percent of the samples shall exceed an MPN of 43/100 mL for a 5-tube decimal dilution test in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

TABLE 1

1989 LDEQ NUMERICAL STANDARDS APPLICABLE TO SURFACE WATERS IN THE STUDY AREA

Stream Description	Water Uses							CL mg/L	SO_4 mg/L	DO mg/L	pH Range su	Bacterial Standard BAC	Temperature ^{o}C	TDS mg/L
	A	B	C	D	E	F	G							
Bayou Lacombe - U.S. 190 to Lake Pontchartrain (Scenic & Estuarine)	X	X	X				X	835	135	4.0	6.0-8.5	1	32	1850
Bayou Liberty - La. Hwy. 433 to confluence with Bayou Bonfouca (Estuarine)	X	X	X					N/A[1]	N/A	4.0	6.0-8.5	1	32	N/A
Bayou Bonfouca - La. Hwy. 433 to Lake Pontchartrain (Estuarine)	X	X	X					N/A	N/A	4.0	6.0-8.5	1	32	N/A
Ponchatoula Creek and Ponchatoula River	X	X	X					30	20	5.0	6.0-8.5	1	30	150
Tangipahoa River - Mississippi State Line to Interstate Highway I-12 (Scenic)	X	X	X				X	30	10	5.0	6.0-8.5	1	30	140
Tangipahoa River - From Inter-State Highway I-12 to Lake Pontchartrain	X	X	X					30	10	5.0	6.0-8.5	1	30	140
Tchefuncte River and Tributaries - Headwaters to confluence with Bogue Falaya River (Scenic)	X	X	X				X	20	10	5.0	6.0-8.5	1	30	110
Lower Tchefuncte River - From the Bogue Falaya River down to La. Hwy. 22, excluding any tributaries from the Bogue Falaya River south to La. Hwy. 22 (Scenic)	X	X	X				X	850	135	5.0	6.0-8.5	1	30	1850
Lower Tchefuncte River - From La. Hwy. 22 to Lake Pontchartrain (Estuarine)	X	X	X					N/A	N/A	4.0	6.0-8.5	1	30	N/A
logue Falaya River - Headwaters to Tchefuncte River	X	X	X					20	10	5.0	6.0-8.5	1	30	110

Tickfaw River - Mississippi State Line to La. Hwy 42 (Scenic)	X	X	X		X	10	5	5.0	6.0-8.5	1	30	55
Tickfaw River - La. Hwy. 42 to Lake Maurepas	X	X	X			10	5	5.0	6.0-8.5	1	30	55
Lake Pontchartrain - West of Highway 11 Bridge (Estuarine)	X	X	X			N/A	N/A	4.0	6.5-9.0	1	32	N/A
Lake Pontchartrain - East of Highway 11 Bridge (Estuarine)	X	X	X	X		N/A	N/A	4.0	6.5-9.0	4	32	N/A
Lake Maurepas (Estuarine)	X	X	X			1600	200	5.0	6.0-8.5	1	32	3,000

1 N/A - not applicable at present

(f) Toxic substances. The LDEQ has also established numerical criteria for several toxic substances that are of particular concern for the State of Louisiana. These substances were selected for human health considerations, taste and odor problems, persistence and bioaccumulative capabilities, and potential negative effects on aquatic biota. Table 2 is a listing of these substances and their criteria.

TABLE 2

1989 LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

NUMERICAL CRITERIA FOR SPECIFIC TOXIC SUBSTANCES

(In micrograms per liter (ug/L) or parts per billion (ppb) unless otherwise stated)

	Aquatic Life Protection				Human Health	
Toxic Substance	Freshwater Acute	Freshwater Chronic	Marine Acute	Marine Chronic	Drinking Supply[1]	Non Drinking Supply[2]
Pesticides and PCB's						
Aldrin	3.00	-	1.300	-	0.04 ng/L	0.04 ng/L[3]
Chlordane	2.40	0.0043	0.090	0.0040	0.19 ng/L	0.19 ng/L
DDT	1.10	0.0010	0.130	0.0010	0.19 ng/L	0.19 ng/L
TDE (DDD)	0.03	0.0060	1.250	0.2500	-	-
DDE	52.5	10.500	0.700	0.1400	-	-
Dieldrin	2.50	0.0019	0.710	0.0019	0.05 ng/L	0.05 ng/L
Endosulfan	0.22	0.0560	0.034	0.0087	0.47	0.64
Endrin	0.18	0.0023	0.037	0.0023	0.26	0.26
Heptachlor	0.52	0.0038	0.053	0.0036	0.07 ng/L	0.07 ng/L

Hexachlorocyclohexane (gamma BHC, Lindane)	2.00	0.0800	0.160	-	0.011	0.02
Polychlorinated Biphenyls, Total (PCB's)	2.00	0.0140	10.00	0.0300	0.03 ng/L	0.03 ng/L
Toxaphene	0.73	0.0002	0.210	0.0002	0.24 ng/L	0.24 ng/L
2,4-Dichlorophenoxyacetic acid (2,4-D)	-	-	-	-	100.0	-
2-(2,4,5-Trichlorophenoxy) propionic acid (2,4,5-TP, Silvex)	-	-	-	-	10.00	-
Volatile Organic Chemicals						
Benzene	2249	1125	2700	1350	1.1	12.5
Carbon Tetrachloride (Tetrachloromethane)	2730	1365	15000	7500	0.22	1.2
Chloroform (Trichloromethane)	2890	1445	8150	4075	5.3	70
Ethylbenzene	3200	1600	8760	4380	2.39 mg/L	8.1 mg/L[4]
1, 2-Dichloroethane (EDC)	11800	5900	11300	5650	0.36	6.8
1, 1, 1-Trichloroethane	5280	2640	3120	1560	200	31.34 mg/L
1, 1, 2-Trichloroethane	1800	900	-	-	0.56	6.9
1, 1, 2, 2-Tetrachloroethane	923	462	902	451	0.16	1.8
1, 1-Dichloroethylene	1160	580	22400	11200	0.05	0.58
Trichloroethylene	3900	1950	200	100	2.8	21
Tetrachloroethylene	850	425	130	65	0.65	2.5
Toluene	1270	635	950	475	9.1 mg/L	69.3 mg/L
Vinyl Chloride (Chloroethylene)	-	-	-	-	1.9	35.8
Bromoform (Tribromomethane)	2930	1465	1790	895	5.1	45
Bromodichloromethane	-	-	-	-	5.3	70
Methylene chloride (Dichloromethane)	19300	9650	25600	12800	4.4	87
Methyl chloride (Chloromethane)	55000	27500	27000	13500	5.3	70
Dibromochloromethane	-	-	-	-	5.3	70
1-3 Dichloropropene	606	303	79	39.5	0.18	3.0
Acid - Extractable Organic Chemicals						
2-Chlorophenol	258	129	-	-	0.100	126.4
3-Chlorophenol	-	-	-	-	0.100	-
4-Chlorophenol	383	192	535	268	0.100	-
2, 3-Dichlorophenol	-	-	-	-	0.040	-
2, 4-Dichlorophenol	202	101	-	-	0.300	232.6
2, 5-Dichlorophenol	-	-	-	-	0.500	-
2, 6-Dichlorophenol	-	-	-	-	0.200	-
3, 4-Dichlorophenol	-	-	-	-	0.300	-
Phenol (Total)	700	350	580	290	5.000	5.000[5]
Base/Neutral Extractable Organic Chemicals						
Benzidine	250	125	-	-	0.08 ng/L	0.17 ng/L
Hexachlorobenzene	-	-	-	-	0.24 ng/L	0.24 ng/L
Hexachlorobutadiene[6]	5.1	1.02	1.6	0.32	0.09	0.11
Metals						
Arsenic	360	190	69.00	36.00	50.00	-

Chromium III (Tri)[7]	(980,1700,3100)	(120,210,370)	515	103.0	50.00	-
Chromium VI (Hex)	16	11	1.100 mg/L	50.00	50.00	-
Zinc[8]	(65,120,210)	(59,110,190)	95.00	86.00	5.000 mg/L	-

1 Applies to surface waterbodies designated as a Drinking Water Supply and also protects for primary and secondary contact recreation and fish consumption.

2 Applies to surface waterbodies not designated as a Drinking Water Supply and protects for primary and secondary contact recreation and fish consumption.

3 ng/L = nanograms per liter, parts per trillion

4 mg/L = milligrams per liter, parts per million

5 total phenol as measured by the 4 - aminoantipyrine (4AAP) method

6 Includes Hexachloro-1,3-butadiene

7 Hardness-dependent criteria for fresh water based on the following natural logarithm formulas for acute and chronic protection respectively: acute = e(0.8190[ln(hardness)]+3.688), chronic = e(0.8190[ln(hardness)]+1.561), numbers in parenthesis represent criteria in ug/L at hardness values of 50, 100, 200 mg/L $CaCo_3$ rounded off a whole numbers

8 Hardness-dependent criteria for fresh water based on the following natural logarithm formulas for acute and chronic protection respectively: acute = e(0.8473[ln(hardness)]+0.8604), chronic = e(0.8473[ln(hardness)]+0.7614), numbers in parenthesis represent criteria in ug/L at hardness values of 50, 100, 200 mg/L $CaCo_3$ rounded off to whole numbers

b. EPA water quality criteria. The EPA has established ambient water quality criteria applicable to surface waters in the study area. These criteria are shown in Tables 3, 4 and 5. The numerical criteria listed in Tables 3, 4 and 5 have been developed for various physical parameters, nutrients, metals, life, marine and estuarine aquatic life, and public water supply, respectively.

(1) EPA water quality tables follow.

TABLE 3

1986 EPA FRESHWATER AQUATIC LIFE CRITERIA

(All values in ug/L except where noted)

Parameter	Chronic (24-Hour Average)	Acute (Maximum at Any Time)	Chronic[1] (4-Day Average)	Acute[2] (1-Hour Average)
Aesthetic Qualities	(Narrative statement - SEE CRITERIA DOCUMENT)			
Aldrin[P]	-	3.0	-	-
Alkalinity	(20 mg/L MINIMUM)			
Ammonia	(Criteria are pH and temperature dependent-SEE CRITERIA DOCUMENT)			
Arsenic(III)[P]	-	-	190	360
Boron	(750 ug/L for long-term irrigation on sensitive crops)			
Cadmium[4,P]	-	-	1.1/1.6/2	3.9/1.6/8.6
Chlordane[P]	0.0043	2.4	-	-
Chlorine	-	-	11	19

Chlorpyrifos	-	-	0.041	0.083
Chromium (VI)[P]	-	-	11	16
Chromium(III)[4]	-	-	210/289/370	1700/2420/3100
Color	(Narrative statement - SEE CRITERIA DOCUMENT)			
Copper[4,P]	-	-	12/17/21	18/22/34
Cyanide[P]	-	-	5.2	22
DDT[P]	0.0010	1.1	-	-
Demeton[P]	0.1	-	-	-
Dieldrin[P]	0.0019	2.5	-	-
Endosulfan[P]	0.056	0.22	-	-
Endrin[P]	0.0023	0.18	-	-
Gases, Total Dissolved	(Narrative statement - SEE CRITERIA DOCUMENT)			
Guthion	0.01	-	-	-
Heptachlor[P]	0.0038	0.52	-	-
Hexachlorocyclohexane (Lindane)[P]	0.080	2.0	-	-
Iron	1000	-	-	-
Lead[4,P]	-	-	3.2/5.3/7.7	82/137/200
Malathion	0.1	-	-	-
Mercury[P]	-	-	0.012	2.4
Methoxychlor	0.03	-	-	-
Mirex	0.001	-	-	-
Nickel[4,P]	-	-	160/222/280	1400/1999/2500
Oil and Grease	(Narrative statement - SEE CRITERIA DOCUMENT)			
Oxygen, Dissolved	(Warmwater and Coldwater Matrix - SEE CRITERIA DOCUMENT)			
Parathion	-	-	0.013	0.065
Polychlorinated Biphenyls (PCB's)[P]	0.014	2.0	-	-
Penpachlorophenol (PCP)[3,P]	-	-	3.5/13/43	5.5/20/68
pH	(6.5 - 9.0 su)		-	-
Selenite (inorganic)[P]	35	260	-	-
Silver[4,P]	-	4.1/8.2/13	-	-
Solids (Suspended) and Turbidity	(Narrative statement - SEE CRITERIA DOCUMENT)			
Sulfide-Hydrogen Sulfide	2.0	-	-	-
Temperature	(Species dependent criteria - SEE CRITERIA DOCUMENT)			
Toxaphene[P]	-	-	0.0002	0.73
Zinc[4,P]	-	-	110/149/190	120/165/210

1 4-day average concentration not to be exceeded more than once every 3 years on the average.

2 1-hour average concentration not to be exceeded more than once every 3 years on the average.

3 pH dependent criteria. Values presented are for 6.5/7.8/9.0 standard pH units.

4 Hardness dependent criteria. Values presented are for 100/150/200 mg/L as $CaCO_3$.

P Priority Pollutant

TABLE 4

1986 EPA **SALTWATER** AQUATIC LIFE CRITERIA

(All values in ug/L)

Parameter	Chronic (24-Hour Average)	Acute (Maximum at Any Time)	Chronic[1] (4-Day Average)	Acute[2] (1-Hour Average)
Aesthetic Qualities	(Narrative statement - SEE CRITERIA DOCUMENT)			
Aldrin[P]	-	1.3	-	-
Arsenic(III)[P]	-	-	36	69
Cadmium[P]	)	-	9.3	43
Chlordane[P]	0.004	0.09	-	-
Chlorine	-	-	7.5	13
Chlorpyrifos	-	-	0.0056	0.011
Chromium (VI)[P]	-	-	50	1,100
Color	(Narrative statement - SEE CRITERIA DOCUMENT)			
Copper[P]	-	-	-	2.9
Cyanide[P]	-	-	-	1.0
DDT[P]	0.0010	0.13	-	-
Demeton[P]	0.1	-	-	-
Dieldrin[P]	0.0019	0.71	-	-
Endosulfan[P]	0.0087	0.034	-	-
Endrin[P]	0.0023	0.037	-	-
Gases, Total Dissolved	(Narrative statement - SEE CRITERIA DOCUMENT)			
Guthion	0.01	-	-	-
Heptachlor[P]	0.0036	0.053	-	-
Hexachlorocyclohexane (Lindane)[P]	-	0.16	-	-
Lead[P]	-	-	5.6	140
Malathion	0.1	-	-	-
Mercury[P]	-	-	0.025	2.1
Methoxychlor	0.03	-	-	-
Mirex	0.001	-	-	-
Nickel[P]	-	-	8.3	75
Oil and Grease	(Narrative statement - SEE CRITERIA DOCUMENT)			
Polychlorinated Biphenyls (PCB's)[P]	0.030	10	-	-
Pentachlorophenol (PCP)[P]	-	-	7.9	13
pH	(6.5 - 8.5 su)		-	-
Phosphorus (elemental)	0.10	-	-	-
Selenite (inorganic)[P]	54	410	-	-
Silver[P]	-	2.3	-	-
Sulfide-Hydrogen Sulfide	2.0	-	-	-
Temperature	(Species dependent criteria - SEE CRITERIA DOCUMENT)			
Toxaphene[P]	-	-	0.0002	0.21
Zinc[P]	-	-	86	95

1 4-day average concentration not to be exceeded more than once every 3 years on the average.

2 1-hour average concentration not to be exceeded more than once every 3 years on the average.

P Priority Pollutant

TABLE 5

1986 EPA HUMAN HEALTH CRITERIA

(Units per liter)

Parameter	Fish and Water Ingestion	Fish Consumption Only	Drinking Water M.C.L.[1]	Organo-leptic Criteria[2]
Acenapthene[P]	-	-	-	0.02 mg
Acrolein[P]	320 ug	780 ug	-	-
Acrylonitrile[P,C]	0.58/0.058/0.006 ug	6.5/0.65/0.065 ug	-	-
Aesthetic Qualities	(Narrative Statement - SEE CRITERIA DOCUMENT)		-	-
Aldrin[P,C]	0.74/0.074/0.0074 ng	0.79/0.079/0.0079 ng	-	-
Antimony[P]	146 ug	45,000 ug	-	-
Arsenic[P,C]	22/2.2/0.22 ng	175/17.5/1.75 ng	0.05 mg	-
Asbestos[P.C]	300,000/30,000/3,000 Fibers	-	-	-
Bacteria	(For Primary Recreation And Shellfish Uses - SEE CRITERIA DOCUMENT)			
Barium	-	-	1.0 mg	-
Benzene[P,C]	6.6/0.66/0.066 ug	400/40/4 ug	-	-
Benzidine[P,C]	1.2/0.12/0.01 ng	5.3/0.53/0.05 ng	-	-
Beryllium[P,C]	68/6.8/0.68 ng	1170/117/11.71 ng	-	-
Cadmium[P]	10 ug	-	0.010 mg	-
Carbon Tetrachloride[P,C]	4/0.4/0.04 ug	69.4/6.94/0.69 ug	-	-
Chlordane[P,C]	4.6/0.46/0.046 ng	4.8/0.48/0.048 ng	-	-
Chloroethyl Ether(BIS-2)[P,C]	0.3/0.03/0.003 ug	13.6/1.36/0.136 ug	-	-
Chloroform[P,C]	1.9/0.19/0.019 ug	157/15.7/1.57 ug	-	-
Chloroisopropyl Ether (BIS-2)[P]	34.7 ug	4.36 mg	-	-
Chloromethyl Ether (BIS)[C]	$[37.6/3.76/0.376]X10^{-6}$ ug	$[18.4/1.84/.184]x10^{-3}$ ug	-	-
2-Chlorophenol[P]	-	-	-	.1 ug
4 Chlorophenol	-	-	-	.1 ug
Chlorophenoxy Herbicides(2,4,5,-TP)(Silvex)	10 ug	-	10 ug	-
Chlorophenoxy Herbicides(2,4-D)	100 ug	-	100 ug	-
Chloro-4 Methyl-3 Phenol	-	-	-	3000 ug
Chromium (VI)[P]	50 ug	-	0.05 mg	-
Chromium(III)	170 mg	3,433 mg	-	-
Color	(Narrative statement - SEE CRITERIA DOCUMENT)		-	-
Copper[P]	-	-	-	1 mg
Cyanide[P]	200 ug	-	200 ug	-
DDT[P,C]	0.24/0.024/0.0024 ng	0.24/0.024/0.0024 ng	-	-
Dibutyl Phthalate[P]	34 mg	154 mg	-	-
Dichlorobenzenes[P]	400 ug	2.6 mg	-	-

Dichlorobenzidine[P,C]	0.103/0.01/0.001 ug	0.204/0.20/0.002 ug	-	-
1,2 Dichloroethane[P,C]	9.4/0.94/0.094 ug	2,430/243/24.3 ug	-	-
Dichloroethylenes[P,C]	0.33/0.033/0.003 ug	18.5/1.85/0.185 ug	-	-
2,4-Dichlorophenol	3.09 mg	-	-	0.3 ug
Dichloropropene[P]	87 ug	14.1 mg	-	-
Dieldrin[P,C]	0.71/0.071/0.0071 ng	0.76/0.076/0.0076 ng	-	-
Diethyl Phthalate[P]	350 mg	1.8 g	-	-
2,4-Dimethylphenol[P]	-	-	-	400 ug
Dimethyl Phthalate[P]	313 mg	2.9 g	-	-
2,4 Dinitrotoluene[C]	1.1/0.11/0.011 ug	91/9.1/0.91 ug	-	-
2,4 Dinitro-o-Cresol[P]	13.4 ug	765 ug	-	-
2,3,7,8-TCDD (Dioxin)[P,C]	[0.13/0.013/0.0013]X10^{-6} ug	[0.14/0.014/.0014]x10^{-6} ug	-	-
Diphenylhdrazine[P]	422/42/4 ng	5.6/0.56/0.056 ug	-	-
Di-2-EthylHexyl Phthalate[P]	15 mg	50 mg	-	-
Endosulfan[P]	74 ug	159 ug	-	-
Endrin[P]	1 ug	-	0.0002 mg	-
Ethylbenzene[P]	1.4 mg	3.28 mg	-	-
Fluoranthene[P]	42 ug	54 ug	-	-
Halomethanes[P,C]	1.9/0.19/0.019 ug	157/15.7/1.57 ug	-	-
Heptachlor[P,C]	2.78/0.28/0.028 ng	2.85/0.29/0.029 ng	-	-
Hexachloroethane[C]	19/1.9/0.19 ug	87.4/8.74/0.87 ug	-	-
Hexachlorobenzene[P,C]	7.2/0.72/0.072 ng	7.4/0.74/0.074 ng	-	-
Hexachlorobutadiene[P,C]	4.47/0.45/0.045 ug	500/50/5 ug	-	-
Hexachlorocycohexane-Alpha[P,C]	92/9.2/0.92 ng	310/31/3.1 ng	-	-
Hexachlorocyclohexane-Beta[P,C]	163/16.3/1.63 ng	547/54.7/5.47 ng	-	-
Hexachlorocyclohexane-Gama[P,C]	186/18.6/1.86 ng	625/62.5/6.25 ng	-	-
Hexachlorocyclohexane-Technical[P,C]	123/12.3/1.23 ng	414/41.4/4.14 ng	-	-
Hexachlorocyclopentadiene[P]	206 ug	-	-	1 ug
Iron	0.3 mg	-	.3 mg	-
Isophorone[P]	5.2 mg	520 mg	-	-
Lead[P]	50 ug	-	0.05 mg	-
Manganese	50 ug	100 ug	50 ug	-
Mercury[P]	144 ng	146 ng	0.002 mg	-
Methoxychlor	100 ug	-	0.1 mg	-
Monochlorobenzene[P]	488 ug	-	-	20 ug
Nickel[P]	13.4 ug	100 ug	-	-
Nitrates	10 mg	-	10 mg	-
Nitrobenzene[P]	19.8 mg	-	-	30 ug
Nitrosodibutylamine N[P,C]	64/6.4/0.64 ng	5,868/587/58.7 ng	-	-
Nitrosodiethylamine N[P,C]	8/0.8/0.08 ng	12400/1,240/124 ng	-	-
Nitrosodimethylamine N[P,C]	14/1.4/0.14 ng	160000/16,000/1600 ng	-	-
Nitrosodiphenylamine N[P,C]	49000/4,900/490 ng	161000/16,100/1610 ng	-	-
Nitrosopyrrolidine N[P,C]	160/16/1.6 ng	919000/91,900/9190 ng	-	-
Oil And Grease	(Narrative Statement - SEE CRITERIA DOCUMENT)		-	-
PCB's[P,C]	0.79/0.079/0.0079 ng	0.79/0.079/0.0079 ng	-	-
Pentachlorobenzene	74 ug	85 ug	-	-
Pentachlorophenol[P]	1.01 mg	-	-	-
Phenol[P]	3.5 mg	-	-	0.3 mg
Polynuclear Aromatic Hydrocarbons[P,C]	28/2.8/0.28 ng	311/31.1/3.11 ng	-	-

Selenium[P]	10 ug	-	0.01 mg	-
Silver[P]	50 ug	-	0.05 mg	-
Solids(Dissolved)And Salinity	-	-	250 mg	-
Tainting Substances	(Narrative Statement - SEE CRITERIA DOCUMENT)		-	-
1,2,4,5 Tetrachlorobenzene[P]	38 ug	48 ug	-	-
1,1,2,2-tetrachloroethane[P,C]	1.7/0.17/0.017 ug	107/10.7/1.07 ug	-	-
Tetrachloroethylene[P,C]	8/0.8/0.08 ug	88.5/8.85/0.88 ug	-	-
Thalium[P]	13 ug	48 ug	-	-
Toluene[P]	14.3 mg	424 mg	-	-
Toxaphene[P,C]	7.1/0.71/0.07 ng	7.3/0.73/0.07 ng	0.005 mg	-
1,1,1-trichloroethane[P]	18.4 mg	1.03 g	-	-
1,1,2-trichloroethane[P,C]	6/0.6/0.06 ug	418/41.8/4.18 ug	-	-
Trichloroethylene[P,C]	27/2.7/0.27 ug	807/80.7/8.07 ug	-	-
2,4,5-trichlorophenol	2,600 ug	-	-	1 ug
2,4,6-trichlorophenol[P,C]	12/1.2/0.12 ug	36/3.6/0.36 ug	-	2 ug
Vinyl Chloride[P,C]	20/2/0.2 ug	5246/525/52.5 ug	-	-

1 M.C.L. is maximum contaminant level

2 To control undesirable taste and order quality of ambient water. It should be recognized that organoleptic data have limitations as a basis for establishing water quality criteria, and have no demonstrated relationship to potential adverse human health effects.

P Priority Pollutant

C Carcinogenic pollutant. For the maximum protection of human health from the potential carcinogenic effects resulting from exposure to these pollutants, the ambient water concentrations should be zero. The levels presented are for $10^{-5}/10^{-6}/10^{-7}$ incremental increase of cancer risk over the lifetime.

(2) Additional EPA water quality criteria include aesthetic qualities; color; dissolved oxygen; fecal coliform bacteria; oil and grease; setteable and suspended solids; and tainting substances.

(3) Existing Water Quality and With-Project Impacts. The following paragraphs will discuss the existing water quality and with project impacts of each alternative for the Tangipahoa, Tchefuncte and Tickfaw Rivers reconnaissance study. Water quality data was obtained from EPA's water quality database, STORED, and LDEQ's 1988 Water Quality Management Plan.

a. Bayou Lacombe Hurricane Protection. Bayou Lacombe is designated as an outstanding natural resource water from U.S. 190 to Lake Pontchartrain. Currently there are no active watger quality stations on Bayou Lacombe. Water quality and sediment samples were collected in June 1969 and March 1974. These samples do not suggest any contraventions of the state or EPA criteria for physical parameters, pesticides or PCB's. However, cadmium exceeded the EPA chorinic aquatic life criteria. Since these parameterw were sampled only once and the criterial specify minimum sampling durations, these contraventions should be regarded only as "possible exceedances". Also, in 1988, the LDEQ assessed Lacombe, from U.S. 190 to Lake Pontchartrain, as partially supporting its designated water uses. The

evaluated assessment was based on information other than current site-specific ambient water data. This information included but was not limited to direct observations and general knowledge of the water body, location of pollution sources, citizen complaints, fish kill investibations, fishing success and short-term intensive surveys and fisheries surveys. The suspected causes for assessing Bayou Lacombe as partially supportive were nutrients, organic enrichment and pathogens. The The suspected sources were on-site wastewater systems, spills and unsewered facilities.

The water quality impacts associated with this alternative are mostly related to the activities of the levee construction such as site preparation, earth borrow, and earthwork. Site preparation activities, fill extractions, stockpiling, and the construction of temporary access roads will result in large denuded areas. This clearing of the land permits the rainfall to strike the bare land surface which leads to increased surface runoff and severe erosion. Runoff and erosion adds a great deal of soil solids to the surrounding waterbodies in the form of turbidity and increased sedimentation. Denuded areas have been shown to lose large quantities of dissolved minerals, particularly sodium, potassium, calcium, magnesium, nitrates and phosphates. The primary effect of these mineral nutrients is the stimulation of plant growth. Secondarily, this enrichment stimulates animal production, decomposition, and increased oxygen demand. Also, if the trees and brush cleared from the land are burned in the floodplain the ashes, which are highly alkaline, could enter nearby waterbodies and cause an immediate increase in the pH of the water.

The highest turbidity levels will occur during construction. After construction ends these high turbidity levels will rapidly diminish. Thus, the impacts associated with the levee construction will be short-term. Environmental protection practices normally implemented at construction sites can be effective in reducing the gross erosion and soil loss that can result in high turbidity levels in nearby waterbodies.

A control structure will be constructed to allow Bayou Lacombe flows to continue downstream of the levee. As this flood gate will remain open except when flooding from Lake Pontchartrain is imminent, there should be no long-term water quality impacts associated with the control structure. Shortterm impacts will be related to the construction of the control structure. Mainly, this includes high turbidity levels, which can affect the water quality in Bayou Lacombe in several ways. The suspended sedimentary particles decrease the light penetration and interferes with the photosynthetic production of oxygen. At the same time these particles absorb solar energy from the sunlight and transform this energy into heat, thus elevating the temperature of the bayou. Thus oxygen levels could be temporarily decreased. Also of concern is the fact that concrete surfaces leach out chemical substances. Mostly carbonates and hydroxide of calcium and magnesium come from cement mixing operations and from the cement itself. Although the greatest leaching occurs during and immediately after

construction, long-term leaching undoubtedly takes place. These above mentioned short-term impacts are however amplified by the fact that Bayou Lacombe is designated as an outstanding natural resource.

There are two drainage alternatives for the Bayou Lacombe hurricane protection plan. One plan calls for forced drainage via pumping stations. The other plan calls for multiple gated culverts to allow for gravity drainage. Since the levee alignment is the same for these two plans, significant differences in water quality impacts are not expected.

b. Western Slidell Hurricane Protection. Currently there are no active water quality stations on Bayou Liberty or Bayou Bonfouca. Sediment samples only were collected in October 1977 on both bayous. The sediments were analyzed for PCB's and pesticides. For both bayous, PCB-1254 was the pollutant which had the highest recorded concentration. The maximum sediment concentration of PCB-1254 was 8 ppm in Bayou Liberty. In 1988, the LDEQ assessed Bayou Liberty and Bayou Bonfouca, from La. Hwy. 433 to their mouths, as fully and partially supportive of their designated water uses, respectively. Again, these assessments were based on evaluated information rather than site-specific ambient water quality data. The suspected causes for assessing Bayou Bonfouca as partially supportive were priority organics, nutrients, organic enrichment and pathogens. The suspected sources were municipal discharges, landfills and on-site wastewater systems. Bayou Bonfouca has been placed on the Superfund Priority List due to contamination by creosote, a phenolic compound commonly used as a wood preservative, as a result of a 1970 fire and tank explosion in which several thousand cubic yards of the compound spilled into Bayou Bonfouca and onto an adjacent land area. An advisory against swimming in and consumption of fish from the bayou has been issued. The area posted extends from one-quarter mile upstream of the Old American Creosote site to one mile south of La. Hwy. 433. Thus, the superfund site will not be impacted by the Western Slidell Hurricane protection alternatives.

There are two alternatives for this project. Plan B calls for a hurricane protection levee with flood gates at both Bayou Liberty and Bayou Bonfouca, while Plan A calls for the lower reaches of both bayous, on the protected side of the levee, to be realigned and diverted through one flood gate only. The impacts of Plan A and B would be very similar to those for the Bayou Lacombe Hurricane Protection alternative since they would be largely related to the construction of the levee, drainage culverts and the control structures on the bayous. However, the impacts of Plan A would be more significant than those of Plan B. Approximately one-half mile and 2 1/2 miles of Bayou Liberty and Bayou Bonfouca, respectively, would be bypassed by the proposed diversion channel. Thus, there would be interference in the natural surface drainage pattern which could result in lower water table levels in the marsh areas surrounding the cut-off bayous. Also, there would be greater turbidity levels and decreased oxygen levels,

in the short-term, due to the construction and opening of the diversion channel.

As for the Bayou Lacombe hurricane protection plan, there are two drainage alternatives for the Western Slidell hurricane protection plan. One plan calls for forced drainage via pumping stations. The other plan calls for multiple gated culverts to allow for gravity drainage. Likewise, significant differences in water quality impacts are not expected since the levee alignment is the same for both drainage plans.

c. Mandeville Hurricane Protection. Currently there are no active water quality stations located along the north shore of Lake Pontchartrain. There are three active water quality stations on the Lake Pontchartrain Causeway Bridge. Based only on fecal coliform, temperature, dissolved oxygen, pH, chloride, sulfate and total dissolved solids data from these three stations, the LDEQ has determined that Lake Pontchartrain, west of the Hwy. 11 bridge, fully supports its designated water uses of primary and secondary contact recreation and fish and wildlife propagation. However, in 1988 the LDEQ assessed Lake Pontchartrain, west of the Hwy. 11 bridge, as partially supportive of its designated water uses. This assessment was based on evaluated information rather than site-specific ambient water quality data. The suspected causes for assessing Lake Pontchartrain as partially supportive were nutrients, organic enrichment, pathogens, and oil and grease. The suspected sources were municipal, urban runoff, petroleum activities, on-site wastewater systems and unsewered facilities. In short, the designated water uses of Lake Pontchartrain, west of the Hwy. 11 bridge, are fully supported, but threatened, by the quality of water found in Lake Pontchartrain.

While a portion of the proposed hurricane protection plan involves levees whose impacts would be similar to those discussed earlier, a large part of the plan involves construction of a seawall on the north shore of Lake Pontchartrain. Typical seawall construction operations involve foundation excavation, foundation dewatering if necessary, form placement, placement of reinforcing steel, pouring of the concrete, form removal and backfill behind the seawall. These construction operations would be located on or near the water's edge. Thus, the water quality impacts associated with the seawall construction would be similar to those related to the construction of the control structures on the bayous for the previously discussed plans. However, due to the length of the seawall the impacts are expected to be somewhat greater. The impacts of increased turbidity and concrete surface leaching have already been discussed. There is concern that disturbing Lake Pontchartrain sediments could release harmful concentrations of heavy metals into the water column. However, a report on shell dredging found that those metals with high sediment concentrations are held in relatively stable phases. The report also states that any released metals are quickly scavenged from the water column. The water quality impacts of realigning the lower reach of Little

Bayou Castine should be relatively short-term and would be related mostly to high turbidity levels and low dissolved oxygen levels.

As for the previous hurricane protection plans, there are two drainage alternatives for the Mandeville hurricane protection plan. One plan calls for forced drainage via pumping stations. The other plan calls for multiple gated culverts to allow for gravity drainage. Likewise, significant differences in water quality impacts are not expected since the levee alignment is the same for both drainage plans.

d. Madisonville Hurricane Protection. The Tchefuncte River is designated as an outstanding natural resource water from its headwaters down to La. Hwy. 22. The LDEQ has an active water quality station located on the Tchefuncte River at Madisonville, Louisiana. However, only the more common physical, bacteriological and heavy trace metal parameters are sampled; no sediment data is collected. This data does suggest frequent contraventions of the LDEQ general water quality criteria listed in Table 1. Copper, lead and mercury values frequently exceeded both the chronic saltwater and freshwater EPA aquatic life criteria. These three metals seldom violated the acute saltwater and freshwater EPA aquatic life criteria. Also, in 1988, the LDEQ assessed the Tchefuncte River as partially supportive of its designated water uses. This assessment was based on evaluated information rather than site-specific ambient water quality data from the Madisonville station. The suspected causes for assessing the Tchefuncte River as partially supportive were nutrients, organic enrichment and pathogens. The suspected sources were municipal and unsewered facilities.

This plan calls for construction of a levee and a floodwall around the town of Madisonville, Louisiana. As the project alignment does not cross any streams, no control structures are required. The water quality impacts of this plan would be similar to those impacts associated with the plans previously discussed. Mainly, these impacts include short-term impacts such as high turbidity levels, decreased oxygen concentrations and concrete surface leaching from the construction of the levee and floodwall. These impacts would occur in both the surrounding marsh areas and in the Tchefuncte River.

As for the previous hurricane protection plans, there are two drainage alternatives for the Madisonville hurricane protection plan. One plan calls for forced drainage via pumping stations. The other plan calls for multiple gated culverts to allow for gravity drainage. Likewise, significant differences in water quality impacts are not expected since the levee alignment is the same for both drainage plans.

e. Mile Branch Flood Protection. There is no existing water quality or sediment data for Mile Branch. However, due to the surrounding land use

alternatives, described above (Figure 9).

POTENTIAL SIGNIFICANT IMPACTS

The direct impacts of each alternative (excluding the Bayou Chinchuba alternative, which has no direct impacts) on various habitat types are shown in Table 1. Table 2 provides a comparative listing of associated fish and wildlife impacts for each alternative. The potential impacts for each alternative being considered are discussed below:

1. Bayou Chinchuba Drainage Improvements - The actual construction of this alternative would have minimal direct impacts to fish and wildlife resources since construction activities will be confined to the existing right-of-way along Causeway Boulevard. However, the potential exists for draining existing wetlands located adjacent to Bayou Chinchuba east of Causeway Boulevard, causing a loss or substantial reduction of the fish and wildlife values associated with those wetlands. Depending on the operation of the sluice gates, low flow problems may occur in Bayou Chinchuba west of Causeway Boulevard, adversely impacting water quality and fish habitat in Bayou Chinchuba.

2. Ponchatoula Creek Channel Improvements - Implementation of this alternative would result in adverse impacts to stream habitat, forested wetlands including riparian areas and bottomland hardwoods, and pine/hardwood areas. Some scattered portions of the channel are within developed areas and devoid of streambank vegetation; however, most of the creek is bordered by wooded riparian habitat of varying width. Enlargement of the creek and associated spoil disposal would severely degrade fish and wildlife resources associated with wooded riparian areas. Construction activities would remove in-stream cover, temporarily increase turbidity and eliminate all wooded vegetation on both banks of the creek. Those alterations would be expected to substantially reduce fish populations.

3. Tchefuncte River Diversion Channel - Construction of a diversion channel would impact all major habitat types found within the study area including forested wetlands such as bottomland hardwoods, cypress swamp, and riparian areas, pine flatwoods and pine savannahs. The proposed work would severely degrade or destroy those habitats and the fish and wildlife resource values associated with them. The diversion channel has the potential for reducing the extent and duration of flooding on wetlands along the entire proposed length. Flood reduction along the Tchefuncte River would increase the pressure for secondary development in adjacent wetland areas. Such development would include a corresponding degradation in adjacent wetland areas. Flood reduction would also impact fishery resources by limiting access to wetlands during the spawning season. Water quality

Table 1. Preliminary estimate of direct project impacts (acres) resulting from channel enlargement, levee construction, and channel diversion

Alternative		Habitat Acres						
		Bottomland Hardwood	Pine Flatwoods	Wooded Swamp	Mixed Pine/Hardwood	Marsh	Pine Savannah	Lake Bottom
Ponchatoula Creek		17			56			
Mile Branch								
(25-year)		33		6				
(100-year)		34		6				
Lateral "A"								
(25-year)		9		0.8				
(100-year)		4		0.8				
Mandeville/Lewisburg Hurricane Protection								
100-year	cast[1]	76			29			55
	haul[2]	70			29			17
SPH[3]	cast	92			30			63
	haul	77			35			20
Mandeville Hurricane Protection								
100-year	cast	40			4			55
	haul	34			23			17
SPH	cast	46			4			63
	haul	36			28			20
Lewisburg Hurricane Protection								
100-year	cast	37			25			
	haul	37			25			
SPH	cast	46			22			
	haul	41			27			

it is unlikely that the stream segment is highly polluted with pesticides or heavy trace metals. Water quality problems are more likely related to low dissolved oxygen concentrations and high fecal coliform levels.

Channel improvements are often used to increase stream capacity for flood control. The major types of channel improvements for flood control are channel enlargement, clearing and snagging, and channel realignment. Channel improvements have resulted in many positive benefits besides the primary benefit of flood protection of urban areas. However, channel improvements have also had adverse impacts on the environment and water quality in the project area. This alternative calls for enlarging and straightening the stream channel with some segments concrete lined. Channel enlargement implies widening and/or deepening the channel. Normally, this is accomplished with a dragline working from one or both banks. Protection for both a 25-year and 100-year flood event is being considered. The water quality impacts discussed below apply to both levels of protection. As expected, the water quality impacts associated with the 100-year flood protection plan are greater than those for the 25-year flood protection plan.

As for the previously discussed plans, the initial clearing of the land for site preparation and developing access routes leads to an immediate increase in runoff and erosion. Thus the problems associated with turbidity will appear almost at the time construction starts up. Also, channel enlargement and channel realignment remove stream bank cover which decreases the amount of shade on the stream, thus elevating the temperature of the stream and decreasing the dissolved oxygen concentration. This reduced stream bank cover helps to further elevate the increased runoff and erosion problem. Short term turbidity increases are also expected in the immediate downstream reach of the Tchefuncte River, which is designated as an outstanding natural resource. The effects of increased turbidity on the water quality of a stream have already been discussed. Again, environmental protection practices normally implemented at construction sites can be effective in reducing the gross erosion and soil loss that can cause shoaling and elevated levels of suspended solids at some relatively short distance downstream of the project site.

Also, both channel enlargement and channel realignment, disturb the bottom sediment of a stream. The primary results are the creation of deep holes or linear channels and the temporary suspension of large clouds of sedimentary particles. The nature of pollution caused by disturbing the bottom sediment is in a large measure dependent on the material being disturbed. If there is a large amount of organic matter (trees, roots, shrubs, etc.) in the channel or on its banks, then decomposition products of this matter may be present. Also, most of the sediments removed or disturbed are from the deep unoxidized layer of soil and are thus in a chemically reduced state. Such materials have very high chemical and biological oxygen demands.

Although flood control channel cross sections are usually designed to minimize erosion problems, some channel stabilization and bank protection is required on nearly all flood control channels. This plan calls for revetment to be placed on the banks of the improved channel. Thus, concrete surface leaching could be another impact.

While these adverse impacts are temporary in nature and will diminish soon after the completion of the project, the permanent loss of stream bank cover due to the placement of the revetment will likely result in a long-term increase in stream temperature.
These higher water temperatures could result in lower dissolved oxygen levels during low flow conditions. No significant differences in nutrient and contaminant fecal levels are expected since these levels are mainly related to types of land use and their distribution within the drainage basin. However, in those projects where reduced flooding encourages urban development or widespread clearing of land and expansion of crop production, concomitant increases in nutrient and contaminant fecal levels can be expected. By and large, especially at times of moderate to high flows, channel improvements facilitate water flow and flushing. As a result of the increased assimilative capacity of the stream, the water quality with respect to many parameters, and particularly dissolved oxygen content, may increase after the channel improvements.

In closing, there are several construction techniques which will greatly reduce these adverse environmental effects with little loss in flood control. The most promising of these techniques is the single-bank modification approach. This technique applies to both bank clearing and channel enlargement. Some key aspects are: (1) that the existing channel alignment is followed; (2) clearing and widening should generally be restricted to the northerly or easterly bank so that the channel remains shaded as much as possible, and (3) existing vegetation on the opposing bank is disturbed as little as possible, although snags that would interfere with flow or trees that might fall into the channel may be removed. Other protective measures are the revegetation of disturbed or disposal areas and the wise use of existing access routes within the project area. Also buffer strips of vegetated land as wide or wider than the channel should be established on both sides of the channel.

f. North Hammond Flood Protection. Currently there are no active water quality stations on Ponchatoula Creek. Water quality samples were collected from Ponchatoula Creek just north of Ponchatoula, La. in June 1969 and March 1974. Only the 1974 samples were analyzed for heavy metals, pesticides and fecal coliforms. These data show that the state criteria for temperature and total dissolved solids were slightly exceeded. The fecal coliform level in 1974 was 5,900 colonies per 100 mL. This value greatly exceeds the state criteria for primary and secondary contact recreation. No pesticides were detected in the water samples while only small quantities of DDE, dieldrin and diazinon were detected in the sediment samples. No metals exceeded the freshwater acute EPA aquatic life

Table 1. (Cont.)

Alternative	Habitat Acres						
	Bottomland Hardwood	Pine Flatwoods	Wooded Swamp	Mixed Pine/Hardwood	Marsh	Pine Savannah	Lake Bottom
West Slidell Hurricane Protection							
Plan A							
100-year	3			107	120		
SPH	3			128	143		
Plan B							
100-year	3				54		
SPH	3				65		
Tchefeucte River Diversion	158	132	3	272		135	

1. Material is dredged from lake bottom
2. Material is hauled in by truck
3. SPH - Standard Protection Hurricane

criteria, although cadmium, lead and mercury exceeded the freshwater chronic EPA aquatic life criteria. Additionally, in 1988 the LDEQ assessed Ponchatoula Creek as partially supportive of its designated water uses. This evaluative assessment was based on information other than current site-specific ambient water quality data. The suspected causes for assessing Ponchatoula Creek as partially supportive were nutrients, organic enrichment and pathogens. The suspected sources were industrial and municipal.

As this plan calls for enlarging and/or deepening Ponchatoula Creek, the impacts would be similar to those discussed in the previous paragraphs under Mile Branch Flood Protection.

g. Bayou Chinchuba Flood Protection. There is no existing water quality or sediment data for Bayou Chinchuba. However, due to the surrounding land use it is unlikely that the stream segment is highly polluted with pesticides or heavy trace metals. Water quality problems are more likely related to low dissolved oxygen concentrations and high fecal coliform levels.

This plan calls for the excavation of a diversion channel to divert from 20 to 30 percent of Bayou Chinchuba's flow to Lake Pontchartrain along the east side of Causeway Blvd. As for the hurricane protection plans discussed previously, site preparation activities, fill extractions, stockpiling and construction of temporary access roads will result in large denuded areas with a consequent increase in runoff and erosion. Thus turbidity levels will increase greatly, both in Bayou Chinchuba and Lake Pontchartrain, during construction of and immediately after opening the diversion channel. These high turbidity levels could then increase the water temperatures and decrease the dissolved oxygen levels in these waterbodies.

In short, the impact on Bayou Chinchuba and Lake Pontchartrain will be short-term and localized. Environmental protection practices normally implemented at construction sites can be effective in reducing these adverse impacts.

h. Tchefuncte River Diversion Plan. There are two plans for flood protection along the Tchefuncte River as discussed below.

The Tchefuncte River, from its headwaters down to La. Hwy. 22 is designated as an outstanding natural resource water. Both the U.S. Geological Survey and the LDEQ have active water quality stations located on the Tchefuncte River at Covington, La. Data from these two locations show that the state's criteria for pH, temperature, chlorides, sulfates, dissolved oxygen and total dissolved solids are infrequently exceeded. However, the fecal coliform criteria appear to be frequently exceeded. Also, cadmium, copper, lead and mercury all exceeded the chronic EPA freshwater aquatic life criteria, while only cadmium and copper exceeded

Table 2. Proposed alternatives for Tangipahoa, Tchefuncte, and Tickfaw Rivers, Louisiana, Flood Control Study and their expected impacts on fish and wildlife resources

Impact	Proposed Channel Enlargement		Proposed Levee Construction			Proposed Diversion Channel
	Ponchatoula Creek	Mile Branch Lateral "A"	Western Slidell	Mandeville/ Lewisburg*	Bayou Chinchuba	Tchefuncte River
Elimination of instream cover	X	X				
Disturbance of lake bottoms				X		
Reduction in fish biomass and diversity	X	X	X			
Reduction in invertebrate biomass and diversity	X	X		X		
Increased turbidity	X	X		X		X
Alteration of seasonal flow (volume and velocity)						X
Reduction in water quality	X	X	X	X		X
Elimination of riparian vegetation	X	X				
Loss and degradation of adjacent floodplain wetlands	X	X		X		X
Secondary development of wetlands	X	X		X	X	X
Reduction in frequency and duration of overbank flooding	X	X	X		X	X

* Includes Mandeville, Lewisburg, and Mandeville/Lewisburg Hurricance Protection Levee Alternatives.

the acute EPA freshwater aquatic life criteria. No pesticide concentrations exceeded the state or EPA criteria. Based only on fecal coliform, temperature, dissolved oxygen, pH, chloride, sulfate and total dissolved solids data from its water quality station, the LDEQ has determined that the uses of this reach of the Tchefuncte River are fully supported, but threatened by the quality of water in the Tchefuncte River. However, in 1988 the LDEQ assessed this reach of the Tchefuncte River as partially supportive of its designated water uses. This assessment was based on evaluated information rather than site-specific ambient water quality data. The suspected causes for assessing this reach of the Tchefuncte River as partially supportive were nutrients, organic enrichment, and pathogens. The suspected sources were speciality crop production, on-site wastewater systems and unsewered facilities.

This plan calls for a diversion channel to be constructed from the Tchefuncte River, at U.S. Hwy. 190, south to the headwaters of Black River. Levees would then be built on both sides of Black River downstream to the marsh area. Only floods with a return period in excess of ten years would be diverted via a control structure. The impacts of constructing the diversion channel, the control structure and the levees would be similar to the impacts discussed previously for the construction of the Bayou Lacombe hurricane protection levee and the Bayou Chinchuba diversion channel.

Appendix B
Preliminary Cost Estimates

Slidell Area

TABLE 1

Western Slidell Hurricane Protection Levee---Alignment "A"
100-Year Protection-- Forced Drainage (6,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations (1,300 cfs)		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--5100 cfs		31,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		56,930,000
Contingencies (25%)	0.25	14,232,500
E&D	0.12	8,539,500
S&A	0.1	7,116,250
Subtotal		86,818,250
Real Estate Costs		173,000
Total Western Slidell Segment		91,982,809
TOTAL		106,977,727
TOTAL (ROUNDED)		107,000,000

TABLE 2

Western Slidell Hurricane Protection Levee---Alignment "A"
100-Year Protection-- Forced Drainage (7,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations 1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,13[illegible]
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--6100 cfs		38,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		63,930,000
Contingencies (25%)	0.25	15,982,500
E&D	0.12	9,589,500
S&A	0.1	7,991,250
Subtotal		97,493,250
Real Estate Costs		173,000
Total Western Slidell Segment		102,657,809
TOTAL		117,652,727
TOTAL (ROUNDED)		117,700,00[illegible]

TABLE 3

Western Slidell Hurricane Protection Levee---Alignment "A"
100-Year Protection--Forced Drainage (8,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations--1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--7100 cfs		45,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		70,930,000
Contingencies (25%)	0.25	17,732,500
E&D	0.12	10,639,500
S&A	0.1	8,866,250
Subtotal		108,168,250
Real Estate Costs		173,000
Total Western Slidell Segment		113,332,809
TOTAL		128,327,727
TOTAL (ROUNDED)		128,300,000

TABLE 4

Western Slidell Hurricane Protection Levee---Alignment "A"
100-Year Protection-- Forced Drainage (9,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations--1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,26'
Subtotal		11,715,13
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--8100 cfs		52,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		77,930,000
Contingencies (25%)	0.25	19,482,500
E&D	0.12	11,689,500
S&A	0.1	9,741,250
Subtotal		118,843,250
Real Estate Costs		173,000
Total Western Slidell Segment		124,007,809
TOTAL		139,002,727
TOTAL (ROUNDED)		139,000,00

TABLE 5

Western Slidell Hurricane Protection Levee Alignment "A"
100-Year Protection-- Forced Drainage (5,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--5100 cfs		31,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		56,930,000
Contingencies (25%)	0.25	14,232,500
E&D	0.12	8,539,500
S&A	0.1	7,116,250
Subtotal		86,818,250
Real Estate Costs		173,000
Total Western Slidell Segment		91,982,809
TOTAL		96,072,727
TOTAL (ROUNDED)		96,100,000

TABLE 6

Western Slidell Hurricane Protection Levee--- Alignment "A"
100-Year Protection-- Forced Drainage (6,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,51'
Subtotal		810,13
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--6100 cfs		38,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		63,930,000
Contingencies (25%)	0.25	15,982,500
E&D	0.12	9,589,500
S&A	0.1	7,991,250
Subtotal		97,493,250
Real Estate Costs		173,000
Total Western Slidell Segment		102,657,809
TOTAL		106,747,727
TOTAL (ROUNDED)		106,700,00'

TABLE 7

Western Slidell Hurricane Protection Levee--- Alignment "A"
100-Year Protection--Forced Drainage (7,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--7100 cfs		45,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		70,930,000
Contingencies (25%)	0.25	17,732,500
E&D	0.12	10,639,500
S&A	0.1	8,866,250
Subtotal		108,168,250
Real Estate Costs		173,000
Total Western Slidell Segment		113,332,809
TOTAL		117,422,727
TOTAL (ROUNDED)		117,400,000

TABLE 8

Western Slidell Hurricane Protection Levee--- Alignment "A"
100-Year Protection-- Forced Drainage (8,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,13
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Pump Station--8100 cfs		52,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		77,930,000
Contingencies (25%)	0.25	19,482,500
E&D	0.12	11,689,500
S&A	0.1	9,741,250
Subtotal		118,843,250
Real Estate Costs		173,000
Total Western Slidell Segment		124,007,809
TOTAL		128,097,727
TOTAL (ROUNDED)		128,100,00

TABLE 9

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (6,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations (1,300 cfs)		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--5100 cfs		31,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		56,930,000
Contingencies (25%)	0.25	14,232,500
E&D	0.12	8,539,500
S&A	0.1	7,116,250
Subtotal		86,818,250
Real Estate Costs		208,000
Total Western Slidell Segment		92,100,672
TOTAL		107,095,590
TOTAL (ROUNDED)		107,100,000

TABLE 10

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (7,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations 1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--6100 cfs		38,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		63,930,000
Contingencies (25%)	0.25	15,982,500
E&D	0.12	9,589,500
S&A	0.1	7,991,250
Subtotal		97,493,250
Real Estate Costs		208,000
Total Western Slidell Segment		102,775,672
TOTAL		117,770,590
TOTAL (ROUNDED)		117,800,000

TABLE 11

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection--Forced Drainage (8,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations--1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,261
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--7100 cfs		45,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		70,930,000
Contingencies (25%)	0.25	17,732,500
E&D	0.12	10,639,500
S&A	0.1	8,866,250
Subtotal		108,168,250
Real Estate Costs		208,000
Total Western Slidell Segment		113,450,672
TOTAL		128,445,590
TOTAL (ROUNDED)		128,400,000

TABLE 12

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (9,400 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Pump Stations--1,300 cfs		7,270,000
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		7,810,090
Contingencies (25%)	0.25	1,952,523
E&D	0.1	976,261
S&A	0.1	976,26
Subtotal		11,715,135
Real Estate		78,000
Total Schneider Canal Segment		14,994,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--8100 cfs		52,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		77,930,000
Contingencies (25%)	0.25	19,482,500
E&D	0.12	11,689,500
S&A	0.1	9,741,250
Subtotal		118,843,250
Real Estate Costs		208,000
Total Western Slidell Segment		124,125,672
TOTAL		139,120,59
TOTAL (ROUNDED)		139,100,0

TABLE 13

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (5,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--5100 cfs		31,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		56,930,000
Contingencies (25%)	0.25	14,232,500
E&D	0.12	8,539,500
S&A	0.1	7,116,250
Subtotal		86,818,250
Real Estate Costs		208,000
Total Western Slidell Segment		92,100,672
TOTAL		96,190,590
TOTAL (ROUNDED)		96,200,000

TABLE 14

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (6,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,51'
Subtotal		810,13
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--6100 cfs		38,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		63,930,000
Contingencies (25%)	0.25	15,982,500
E&D	0.12	9,589,500
S&A	0.1	7,991,250
Subtotal		97,493,250
Real Estate Costs		208,000
Total Western Slidell Segment		102,775,672
TOTAL		106,865,590
TOTAL (ROUNDED)		106,900,00'

TABLE 15

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection--Forced Drainage (7,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--7100 cfs		45,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		70,930,000
Contingencies (25%)	0.25	17,732,500
E&D	0.12	10,639,500
S&A	0.1	8,866,250
Subtotal		108,168,250
Real Estate Costs		208,000
Total Western Slidell Segment		113,450,672
TOTAL		117,540,590
TOTAL (ROUNDED)		117,500,000

TABLE 16

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Forced Drainage (8,100 cfs)

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Pump Station--8100 cfs		52,500,000
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		77,930,000
Contingencies (25%)	0.25	19,482,500
E&D	0.12	11,689,500
S&A	0.1	9,741,250
Subtotal		118,843,250
Real Estate Costs		208,000
Total Western Slidell Segment		124,125,672
TOTAL		128,215,590
TOTAL (ROUNDED)		128,200,000

TABLE 17

Western Slidell Hurricane Protection Levee--- Alignment "A"
100-Year Protection-- Gravity Drainage

ITEM		COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,511
Subtotal		810,135
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,290,206
Relocations		37,500
Subtotal		3,327,706
Contingencies (25%)	0.25	831,927
E&D	0.1	415,963
S&A	0.1	415,963
Subtotal		4,991,559
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		25,430,000
Contingencies (25%)	0.25	6,357,500
E&D	0.12	3,814,500
S&A	0.1	3,178,750
Subtotal		38,780,750
Real Estate Costs		173,000
Total Western Slidell Segment		43,945,309
TOTAL		48,035,227
TOTAL (ROUNDED)		48,000,000

TABLE 18

Western Slidell Hurricane Protection Levee--- Alignment "B"
100-Year Protection-- Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Schneider Canal Segment		
Levees- Schneider Canal Portion		1,572,080
Relocations		507,000
Subtotal		2,079,080
Contingencies (25%)	0.25	519,770
E&D	0.12	311,862
S&A	0.1	291,071
Subtotal		3,201,783
Floodwalls and Floodgates		480,090
Culverts		60,000
Subtotal		540,090
Contingencies (25%)	0.25	135,023
E&D	0.1	67,511
S&A	0.1	67,51[illegible]
Subtotal		810,13[illegible]
Real Estate		78,000
Total Schneider Canal Segment		4,089,918
Western Slidell Segment		
Levees-Western Portion		3,345,448
Relocations		37,500
Subtotal		3,382,948
Contingencies (25%)	0.25	845,737
E&D	0.1	422,869
S&A	0.1	422,869
Subtotal		5,074,422
Culverts		12,630,000
Navigable Sector Gated Structure		12,800,000
Subtotal		25,430,000
Contingencies (25%)	0.25	6,357,500
E&D	0.12	3,814,500
S&A	0.1	3,178,750
Subtotal		38,780,750
Real Estate Costs		208,000
Total Western Slidell Segment		44,063,172
TOTAL		48,153,090
TOTAL (ROUNDED)		48,200,000

Bayou Chinchuba

TABLE 1

Bayou Chinchuba Channel Diversion
Concrete Culvert

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		55,000
Clearing and Grubbing		22,000
Roadway Work		495,000
Excavation (incls. braced cofferdam)		6,050,000
Concrete Culvert (two, 7 ft. by 11 ft.)		6,600,000
Sluice Gates (two, 7 ft. by 11 ft.)		195,000
Subtotal		13,417,000
Contingencies (25%)	0.25	3,354,000
E&D	0.1	1,677,000
S&A	0.1	1,677,000
Subtotal		20,125,000
Relocations		640,000
Real Estate		948,000
TOTAL		21,713,000
TOTAL (ROUNDED)		21,713,000

TABLE 2

Bayou Chinchuba Channel Diversion
Concrete Arch Pipe

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		55,000
Clearing and Grubbing		22,000
Roadway Work		495,000
Excavation (incls. braced cofferdam)		2,398,000
Concrete Culvert (two, 77 in. by 122 in.)		3,941,000
Sluice Gates (two, 78 in. by 129 in.)		175,000
Subtotal		7,086,000
Contingencies (25%)	0.25	1,772,000
E&D	0.1	886,000
S&A	0.1	886,000
Subtotal		10,630,000
Relocations		640,000
Real Estate		1,115,000
TOTAL		12,385,000
TOTAL (ROUNDED)		12,385,000

Mandeville and Lewisburg

TABLE 1

Mandeville and Lewisburg Hurricane Protection Alignment
100-year Protection--Adjacent Cast, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		13,315,756
Relocations		52,500
Subtotal		13,368,256
Contingencies (25%)	0.25	3,342,064
E&D	0.1	1,671,032
S&A	0.1	1,671,032
Subtotal		20,052,384
Mandeville		
Pump Station--125 cfs		1,100,000
Gates		201,300
Culverts		135,000
Subtotal		1,436,300
Contingencies (25%)	0.25	359,075
E&D	0.12	215,445
S&A	0.1	179,538
Subtotal		2,190,358
Lewisburg		
Pump Station--50 cfs		380,000
Culverts		390,000
Subtotal		770,000
Contingencies (25%)	0.25	192,500
E&D	0.12	115,500
S&A	0.1	96,250
Subtotal		1,174,250
Real Estate Costs		3,832,000
Mitigation		307,000
TOTAL		27,555,992
TOTAL (ROUNDED)		27,556,000

TABLE 2

Mandeville and Lewisburg Hurricane Protection Alignment
100-year Protection--Adjacent Cast, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		13,315,756
Relocations		52,500
Subtotal		13,368,256
Contingencies (25%)	0.25	3,342,064
E&D	0.1	1,671,032
S&A	0.1	1,671,032
Subtotal		20,052,384
Mandeville		
Gates		201,300
Culverts		135,000
Subtotal		336,300
Contingencies (25%)	0.25	84,075
E&D	0.12	50,445
S&A	0.1	42,038
Subtotal		512,858
Lewisburg		
Culverts		390,000
Subtotal		390,000
Contingencies (25%)	0.25	97,500
E&D	0.12	58,500
S&A	0.1	48,750
Subtotal		594,750
Real Estate Costs		3,832,000
Mitigation		307,000
TOTAL		25,298,992
TOTAL (ROUNDED)		25,299,000

TABLE 3

Mandeville and Lewisburg Hurricane Protection Alignment
SPH Protection--Adjacent Cast Along Lakefront Levee, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		17,230,485
Relocations		75,000
Subtotal		17,305,485
Contingencies (25%)	0.25	4,326,371
E&D	0.1	2,163,186
S&A	0.1	2,163,186
Subtotal		25,958,228
Mandeville		
Pump Station--125 cfs		1,125,000
Gates		241,500
Bridges		135,000
Subtotal		1,501,500
Contingencies (25%)	0.25	375,375
E&D	0.12	225,225
S&A	0.1	187,688
Subtotal		2,289,788
Lewisburg		
Pump Station--50 cfs		380,000
Culverts		390,000
Subtotal		770,000
Contingencies (25%)	0.25	192,500
E&D	0.12	115,500
S&A	0.1	96,250
Subtotal		1,174,250
Real Estate Costs		4,184,000
Mitigation		393,000
TOTAL		33,999,265
TOTAL (ROUNDED)		33,999,000

TABLE 4

Mandeville and Lewisburg Hurricane Protection Alignment
SPH Protection--Adjacent Cast Along Lakefront Levee, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		17,230,485
Relocations		75,000
Subtotal		17,305,485
Contingencies (25%)	0.25	4,326,371
E&D	0.1	2,163,186
S&A	0.1	2,163,186
Subtotal		25,958,228
Mandeville		
Gates		241,500
Culverts		135,000
Subtotal		376,500
Contingencies (25%)	0.25	94,125
E&D	0.12	56,475
S&A	0.1	47,063
Subtotal		574,163
Lewisburg		
Culverts		400,000
Subtotal		400,000
Contingencies (25%)	0.25	100,000
E&D	0.12	60,000
S&A	0.1	50,000
Subtotal		610,000
Real Estate Costs		4,184,000
Mitigation		393,000
TOTAL		31,719,390
TOTAL (ROUNDED)		31,719,000

TABLE 5

Mandeville and Lewisburg Hurricane Protection Alignment
100-year Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		10,378,331
Relocations		52,500
Subtotal		10,430,831
Contingencies (25%)	0.25	2,607,708
E&D	0.1	1,303,854
S&A	0.1	1,303,854
Subtotal		15,646,247
Mandeville		
Pump Station--125 cfs		1,100,000
Gates		201,300
Culverts		135,000
Subtotal		1,436,300
Contingencies (25%)	0.25	359,075
E&D	0.12	215,445
S&A	0.1	179,538
Subtotal		2,190,358
Lewisburg		
Pump Station--50 cfs		380,000
Culverts		390,000
Subtotal		770,000
Contingencies (25%)	0.25	192,500
E&D	0.12	115,500
S&A	0.1	96,250
Subtotal		1,174,250
Real Estate Costs		4,479,000
Mitigation		291,000
TOTAL		23,780,854
TOTAL (ROUNDED)		23,781,000

TABLE 6

Mandeville and Lewisburg Hurricane Protection Alignment
100-year Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		10,378,331
Relocations		75,000
Subtotal		10,453,331
Contingencies (25%)	0.25	2,613,333
E&D	0.1	1,306,666
S&A	0.1	1,306,666
Subtotal		15,679,997
Mandeville		
Gates		201,300
Culverts		135,000
Subtotal		336,300
Contingencies (25%)	0.25	84,075
E&D	0.12	50,445
S&A	0.1	42,038
Subtotal		512,858
Lewisburg		
Culverts		390,000
Subtotal		390,000
Contingencies (25%)	0.25	97,500
E&D	0.12	58,500
S&A	0.1	48,750
Subtotal		594,750
Real Estate Costs		4,479,000
Mitigation		291,000
TOTAL		21,557,604
TOTAL (ROUNDED)		21,558,000

TABLE 7

Mandeville and Lewisburg Hurricane Protection Alignment
SPH Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		13,450,510
Relocations		75,000
Subtotal		13,525,510
Contingencies (25%)	0.25	3,381,378
E&D	0.1	1,690,689
S&A	0.1	1,690,689
Subtotal		20,288,265
Mandeville		
Pump Station--125 cfs		1,125,000
Gates		241,500
Culverts		135,000
Subtotal		1,501,500
Contingencies (25%)	0.25	375,375
E&D	0.12	225,225
S&A	0.1	187,688
Subtotal		2,289,788
Lewisburg		
Pump Station--50 cfs		400,000
Culverts		400,000
Subtotal		800,000
Contingencies (25%)	0.25	200,000
E&D	0.12	120,000
S&A	0.1	100,000
Subtotal		1,220,000
Real Estate Costs		5,008,000
Mitigation		329,000
TOTAL		29,135,053
TOTAL (ROUNDED)		29,135,000

TABLE 8

Mandeville and Lewisburg Hurricane Protection Alignment
SPH Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		13,450,510
Relocations		52,500
Subtotal		13,503,010
Contingencies (25%)	0.25	3,375,753
E&D	0.1	1,687,876
S&A	0.1	1,687,876
Subtotal		20,254,515
Mandeville		
Gates		241,500
Culverts		135,000
Subtotal		376,500
Contingencies (25%)	0.25	94,125
E&D	0.12	56,475
S&A	0.1	47,063
Subtotal		574,163
Lewisburg		
Culverts		400,000
Subtotal		400,000
Contingencies (25%)	0.25	100,000
E&D	0.12	60,000
S&A	0.1	50,000
Subtotal		610,000
Real Estate Costs		5,008,000
Mitigation		329,000
TOTAL		26,775,678
TOTAL (ROUNDED)		26,776,000

TABLE 9

Mandeville Hurricane Protection Alignment
100-year Protection--Adjacent Cast, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		8,308,024
Subtotal		8,308,024
Contingencies (25%)	0.25	2,077,006
E&D	0.1	1,038,503
S&A	0.1	1,038,503
Subtotal		12,462,036
Mandeville		
Pump Station--125 cfs		1,100,000
Floodwall and Gates		909,300
Culverts		135,000
Subtotal		2,144,300
Contingencies (25%)	0.25	536,075
E&D	0.12	321,645
S&A	0.1	268,038
Subtotal		3,270,058
Real Estate Costs		2,424,000
Mitigation		167,000
TOTAL		18,323,094
TOTAL (ROUNDED)		18,323,000

TABLE 10

Mandeville Hurricane Protection Alignment
100-year Protection--Adjacent Cast, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		8,308,024
Subtotal		8,308,024
Contingencies (25%)	0.25	2,077,006
E&D	0.1	1,038,503
S&A	0.1	1,038,503
Subtotal		12,462,036
Mandeville		
Floodwall and Gates		909,300
Culverts		135,000
Subtotal		1,044,300
Contingencies (25%)	0.25	261,075
E&D	0.12	156,645
S&A	0.1	130,538
Subtotal		1,592,558
Real Estate Costs		2,424,000
Mitigation		167,000
TOTAL		16,645,594
TOTAL (ROUNDED)		16,646,000

TABLE 11

Mandeville Hurricane Protection Alignment
SPH Protection--Adjacent Cast, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		9,554,391
Subtotal		9,554,391
Contingencies (25%)	0.25	2,388,598
E&D	0.1	1,194,299
S&A	0.1	1,194,299
Subtotal		14,331,587
Mandeville		
Pump Station--125 cfs		1,125,000
Floodwall and Gates		1,212,060
Culverts		135,000
Subtotal		2,472,060
Contingencies (25%)	0.25	618,015
E&D	0.12	370,809
S&A	0.1	309,008
Subtotal		3,769,892
Real Estate Costs		2,504,000
Mitigation		196,000
TOTAL		20,801,478
TOTAL (ROUNDED)		20,801,000

TABLE 12

Mandeville Hurricane Protection Alignment
SPH Protection--Adjacent Cast, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		8,308,024
Subtotal		8,308,024
Contingencies (25%)	0.25	2,077,006
E&D	0.1	1,038,503
S&A	0.1	1,038,503
Subtotal		12,462,036
Mandeville		
Floodwall and Gates		909,300
Culverts		135,000
Subtotal		1,044,300
Contingencies (25%)	0.25	261,075
E&D	0.12	156,645
S&A	0.1	130,538
Subtotal		1,592,558
Real Estate Costs		2,504,000
Mitigation		196,000
TOTAL		16,754,594
TOTAL (ROUNDED)		16,755,000

TABLE 13

Mandeville Hurricane Protection Alignment
100-year Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		6,125,085
Subtotal		6,125,085
Contingencies (25%)	0.25	1,531,271
E&D	0.1	765,636
S&A	0.1	765,636
Subtotal		9,187,628
Mandeville		
Pump Station--125 cfs		1,100,000
Floodwall and Gates		1,044,000
Culverts		135,000
Subtotal		2,279,000
Contingencies (25%)	0.25	569,750
E&D	0.12	341,850
S&A	0.1	284,875
Subtotal		3,475,475
Real Estate Costs		2,885,000
Mitigation		137,000
TOTAL		15,685,103
TOTAL (ROUNDED)		15,685,000

TABLE 14

Mandeville Hurricane Protection Alignment
100-year Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		6,125,085
Subtotal		6,125,085
Contingencies (25%)	0.25	1,531,271
E&D	0.1	765,636
S&A	0.1	765,636
Subtotal		9,187,628
Mandeville		
Floodwall and Gates		1,044,000
Culverts		135,000
Subtotal		1,179,000
Contingencies (25%)	0.25	294,750
E&D	0.12	176,850
S&A	0.1	147,375
Subtotal		1,797,975
Real Estate Costs		2,885,000
Mitigation		137,000
TOTAL		14,007,603
TOTAL (ROUNDED)		14,008,000

TABLE 15

Mandeville Hurricane Protection Alignment
SPH Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		7,934,346
Subtotal		7,934,346
Contingencies (25%)	0.25	1,983,587
E&D	0.1	991,793
S&A	0.1	991,793
Subtotal		11,901,519
Mandeville		
Pump Station--125 cfs		1,125,000
Floodwall and Gates		1,213,000
Culverts		135,000
Subtotal		2,473,000
Contingencies (25%)	0.25	618,250
E&D	0.12	370,950
S&A	0.1	309,125
Subtotal		3,771,325
Real Estate Costs		3,031,000
Mitigation		156,000
TOTAL		18,859,844
TOTAL (ROUNDED)		18,860,000

TABLE 16

Mandeville Hurricane Protection Alignment
SPH Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		7,934,346
Subtotal		7,934,346
Contingencies (25%)	0.25	1,983,587
E&D	0.1	991,793
S&A	0.1	991,793
Subtotal		11,901,519
Mandeville		
Floodwall and Gates		1,213,000
Culverts		135,000
Subtotal		1,348,000
Contingencies (25%)	0.25	337,000
E&D	0.12	202,200
S&A	0.1	168,500
Subtotal		2,055,700
Real Estate Costs		3,031,000
Mitigation		156,000
TOTAL		17,144,219
TOTAL (ROUNDED)		17,144,000

TABLE 17

Lewisburg Hurricane Protection Alignment
100-year Protection--Adjacent Cast Along Lakefront, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		5,541,135
Subtotal		5,541,135
Contingencies (25%)	0.25	1,385,284
E&D	0.1	692,642
S&A	0.1	692,642
Subtotal		8,311,703
Lewisburg		
Pump Station--50 cfs		380,000
Floodwall and Gates		1,095,200
Culverts		1,170,000
Subtotal		2,645,200
Contingencies (25%)	0.25	661,300
E&D	0.12	396,780
S&A	0.1	330,650
Subtotal		4,033,930
Real Estate Costs		4,254,000
Mitigation		170,000
TOTAL		16,769,633
TOTAL (ROUNDED)		16,770,000

TABLE 18

Lewisburg Hurricane Protection Alignment
100-year Protection--Adjacent Cast Along Lakefront, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		5,541,135
Subtotal		5,541,135
Contingencies (25%)	0.25	1,385,284
E&D	0.1	692,642
S&A	0.1	692,642
Subtotal		8,311,703
Lewisburg		
Floodwall and Gates		1,095,200
Culverts		1,170,000
Subtotal		2,265,200
Contingencies (25%)	0.25	566,300
E&D	0.12	339,780
S&A	0.1	283,150
Subtotal		3,454,430
Real Estate Costs		4,254,000
Mitigation		170,000
TOTAL		16,190,133
TOTAL (ROUNDED)		16,190,000

TABLE 19

Lewisburg Hurricane Protection Alignment
SPH Protection--Adjacent Cast Along Lakefront, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		7,110,823
Subtotal		7,110,823
Contingencies (25%)	0.25	1,777,706
E&D	0.1	888,853
S&A	0.1	888,853
Subtotal		10,666,235
Lewisburg		
Pump Station--50 cfs		400,000
Floodwall and Gates		1,487,000
Culverts		1,200,000
Subtotal		3,087,000
Contingencies (25%)	0.25	771,750
E&D	0.12	463,050
S&A	0.1	385,875
Subtotal		4,707,675
Real Estate Costs		4,540,000
Mitigation		198,000
TOTAL		20,111,910
TOTAL (ROUNDED)		20,112,000

TABLE 20

Lewisburg Hurricane Protection Project
SPH Protection--Adjacent Cast Along Lakefront, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		7,110,823
Subtotal		7,110,823
Contingencies (25%)	0.25	1,777,706
E&D	0.1	888,853
S&A	0.1	888,853
Subtotal		10,666,235
Lewisburg		
Floodwall and Gates		1,487,000
Culverts		1,200,000
Subtotal		2,687,000
Contingencies (25%)	0.25	671,750
E&D	0.12	403,050
S&A	0.1	335,875
Subtotal		4,097,675
Real Estate Costs		4,540,000
Mitigation		198,000
TOTAL		19,501,910
TOTAL (ROUNDED)		19,502,000

TABLE 21

Lewisburg Hurricane Protection Alignment
100-year Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		4,450,254
Subtotal		4,450,254
Contingencies (25%)	0.25	1,112,564
E&D	0.1	556,282
S&A	0.1	556,282
Subtotal		6,675,381
Lewisburg		
Pump Station--50 cfs		380,000
Floodwall and Gates		1,095,200
Culverts		1,170,000
Subtotal		2,645,200
Contingencies (25%)	0.25	661,300
E&D	0.12	396,780
S&A	0.1	330,650
Subtotal		4,033,930
Real Estate Costs		4,559,000
Mitigation		159,000
TOTAL		15,427,311
TOTAL (ROUNDED)		15,427,000

TABLE 22

Lewisburg Hurricane Protection Alignment
100-year Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		4,450,254
Subtotal		4,450,254
Contingencies (25%)	0.25	1,112,564
E&D	0.1	556,282
S&A	0.1	556,282
Subtotal		6,675,381
Lewisburg		
Floodwall and Gates		1,095,200
Culverts		1,170,000
Subtotal		2,265,200
Contingencies (25%)	0.25	566,300
E&D	0.12	339,780
S&A	0.1	283,150
Subtotal		3,454,430
Real Estate Costs		4,559,000
Mitigation		159,000
TOTAL		14,847,811
TOTAL (ROUNDED)		14,848,000

TABLE 23

Lewisburg Hurricane Protection Alignment
SPH Protection--Truck Haul, Forced Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		5,711,452
Subtotal		5,711,452
Contingencies (25%)	0.25	1,427,863
E&D	0.1	713,932
S&A	0.1	713,932
Subtotal		8,567,178
Lewisburg		
Pump Station--50 cfs		400,000
Floodwall and Gates		1,487,000
Culverts		1,200,000
Subtotal		3,087,000
Contingencies (25%)	0.25	771,750
E&D	0.12	463,050
S&A	0.1	385,875
Subtotal		4,707,675
Real Estate Costs		4,934,000
Mitigation		179,000
TOTAL		18,387,853
TOTAL (ROUNDED)		18,388,000

TABLE 24

Lewisburg Hurricane Protection Alignment
SPH Protection--Truck Haul, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		7,110,823
Subtotal		7,110,823
Contingencies (25%)	0.25	1,777,706
E&D	0.1	888,853
S&A	0.1	888,853
Subtotal		10,666,235
Lewisburg		
Floodwall and Gates		1,487,000
Culverts		1,200,000
Subtotal		2,687,000
Contingencies (25%)	0.25	671,750
E&D	0.12	403,050
S&A	0.1	335,875
Subtotal		4,097,675
Real Estate Costs		4,934,000
Mitigation		179,000
TOTAL		19,876,910
TOTAL (ROUNDED)		19,877,000

Mile Branch and Lateral "A"

TABLE 1

Mile Branch Channel Improvements
25-Year Plan, Concrete Lining

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		40,000
Clearing		
For channel dredging		66,100
For disposal areas		27,500
Dredging		166,100
Channel Lining		
Side Slope Paving (4 in. reinforced conc.)		1,050,900
Channel Bottom Paving (6 in. reinforced conc.)		1,064,400
Subtotal		2,415,000
Contingencies (25%)	0.25	604,000
E&D	0.06	181,000
S&A	0.08	242,000
Subtotal		3,442,000
Relocations		61,100
Real Estate		586,000
Mitigation		112,000
TOTAL		4,201,100
TOTAL (ROUNDED)		4,201,000

TABLE 2

Mile Branch Channel Improvements
25-Year Plan, Gabion Lining

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		40,000
Clearing		
For channel dredging		66,100
For disposal areas		27,500
Dredging		166,100
Channel Lining (8 in. gabions)		2,684,400
Subtotal		2,984,100
Contingencies (25%)	0.25	746,000
E&D	0.06	224,000
S&A	0.08	298,000
Subtotal		4,252,100
Relocations		61,100
Real Estate		586,000
Mitigation		112,000
TOTAL		5,011,200
TOTAL (ROUNDED)		5,011,000

TABLE 3

Lateral "A" Channel Improvements
25-Year Plan, Concrete Lining

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		35,000
Clearing		
For channel dredging		26,300
For disposal areas		10,000
Dredging		54,300
Channel Lining		
Side Slope Paving (4 in. reinforced conc.)		252,500
Channel Bottom Paving (6 in. reinforced conc.)		370,900
Subtotal		749,000
Contingencies (25%)	0.25	187,000
E&D	0.06	56,000
S&A	0.08	75,000
Subtotal		1,067,000
Relocations		339,400
Real Estate		262,000
Mitigation		35,000
TOTAL		1,703,400
TOTAL (ROUNDED)		1,703,000

TABLE 4

Lateral "A" Channel Improvements
25-Year Gabion Lining

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		35,000
Clearing		
For channel dredging		26,300
For disposal areas		10,000
Dredging		54,300
Channel Lining (8 in. gabions)		790,000
Subtotal		915,600
Contingencies (25%)	0.25	229,000
E&D	0.06	69,000
S&A	0.08	92,000
Subtotal		1,305,600
Relocations		339,400
Real Estate		262,000
Mitigation		35,000
TOTAL		1,942,000
TOTAL (ROUNDED)		1,942,000

Tchefuncte River Diversion

Tchefuncte River Diversion

ITEM	UNIT	COST $
CONSTRUCTION		
Channels		
Mob and Demob		160,000
Clearing		
For channel dredging		512,000
For disposal areas		474,100
Dredging		7,841,700
Subtotal		8,987,800
Contingencies (25%)	0.25	2,247,000
E&D	0.06	674,000
S&A	0.08	899,000
Subtotal		12,807,800
Flood Control and Diversion Structures		4,038,120
Contingencies (30%)	0.3	1,211,000
E&D	0.06	315,000
S&A	0.08	420,000
Subtotal		5,984,120
Relocations		10,298,400
Mitigation		1,137,000
TOTAL		30,227,320
TOTAL (ROUNDED)		30,227,000

Ponchatoula Creek

Ponchatoula Creek Channel Improvements

ITEM	UNIT	COST $
CONSTRUCTION		
Mob and Demob		25,000
Clearing		
For channel dredging		107,300
For disposal areas		42,600
Dredging		224,800
Subtotal		399,700
Contingencies (25%)	0.25	100,000
E&D	0.06	30,000
S&A	0.08	40,000
Subtotal		569,700
Relocations		64,700
Real Estate		253,000
Mitigation		108,000
TOTAL		995,400
TOTAL (ROUNDED)		995,000

Lacombe Area

TABLE 1

Lacombe Hurricane Protection Levee
100-year Project, Forced Drainage

ITEM		UNIT	COST $
CONSTRUCTION			
Levees			4,781,442
Relocations			131,000
Subtotal			4,912,442
Contingencies (25%)		0.25	1,228,111
E&D		0.1	614,055
S&A		0.1	614,055
Subtotal			7,368,663
Pump Stations--4500 cfs	0.25		24,000,000
Sector-Gated Structure			12,800
Culverts and Pipes			12,630,
Subtotal			49,430,000
Contingencies (25%)		0.25	12,357,500
E&D		0.12	7,414,500
S&A		0.1	6,178,750
Subtotal			75,380,750
TOTAL			82,749,413
TOTAL (ROUNDED)			82,749,000

TABLE 2

Lacombe Hurricane Protection Levee
SPH Project, Forced Drainage

ITEM		UNIT	COST $
CONSTRUCTION			
Levees			6,581,862
Relocations			143,000
Subtotal			6,724,862
Contingencies (25%)		0.25	1,681,216
E&D		0.1	840,608
S&A		0.1	840,608
Subtotal			10,087,293
Pump Stations--4500 cfs	0.25		25,200,000
Sector-Gated Structure			14,200,000
Culverts and Pipes			13,035,000
Subtotal			52,435,000
Contingencies (25%)		0.25	13,108,750
E&D		0.12	7,865,250
S&A		0.1	6,554,375
Subtotal			79,963,375
TOTAL			90,050,668
TOTAL (ROUNDED)			90,051,000

TABLE 3

Lacombe Hurricane Protection Levee
100-year Project, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		4,781,442
Relocations		131,000
Subtotal		4,912,442
Contingencies (25%)	0.25	1,228,111
E&D	0.1	614,055
S&A	0.1	614,055
Subtotal		7,368,663
Sector-Gated Structure		12,800
Culverts and Pipes		12,630,
Subtotal		25,430,000
Contingencies (25%)	0.25	6,357,500
E&D	0.12	3,814,500
S&A	0.1	3,178,750
Subtotal		38,780,750
TOTAL		46,149,413
TOTAL (ROUNDED)		46,149,000

TABLE 4

Lacombe Hurricane Protection Levee
SPH Project, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION		
Levees		6,581,862
Relocations		143,000
Subtotal		6,724,862
Contingencies (25%)	0.25	1,681,216
E&D	0.1	840,608
S&A	0.1	840,608
Subtotal		10,087,293
Sector-Gated Structure		14,200,000
Culverts and Pipes		13,035,000
Subtotal		27,235,000
Contingencies (25%)	0.25	6,808,750
E&D	0.12	4,085,250
S&A	0.1	3,404,375
Subtotal		41,533,375
TOTAL		51,620,668
TOTAL (ROUNDED)		51,621,000

Madisonville Area

TABLE 1

Madisonville Hurricane Protection Alignment
100-year Protection, Forced Drainage

ITEM		UNIT	COST $
CONSTRUCTION*			
Levees (1st Lift)			2,518,168
Relocations			97,500
Subtotal			2,615,668
Contingencies (25%)		0.25	653,917
E&D		0.1	326,959
S&A		0.1	326,959
Subtotal			3,923,502
Levees (2nd Lift)			1,415,695
Relocations			106,500
Subtotal			1,522,1
Contingencies (25%)		0.25	380,5
E&D		0.1	190,274
S&A		0.1	190,274
Subtotal			2,283,293
Pump Station--125 cfs	0.25		380,000
Floodwalls and Gates			3,808,900
Culverts			1,520,000
Subtotal			5,708,900
Contingencies (25%)		0.25	1,427,225
E&D		0.12	856,335
S&A		0.1	713,613
Subtotal			8,706,073
TOTAL			14,912,867
TOTAL (ROUNDED)			14,910,000

* Excludes Real Estate Costs

TABLE 2

Madisonville Hurricane Protection Alignment
100-Year Protection-- Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION*		
Levees (1st Lift)		2,518,168
Relocations		97,500
Subtotal		2,615,668
Contingencies (25%)	0.25	653,917
E&D	0.1	326,959
S&A	0.1	326,959
Subtotal		3,923,502
Levees (2nd Lift)		1,415,695
Relocations		106,500
Subtotal		1,522,195
Contingencies (25%)	0.25	380,549
E&D	0.1	190,274
S&A	0.1	190,274
Subtotal		2,283,293
Floodwalls and Gates		3,808,900
Culverts		1,520,000
Subtotal		5,328,900
Contingencies (25%)	0.25	1,332,225
E&D	0.12	799,335
S&A	0.1	666,113
Subtotal		8,126,573
TOTAL		14,333,367
TOTAL (ROUNDED)		14,330,000

* Excludes Real Estate Costs

TABLE 3

Madisonville Hurricane Protection Alignment
SPH Protection, Forced Drainage

ITEM		UNIT	COST $
CONSTRUCTION*			
Levees (1st Lift)			3,113,878
Relocations			106,500
Subtotal			3,220,378
Contingencies (25%)		0.25	805,095
E&D		0.1	402,547
S&A		0.1	402,547
Subtotal			4,830,567
Levees (2nd Lift)			2,239,924
Relocations			117,300
Subtotal			2,357,224
Contingencies (25%)		0.25	589,306
E&D		0.1	294,65[illegible]
S&A		0.1	294,[illegible]
Subtotal			3,535,8[illegible]
Pump Station--125 cfs	0.25		400,000
Floodwalls and Gates			3,927,600
Culverts			1,600,000
Subtotal			5,927,600
Contingencies (25%)		0.25	1,481,900
E&D		0.12	889,140
S&A		0.1	740,950
Subtotal			9,039,590
TOTAL			17,405,993
TOTAL (ROUNDED)			17,410,000

* Excludes Real Estate Costs

TABLE 4

Madisonville Hurricane Protection Alignment
SPH Protection, Gravity Drainage

ITEM	UNIT	COST $
CONSTRUCTION*		
Levees (1st Lift)		3,113,878
Relocations		106,500
Subtotal		3,220,378
Contingencies (25%)	0.25	805,095
E&D	0.1	402,547
S&A	0.1	402,547
Subtotal		4,830,567
Levees (2nd Lift)		2,239,924
Relocations		117,300
Subtotal		2,357,224
Contingencies (25%)	0.25	589,306
E&D	0.1	294,653
S&A	0.1	294,653
Subtotal		3,535,836
Floodwalls and Gates		3,927,600
Culverts		1,600,000
Subtotal		5,527,600
Contingencies (25%)	0.25	1,381,900
E&D	0.12	829,140
S&A	0.1	690,950
Subtotal		8,429,590
TOTAL		16,795,993
TOTAL (ROUNDED)		16,800,000

* Excludes Real Estate Costs

Appendix C
Real Estate Cost Estimates

IDENTIFICATION
NUMBER 10409R

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
ST. TAMMANY PARISH, LOUISIANA

Mandeville & Lewisburg Areas - 100 Yr. Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	28.5	$500	$ 14,250
	Waterbottom	35.2	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	6.2	$63,300	392,460
	Woodland	7.4	$800	5,920
	Woodland/Potential Commercial	2.3	$283,140	651,222
	Woodland/Potential Residential	1.8	$17,424	31,363
	Perpetual Borrow Easement			
	Upper Swamp	47.8	$500	23,900
	Waterbottom	66.8	$0	0
	Waterfront/Potential Residential	4.6	$63,300	291,180
	Woodland	13.4	$800	10,720
	Woodland/Potential Commercial	4.2	$283,140	1,189,188
	Woodland/Potential Residential	7.5	$17,424	130,680
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$2,927,000
(b)	Contingencies 25% (R)			732,000
(c)	Acquisition Costs (46 Tracts)			
	Federal 46 @ $1,250 per tract			58,000
	Non-Federal 46 @ $2,500 per tract			115,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$3,832,000

IDENTIFICATION
NUMBER 10409R

Mandeville & Lewisburg Areas - 100 Yr. Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	28.5	$500	$ 14,250
	Waterbottom	35.2	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	6.2	$63,300	392,460
	Woodland	7.4	$800	5,920
	Woodland/Potential Commercial	2.3	$283,140	651,222
	Woodland/Potential Residential	1.8	$17,424	31,363
	Perpetual Borrow Easement			
	Upper Swamp	41.7	$500	20,850
	Waterfront/Potential Residential	4.6	$63,300	291,180
	Woodland	13.4	$800	10,720
	Woodland/Potential Commercial	4.2	$283,140	1,189,188
	Woodland/Potential Residential	37.4	$17,424	651,658
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$3,445,000
(b)	Contingencies 25% (R)			861,000
(c)	Acquisition Costs (46 Tracts)			
	Federal 46 @ $1,250 per tract			58,000
	Non-Federal 46 @ $2,500 per tract			115,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,479,000

IDENTIFICATION
NUMBER 10409R

Mandeville & Lewisburg Areas - SPH Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	33.5	$500	$ 16,750
	Waterbottom	39.0	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	6.2	$63,300	392,460
	Woodland	9.2	$800	7,360
	Woodland/Potential Commercial	2.7	$283,140	764,478
	Woodland/Potential Residential	2.4	$17,424	41,818
	Perpetual Borrow Easement			
	Upper Swamp	58.5	$500	29,250
	Waterbottom	75.7	$0	0
	Waterfront/Potential Residential	5.1	$63,300	322,830
	Woodland	10.0	$800	8,000
	Woodland/Potential Commercial	4.6	$283,140	1,302,444
	Woodland/Potential Residential	7.9	$17,424	137,650
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$3,209,000
(b)	Contingencies 25% (R)			802,000
(c)	Acquisition Costs (46 Tracts)			
	Federal 46 @ $1,250 per tract			58,000
	Non-Federal 46 @ $2,500 per tract			115,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,184,000

Mandeville & Lewisburg Areas - SPH Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	31.4	$500	$ 15,700
	Waterbottom	40.9	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	6.2	$63,300	392,460
	Woodland	9.2	$800	7,360
	Woodland/Potential Commercial	2.7	$283,140	764,478
	Woodland/Potential Residential	2.4	$17,424	41,818
	Perpetual Borrow Easement			
	Upper Swamp	45.5	$500	22,750
	Waterfront/Potential Residential	5.1	$63,300	322,830
	Woodland	15.0	$800	12,000
	Woodland/Potential Commercial	4.6	$283,140	1,302,444
	Woodland/Potential Residential	45.9	$17,424	799,762
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$3,868,000
(b)	Contingencies 25% (R)			967,000
(c)	Acquisition Costs (46 Tracts)			
	Federal 46 @ $1,250 per tract			58,000
	Non-Federal 46 @ $2,500 per tract			115,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$5,008,000

IDENTIFICATION
NUMBER 10409R

Mandeville Area - 100 Yr. Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	15.0	$500	$ 7,500
	Waterbottom	22.2	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	1.9	$63,300	120,271
	Woodland	0.8	$800	640
	Woodland/Potential Residential	1.8	$17,424	31,363
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	24.8	$500	12,400
	Waterbottom	39.9	$0	0
	Waterfront/Potential Residential	4.6	$63,300	291,180
	Woodland	1.9	$800	1,520
	Woodland/Potential Residential	6.2	$17,424	108,029
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$1,891,000
(b)	Contingencies 25% (R)			473,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$2,424,000

Mandeville Area - 100 Yr. Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	15.0	$500	$ 7,500
	Waterbottom	22.2	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	1.9	$63,300	120,271
	Woodland	0.8	$800	640
	Woodland/Potential Residential	1.8	$17,424	31,363
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	18.7	$500	9,350
	Waterfront/Potential Residential	4.6	$63,300	291,180
	Woodland	1.9	$800	1,520
	Woodland/Potential Residential	27.5	$17,424	479,160
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$2,260,000
(b)	Contingencies 25% (R)			565,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$2,885,000

Mandeville Area - SPH Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	18.4	$500	$ 9,200
	Waterbottom	23.9	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	1.9	$63,300	120,270
	Woodland	1.5	$800	1,200
	Woodland/Potential Residential	2.2	$17,424	38,333
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	28.0	$500	14,000
	Waterbottom	43.0	$0	0
	Waterfront/Potential Residential	5.1	$63,300	322,830
	Woodland	2.6	$800	2,080
	Woodland/Potential Residential	7.4	$17,424	128,938
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$1,955,000
(b)	Contingencies 25% (R)			489,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$2,504,000

Mandeville Area - SPH Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	18.4	$500	$ 9,200
	Waterbottom	23.9	$0	0
	Recreation (Public Land)	6.0	$1,000	6,000
	Waterfront/Potential Residential	1.9	$63,300	120,270
	Woodland	1.5	$800	1,200
	Woodland/Potential Residential	2.2	$17,424	38,333
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	20.0	$500	10,000
	Waterfront/Potential Residential	5.1	$63,300	322,830
	Woodland	2.6	$800	2,080
	Woodland/Potential Residential	31.8	$17,424	554,083
	Improvements			
	Oak Trees (30)			180,000
	Severance Damage			0
	Total (R)			$2,377,000
(b)	Contingencies 25% (R)			594,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$3,031,000

IDENTIFICATION
NUMBER 10409R

Lewisburg Area - 100 Yr. Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	13.5	$500	$ 6,750
	Waterbottom	13.4	$0	0
	Waterfront/Potential Residential	4.3	$63,300	272,190
	Woodland	6.8	$800	5,440
	Woodland/Potential Commercial	2.3	$283,140	651,222
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	23.0	$500	11,500
	Waterbottom	28.8	$0	0
	Woodland	11.5	$800	9,200
	Woodland/Potential Commercial	4.2	$283,140	1,189,188
	Woodland/Potential Residential	1.0	$17,424	17,424
	Improvements			0
	Severance Damage			0
	Total (R)			$3,295,000
(b)	Contingencies 25% (R)			824,000
(c)	Acquisition Costs (36 Tracts)			
	Federal 36 @ $1,250 per tract			45,000
	Non-Federal 36 @ $2,500 per tract			90,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,254,000

Lewisburg Area - 100 Yr. Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	13.5	$500	$ 6,750
	Waterbottom	13.4	$0	0
	Waterfront/Potential Residential	4.3	$63,300	272,190
	Woodland	6.8	$800	5,440
	Woodland/Potential Commercial	2.3	$283,140	651,222
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	23.0	$500	11,500
	Woodland	11.5	$800	9,200
	Woodland/Potential Commercial	4.2	$283,140	1,189,188
	Woodland/Potential Residential	15.0	$17,424	261,360
	Improvements			0
	Severance Damage			0
	Total (R)			$3,539,000
(b)	Contingencies 25% (R)			885,000
(c)	Acquisition Costs (36 Tracts)			
	Federal 36 @ $1,250 per tract			45,000
	Non-Federal 36 @ $2,500 per tract			90,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,559,000

IDENTIFICATION
NUMBER 10409R

Lewisburg Area - SPH Hurricane Protection

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	15.1	$500	$ 7,550
	Waterbottom	15.3	$0	0
	Waterfront/Potential Residential	4.3	$63,300	272,190
	Woodland	7.7	$800	6,160
	Woodland/Potential Commercial	2.7	$283,140	764,478
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	30.5	$500	15,250
	Waterbottom	32.7	$0	0
	Woodland	7.4	$800	5,920
	Woodland/Potential Commercial	4.6	$283,140	1,302,444
	Woodland/Potential Residential	1.0	$17,424	17,424
	Improvements			0
	Severance Damage			0
	Total (R)			$3,524,000
(b)	Contingencies 25% (R)			881,000
(c)	Acquisition Costs (36 Tracts)			
	Federal 36 @ $1,250 per tract			45,000
	Non-Federal 36 @ $2,500 per tract			90,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,540,000

Lewisburg Areas - SPH Hurricane Protection (Truck Haul)

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Upper Swamp	15.1	$500	$ 7,550
	Waterbottom	15.3	$0	0
	Waterfront/Potential Residential	4.3	$63,300	272,190
	Woodland	7.7	$800	6,160
	Woodland/Potential Commercial	2.7	$283,140	764,478
	Commercial	4.0	$283,140	1,132,560
	Perpetual Borrow Easement			
	Upper Swamp	25.5	$500	12,750
	Woodland	12.4	$800	9,920
	Woodland/Potential Commercial	4.6	$283,140	1,302,444
	Woodland/Potential Residential	19.0	$17,424	331,056
	Improvements			0
	Severance Damage			0
	Total (R)			$3,839,000
(b)	Contingencies 25% (R)			960,000
(c)	Acquisition Costs (36 Tracts)			
	Federal 36 @ $1,250 per tract			45,000
	Non-Federal 36 @ $2,500 per tract			90,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$4,934,000

ASSUMPTIONS

1. The levee along Lake Pontchartrain on the Mandeville and Lewisburg areas will be constructed mostly in the water. Only 32 feet of the width of the levee will be constructed over waterfront land.

2. The area for the truck haul borrow is assumed to be located in the vicinity of Township 7 South, Range 11 East, Sections 40 and 41. The land is woodland/potential residential. However, Levees Section has not selected a specific site; if at the time of selection the site is not in the aforementioned area, a revised cost estimate may be necessary.

3. According to Levees Section, no improvements will be disturbed for the construction of the levees or of the floodwalls along North Causeway Boulevard.

4. The land classes and acreages included in this report were provided by Mr. Scott Clark of CELMN-PD-RE.

Judith Y. Gutierrez
Judith Y. Gutiérrez
Appraiser
April 9, 1991

Approved:

Warren E. deSambourg
Warren E. deSambourg
Chief, Appraisal Branch
April 9, 1991

IDENTIFICATION
NUMBER 10503R

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
WESTERN SLIDELL HURRICANE PROTECTION PLANS
ST. TAMMANY PARISH, LOUISIANA

Plan A - 100 Yrs.

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Marsh	54.2	$250	$13,550
	Wet Woodland	46.1	$500	23,050
	Perpetual Borrow Easement			
	Marsh	77.3	$250	19,325
	Wet Woodland	68.0	$500	34,000
	Improvements			0
	Severance Damage			0
	Total (R)			$90,000
(b)	Contingencies 25% (R)			23,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$173,000

IDENTIFICATION
NUMBER 10503R

Plan A - SPH

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Marsh	66.0	$250	$16,500
	Wet Woodland	57.3	$500	28,650
	Perpetual Borrow Easement			
	Marsh	92.1	$250	23,025
	Wet Woodland	79.3	$500	39,650
	Improvements			0
	Severance Damage			0
	Total (R)			$108,000
(b)	Contingencies 25% (R)			27,000
(c)	Acquisition Costs (10 Tracts)			
	Federal 10 @ $2,000 per tract			20,000
	Non-Federal 10 @ $4,000 per tract			40,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$195,000

Plan B - 100 Yrs.

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Marsh	40.4	$250	$10,100
	Wet Woodland	64.8	$500	32,400
	Perpetual Borrow Easement			
	Marsh	57.8	$250	14,450
	Wet Woodland	94.9	$500	47,450
	Improvements			0
	Severance Damage			0
	Total (R)			$104,000
(b)	Contingencies 25% (R)			26,000
(c)	Acquisition Costs (13 Tracts)			
	Federal 13 @ $2,000 per tract			26,000
	Non-Federal 13 @ $4,000 per tract			52,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$208,000

IDENTIFICATION
NUMBER 10503R

Plan B - SPH

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Easement			
	Marsh	48.3	$250	$12,075
	Wet Woodland	80.2	$500	40,100
	Perpetual Borrow Easement			
	Marsh	68.7	$250	17,175
	Wet Woodland	110.8	$500	55,400
	Improvements			0
	Severance Damage			0
	Total (R)			$125,000
(b)	Contingencies 25% (R)			31,000
(c)	Acquisition Costs (13 Tracts)			
	Federal 13 @ $2,000 per tract			26,000
	Non-Federal 13 @ $4,000 per tract			52,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$234,000

Judith Y. Gutiérrez
Judith Y. Gutiérrez
Appraiser
May 3, 1991

Approved:

Joseph G. Kopec
Joseph G. Kopec
Review Appraiser
May 3, 1991

IDENTIFICATION
NUMBER 00523

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
WESTERN SLIDELL AND SCHNEIDER CANAL HURRICANE PROTECTION PLANS
SLIDELL, ST. TAMMANY PARISH, LOUISIANA

100-Year Alternative (With I-Wall Levee)

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Right-of-way Wet Woodland	61.0	$500	$30,500
	Perpetual Levee Right-of-way Marsh	17.0	250	4,250
	Perpetual I-Wall/Levee W/in existing road/railroad r/w*	16.5	0	0
	Interstate Median Right-of-way W/in existing road right-of-way	18.0	0	0
	Perpetual Borrow Easement Wet Woodland	6.25	500	3,125
	Perpetual Drainage Structure Right-of-way Waterbottom	1.0	0	0
	Perpetual Floodgate Right-of-way W/in existing road right-of-way	0.25	0	0
	Improvements			0
	Severance Damage			0
	Total (R)			$38,000
(b)	Contingencies 25% (R)			10,000
(c)	Acquisition Costs (5 Tracts)			
	Non-Federal 5 @ 4,000 per tract			20,000
	Federal 5 @ 2,000 per tract			10,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Cost (R)			$78,000

* A floodgate will be built at the intersection of the I-Wall and the train station.

100-Year Alternative (Without I-Wall Levee)

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Right-of-way Wet Woodland	61.0	$500	$30,500
	Perpetual Levee Right-of-way Marsh	17.0	250	4,250
	Interstate Median Right-of-way W/in existing road right-of-way	18.0	0	0
	Perpetual Borrow Easement Wet Woodland	6.25	500	3,125
	Perpetual Drainage Structure Right-of-way Waterbottom	1.0	0	0
	Perpetual Floodgate Right-of-way W/in existing road right-of-way	0.25	0	0
	Improvements			0
	Severance Damage			0
	Total (R)			$38,000
(b)	Contingencies 25% (R)			10,000
(c)	Acquisition Costs (5 Tracts)			
	Non-Federal 5 @ 4,000 per tract			20,000
	Federal 5 @ 2,000 per tract			10,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Cost (R)			$78,000

Judith Y. Gutierrez
Judith Y. Gutierrez
Appraiser
May 23, 1991

Approved:

Joseph G. Kopec
Joseph G. Kopec
Review Appraiser
May 23, 1991

IDENTIFICATION
NUMBER 91024

REAL ESTATE COST ESTIMATE
SCHNEIDER CANAL
SLIDELL, ST. TAMMANY PARISH, LOUISIANA

100-Year Alternative

Estimate of Costs (Date of Value - February 1989)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Right-of-way wooded (wet)	61.0	$1,500	$91,500
	Perpetual Levee Right-of-way marsh	17.0	500	8,500
	Perpetual I-Wall/Levee w/in existing road/railroad r/w*	16.5	0	0
	Interstate Median Right-of-way w/in existing road right-of-way	18.0	0	0
	Perpetual Borrow Easement wooded (wet)	6.25	1,500	9,375
	Perpetual Drainage Structure Right-of-way waterbottom	1.0	0	0
	Perpetual Floodgate Right-of-way w/in existing road right-of-way	0.25	0	0
	Improvements			0
	Severance Damage			0
	Total (R)			$109,000
(b)	Contingencies 25% (R)			27,000
(c)	Acquisition Costs (5 Tracts)			
	Non-Federal 5 @ 2000 per tract			10,000
	Federal 5 @ 1000 per tract			5,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Cost (R)			$151,000

* A floodgate will be built at the intersection of the I-Wall and the train station.

100-Year Alternative

Estimate of Costs (Date of Value - October 1989)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Levee Right-of-way wooded (wet)	61.0	$1,500	$91,500
	Perpetual Levee Right-of-way marsh	17.0	500	8,500
	Perpetual I-Wall/Levee w/in existing road/railroad r/w*	16.5	0	0
	Interstate Median Right-of-way w/in existing road right-of-way	18.0	0	0
	Perpetual Borrow Easement wooded (wet)	6.25	1,500	9,375
	Perpetual Drainage Structure Right-of-way waterbottom	1.0	0	0
	Perpetual Floodgate Right-of-way w/in existing road right-of-way	0.25	0	0
	Improvements			0
	Severance Damage			0
	Total (R)			$109,000
(b)	Contingencies 25% (R)			27,000
(c)	Acquisition Costs (5 Tracts)			
	Non-Federal 5 @ 4000 per tract			20,000
	Federal 5 @ 2000 per tract			10,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Cost (R)			$166,000

* A floodgate will be built at the intersection of the I-Wall and the train station.

Judith Y. Gutierrez
JUDITH Y. GUTIERREZ
Appraiser
October 24, 1989

Approved:

Warren E. deSambourg
WARREN E. deSAMBOURG
Review Appraiser
October 24, 1989

IDENTIFICATION
NUMBER 10530R

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
MILE BRANCH AND LATERAL "A" CHANNEL IMPROVEMENTS
COVINGTON, ST. TAMMANY PARISH, LOUISIANA

MILE BRANCH - 25 YEAR PLAN

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Channel Right-of-way Within Existing Channel Right-of-Way	30.9	$0	$ 0
	Perpetual Disposal Easement*			
	Upper Swamp	2.7	$500	1,350
	Wet Woodland	10.1	$800	8,080
	Woodland/Potential Residential	7.8	$26,136	203,861
	Woodland/Potential Residential	6.9	$15,246	105,197
	Improvements			0
	Severance Damage			0
	Total (R)			$318,000
(b)	Contingencies 25% (R)			80,000
(c)	Acquisition Costs (50 Tracts)			
	Federal 50 @ $1,250 per tract			63,000
	Non-Federal 50 @ $2,500 per tract			125,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$586,000

* No improvements will be affected by the project.

IDENTIFICATION
NUMBER 10530R

MILE BRANCH - 100 YEAR PLAN

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Channel Right-of-way			
	Within Existing Channel Right-of-Way	31.7	$0	$ 0
	Perpetual Disposal Easement*			
	Upper Swamp	2.7	$500	1,350
	Wet Woodland	10.1	$800	8,080
	Woodland/Potential Residential	7.8	$26,136	203,861
	Woodland/Potential Residential	6.9	$15,246	105,197
	Improvements			0
	Severance Damage			0
	Total (R)			$318,000
(b)	Contingencies 25% (R)			80,000
(c)	Acquisition Costs (50 Tracts)			
	Federal 50 @ $1,250 per tract			63,000
	Non-Federal 50 @ $2,500 per tract			125,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$586,000

* No improvements will be affected by the project.

IDENTIFICATION
NUMBER 10530R

LATERAL "A" - 25 YEAR PLAN

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Channel Right-of-way Within Existing Channel Right-of-Way	10.5	$0	$ 0
	Perpetual Disposal Easement*			
	Wet Woodland	5.6	$800	4,480
	Woodland/Potential Residential	4.4	$26,136	114,998
	Improvements			0
	Severance Damage			0
	Total (R)			$119,000
(b)	Contingencies 25% (R)			30,000
(c)	Acquisition Costs (25 Tracts)			
	Federal 25 @ $1,500 per tract			38,000
	Non-Federal 25 @ $3,000 per tract			75,000
(d)	PL 91-646			
(e)	Total Estimated Real Estate Costs (R)			$262,000

* No improvements will be affected by the project.

IDENTIFICATION
NUMBER 10530R

LATERAL "A" - 100 YEAR PLAN

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Channel Right-of-way Within Existing Channel Right-of-Way	10.5	$0	$ 0
	Perpetual Disposal Easement*			
	Wet Woodland	0.7	$800	560
	Woodland/Potential Residential	4.4	$26,136	114,998
	Improvements			0
	Severance Damage			0
	Total (R)			$116,000
(b)	Contingencies 25% (R)			29,000
(c)	Acquisition Costs (25 Tracts)			
	Federal 25 @ $1,500 per tract			38,000
	Non-Federal 25 @ $3,000 per tract			75,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$258,000

* No improvements will be affected by the project.

Judith Y. Gutiérrez
Judith Y. Gutiérrez
Appraiser
May 30, 1991

Approved:

Warren E. deSambourg
Warren E. deSambourg
Chief, Appraisal Branch
May 30, 1991

IDENTIFICATION
NUMBER 10426R

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
BAYOU CHINCHUBA CHANNEL DIVERSION PLANS
ST. TAMMANY PARISH, LOUISIANA

Bayou Chinchuba Channel Diversion, Arch Pipe Plan

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Drainage Easement*			
	Potential Commercial	3.37	$283,140*75%	$715,636
	Existing Road Right-of-way	1.93**	$0	0
	Temporary Construction Easement (2 Yrs.)			
	Potential Commercial	1.26	$283,140*40%	142,703
	Improvements			0
	Severance Damage			0
	Total (R)			$858,000
b)	Contingencies 25% (R)			215,000
(c)	Acquisition Costs (7 Tracts)			
	Federal 7 @ $2,000 per tract			14,000
	Non-Federal 7 @ $4,000 per tract			28,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$1,115,000

* The drainage easement is located underground; the area will be resurfaced after construction is completed.

** From Station 0+00 to Station 28+00, a 30-foot wide strip of the easement is located under the service road right-of-way, and no value has been attributed to it.

According to Planning Division, no improvements will be disturbed for the construction of this project.

IDENTIFICATION
NUMBER 10426R

ayou Chinchuba Channel Diversion, Culvert Plan

Estimate of Costs (Date of Value - April 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Underground Easement*			
	Potential Commercial	2.74	$283,140*75%	$581,853
	Existing Road Right-of-way	1.93**	$0	0
	Temporary Construction Easement (2 Yrs.)			
	Potential Commercial	1.26	$283,140*40%	142,703
	Improvements			0
	Severance Damage			0
	Total (R)			$725,000
(b)	Contingencies 25% (R)			181,000
(c)	Acquisition Costs (7 Tracts)			
	Federal 7 @ $2,000 per tract			14,000
	Non-Federal 7 @ $4,000 per tract			28,000
d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$948,000

* The drainage easement is located underground; the area will be resurfaced after construction is completed.

** From Station 0+00 to Station 28+00, a 30-foot wide strip of the easement is located under the service road right-of-way, and no value has been attributed to it.

According to Planning Division, no improvements will be disturbed for the construction of this project.

Judith Y. Gutiérrez
Judith Y. Gutiérrez
Appraiser
April 26, 1991

Approved:

Joseph G. Kopec
Joseph G. Kopec
Review Appraiser
April 26, 1991

IDENTIFICATION
NUMBER 10514R

REAL ESTATE COST ESTIMATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS
RECONNAISSANCE STUDY
PONCHATOULA CREEK CHANNEL IMPROVEMENT PLAN
HAMMOND, TANGIPAHOA PARISH, LOUISIANA

Estimate of Costs (Date of Value - May 1991)

		Acres	Unit Value	Total Value
(a)	Lands and Damages			
	Perpetual Channel Right-of-way Woodland/Channel Banks	21.0	$800	$ 16,800
	Perpetual Disposal Easement* Woodland**	44.59	$800	35,672
	Improvements			0
	Severance Damage			0
	Total (R)			$ 52,000
(b)	Contingencies 25% (R)			13,000
(c)	Acquisition Costs (50 Tracts)			
	Federal 50 @ $1,250 per tract			63,000
	Non-Federal 50 @ $2,500 per tract			125,000
(d)	PL 91-646			0
(e)	Total Estimated Real Estate Costs (R)			$253.000

* No improvements will be affected by the project. Those areas along the channel which have improvements have been designated as no work areas.

** This area is considered part of the Ponchatoula Creek Floodway; therefore, construction of buildings is prohibited. The parish of Tangipahoa has requested that FEMA reevaluate this area. If the designation of the area changes in the future, a current cost estimate should be prepared at that time.

Judith Y. Gutierrez
Judith Y. Gutierrez
Appraiser
May 14, 1991

Approved:

Joseph G. Kopec
Joseph G. Kopec
Review Appraiser
May 14, 1991

Appendix D
U.S. Fish and Wildlife Service
Planning Aid Letter

United States Department of the Interior
FISH AND WILDLIFE SERVICE
825 Kaliste Saloom Road
Brandywine Bldg. II, Suite 102
Lafayette, Louisiana 70508

June 24, 1991

Colonel Michael Diffley
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160-0267

Dear Colonel Diffley:

Reference is made to the "Tangipahoa, Tchefuncte, and Tickfaw Rivers, Louisiana" Flood Control Study. The Fish and Wildlife Service has prepared the attached planning-aid report to assist your staff in the preparation of a Reconnaissance Report for that study. The attached report does not fulfill our responsibilities under Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

We will continue to work closely with your staff in an effort to develop feasible, ecologically sound flood control measures for the study area. Please keep Ms. Terry Rabot of this office advised as the study progresses.

Sincerely yours,

David W. Frugé

David W. Frugé
Field Supervisor

cc: FWS, Atlanta, GA (AWE/ES)
EPA, Dallas, TX
LA Dept. of Wildlife and Fisheries, Baton Rouge, LA
LA Dept. of Natural Resources (CMD), Baton Rouge, LA
NMFS, Baton Rouge, LA

PLANNING-AID REPORT

ON

TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS, LOUISIANA

U.S. Fish and Wildlife Service
Fish and Wildlife Enhancement
Lafayette, Louisiana

June 1991

PLANNING-AID REPORT

ON

TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS, LOUISIANA

Prepared by
Theresa E. Rabot
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Fish and Wildlife Enhancement
Lafayette, Louisiana

June 1991

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INTRODUCTION

The New Orleans District, Corps of Engineers (Corps), is conducting a reconnaissance study of flooding problems in the Tangipahoa, Tchefuncte, and Tickfaw River Basins in Livingston, Tangipahoa, and St. Tammany Parishes, Louisiana. The study was authorized by a resolution adopted by the Public Works and Transportation Committee of the U.S. House of Representatives in August 1984. This report provides: 1) a description of fish and wildlife resources of the study area, 2) a discussion of fish- and wildlife-related problems, opportunities, and planning objectives, 3) a preliminary analysis of the effects of project alternatives on fish and wildlife resources, 4) estimates of data and funding needed for feasibility grade input by the Fish and Wildlife Service (Service), and 5) preliminary conservation recommendations. This report is provided on a planning-aid basis and does not constitute the report of the Department of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act.

DESCRIPTION OF THE STUDY AREA

The study area includes the central and eastern portions of the Lake Pontchartrain basin of southeastern Louisiana (Figure 1). The primary drainage basins within this portion of the Lake Pontchartrain basin are the Tangipahoa and Tchefuncte Rivers. The study area also includes the drainage basins of Bayou Chinchuba, Bayou Lacombe, Bayou Liberty, Bayou Bonfouca, and the Tickfaw River. Except for the Tickfaw River, these are smaller waterways located between the Tchefuncte River and Pearl River; they drain directly into Lake Pontchartrain.

DESCRIPTION OF FISH AND WILDLIFE RESOURCE CONDITIONS

The Tangipahoa and Tchefuncte Rivers originate in the high Pleistocene Terrace where the terrain is steep to gently rolling, streambanks are steep, and floodplains narrow. As the rivers flow south through the Prairie Terrace, the terrain becomes relatively flat but streambanks remain steep and the floodplains narrow. Near the mouths of the rivers, the floodplains widen as the rivers flow through alluvial deposits from the Mississippi River. As the slopes of the rivers gradually diminish they become tidally influenced. Tidal influence on these rivers extends through the Prairie Terrace and as far north as Covington on the Tchefuncte River.

The southern portion of the study area contains extensive wetlands; wetlands are usually found on alluvial deposits. A narrow band of fresh to brackish marsh borders the north shore of Lake Pontchartrain from Madisonville to Slidell. Fresh marsh is characterized by a salinity range of less than 0.5 parts per thousand. Vegetation

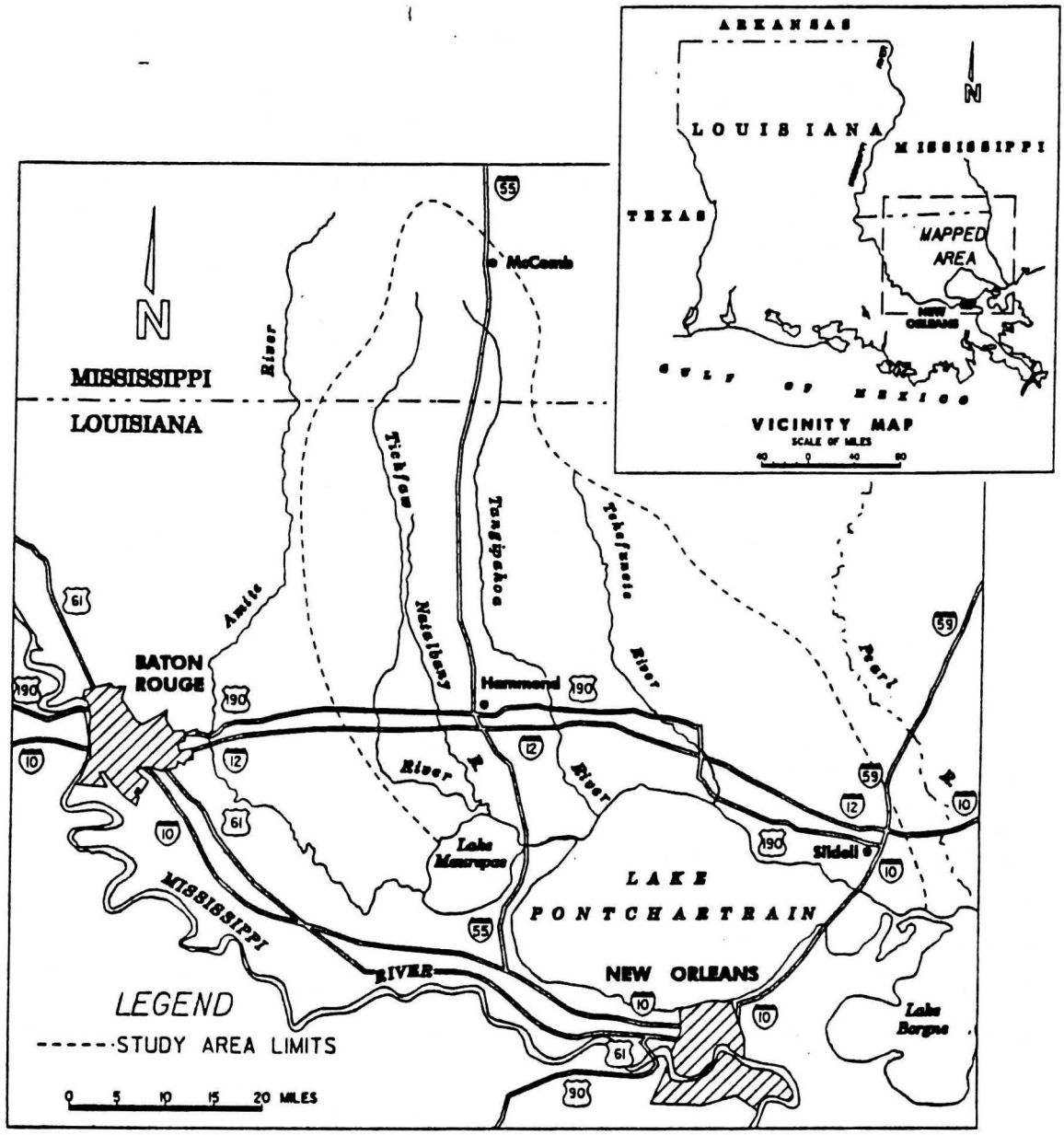

Figure 1. Study area for Tangipahoa, Tchefuncte, and Tickfaw Rivers, Louisiana, Flood Control Study

commonly found in fresh marsh includes bulltongue, sawgrass, maidencane, cattail, smartweed, alligatorweed, and spikerush. Intermediate marsh is characterized by a salinity range of 0.5 to 5.0 parts per thousand. Common species found in intermediate marsh include saltmeadow cordgrass, cyperus, bulltongue, southern bulrush, and common reed. Brackish marsh is characterized by a salinity range of 5.0 to 18.0 parts per thousand. Vegetation common to this marsh type includes saltmeadow cordgrass, Olney's bulrush, leafy bulrush, saltgrass, saltmarsh cordgrass, and black rush.

From Madisonville west to the Tickfaw River, forested wetlands, mainly swamps, occur on the Mississippi River alluvial deposits bordering Lake Pontchartrain and Lake Maurepas. Within the study area, wooded swamps also occur within the lower areas adjacent to bayous and rivers. Bald cypress and water tupelo are the dominant tree species in the swamps.

As the frequency of flooding decreases away from Lakes Pontchartrain and Maurepas, bottomland hardwoods become the predominant cover type. Bottomland hardwoods are intermittently flooded wooded areas; this cover type is also commonly found along the bayous and rivers in the study area. Predominant tree species present in bottomland hardwood forests include water oak, overcup oak, Nuttall oak, swamp chestnut oak, sugarberry, sycamore, red maple, green ash, bitter pecan, and sweetgum.

Riparian is a term used to describe an area immediately adjacent to a stream, bayou, river, or lake. Wooded swamp and bottomland hardwood cover types may both be found in the riparian zone. Riparian habitat is usually defined and evaluated as a separate cover type because of its specific values to fish and wildlife.

The upper portion of the study area once supported predominately longleaf and slash pine. These forests were cleared during the late 1800's and early 1900's. Partially because of poor sandy soils, these forests did not readily regenerate and supported only wiregrass, sedges, gallberry, and wax myrtle. Today, commercial forestry interests have replanted much of the area to loblolly and slash pine. Longleaf pine has regenerated on the better soils. Mixed pine/hardwoods and bottomland hardwoods are present in the river and stream bottoms. In addition to pine and pine/hardwood communities, pine flatwoods are found in the Prairie Terrace portion of the study area. The pine flatwoods are wetlands with acidic and often nutrient-poor soils and a high water table. Vegetation present in these areas include longleaf, slash, loblolly, and spruce pine, water oak, sweetbay, red maple, sweetgum, and black gum.

Pine savannahs are also found within the study area. Historically, pine savannahs burned regularly, maintaining a grassland state with scattered longleaf pine and thick herbaceous ground cover. Plant species diversity in pine savannahs is extremely high and many of the species in flatwoods are endemic to that community. When the

frequency of fire is reduced, slash pine, sweet bay, black gum, live oak, blackjack oak, and wax myrtles will invade pine savannahs. The great diversity of herbaceous vegetation found in these areas includes broomsedges, bluestem, panic grasses, three-awn grasses, toothache grass, plume grasses, jointgrasses, beak-rushes, umbrella grasses, pitcher plants, sundews, and a number of orchid species.

The fresh and low-salinity waters of the study area, including area streams and rivers, support many commercially and recreationally important fishes and shellfishes. Freshwater sport fishes include largemouth bass, yellow bass, black crappie, white crappie, bluegill, redear sunfish, spotted sunfish, warmouth, channel catfish, flathead catfish, and blue catfish. Blue catfish, flathead catfish, channel catfish, yellow bullhead, freshwater drum, bowfin, carp, buffaloes, and gars are the primary freshwater fishes of commercial importance.

The low-to-moderate salinity waters and marshes of the study area also provide habitat for many estuarine-dependent fishes and shellfishes. Some species are permanent residents while others are present only during early life stages. The latter species utilize the highly productive, low-to-moderate salinity portions of the study area as nursery habitat, moving to more saline waters as they mature. These include southern flounder, sand seatrout, Atlantic croaker, black drum, red drum, striped mullet, Gulf menhaden, blue crab, and white shrimp. Decaying plant material (detritus) is carried by surface runoff and tidal action from the study area wetlands into the adjacent estuarine waters, thereby substantially contributing to the detritus-based food web that supports a high level of estuarine-dependent finfish and shellfish productivity.

The study area marshes provide habitat for a number of wildlife species. Migratory waterfowl including mallard, gadwall, American widgeon, green-winged teal, shoveler, pintail, mottled duck and lesser scaup utilize the study area. Wading birds expected to occur in the marshes of the study area include great egret, great blue heron, Louisiana heron, green-backed heron, and white ibis. Pied-billed grebe, black-necked stilt, and common snipe are also present. Mammals expected to occur in the marshes of the study area include white-tailed deer, swamp rabbit, muskrat, nutria, raccoon, river otter, mink, and opossum.

The fresh to brackish marshes which border Lake Pontchartrain also provide floodwater storage. In addition, these marshes help to filter runoff and sewage discharge from residential developments located along the north shore that are not part of any municipal wastewater treatment system. Water quality deterioration in the Lake Pontchartrain Basin is also at least partially blamed on the loss of that basin's wetlands and their associated waste-assimilation capacity.

Riparian and forested portions of the study area provide valuable foraging and breeding habitat to a variety of migratory birds such as

warblers, wrens, woodpeckers, vireos, summer tanagers, and kinglets. Wood ducks breed in riparian zones and adjacent bottomland hardwood forests and cypress swamps then utilize the vegetated portions of the channels and flooded swamps for brood-rearing habitat. Raptors such as red-shouldered hawks, Mississippi kites, barred owls, screech owls, and great horned owls nest and forage in forested tracts within the study area. Eastern cottontail, swamp rabbit, gray squirrel, fox squirrel, white-tailed deer, raccoon, opossum, and mink are common to abundant in riparian and forested cover types.

Forested wetlands of the study area also provide floodwater storage and perform important water quality functions such as reduction of excessive dissolved nutrient levels and other pollutants, and removal of suspended sediments. Riparian zones are particularly valuable as travel corridors and other habitats for wildlife, and also contribute to fishery resources through detrital input, water shading, and as a source of limbs and other debris that provide instream cover.

Mixed pine/hardwood habitats provide moderate to high value habitat for game species such as white-tailed deer, squirrel, turkey, Eastern cottontail, mourning dove, bobwhite, and American woodcock. They also provide habitat for a number of songbirds and raptors. Pine flatwoods and pine savannahs provide low to moderate habitat for the same species.

Federally endangered species present within the study area include the bald eagle (nesting and foraging) and the red-cockaded woodpecker (nesting and foraging). The gopher tortoise is a Federally threatened species present in the study area. The Gulf of Mexico sturgeon, a proposed threatened species, may be present in the Tangipahoa, Tchefuncte, Tickfaw, Amite, and Pearl Rivers.

FISH- AND WILDLIFE-RELATED PROBLEMS, OPPORTUNITIES, AND PLANNING OBJECTIVES

The major fish and wildlife resource concerns in the project area include the loss or degradation of wetlands and riparian habitats and the associated reduction of floodwater storage capacity, increased floodplain development, urban expansion, subsidence of coastal marshes, and shoreline erosion. To ensure that fish and wildlife resources receive equal consideration, the Service recommends that the following objectives be adopted as integral components of the planning process:

1. Select alternatives, including non-structural alternatives, that minimize impacts to important fish and wildlife habitats, including marsh, forested wetlands, and riparian zones.

2. Limit hurricane protection to existing urban developments; hurricane protection levees should follow the wetlands/nonwetland interface as closely as possible.

3. Develop a sound floodplain management plan which utilizes existing wetlands for floodwater storage.

4. Avoid adverse impacts to threatened and endangered species and their habitats.

5. Provide full replacement of all unavoidable project-related losses of significant fish and wildlife habitat.

ALTERNATIVES UNDER CONSIDERATION

The Corps has identified several alternatives that would reduce flooding in the study area. Several of these alternatives involve drainage improvements; the others involve hurricane protection. Alternatives considered are listed below:

1. Bayou Chinchuba Drainage Improvements - This plan involves diverting Bayou Chinchuba into Lake Pontchartrain via two culverts placed just east of Causeway Boulevard in Mandeville (Figure 2). The proposed culverts would extend north from the lake approximately 6,000 feet. Approximately 20 to 30 percent of Bayou Chinchuba's flow would be diverted. The culverts and associated sluice gates would be operated during hurricanes and other severe storms.

2. Ponchatoula Creek Channel Improvements - Ponchatoula Creek is located in Tangipahoa Parish, north of Hammond (Figure 3). The proposed work includes deepening and widening the creek for 2.6 miles from its northernmost confluence with Yellow Water River to just north of U.S. Highway 190. Material dredged from the creek would be deposited on both banks.

3. Tchefuncte River Diversion - This alternative involves diverting flows from the Tchefuncte River to the Black River by constructing a 6-mile channel from the Tchefuncte River just south of U.S. Highway 190 to the Black River (Figure 4). Excavated material would be deposited on the banks of the diversion channel. A diversion control structure would be placed at the Tchefuncte River to control flows into the diversion channel and Tchefuncte River. Levees would be constructed on both sides of the channel beginning at the 24-foot contour, e.g., the lower reach of the channel.

4. Mile Branch Channel Improvements and Lateral "A" Channel Improvements - This plan calls for enlargement of two drainage channels in Covington (Figure 5). Miles Branch would be enlarged for two miles; Lateral "A" would be enlarged for approximately 1 mile. Material dredged would be deposited on both sides of the waterways. The Corps is examining both 25-year and 200-year levels of protection.

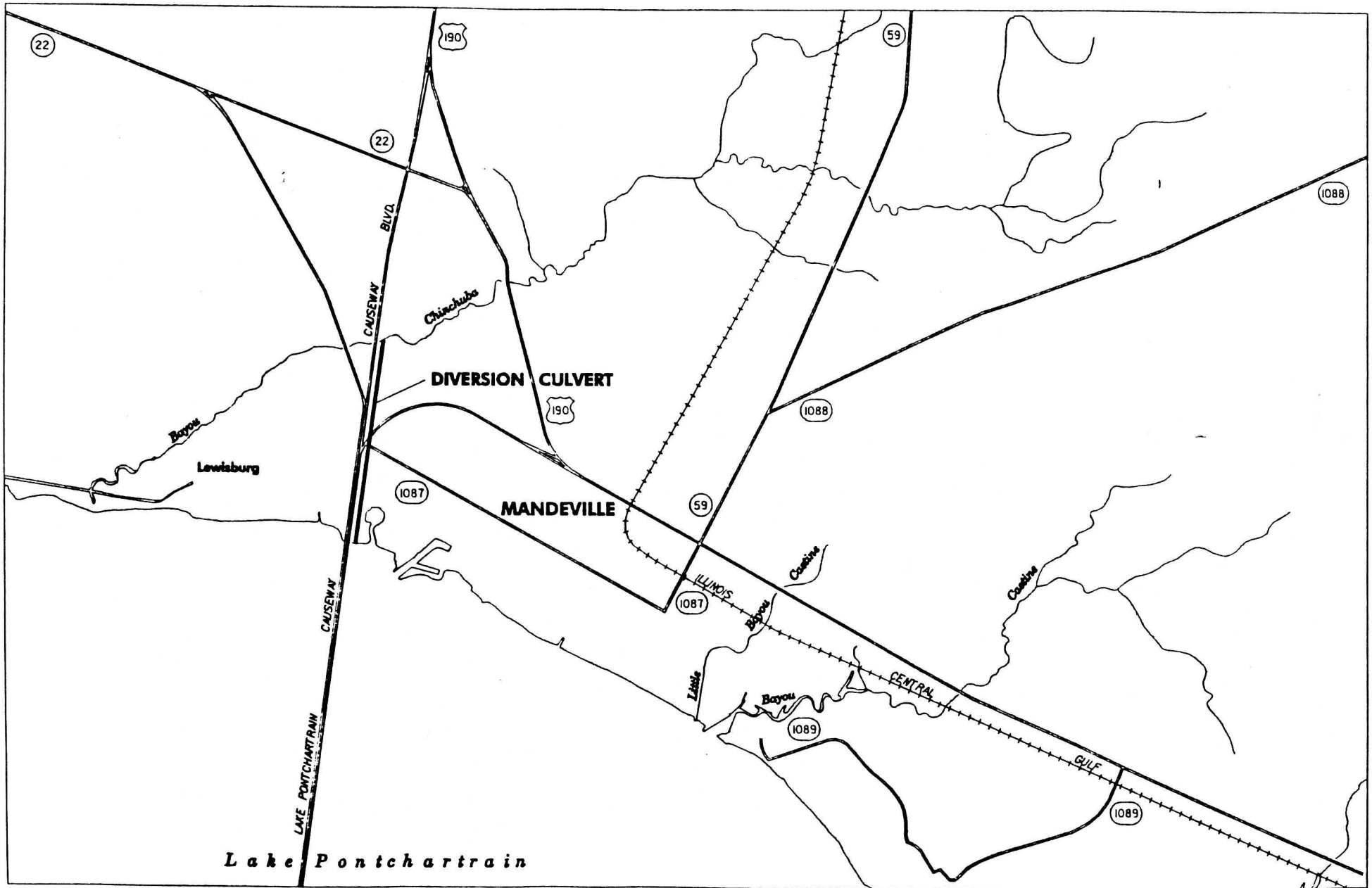

Figure 2. Bayou Chinchuba Drainage Improvements

0 1/2 Mile

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

BAYOU CHINCHUBA CHAN[illegible]IVERSION

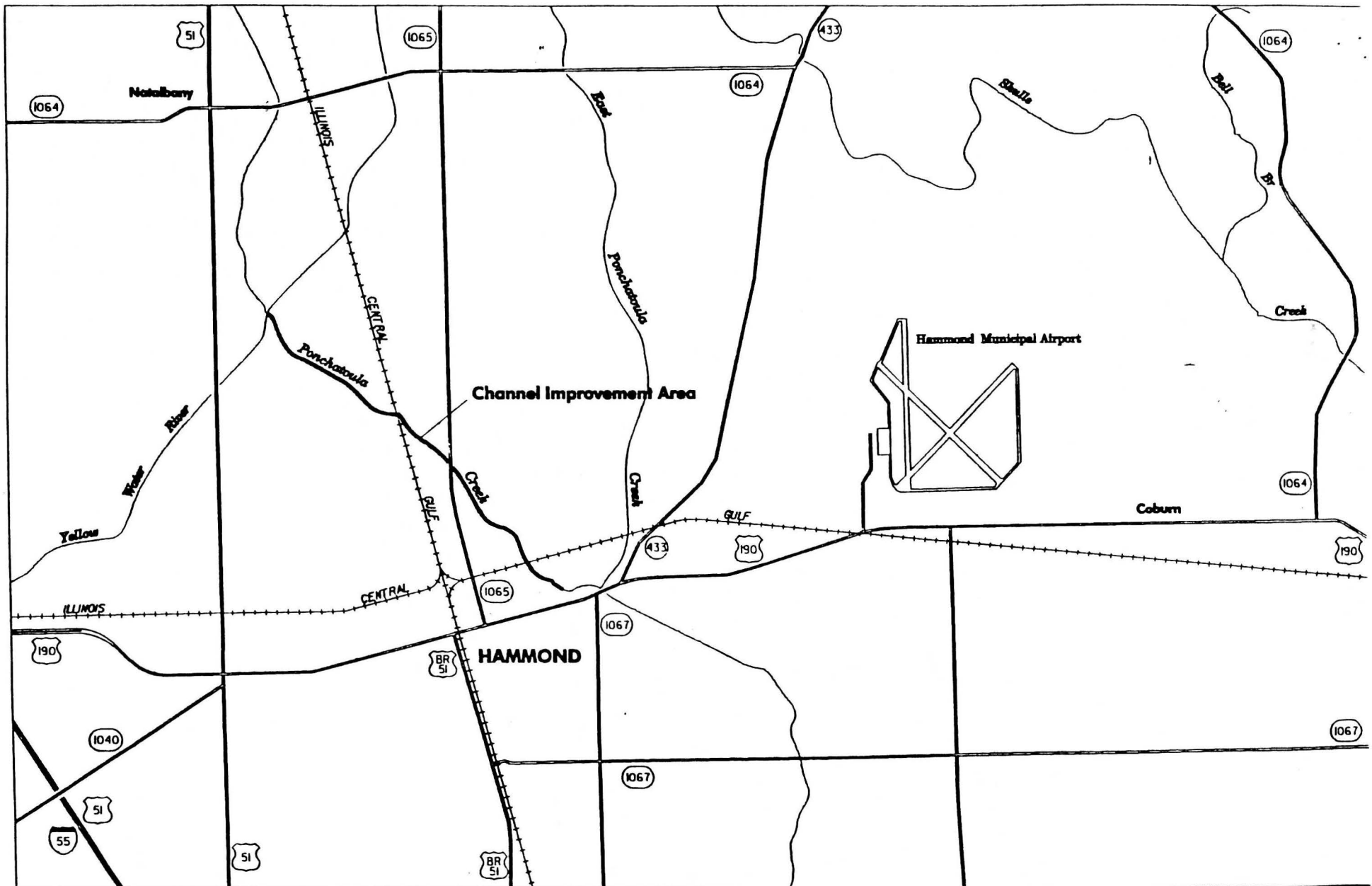

Figure 3. Ponchatoula Creek Channel Improvements

0 ½ Mile

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

PONCHATOULA CREEK CHANNEL

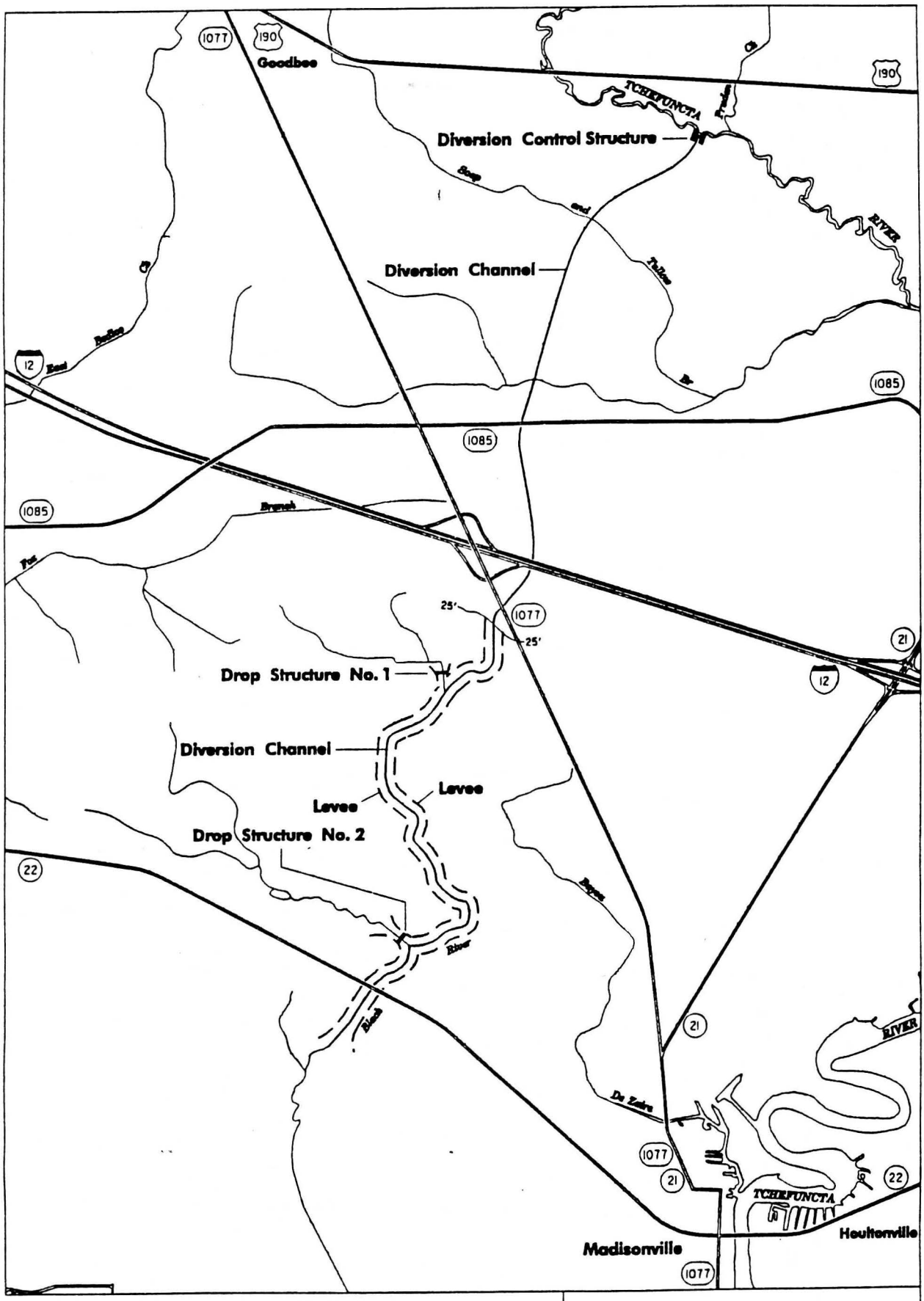

Figure 4. Tchefuncte River Diversion Channel

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
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TCHEFUNCTE RIVER DIVERSION

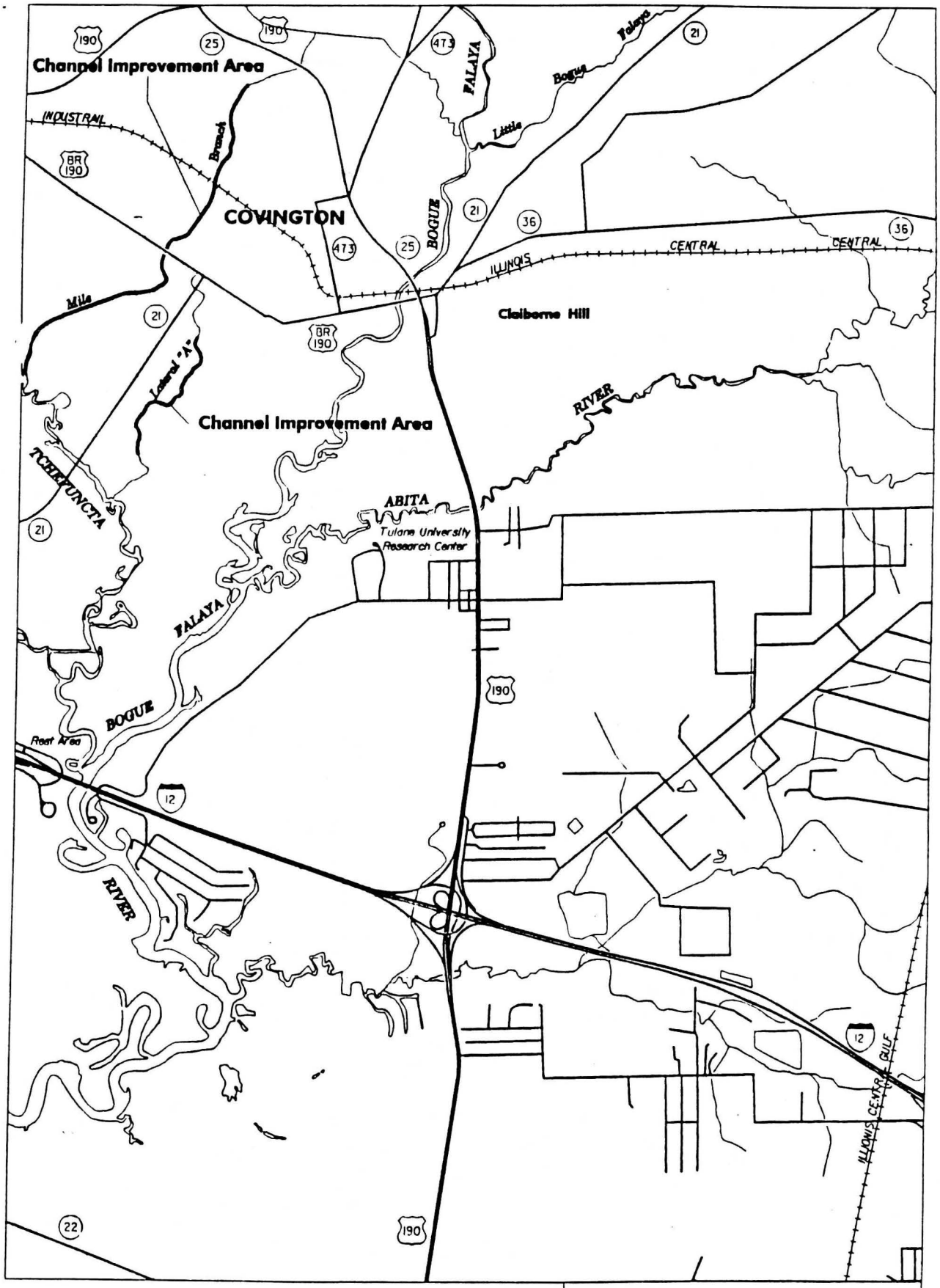


Figure 5. Mile Branch and Lateral "A" Channel Improvements

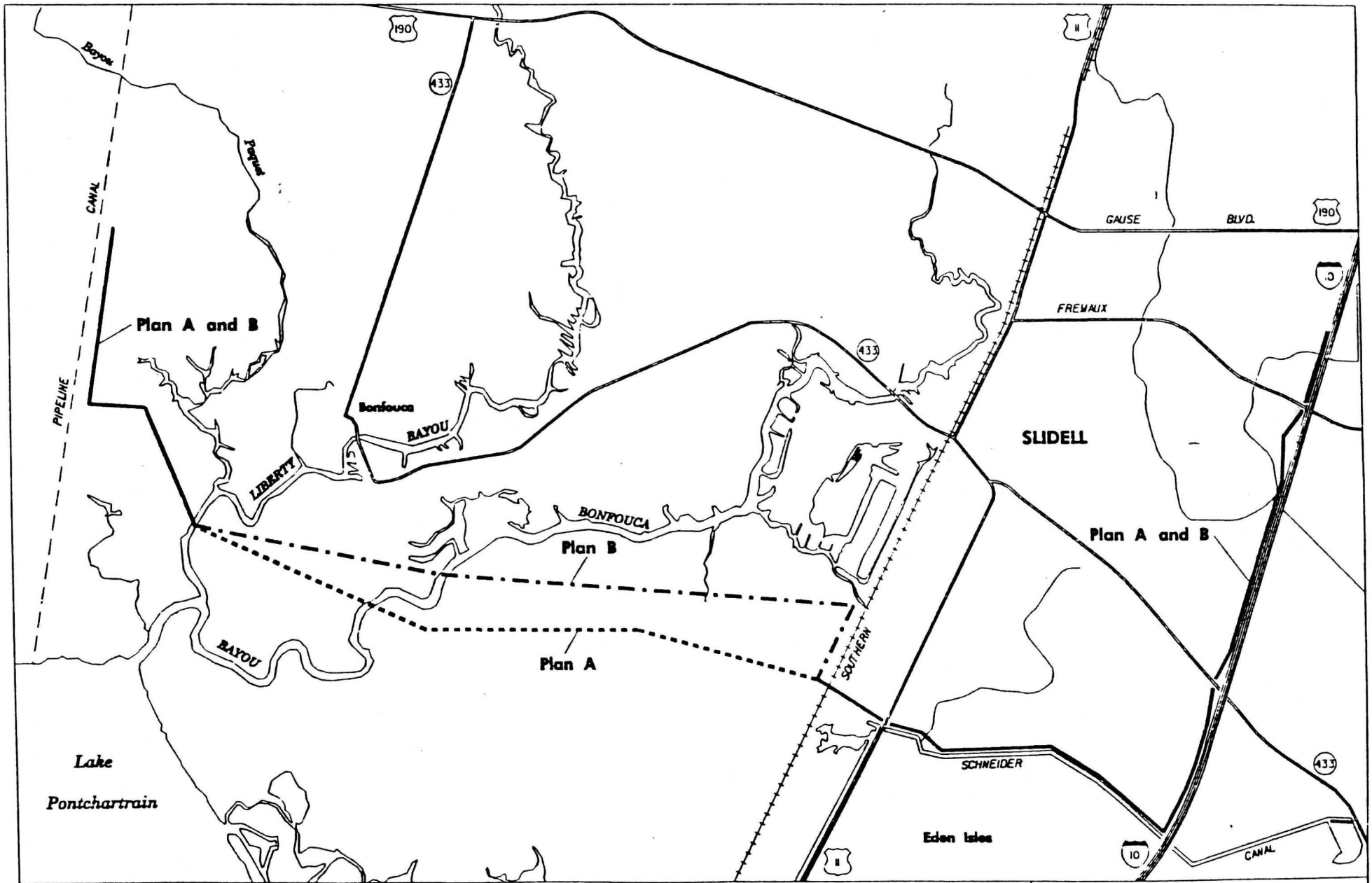


Figure 6. Western Slidell Hurricane Protection Levee Alignment

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

WESTERN SLIDELL HURRICANE PROTECTION ALIGNMENTS A AND B, 100 – YEAR AND [illegible] PLANS

5. Western Slidell Hurricane Protection Project - Two alignments are being considered under this alternative, i.e., Plan A and Plan B (Figure 6). For each Plan, 100-year and standard project hurricane levees (SPH) are being studied. Plan A involves constructing 10 miles of levee starting near the intersection of U.S. Highway 190 and Interstate 10; the levee would then follow the Interstate Highway 10 right-of-way south, turn west at Schneider Canal, cross Bayou Bonfouca and Bayou Liberty, then turn north at a pipeline canal to tie into higher ground near U.S. Highway 190. The levee would be constructed using borrow pits located parallel to the proposed levee on the protected side, facilitating interior drainage. Also included in the plan are two navigable floodgates, 27 concrete culverts, two drainage structures, and two bottom roller gates. Plan B is similar to Plan A except that it encloses less marsh.

6. Mandeville Hurricane Protection Project - This alternative calls for 3 miles of levee and 4,000 feet of floodwall. The proposed levee would enclose that portion of Mandeville east of Causeway Boulevard (Figure 7). The 100-year and SPH levels of protection are being studied. The levee would begin near the Illinois Central Gulf Railroad crossing over Little Bayou Castine, travel south down the west bank of Little Bayou Castine and head generally west before terminating at Causeway Boulevard. The proposed floodwall would begin at Causeway Boulevard and travel north, tying into higher ground near Bayou Chinchuba's crossing under Causeway Boulevard. The eastern portion of the levee would be constructed with material dredged from a borrow canal on the unprotected side of the levee. Once the levee reaches the lake, the material would be obtained from an off-site area (hauled) or from a borrow canal located on the lakeside of the levee (cast). The western portion of the levee would be in developed areas and constructed using truck-hauled material. This alternative includes the construction of a pump station, swing gates, and culverts.

7. Lewisburg Hurricane Protection Levee - This alternative involves construction of 2.6 miles of levee and 4,000 feet of floodwall around Lewisburg (Figure 8). The proposed levee would border Lake Pontchartrain and Bayou Chinchuba and tie into a floodwall constructed parallel to Causeway Boulevard, between the lakefront to just south of the Causeway Boulevard crossing over Bayou Chinchuba. The Corps is examining two levels of protection (100-year and SPH). Material for the portion of levee paralleling Bayou Chinchuba would be obtained from a borrow canal located on the protected side of the levee; the levee segment along the lakefront would be constructed using material from the lake bottom. This alternative includes a gate-valve culvert, gated culverts, and pump station.

8. Mandeville and Lewisburg Hurricane Protection Levee - This alternative will combine of the Mandeville and Lewisburg

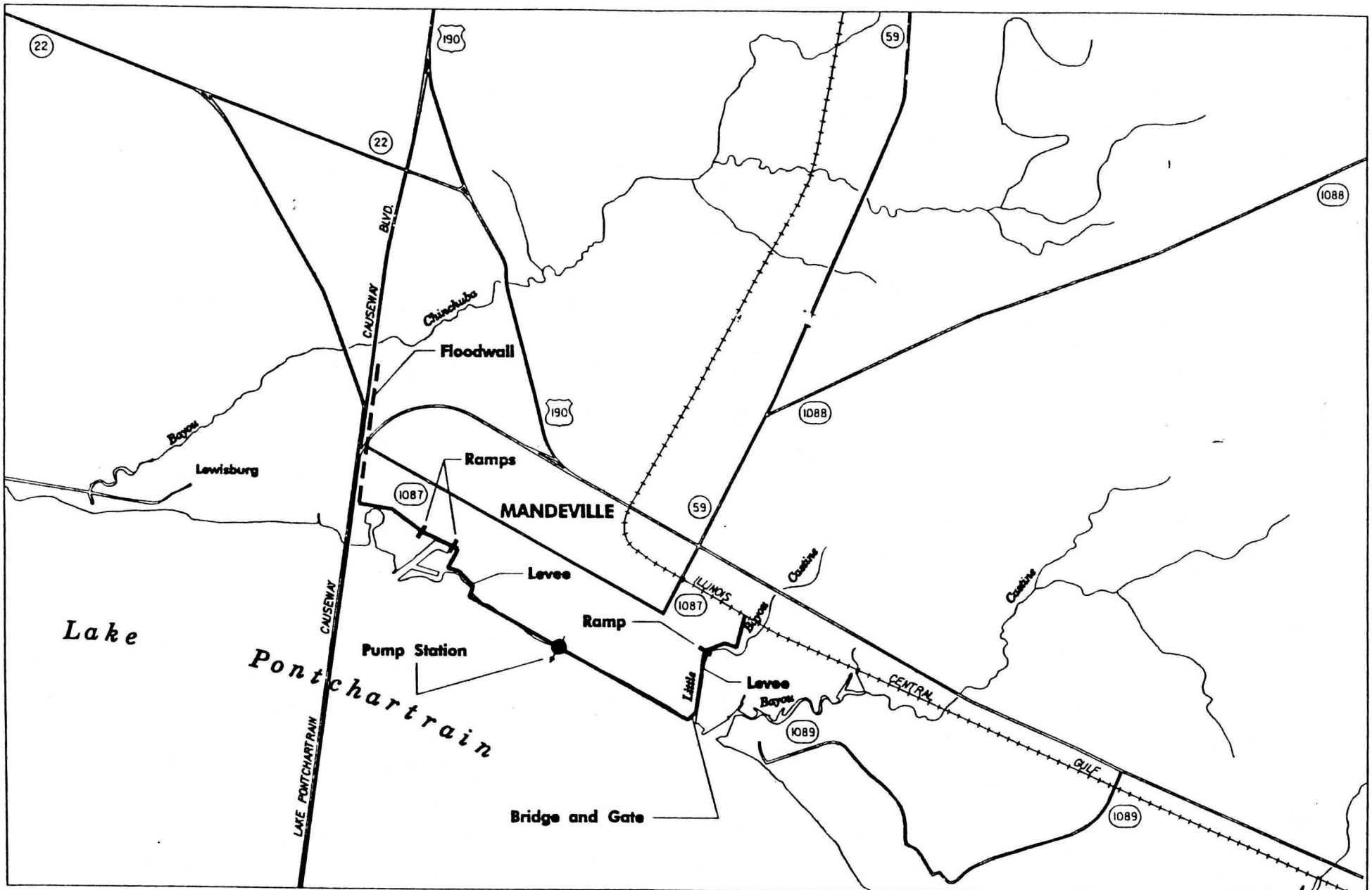


Figure 7. Mandeville Hurricane Protection Levee Alignment

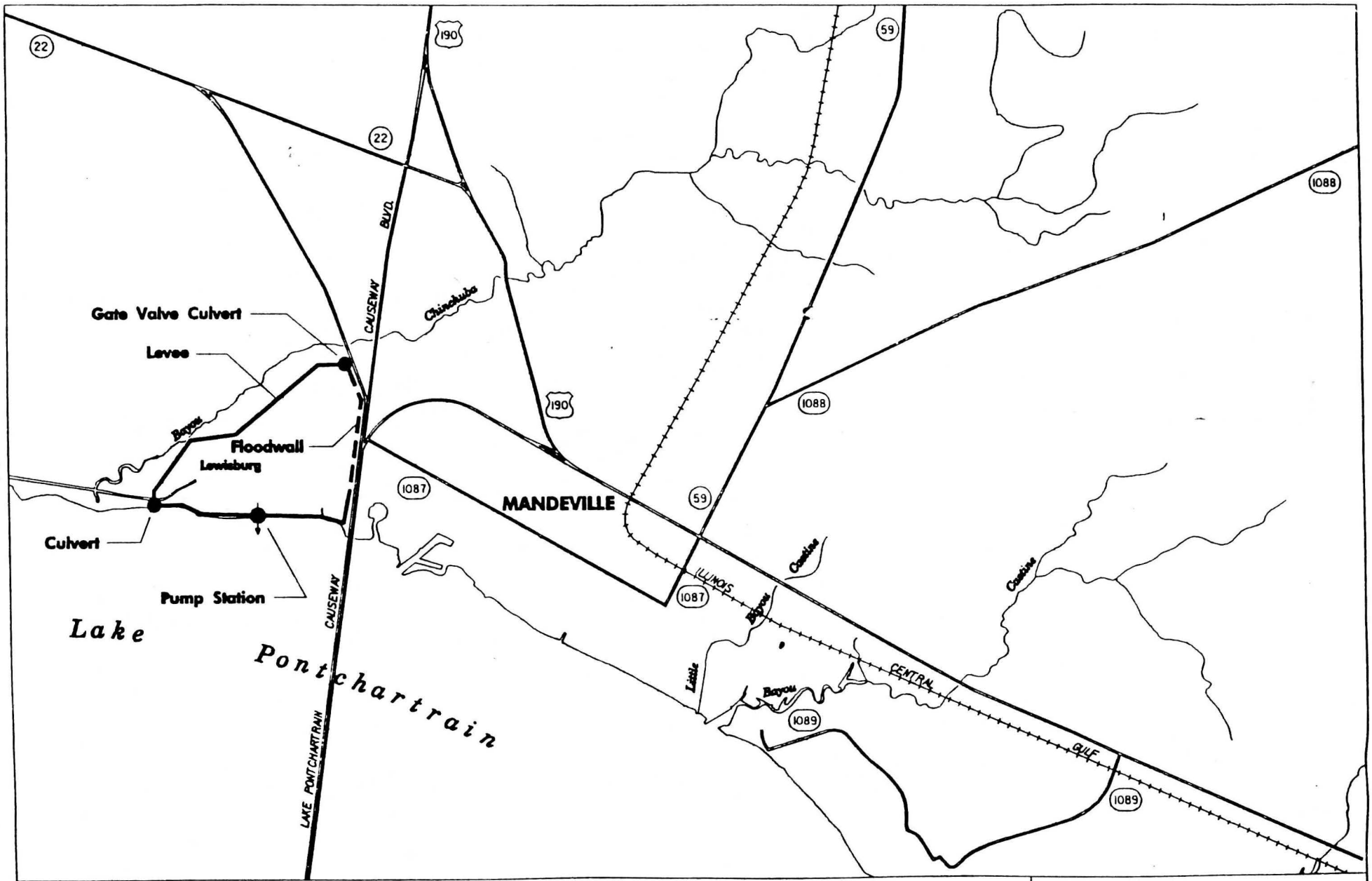


Figure 8. Lewisburg Hurricane Protection Levee Alignment

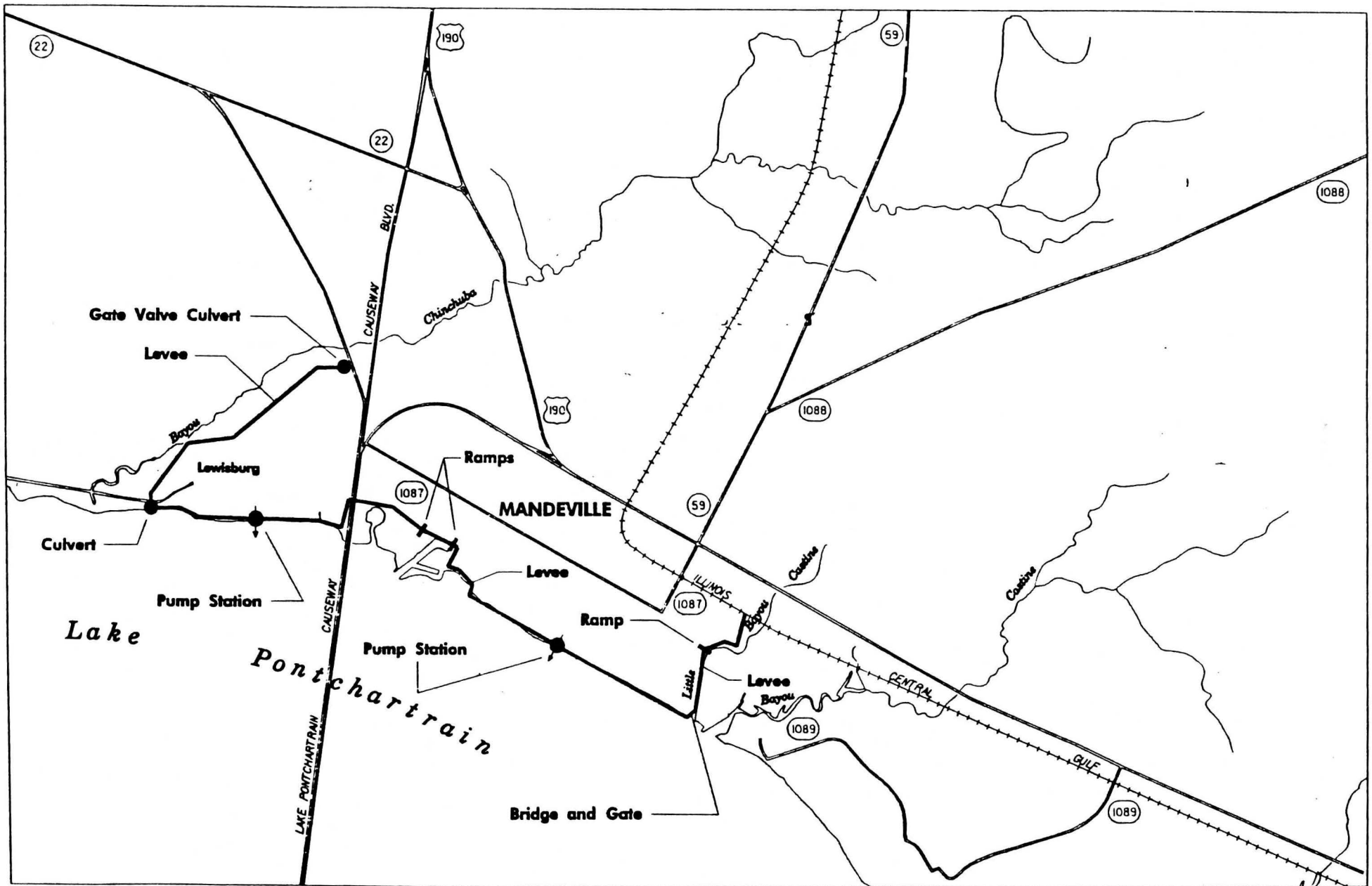


Figure 9. Mandeville/Lewisburg Hurricane Protection Levee Alignment

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

MANDEVILLE AND LEWISBURG HURRICANE PROTECTION ALIGNMENT
100 - YEAR AND SPH PLANS

impacts due to reduced flows downstream from the diversion channel, may occur in the Tchefuncte River impacting the fishery resources of the area by reducing dissolved oxygen levels. The marshes located at the mouth of the river could experience reduced flushing and, consequently, reduced detrital input to adjacent waters. This would have a negative impact on fishery resources in and around the impacted area. Construction of the diversion channel as currently proposed may affect a pair of endangered bald eagles and their nest. Reduced water quality and low flows in the Tchefuncte River may affect the spawning habits of the Gulf of Mexico sturgeon, a proposed threatened species.

4. Mile Branch and Lateral "A" Channel Improvements - The majority of this work area is located along developed lands (mostly residential) in Covington. Both channels have been previously excavated. Habitat types affected by the proposed work include bottomland hardwoods, wooded swamp, and mixed hardwoods and pine adjacent to developed residential areas. Enlargement of these streams would remove in-stream cover and reduce water quality thus reducing the value of the waterways to fishery resources. Spoil disposal will eliminate all woody vegetation on both banks, at least temporarily eliminating areas which provide travel corridors, buffers zones, and nesting and feeding areas for an abundance of wildlife species.

5. Western Slidell Hurricane Protection Project - Construction of the proposed levee (Plan A and B) would directly impact marsh, wooded swamp, and pine flatwood cover types and the fish and wildlife resources found in those areas. As currently proposed, Plan B would enclose some forested wetlands and marsh; Plan A would enclose significantly more. Although culverts are proposed for both plans in order to maintain natural flows, enclosing wetlands could lead to their eventual development. The marshes located between the proposed levee and Lake Pontchartrain would be directly impacted by the loss of sheet flow; placement of culverts would further restrict freshwater input to the marsh. Such action would also reduce the filtering capacity of these marshes; subsequent water quality deterioration would be expected in the marsh and Lake Pontchartrain and would adversely affect fishery resources.

6. Mandeville Hurricane Protection Levee - Construction of hurricane protection measures would adversely impact habitat found along Little Bayou Castine, the Lake Pontchartrain shoreline, and in Lake Pontchartrain. Construction of a levee and borrow pit along Little Bayou Castine may severely degrade or destroy the wooded riparian zone of the Bayou, and the fish and wildlife values associated with it. Construction of the levee in this area may affect the red-cockaded woodpecker, an endangered species. The majority of the area along the shoreline of Lake Pontchartrain in Mandeville is developed or consists of open park-like areas. Construction of a levee and excavation of borrow material in the

lake would adversely impact the benthic community of the affected lake bottom and would degrade water quality and fish and shellfish habitat.

7. Lewisburg Hurricane Protection Levee - Cover types that would be impacted in the Lewisburg area via levee construction consists primarily of live oak-magnolia forest within residential areas which extend to the lakefront. However, the western edge of the proposed levee and borrow pit would be constructed adjacent to Bayou Chinchuba. The riparian zone of that portion of Bayou Chinchuba consists of a mixture of wooded swamp and bottomland hardwood cover types. The proposed work would eliminate virtually all woody vegetation on the western bank of the Bayou, greatly reducing the wildlife values of the riparian zone. Increased turbidity and removal of in-stream cover would reduce populations in Bayou Chinchuba.

8. Mandeville and Lewisburg Hurricane Protection Levee - Construction of this alternative will combine the Mandeville and Lewisburg alternatives. Project impacts will be the same as described under those alternatives.

FISH AND WILDLIFE CONSERVATION MEASURES

The Service believes that project plans should be modified to avoid or minimize negative impacts to fish and wildlife resources as much as possible, and to compensate for unavoidable losses. The President's Council on Environmental Quality defined the term "mitigation" in the National Environmental Policy Act regulations to include: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by replacing or providing substitute resources or environments. The Service's Mitigation Policy (Federal Register Volume 46, No. 15, January 23, 1981) supports and adopts this definition of mitigation and considers its specific elements to represent the desirable sequence of steps in the mitigation planning process.

The forested wetlands and fresh to brackish marshes to be impacted by the proposed hurricane protection levees, channel enlargements, and the diversion channel are considered to have high value for wildlife, and are becoming relatively scarce on a regional and national basis. Although pine savannahs provide moderate habitat for wildlife, the scarcity and uniqueness of that habitat type justify special conservation efforts. The Service's mitigation goal for those cover types is no net loss of in-kind of habitat value. This goal could best be achieved via avoidance of loss of those habitats. Avoidance

measures include designating flood storage areas adjacent to the Tchefuncte River and aligning the diversion channel through non-wetland areas. Impacts associated with stream enlargements such as that proposed for Ponchatoula Creek could be avoided by purchasing undeveloped flood-prone lands and designating them as sump areas. Development in these areas would be prohibited; the areas would be used for floodwater storage during high water periods, with retention structures utilized if necessary. Other avoidance measures include aligning hurricane protection levees so that forested wetlands and marsh would not be lost to levee construction or enclosed within a levee system.

Minimizing habitat loss is the next preferred mitigation technique. Minimization could be achieved by restricting the planned stream enlargement activities to the absolute minimum necessary to maintain adequate stream flow. This would include selective clearing and snagging of instream obstructions in lieu of channel excavation. If channel excavation is determined to be necessary, all work should be done in such a manner to minimize impacts, e.g., working from one bank only or alternating banks, whichever method best minimizes impacts to wooded riparian areas, and depositing spoil material in cleared upland areas. Impacts to wetlands enclosed by hurricane protection levees could be minimized via installation and operation of water control structures in the levee to allow adequate water exchange, and by purchasing non-development easements on wetlands enclosed by levees. Impacts associated with a diversion channel could be minimized by aligning the channel through cleared, non-wetland areas or avoiding as many wetland areas as possible.

Compensation for unavoidable habitat losses associated with the various impacts, including levee construction and stream enlargements, would likely involve acquisition and management of similar wetlands or restoration of former wetlands. Detailed mitigation needs and measures would have to be determined during the anticipated feasibility study.

FISH AND WILDLIFE SERVICE ACTIVITIES IN THE FEASIBILITY STAGE

Data Needs From Corps of Engineers

Should a feasibility study be conducted, the Service would need the following data to conduct a detailed analysis of project impacts on fish and wildlife resources and to formulate measures to mitigate losses of those resources.

1. A detailed description of the alternatives under consideration including exact levee and diversion channel alignments, designated spoil disposal and borrow sites, flow regimes under with- and without-project conditions, and anticipated maintenance requirements and frequency.

2. An estimate of current, future with-project, and future without-project acreages of habitat types within the area(s) to be impacted by the alternatives considered. The data should be presented for 10-year intervals.

Fish and Wildlife Service Tasks and Associated Cost Estimates

Additional fish and wildlife studies and reports would be necessary if this study proceeds into later stages of planning. Among those Service requirements would be completion of a Habitat Evaluation Procedures analysis and preparation of draft and final Fish and Wildlife Coordination Act reports. The estimated funding requirements for a draft and final Fish and Wildlife Coordination Act report (including a Habitat Evaluation Procedures analysis) are $24,000 and $6,400, respectively.

RECOMMENDATIONS

The following recommendations are provided in the interest of fish and wildlife conservation:

1. Include the Service in earliest stages of feasibility planning to ensure that the most environmentally sound alternatives are identified.

2. Incorporate those planning objectives previously identified in this report in future project planning.

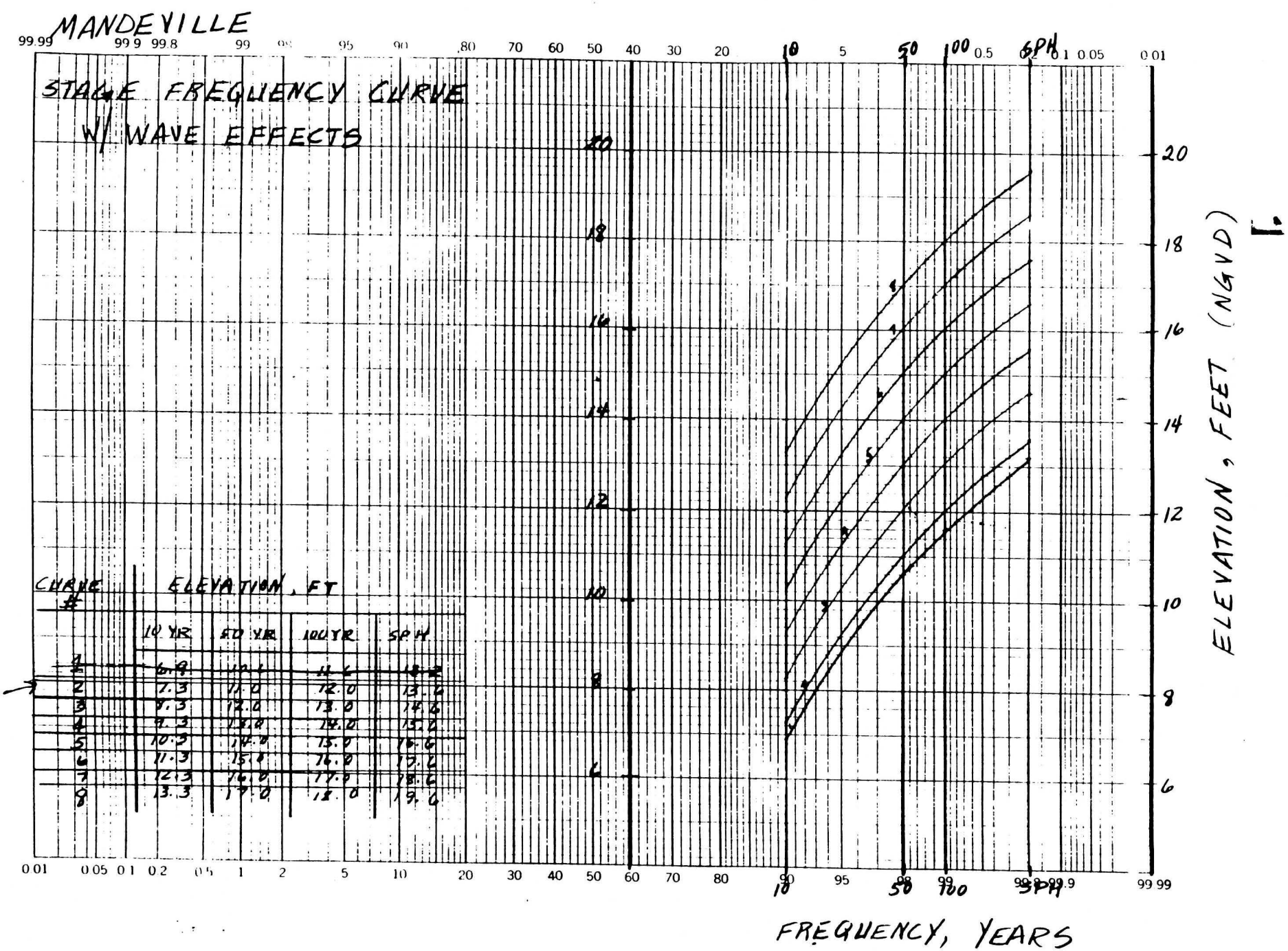
3. Any plans recommended for further investigation should include measures to preserve any unavoidably enclosed wetlands, and to fully offset unavoidable losses of fish and wildlife habitat. Currently proposed alternatives which would result in unacceptable losses to fish and wildlife resources and should be dropped from further consideration include Alignment A of the Western Slidell Hurricane Protection Project and the Tchefuncte River Diversion Channel.

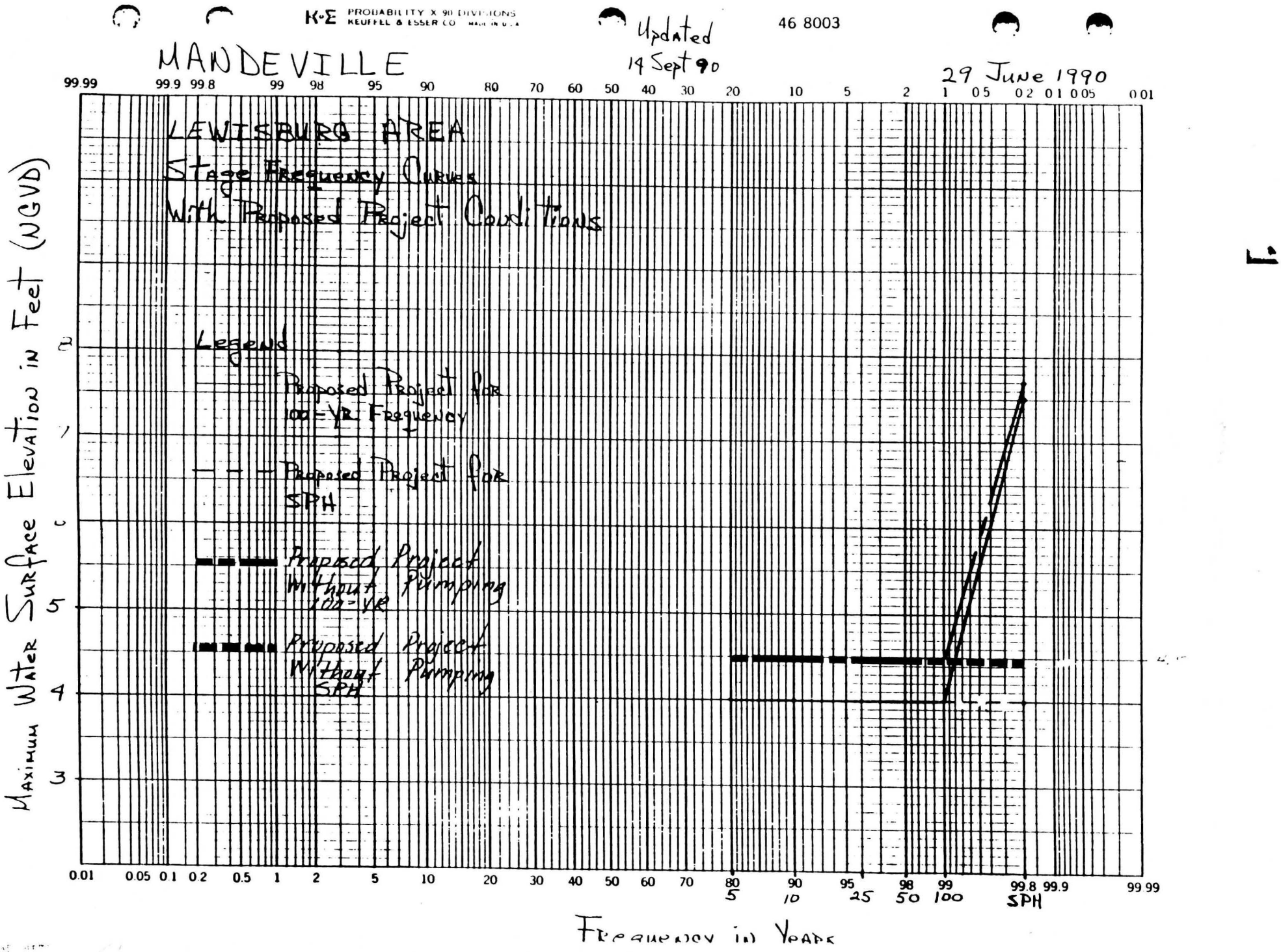
Appendix E
Engineering Data

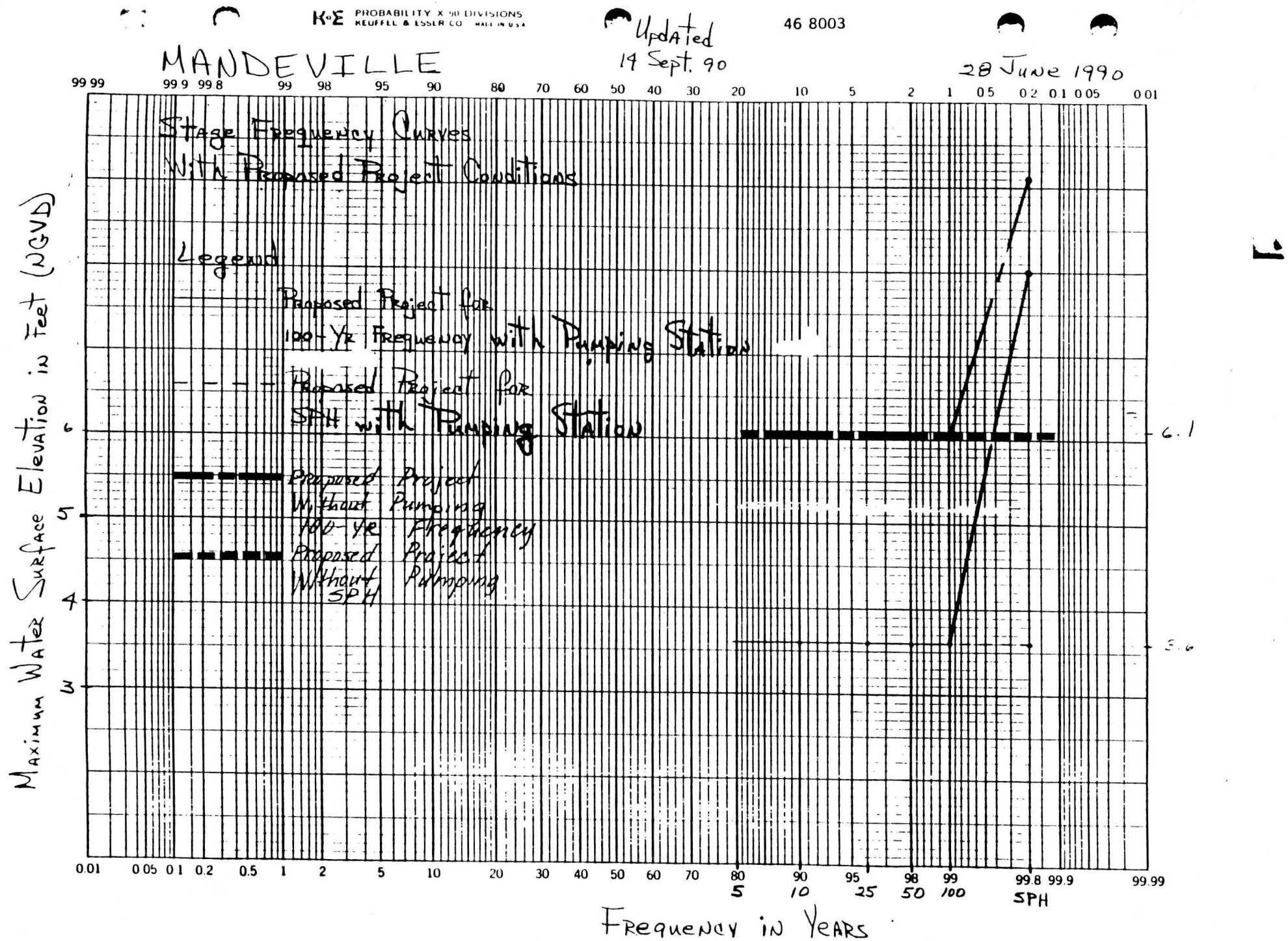
Stage-Frequency Curves

K&E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003




K-E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.
46 8003
Updated
14 Sept 90
MANDEVILLE
29 June 1990
LEWISBURG AREA
Stage Frequency Curves
With Proposed Project Conditions
Legend
Proposed Project for 100-YR Frequency
Proposed Project for SPH
Proposed Project Without Pumping 100-YR
Proposed Project Without Pumping SPH
Maximum Water Surface Elevation in Feet (NGVD)
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
5 10 25 50 100 SPH
Frequency in Years


K•E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.
46 8003
Updated
14 Sept. 90
MANDEVILLE
28 June 1990
Stage Frequency Curves
With Proposed Project Conditions
Legend
Proposed Project for
100-Yr Frequency with Pumping Station
Proposed Project for
SPH with Pumping Station
Proposed Project
Without Pumping
100-Yr Frequency
Proposed Project
Without Pumping
SPH
Maximum Water Surface Elevation in Feet (NGVD)
Frequency in Years
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
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4
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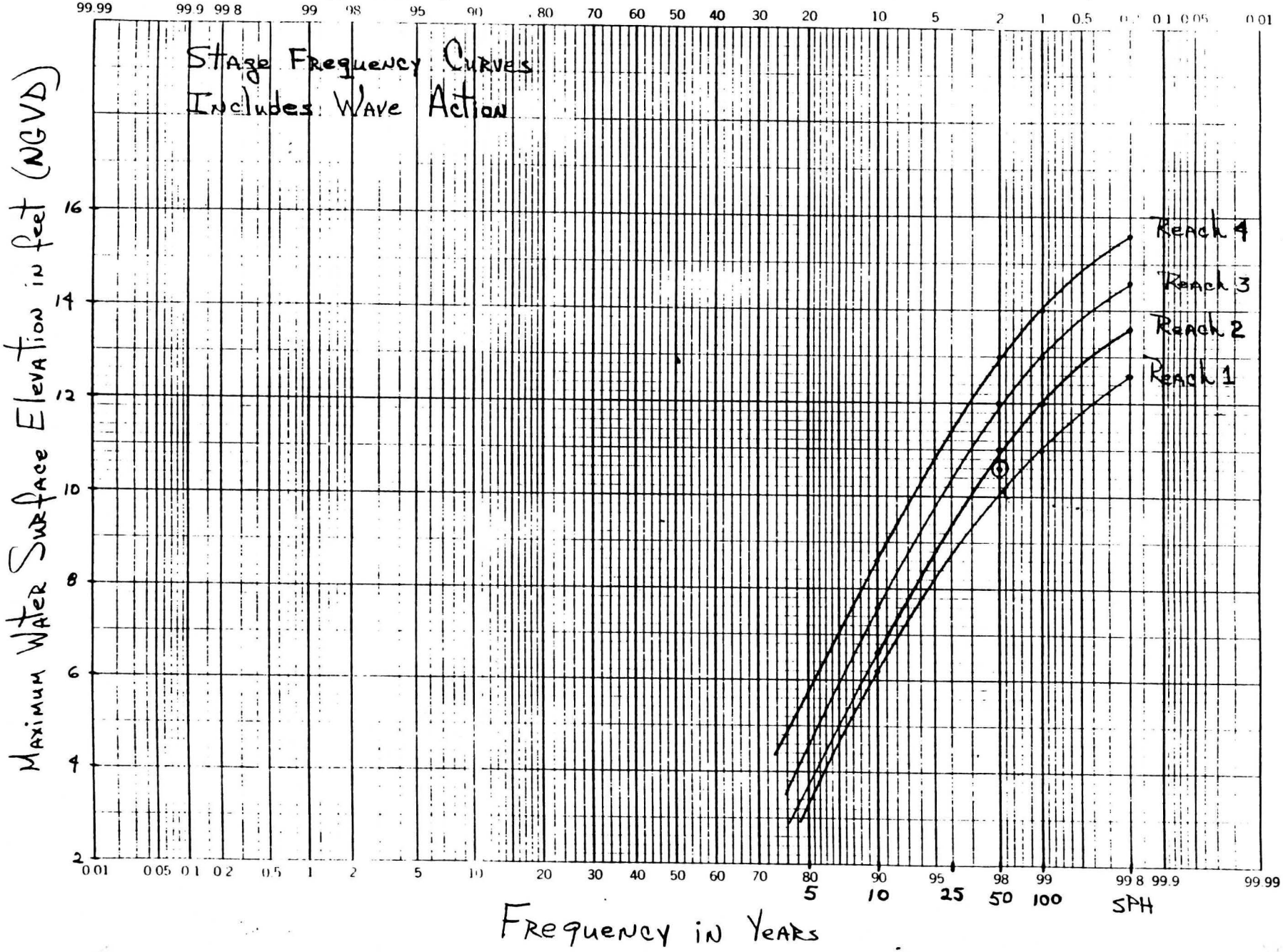
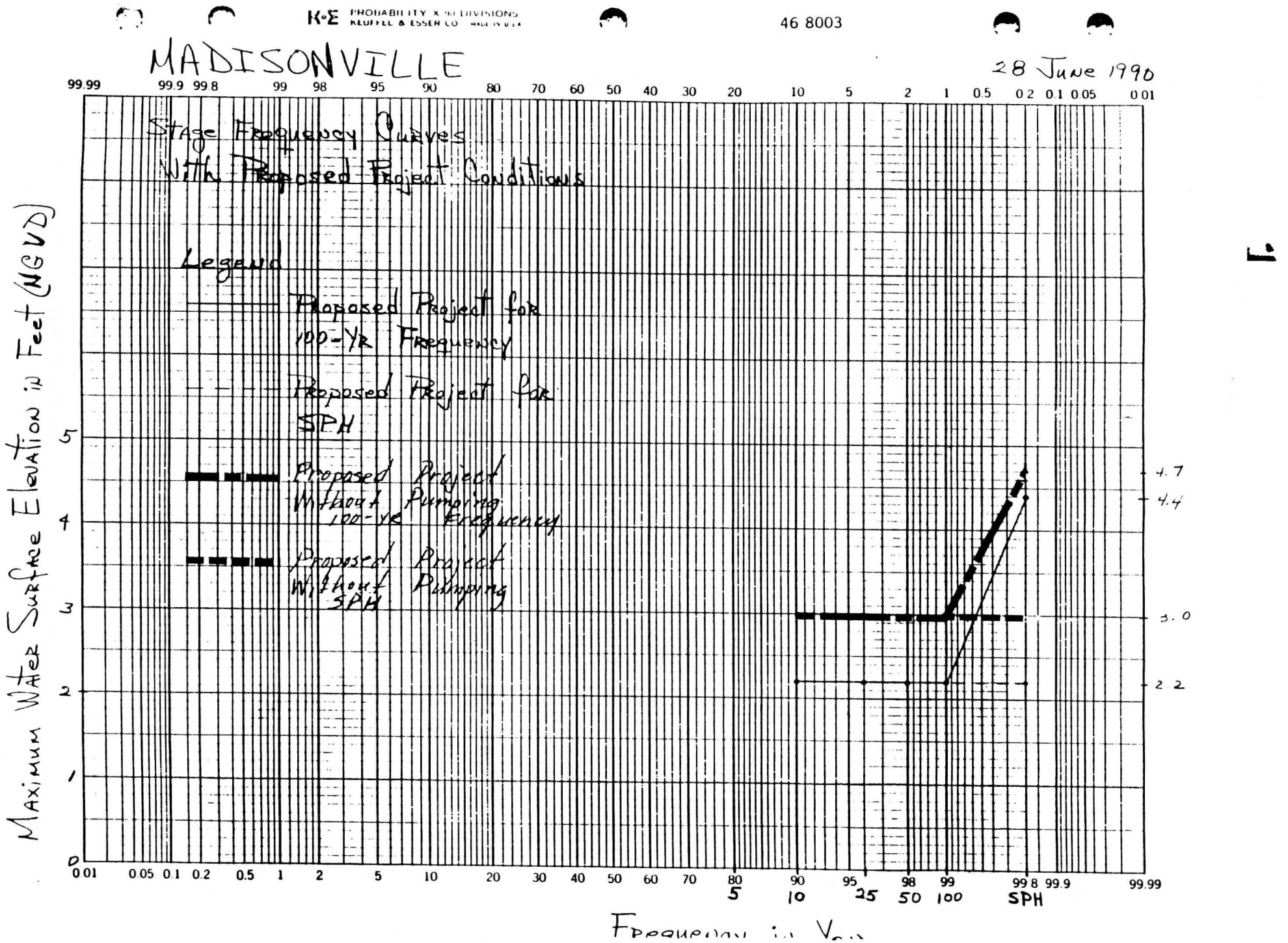
46 8003

MADISONVILLE

29 MAR 90

Stage Frequency Curves
Includes Wave Action




K•E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO
46 8003
MADISONVILLE
28 June 1990
Stage Frequency Curves
With Proposed Project Conditions
Legend
Proposed Project for 100-Yr Frequency
Proposed Project for SPH
Proposed Project Without Pumping 100-Yr Frequency
Proposed Project Without Pumping SPH
Maximum Water Surface Elevation in Feet (NGVD)
Frequency in Years
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
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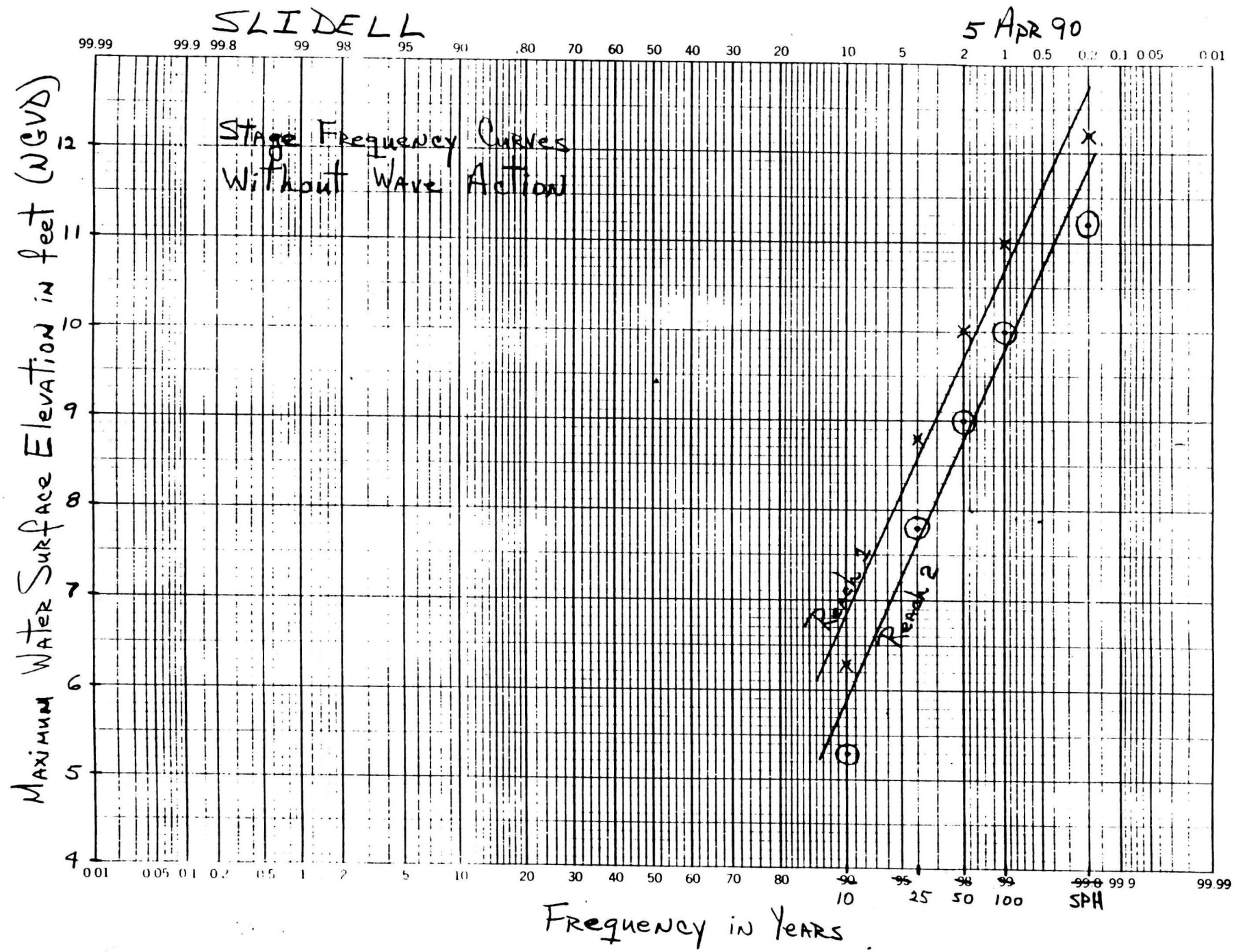
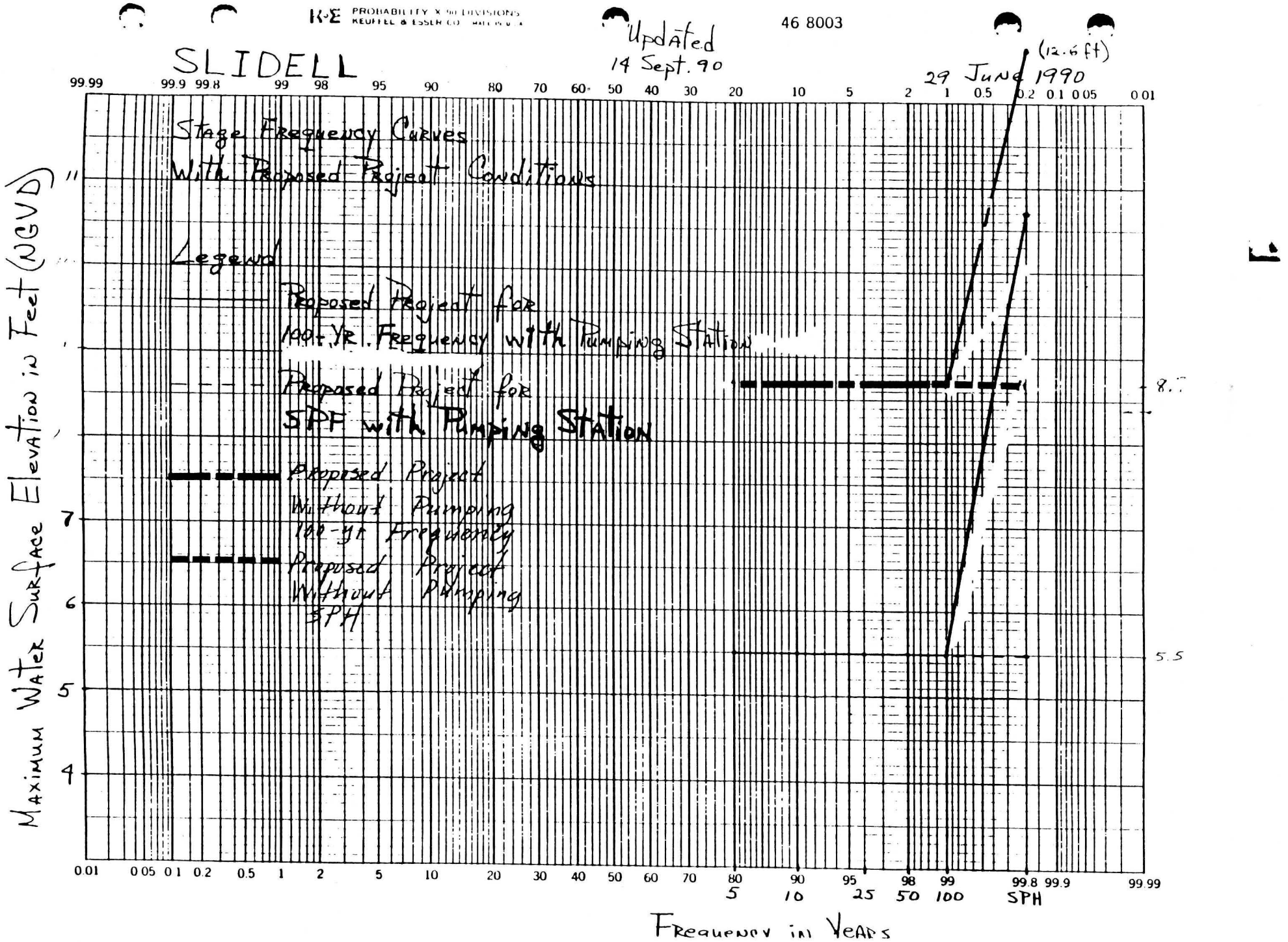
46 8003




K-E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO.
46 8003
SLIDELL
Updated
14 Sept. 90
(12.6 ft)
29 JUNE 1990
Stage Frequency Curves
With Proposed Project Conditions
Legend
Proposed Project for
100 Yr. Frequency with Pumping Station
Proposed Project for
SPF with Pumping Station
Proposed Project
Without Pumping
100-yr Frequency
Proposed Project
Without Pumping
SPH
Maximum Water Surface Elevation in Feet (NGVD)
11
10
9
8
7
6
5
4
8.7
5.5
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
5 10 25 50 100 SPH
Frequency in Years

46 8003

* LACOMBE (REACH 1 - LAKE PONTCHARTRAIN TO GULF MOBILE AND OHIO RAILROAD)

STAGE FREQUENCY CURVE
(AFFECTED BY WAVE ACTION)

CURVE #	ELEVATION, ft			
	10 YR	50 YR	100 YR	SPH
1	6.0	9.0	10.0	12.0
2	7.0	10.0	11.0	13.0
3	8.0	11.0	12.0	14.0
4	9.0	12.0	13.0	15.0
5	10.0	13.0	14.0	16.0
6	11.0	14.0	15.0	17.0
7	12.0	15.0	16.0	18.0

SWL →

99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01

0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

10 50 100 SPH

FREQUENCY, YEARS

ELEVATION, FEET (NGVD)

6 8 10 12 14 16 18

PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO.

46 8003

LACOMBE (REACH 2 - GULF MOBILE AND OHIO RAILROAD TO HWY 190)

STAGE FREQUENCY CURVE

STILLWATER ELEVATION			
10YR	50YR	100YR	SPH
6.0	9.0	10.0	12.0

99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 50 100 0.5 SPH 1 0.05 0.01

0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

10 50 100 SPH

12 11 10 9 8 7 6

ELEVATIONS, FEET (NGVD)

FREQUENCY, YEARS

PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

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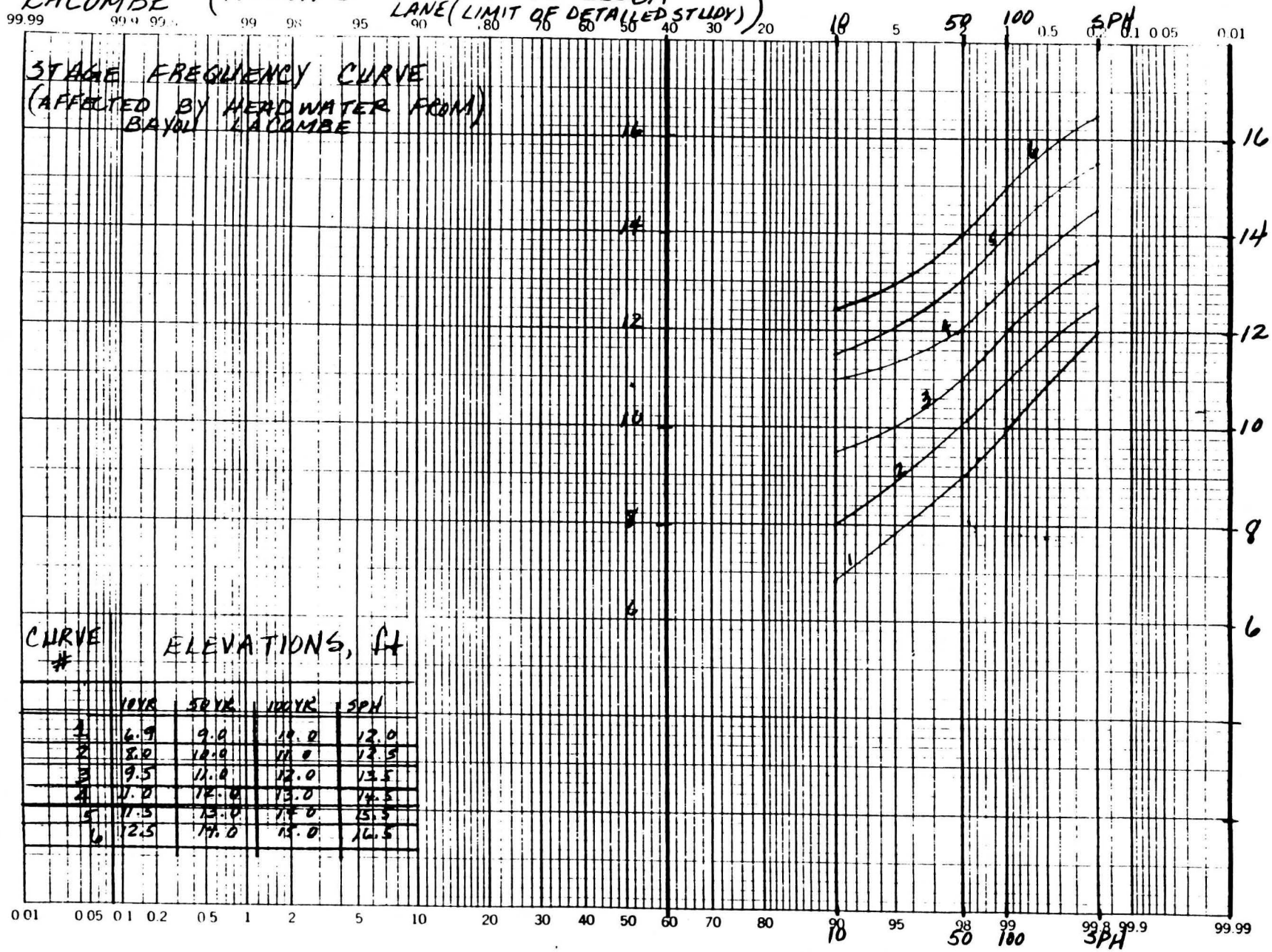
LACOMBE (REACH 3 - HWY 190 to ZELDA LANE (LIMIT OF DETAILED STUDY))

STAGE FREQUENCY CURVE
(AFFECTED BY HEADWATER FROM) BAYOU LACOMBE

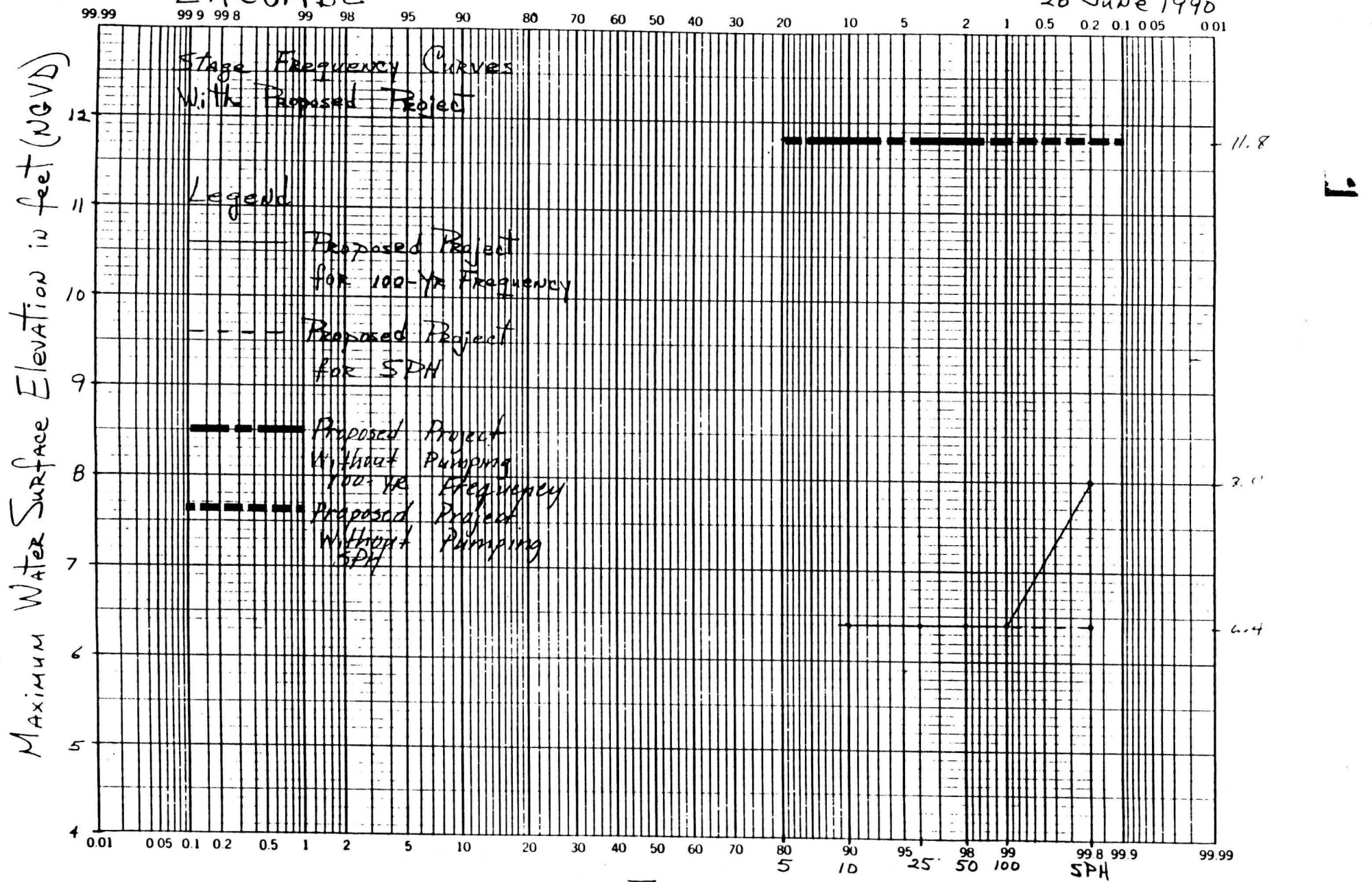


CURVE #	ELEVATIONS, ft			
	10 YR	50 YR	100 YR	SPH
1	6.9	9.0	10.0	12.0
2	8.0	10.0	11.0	13.5
3	9.5	11.0	12.0	13.5
4	11.0	12.0	13.0	14.5
5	11.5	13.0	14.0	15.5
6	12.5	14.0	15.0	16.5

46 8003

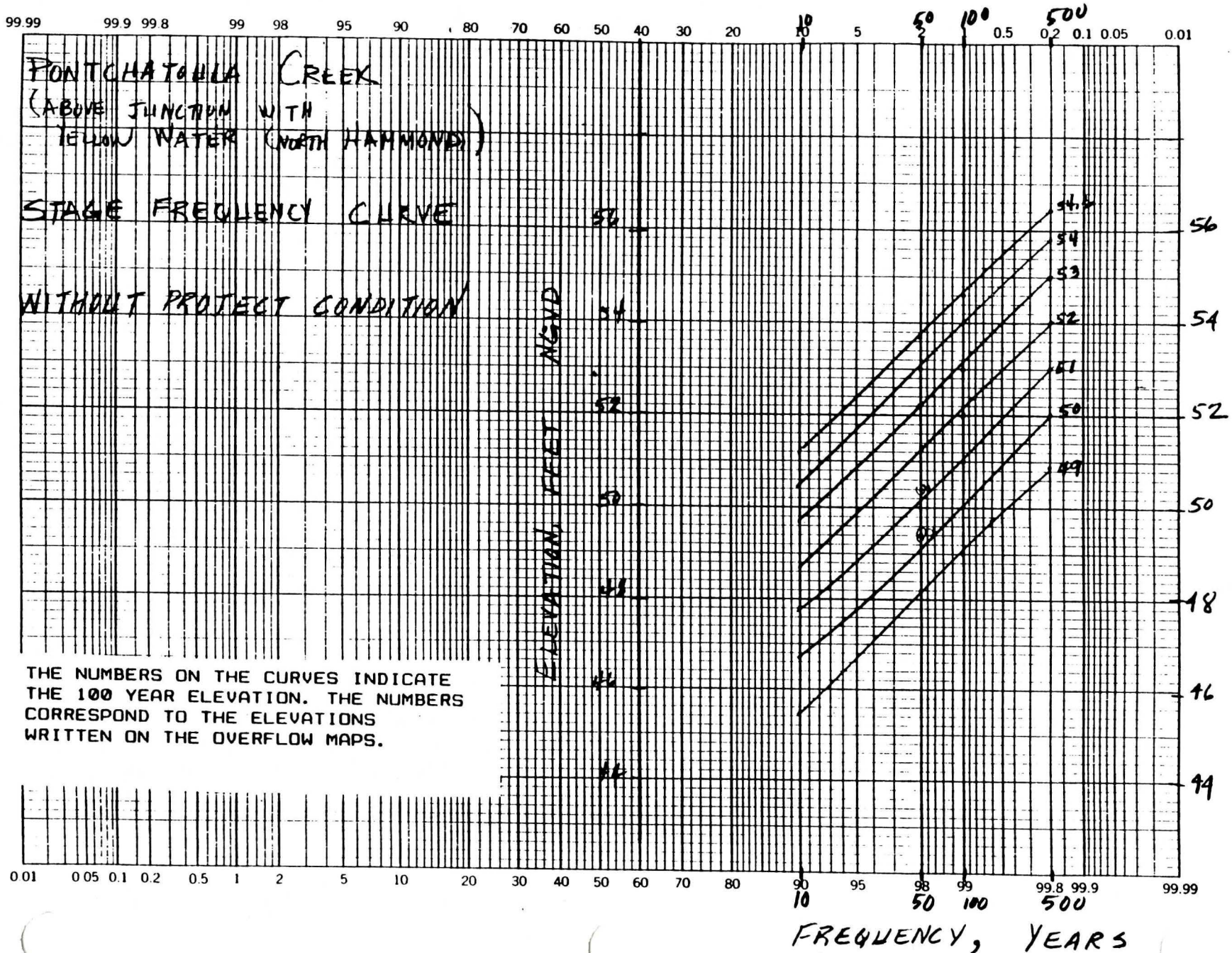
LACOMBE

28 JUNE 1990



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003



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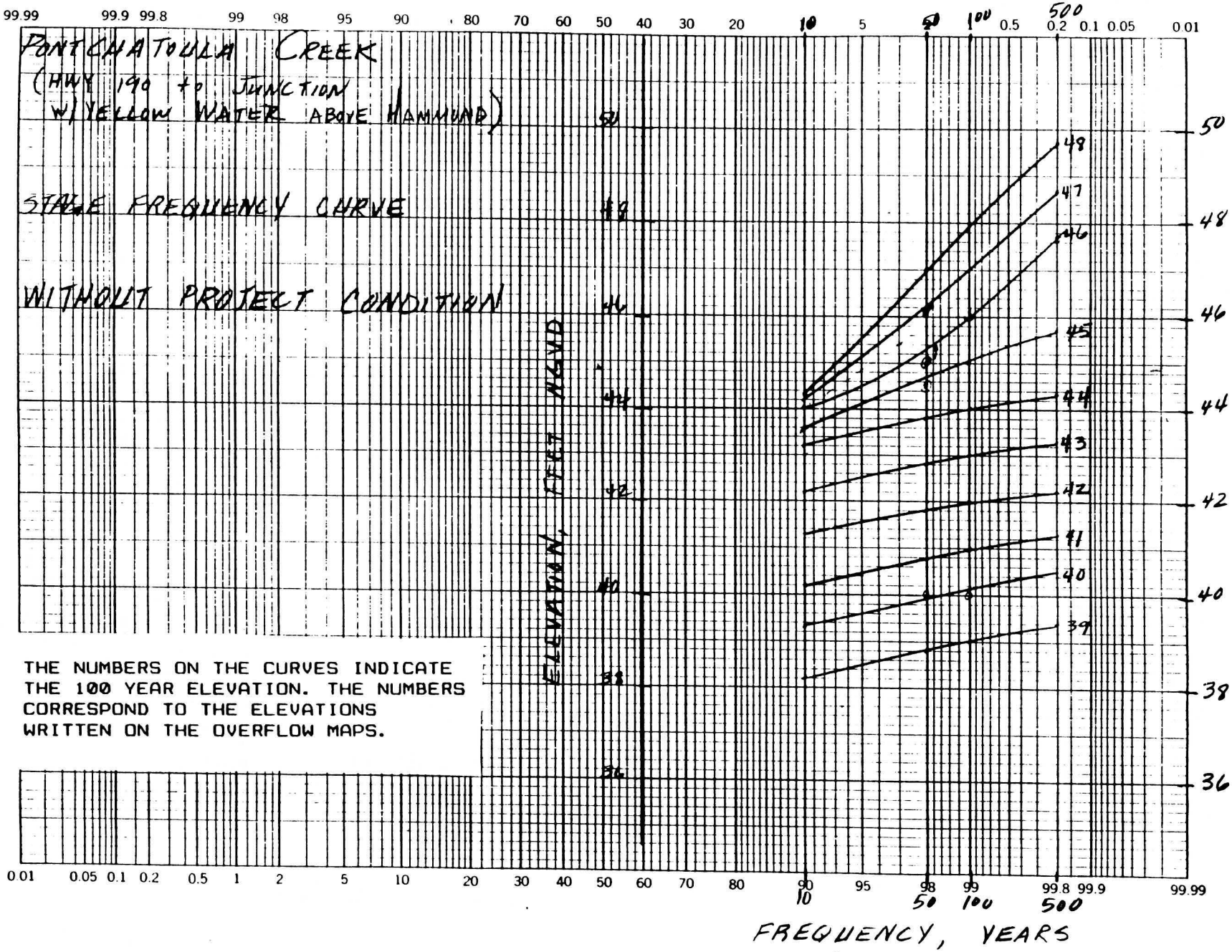

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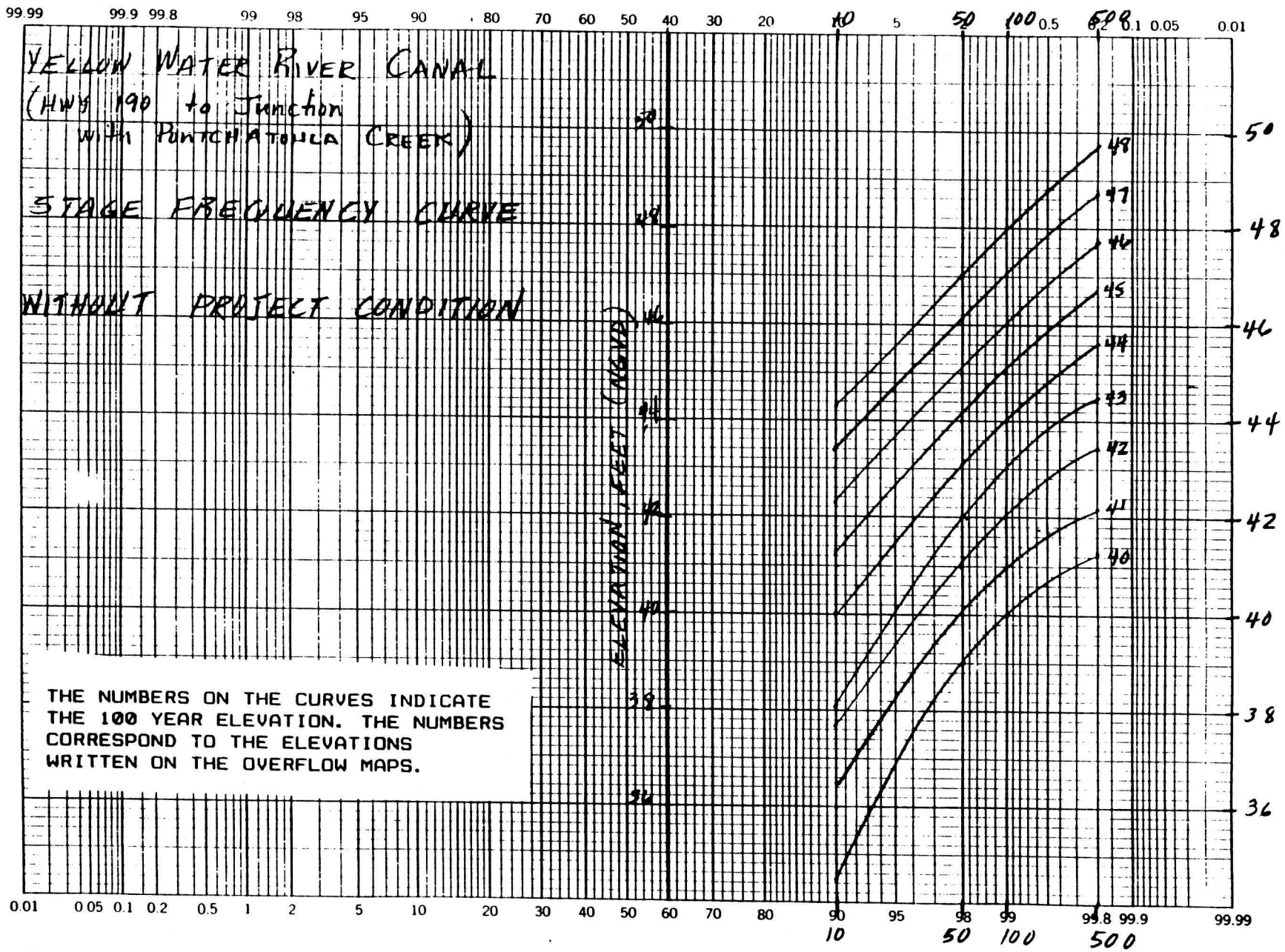
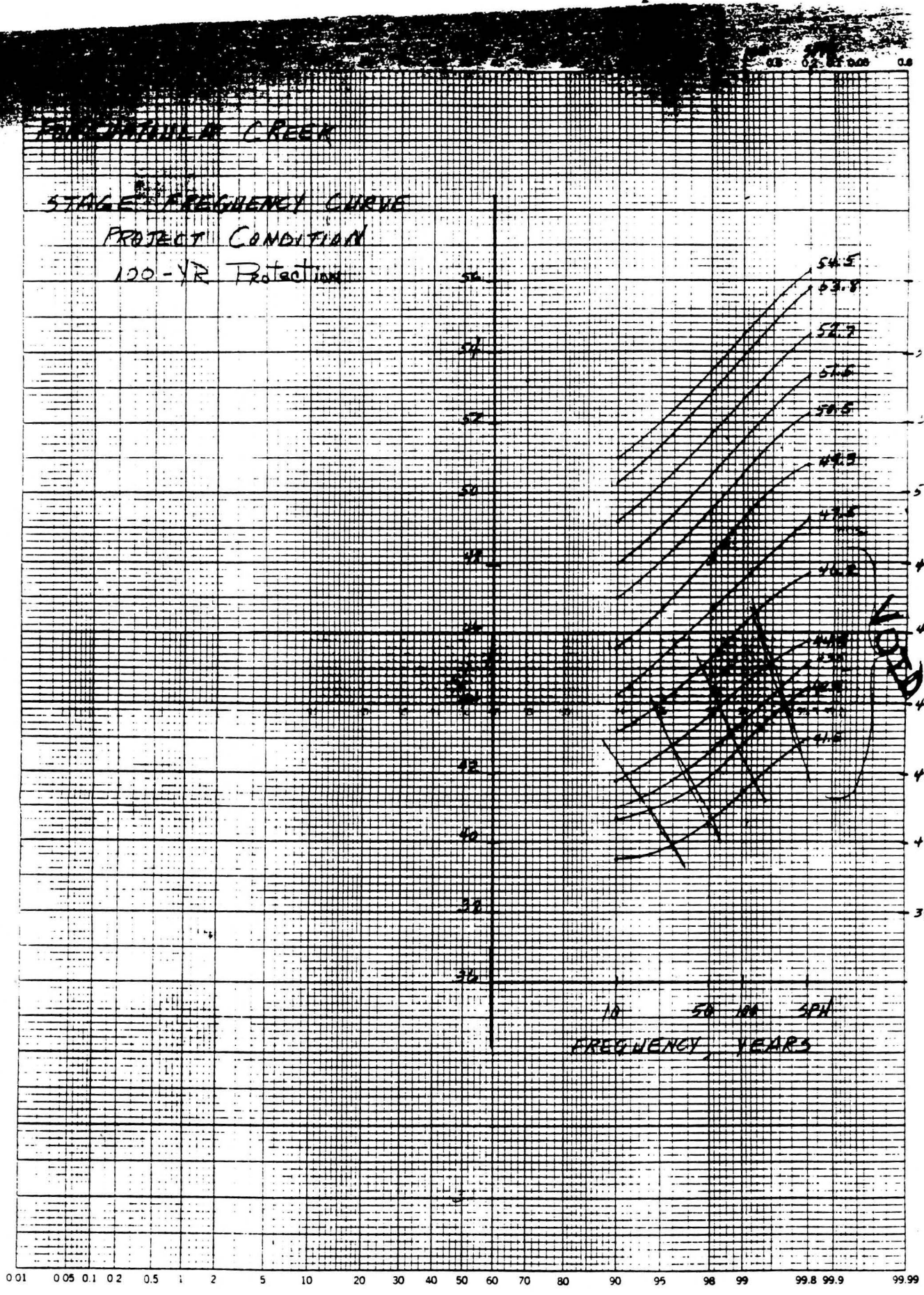
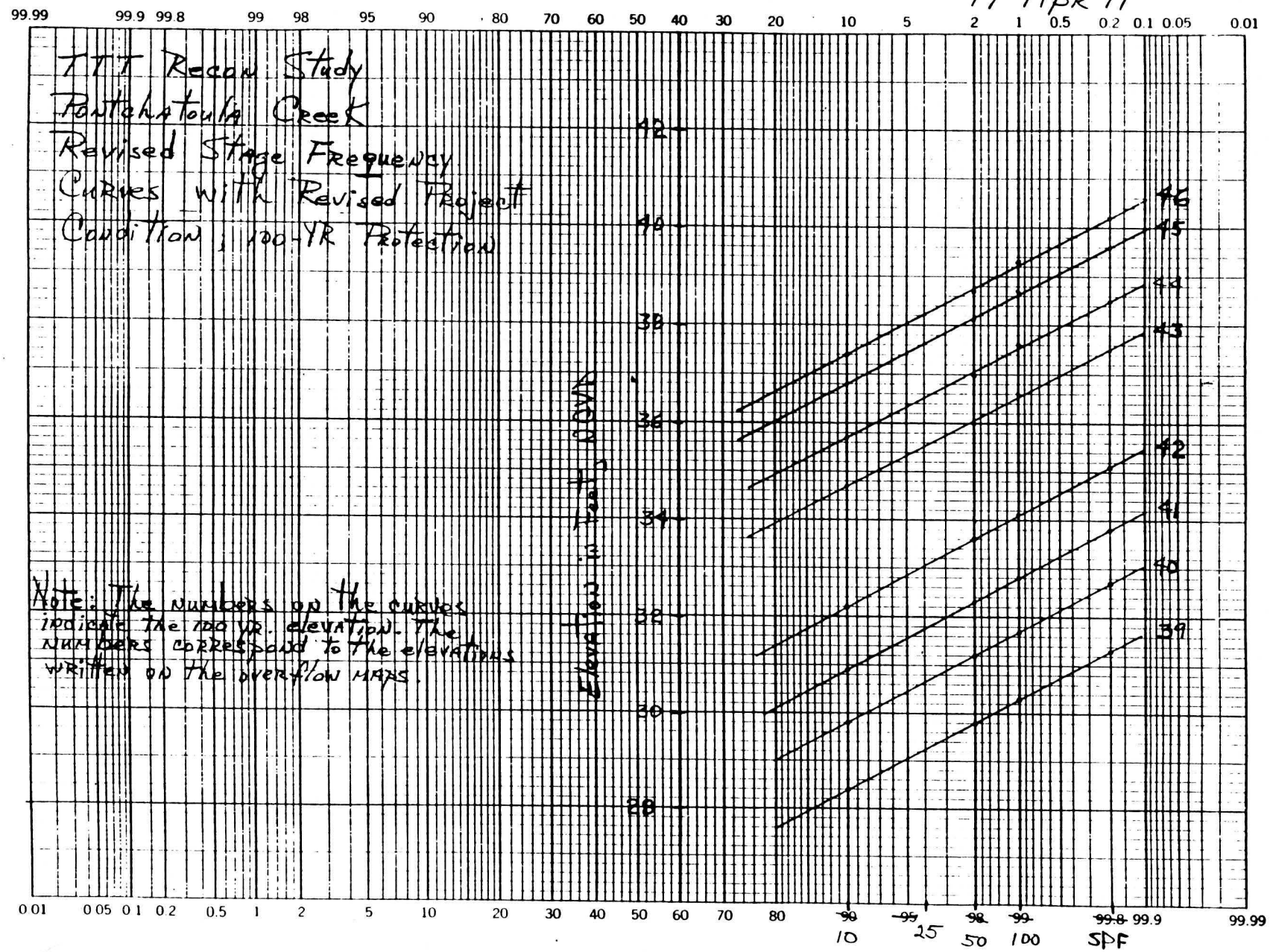



STAGE FREQUENCY CURVE
PROJECT CONDITION
100-YR Protection
54.5
53.8
52.7
51.6
50.5
49.3
48.2
47.2
46.2
41.6
56
54
52
50
48
46
44
42
40
38
36
10
50
100
SPH
FREQUENCY, YEARS
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99

K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

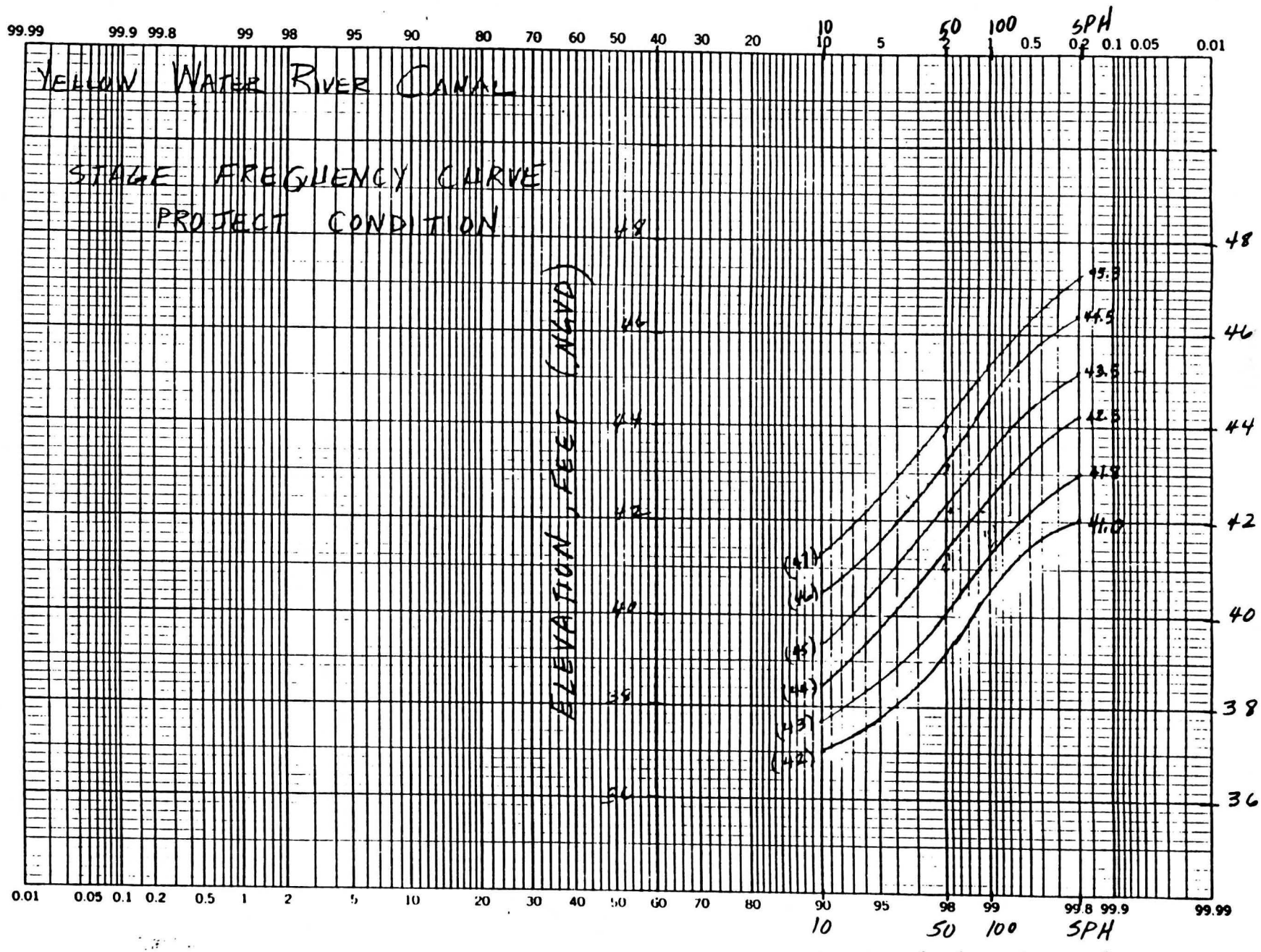
46 8003

19 APR 91



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003

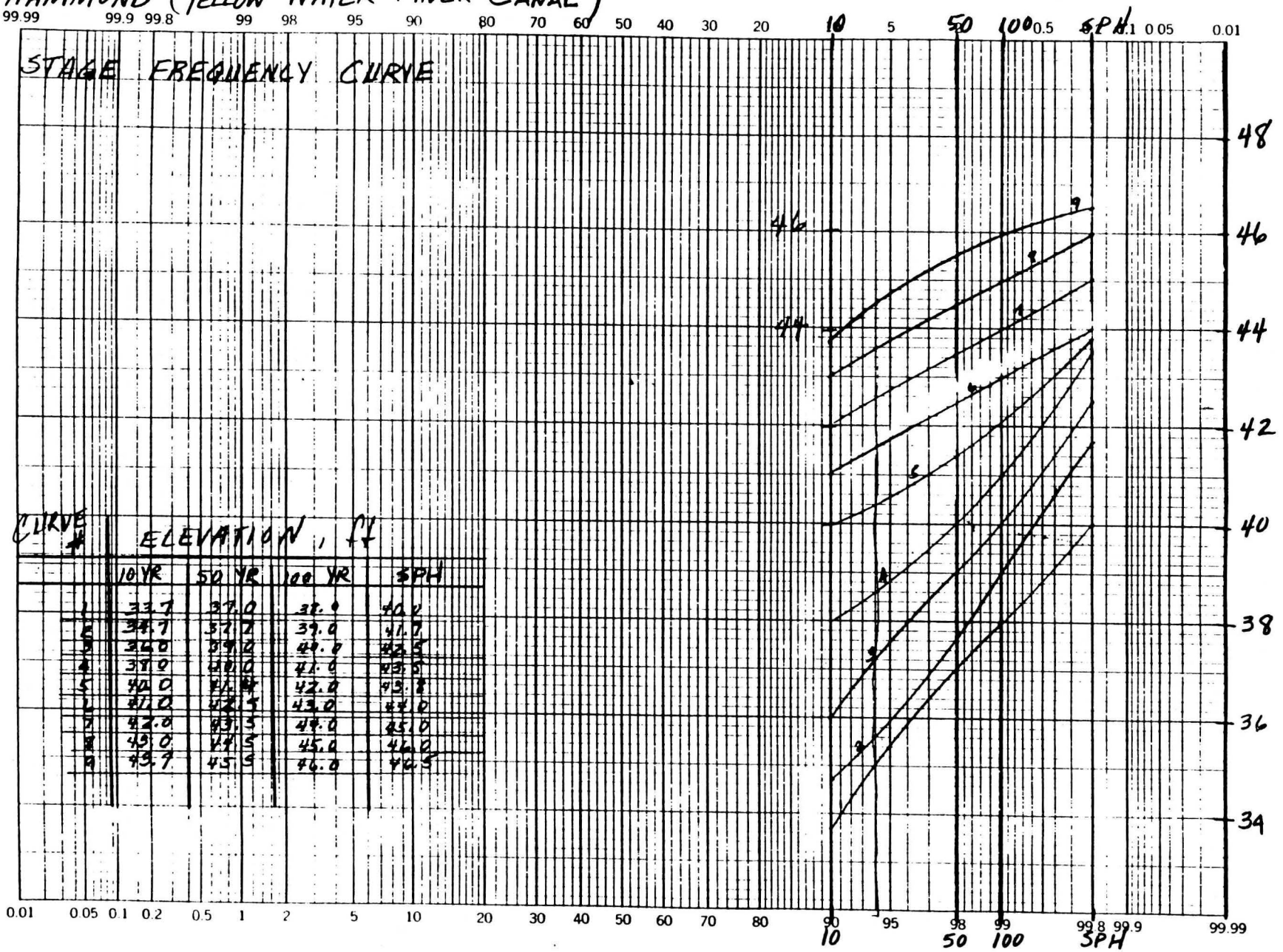


K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003

HAMMOND (YELLOW WATER RIVER CANAL)

STAGE FREQUENCY CURVE



CURVE #	ELEVATION, ft			
	10 YR	50 YR	100 YR	SPH
1	33.7	37.0	38.0	40.2
2	34.7	37.7	39.0	41.0
3	35.0	39.0	40.0	42.5
4	37.0	40.0	41.0	43.5
5	40.0	41.8	42.0	43.8
6	41.0	42.5	43.0	44.0
7	42.0	43.5	44.0	45.0
8	43.0	44.5	45.0	46.0
9	43.7	45.5	46.0	46.5

K&E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

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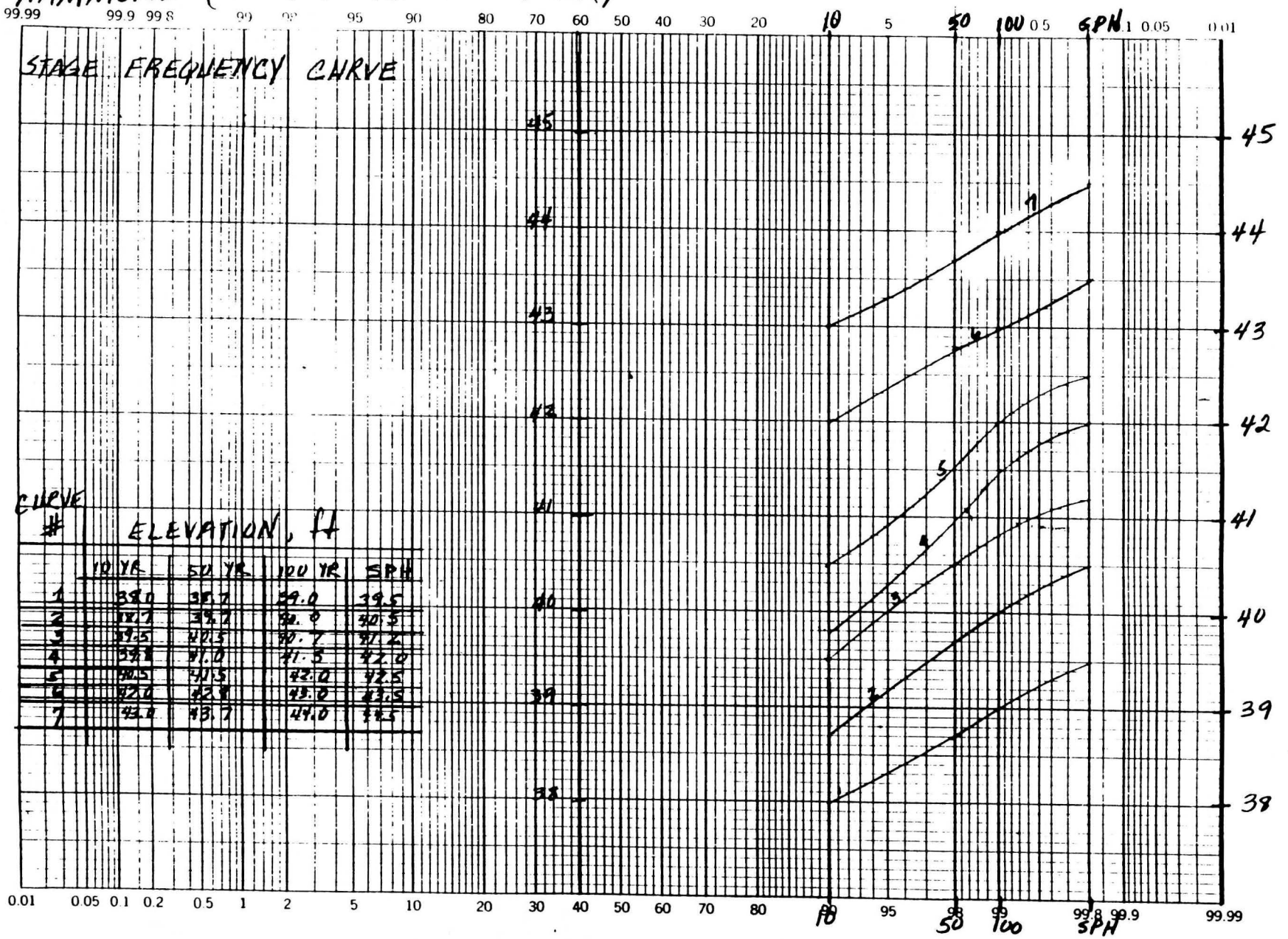
HAMMOND (PONTCHATOULA CREEK)

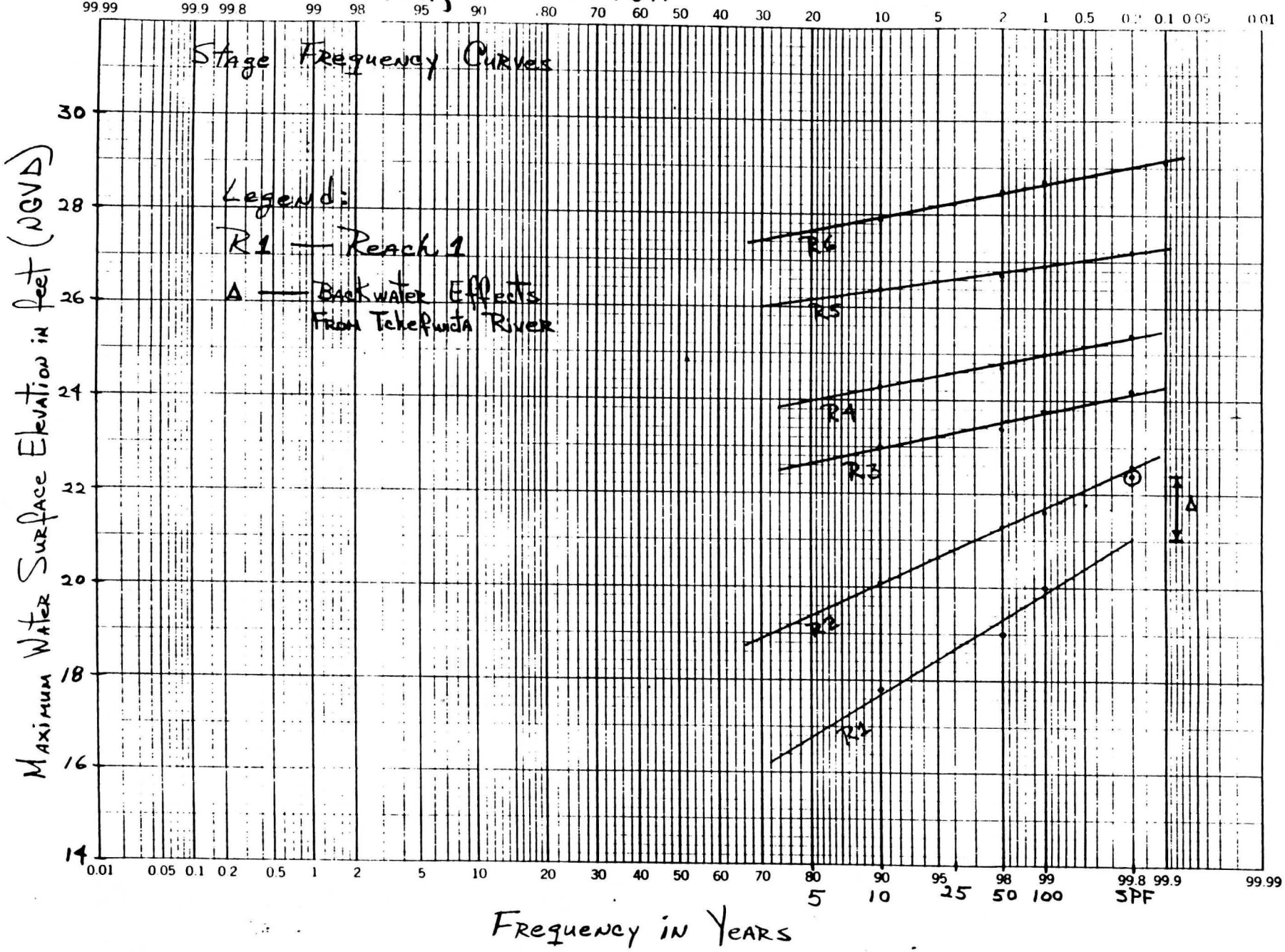
STAGE FREQUENCY CURVE



CURVE #	ELEVATION, ft			
	10 YR	50 YR	100 YR	SPH
1	38.0	38.7	39.0	39.5
2	38.7	39.7	40.0	40.5
3	39.5	40.5	40.7	41.2
4	39.8	41.0	41.5	42.0
5	40.5	41.5	42.0	42.5
6	42.0	42.8	43.0	43.5
7	42.8	43.7	44.0	44.5

MILE BRANCH, COVINGTON

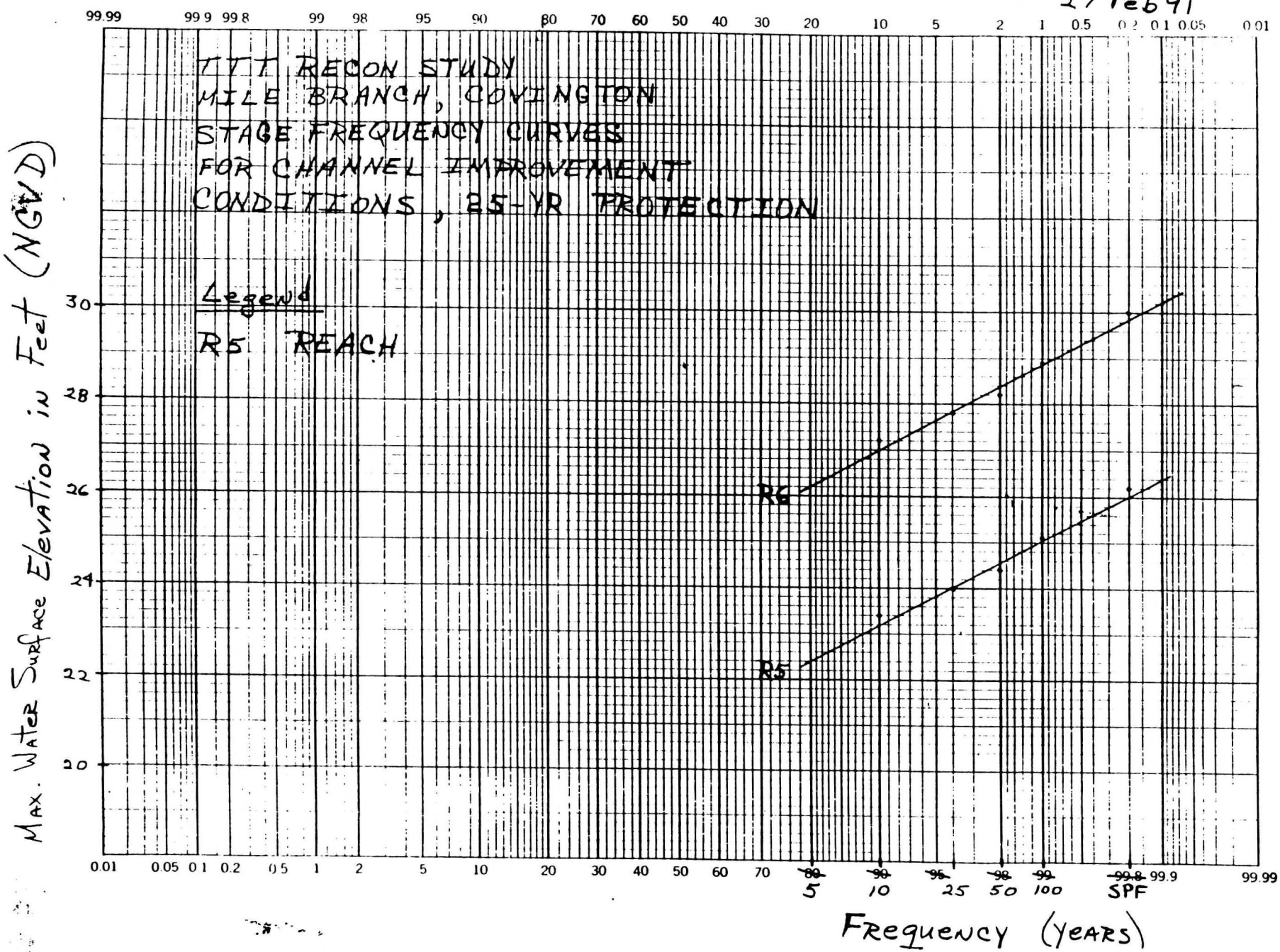
29 MAR 90



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

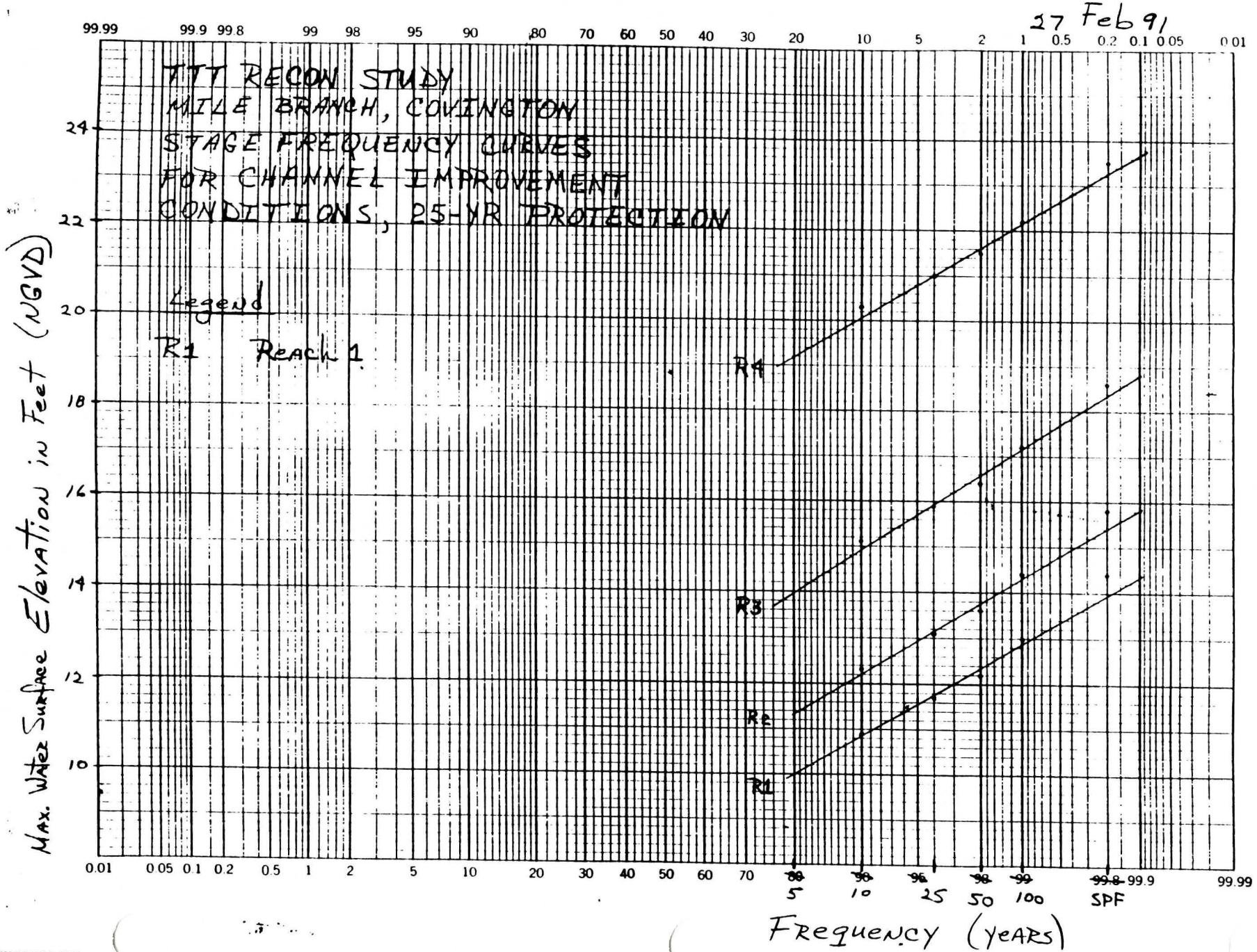
46 8003

27 Feb 91



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003

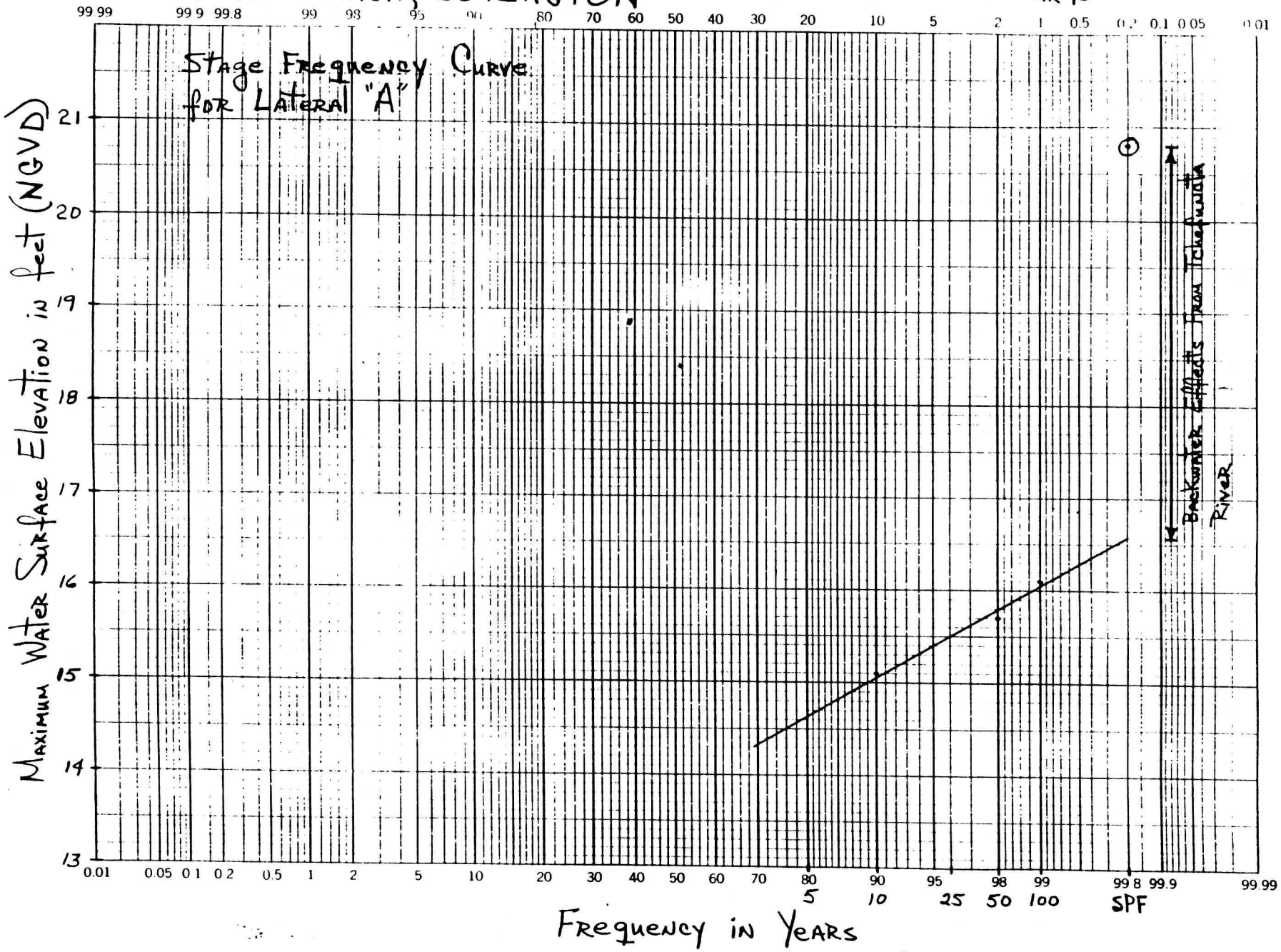


46 8003

MILE BRANCH, COVINGTON

30 MAR 90

Stage Frequency Curve for Lateral "A"

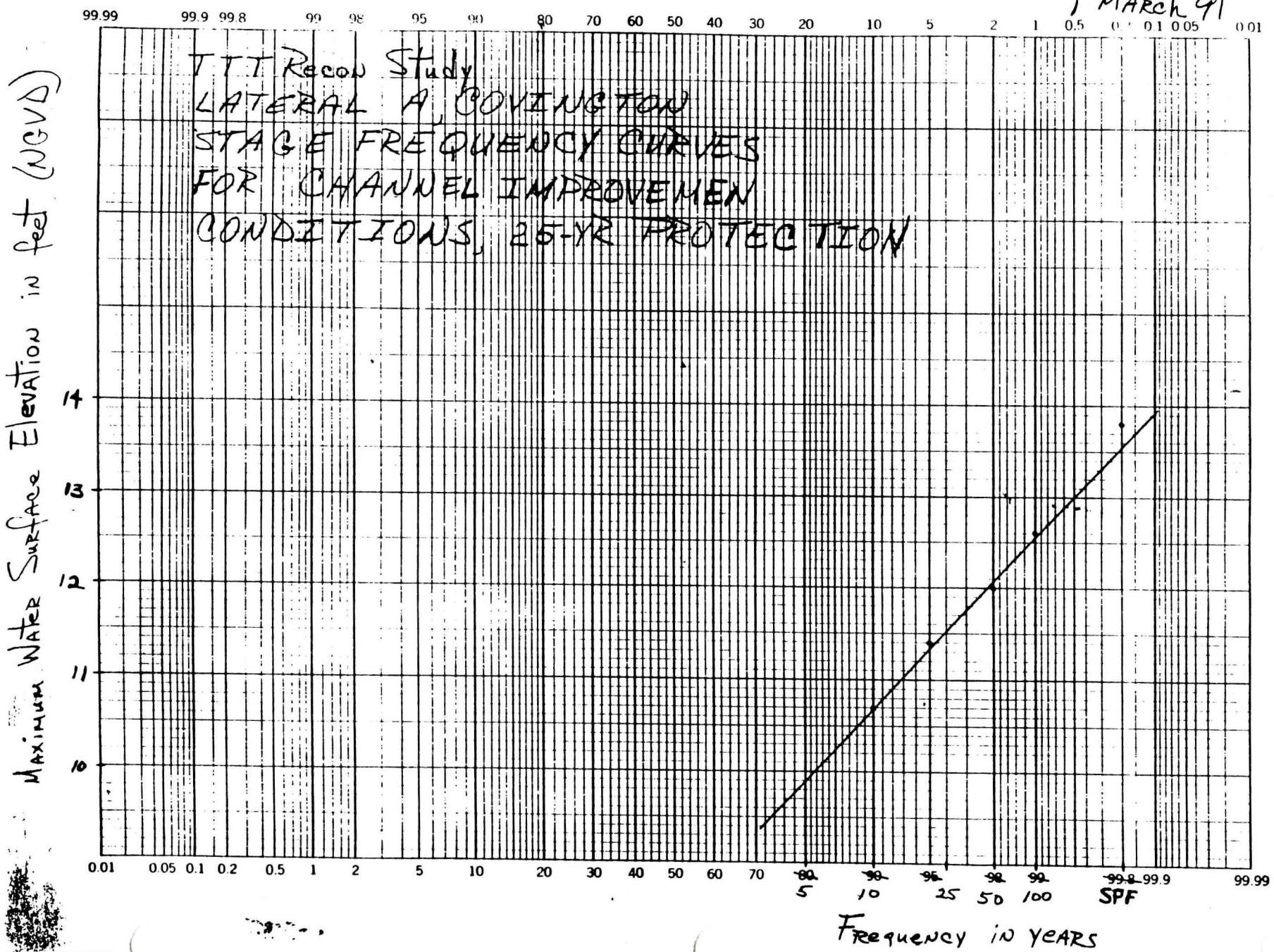


Frequency in Years

K•Σ PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

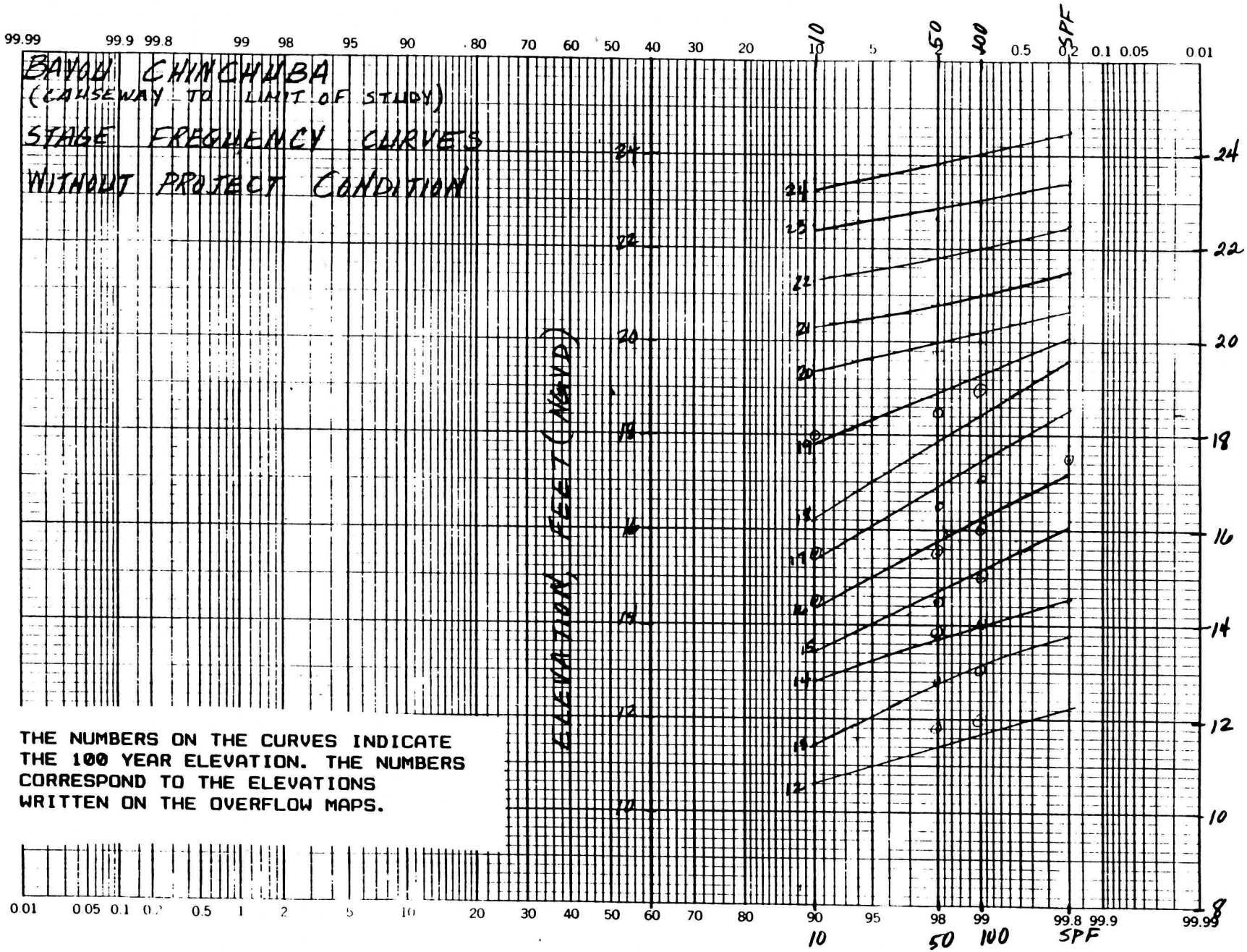
46 8003

1 March 91



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

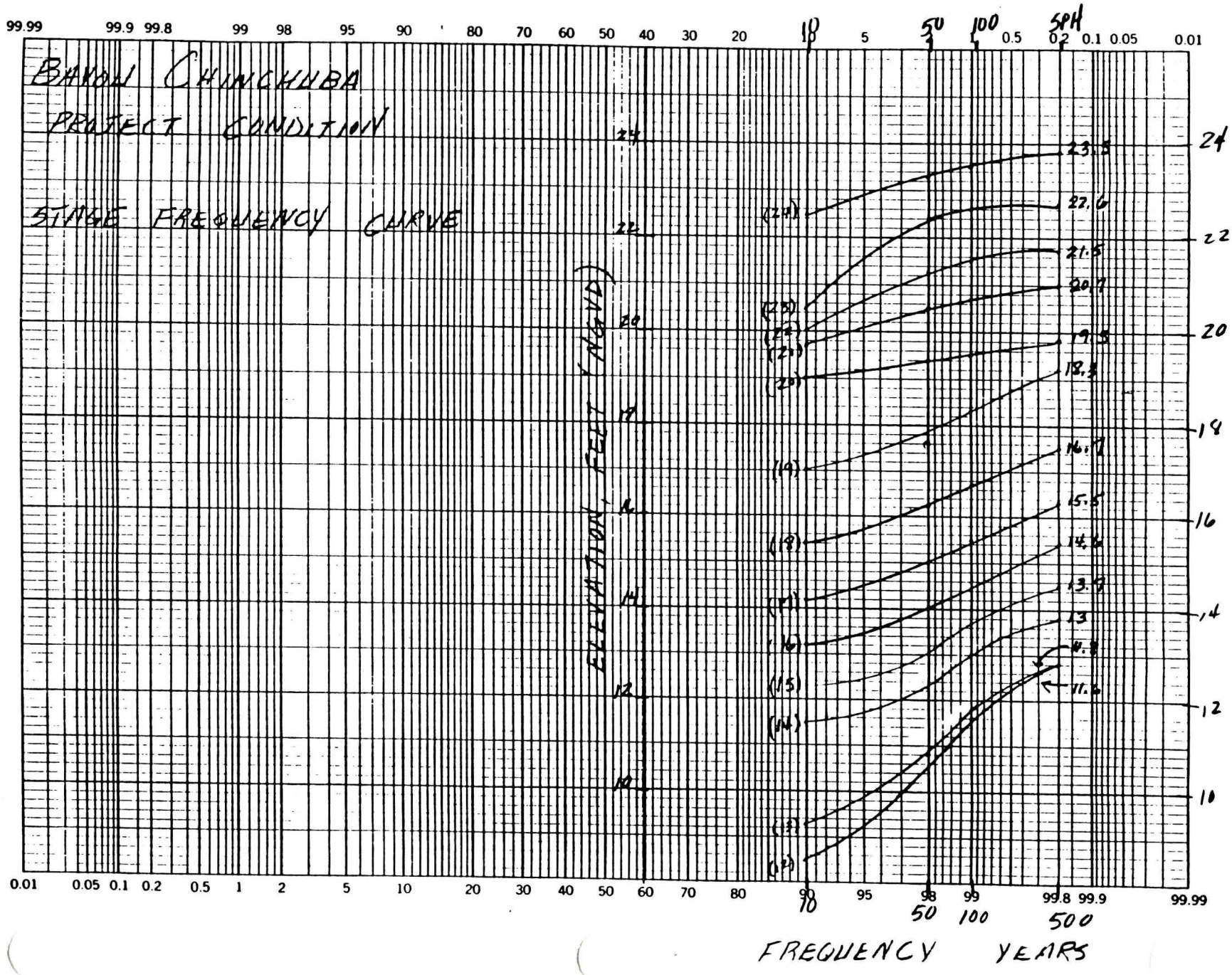
46 8003



FREQUENCY CURVE

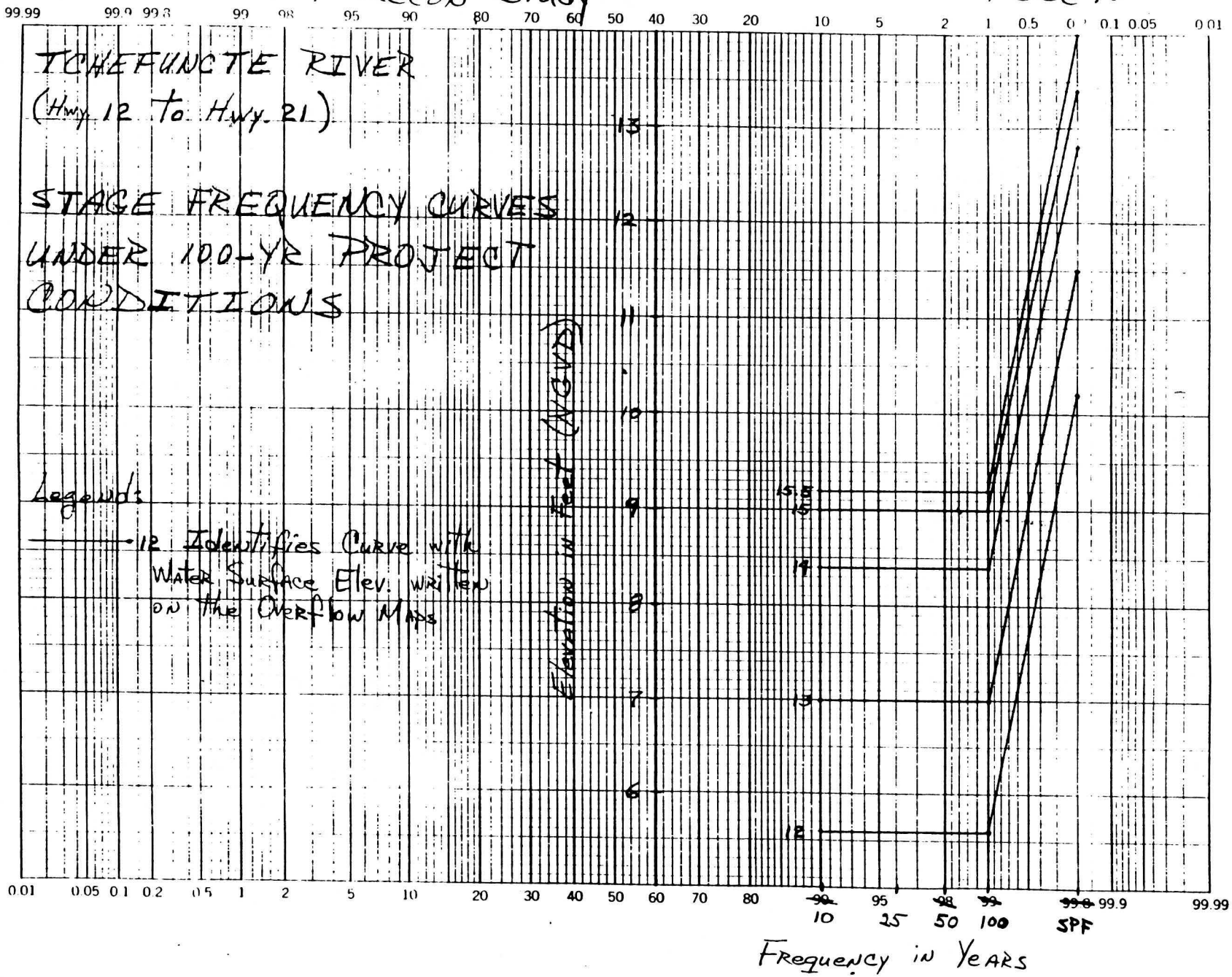
K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003



TTT Recon Study

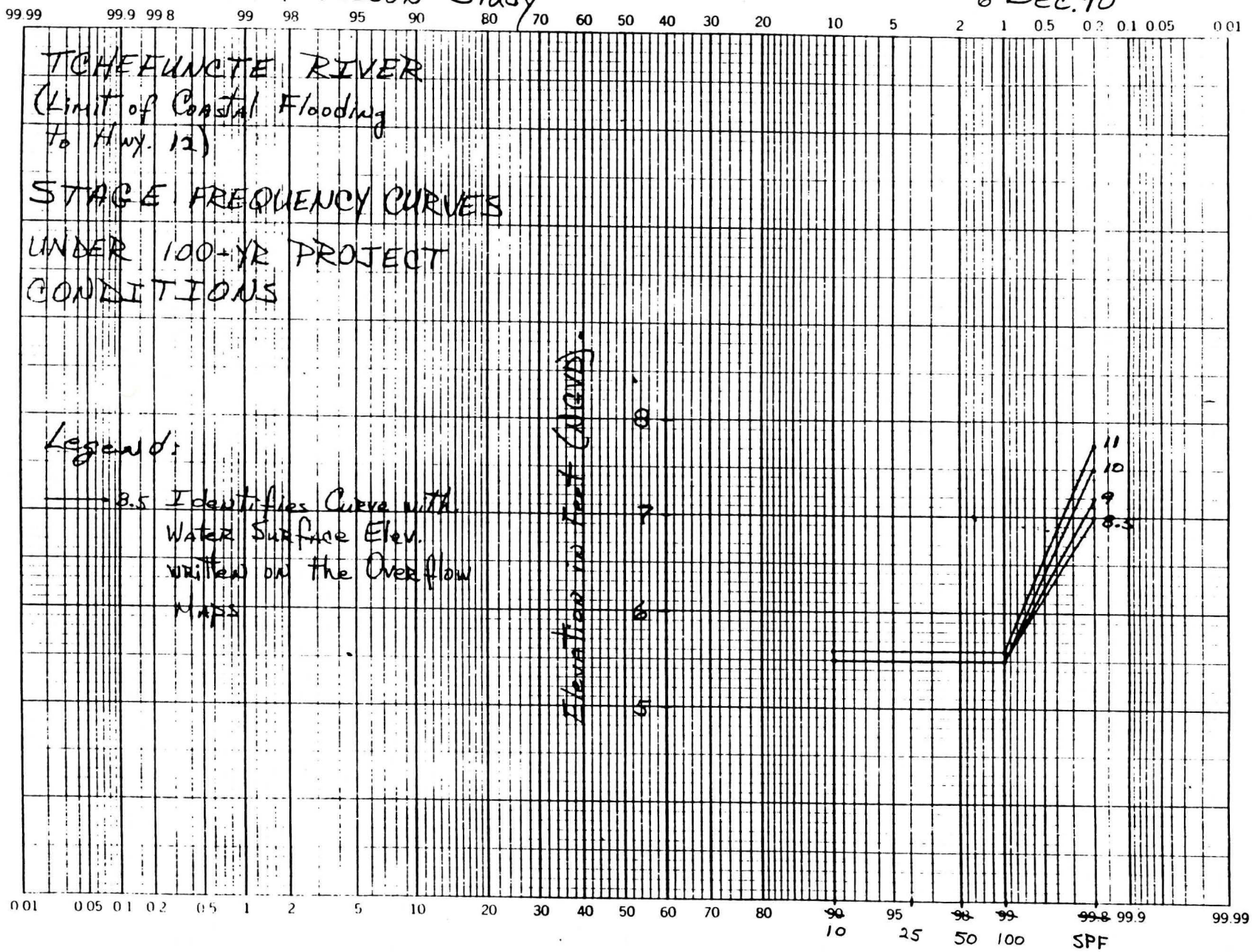
7 Dec 90



46 8003

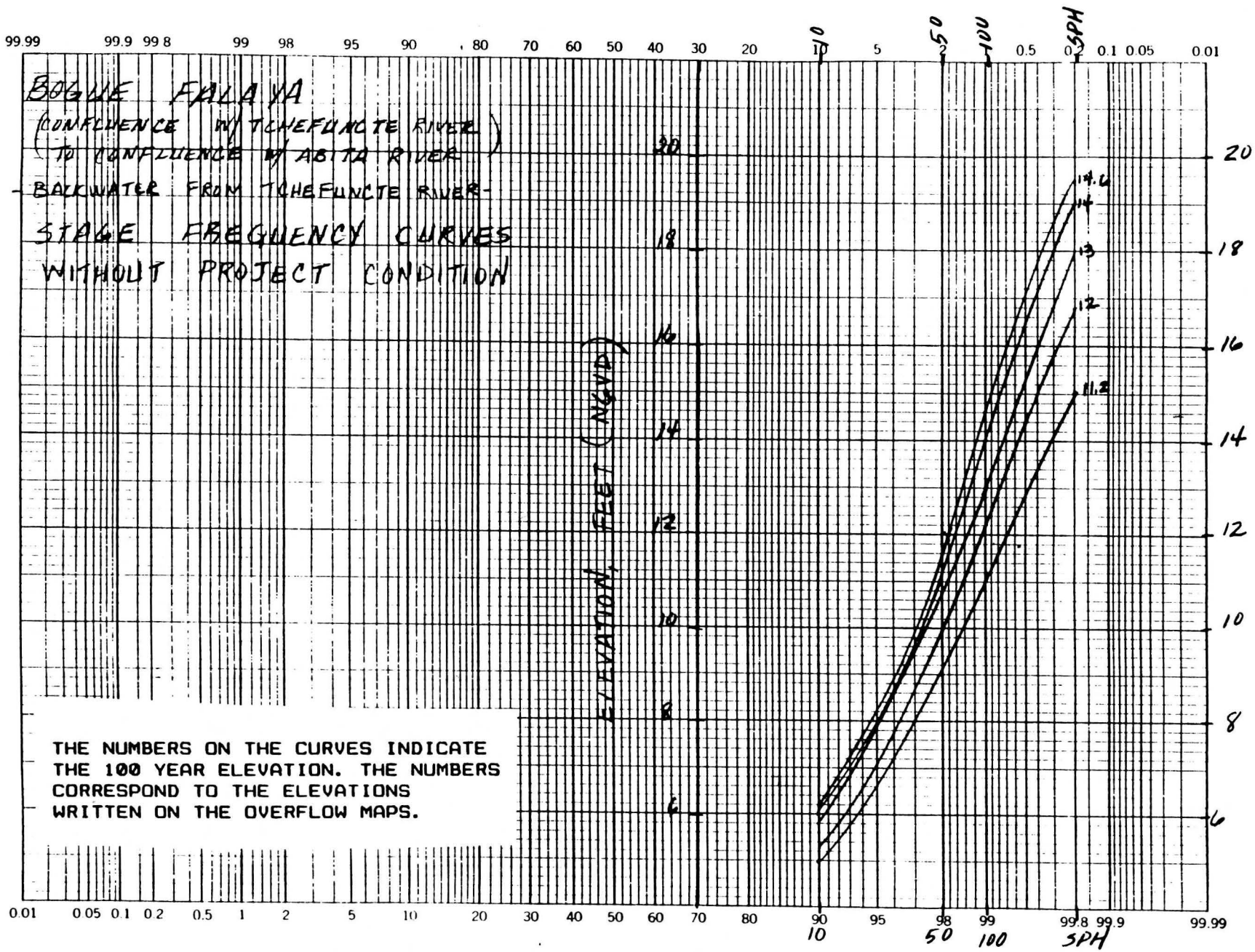
TTT Recon Study

6 Dec. 90



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

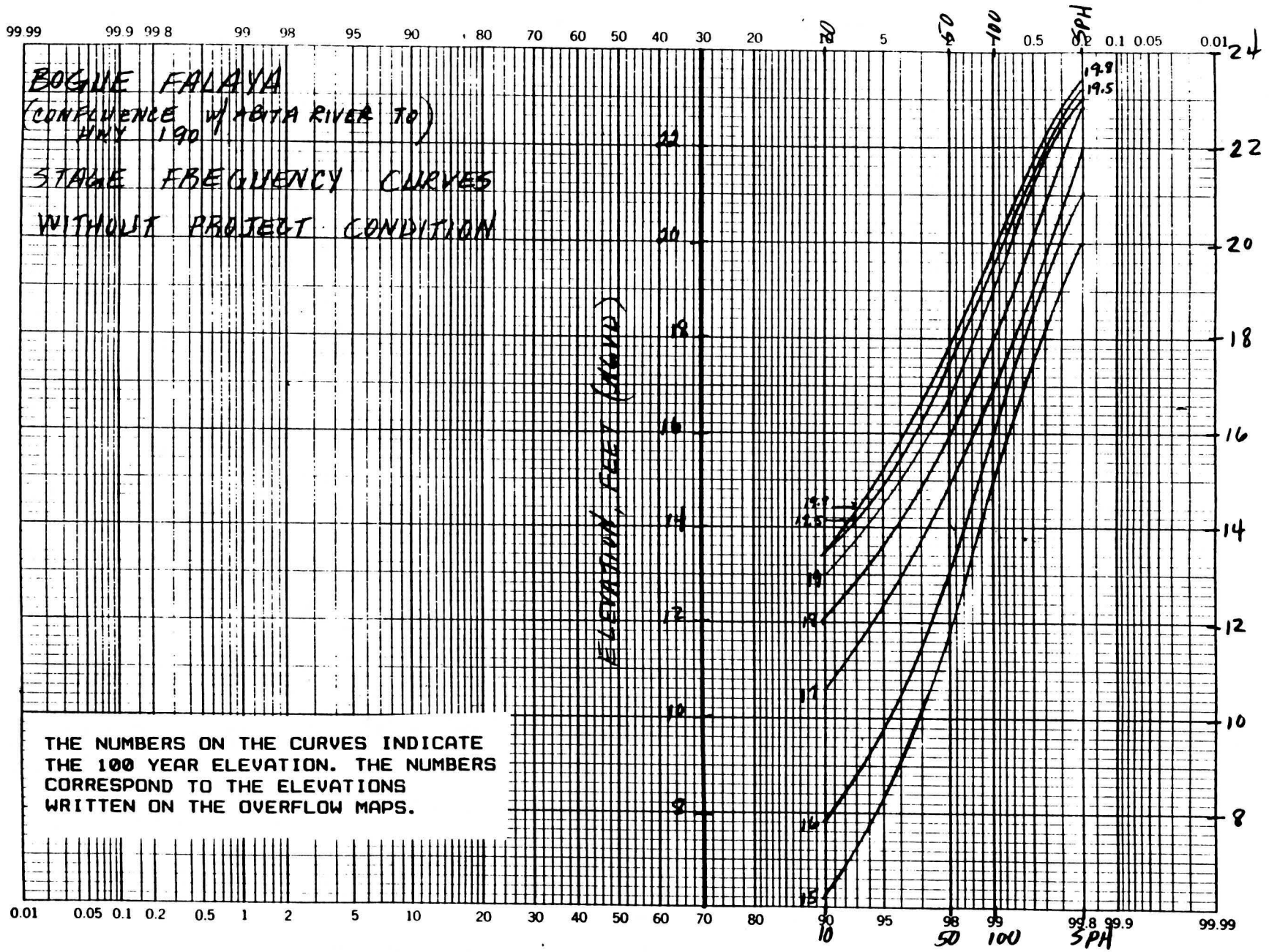
46 8003



FREQUENCY. YEARS

K•E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

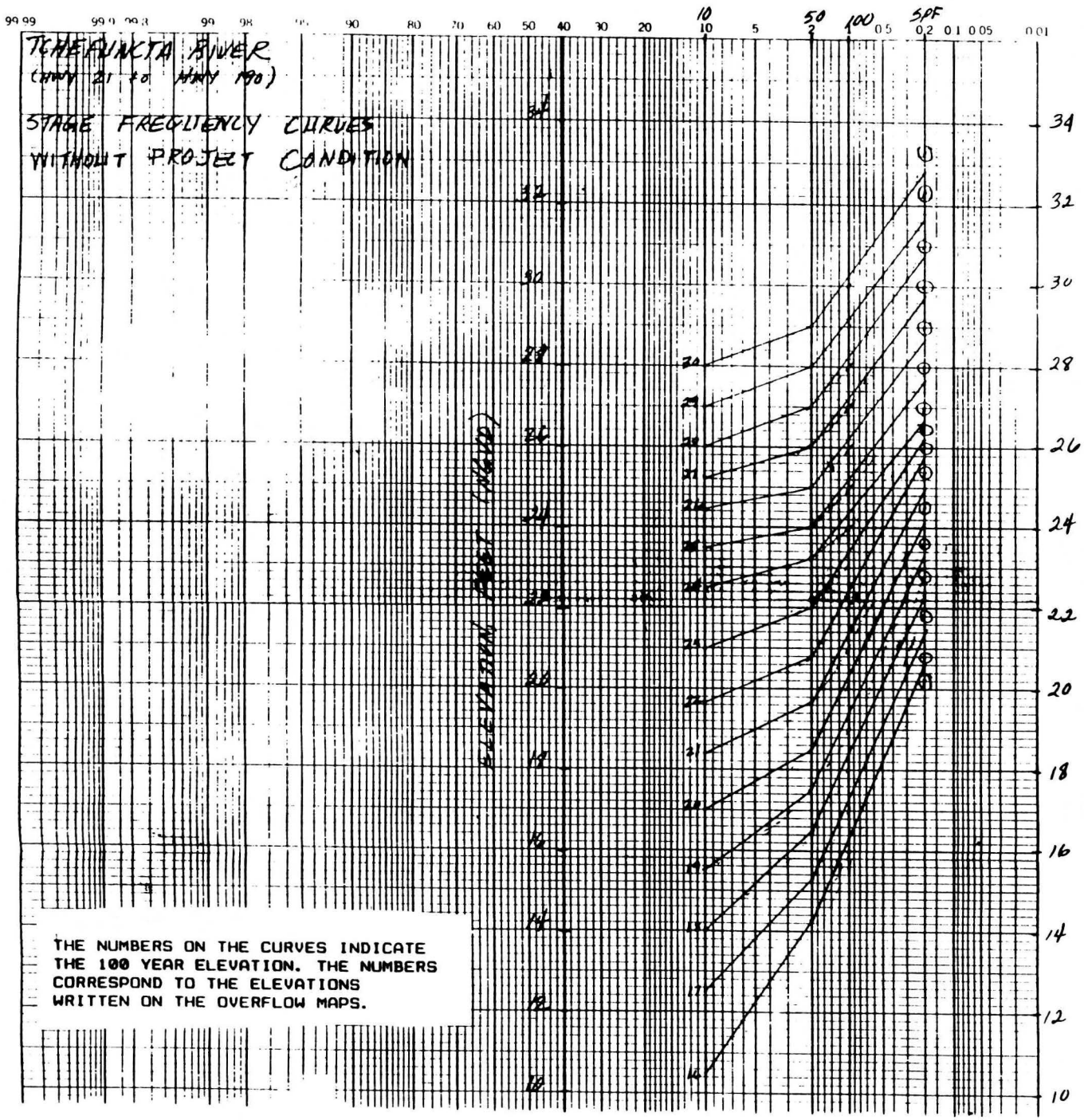
46 8003



- FREQUENCY VERSUS

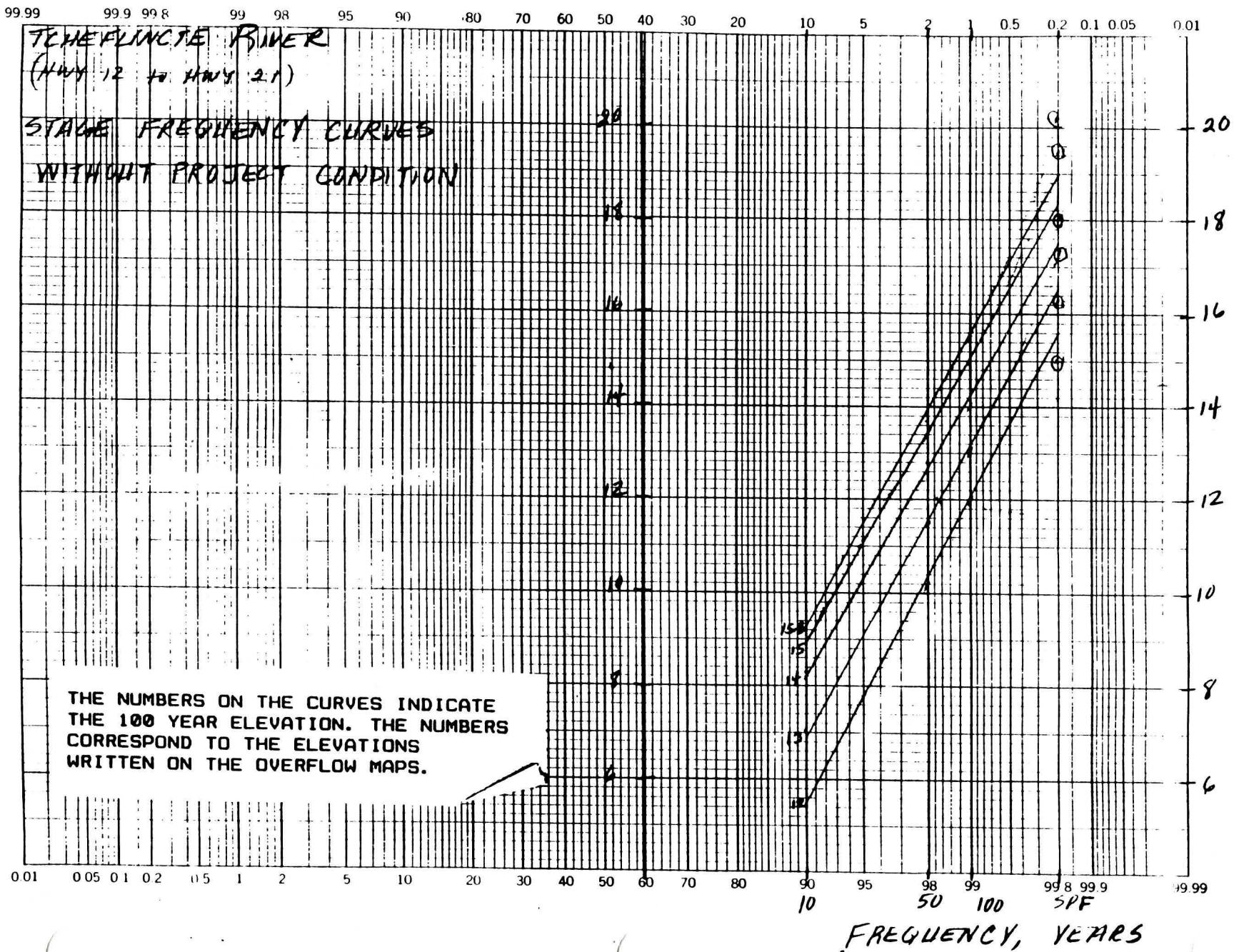
K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO.

46 80



K&E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 8003



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

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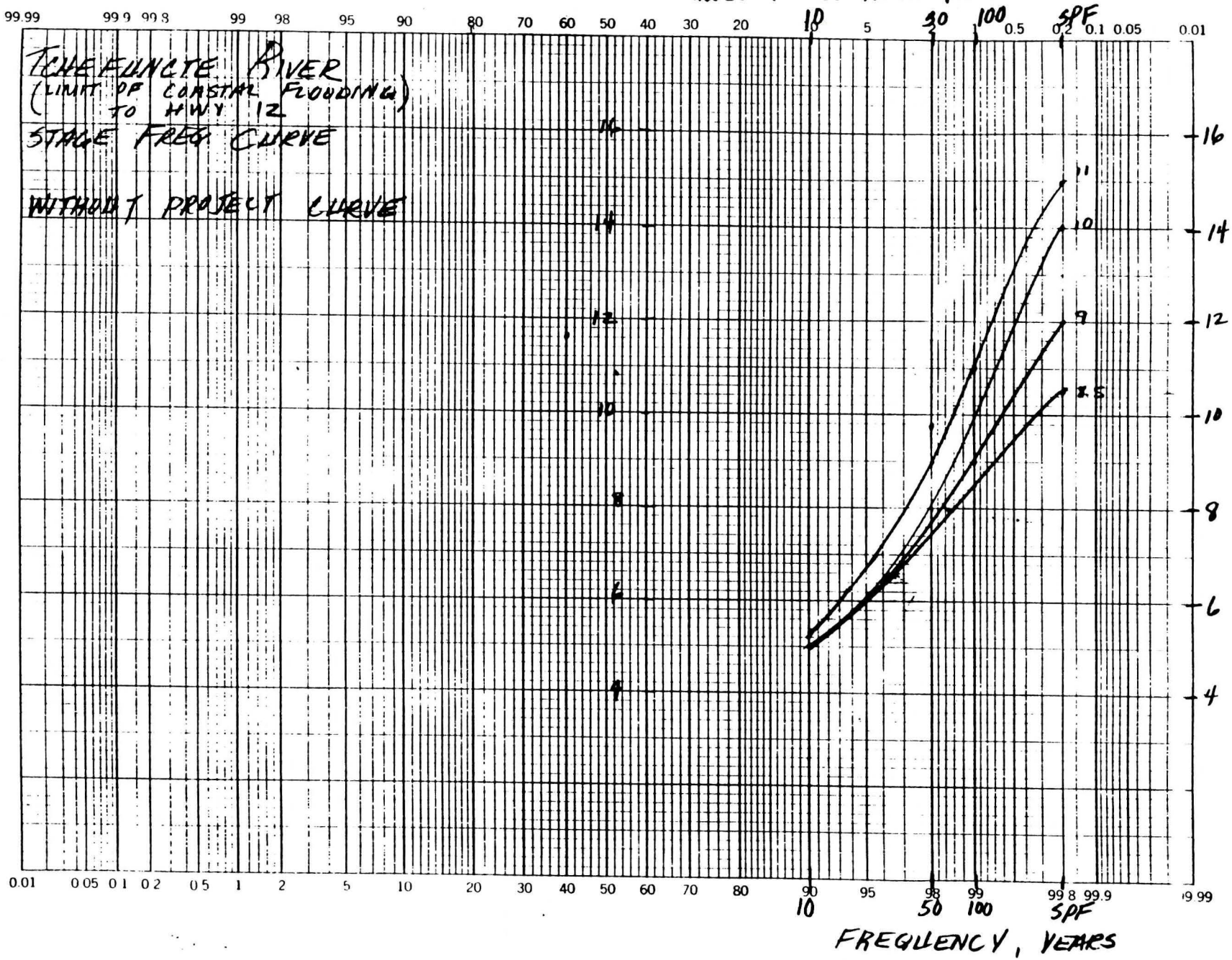
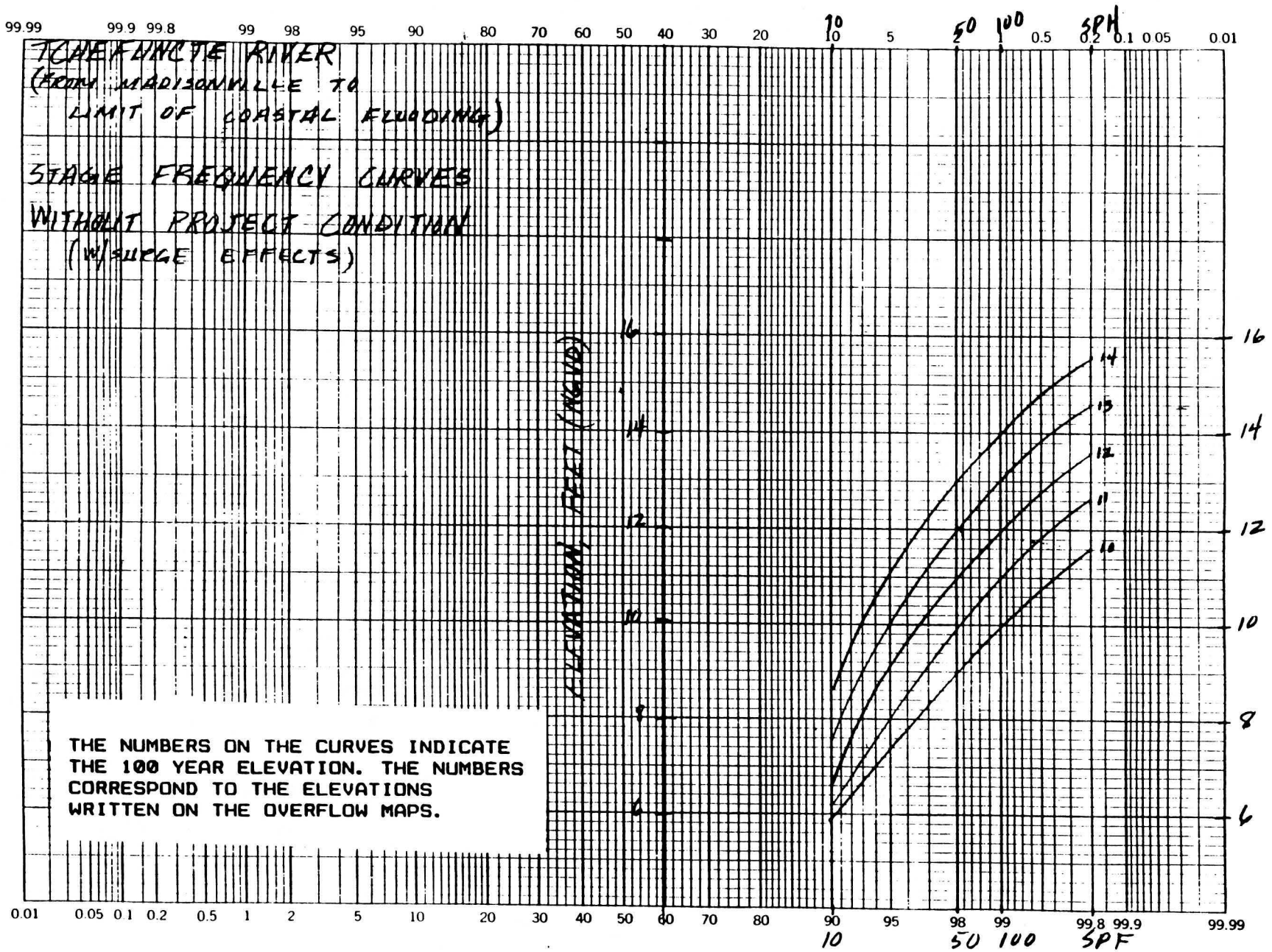
Curves revised on. 18 Apr 91



K·Σ PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

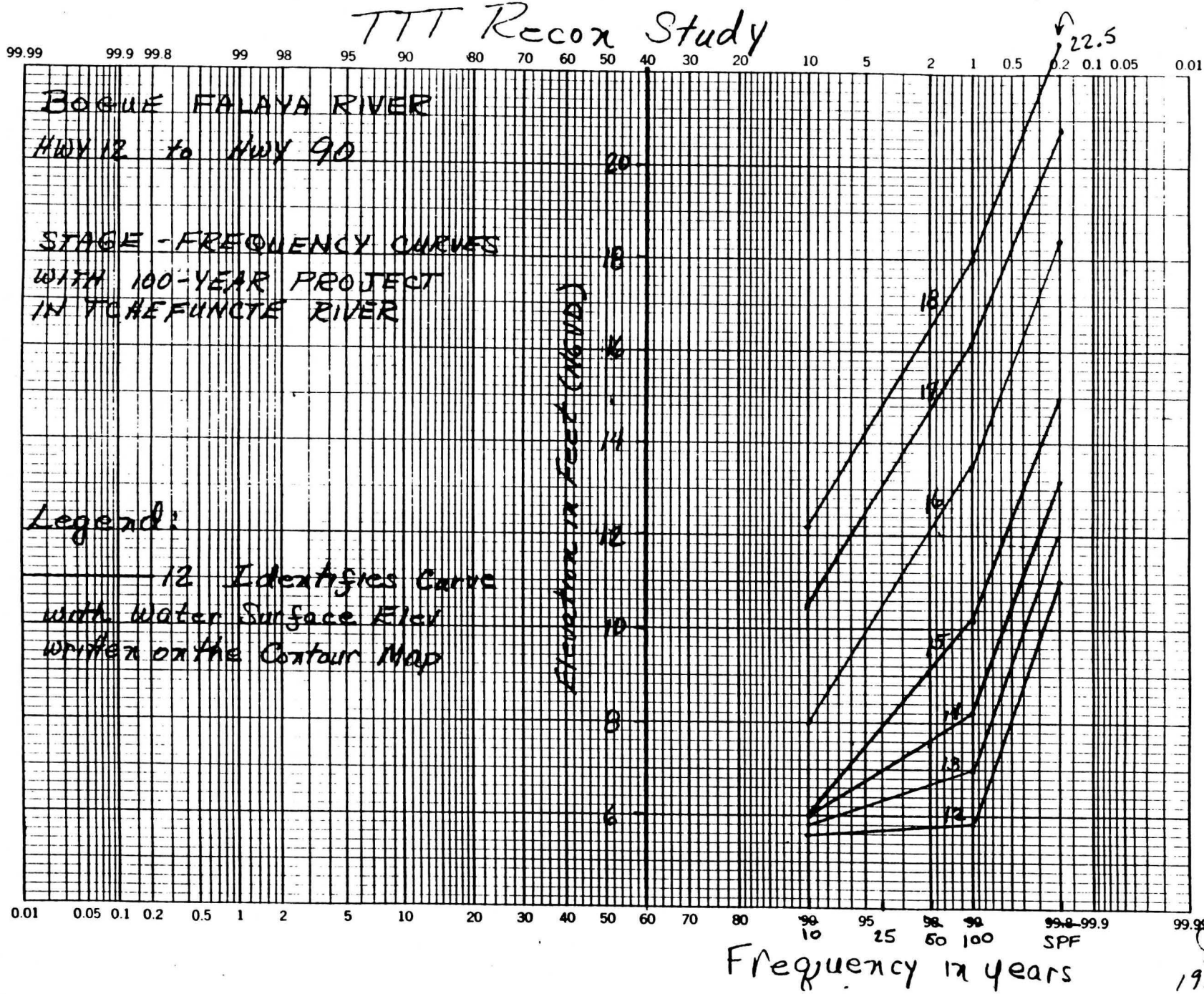
46 8003



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003

TTT Recon Study



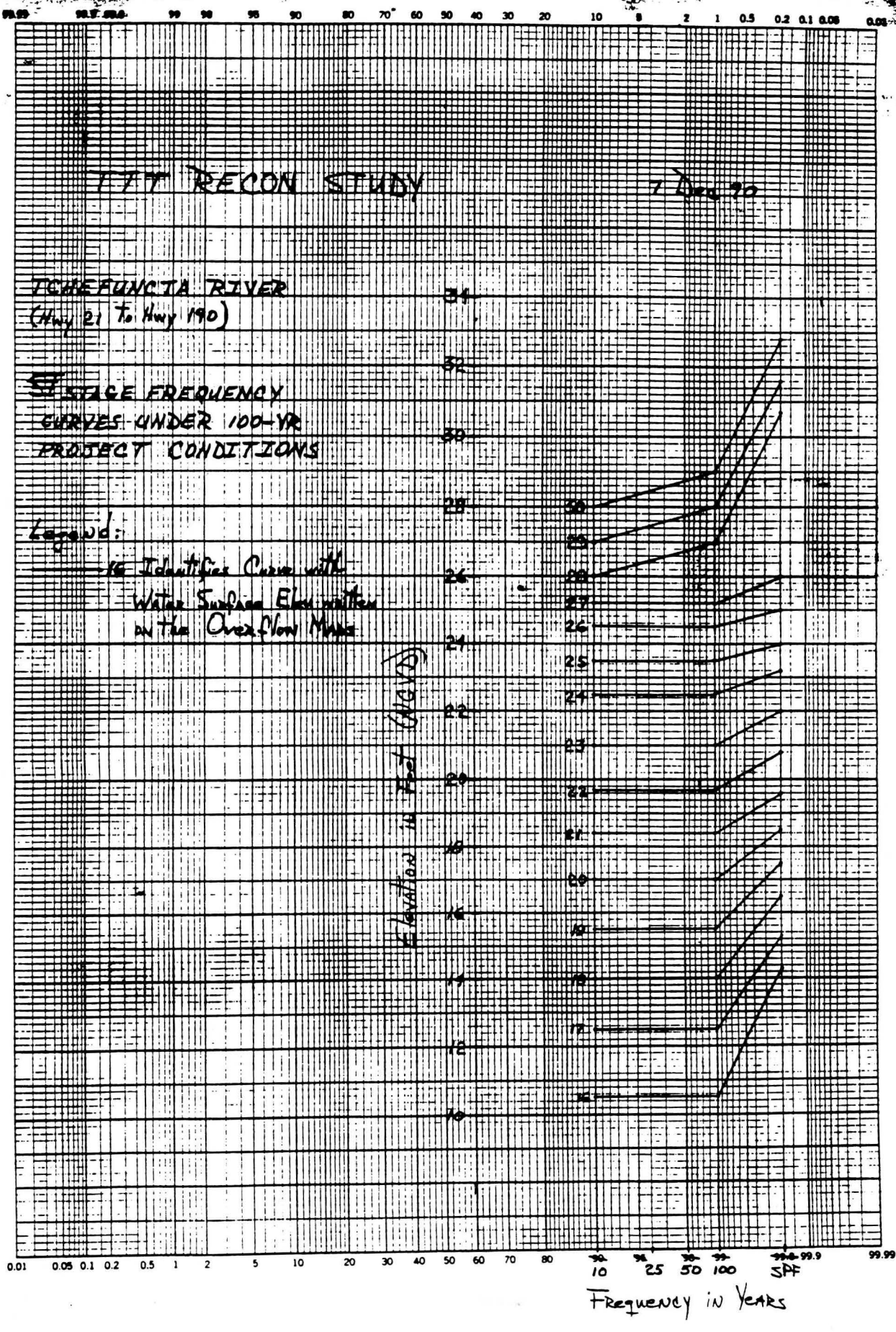
BOGUE FALAYA RIVER
HWY 12 to HWY 90

STAGE - FREQUENCY CURVES
WITH 100-YEAR PROJECT
IN TCHEFUNCTE RIVER

Legend:

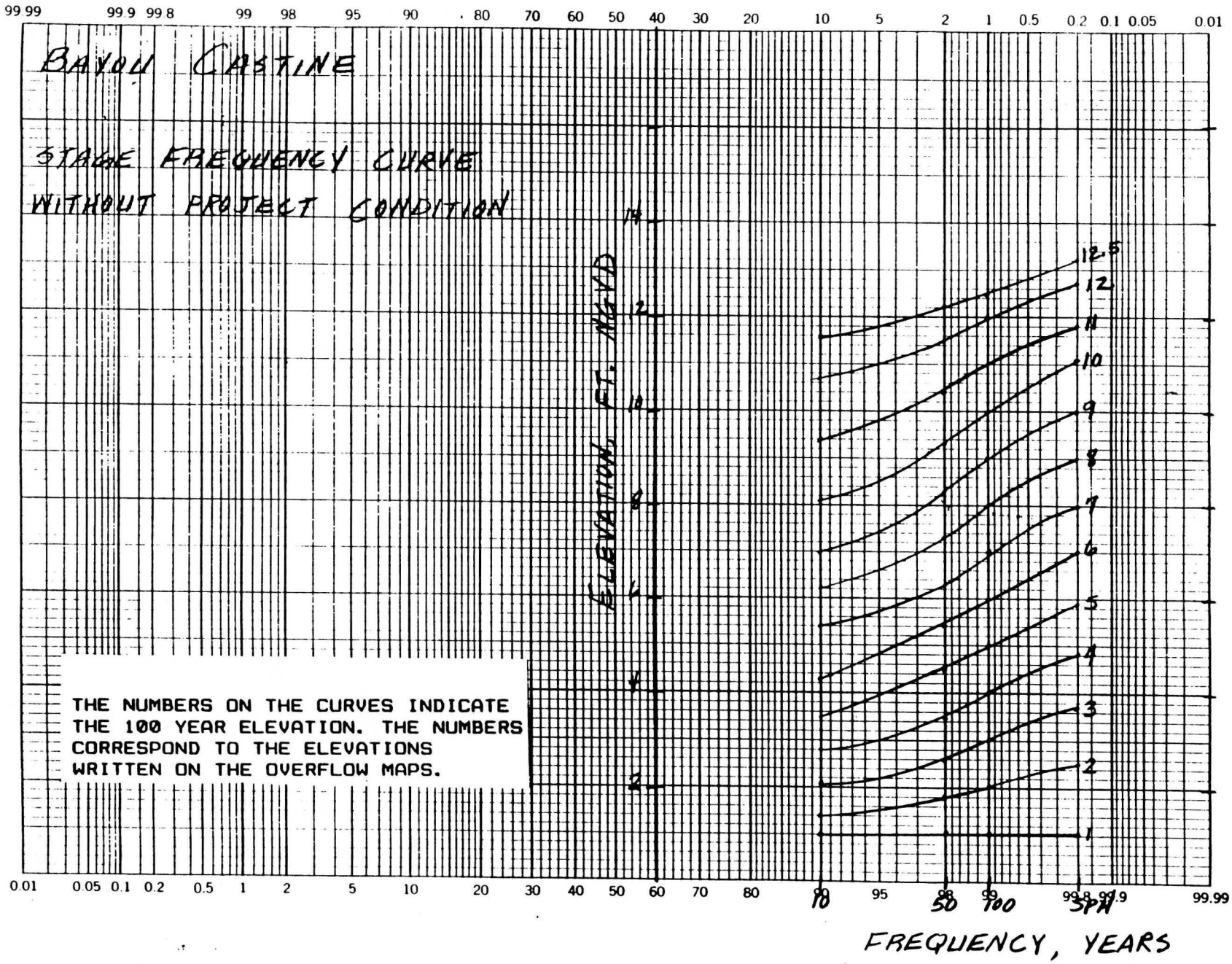
12 Identifies Curve with Water Surface Elev written on the Contour Map

Jm H
19 Apr 91


I/I/T RECON STUDY
7 Dec 90
TCHEFUNCTA RIVER
(Hwy 21 To Hwy 190)
STAGE FREQUENCY
CURVES UNDER 100-YR
PROJECT CONDITIONS
Legend:
16 Identifies Curve with
Water Surface Elev written
on the Overflow Mark
Elevation in Feet (NGVD)
34
32
30
28
26
24
22
20
18
16
14
12
10
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99
10 25 50 100 SPF
Frequency in Years

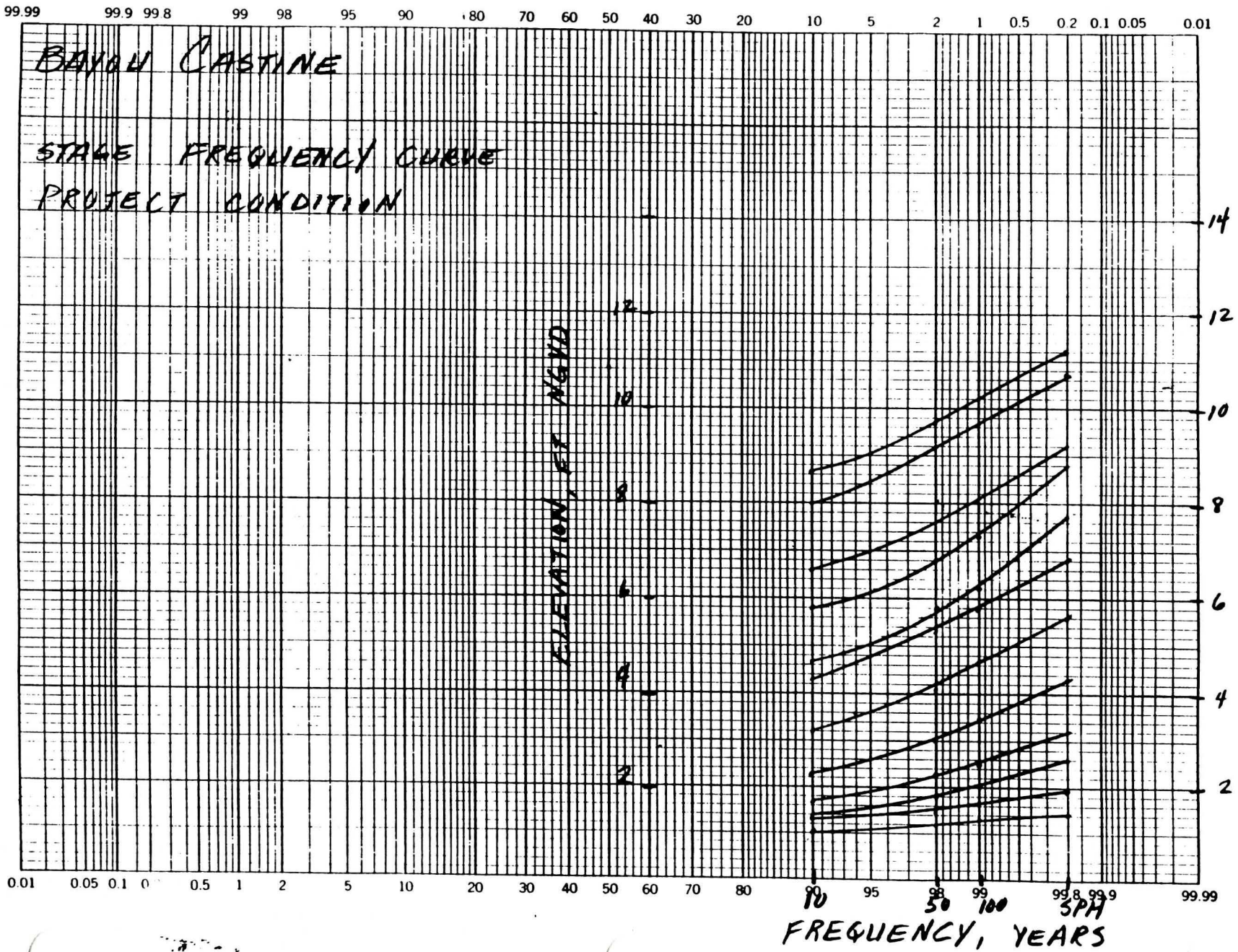
K&E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 8003



K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003



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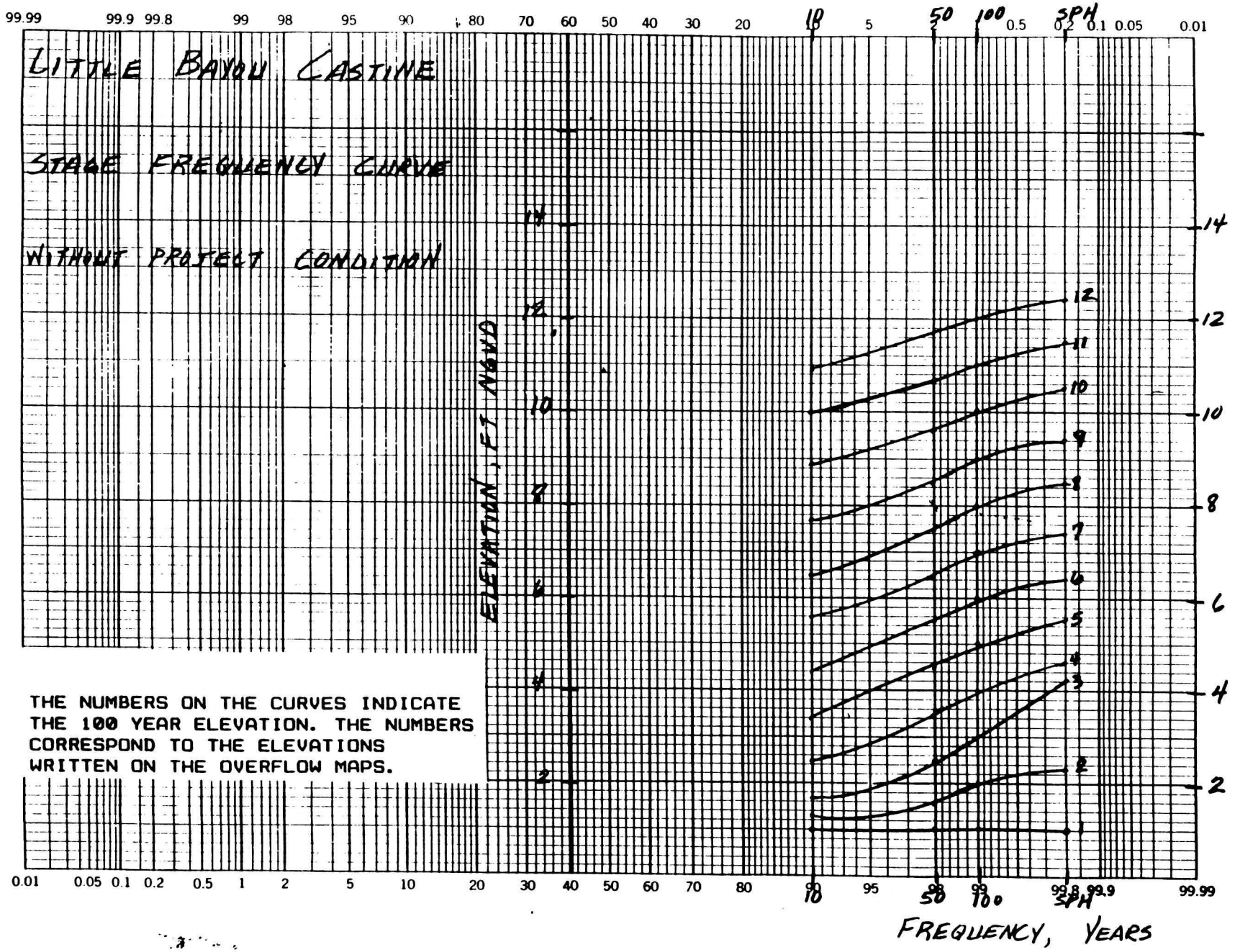
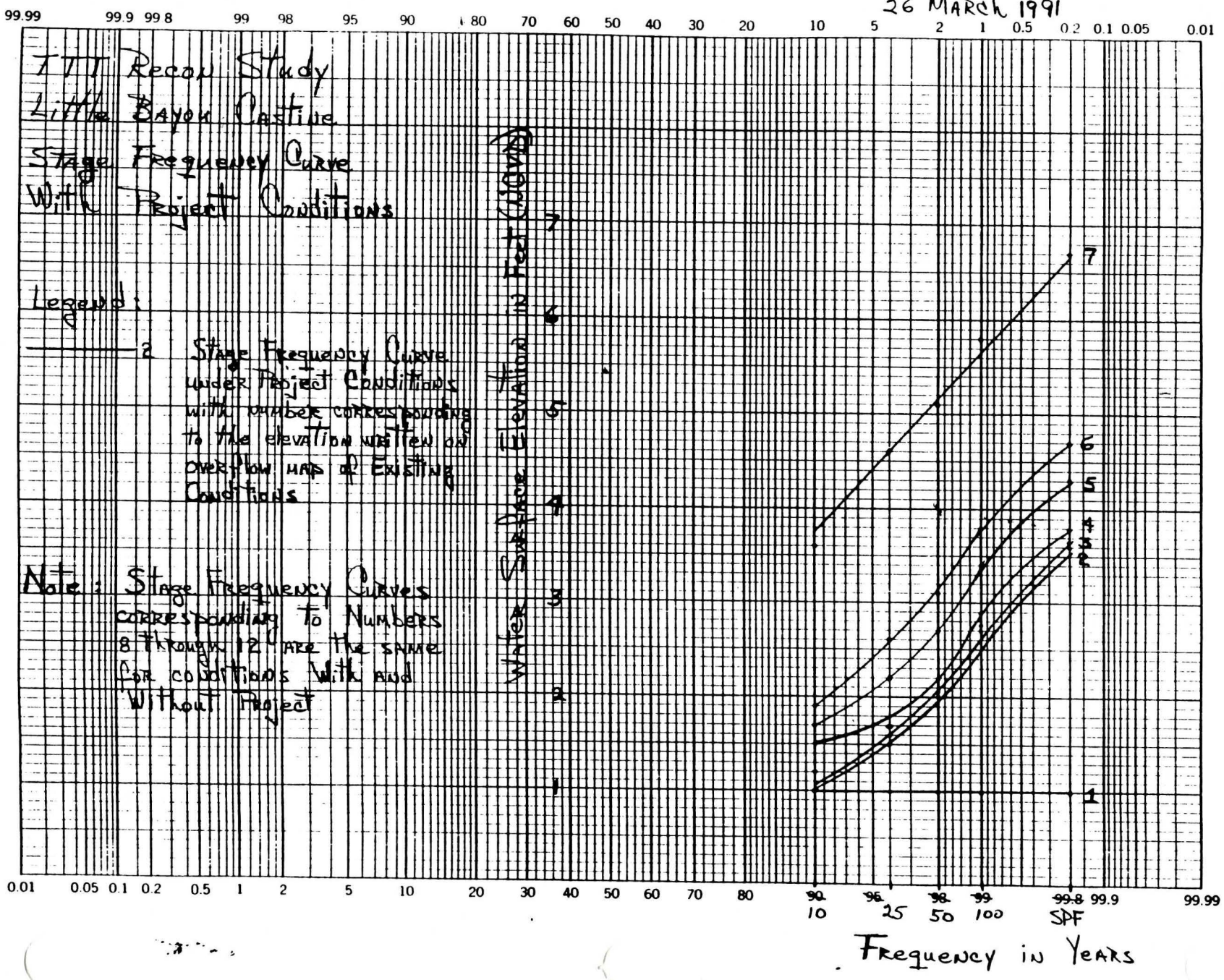


K·E PROBABILITY X 90 DIVISIONS
KEUFFEL & ESSER CO MADE IN U.S.A.

46 8003

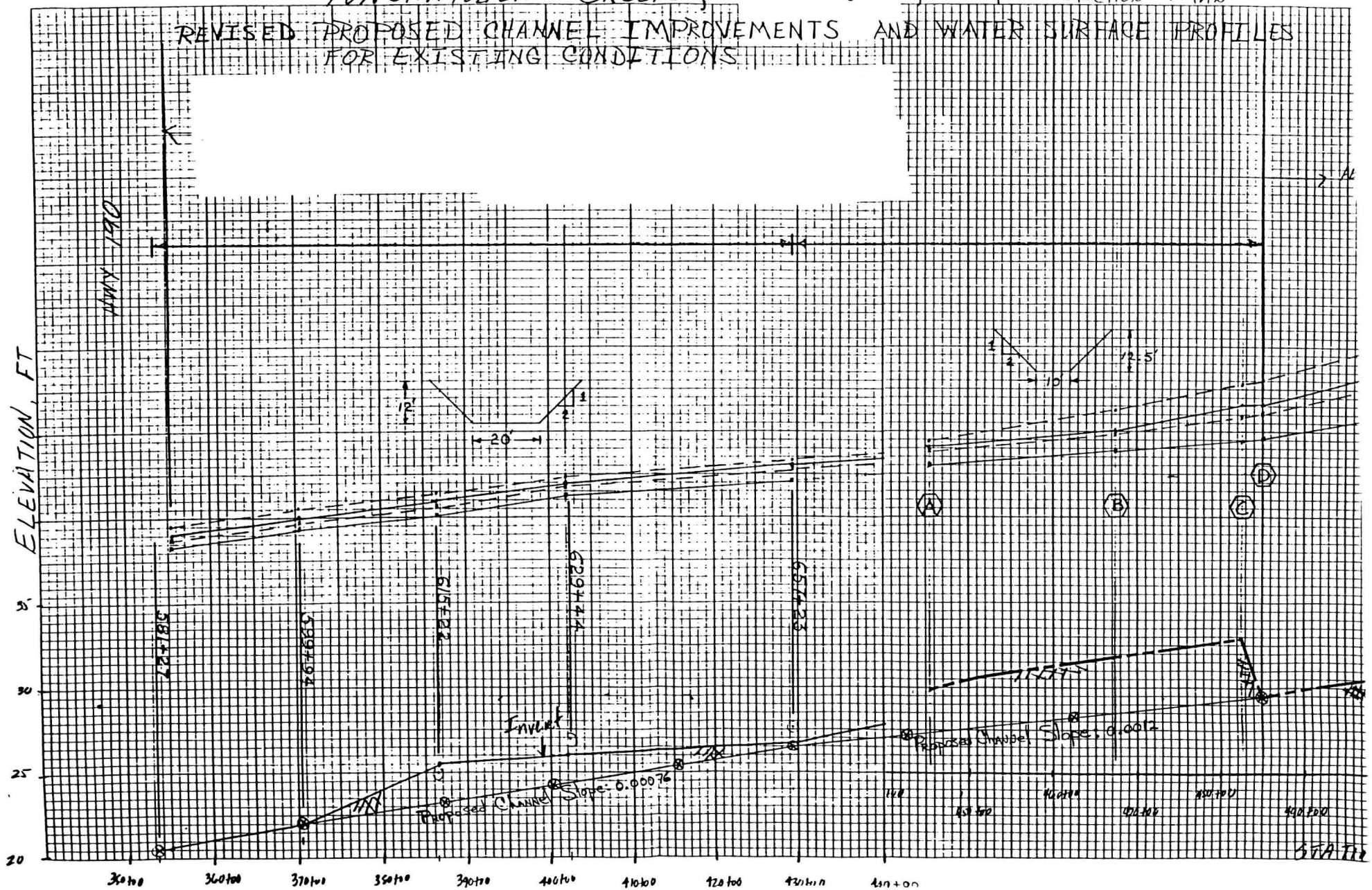
26 MARCH 1991



Preliminary Design Information

PONCHATOULA CREEK, - HAMMOND, 100-YR Protection Plan

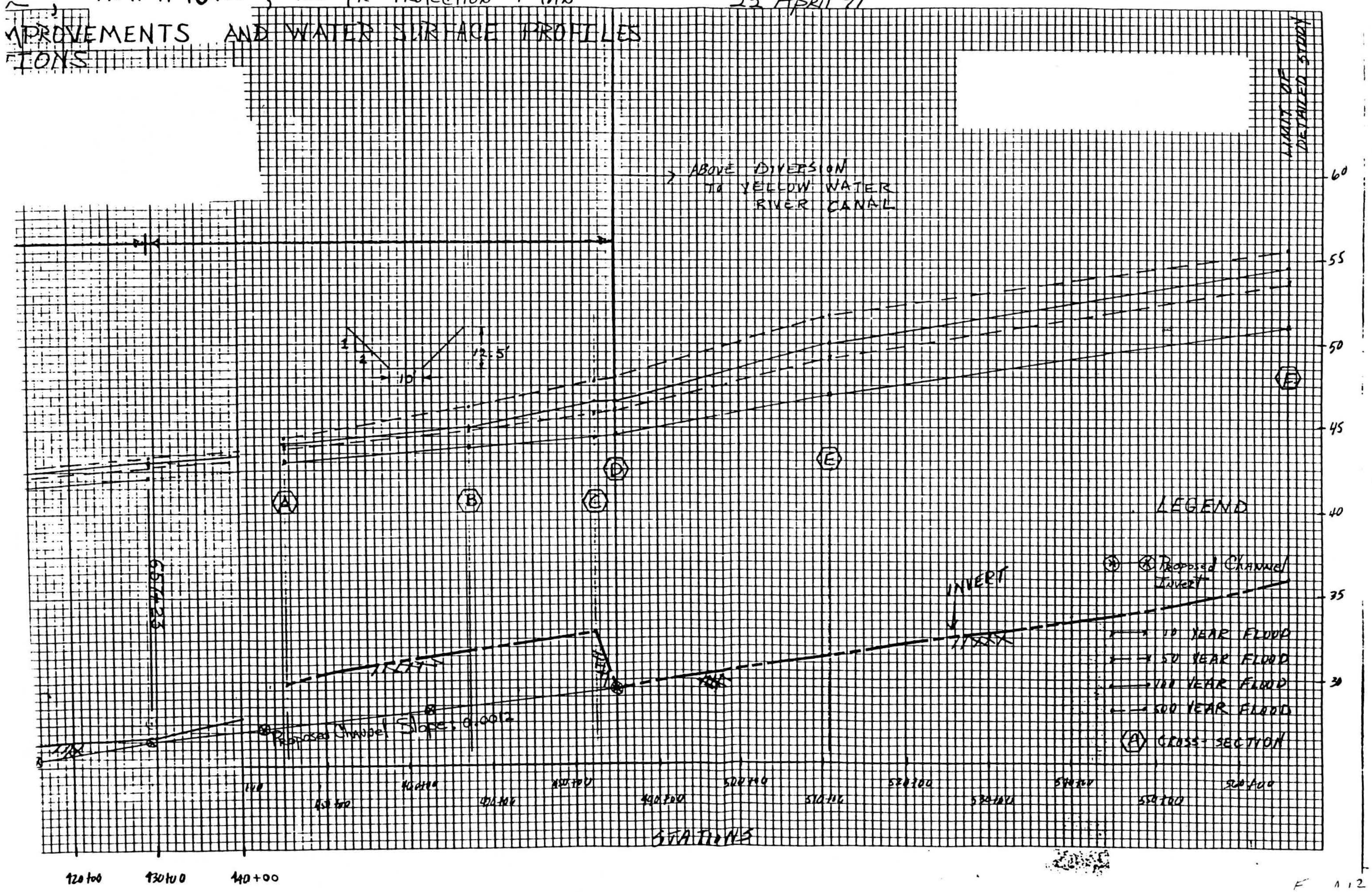
REVISED PROPOSED CHANNEL IMPROVEMENTS AND WATER SURFACE PROFILES FOR EXISTING CONDITIONS



..., 100-K Protection Plan 22 April 91

IMPROVEMENTS AND WATER SURFACE PROFILES

TIONS



F 112

PONTCHATOULA CREEK

4/15/91

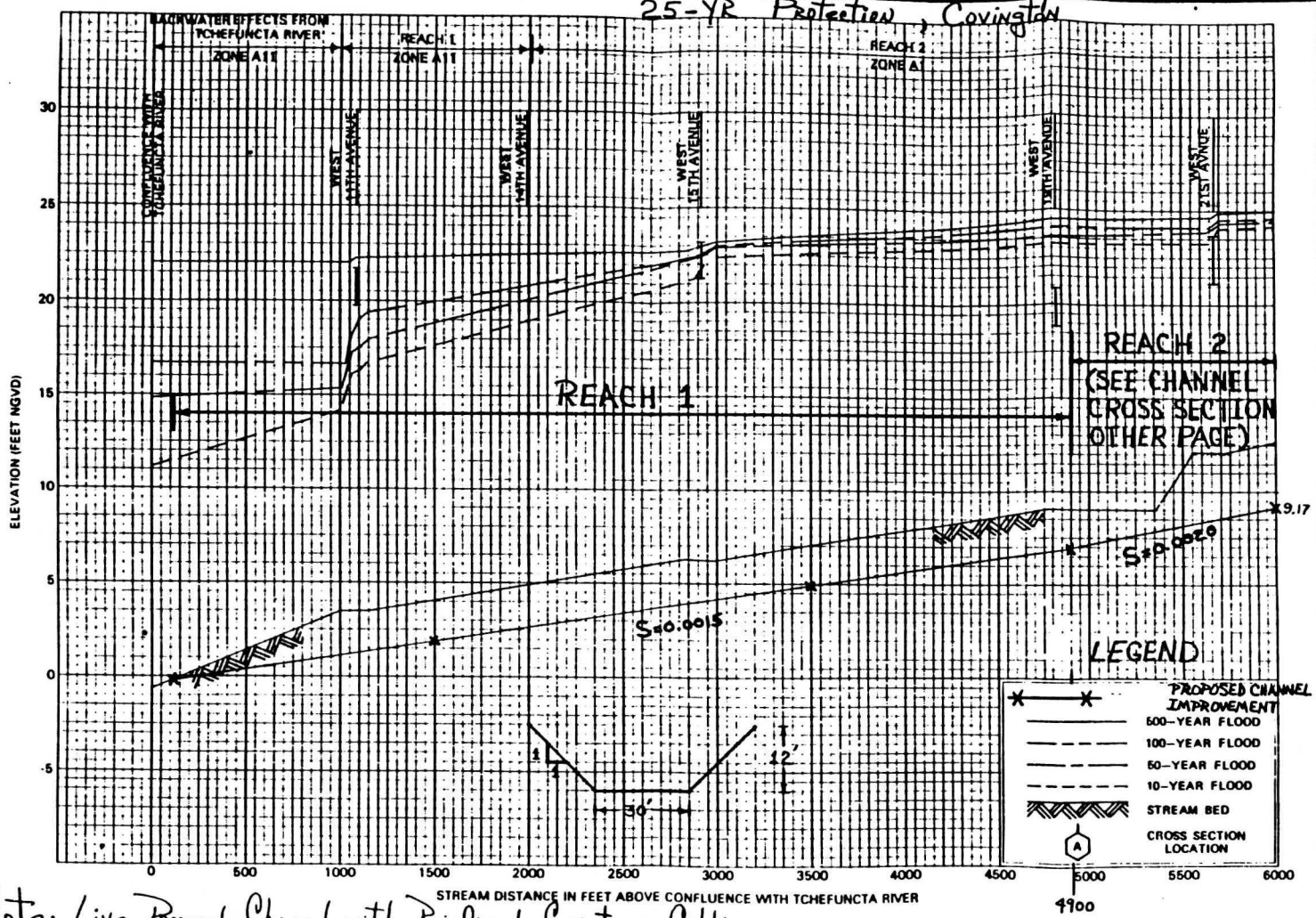
Top-of-bank to Top-of-bank Existing

Acres of "developable" land converted to channel R/W

STATION	YARDAGE	DISTANCE	CHAN R/W		CHAN AC			
57345	0	0	161	100'	0			
57698	4572	353	160	150'	1.296602	-	1.01	= 0.29
57742	499	44	158	132'	.1595960	-	0.14	= 0.02
57798	513	56	161	161' +	.2069789	-	0.19	= 0.0169
58174	5378	376	130	80'	1.122130	-	1.04	= 0.082
58481	6515	307	128	100'	.9021120	-	0.63	= 0.27
58900	8550	419	190	106'	1.827594	-	0.99	= 0.84
59184	5247	284	176	92'	1.147475	-	0.65	= 0.50
59497	5052	313	153	110'	1.099380	-	0.72	= 0.38
59994	7961	497	168	80'	1.916804	-	1.08	= 0.84
60040	843	46	173	86'	.1826905	-	0.088	= 0.095
60155	2346	115	171	60'	.4514463	-	0.19	= 0.261
60186	653	31	171	60'	.1216942	-	0.04	= 0.0816
60543	4798	357	130	130'	1.065427	-	0.78	= 0.29
60557	87	14	119	119' +	.0382461	-	.038	= 0
60804	2257	247	147	147' +	.8335399	-	.75	= 0.083
61252	5397	448	155	124'	1.594123	-	1.39	= 0.2
61522	1997	270	156	94'	.9669421	-	0.66	= 0.26
61714	3874	192	216	116'	.9520661	-	0.46	= 0.49
62111	10212	397	166	70'	1.512902	-	0.85	= 0.66
62135	300	24	166	72'	.0914601	-	0.039	= 0.052
62256	1445	121	129	82'	.3583333	-	0.21	= 0.15
62552	3350	296	160	65'	1.087236	-	0.50	= 0.59
62846	2648	294	144	58'	.9719008	-	0.42	= 0.55
62944	1143	98	181	75'	.4072084	-	0.15	= 0.26
63330	4865	386	131	131' +	1.160836	-	0.91	= 0.25
63790	5807	460	165	76'	1.742424	-	1.09	= 0.65
63927	2113	137	122	76'	.3837006	-	0.24	= 0.14
64406	6659	479	143	143' +	1.572475	-	1.20	= 0.37
64584	2119	178	171	76'	.6987603	-	0.45	= 0.25
64618	354	34	171	78'	.1334711	-	0.06	= 0.073
64986	3615	368	165	78'	1.393939	-	0.66	= 0.73
65014	280	28	162	78'	.1041322	-	0.05	= 0.06
65213	1944	199	128	88'	.5847567	-	0.38	= 0.21
65723	6698	510	120	95'	1.404959	-	1.07	= 0.33
66200	5868	477	114	114' +	1.248347	-	1.14	= 0.11
66381	1832	181	139	120'	.5775712	-	0.49	= 0.087
66630	5038	249	179	40'	1.023209	-	0.46	= 0.563
66678	1426	48	184	40'	.2027548	-	0.044	= 0.16
66886	6719	208	206	110'	.9836547	-	0.36	= 0.62
67043	4082	157	167	58'	.6019054	-	0.30	= 0.30
67071	467	28	164	58'	.1054178	-	0.037	= 0.07
67323	4159	252	176	95'	1.018182	-	0.44	= 0.58
67829	8860	506	167	70'	1.939899	-	0.96	= 0.98
68118	4667	289	149	60'	.9885445	-	0.2	= 0.79
68306	2662	188	158	118'	.6819100	-	0.38	= 0.3
68769	6774	463	164	106'	1.743159	-	1.19	= 0.55
69300	7902	531	158	74'	1.926033	-	1.10	= 0.82
69516	3597	216	159	42'	.7884298	-	0.29	= 0.5
69544	582	28	165	40'	.1060606	-	0.03	= 0.08
70000	8789	456	177	112'	1.852893	-	0.80	= 1.05
70241	4086	241	157	76'	.8686180	-	0.52	= 0.35
71200	19963	959	200	110'	4.403122	-	2.05	= 2.35
	217564	159.0566			50.55305			20.5
	ROUND 220,000	ROUND 160			ROUND 51			round 21 acres

TTT RECON STUDY — Mile Branch Channel Improvement — 22 Feb 91

25-YR Protection, Covington



Note: Line Proposed Channel with Reinforced Concrete or Gabions

FLOOD PROFILES

MILE BRANCH

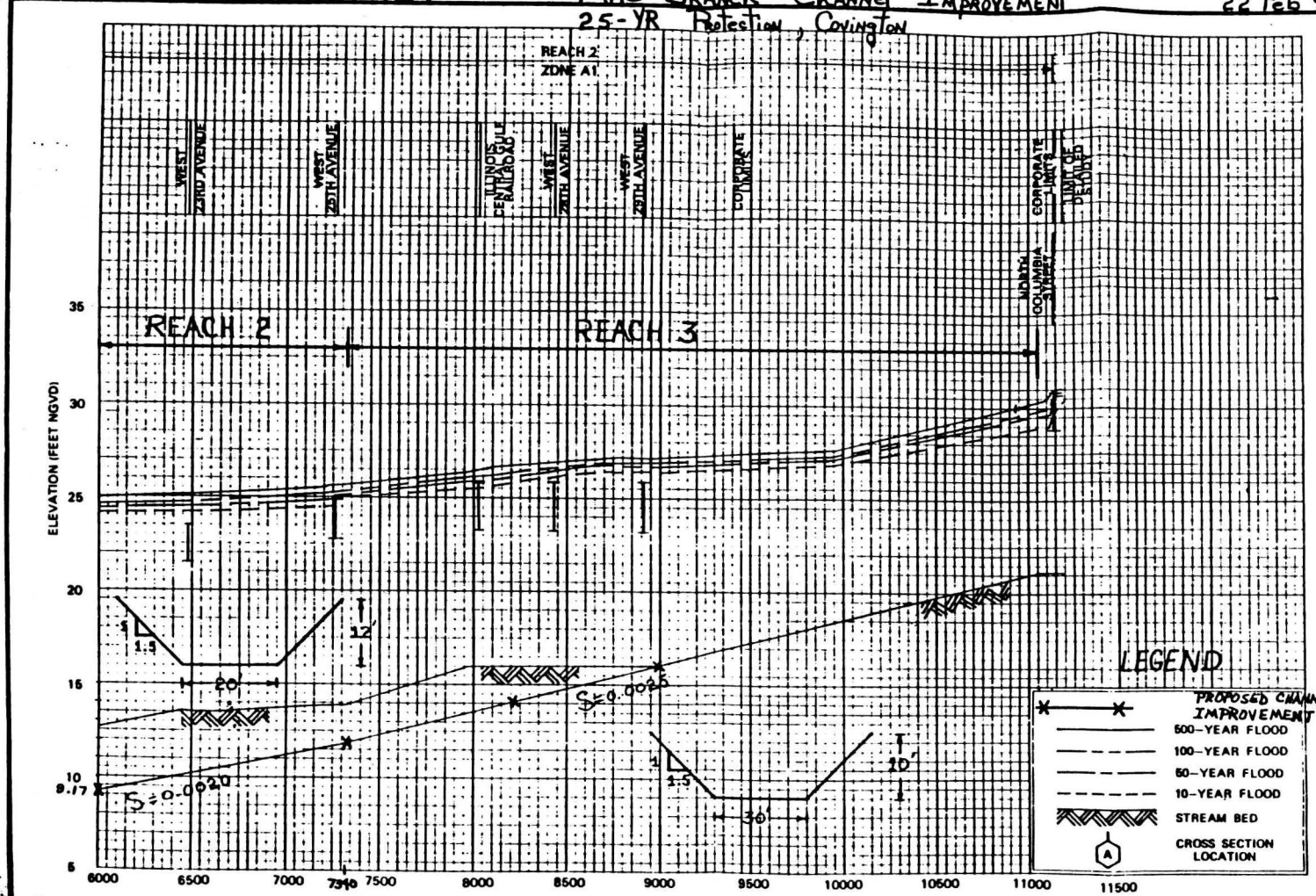
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF COVINGTON, LA
(ST. TAMMANY PARISH)

05P

TTT RECON STUDY Mile Branch Channel Improvement 22 Feb 91

25-YR Protection, Covington



Note: Line Proposed Channel with Reinforced Concrete or Gabbions

FLOOD PROFILES

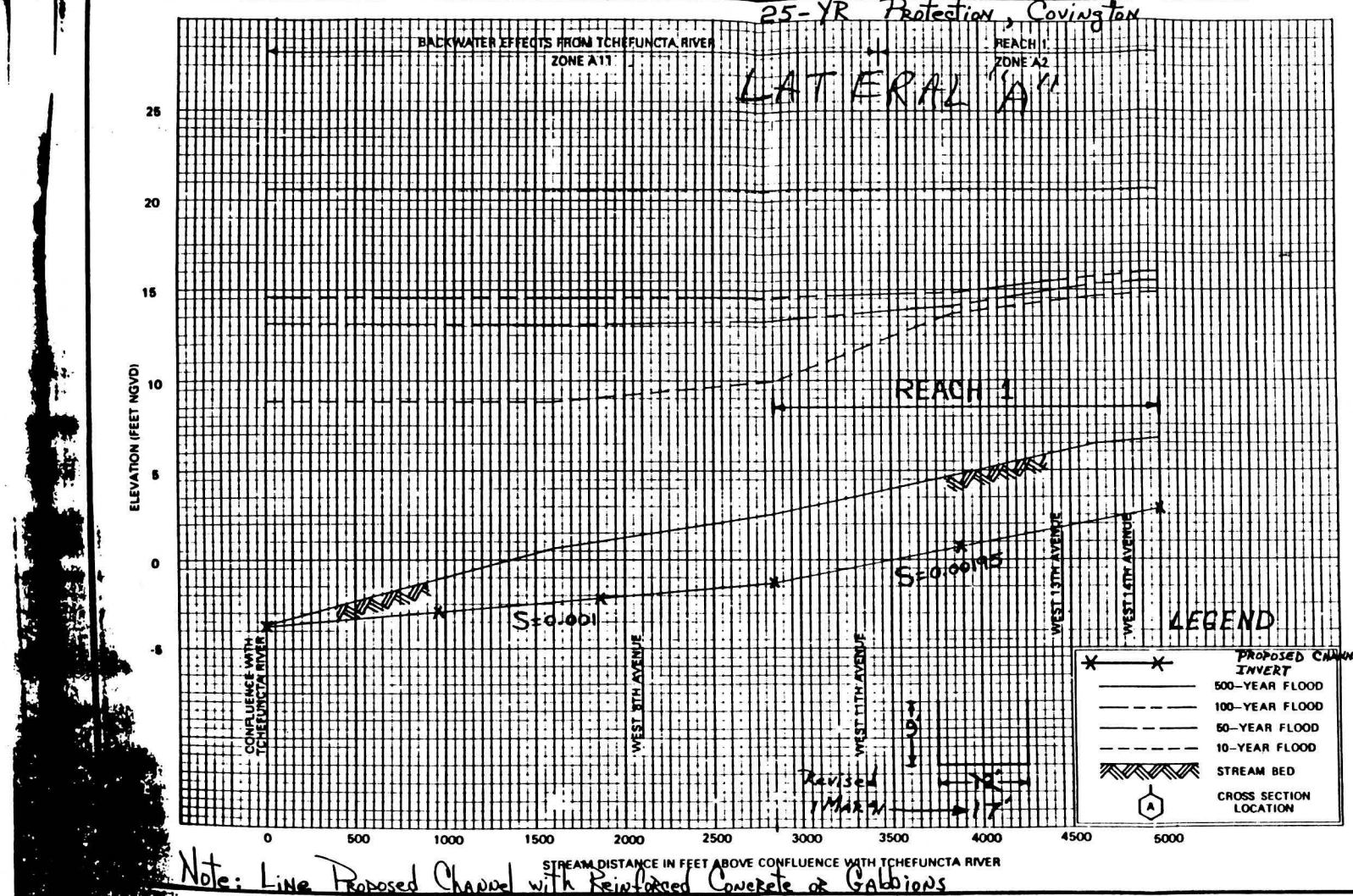
MILE BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF COVINGTON, LA
(ST. TAMMANY PARISH)

06P

25-YR Protection, Covington



Note: Line Proposed Channel with Reinforced Concrete or Gabbions

FLOOD PROFILES

LATERAL A

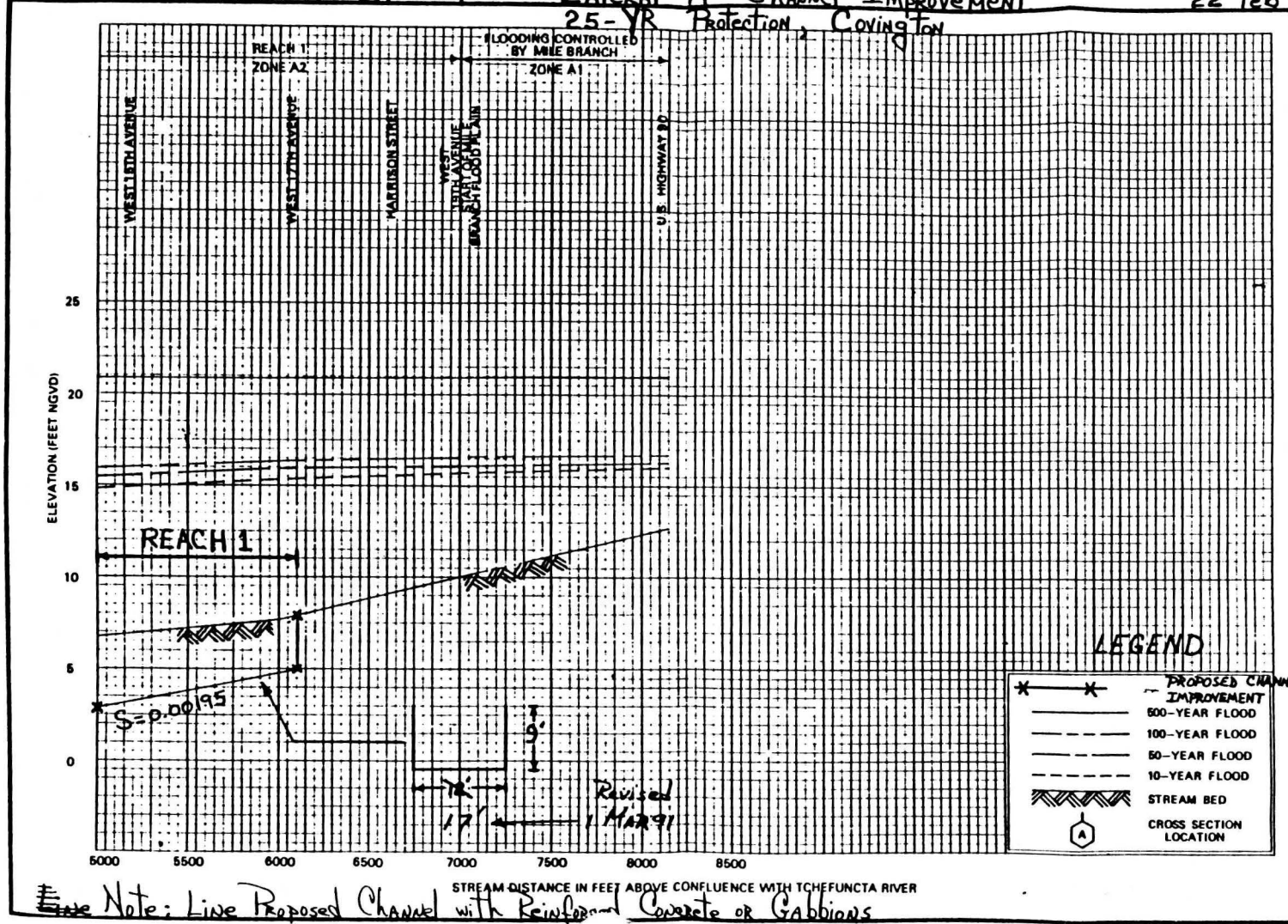
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF COVINGTON, LA
(ST. TAMMANY PARISH)

07P

TTT RECON STUDY Lateral A Channel Improvement 22 Feb 91

25-YR Protection, Covington



Line Note: Line Proposed Channel with Reinforced Concrete or Gabbions

FLOOD PROFILES

LATERAL A

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF COVINGTON, LA
(ST. TAMMANY PARISH)

08P

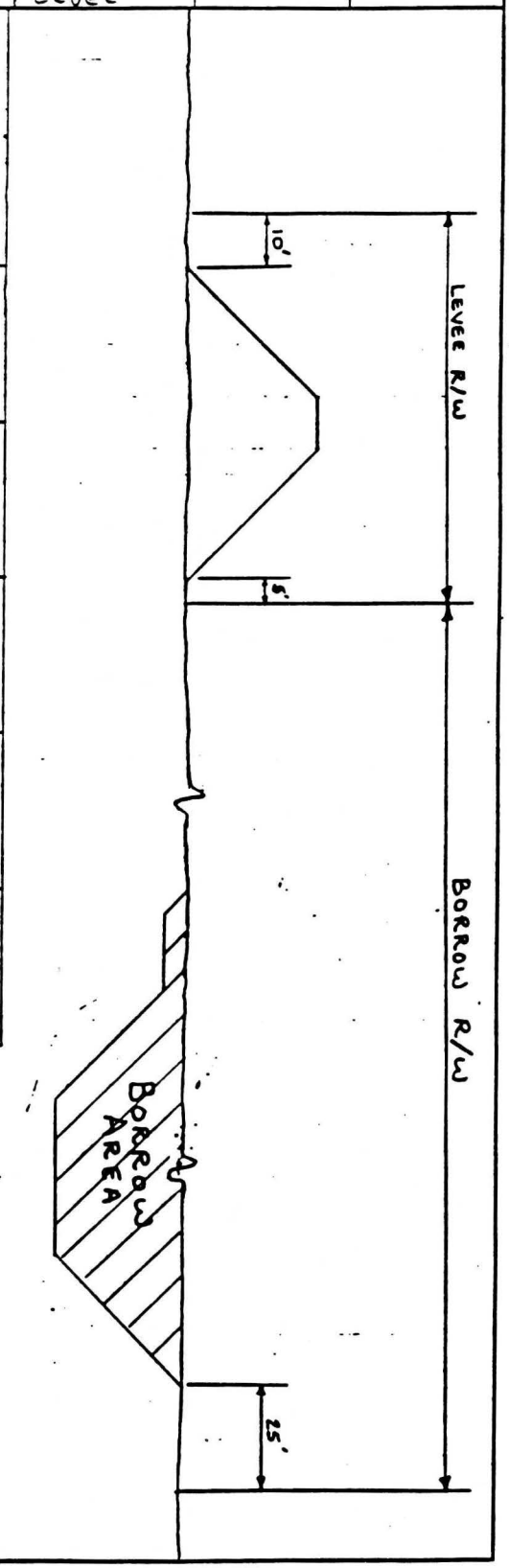
COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AND LEWISBURG AREAS

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BK	DATE 1 OCT 90
SUBJECT MANDEVILLE AREA SPH HURR. PROT. LEVEE		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)		BORROW R/W (FT)	BORROW R/W (AC)	
0+00 TO 5+00	500	95	1.1		106	1.2	
5+00 TO 10+00	500	114	1.3		206	2.4	
10+00 TO 40+00	3000	130	9.0		223	15.4	
129+00 TO 154+00	2500	130	7.5		223	12.8	
170+00 TO 179+00	900	130	2.7		223	4.6	
237+00 TO 306+00	6900	144	22.8		239	37.9	
				44.3			74.2



USE LEVEE R/W = 44 ACRES

USE BORROW R/W = 74 ACRES

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AND LEWISBURG AREAS

PROJECT		Page —of—	COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS			BJK	10 OCT 90
SUBJECT			CHECKED BY	DATE
MANDEVILLE AREA SPH HURRICANE PROTECTION				

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
40+00 TO 129+00	8900	147	30.0
179+00 TO 237+00	5800	147	19.6
			49.6

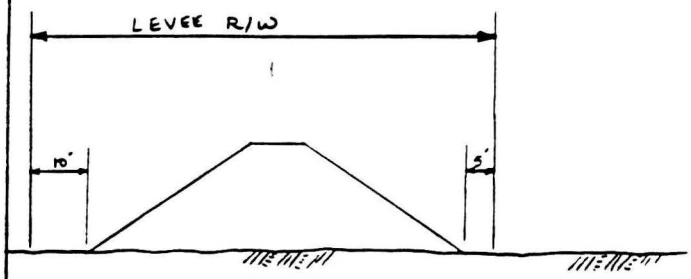
USE LEVEE R/W = 50 ACRES

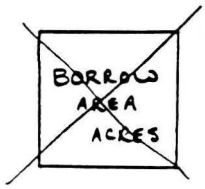
COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AND LEWISBURG AREAS

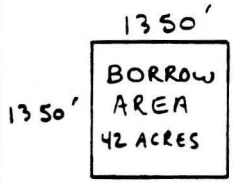
PROJECT RECON STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BK	DATE 10 CT 90
SUBJECT MANDEVILLE AREA SPH H.D.L.		CHECKED BY	DATE





LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	130	4.8

USE LEVEE R/W = 5 ACRES



TRUCK HAULED BORROW

USE BORROW R/W = 42. ACRES

FOR LEVEE STATIONS:

40+00 TO 129+00

179+00 TO 237+00

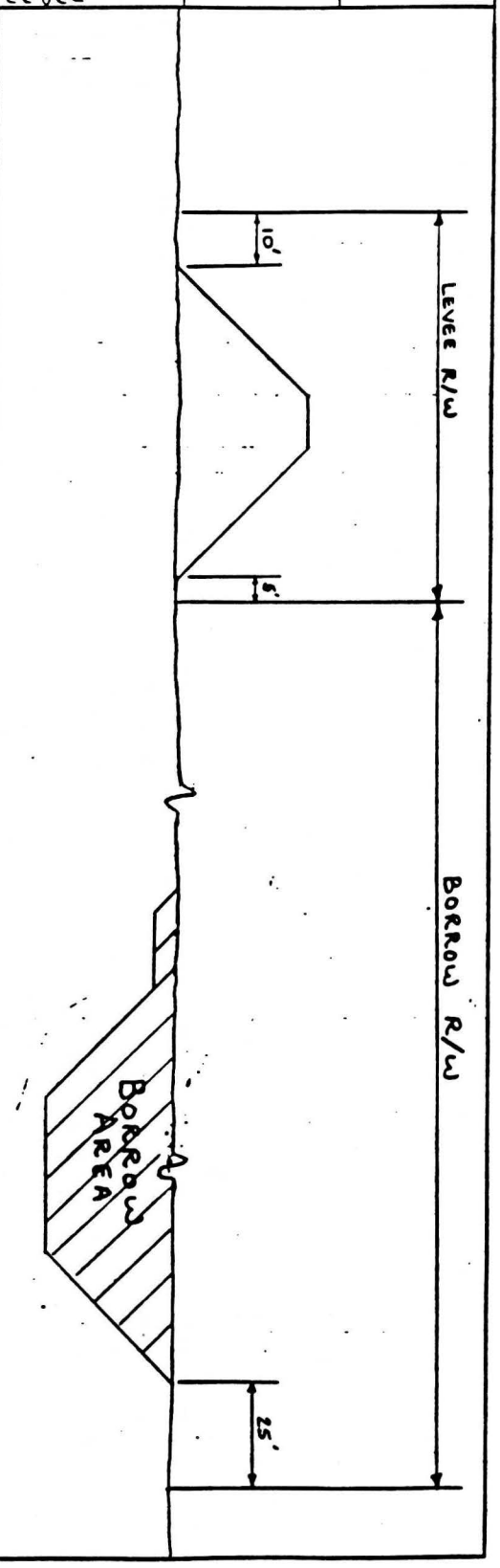
154+00 TO 170+00

COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT	PAGE	COMPUTED BY	DATE
RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	___ OF ___	BK	1 OCT 90
SUBJECT: MANDEVILLE AREA SPH HURR PROT. LEVEL		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)		BORROW R/W (FT)	BORROW R/W (AC)	
0+00 TO 5+00	500	95	1.1		106	1.2	
5+00 TO 10+00	500	116	1.3		206	2.4	
10+00 TO 40+00	3000	130	9.0		223	15.4	
129+00 TO 154+00	2500	130	7.5	18.9	223	12.8	31.8



USE LEVEE R/W = 19 ACRES

USE BORROW R/W = 32 ACRES

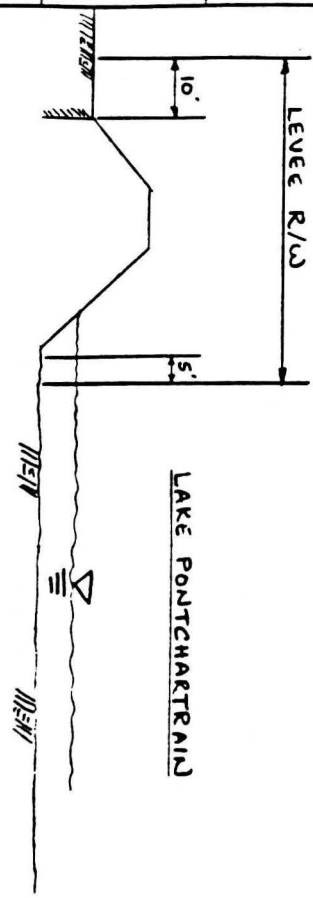
LMV FORM MAR 82 107b — PREVIOUS EDITIONS MAY BE USED — (FOR USE WITH 5 x 5 GRID)

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT: RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	COMPUTED BY: JJK	DATE: 10 CT 90
SUBJECT: MANDEVILLE AREA SPH HURRICANE PROTECTION		CHECKED BY	DATE

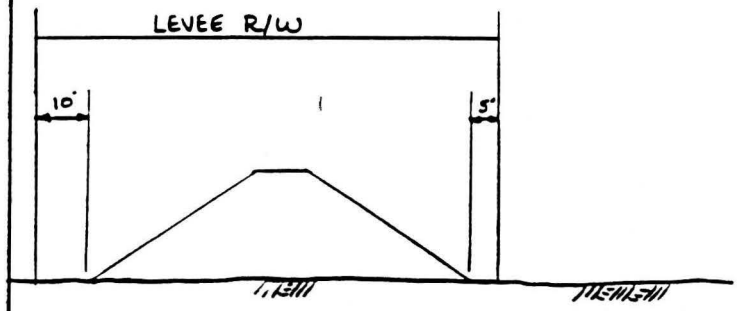
LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
40+00 TO 129+00	8900	147	30.0



USE LEVEE R/W = 30 ACRES

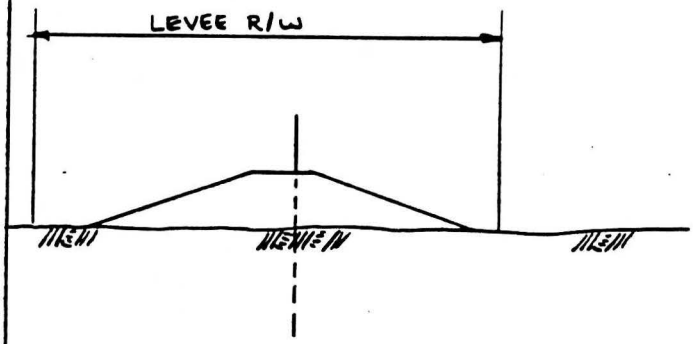
TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECON STUDY	Page —of—	COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS		BK	10 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA SPH HURRICANE PROTECTION			



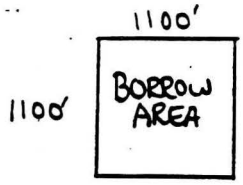
LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
134+00 TO 150+00	1600	130	4.8

USE LEVEE R/W = 5 ACRES



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES



TRUCK HAULED BORROW FOR THE FOLLOWING LEVEE STATIONS:

40+00 TO 129+00
154+00 TO 170+00
4000' ALONG CAUSEWAY

USE BORROW R/W = 28 ACRES

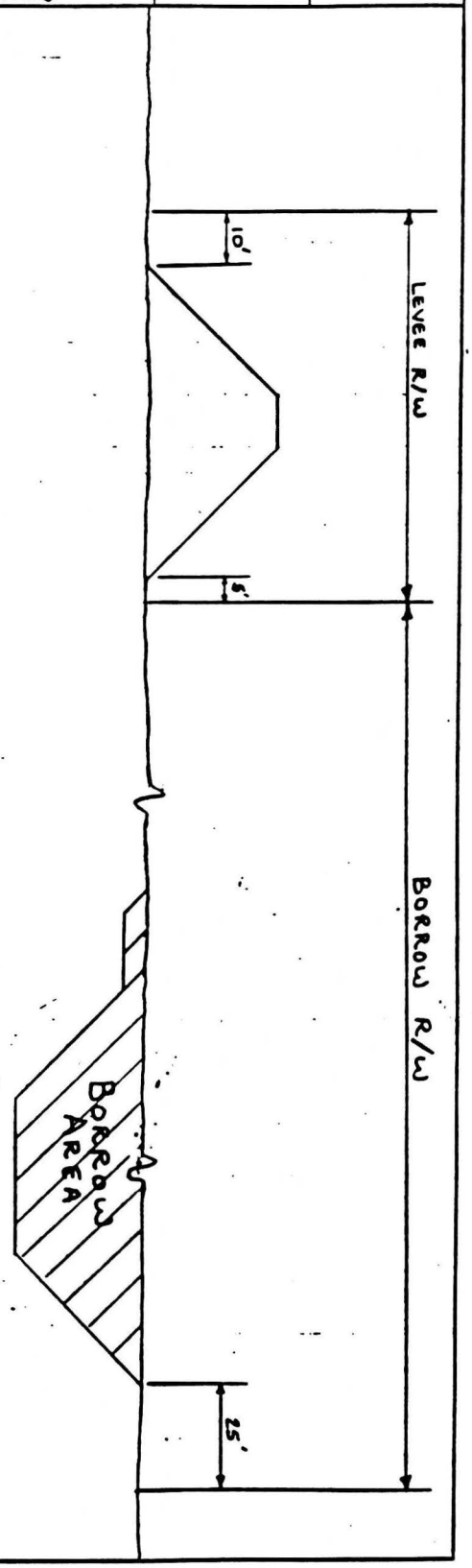
COMPUTATION SHEET

TRUCK HAUL SECTION ALONG LAKEFRONT LEVEE

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BK	DATE 10 OCT 90
SUBJECT LANDRUM AREA SPH HURRICANE PROTECTION		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)		BORROW R/W (FT)	BORROW R/W (AC)	
170+00 TO 179+00	900	130	2.7		223	4.6	
237+00 TO 306+00	6900	144	22.8	25.5	239	37.9	42.5



USE LEVEE R/W = 26 ACRES

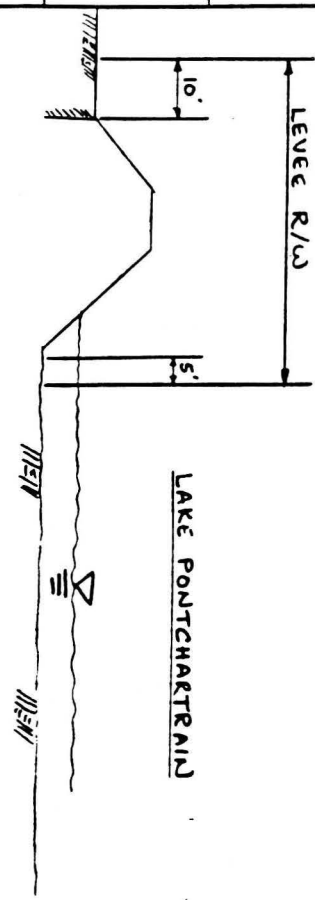
USE BORROW R/W = 43 ACRES

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE

LEWISBURG FREA ONLY (WEST OF CAUSEWAY)

PROJECT		COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	EJK	10 OCT 90
SUBJECT		CHECKED BY	DATE
SLIDELL AREA SPH HURRICANE PROTECTION			

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
179+00 TO 237+00	5800	147	19.6

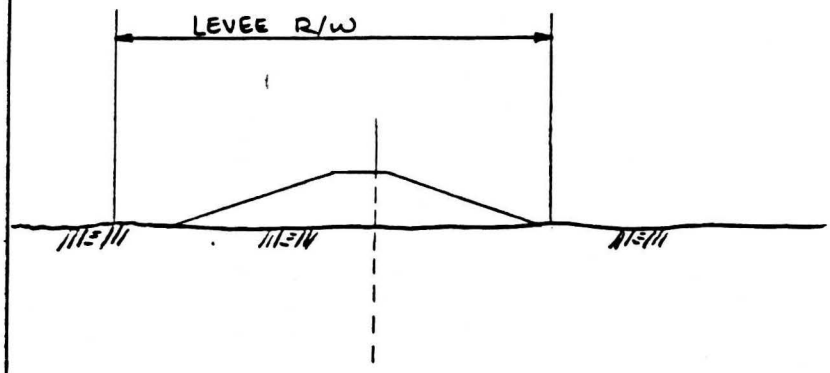


USE LEVEE R/W = 20 ACRES

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT		COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA HURRICANE PROTECTION			



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES

[redacted]

900'

900' BORROW AREA 19 ACRES

TRUCK HAULED BORROW FOR THE FOLLOWING LEVEE STATIONS:

179+00 TO 237+00

4000 FT ALONG CAUSEWAY

USE BORROW R/W = 19 ACRES

COMPUTATION SHEET

MANDEVILLE AND LEWISBURG AREAS

PROJECT RECONNAISSANCE STUDY
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS

PAGE ___ OF ___

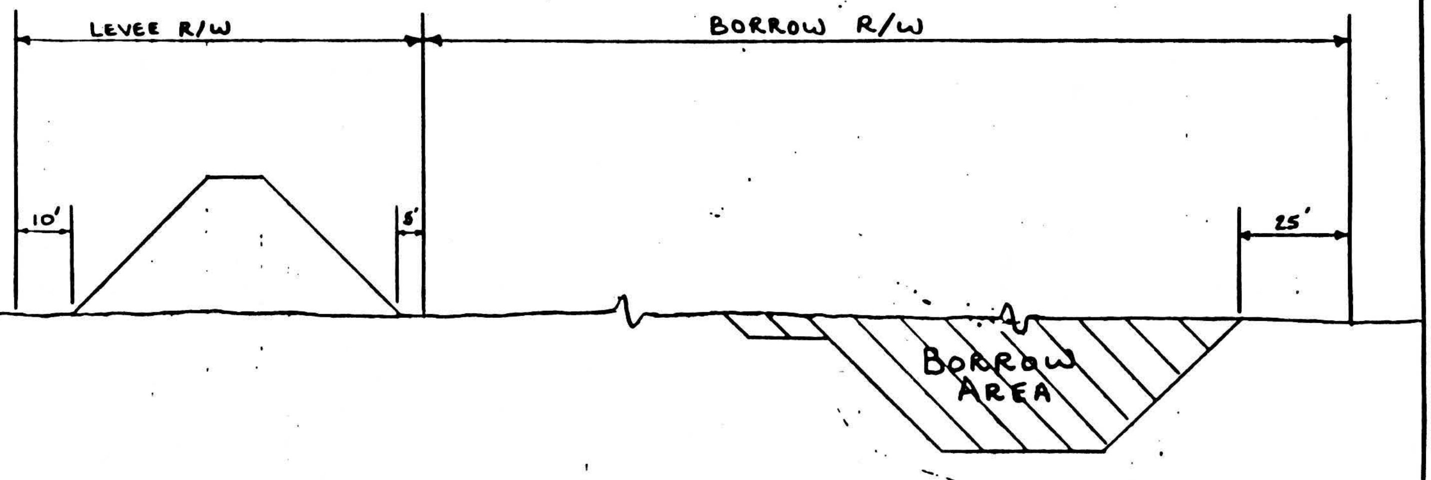
COMPUTED BY BK

DATE 1 OCT 90

CHECKED BY

DATE

SUBJECT [illegible] AREA SPH [illegible]



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
0+00 TO 5+00	500	95	1.1	106	1.2
5+00 TO 10+00	500	116	1.3	206	2.4
10+00 TO 40+00	3000	130	9.0	223	15.4
129+00 TO 154+00	2500	130	7.5	223	12.8
170+00 TO 179+00	900	130	2.7	223	4.6
237+00 TO 306+00	6900	144	22.8	239	37.9
			44.3		74.2

USE LEVEE R/W = 44 ACRES

USE BORROW R/W = 74 ACRES

MANDEVILLE AND LEWISBURG AREAS

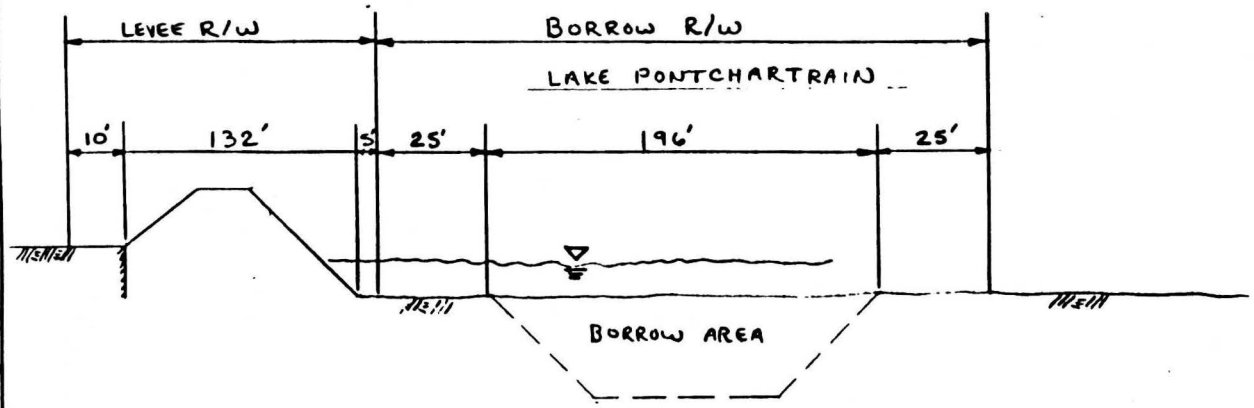
PROJECT RECON STUDY
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS

SUBJECT
MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL

COMPUTED BY BK DATE 10 OCT 90

CHECKED BY DATE

Page —of—



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
40+00 TO 129+00	8900	147	30.0	246	50.3
179+00 TO 237+00	5800	147	19.6	246	32.7
			49.6		83.0

USE LEVEE R/W = 50 ACRES

USE BORROW R/W = 83 ACRES

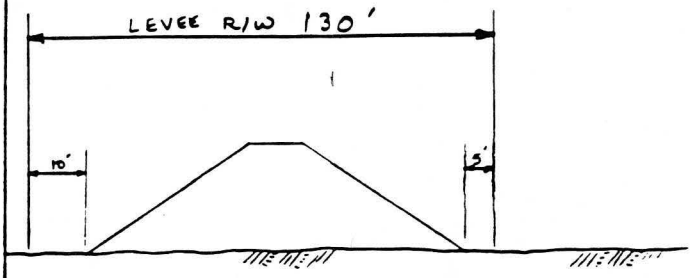
COMPUTATION SHEET

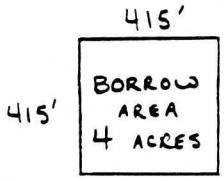
LMV FORM 1 AUG 68 1076

COMPUTATION SHEET

MANDEVILLE AND LEWISBURG AREAS

PROJECT	PAGE ___ OF ___	COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS		BJC	1 OCT 90
SUBJECT: MANDEVILLE AREA SPH HURR. PROTECTION		CHECKED BY	DATE





USE BORROW R/W = 4 ACRES

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	130	4.8

USE LEVEE R/W = 5 ACRES

USE BORROW R/W = 4 ACRES

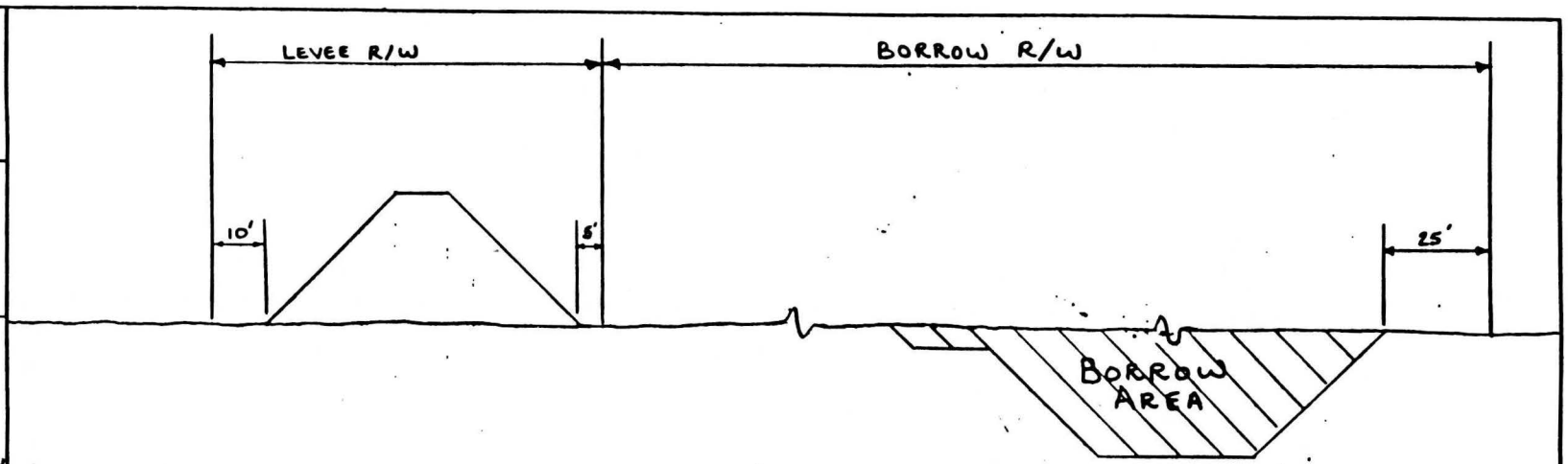
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS | PAGE ___ OF ___

SUBJECT MANDEVILLE AREA SPH HURR PROT LEVEL

COMPUTED BY BK | DATE 1 OCT 90

CHECKED BY | DATE



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
0+00 TO 5+00	500	95	1.1	106	1.2
5+00 TO 10+00	500	116	1.3	206	2.4
10+00 TO 40+00	3000	130	9.0	223	15.4
129+00 TO 154+00	2500	130	7.5	223	12.8
			18.9		31.8

USE LEVEE R/W = 19 ACRES

USE BORROW R/W = 32 ACRES

(FOR USE WITH 8 x 8 GRID)

PREVIOUS EDITIONS MAY BE USED

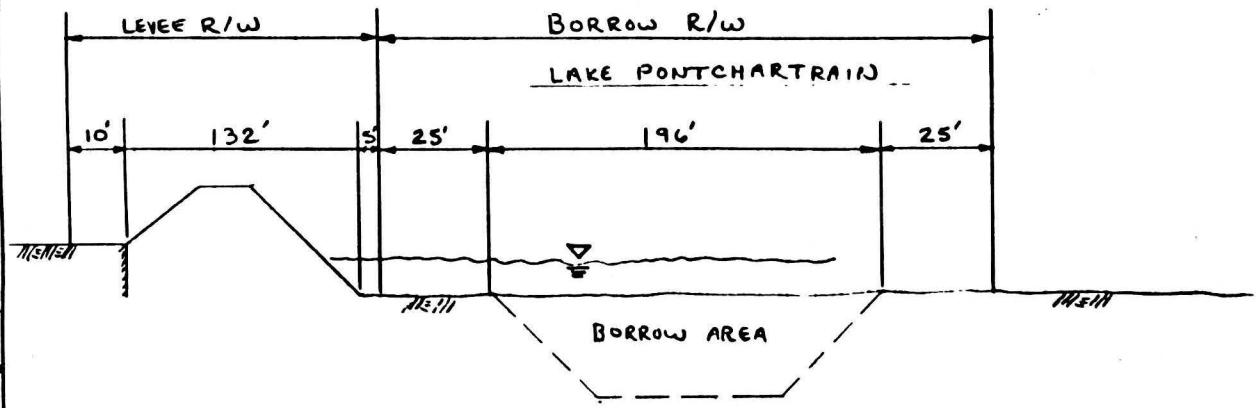
LMV FORM MAR 82 107b

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECON STUDY
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS

SUBJECT
MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL

COMPUTED BY BK — DATE 10 OCT 90
CHECKED BY — DATE
Page —of—



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
40+00 TO 129+00	8900	147	30.0	246	50.3

USE LEVEE R/W = 30 ACRES
USE BORROW R/W = 51 ACRES

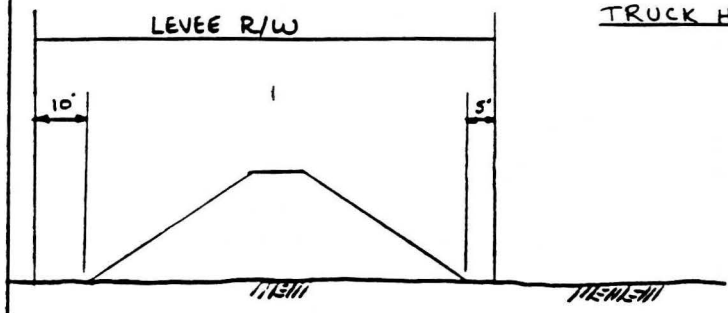
COMPUTATION SHEET

LMV FORM 1 AUG 68 1076

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

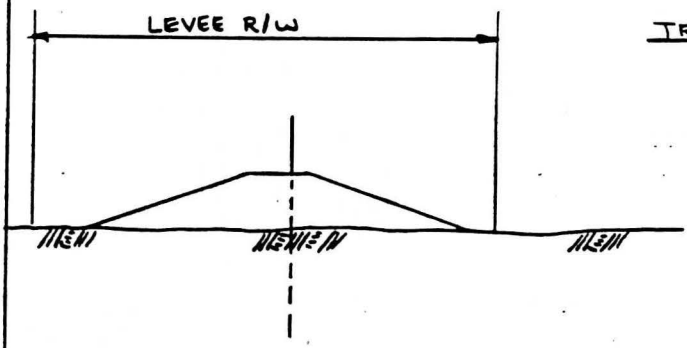
PROJECT RECON STUDY		COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA SPH HURRICANE PROTECTION			

TRUCK HAULED BORROW



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	130	4.8

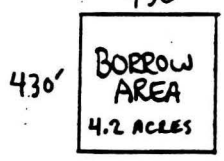
USE LEVEE R/W = 5 ACRES



TRUCK HAULED BORROW

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 AC



BORROW AREA FOR BOTH REACHES OF LEVEE.

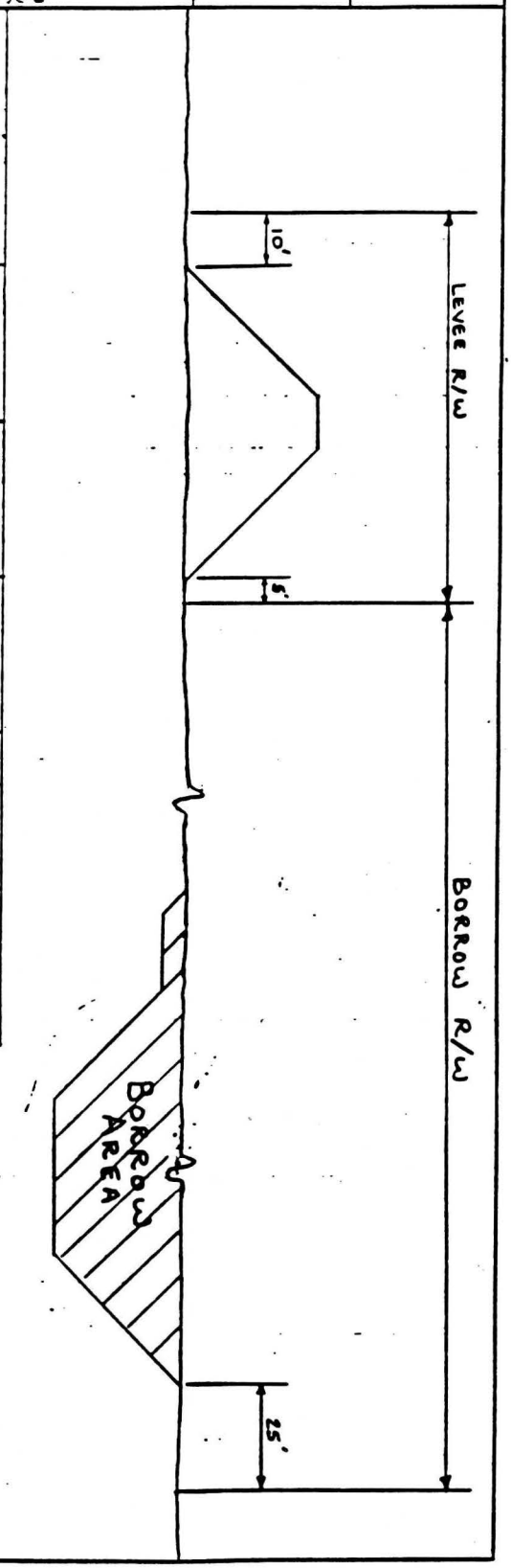
USE BORROW R/W = 4 ACRES

COMPUTATION SHEET

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT	PAGE	COMPUTED BY	DATE
RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	___ OF ___	BK	10 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA SPH HURC. LEVEE LEVEL			

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)		BORROW R/W (FT)	BORROW R/W (AC)	
170+00 TO 179+00	900	130	2.7		223	4.6	
237+00 TO 306+00	6900	144	22.8		239	37.9	
				25.5			42.5



USE LEVEE R/W = 26 ACRES

USE BORROW R/W = 43 ACRES

LMV FORM MAR 82 1076 PREVIOUS EDITIONS MAY BE USED (FOR USE WITH 5 x 5 GRID)

LEWISBURG AREA (WEST OF CAUSEWAY)

PROJECT RECON STUDY

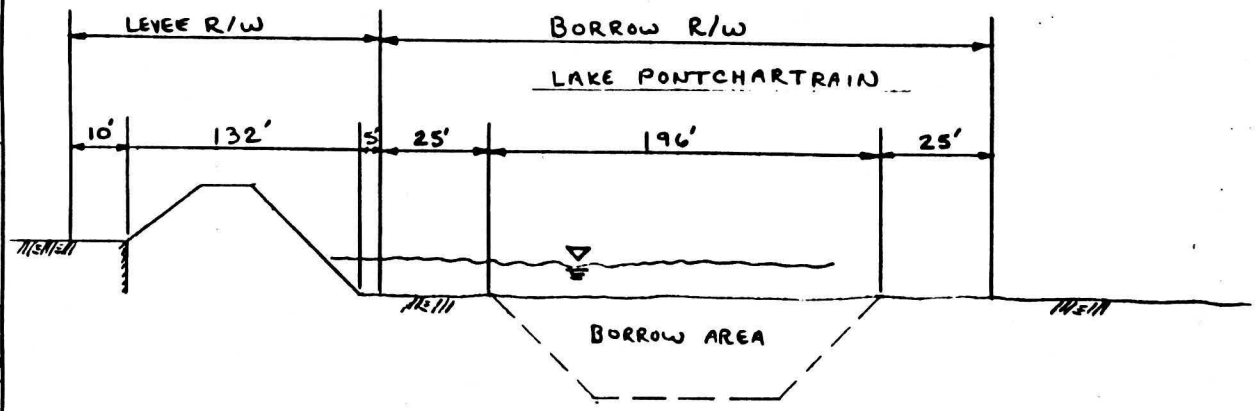
TANGIPAHOA TCHEFUNCTE AND TICKFAW RIVERS

SUBJECT
MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL

COMPUTED BY BK DATE 10 OCT 90

CHECKED BY DATE

Page —of—



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
179+00 TO 237+00	5800	147	19.6	246	32.7

USE LEVEE R/W = 20 ACRES

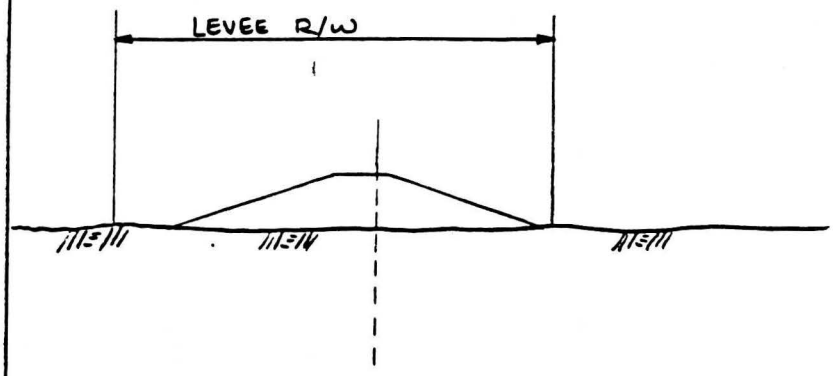
USE BORROW R/W = 33 ACRES

COMPUTATION SHEET

LMV FORM 1 AUG 68 1076

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT		COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MADISVILLE AREA SPH HURRICANE PROTECTION			



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES

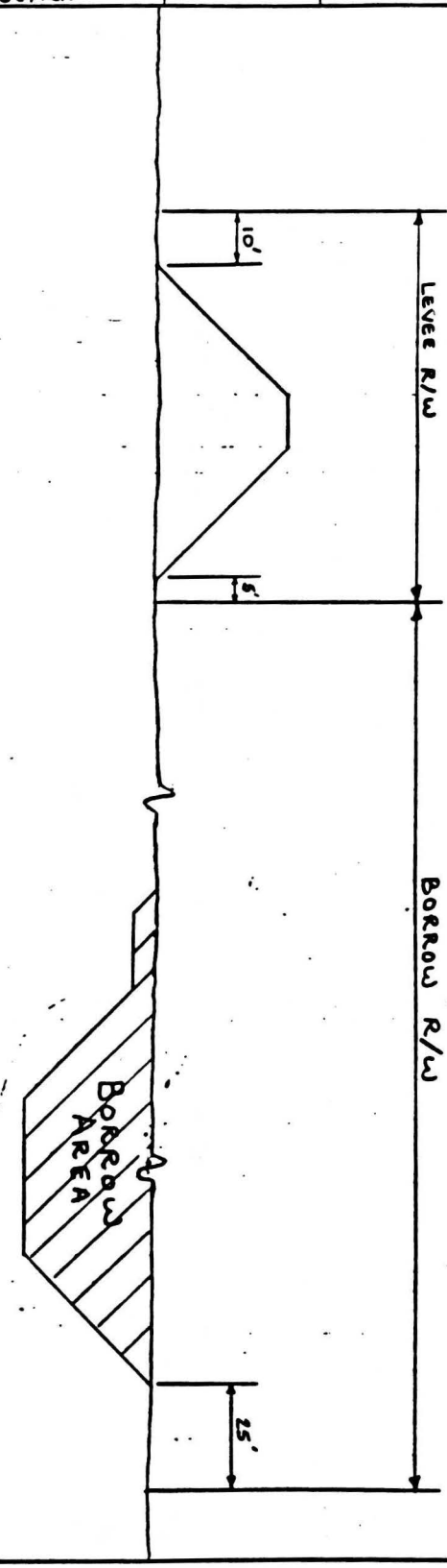
USE BORROW F/W = 1 ACRES

COMPUTATION SHEET

MANDEVILLE AND LEWISBURG AREAS

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BJC	DATE 10 OCT 90
SUBJECT MANDEVILLE AREA 100-YR HURRICANE PROTECTION		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
0+00 TO 5+00	500	79.4	0.9	118.0	1.4
5+00 TO 10+00	500	99.8	1.1	185.0	2.1
10+00 TO 40+00	3000	113.4	7.8	202.0	13.9
129+00 TO 154+00	2500	113.4	6.5	202.0	11.6
170+00 TO 179+00	900	113.4	2.3	202.0	4.2
237+00 TO 306+00	6900	127.0	20.1	218.0	34.5
			38.8		67.7



USE LEVEE R/W = 39 ACRES

USE BORROW R/W = 68 ACRES

LMV FORM MAR 82 1076 PREVIOUS EDITIONS MAY BE USED (FOR USE WITH 5 x 5 GRID)

COMPUTATION SHEET

MANDEVILLE AND LEWISBURG AREAS

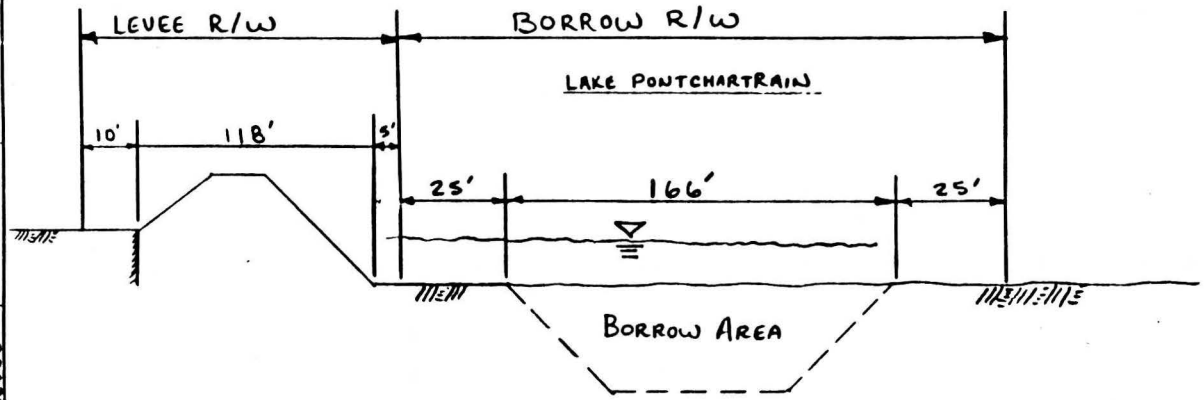
PROJECT RECON STUDY
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS

SUBJECT
MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEE

PAGE ___ OF ___

COMPUTED BY BK DATE 1 OCT 90

CHECKED BY DATE



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
40+00 TO 129+00	8900	133	27.2	216	44.1
179+00 TO 237+00	5800	133	17.7	216	28.8
			44.9		72.9

USE LEVEE R/W = 45 ACRES

USE BORROW R/W = 73 ACRES

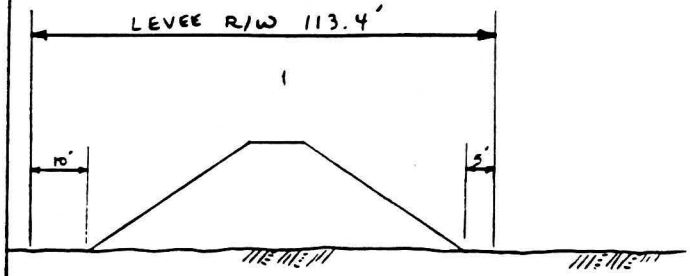
LMV FORM MAR 82 1076

PREVIOUS EDITIONS MAY BE USED

(FOR USE WITH 8 x 5 GRID)

COMPUTATION SHEET

PROJECT	PAGE	COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	___ OF ___	BK	1 OCT 90
SUBJECT: MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL		CHECKED BY	DATE



BORROW AREA 3.1 ACRES

370'

370'

USE BORROW R/W = 3 ACRES

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	113.4	4.2

USE LEVEE R/W = 4 ACRES

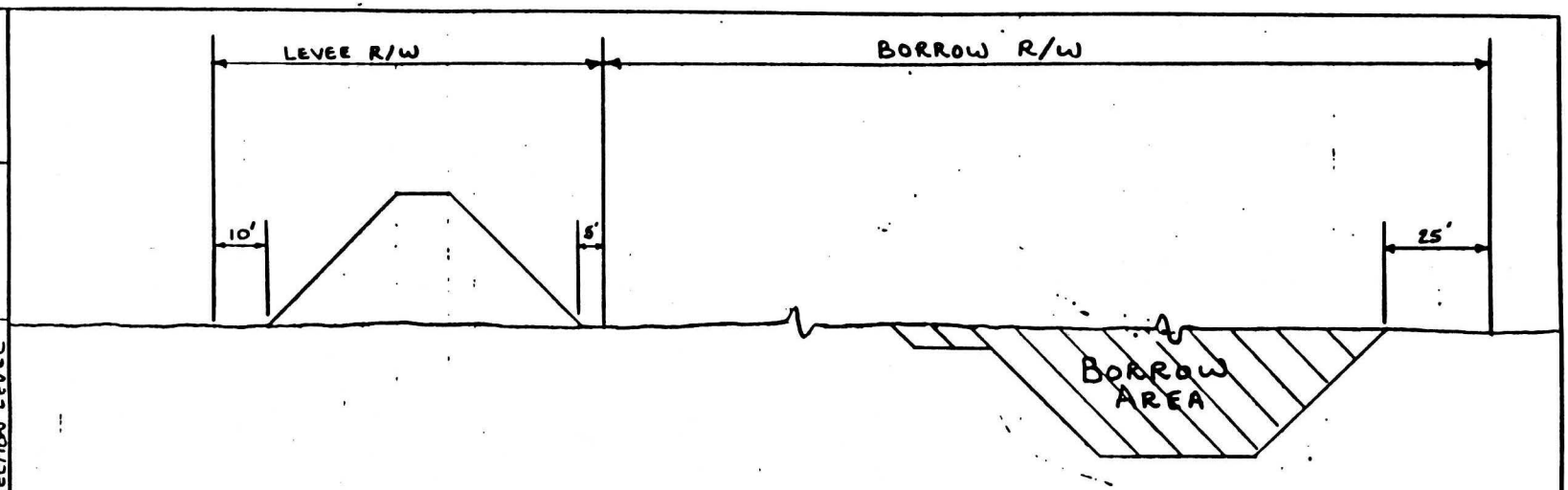
USE BORROW R/W = 3 ACRES

COMPUTATION SHEET

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS | PAGE ___ OF ___ | COMPUTED BY BK | DATE 1 OCT 90 | CHECKED BY | DATE

SUBJECT MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
0+00 TO 5+00	500	79.4	0.9	118.0	1.4
5+00 TO 10+00	500	99.8	1.1	185.0	2.1
10+00 TO 40+00	3000	113.4	7.8	202.0	13.9
129+00 TO 154+00	2500	113.4	6.5	202.0	11.6
			16.3		29.0

USE LEVEE R/W = 16 ACRES

USE BORROW R/W = 29 ACRES

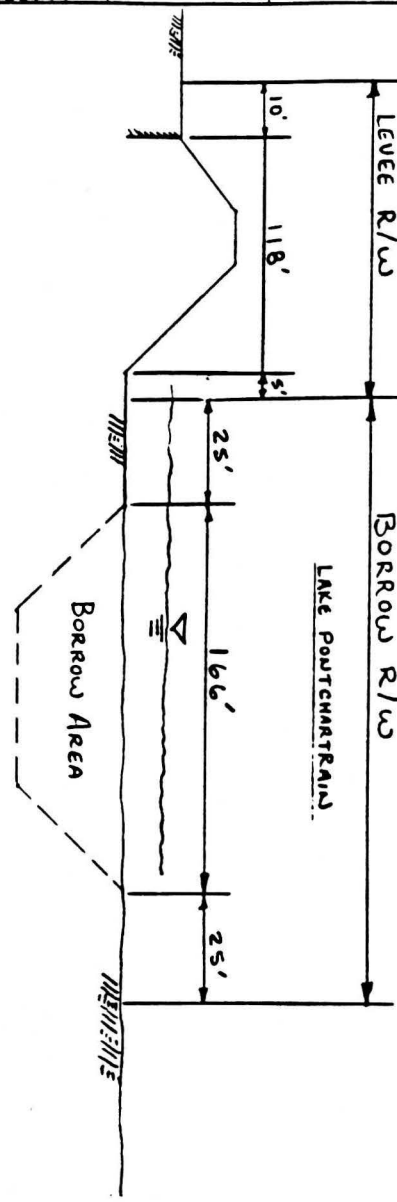
LMV FORM MAR 82 1076 PREVIOUS EDITIONS MAY BE USED (FOR USE WITH 8 x 8 GRID)

COMPUTATION SHEET

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT	PAGE	COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	___ OF ___	BK	10 OCT 90
SUBJECT: MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEE		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
40+00 TO 129+00	8900	133	27.2	216	44.1

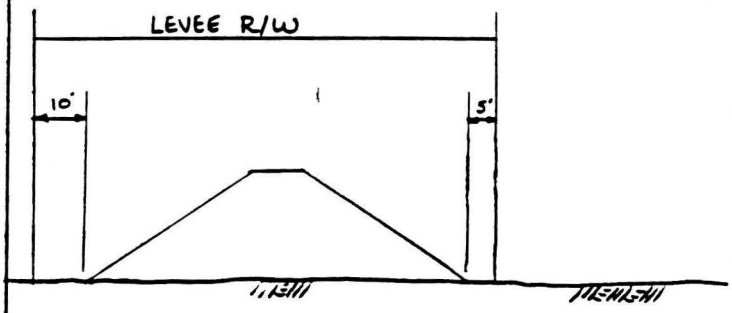


USE LEVEE R/W = 27 ACRES

USE BORROW R/W = 44 ACRES

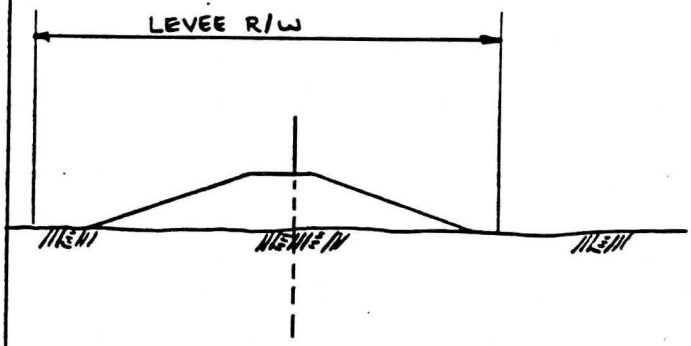
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECON STUDY		COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA 100-YR HURRICANE PROTECTION			



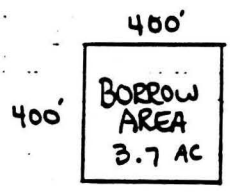
LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	113.4	4.2

USE LEVEE R/W = 4 ACRES



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
4000 FT. ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES



BORROW AREA FOR BOTH REACHES OF LEVEE.

USE BORROW R/W = 4 AC

COMPUTATION SHEET

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

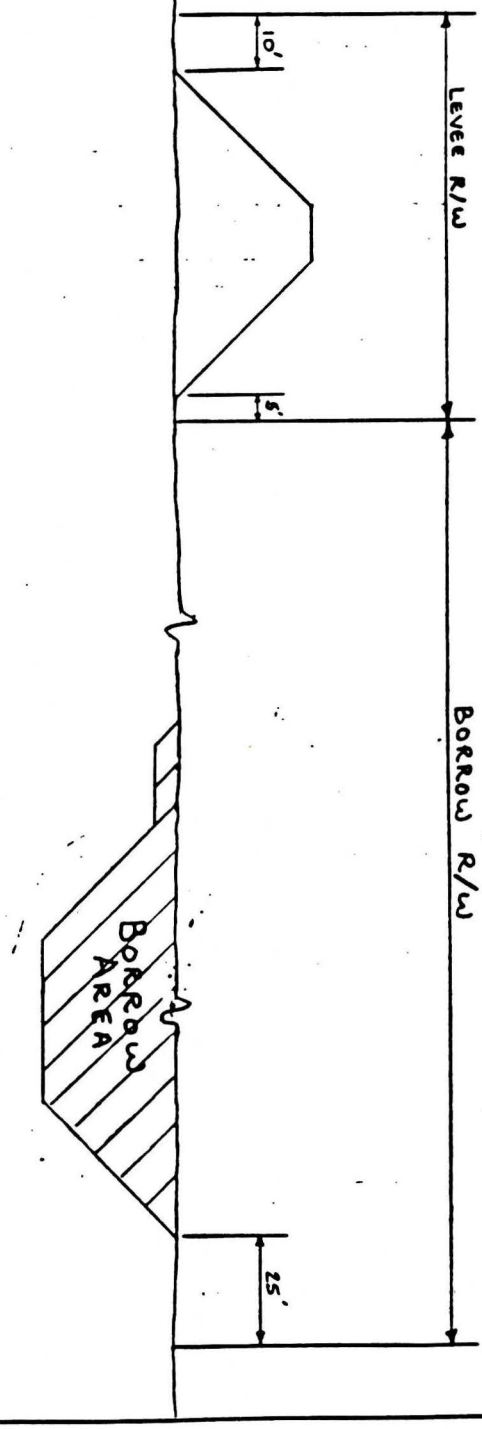
PROJECT: RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS | PAGE ___ OF ___ | COMPUTED BY: BK | DATE: 1 OCT 90

SUBJECT: MANDEVILLE AREA 100-YR HURR. PROT. LEVEL | CHECKED BY | DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
170+00 TO 179+00	900	113.4	2.3	202.0	4.2
237+00 TO 306+00	6900	127.0	20.1	218.0	34.5
			22.4		38.7

USE LEVEE R/W = 22 ACRES

USE BORROW R/W = 39 ACRES



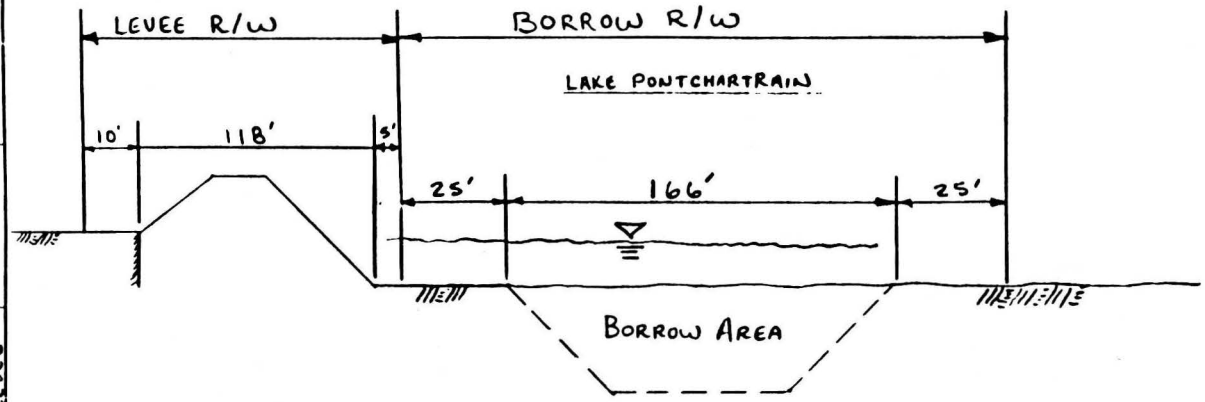
LMV FORM MAR 82 107b | PREVIOUS EDITIONS MAY BE USED | (FOR USE WITH 5 x 5 GRID)

COMPUTATION SHEET

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT RECON STUDY
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS
SUBJECT
MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEE

COMPUTED BY BK | DATE 10CT 90
CHECKED BY | DATE
PAGE ___ OF ___



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
179+00 TO 237+00	5800	133	17.7	216	28.8

USE LEVEE R/W = 18 ACRES

USE BORROW R/W = 29 ACRES

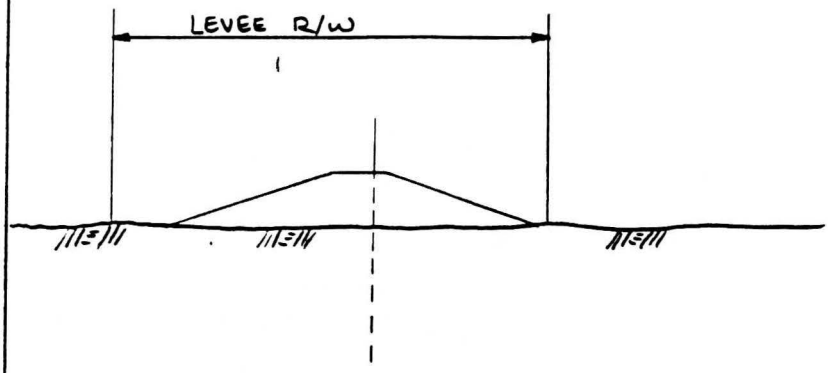
LMV FORM MAR 82 1076

PREVIOUS EDITIONS MAY BE USED

(FOR USE WITH 5 x 5 GRID)

LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	COMPUTED BY BK	DATE 1 OCT 90
SUBJECT MANDEVILLE AREA 100-YR HURRICANE PROTECTION		CHECKED BY	DATE



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES

USE BORROW R/W = 1 ACRES

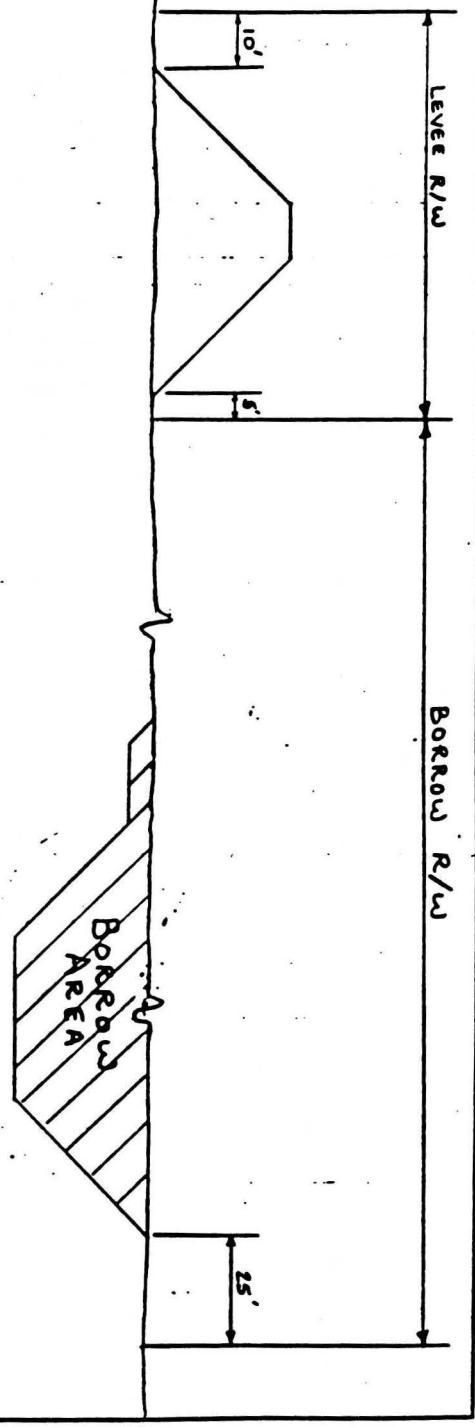
COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AND LEWISBURG AREAS

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BK	DATE 1 OCT 90
SUBJECT MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
0+00 TO 5+00	500	79.4	0.9	118.0	1.4
5+00 TO 10+00	500	99.8	1.1	185.0	2.1
10+00 TO 40+00	3000	113.4	7.8	202.0	13.9
129+00 TO 154+00	2500	113.4	6.5	202.0	11.6
170+00 TO 179+00	900	113.4	2.3	202.0	4.2
237+00 TO 306+00	6900	127.0	20.1	218.0	34.5
			38.8		67.7



USE LEVEE R/W = 39 ACRES

USE BORROW R/W = 68 ACRES

LMV FORM MAR 82 1076 PREVIOUS EDITIONS MAY BE USED (FOR USE WITH 8 x 8 GRID)

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES

MANDEVILLE AND LEWISBURG AREAS

PROJECT		Page —of—	COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS			P/K	10 OCT 90
SUBJECT			CHECKED BY	DATE
MANDEVILLE AREA 100-YR HURRICANE PROTECTION				

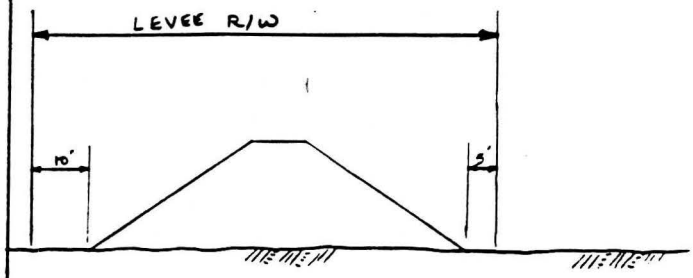
LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
40+00 TO 129+00	8900	133	27.2
179+00 TO 237+00	5800	133	17.7
			44.9

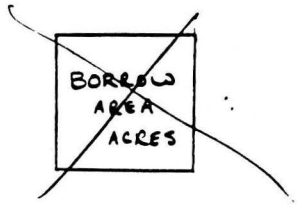
USE LEVEE R/W = 45 ACRES

COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEES.
MANDEVILLE AND LEWISBURG AREAS

PROJECT RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BK	DATE 1 OCT 90
SUBJECT MANDEVILLE AREA 100-YR HURR. PROTECTION		CHECKED BY	DATE

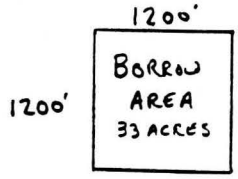




SEE BOTTOM OF PAGE FOR TOTAL TRUCK HAULED BORROW R/W.

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	113.4	4.2

USE LEVEE R/W = 4 ACRES



TRUCK HAULED BORROW

USE BORROW R/W = 33 ACRES

FOR LEVEE STATIONS:

40+00 TO 129+00

179+00 TO 237+00

154+00 TO 170+00

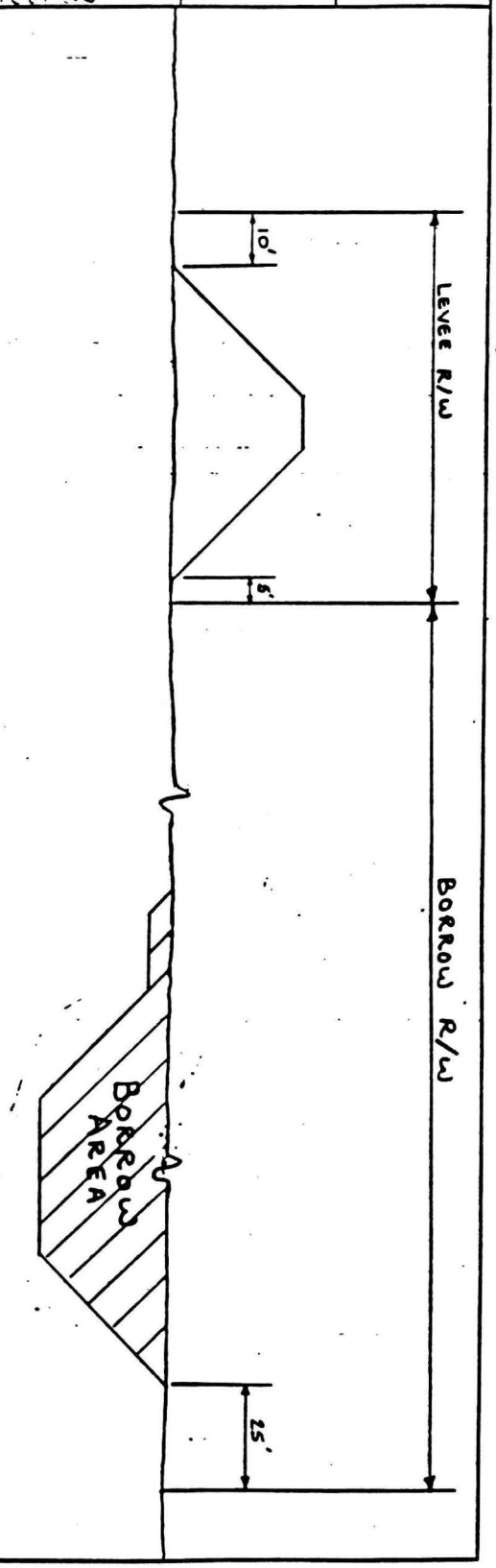
COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	PAGE ___ OF ___	COMPUTED BY BIC	DATE 1 OCT 90
SUBJECT MANDEVILLE AREA 100-YR HURRICANE PROTECTION		CHECKED BY	DATE

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)		BORROW R/W (FT)	BORROW R/W (AC)	
0+00 TO 5+00	500	79.4	0.9		118.0	1.4	
5+00 TO 10+00	500	99.8	1.1		185.0	2.1	
10+00 TO 40+00	3000	113.4	7.8		202.0	13.9	
129+00 TO 154+00	2500	113.4	6.5	16.3	202.0	11.6	29.0



USE LEVEE R/W = 17 ACRES

USE BORROW R/W = 29 ACRES

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE

MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECON STUDY	Page — of —	COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS		BJK	10 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA HURRICANE PROTECTION			

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
40+00 TO 129+00	8900	133	27.2

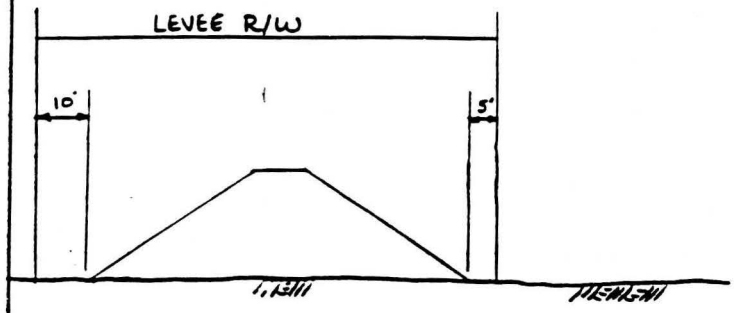
USE LEVEE R/W = 28 ACRES

LMV FORM 1 AUG 68 1076

COMPUTATION SHEET

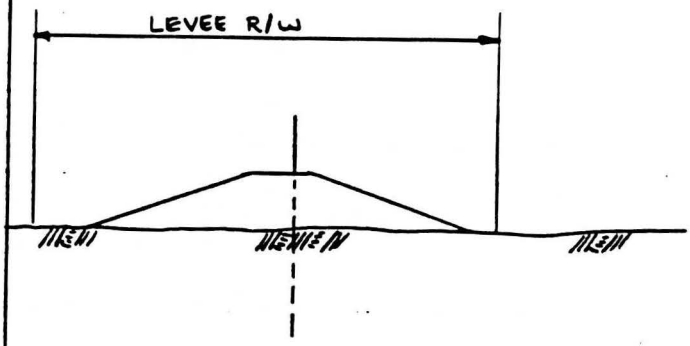
TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

PROJECT RECON STUDY		COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA 100-YR HURRICANE PROTECTION			



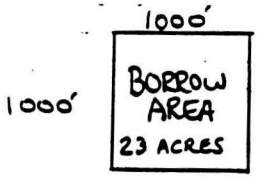
LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
154+00 TO 170+00	1600	113.4	4.2

USE LEVEE R/W = 4 ACRES



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOOD WALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES



TRUCK HAULED BORROW FOR THE FOLLOWING LEVEE STATIONS:

40+00 TO 129+00
154+00 TO 170+00
4000' ALONG CAUSEWAY

USE BORROW R/W = 23 ACRES

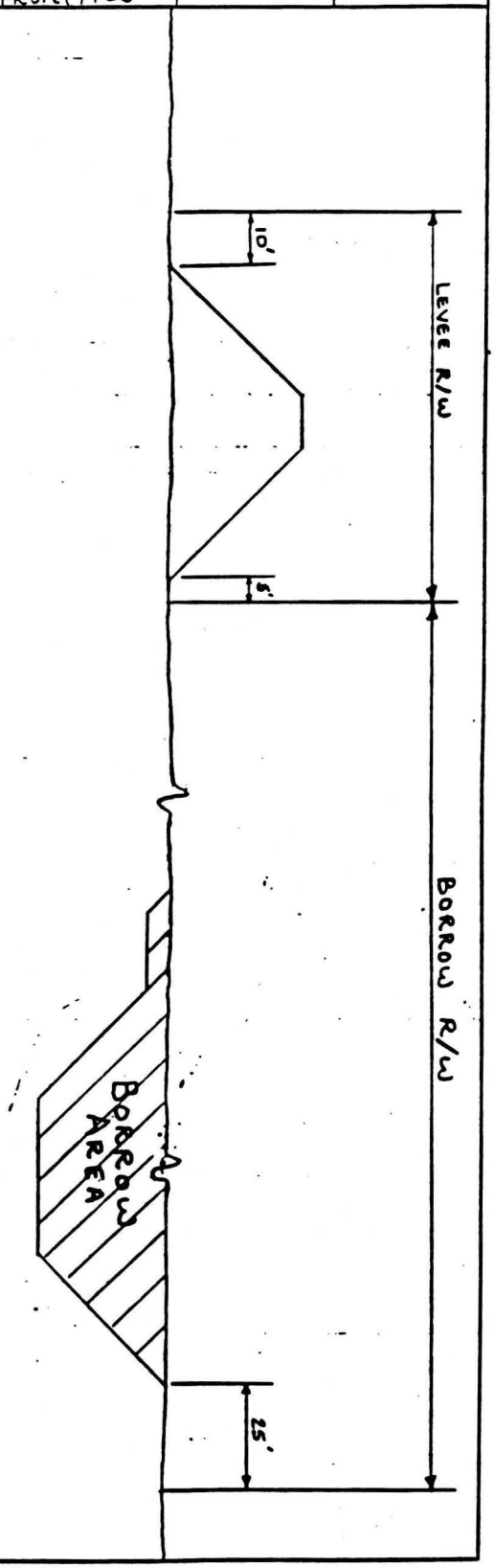
COMPUTATION SHEET

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE

LEWIS POINT AREA ONLY (WEST OF CAUSEWAY)

PROJECT	PAGE	COMPUTED BY	DATE
RECONNAISSANCE STUDY TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS	___ OF ___	BK	1 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA 100-YR HURRICANE PROTECTION			

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)	BORROW R/W (FT)	BORROW R/W (AC)
170+00 TO 179+00	900	113.4	2.3	202.0	4.2
237+00 TO 306+00	6900	127.0	20.1	218.0	34.5
			22.4		38.7



USE LEVEE R/W = 22 ACRES

USE BORROW R/W = 39 ACRES

TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE
LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

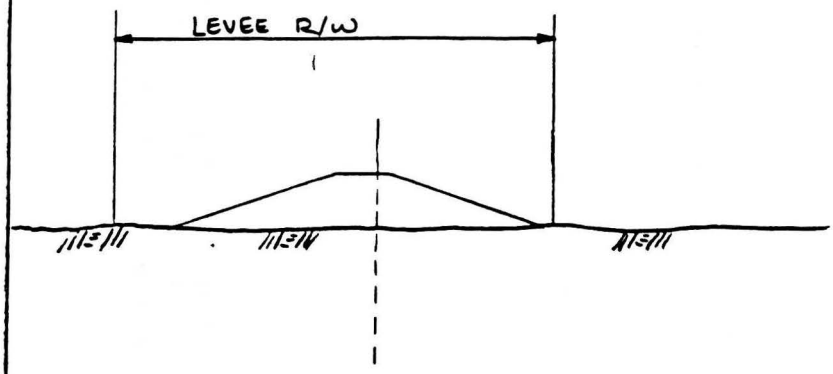
PROJECT RECON STUDY	Page —of—	COMPUTED BY	DATE
TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS		F/K	10 OCT 90
SUBJECT		CHECKED BY	DATE
MANDEVILLE AREA 100-YR HURRICANE PROTECTION			

LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
179+00 TO 237+00	5800	133	17.7

USE LEVEE R/W = 18 ACRES

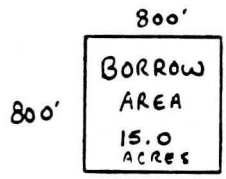
TRUCK HAUL OPTION ALONG LAKEFRONT LEVEE
LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

PROJECT		COMPUTED BY	DATE
RECON STUDY TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS	Page —of—	BK	1 OCT 90
SUBJECT: MANDEVILLE AREA INTERIOR HURRICANE PROTECTION		CHECKED BY	DATE



LEVEE STATION LIMITS	DISTANCE (FT)	LEVEE R/W (FT)	LEVEE R/W (AC)
FLOODWALL ALONG CAUSEWAY	4000	43	4

USE LEVEE R/W = 4 ACRES



TRUCK HAULED BORROW FOR THE FOLLOWING LEVEE STATIONS:

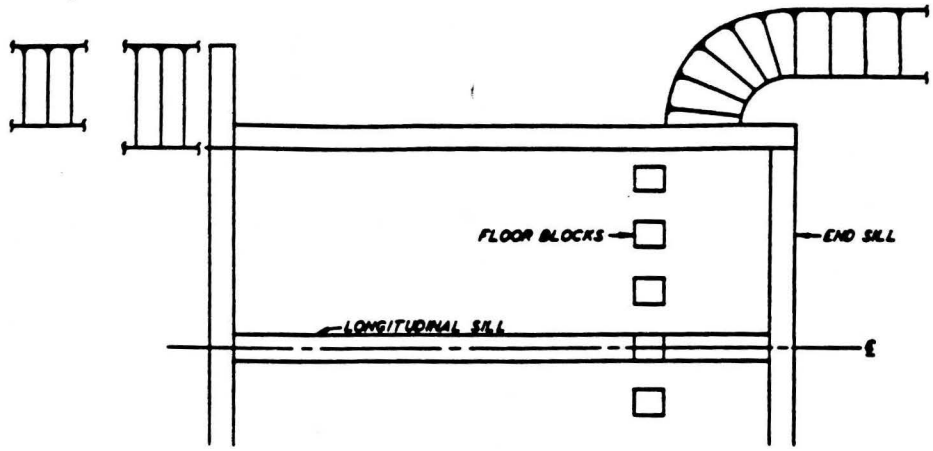
179+00 TO 237+00

4000 FT ALONG CAUSEWAY

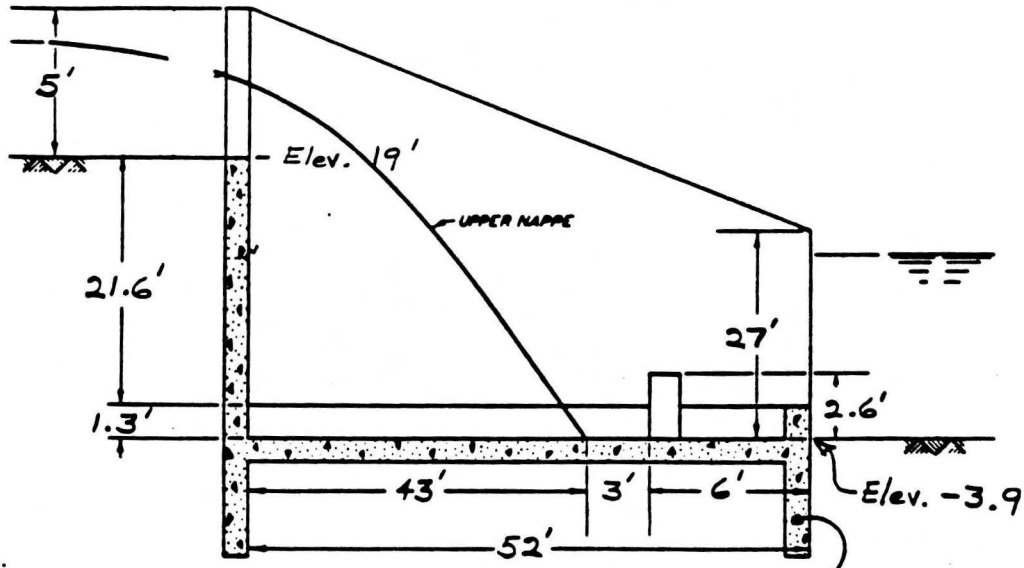
USE BORROW R/W = 15 ACRES

TTT Recon Study 18 JAN 91

Tchefuncta River Diversion



HALF PLAN



CENTER-LINE SECTION

Reinforced Concrete

NOTE:
H = HEAD ON WEIR = $f(d_c)$
h_a = VELOCITY HEAD
d_s = TAILWATER DEPTH
d_c = CRITICAL DEPTH OVER CREST
h = HEIGHT OF DROP
h' = HEIGHT OF END SILL
L_B = LENGTH OF STILLING BASIN = $X_a + X_b + X_c$
X_a = HORIZONTAL DISTANCE FROM CREST TO INTERSECTION OF UPPER NAPPE AND STILLING BASIN FLOOR
X_b = HORIZONTAL DISTANCE FROM INTERSECTION OF UPPER NAPPE AND STILLING BASIN FLOOR TO UPSTREAM FACE OF FLOOR BLOCKS
X_c = HORIZONTAL DISTANCE FROM UPSTREAM FACE OF FLOOR BLOCKS TO END OF STILLING BASIN

REDRAWN FROM FIG. 10, REFERENCE 4.

SUBCRITICAL OPEN CHANNEL FLOW

SAF-TYPE DROP STRUCTURE BASIC GEOMETRY

HYDRAULIC DESIGN CHART 624

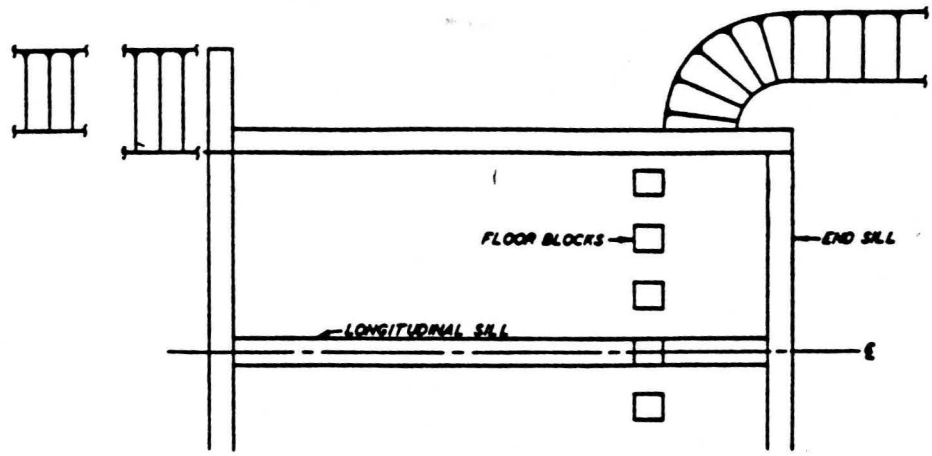
WES 7-73

Angel Mislán

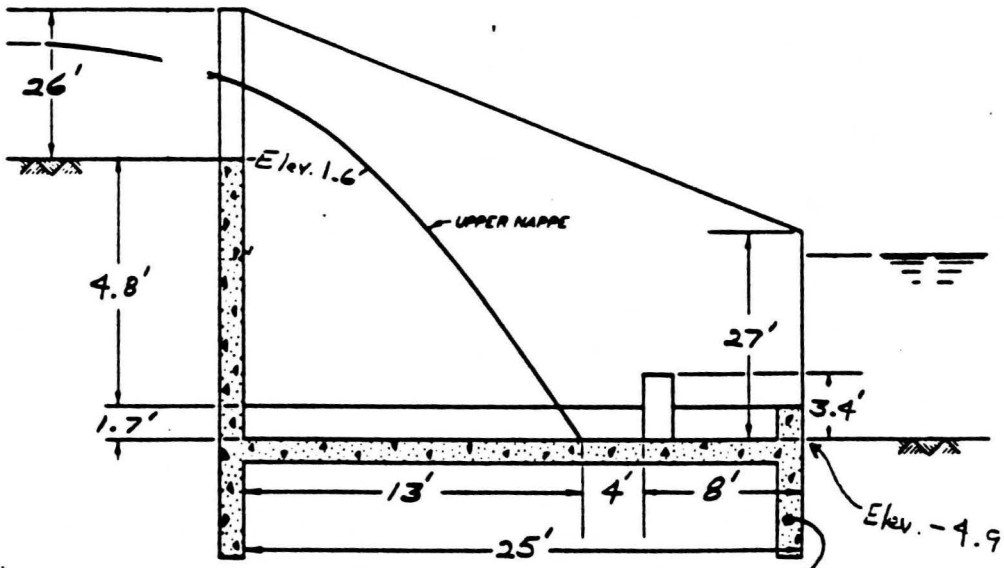
D.S. 1

TTT Recon Study 22 JAN 71

Tchefuncta River Diversion



HALF PLAN



CENTER-LINE SECTION

NOTE:

- H = HEAD ON WEIR = $\frac{2}{3}(d_c)$
- h_v = VELOCITY HEAD
- d_2 = TAILWATER DEPTH
- d_c = CRITICAL DEPTH OVER CREST
- h = HEIGHT OF DROP
- W = HEIGHT OF END SILL
- L_B = LENGTH OF STILLING BASIN = $X_a + X_b + X_c$
- X_a = HORIZONTAL DISTANCE FROM CREST TO INTERSECTION OF UPPER NAPPE AND STILLING BASIN FLOOR
- X_b = HORIZONTAL DISTANCE FROM INTERSECTION OF UPPER NAPPE AND STILLING BASIN FLOOR TO UPSTREAM FACE OF FLOOR BLOCKS
- X_c = HORIZONTAL DISTANCE FROM UPSTREAM FACE OF FLOOR BLOCKS TO END OF STILLING BASIN

REDRAWN FROM FIG. 10, REFERENCE 4.

SUBCRITICAL OPEN CHANNEL FLOW

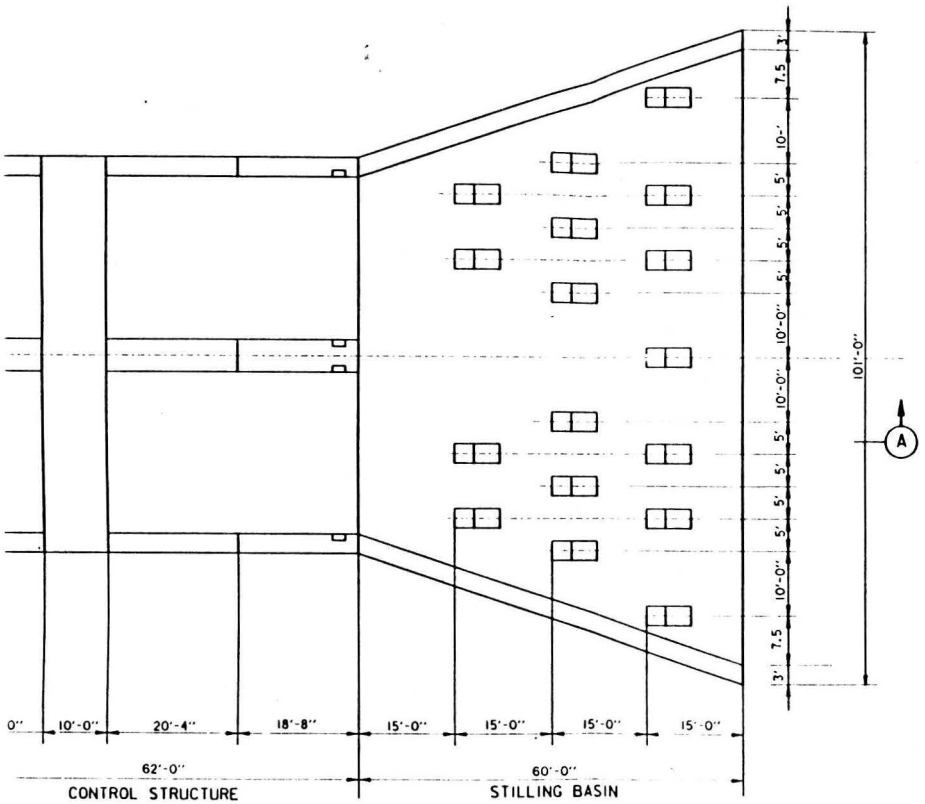
SAF-TYPE DROP STRUCTURE BASIC GEOMETRY

HYDRAULIC DESIGN CHART 624

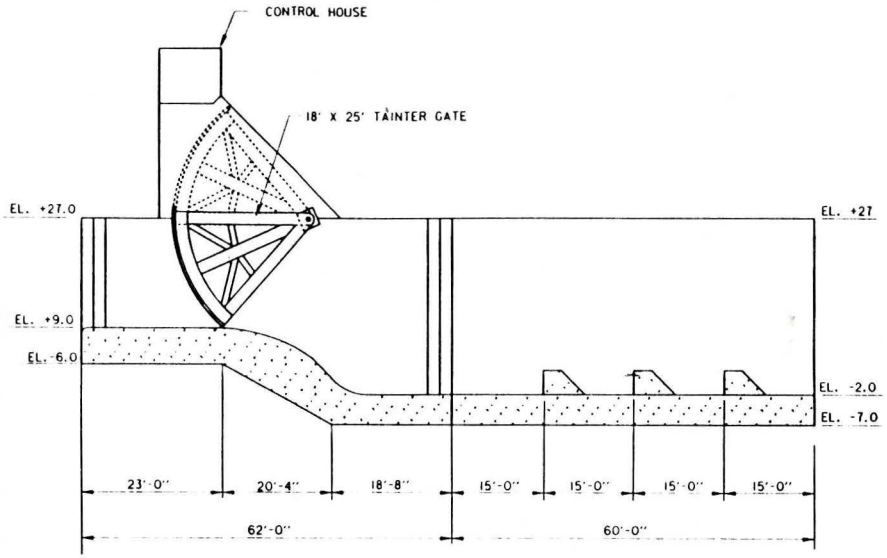
WES 7-73

A.M.

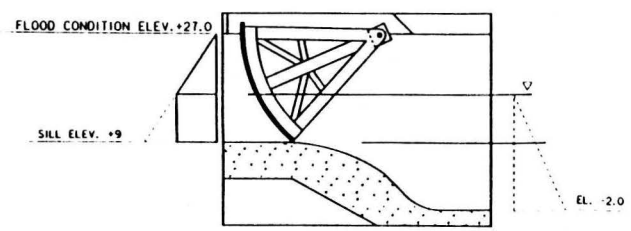
D.S. 2



PLAN - FLOOD CONTROL STRUCTURE



SECTION (A)



TYPICAL GATE LOADING CONDITION

Tangipahoa, Tchefuncte and Tickfaw Rivers

RECONNAISANCE STUDY

Tchefuncte River Diversio

Diversion Structure

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

DESIGNED BY:	R.J.G.	PLOT SCALE: 1.0	PLOT DATE: 15 May 91	CADD FILE: 3fcstr
DRAWN BY:	X			FILE NO. X
CHECKED BY:	X	DATE: 15 May 1991		

PLATE

Preliminary Cost Estimates

1IL25ST2

RECONNAISSANCE COST ESTIMATE				SHEET 1 OF 1	
PROJECT: TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS, LA.- MILE BRANCH 25 YEAR DESIGN-LINING WITH GABIONS				DATE: 04/17/91	BY: LJJ/RV
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
A.					
1.	MOB AND DEMOB	LUMP SUM	L.S.		$40,000.00
2.	CLEARING AND SNAGGING	.00	MILES		
3.	CLEARING				
a.	Clearing for channel dredging	30.90	ACRES	$2,140.00	$66,100.00
b.	Clearing disposal areas	27.50	ACRES	$1,000.00	$27,500.00
4.	DREDGING	123,000.00	CU.YDS	$1.35	$166,100.00
5.	CHANNEL LINING (8" gabions)	7,895.40	SQUARE	$340.00	$2,684,400.00
	SUBTOTAL				$2,984,100.00
	CON %	.25			$746,000.00
	SUBTOTAL				$3,730,100.00
	E&D %	.06			$223,800.00
	S&A %	.08			$298,400.00
	TOTAL				$4,252,300.00

IL25ST1

RECONNAISSANCE COST ESTIMATE				SHEET 1 OF 1	
PROJECT: TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS, LA.- MILE BRANCH 25 YEAR DESIGN-CONCRETE LINING				DATE: 04/17/91	BY: LJJ/RV
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
A.					
1.	MOB AND DEMOB	LUMP SUM	L.S.		$40,000.00
2.	CLEARING AND SNAGGING	.00	MILES		
3.	CLEARING				
a.	Clearing for channel dredging	30.90	ACRES	$2,140.00	$66,100.00
b.	Clearing disposal areas	27.50	ACRES	$1,000.00	$27,500.00
4.	DREDGING	123,000.00	CU.YDS	$1.35	$166,100.00
5.	CHANNEL LINING				
a.	SIDE SLOPE PAVING (4" reinforced concrete)	4,569.20	SQUARE	$230.00	$1,050,900.00
b.	CHANNEL BOTTOM PAVING (6" reinforced concrete)	3,326.20	SQUARE	$320.00	$1,064,400.00
	SUBTOTAL				$2,415,000.00
	CON %	.25			$603,800.00
	SUBTOTAL				$3,018,800.00
	E&D %	.06			$181,100.00
	S&A %	.08			$241,500.00
	TOTAL				$3,441,400.00

T25ST2

RECONNAISSANCE COST ESTIMATE					SHEET 1 OF 1	
PROJECT: TANGIPAHOA,TCHEFUNCTE AND TICKFAW RIVERS, LA.- LATERAL A 25 YEAR DESIGN-LINING WITH GABIONS					DATE: 04/17/91	BY: LJJ/RV
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE		ESTIMATED AMOUNT
A.						
1.	MOB AND DEMOB	LUMP SUM	L.S.			$35,000.00
2.	CLEARING AND SNAGGING	.00	MILES			
3.	CLEARING					
a.	Clearing for channel dredging	10.50	ACRES	$2,500.00		$26,300.00
b.	Clearing disposal areas	10.00	ACRES	$1,000.00		$10,000.00
4.	DREDGING	36,200.00	CU.YDS	$1.50		$54,300.00
	CHANNEL LINING (8" gabions)	2,257.00	SQUARE	$350.00		$790,000.00
	SUBTOTAL					$915,600.00
	CON %	.25				$228,900.00
	SUBTOTAL					$1,144,500.00
	E&D %	.06				$68,700.00
	S&A %	.08				$91,600.00
	TOTAL					$1,304,800.00

25ST1

RECONNAISSANCE COST ESTIMATE				SHEET 1 OF 1	
PROJECT: TANGIPAHOA,TCHEFUNCTE AND TICKFAW RIVERS, LA.- LATERAL A 25 YEAR DESIGN-CONCRETE LINING				DATE: 04/17/91 BY: LJJ/RV	
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
A.					
1.	MOB AND DEMOB	LUMP SUM	L.S.		$35,000.00
2.	CLEARING AND SNAGGING	.00	MILES		
3.	CLEARING				
a.	Clearing for channel dredging	10.50	ACRES	$2,500.00	$26,300.00
b.	Clearing disposal areas	10.00	ACRES	$1,000.00	$10,000.00
4.	DREDGING	36,200.00	CU.YDS	$1.50	$54,300.00
5.	CHANNEL LINING				
a.	SIDE SLOPE PAVING (4" reinforced concrete)	1,098.00	SQUARE	$230.00	$252,500.00
b.	CHANNEL BOTTOM PAVING (6" reinforced concrete)	1,159.00	SQUARE	$320.00	$370,900.00
	SUBTOTAL				$749,000.00
	CON %	.25			$187,300.00
	SUBTOTAL				$936,300.00
	E&D %	.06			$56,200.00
	S&A %	.08			$74,900.00
	TOTAL				$1,067,400.00

Encl 5

Mile Branch St.Tammany Parish, Covington, LA
Existing Facilities

ITEM	DESCRIPTION Utilities	OWNERS	Approx Length ft.	Cost Estimate	NOTE
E-3	elect. cables 2 pair	LP&L	125	5,000	relocate aerial
W-1	water 4" steel pipe	City of	130	3,900	Replace under channel
W-5	water 4" steel pipe	Covington	90	2,250	replace w/pipe bridge
W-9	water 6" steel pipe		90	4,950	replace w/pipe bridge
S-3	sewerage 12" CI pipe	City of	90	4,950	Replace under channel
S-5	sewerage 12" CI pipe	Covington	90	4,950	replace w/pipe bridge
S-9	sewerage 12" CI pipe		90	4,950	replace w/pipe bridge
G-4	gas 4" steel pipe	LA Gas	70	3,850	Replace under channel
G-5	gas 4" steel pipe	LA Gas	90	4,050	Replace under channel
G-9	gas 6" steel pipe	LA Gas	90	4,050	replace w/pipe bridge
	Subtotal			42,900	
	Contingencies +/-25%			10,725	
	Total Construction			53,625	
	Eng. & Design 6%			3,218	
	Superv. & Admn. 8%			4,290	
			TOTAL	61,133	
			USE	61,100	

Encl 2

PONTSTR

RECONNAISSANCE COST ESTIMATE				SHEET 1 OF 1		
PROJECT: TANGIPAHOA,TCHEFUNCTE AND TICKFAW RIVERS, LA.- PONTCHATOULA CREEK				DATE:04/17/91 BY: LJJ/RV REVISED 6/14/91		
ITEM NO.	DESCRIPTION		ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
A.						
1.	MOB AND DEMOB		LUMP SUM	L.S.	$25,000.00	$25,000.00
2.	CLEARING AND SNAGGING		.00	MILES		
3.	CLEARING					
a.	Clearing for channel dredging		42.90	ACRES	$2,500.00	$107,300.00
b.	Clearing disposal areas		32.30	ACRES	$1,320.00	$42,600.00
4.	DREDGING		145,000.00	CU.YDS	$1.55	$224,800.00
		SUBTOTAL				$399,700.00
		CON %	.25			$99,900.00
		SUBTOTAL				$499,600.00
		E&D %	.06			$30,000.00
		S&A %	.08			$40,000.00
		TOTAL				$569,600.00

CELMN-ED-SR May 91

Ponchatoula Creek, Tangipahoa Parish, Hammond, LA
Existing Facilities

ITEM	DESCRIPTION	OWNERS	Approx Length ft	Cost Estimate	NOTE
RR-1	Railroad/Bridg abandoned wood trestle	Illionis Central Gulf	120	4,800	Remove
	Utilities				
T-2a	ug tele cable	SCB	120	1,800	Replace under channel
C-6	ug cable 50 pr		100	2,000	Replace under channel
C-6a	ug cable 25 pr		100	2,000	Replace under channel
C-6b	ug cable 50 pr		100	2,000	Replace under channel
W-3	water 8" steel pipe	City of	90	5,400	Replace under channel
W-5	water 6" steel pipe	Hammon	90	4,950	Replace under channel
W-6	water 6" steel pipe with valve		100	5,500	Replace under channel
S-4	sewerage 12" CI pipe	City of	90	4,950	Replace under channel
S-6	sewerage 8" PVC	Hammon	100	3,000	Replace under channel
G-3	gas 8" steel pipe	LA Gas	90	4,950	Replace under channel
G-5	gas 4" steel pipe	LA Gas	90	4,050	Replace under channel
	Subtotal Utilities			40,600	
	Subtotal Railroad			4,800	
	Subtotal			45,400	
	Contingencies +/-25%			11,350	
	Total Construction			56,750	
				3,405	
				4,540	
			TOTAL	64,695	
			USE	64,700	

Encl 1

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RECONNAISSANCE COST ESTIMATE				SHEET 1 OF 1		
PROJT: TANGIPAHOA, TCHEFUNCTE AND TICKFAW RIVERS, LA.- TCHEFUNCTE RIVER DIVERSION CANAL				DATE: 05/30/91		BY: LJJ/RV
IT NO	DESCRIPTION	ESTIMATED QUANTITY		UNIT	UNIT PRICE	ESTIMATED AMOUNT
A.						
1.	MOB AND DEMOB	LUMP SUM		L.S.		$160,000.00
2.	CLEARING AND SNAGGING	.00		MILES		
3.	CLEARING					
	Clearing for channel dredging & levees	256.00		ACRES	$2,000.00	$512,000.00
	Clearing disposal areas	474.10		ACRES	$1,000.00	$474,100.00
4.	DREDGING	4,356,500.00		CU.YDS	$1.80	$7,841,700.00
			SUBTOTAL			$8,987,800.00
			CON %	.25		$2,247,000.00
			SUBTOTAL			$11,234,800.00
			E&D %	.06		$674,100.00
			S&A %	.08		$898,800.00
			TOTAL			$12,807,700.00

E 1 4

N-ED-SR JUN 91

Tangipahoa, Tchefuncta & Tickfaw River. LA - Tchefuncta Diverison Reconnaissance Study

Table of Existition Facilities

Station	Description	Owner	Length	Est. Cost
11+00	Road, gravle 16 ft wide; Bridge needed (note 1)	Private	Replace 100 Lin Ft New 250 Lin Ft	1,500 160,000
90+00	LA Hwy 1085 2-lane asphalt 28 ft wide Medium-Duty; Bridge needed (note 1)	State of LA DOTD	New 300 LinFt	700,000
128+00	Interstate I-12 4-lain Hwy Bridge needed (note 1)	U.S. Fed. Gov.t	New 400 Lin Ft	1,720,000
140+00	LA Hwy 1085 2-lane asphalt 28 ft wide Medium-Duty; Bridge needed (note 1)	State of LA DOTD	New 300 Lin Ft	700,000
182+50	Road, 2-lane asphalt 24 ft wide Light-Duty Bridge needed (note 1)	St. Tammany Parish	Replace 150 Lin Ft New 250 Lin Ft	580,000
207+00 to 213+00	Paralleling Road 2-lane apshalt Light-Duty	St. Tammany Parish	Relocate 600 Lin Ft	57,000
240+00	Road, 2-lane asphalt 24 ft wide Light-Duty Bridge needed (note 1)	St. Tammany Parish	Replace 150 Lin Ft New 250 Lin Ft	580,000
290+00	LA Hwy 22, 2-lane 30 ft wide Road/Bridge Heavy-Duty (note 1)	State of LA DOTD	Adjustment 500 Lin Ft	700,000

Note: 1. Information on bridge desing will be provided by CELMN-ED-DD.

Encl 6

CELMN-ED-SR JUN 91

Tangipahoa, Tchefuncta & Tickfaw River, LA - Tchefuncta Diverison Reconnaissance Study

Table of Existition Facilities

Station	Description	Owner	Length	Est. Cost
	UTILITIES			
57+50	Elect. transmission (hi voltage) line	LP&L 230 KV	Adjustment 400 Lin Ft	1,500,000
500' clear	(More Tower)			
90+00	Powerline, distri.		Adjustment 400 Lin Ft	11,200
	Telephone cable, (100 pair) aerial	SCB	400 Lin Ft	2,000
			relocate 4"	105,000
	Possible 2 pipes 4"gas & 6"water		400 Lin Ft each 6"	95,000
140+00	Powerline, distri.		Adjustment 400 Lin Ft	11,200
	Telephone cable, (100 pair) aerial	SCB	400 Lin Ft	2,000
	Telephone cable, underground		Remove 400 Lin Ft	1,000
			Replace 650 Lin Ft	75,000
			Relocate 4"	105,000
	Possible 2 pipes 4"gas & 6"water!		400 Lin Ft each 6"	95,000
212+50	Elect. transmission (hi voltage) line	LP&L 230 KV	Adjustment 400 Lin Ft	1,500,000
500' clear	(More Tower)			
290+00	Powerline, distri.		Remove & Replace 500 Lin Ft	14,000
	Telephone cable (50 & 100 pair) aerial	SCB	500 Lin Ft	3,000
	8" dia CI pipe		500 Lin Ft	88,000

Tangipahoa, Tchefuncte, and Tickfaw Rivers DIVERSION STRUCTURE, FLOOD CONTROL
Diversion of Tchefuncte River, Reconnaisance Study

Account Number	Account Number Description	Estimated Quantity	Unit	Unit Cost $ / Unit	Account No. Cost Quantity X UC $
15——	FLOOD CONTROL AND DIVERSION STRUCTURES				
150A-	Mobilization & Demobilization:	LUMPSUM	LS	$75,000.00	$75,000
150C-	Permanent Access Road and Parking: (2" Asphaltic wearing course, 1-1/2" Asphaltic binder course, 1/4 acres)	LUMPSUM	LS	$15,000.00	$15,000
150B-	Care and Diversion of Water:				
150BB	Dewatering(sump pumps-no well point system)	LUMPSUM	LS	$50,000.00	$50,000
150D-	Earthwork for Structures:				
150DB	Excavation	22,800.0	CY	$6.00	$136,800
150DB	Backfill	15,900.0	CY	$8.00	$127,200
150E-	Foundation Work:				
	Geotextile	2,085.0	SY	$8.00	$16,680
150F-	Seepage Control: PZ-22 Steel Sheet Piling, 20 feet long, 30 feet on each side of structure, and along perimeter of Stilling Basin	9,220.0	SF	$12.00	$110,640
150G-	Drainage:				
	2 - Concrete Rectangular Culverts 18' by 25', 300' long, with concrete guidewalls, to be placed under an existing Interstate hiway	LUMPSUM	LS	$875,000.00	$875,000
1501-	Overflow Structure(Diversion Structure):				
1501C	Concrete - Base Slab	950.0	CY	$200.00	$190,000
1501C	Concrete - Walls	750.0	CY	$450.00	$337,500
1501-	Overflow Structure(Drop Structure 1):				
1501C	Concrete - Base Slab	840.0	CY	$200.00	$168,000
1501C	Concrete - Walls	950.0	CY	$450.00	$427,500
1501-	Overflow Structure(Drop Structure 2):				
1501C	Concrete - Base Slab	540.0	CY	$200.00	$108,000
1501C	Concrete - Walls	560.0	CY	$450.00	$252,000
1502-	Stilling Basin:				
1502C	Concrete - Base Slab	925.0	CY	$200.00	$185,000
1502C	Concrete - Walls	450.0	CY	$450.00	$202,500
1502C	Concrete - Baffle Blocks	40.0	CY	$350.00	$14,000
1503-	Embedded Metal Work: Handrails, Chain Link Fence, Corner Protection	LUMPSUM	LS	$100,000.00	$100,000
15——	Subtotal: Flood Control and Diversion Structures				3,390,820.00

Encl 3

ED-OD

TAFC TANGIPAHOA, TCHEFUNCTE & TICFAW RIVERS-CHINCHUBA CULVERTS 5/6/91					
Item	Description	Quantity	Unit	Unit Price	Amount
A.	MOB & DEMOB		L.S.	$55,000	$55,000
B.	CLEARING & GRUBBING		L.S.	$22,000	$22,000
C.	ROADWAY WORK		L.S.	$495,000	$495,000
D.	EXCAVATION				
	I. BRACED COFFERDAM		L.S.	$6,050,000	$6,050,000
	1. PZ-27 SHEET PILES				
	3. STRUCTURAL EXCAVATION				
	4. DEWATERING SYSTEM				
	5. STRUCTURAL BACKFILL				
E.	CONCRETE CULVERT		L.S.	$6,600,000	$6,600,000
	I. BASE SLAB				
	II. WALLS				
	III. TOP				
F.	SLUICE GATES (TWO,7'X11')		L.S.	$195,000	$195,000
	SUBTOTAL				$13,417,000
	CONTINGENCIES (25%)				$3,354,250
	SUBTOTAL				$16,771,250
	ENGINEERING & DESIGN				$2,012,550
				TOTALS	$18,783,800

Encl. 1

ED-DD

AFPC TANGIPAHOA, TCHEFUNCTE & TICFAW RIVERS-CHINCHUBA CULVERTS 5/8/91

Item	Description	Quantity	Unit	Unit Price	Amount
A.	MOB & DEMOB		L.S.	$55,000	$55,000
B.	CLEARING & GRUBBING		L.S.	$22,000	$22,000
C.	ROADWAY WORK		L.S.	$495,000	$495,000
D.	EXCAVATION				
	I. CANTILEVER COFFERDAM		L.S.	$2,398,000	$2,398,000
	1. PZ-27 SHEET PILES				
	3. STRUCTURAL EXCAVATION				
	4. DEWATERING SYSTEM				
	5. STRUCTURAL BACKFILL				
E.	CONCRETE ARCH PIPE		L.S.	$3,941,000	$3,941,000
F.	SLUICE GATES (TWO 120"X78")		L.S.	$175,000	$175,000
	SUBTOTAL				$7,086,000
	CONTINGENCIES (25%)				$1,771,500
	SUBTOTAL				$8,857,500
	ENGINEERING & DESIGN				$1,062,900
				TOTALS	$9,920,400

Encl. 2

ADJACENT CAST ALONG LAKEFRONT LEVEE
ENTIRE MANDEVILLE AREA (MANDEVILLE AND LEWISBURG)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY MANDEVILLE AREA 100-YR. HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	105	AC	1200	126,000
3	SEED, FERTILIZE, AND MULCH	63	AC	1200	75,600
4	EMBANKMENT - SEMICOMPACTED FILL				
*	CAST - 255 FT CAST	1,185,850	CY	5.50	6,522,175
	HAUL - 3 MI ONE WAY	52,220	CY	3.40	177,548
5	HWY RELOCATION - CAUSEWAY	350	LF	150	52,500
6	ROCK	290,600	TONS	14.00	4,068,400
7	GABIONS - 9" THICK	70,560	YD^2	28.50	2,010,960
8	FILTER FABRIC (USE MIN. STRENGTH)	72,330	YD^2	3.25	235,073
	SUBTOTAL				13,368,256
	25% CONTINGENCIES				3,342,064
	TOTAL CONSTRUCTION				16,710,320
	ENGINEERING & DESIGN 10%				1,671,032
	SUPERVISION & ADMIN 10%				1,671,032
				TOTAL	20,052,384
	LEVEE RIGHT OF WAY	88	AC		
	BORROW RIGHT OF WAY	144	AC		

ENG FORM 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE.

SPD : 1982 0 - 38---33

ADJACENT CAST ALONG LAKEFRONT LEVEE
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	MANDEVILLE ONLY: 0+00 TO 169+00				
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	52	AC	1200	62,400
3	SEED, FERTILIZE, AND MULCH	36	AC	1200	43,200
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - FT CAST	599370	CY	6.80	4,075,716
	HAUL - 3 MI ONE WAY	59,520	CY	3.40	202,368
5	ROCK	175,950	TON	14.00	2,463,300
6	GABIONS - 9" THICK	42,720	YD^2	28.50	1,217,520
7	FILTER FABRIC (USE MIN. STRENGTH)	44,160	YD^2	3.25	143,520
	SUBTOTAL				8,308,024
	25% CONTINGENCIES				2,077,006
	TOTAL CONSTRUCTION				10,385,030
	ENGINEERING & DESIGN 10%				1,038,503
	SUPERVISION & ADMIN. 10%				1,038,503
				TOTAL	12,462,036
	LEVEE RIGHT OF WAY	52	AC		
	BORROW RIGHT OF WAY	77	AC		
				8/10/70	
				Tom	

ENG FORM APR 67 1738 SUPERSEDES ENG FORM 1738, 1 APR 64, WHICH IS OBSOLETE. EPS : 1982 0 - 38---33

ADJACENT CAST ALONG LAKEFRONT LEVEE
LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS REconnaissance STUDY MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	LEWISBURG AREA ONLY; 170+00 TO 306+10				
1	MOB AND DEMOB		L.S.		~~180,000~~
2	CLEAR AND GRUB	63	AC	1200	75,600
3	SEED, FERTILIZE, AND MULCH	34	AC	1200	~~40,800~~
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - FT CAST	582820	CY	4.80	2,797,536
	HAUL - 3 MI ONE WAY	~~10,360~~	CY	3.40	~~35,904~~
5	ROCK	114,650	TON	14.00	1,605,100
6	GABIONS - 9" THICK	27,840	YD^2	28.50	793,440
7	FILTER FABRIC (USE MIN. STRENGTH)	28,540	YD^2	3.25	92,755
	SUBTOTAL				5,541,135
	25% CONTINGENCIES				1,385,284
	TOTAL CONSTRUCTION				6,926,419
	ENGINEERING & DESIGN 10%				692,642
	SUPERVISION & ADMIN. 10%				692,642
				TOTAL	8,311,703
	LEVEE RIGHT OF WAY	44	AC		
	BORROW RIGHT OF WAY	72	AC		
				8/10/90	
				Tom	

ENG FORM 1738 APR 87 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE.

GPO : 1987 O - 38---33

ADJACENT CAST ALONG LAKEFRONT LEVEE
ENTIRE MANDEVILLE AREA (MANDEVILLE AND LEWISBURG)

REASONABLE CONTRACT ESTIMATE — SHEET OF

PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY — INVITATION NO.

MANDEVILLE AREA SPH - HURRICANE PROTECTION LEVEL

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	113	AC	1200	135,600
3	SEED, FERTILIZE, AND MULCH	70	AC	1200	84,000
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 290 FT CAST	1520940	CY	5.50	8,365,170
	HAUL - 3 MI ONE WAY	69,630	CY	3.40	236,742
5	HWY RELOCATION - CAUSEWAY	500	LF	150	75,000
6	ROCK	411900	TONS	14.00	5,766,600
7	GABIONS - 9" THICK	79,870	YD^2	28.50	2,276,295
8	FILTER FABRIC (USE MINIMUM STRENGTH)	81,870	YD^2	3.25	266,078
	SUBTOTAL				17,305,485
	25% CONTINGENCIES				4,326,371
	TOTAL CONSTRUCTION				21,631,856
	ENGINEERING & DESIGN 10%				2,163,186
	SUPERVISION & ADMIN 10%				2,163,186
				TOTAL	25,958,228
	LEVEE RIGHT OF WAY	97	AC		
	BORROW RIGHT OF WAY	159	AC		

ENG FORM APR 87 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE.

GPO : 1987 0 - 30---33

ADJACENT CAST ALONG LAKEFRONT LEVEE
MANDEVILLE AREA ONLY (EAST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE — SHEET OF

PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY — INVITATION NO.
MANDEVILLE AREA 5 PH HURRICANE PROTECTION LEVEL

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	MANDEVILLE AREA : 0+00 TO 169+00				
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	58	AC	1200	69,600
3	SEED, FERTILIZE, AND MULCH	40	AC	1200	48,000
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - FT CAST	770,940	CY	5.25	4,047,435
	HAUL - 3 MI ONE WAY	75,840	CY	3.40	257,856
5	ROCK	249,350	TON	14.00	3,490,900
6	GABIONS - 9" THICK	48400	YD^2	28.50	1,379,400
7	FILTER FABRIC (USE MIN. STRENGTH)	49600	YD^2	3.25	161,200
	SUBTOTAL				9,554,391
	25% CONTINGENCIES				2,388,598
	TOTAL CONSTRUCTION				11,942,989
	ENGINEERING & DESIGN 10%				1,194,299
	SUPERVISION & ADMIN. 10%				1,194,299
				TOTAL	14,331,587
	LEVEE RIGHT OF WAY	58	AC		
	BORROW RIGHT OF WAY	87	AC		
				8/10/90	
				Tom	

ENG FORM APR 87 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE. GPO : 1987 O - 38---33

ADJACENT CAST ALONG LAKEFRONT LEVEE
LEWISBURG AREA ONLY (WEST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TENNESSEE, AND TICKFAW RIVERS SECOND PHASE STUDY MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	LEWISBURG AREA: 170+00 TO 306+00				
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	65	AC	1200	78,000
3	SEED, FERTILIZE, AND MULCH	36	AC	1200	43,200
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - FT CAST	744,880	CY	4.80	3,575,424
	HAUL - 3 MI ONE WAY	10,560	CY	3.40	35,904
5	ROCK	162,500	TON	14.00	2,275,000
6	GABIONS - 9" THICK	31,520	YD^2	28.50	898,320
7	FILTER FABRIC (USE MIN. STRENGTH)	32,300	YD^2	3.25	104,975
	SUBTOTAL				7,110,823
	25% CONTINGENCIES				1,777,706
	TOTAL CONSTRUCTION				8,888,529
	ENGINEERING & DESIGN 10%				888,853
	SUPERVISION & ADMIN. 10%				888,853
				TOTAL	10,666,235
	LEVEE RIGHT OF WAY	47	AC		
	BORROW RIGHT OF WAY	77	AC		
				8/10/90	

ENG FORM 1738 APR 87 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE. SPD : 1987 O - 38---33

TRUCK HAUL LAKEFRONT LEVEE
OPTION 1: ENTIRE MANDEVILLE AREA (MANDEVILLE AND LEWISBURG)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	134	AC	1200	160,800
3	SEED, FERTILIZE, AND MULCH	62	AC	1200	74,400
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 25+4 FT CAST	520,280	CY	2.50	1,300,700
	HAUL - 3 MI ONE WAY	714,220	CY	3.40	2,428,348
5	ROCK	290,575	TON	14.00	4,068,050
6	GABIONS - 9" THICK	70,560	YD^2	28.50	2,010,960
7	FILTER FABRIC (USE MIN STRENGTH)	72,330	YD^2	3.25	235,073
8	HWY RELOCATION (CAUSEWAY)	350	LF	150	52,500
	SUBTOTAL				10,430,831
	25% CONTINGENCIES				2,607,708
	TOTAL CONSTRUCTION				13,038,539
	ENGINEERING & DESIGN 10%				1,303,854
	SUPERVISION & ADMIN. 10%				1,303,854
				TOTAL	15,646,247
	LEVEE RIGHT OF WAY	88	AC		
	BORROW RIGHT OF WAY	101	AC		
				8/10/90	
				Jbm	

ENG FORM 1738 SUPERSEDES ENG FORM 1726, 1 APR 84, WHICH IS OBSOLETE.

GPO : 1982 0 - 38---33

TRUCK HAUL LAKEFRONT LEVEE
OPTION 2: MANDEVILLE ONLY (EAST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		180,000
2	CLEAR AND GRUB	72	AC	1200	86,400
3	SEED, FERTILIZE, AND MULCH	36	AC	1200	43,200
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 23' FT CAST	198,610	CY	2.50	496,525
	HAUL - 3 MI ONE WAY	463,580	CY	3.40	1,576,172
5	ROCK	175,925	TON	14.00	2,462,950
6	GABIONS - 9" THICK	42,720	YD^2	28.50	1,217,520
7	FILTER FABRIC (USE MIN STRENGTH)	43,790	YD^2	3.25	142,318
	SUBTOTAL				6,125,085
	25% CONTINGENCIES				1,531,271
	TOTAL CONSTRUCTION				7,656,356
	ENGINEERING & DESIGN 10%				765,636
	SUPERVISION & ADMIN. 10%				765,636
				TOTAL	9,187,628
	LEVEE RIGHT OF WAY	53	AC		
	BORROW RIGHT OF WAY	52	AC		
				8/10/90	
				JDM	

ENG FORM APR 87 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE. SPD : 1987 0 - 36---33

ROCK HAUL LAKEFRONT LEVEE
OPTION 3: LEWISBURG AREA (WEST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE — SHEET OF

PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY — INVITATION NO.

MANDEVILLE AREA 100-YR HURRICANE PROTECTION LEVEL

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		~~100,000~~
2	CLEAR AND GRUB	75	AC	1200	~~90,000~~
3	SEED, FERTILIZE, AND MULCH	34	AC	1200	~~40,800~~
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 231 FT CAST	321,670	CY	2.50	804,175
	HAUL - 3 MI ONE WAY	271,760	CY	3.40	923,984
5	ROCK	114,650	TON	14.00	1,605,100
6	GABIONS - 9" THICK	27,840	YD^2	28.50	793,440
7	FILTER FABRIC (USE MIN STRENGTH)	28,540	YD^2	3.25	92,755
	SUBTOTAL				4,450,254
	25% CONTINGENCIES				1,112,564
	TOTAL CONSTRUCTION				5,562,818
	ENGINEERING & DESIGN 10%				556,282
	SUPERVISION & ADMIN. 10%				556,282
				TOTAL	6,675,382
	LEVEE RIGHT OF WAY	44 ~~22~~	AC		
	BORROW RIGHT OF WAY	54 ~~15~~	AC		

BK 20CT9 RJY 10/2/9

8/10/90 Tom

ENG FORM APR 67 1738 SUPERSEDES ENG FORM 1738, 1 APR 64, WHICH IS OBSOLETE.

GPO : 1982 0 - 386-333

TRUCK HAUL LAKEFRONT LEVEE
OPTION 1 ENTIRE MANDEVILLE AREA (MANDEVILLE AND LEWISBURG)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS REconnaissance STUDY MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	151	AC	1200	181,200
3	SEED, FERTILIZE, AND MULCH	70	AC	1200	84,000
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 284 FT CAST	682,550	CY	2.50	1,706,375
	HAUL - 3 Mi ONE WAY	902,930	CY	3.40	3,069,962
5	ROCK	411,900	TON	14.00	5,766,600
6	GABIONS - 9" THICK	79,870	YD²	28.50	2,276,295
7	FILTER FABRIC (USE MIN STRENGTH)	81,870	YD²	3.25	266,078
8	UGLY RELOCATION	500	L.F.	150	75,000
	SUBTOTAL				13,525,510
	25% CONTINGENCIES				3,381,378
	TOTAL CONSTRUCTION				16,906,888
	ENGINEERING & DESIGN 10%				1,690,689
	SUPERVISION & ADMIN. 10%				1,690,689
				TOTAL	20,288,266
	LEVEE RIGHT OF WAY	97	AC		
	BORROW RIGHT OF WAY	114	AC		
				8/10/90	
				Tom	

ENG FORM APR 87 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE.

EP3 : 1982 0 - 36---33

TRUCK HAUL LAKEFRONT LEVEE

OPTION 2: MANDEVILLE ONLY (EAST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE					SHEET OF
PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	83	AC	1200	99,600
3	SEED, FERTILIZE, AND MULCH	41	AC	1200	49,200
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 2 R4 FT CAST	246,440	CY	2.50	616,100
	HAUL - 3 MI ONE WAY	584,690	CY	3.40	1,987,946
5	ROCK	249,350	TON	14.00	3,490,900
6	GABIONS - 9" THICK	48,400	YD^2	28.50	1,379,400
7	FILTER FABRIC (USE MIN STRENGTH)	49,600	YD^2	3.25	161,200
	SUBTOTAL				7934,346
	25% CONTINGENCIES				1,983,587
	TOTAL CONSTRUCTION				9,917,933
	ENGINEERING & DESIGN 10%				991,793
	SUPERVISION & ADMIN. 10%				991,793
				TOTAL	11,901,519
	LEVEE RIGHT OF WAY	58	AC		
	BORROW RIGHT OF WAY	60	AC		
				8/10/90	
				Tom	

ENG FORM 1738 SUPERSEDES ENG FORM 1738, 1 APR 84, WHICH IS OBSOLETE.

EPS : 1982 O - 36---33

TRUCK HAUL LAKEFRONT LEVEE
OPTION 3: LEWISBURG AREA (WEST OF CAUSEWAY)

REASONABLE CONTRACT ESTIMATE

SHEET OF

PROJECT TANGIPAHOA, TCHEFUNCTE, AND TICKFAW RIVERS RECONNAISSANCE STUDY
MANDEVILLE AREA SPH HURRICANE PROTECTION LEVEL

INVITATION NO.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1	MOB AND DEMOB		L.S.		100,000
2	CLEAR AND GRUB	80	AC	1200	96,000
3	SEED, FERTILIZE, AND MULCH	36	AC	1200	43,200
4	EMBANKMENT - SEMICOMPACTED FILL				
	CAST - 284 FT CAST	416,110	CY	2.50	1,040,275
	HAUL - 3 MI ONE WAY	339,360	CY	3.40	1,153,824
5	ROCK	162,500	TON	14.00	2,275,000
6	GABIONS - 9" THICK	31,515	YD^2	28.50	898,178
7	FILTER FABRIC (USE MIN STRENGTH)	32,300	YD^2	3.25	104,975
	SUBTOTAL				5,711,452
	25% CONTINGENCIES				1,427,863
	TOTAL CONSTRUCTION				7,139,315
	ENGINEERING & DESIGN 10%				713,932
	SUPERVISION & ADMIN. 10%				713,932
				TOTAL	8,567,179
	LEVEE RIGHT OF WAY	47	AC		
	BORROW RIGHT OF WAY	59	AC		
				8/10/90	
				[illegible]	

ENG FORM APR 67 1738 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE.

GPO : 1982 0 - 38---33

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Madisonville Site - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	Floodgate at Hwy. 22	1	EA	110,000.00	110,000.00
2	T-Wall	4700	LF	787.00	3,698,900.00
3	2-36" Reinforced Concrete Pipes	4	EA	380,000.00	1,520,000.00
4	PUmp Station - 40 CFS	LUMP SUM	LS	380,000.00	380,000.00
	SUBTOTAL				5,709,000.00
	CONTINGENCIES - 25%				1,491,000.00
	SUBTOTAL				7,200,000.00
	E & D - 12%				900,000.00
	TOTAL				$8,100,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Madisonville Site - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	Floodgate at Hwy. 22	1	EA	130,000.00	130,000.00
2	T-Wall	4700	LF	808.00	3,797,600.00
3	2-36" Reinforced Concrete Pipes	4	EA	400,000.00	1,600,000.00
4	Pump Station - 40 CFS	LUMP SUM	LS	400,000.00	400,000.00
	SUBTOTAL				5,928,000.00
	CONTINGENCIES - 25%				1,572,000.00
	SUBTOTAL				7,500,000.00
	E & D - 12%				900,000.00
	TOTAL				$8,400,000.00

Tchefuncte; Tickfaw, Tangipahoa Recon. Estimate
Lacombe Hurricane Protection Plan - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	4-5'x5' Reinforced Concrete Culverts	3	EA	700,000.00	2,100,000.00
2	84' Sector Gated Struc.	2	EA	6,400,000.00	12,800,000.00
3	Pump Station - 1500 CFS	3	EA	8,000,000.00	24,000,000.00
4	2-60" Reinforced Concrete Pipes	27	EA	390,000.00	10,530,000.00
	SUBTOTAL				49,430,000.00
	CONTINGENCIES - 25%				7,470,000.00
	SUBTOTAL				56,900,000.00
	E & D - 12%				6,800,000.00
	TOTAL				$63,700,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Lacombe Hurricane Protection Plan - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	4- 5'X5' Reinforced Concrete Culverts	3	EA	745,000.00	2,235,000.00
2	84' Sector Gated Struc.	2	EA	7,100,000.00	14,200,000.00
3	Pump Station - 1500 CFS	3	EA	8,400,000.00	25,200,000.00
4	2- 60" Reinforced Concrete Culverts	27	EA	400,000.00	10,800,000.00
	SUBTOTAL				52,435,000.00
	CONTINGENCIES - 25%				13,165,000.00
	SUBTOTAL				65,600,000.00
	E & D - 12%				7,900,000.00
	TOTAL				$73,500,000.0

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Mandeville - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 125 CFS	1	EA	1,100,000.00	1,100,000.00
2	Bridge	1	EA	135,000.00	135,000.00
3	Swing Gate	2	EA	48,500.00	97,000.00
4	Swing Gate	3	EA	67,100.00	201,300.00
5	I-Wall	1000	LF	253.00	253,000.00
6	I-Wall	2000	LF	179.00	358,000.00
	SUBTOTAL				2,144,000.00
	CONTINGENCIES - 25%				556,000.00
	SUBTOTAL				2,700,000.00
	E & D - 12%				300,000.00
	TOTAL				$3,000,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Mandeville - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 125 CFS	1	EA	1,125,000.00	1,125,000.00
2	Bridge	1	EA	135,000.00	135,000.00
3	Swing Gate	2	EA	58,200.00	116,400.00
4	Swing Gate	3	EA	80,500.00	241,500.00
5	I-Wall	1000	LF	354.16	354,160.00
6	I-Wall	2000	LF	250.44	500,880.00
	SUBTOTAL				2,473,000.00
	CONTINGENCIES - 25%				627,000.00
	SUBTOTAL				3,100,000.00
	E & D - 12%				300,000.00
	TOTAL				$3,400,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Western Slidell - Plan A - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	2- 5'x5' Reinforced Concrete Culverts	3	EA	700,000.00	2,100,000.00
2	84' Sector Gated Struc.	2	EA	6,400,000.00	12,800,000.00
3	Pump Station - 1700 CFS	3	EA	10,500,000.00	31,500,000.00
4	2- 60"Reinforced Concrete Pipes	27	EA	390,000.00	10,530,000.00
	SUBTOTAL				56,930,000.00
	CONTINGENCIES - 25%				14,270,000.00
	SUBTOTAL				71,200,000.00
	E & D - 12%				8,600,000.00
	TOTAL				$79,800,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Western Slidell - Plan A - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	2- 5'x5' Reinforced Concrete Culverts	3	EA	745,000.00	2,235,000.00
2	84' Sector Gated Struc.	2	EA	7,100,000.00	14,200,000.00
3	Pump Station - 1700 CFS	3	EA	11,000,000.00	33,000,000.00
4	2- 60" Reinforced Concrete Pipes	27	EA	400,000.00	10,800,000.00
	SUBTOTAL				60,235,000.00
	CONTINGENCIES - 25%				15,065,000.00
	SUBTOTAL				75,300,000.00
	E & D - 12%				9,000,000.00
	TOTAL				$84,300,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Lewisburg - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 50 CFS	1	EA	380,000.00	380,000.00
2	2- 60" Reinforced Concrete Pipes	1	EA	390,000.00	390,000.00
3	2- 60" Reinforced Concrete Pipes	2	EA	390,000.00	780,000.00
4	I-Wall	2000	LF	179.00	358,000.00
5	I-Wall	2000	EA	253.00	506,000.00
8	Swing Gate	2	EA	67,100.00	134,200.00
9	Swing Gate	2	EA	48,500.00	97,000.00
	SUBTOTAL				2,645,000.00
	CONTINGENCIES - 25%				355,000.00
	SUBTOTAL				3,000,000.00
	E & D - 12%				400,000.00
	TOTAL				$3,400,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Lewisburg – Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 50 CFS	1	EA	400,000.00	400,000.00
2	2- 60" Reinforced Concrete Pipes	1	EA	400,000.00	400,000.00
3	2- 60" Reinforced Concrete Pipes	2	LF	400,000.00	800,000.00
4	I-Wall	2000	LF	250.44	500,880.00
5	I-Wall	2000	EA	354.16	708,320.00
6	Swing Gate	2	EA	80,500.00	161,000.00
7	Swing Gate	2	EA	58,200.00	116,400.00
	SUBTOTAL				3,087,000.00
	CONTINGENCIES - 25%				513,000.00
	SUBTOTAL				3,600,000.00
	E & D - 12%				400,000.00
	TOTAL				$4,000,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Lewisburg - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 50 CFS	1	EA	380,000.00	380,000.00
2	2- 60" Reinforced Concrete Pipes	1	EA	390,000.00	390,000.00
3	2- 60" Reinforced Concrete Pipes	2	EA	390,000.00	780,000.00
4	I-Wall	2000	LF	179.00	358,000.00
5	I-Wall	2000	EA	253.00	506,000.00
8	Swing Gate	2	EA	67,100.00	134,200.00
9	Swing Gate	2	EA	48,500.00	97,000.00
	SUBTOTAL				2,645,000.00
	CONTINGENCIES - 25%				355,000.00
	SUBTOTAL				3,000,000.00
	E & D - 12%				400,000.00
	TOTAL				$3,400,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Lewisburg - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	Pump Station - 50 CFS	1	EA	400,000.00	400,000.00
2	2- 60" Reinforced Concrete Pipes	1	EA	400,000.00	400,000.00
3	2- 60" Reinforced Concrete Pipes	2	LF	400,000.00	800,000.00
4	I-Wall	2000	LF	250.44	500,880.00
5	I-Wall	2000	EA	354.16	708,320.00
6	Swing Gate	2	EA	80,500.00	161,000.00
7	Swing Gate	2	EA	58,200.00	116,400.00
	SUBTOTAL				3,087,000.00
	CONTINGENCIES - 25%				513,000.00
	SUBTOTAL				3,600,000.00
	E & D - 12%				400,000.00
	TOTAL				$4,000,000.00

chefuncte, Tickfaw, Tangipahoa Recon. Estimate
Western Slidell - Plan B - 100 Year Flood

Item	Description	Quantity	Unit	Unit Price	Amount
1	2- 5'x5' Reinforced Concrete Culverts	3	EA	700,000.00	2,100,000.00
2	84' Sector Gated Struc.	2	EA	6,400,000.00	12,800,000.00
3	Pump Station - 1700 CFS	3	EA	10,500,000.00	31,500,000.00
4	2- 60"Reinforced Concrete Pipes	27	EA	390,000.00	10,530,000.00
	SUBTOTAL				56,930,000.00
	CONTINGENCIES - 25%				14,270,000.00
	SUBTOTAL				71,200,000.00
	E & D - 12%				8,600,000.00
	TOTAL				$79,800,000.00

Tchefuncte, Tickfaw, Tangipahoa Recon. Estimate
Western Slidell - Plan B - Standard Project Hurricane

Item	Description	Quantity	Unit	Unit Price	Amount
1	2- 5'x5' Reinforced Concrete Culverts	3	EA	745,000.00	2,235,000.00
2	84' Sector Gated Struc.	2	EA	7,100,000.00	14,200,000.00
3	Pump Station - 1700 CFS	3	EA	11,000,000.00	33,000,000.00
4	2- 60" Reinforced Concrete Pipes	27	EA	400,000.00	10,800,000.00
	SUBTOTAL				60,235,000.00
	CONTINGENCIES - 25%				15,065,000.00
	SUBTOTAL				75,300,000.00
	E & D - 12%				9,000,000.00
	TOTAL				$84,300,000.00