US Army Corps
of Engineers
New Orleans District

PRELIMINARY
SUBJECT TO CORRECTION

Schneider Canal, Slidell, Louisiana
Hurricane Protection

Reconnaissance Report

May 1990

PRELIMINARY
SUBJECT TO CORRECTION

SYLLABUS

This report presents the results of a reconnaissance-level study of hurricane and rainfall flooding in the City of Slidell, Louisiana. The study was conducted under the authority of Section 205 of the Flood Control Act of 1948, as amended.

The study area is located on the northeastern shore of Lake Pontchartrain in St. Tammany Parish, Louisiana. It is comprised of those portions of Slidell and adjacent unincorporated areas bounded by Interstate 10, the Southern Railroad embankment, U.S. Highway 190 (Gause Boulevard), and Schneider Canal. This urban area is vulnerable to flooding from heavy rainfalls as well as high stages in Lake Pontchartrain.

In the study, we considered the preliminary feasibility of constructing a hurricane protection project for the area. A levee and floodwall system was evaluated that would protect against the 100-year frequency hurricane. The system was analyzed for both gravity and forced drainage. With the provision of gravity drainage only, the levee and floodwall system has a first cost of $18,907,000, average annual costs of $1,907,000, average annual benefits of $2,225,000, and a benefit-to-cost ratio of 1.17. With forced drainage, the first cost is $26,686,000, average annual costs are $2,725,000, average annual benefits are $2,786,000, and the benefit-to-cost ratio is 1.02.

From the analysis of these two plans, we concluded that sufficient justification exists to warrant further investigation of hurricane protection. The report recommends that the study be continued into the feasibility phase. Due to the potential scope of the project, the report recommends that the Feasibility Study be conducted under the General Investigations Program and the existing Louisiana Coastal Area authority.

SCHNEIDER CANAL, SLIDELL, LOUISIANA
HURRICANE PROTECTION
RECONNAISSANCE REPORT

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INTRODUCTION

Flooding in southern Slidell, Louisiana, is relatively frequent. Major damages from rainfall flooding were sustained in the area in May 1958, January 1966, and April 1983. Flooding is especially common in low lying areas due to the combination of heavy rainfall and high stages in Lake Pontchartrain. The area is also vulnerable to inundation from hurricane surges.

In 1986, the St. Tammany Parish Police Jury developed plans to construct a pumping station in Schneider Canal to improve drainage in southern Slidell. The pumping station would have a capacity of 800-900 cubic feet per second (cfs) and cost approximately $3.0 million. The police jury applied for partial funding of the project under Louisiana's Statewide Flood Control Program.

In October 1986, the police jury requested that the U.S. Army Corps of Engineers, New Orleans District (NOD) consider funding the project under the Section 205 program. NOD completed a preliminary evaluation of the proposed project in June 1988. The results of this evaluation indicated that providing interior drainage improvements is not likely to be economically feasible under Federal planning criteria. However, there did appear to be a reasonable chance of developing a favorable, economically justified hurricane protection project. Thus, the preparation of a full-scale reconnaissance report was recommended.

SCOPE OF THE STUDY

This reconnaissance study investigates the preliminary feasibility of constructing hurricane protection for a portion of the City of Slidell. The study focuses on establishing whether there exists a feasible plan that warrants detailed study. The engineering analysis consists of developing a design and cost estimate of a floodwall and levee system to provide protection against the 100-year frequency hurricane. The economic analysis estimates the reduction in residential and commercial flood damages resulting from the project. The environmental analysis lists environmental habitats in the area and the possible project-related

environmental impacts.

STUDY AUTHORITY

This study was performed under the continuing authority provided to the Chief of Engineers by Section 205 of the Flood Control Act of 1948, as amended.

STUDY PARTICIPANTS AND COORDINATION

This study was coordinated with the U.S. Fish and Wildlife Service, the Louisiana Department of Transportation and Development, and the City of Slidell.

THE REPORT AND STUDY PROCESS

The reconnaissance study is the first phase of the two-phased process implemented in Corps' feasibility studies of water resource projects. The Corps conducts a reconnaissance study to determine whether a feasibility study is appropriate. Both types of studies follow the guidelines given in the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies.

EXISTING PROJECTS AND PRIOR STUDIES

Metropolitan New Orleans Area. This latter plan, unlike the barrier structure and low-level levee plan, did not afford any hurricane protection to the Slidell 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 area. 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 Slidell area currently has a higher potential for hurricane flooding than reflected in the 1977 study's benefit-to-cost analysis.

A report completed in 1924 authorized 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.

An unpublished report prepared under the authority for small flood control projects, Section 2 of the Flood Control Act of 1937, as amended, was completed in the mid-1940's. The report recommended 1.4 miles of channel clearing and snagging improvements on Bayou Vincent. The improvements were completed in 1947.

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.

PROBLEM IDENTIFICATION

NATIONAL OBJECTIVES

The Federal 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

STUDY AREA

The study area is located in St. Tammany Parish, Louisiana, near the northeastern shore of Lake Pontchartrain (see Plates 1 and 2). It includes the portion of the City of Slidell bounded by U.S. Highway 190 (Gause Boulevard), the Southern Railroad embankment, Interstate 10, and the Schneider Canal spoil bank. Some 70% of this 6.4 square mile area is developed. It is mostly urban and includes residential development, shopping centers, and a number of other small commercial establishments.

The study area is drained by several natural and man-made waterways. The major channels are Bayou Vincent to the west, Schneider Canal to the south, and the W14 and W15 canals to the east. All of these channels drain into Lake Pontchartrain, which is located some two to three miles to the south of the study area. Lake Pontchartrain is tidally influenced by the Gulf of Mexico. As a result, the area is subject to both hurricane surge stages and backwater flooding from hurricane driven tides. Plate 3 shows the overflow limits (area of inundation) associated with a 100-year frequency hurricane.

The area can be broken down into 4 separate drainage basins (see Plate 4). The first is bounded by U.S. Highway 11, Interstate Highway 10, Schneider Canal, and LA Highway 433. This is the Schneider Canal basin. A second basin west of Schneider Canal is bounded to the east and west by U.S. Highway 11 and the Southern Railroad. This basin extends northward from the latitude of Schneider Canal to the junction of U.S. Highway 11 and State Highway 433 and is relatively small in total area. The two remaining basins consist of the area bounded by U.S. Highway 11 and Interstate Highway 10 and extending northward to U.S. Highway 190 (Business Route), also known as Fremaux Avenue. These areas are roughly divided by the eastern Slidell Corporation limit. The western basin is drained to Bayou Vincent and the eastern basin is drained by the W14 canal. The eastern basin also extends north of U.S. Highway 190 to Interstate Highway 12 and incorporates the entire width bounded by U.S. 11 and I 10. These four basins will be referred to as the Schneider Canal, Southern Railway, Bayou Vincent, and W14 basins, respectively, throughout the remainder of this report.

CLIMATE

The climate of the area is generally influenced by the Gulf of Mexico, giving it a semitropical character. Prevailing southerly winds from the gulf reduce extreme summer heat, shorten the duration of infrequent winter polar air masses and provide abundant rain in all seasons.

Temperature. Records of temperatures for Slidell, Louisiana are available from "Climatological Data" for Louisiana, published by the National Climatic Center. The average annual temperature for the period 1978 - 1987 is 67.5 °F, with average monthly temperatures varying from 48.0 °F in January to 82.5°F in July. Maximum temperature extreme recorded over the period of record was 104 °F on June 21, 1964. The lowest temperature at Slidell was 8 °F on January 21, 1985. The average monthly and annual temperatures for the period 1978 - 1987 at Slidell is shown in Table 1.

TABLE 1
Slidell Average Temperatures (° F)
(1978 - 1987)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
48.0	52.0	61.0	67.5	74.7	80.3	82.5	82.1	78.1	69.1	61.4	53.6	67.5

Precipitation. The average annual precipitation based on the National Climatic Center records for Louisiana over the twenty-year period 1968 - 1987 at Slidell, is 59.2 inches. The maximum monthly rainfall total over the period of record was 17.74 inches during May 1958. The maximum recorded daily rainfall also occurred during this month with 13.20 inches falling on the 18th. There have been two months in the period of record in which no precipitation was recorded (October 1962 and October 1978). Based on the twenty-year period, July is the wettest month having a average monthly rainfall of 6.3 inches. October is the driest month, averaging 3.4 inches. The monthly and annual precipitation along with the twenty-year averages is given in Table 2.

TABLE 2

Slidell
Monthly and Annual Precipitation
(1968 - 1987)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL.	AUG	SEP	OCT	NOV	DEC	ANN
1968	0.97	2.99	2.46	3.64	3.95	1.23	5.00	3.26	1.61	5.21	5.33	8.69	44.34
1969	3.88	4.20	7.89	4.47	7.43	0.38	11.16	8.99	0.95	1.06	2.75	5.46	58.60
1970	3.97	3.56	6.30	0.54	5.00	10.38	8.54E	6.79	3.32	7.44	0.81	5.65	62.30E
1971	1.81	5.48	2.47	0.68	2.02	4.45	6.20	3.25	8.91	0.08	2.91	6.86	45.12
1972	9.99	5.56	5.59	1.35	5.42	3.07	7.13	2.77	2.55	3.37	6.11	10.42	63.33
1973	2.81E	3.88	12.22	10.45	1.29	3.26	3.51	5.11	6.36	4.02	4.53	4.88	62.32E
1974	7.67	5.27	5.94	9.13	11.75	1.75	5.33	4.36	5.51	0.13	6.99	5.12	68.95
1975	4.72	4.00	5.52	4.80	7.85	8.53	8.00	10.41	4.87	3.03	4.60	4.55	70.88
1976	1.20	6.53	3.40	0.48	5.86	2.87	2.06	1.32	3.99	6.61	6.39	6.64	47.35
1977	6.26	2.55	5.97	4.79	5.22	0.31	3.57	10.40	9.94	5.84	9.04	5.09	68.98
1978	12.11	2.75	3.67	3.45	8.18	6.57	5.40	8.52	2.82	0.0	4.58	5.01	63.06
1979	6.17	10.73	3.93	6.64	4.29	1.81	13.65	2.85	4.75	1.12	5.39	3.98	65.31
1980	7.14	2.27	11.66	14.78	14.02	1.55	5.43	2.94	5.98	4.58	3.41	1.77	75.53
1981	.93	9.55	1.54	.81	2.42	5.85	3.80	6.40	2.90	1.14	.79	3.63	39.76
1982	2.41	6.16	3.75	4.75	1.06	2.05	9.35	4.55	4.37	4.07	4.41	9.46	56.39
1983	4.55	8.68	4.28	12.34	3.40	6.79	7.57	6.07	6.25	3.49	3.00	7.85	74.28
1984	3.49	5.41	3.81	1.64	3.61	5.76	4.99	4.93	3.82	3.03	3.41	2.79	46.69
1985	4.83	5.07	5.63	0.75	1.42	4.90	9.96	9.59	8.98	9.35	1.23	4.43	66.15
1986	3.38	3.49	3.20	1.55	5.26	2.72	1.35	3.41	1.89	3.73	10.04	4.70	44.72
1987	7.43	7.59	8.10	2.42	6.72	5.77	3.94	8.47	1.49	0.34	3.60	3.15	59.02
AVERAGE	4.79	5.29	5.37	4.47	5.31	4.0	6.30	5.72	4.56	3.38	4.47	5.51	59.15

E - Estimated

Rainfall is also recorded at the Pearl River Lock No. 1, which is north of the study area. The monthly and annual normal precipitation based on the period 1951 - 1980 at this station is shown below in Table 3.

TABLE 3
Pearl River Lock No. 1
Precipitation Normals (inches)
(1951 - 1980)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
4.90	5.07	5.85	5.46	5.20	4.16	6.64	5.20	5.53	2.72	4.41	5.78	60.94

Wind. Wind data taken at New Orleans Moisant Airport is used to describe the study area. The average velocity of the wind over the period 1966 - 1987 is 7.8 miles per hour (mph). The predominant wind directions are north-northeast from September through February and south-southeast from March through June. Winter storms in the area have produced wind speeds of up to 47 mph. The summer is often disturbed by tropical storms and hurricanes that produce winds of over 100 mph. Table 4 shows the average monthly and annual wind speeds and its resultant directions for the 1966 - 1987 period at Moisant Airport.

STORMS AND FLOODS OF RECORD

Flooding in the City of Slidell and vicinity is relatively frequent. It is caused by both headwater flooding due to intense rainfall in the upper reaches of the streams as well as high stages in Lake Pontchartrain caused by hurricanes. One of the worst floods of record for Slidell occurred on May 18, 1958, when 13.20 inches of rainfall in a 24-hour period was recorded at the Central Fire Station in Slidell. At Bayou Liberty, 10.85 inches was measured. A high water stage of 7.1 feet National Geodetic

TABLE 4

Wind Summaries, New Orleans at Moisant Airport (1966-1987)

Average Wind Speed

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1966	9.6	10.5	9.5	10.7	8.7	7.3	6.2	6.4	5.7	7.6	7.4	8.6	8.2
1967	8.3	9.5	9.0	9.3	9.1	6.8	6.2	5.9	7.0	7.4	8.0	9.8	8.0
1968	9.2	10.0	9.3	9.1	8.4	5.6	5.7	5.2	6.4	6.8	8.9	9.3	7.8
1969	9.7	9.8	10.0	8.6	7.3	7.2	6.5	6.8	6.7	9.7	8.0	9.1	8.3
1970	9.5	9.2	9.8	9.9	8.5	6.8	5.4	6.0	6.7	7.7	8.0	7.4	7.9
1971	8.4	9.8	9.8	8.5	7.9	5.3	5.7	5.0	6.5	4.8	8.0	8.7	7.4
1972	8.9	8.6	9.1	10.2	7.3	9.3	7.5	6.4	7.0	8.3	9.9	9.4	8.5
1973	9.6	10.2	12.0	11.5	10.0	6.7	6.7	6.3	7.9	7.0	9.6	11.4	9.1
1974	9.2	11.0	10.8	10.7	8.2	7.4	5.0	5.2	8.6	7.4	8.5	8.5	8.4
1975	9.4	8.6	11.0	10.0	7.4	6.5	6.5	4.9	6.3	6.4	8.0	7.8	7.7
1976	9.6	8.8	10.5	7.6	8.4	6.9	5.4	5.7	6.0	8.5	7.9	8.2	7.8
1977	9.8	8.5	8.5	7.3	5.7	5.3	4.4	5.5	5.4	6.6	8.1	8.8	7.0
1978	9.1	8.9	8.5	8.6	7.9	5.9	5.5	5.3	6.3	6.1	6.7	10.0	7.4
1979	10.5	9.0	9.3	8.0	7.2	6.5	6.7	4.4	8.0	6.7	8.1	6.3	7.6
1980	7.6	8.0	9.8	8.8	7.5	7.4	5.6	5.7	5.3	5.9	6.4	5.9	7.0
1981	7.6	8.3	7.7	7.3	7.8	6.9	5.7	4.8	5.7	7.0	7.3	8.6	7.1
1982	9.8	8.3	8.9	9.4	6.5	6.2	4.6	4.4	7.1	7.5	7.6	10.0	7.5
1983	8.0	10.0	8.8	10.4	7.8	6.3	5.8	5.3	6.0	6.8	8.3	10.0	7.8
1984	8.0	8.7	7.8	9.4	8.2	4.7	4.1	5.8	9.2	7.6	9.6	8.8	7.7
1985	9.4	10.1	9.7	9.2	8.3	7.8	6.1	7.3	8.6	9.6	8.1	8.2	8.5
1986	9.1	10.8	9.2	9.0	9.1	6.7	6.7	6.6	6.8	7.5	9.8	8.6	8.3
1987	9.2	10.3	9.2	8.4	6.3	6.7	5.9	5.9	6.4	7.7	9.5	9.4	7.9
Average	9.1	9.3	9.5	9.2	7.9	6.7	5.7	5.6	6.8	7.3	8.3	8.8	7.8

Wind Summaries, New Orleans at Moisant Airport (1966-1987)

Resultant Direction*

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1966	02	04	07	16	07	07	23	15	02	03	03	05	05
1967	03	02	13	15	16	11	21	02	05	06	05	08	09
1968	03	35	12	16	15	19	12	05	06	04	04	06	07
1969	07	02	02	13	09	18	24	09	04	05	36	01	05
1970	03	03	08	17	19	21	29	12	08	03	32	06	09
1971	02	12	13	15	13	23	20	01	07	04	04	12	09
1972	07	07	12	15	04	20	14	34	12	06	02	06	08
1973	02	36	16	16	20	18	24	04	10	07	13	20	12
1974	12	24	16	13	16	16	25	13	05	06	06	16	12
1975	09	21	14	11	15	18	25	17	03	05	08	04	10
1976	04	19	15	15	15	13	25	01	04	02	02	02	07
1977	01	09	13	14	13	21	20	12	15	03	10	13	11
1978	01	01	28	15	16	12	19	11	08	03	08	07	07
1979	01	04	15	14	14	15	17	13	04	11	03	03	08
1980	06	06	09	20	15	22	27	13	09	04	02	02	08
1981	02	02	21	15	13	16	22	11	05	06	10	04	09
1982	11	01	12	10	13	22	21	21	06	06	06	10	09
1983	04	05	29	18	15	12	10	11	07	05	10	03	08
1984	03	08	16	18	14	17	13	18	06	13	04	12	12
1985	34	04	14	13	20	19	23	11	08	08	09	02	09
1986	01	23	10	15	15	18	24	33	13	08	05	03	10
1987	34	06	04	29	15	13	13	24	02	03	06	10	06

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

Vertical Datum (NGVD) was recorded in the center of Slidell. Another large flood occurred on January 3-5, 1966. It was associated with a 3-day rainfall of 14.87 inches recorded at the Slidell Central Fire Station and caused a stage of 7.4 feet NGVD at Bayou Vincent. On April 7, 1983, 8.7 inches of rain over a 10-hour period was recorded in Slidell. This storm caused wide-spread residential and commercial flooding, with Schneider Canal basin being one of the hardest hit areas.

Other significant floods due to rainfall were those of July 22-23, 1946; June 12-13, 1956; September 23-24, 1956; September 30 and October 10, 1956; July 21-22, 1958; March 17-18, 1961; March 25, 1973; and May 21-22, 1974. Major flooding from the Pearl River was experienced in northern and western Slidell (outside the Schneider Canal study area), in 1979, 1980, and 1983.

Flooding in the lower part of the study area has resulted from high stages in Lake Pontchartrain caused by hurricanes. Some of the significant hurricanes in recent times affecting Slidell are as follows; September - October 1915; Hurricane Flossy - September 1956; Hurricane Hilda - October 1964; Hurricane Betsy - September 1965; Hurricane Camille - August 1969; Hurricane Carmen - September 1974; and Hurricane Juan - October - November 1985. St. Tammany Parish was declared a national disaster area subsequent to Hurricanes Betsy, Camille, and Juan.

STREAMFLOW DATA

Daily streamflow data is taken at two gages near the study area. Maximum stages at both gages were affected by Hurricane Camille in August 1969. Table 5 gives pertinent data such as period of record, extremes, and dates for the two streamflow gaging stations. Discharge data are not taken due to tidal influence.

GEOLOGY

The study area is located in the eastern portion of the Lake Pontchartrain Basin. Specifically, the project is located on the northeast margin of Lake

TABLE 5

Streamflow Data

Station	Period of Record	Record Stages (Ft. NGVD)			
		Maximum	Date	Minimum	Date
Bayou BonFouca at Slidell	Aug 62 - Date	6.8[a]	18 Aug 69	-0.6	15 Feb 63
Rigolets NR Lake Pontchartrain	Sep 31 - Date	9.0[a]	18 Aug 69	-1.9	26 Jan 38

(a) caused by Hurricane Camille

Pontchartrain underlain by Holocene swamp-marsh deposits and Pleistocene deposits. Holocene deposits generally consist of soft to soft organic clays and silts and organic material. Underlying these Holocene deposits are the stiff clays and clayey sands of the Pleistocene.

ENVIRONMENTAL RESOURCES

BIOLOGICAL

The majority of the study area is developed, both residentially and commercially. The remainder is characterized as predominantly a pine-oak wooded area along Schneider Canal and along the southeastern and eastern border of Interstate 10. The remainder of the study area consists of mixed hardwood clusters interspersed within the residential limits of the City of Slidell. Shrubs include eastern baccharis, yaupon, and wax myrtle. Herbaceous vegetation found in the understory includes meadow beauty, goldenrod, blackberry, milkwort, spade leaf, and numerous grasses and sedges. Isolated forested wetland areas are found where ponding has occurred in response to slow-draining soil characteristics. The extreme southwestern portion of the study area contains brackish marsh.

Several species of fish, including various minnows, mosquito fish, sunfish, sailfin mollies, and occasionally blue catfish, are found in Schneider Canal in addition to snails, small clams, and polychaete worms. These aquatic organisms may also be found in the numerous borrow pits located along the eastern border study area. Reptiles and amphibians are present throughout the study area. Mammals such as rabbits, armadillos, raccoons, and squirrels are present in and adjacent to forested areas.

The pine-oak woods attract woodpeckers, crows, warblers, mourning doves, and various hawks. Other birds found in the residential area include red-winged blackbirds, sparrows, bluejays, cardinals, mockingbirds, grackles, and bluebirds. Migratory waterfowl may also frequent the area.

ENDANGERED AND THREATENED SPECIES

The only threatened species that might be present near or in Schneider Canal and the borrow pits is the American alligator. Although the American alligator is listed as threatened by the U.S. Fish and Wildlife Service, it is threatened only due to similarity of appearance.

RECREATION

The Schneider Canal study area is contained within Louisiana State Comprehensive Outdoor Planning Region 1. This region contains approximately 30 percent of the State's population. The Schneider Canal study area is mostly urban containing residences, shops with numerous wooded areas existing to the south and east. Recreational activities taking place within the study area include sport fishing and crabbing in Schneider Canal and outdoor oriented field sports, along with walking, hiking, nature observation, bicycling etc. Adjacent to the study area, hunting and fishing opportunities abound. Access to Lake Pontchartrain can be gained by numerous water routes including Bayou Bonfouca and the Highway 11 Canal both located along the western boundary of the project. Motor boating, water skiing, sailing and the North Shore Beach are available to recreationalists in the area.

WATER QUALITY

Water quality in Schneider Canal, W-14 Canal, and other waterways in the study area is subject to occasionally high levels of oxygen-demanding substances and nutrients following rainfall runoff events. Partially-treated municipal sewage and untreated runoff from residential and commercial developments are chronic sources of bacterial pathogens. The Water Pollution Control Division of the Louisiana Department of Environmental Quality (DEQ) has evaluated water bodies in the study area vicinity with respect to nonpoint pollution, and has determined that the designated uses of primary and secondary contact recreation and fish and wildlife propagation are partially supported from a water quality standpoint. Presently available information indicates that water quality problems are

not yet serious, but that future levels of management and treatment of water and wastewater in the study area must at least keep pace with future urbanization trends for the continued avoidance of major problems.

CULTURAL RESOURCES

None of the nine National Register of Historic Places sites in St. Tammany Parish is located in the study area. This developed area could contain unrecorded cultural resources, although the possibility is slight.

DEVELOPMENT AND ECONOMY

POPULATION AND EMPLOYMENT

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 commercial and residential structures with a number of mobile home parks. 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 study area, as of the 1980 Census, contributed 12,600 to the total population. From current development patterns it can be assumed that the population will remain fairly constant for the future.

The Louisiana Department of Labor's "Labor Market Information" for March 1988 indicated that the civilian labor force in the St. Tammany Parish area increased from 62,800 to 63,800 during the past 12-month period. The unemployment rate appears to be improving slightly, dropping from 9.8 percent to 9.0 percent, with total unemployment decreasing from 6,100 to 5,700.

DEVELOPMENT

Development within the area consists of single-story residential structures, several small commercial structures, mobile homes and apartment complexes. The compiled information was taken from the Lake Pontchartrain Hurricane Protection Report and updated by current field surveys. A study of aerial photos and field surveys determined that there is little residential or commercial development at elevations below +5.5 feet NGVD. A survey in the area appraising the value of the residential structures yielded an average depreciated value of over $45,000 per structure based on the Marshall & Swift Valuation Program with values ranging from $18,000 to $68,000. Mobile homes were assigned a depreciated value of $7,500 each. The commercial structures were assigned a value based on the Marshall & Swift Valuation Program and varied in structure value in accordance with structure type and size. Total value of all residential improvements within the area was $108,393,000 (April 1989 price levels).

CONDITIONS IF NO FEDERAL ACTION IS TAKEN

If no Federal action is taken, the study area will continue to experience flooding from high tides in Lake Pontchartrain due to storms and hurricanes. Flood damage to new development should be moderated by the parish'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

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.

In conjunction with the above improvements, the Landmark Land Company

of Louisiana, Inc. is constructing 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

The study area is vulnerable to flooding from hurricanes and heavy rainstorms. In addition, the combination of high stages in Lake Pontchartrain and rainfall frequently causes street flooding and minor property damage to low lying areas near Schneider Canal. Local interests are taking steps to improve interior drainage in these floodprone areas. None of these plans, however, will provide significant hurricane protection. Tidal surges associated with even minimal hurricanes could overtop the low, wooded area between the Southern Railroad embankment and U.S. Highway 11. A hurricane greater in magnitude than the 20-year storm could create a surge that would overtop the railroad embankment, which is built to an elevation of approximately +8.0 feet NGVD. The crown of the Interstate 10 embankment, at elevation +10.5 feet NGVD, would be overtopped by the storm surge of hurricanes greater in magnitude than the 90-year frequency hurricane. Storm surges could also enter the study area through Schneider Canal, Bayou Vincent, and the W14 and W15 Canals.

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 along the Interstate 10 and Southern Railroad embankments and by avoiding marsh.

PLANNING OBJECTIVE

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

FORMULATION OF PRELIMINARY PLANS

ENGINEERING ANALYSIS

PLAN DESCRIPTION

The two plans evaluated in this study involve the construction of 100-year level hurricane protection system with either gravity drainage or forced drainage. With gravity drainage, the hurricane protection system would be comprised of 6.5 miles of levee, 2.5 miles of floodwall, 8 floodgates, 3 major drainage structures, and a number of small culverts (see Plates 5 and 9). The hurricane protection system with forced drainage is essentially identical, except that two pumping stations are substituted for two of the major drainage structures. These pumping stations would have capacities of 1200 and 100 cfs, respectively.

The levees under either plan would be constructed in two lifts, with 5 years between lifts. Beneficial completion of the project would be reached in 2 years, because the 2nd levee lift is for shaping only. If the the levee system is tied into the Landmark Land Corporation levee (now under construction), only 4.5 miles of levee would need to be constructed.

Cost estimates for initial construction are shown in Table 6 (see Appendix C for cost breakdown). Operation, maintenance, and replacement costs are also shown in Table 6.

HYDROLOGY

Rainfall. The rainfall data for this study was taken from Technical Paper 40 published by the National Weather Service. Runoff data, discharges, and HEC-2 input geometry were supplied by the consulting engineer firm of Burk and Associates, Inc. This data was also corroborated by the City of Slidell flood insurance study and additional rainfall runoff routings using the computer program DROUT.

TABLE 6
COST ESIMATE SUMMARY, EXCLUDING MITIGATION COSTS
(FEBRUARY 1989 PRICE LEVELS)

	100-YR PROTECTION WITHOUT PUMPS	100-YR PROTECTION WITH PUMPS
FIRST COSTS		
LANDS AND DAMAGES	$151,000	$151,000
LEVEES	$3,099,000	$3,099,000
FLOODWALLS AND FLOODGATES	$11,439,000	$11,439,000
DRAINAGE STRUCTURES	$4,218,000	$11,997,000
TOTAL FIRST COST	$18,907,000	$26,686,000
ANNUAL COSTS		
OPERATION AND MAINTENANCE	$48,000	$113,000
REPLACEMENT COSTS	$4,000	$5,000

This program is designed to compute unit hydrographs and has been modified to perform simple pump routings. With the modified program a constant pumping capacity may be specified if desired. The program will then compute the inflow hydrograph resulting from a given rainfall event, and route this hydrograph through the pumps. The program output will furnish the storage required for the sump area adjacent to the pump for a given rainfall event and a given pumping capacity. The assumption is made that an adequate drainage system has been provided to deliver the runoff to the pumps. The program also requires a time of concentration and infiltration rates as input. Times of concentration were provided in the data supplied by Burk and Associates. For this study, a worst case of total ground saturation was assumed and the infiltration rates were assumed to be zero. The peak discharges, provided as an output of the program, approximated those supplied by Burk and Associates closely enough to substantiate these assumptions. Stage storage curves were developed from topographic maps developed for the Lake Pontchartrain and Vicinity Hurricane Protection Study. Using these curves, interior stages were determined based on the required storage provided by the DROUT program for the various combinations of protection and drainage.

For the purposes of analyzing hurricane protection it is assumed that a rainfall event of a 10-year magnitude will accompany any given hurricane event. The resulting peak discharges were used to design interior drainage structures unless existing conditions dictated otherwise. Rainfall events of a magnitude larger then the 10-year event were not otherwise considered in this analysis.

The maximum interior stage resulting from a 10-year rainfall event was determined using the DROUT program. A pump capacity of 1 cfs was given and the resulting required storage was computed for each basin. The volume of water represented by a flow of 1 cfs over the duration of the unit hydrograph did not have a significant impact on the required storage but was accounted for. When these volumes were applied to the stage storage curves mentioned previously, a pattern of overflow became apparent. Storage in the lower W14 basin is extremely limited. When stages in the lower W14 basin reach approximately +7 feet NGVD, overflow into the Bayou Vincent basin begins. Storage below the 7-foot contour in the Bayou Vincent basin is insufficient to store the volume of overflow from the W14 basin. As

a result, once an elevation of 7 feet is crested in the Bayou Vincent basin, overflow continues into the Schneider Canal and ultimately the Southern Railway basins. This pattern is shown on Plate 3. By applying the required storage in each basin to the stage storage curves and balancing the overflow volume a stage of 7.7 feet NGVD over the entire project area was computed.

Hurricane Stages. The hurricane stage data for this study were developed from the Lake Pontchartrain and Vicinity Hurricane Protection Study, the St. Tammany and City of Slidell flood insurance studies, and the Type 5 Flood Insurance Study for Coastal Louisiana. Stage-frequency curves for hurricane events under the with- and without-project conditions are shown on Plates 6-8.

Hurricane stages in the form of still water elevations were determined for the 25-year, 100-year, and SPH (Standard Project Hurricane), conditions without the project in place. Stages for the with-project condition and gravity drainage consisted of the still water elevation produced by the storage of a 10-year rainfall event. For the with-project condition and a forced drainage system, interior stages were held to a calculated "no-damage" level.

INTERIOR DRAINAGE

General. Each of the four described drainage basins were analyzed for gravity drainage with the project in place. This analysis consisted primarily of designing drainage structures to replace existing structures or provide a possible closure in the proposed alignment. Two of the basins, the Southern Railway and the Bayou Vincent basins, are currently serviced by one or more pumping stations. The Schneider Canal and W14 basins were also analyzed utilizing forced drainage in combination with the project.

The criteria used to design structures was to match the current capacity at any specific site. This was a trade off for using a 10-year event as the maximum rainfall coincident with any magnitude hurricane. For the design, of forced drainage, pumps were sized to keep interior stages below a "no-damage" elevation. (The "no-damage" elevation is the maximum still water elevation that causes little or no residential and commercial flood

damage.) The necessary pump capacity was based on the peak discharge for a 10-year rainfall event. "No-damage" elevations were estimated from the Lake Pontchartrain and Vicinity Hurricane Protection Study.

Gravity Drainage. The existing drainage within the Schneider Canal Basin consists of the WP-20 drainage lateral and the Schneider Canal. Schneider Canal drains from I-10 to the west toward Highway 11. There is an existing box culvert at Highway 11, 90 feet in length, consisting of three 9.5 foot by 10 foot culverts with invert at -8 feet NGVD. This culvert discharges into the Highway 11 borrow canal which empties into Lake Pontchartrain. There is also an existing 4-foot by 5-foot box culvert with an invert elevation of 1 foot NGVD at I-10. However, very little flow is passed from the Schneider Canal basin toward the east under I-10. With this in mind, no replacement structure was planned. The proposed plan for hurricane protection calls for a levee to be constructed to the north of Schneider Canal with a continuous borrow canal on the protected side. The portion of Highway 11 crossing the proposed levee will be raised. A replacement box culvert will be constructed which extends from the levee borrow canal, under Highway 11 and discharges into the Highway 11 borrow canal. For the purpose of hurricane protection, this structure will be required to have vertical lift gates. There are two smaller drainage structures passing under I-10 into the Schneider Canal basin. One of these is a pair of 24 inch circular culverts which act as a drain for the interstate median draining both east and west from the center ditch. Because the proposed protection calls for building up the median, no drainage of this area would be required and a positive closure of the culverts could be provided by grouting the median drop inlet. A second structure, a pair of 3 foot by 4 foot culverts, is located immediately south of the junction of I-10 and LA Highway 433. These culverts carry local drainage from the Schneider Canal basin to the east passing under I-10. This structure will require a modification to equip it with some form of positive closure. If a lift gate is used it should be placed on the protected end of the culvert. If a flap-type gate is selected, then placement should be on the flooded side of the protection.

The W14 basin is drained by the W14 canal which originates north of I-12 and flows southward to a point north of Highway 433 then eastward to I-10. Prior to reaching I-10 an unnamed lateral canal flows into the W14 canal. The lateral originates to the east of I-10 flowing westward under the

interstate then southward to W14. The headwater of this lateral, while not in the protected area, is located in ground contours above the SPH stage. The W14 canal passes under I-10 via a concrete lined bridge section and ultimately discharges into Lake Pontchartrain. The design discharge of the I-10 bridge section, as provided by the Louisiana Department of Transportation and Development, is 3700 cfs. This discharge has been verified by other hydrologic data as being equal to the 100-year event. A gated sluice structure will be required on the W14 canal at I-10. The preferred location of the structure would be the east or unprotected side of the I-10 embankment.

There are a number of median drains in the I-10 alignment bounding the W14 basin with 24 inch culverts draining both east and west. The alignment of the hurricane protection is proposed to be to the east of the I-10 embankment north of its intersection with LA Highway 433. This alignment allows closure of the culverts, at the unprotected end, using flap gates. Additional lengths of culvert may be required to extend the outlet beyond the constructed protection.

The Southern Railway basin is presently serviced by two pumping stations. The Dellwood and Lee Street pumping stations have a combined capacity of approximately 78 cfs. There is also one 30 inch circular culvert with a slide-gate closure which drains this area passing flow under the Southern railroad embankment. This culvert is segmented, however, and will require modification by the addition of a length of culvert in order to insure an effective closure.

Since the intent of this project would be to provide hurricane protection, no improvements to the existing forced drainage system were considered. Modification of the outfalls of these pumping stations to provide a positive closure against hurricane stages would be necessary, however. This closure could be provided by the use of flap gates.

The Bayou Vincent basin is currently serviced by a single pumping station. This station has a capacity of approximately 375 cfs. The approach channel to the pumping station passes beneath the Southern Railroad via a trestle several hundred feet upstream. Because the pumping station lies outside the proposed alignment it will be necessary to construct a sluice-gated structure

on the approach channel. This structure would be located adjacent to the railroad trestle on the upstream side and would be tied into the hurricane protection.

Forced Drainage. Analysis of the project area was also undertaken with the inclusion of forced drainage as a feature of the project. Only two of the four drainage basins would require the addition of pump stations, the Schneider Canal and W14 basins. The Southern Railroad Bayou Vincent drainage basins are presently serviced by pumping stations. "No-damage" water surface elevations were again applied to size the structures. Analysis of forced drainage was based on maintaining these stages in conjunction with a 10-year rainfall event.

Storage of the runoff resulting from a 10-year rainfall event during closure of the hurricane protection works would produce a stage of 7.7 feet NGVD within the protected area. The largest volume of runoff is produced in the W14 basin. When stages in the lower W14 basin reach approximately +7 feet NGVD, overflow into the Bayou Vincent basin begins. Storage below the 7 foot contour in the Bayou Vincent basin is insufficient to store the overflow volume from the W14 basin. As a result, once a stage of +7 feet NGVD is reached in the Bayou Vincent basin, overflow begins into the Schneider Canal and ultimately the Southern Railway basins.

Analysis of the W14 basin revealed that a 1200 cfs pumping station located at I-10 and the W14 canal would achieve the specified "no-damage" stage in the W14 and Bayou Vincent basins. While some overflow between these two basins would continue to occur, overflow into the remaining two basins, particularly into the Schneider Canal basin, would be eliminated. With the elimination of overflow into the Schneider Canal basin, analysis determined that a 100 cfs capacity pumping station could achieve the specified "no-damage" elevation of 5.9 feet in that basin. The capacity of the Schneider Canal pump station is dependent on the capacity of the W14 station, however. It should be noted that a 100 cfs capacity pump, while providing drainage to the "no-damage" stage for events up to a 10-year frequency regardless of exterior stage, will not duplicate gravity drainage when exterior stages are below hurricane level. Additionally, for rainfall events of a magnitude greater than 10 years, interior stages will certainly be increased in the Schneider Canal basin with forced drainage. Either

additional pumping capacity or the inclusion of the previously described gravity drainage structure would be necessary to avoid adverse impacts to drainage.

Requirements for Further Studies. While a great deal of data is available concerning the hydrology and drainage of this area, it does not cover all facets of localized drainage in the study area. The analyses made using this data reflect best engineering judgment. Continued consideration of this project should include gathering of additional data and detailed study of the interior drainage patterns within the study area. This should also include computer modeling of water surface profiles in the major drainage channels.

HYDRAULIC DESIGN

Hydraulic design constituted the design of 3 major gravity drainage structures. With the exception of the Southern Railway basin, one structure is located in each of the four drainage basins. The specific structures are addressed, by basin, below.

Schneider Canal. Three 10 ft. x 11 ft. concrete box culverts, 225 ft. long, will be required at the proposed crossing under Highway 11 at the Schneider Canal. These culverts were sized so not to exceed headlosses in the existing three 10 ft. x 9.5 ft. concrete box culverts in Schneider Canal under Highway 11, which they will replace. The existing headloss was calculated for a range of design flows for 2-year through 100-year frequency storms obtained from the Master Drainage Plan, St. Tammany Parish, Louisiana, prepared by Burk and Associates, Inc. in March 1983. Existing and proposed culverts were assumed to be flowing full for the analysis. Entrance losses in the proposed culverts due to the change in the direction of flow were neglected pending final design of the channel and culvert alignment.

W14 Canal. The culverts required in the W14 Canal at I-10 were sized for an allowable headloss of 0.3 ft. for a 100-year frequency storm design flow of

3700 cfs. All three sizes of concrete box culvert (CBC) listed below were found to be hydraulically adequate, and the most cost effective size can be chosen:

a. 11 - 10 ft. x 10 ft. CBC
b. 9 - 11 ft. x 11 ft. CBC
c. 8 - 12 ft. x 12 ft. CBC

These culverts were assumed to be flowing full and only approximately 10 ft. long to facilitate the mounting of gates. The allowable headloss was estimated based upon limited knowledge of the existing internal drainage system. Therefore, while this plan will provide or increase hurricane protection, it may impact stages within the basin for any given rainfall event. Further analysis of this impact and the existing drainage system will be required in future stages of this project.

Bayou Vincent. Two 8 ft. x 9 ft. concrete box culverts will be required in Bayou Vincent at the proposed floodwall. These culverts were sized assuming an allowable headloss of 0.2 ft. for a flow equal to the existing capacity of the Bayou Vincent Pumping Station (approximately 400 cfs). The proposed culverts were assumed to be flowing full and only approximately 10 ft. long to facilitate the mounting of gates. The allowable headloss was estimated based upon limited knowledge of the existing internal drainage system. Therefore, while this plan will provide or increase hurricane protection, it may impact stages within the basin for any given rainfall went. Further analysis of this impact and the existing drainage system will be required in future stages of this project.

ADDITIONAL ENGINEERING STUDIES REQUIRED FOR THE FEASIBILITY PHASE

The City of Slidell has proposed the construction of a pumping station near Highway 11 and Schneider Canal. The effects of this pumping station will need to be considered during the Feasibility Study. A closer look at possible relocations and the work along I-10 will also be needed during the Feasibility Study.

ECONOMIC ANALYSIS

PROBLEM DESCRIPTION

The focus of this preliminary study is the need for hurricane protection. 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. Interior drainage within the Schneider Canal drainage basin was addressed due to special local concerns about rainfall flooding in the area.

ESTIMATE OF DAMAGES

Estimated damages to existing development were derived by using a computerized Urban Flood Damages assessment program. Estimates of structure values, the number of structures and average flood elevations were determined through field surveys and data taken from the Lake Pontchartrain Hurricane Protection Project Report. Stage-damage relationships entered into this computer program for both commercial and residential improvements were those derived in the Lake Pontchartrain Hurricane Protection Project Report for assessing potential damages to the New Orleans metropolitan area. These depth-damage curves indicate the percent damages that would occur to buildings and contents as related to flood depths over floors.

Information from the depth-damage curves was combined with field survey data relating to numbers, types, and value of improvements to determine residential and commercial damages. The computer program then integrated the stage-frequency data with the depth-damage relationships to produce an estimate of average annual damages to be expected under existing conditions.

With the project in place, estimated damages would be limited to the effects of rainfall. The total benefits of the project include the benefits of partial protection during the initial construction period and benefits anticipated over the 100-year project life after completion.

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 7 shows average annual damages prevented in the area.

FIRST COSTS AND ANNUAL CHARGES

The first costs and annual charges for each of the alternatives are shown on Table 8.

UNQUANTIFIED BENEFITS

This study focuses on the potential benefits from the reduction of physical damages to structural improvements within the floodplain resulting from hurricane protection and flood control. This category of benefits is by far the major portion of benefits. Benefits should also include an estimate of savings from reducing damages to vehicles and emergency costs. However, in addition to these benefits, there could possibly be some savings from a reduction in business and financial losses during those times when larger hurricanes do threaten or strike the area.

Another minor category of benefits that was not quantified consists of those reductions in construction costs resulting from a lowering of the first floor elevations presently required under the National Flood Insurance Program in order to secure financing, commonly known as costs of floodproofing saved. Typical local construction methods are to build the houses using a slab foundation on fill. With the subsequent likelihood of a relaxation of the flood insurance construction requirements, that increment of construction costs associated with the raised slab would be saved. There are also minor benefits associated with the reduction of flood damages to streets and roads, communication cables and splicing stands, and gas and electric transmission systems.

TABLE 7

Average Annual Damages Prevented
With Project

	AVERAGE ANNUAL DAMAGES PREVENTED	
	100-YEAR WITHOUT PUMPING STATION	100-YEAR WITH PUMPING STATION
RESIDENTIAL STRUCTURES	$ 1,682,000	$ 2,076,000
COMMERCIAL STRUCTURES	450,000	597,000
APARTMENTS & MOBILE HOMES	93,000	113,000
TOTAL	$ 2,225,000	$ 2,786,000

TABLE 8

First Costs and Annual Charges
(February 1989 Price Levels, 8 7/8% Interest Rate)

	100-YEAR Without PS	100-YEAR With PS
First Costs:	$18,907,000	$26,686,000
Initial Costs:		
Floodwalls & Floodgates	11,439,000	11,439,000
Drainage Structures	4,218,000	11,997,000
1st & 2nd Lifts	3,099,000	3,099,000
Interest During Construction	1,678,000	2,368,000
Gross Investment	$20,584,000	$29,054,000
Average Annual Charges @ 8 7/8%	$ 1,827,000	$ 2,579,000
Operation and Maintenance	48,000	113,000
Replacement Costs	4,000	5,000
Mitigation Costs	28,000	28,000
Total Annual Charges	$ 1,907,000	$ 2,725,000
Average Annual Benefits	$ 2,225,000	$ 2,786,000
Net Benefits	$ 318,000	$ 61,000
Benefit Cost Ratio	1.17 to 1	1.02 to 1

PRELIMINARY ENVIRONMENTAL ANALYSIS

BIOLOGICAL

Air quality impacts associated with the hurricane protection alignment would occur due to the clearing and burning of debris, dust from operation of heavy equipment, and hydrocarbon emissions from related construction equipment. Noise levels resulting from construction of Schneider Canal levee, Railroad I-wall, and Railroad Terminus levee would be elevated above ambient levels.

Mobile wildlife in the immediate vicinity of the wooded area north of Schneider Canal would vacate the construction site; however, less mobile species would be smothered by the placement of levee building material. A portion of the Schneider Canal levee would impact 17 acres of brackish marsh in the southwestern portion of the study area. Construction of the Railroad I-wall and Railroad Terminus levee would have minimal impact on wildlife. Table 9 illustrates the habitat that would be impacted by the 100-year plan. Borrow material, obtained from local sites, would impact approximately 6.3 acres of pine-oak habitat.

An additional feature involves the construction of a levee along the I-10 median. Impacts to wildlife would be considered negligible since the I-10 median would be considered marginal habitat for local wildlife.

Fish and other aquatic organisms in Schneider Canal and adjacent borrow pits would be temporarily impacted by turbidity and possibly low dissolved oxygen during construction. Floodgates would be kept open most of the time, so tidal connection would continue. If pumping stations are used, tidal ingress would be prevented.

THREATENED AND ENDANGERED SPECIES

The American alligator is a mobile species and could vacate Schneider Canal during levee construction; however, its movement into the marsh to the east and west of the study area could be hampered by the presence of a pumping plant and floodgate in Schneider Canal.

TABLE 9
HABITAT IMPACTS FOR 100-YEAR HURRICANE PROTECTION SYSTEM (ACRES)

FEATURE	PINE-OAK	BRACKISH MARSH	DEVELOPED GRASSES	WATERBOTTOM
INTERSTATE 10 LEVEE	0	0	18	0
SCHNEIDER CANAL LEVEE	61	17	0	0
RAILROAD I-WALL	0	0	13.5	0
RAILROAD TERMINUS LEVEE	0	0	3	0
PUMPING PLANT/DRAINAGE STRUCTURE	0	0	0	1
FLOOD GATE	0	0	0.25	0
BORROW PIT	6.3	0	0	0

MITIGATION REQUIREMENTS

Mitigation may be required to offset adverse environmental impacts created by levee construction. At this preliminary stage, average annual mitigation costs are estimated to be $28,000. A mitigation plan could consist of acquiring public land in the immediate vicinity of the project, with management of these lands the responsibility of a state or local agency. The project area is already experiencing development pressures; consequently, the levee construction would not appreciably accelerate development in this area. Thus, no secondary, induced development mitigation costs are identified at this stage.

REQUIREMENTS FOR FURTHER STUDIES

In the feasibility study, another levee route should be considered along the southwestern portion of the study area to minimize environmental impacts to a brackish marsh. Consideration in the design of floodgates, floodwalls, and pumping stations should incorporate features that maintain basin hydrology but do not present barriers to aquatic organisms that may utilize Schneider Canal as a corridor to the marsh areas on the east and west side of the study area. 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.

RECREATION

Construction of project features including a levee and pumping station will have an adverse effect on recreational fishing within project boundaries. The primary area of impacts will occur in Schneider Canal behind the pumping station, which will create a physical barrier in the canal eliminating tidal fluctuations and limiting the movement of fish and crabs sought after

by recreational fishermen. In time, the only water existing in the canal will be storm runoff with little or no fishing value. If floodgates are used, the impact would be minimal. Floodgates would be kept open most of the time so tidal action will continue.

CULTURAL

The listing of cultural resources sites in the State Historic Preservation Office was examined. No sites listed on or eligible for the National Register of Historic Places would be impacted by this project.

The project area could contain unrecorded historic or prehistoric cultural resources. A cultural resources investigation to locate any sites in the project area will be required prior to construction.

WATER QUALITY

The construction of a borrow canal and levee along the north side of Schneider Canal should not cause significant water quality impacts other than temporary and localized turbidity and suspended solids generation and oxygen depletion near dredging operations. Provided the new canal remains hydrologically connected to other water courses by means of culverts except during periods of moderate to high tide levels, general water quality under project conditions should not be diminished.

PROJECT COST SHARING

NON-FEDERAL

If the 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. 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.

PRELIMINARY
SUBJECT TO CORRECTION

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.

CONCLUSIONS

Analysis of the national economic development benefits of 100-year level hurricane protection for the City of Slidell indicates that there is a Federal interest in continuing the study into the feasibility phase. Of the plans evaluated in the study, the most economical appears to be the hurricane protection system with gravity drainage. The first cost of this plan is estimated to be $18,907,000. Average annual costs are $1,907,000, average annual benefits are $2,225,000, and the benefit to cost ratio is 1.17. The provision of forced drainage does not appear to be economically feasible (on an incremental basis) at this stage; the addition of 2 pumping stations would give an overall benefit-to-cost ratio of 1.02 and net average annual benefits of $61,000. The first cost of hurricane protection with forced drainage is estimated to be $26,686,000, with average annual costs of $2,725,000 and average annual benefits of $2,786,000.

Either plan would substantially lower the risk of flooding from high stages in Lake Pontchartrain from hurricanes. However, a detailed interior drainage analysis is required to determine whether gravity or forced drainage is more appropriate for the area. Local drainage improvements being constructed by the City of Slidell and Landmark Land Company of Louisiana, Inc. need to be considered. Other variations of the basic alignment should be considered in the feasibility phase, in order to determine whether the inclusion of more developed areas results in higher net benefits.

Based on the above considerations, the hurricane protection project appears to exceed the scope of the Section 205 program, which has a Federal cost limitation of $5,000,000. Thus, it would be appropriate to conduct the feasibility phase under the General Investigations Program. Hurricane

protection for the Slidell area could be studied under the existing authority provided to the Louisiana Coastal Area Study.

PRELIMINARY
SUBJECT TO CORRECTION

RECOMMENDATIONS

I recommend that this report be approved as the basis for proceeding to a feasibility phase study that will determine the level of Federal interest in constructing hurricane protection for the City of Slidell. Due to the scope of possible hurricane protection projects for the area, I further recommend that the feasibility phase study be conducted under the General Investigations Program and the existing Louisiana Coastal Area authority.

Richard V. Gorski
Colonel, Corps of Engineers
District Engineer

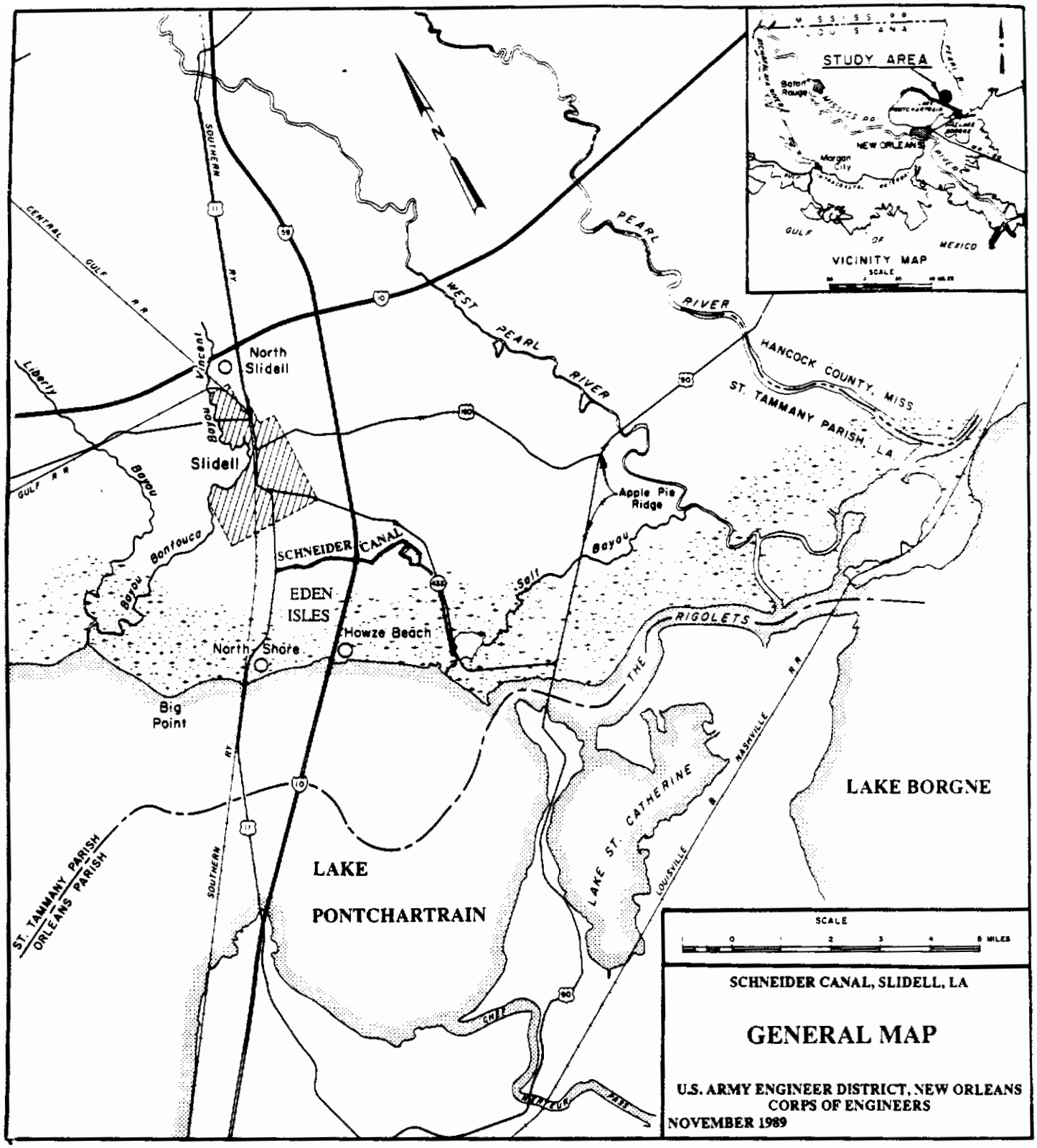

STUDY AREA
VICINITY MAP
NEW ORLEANS
Baton Rouge
Morgan City
GULF OF MEXICO
PEARL RIVER
WEST PEARL RIVER
HANCOCK COUNTY, MISS.
ST. TAMMANY PARISH, LA.
SOUTHERN RY.
CENTRAL GULF R.R.
GULF R.R.
Liberty
Bayou Vincent
North Slidell
Slidell
Bayou Bonfouca
SCHNEIDER CANAL
Apple Pie Ridge
Bayou Sell
EDEN ISLES
Howze Beach
North Shore
RIGOLETS
THE
NASHVILLE R.R.
Big Point
LAKE BORGNE
LAKE ST. CATHERINE
LOUISVILLE & N. R.R.
LAKE PONTCHARTRAIN
ST. TAMMANY PARISH
ORLEANS PARISH
CHEF MENTEUR PASS
SCALE
0 1 2 3 4 5 MILES
SCHNEIDER CANAL, SLIDELL, LA
GENERAL MAP
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 1

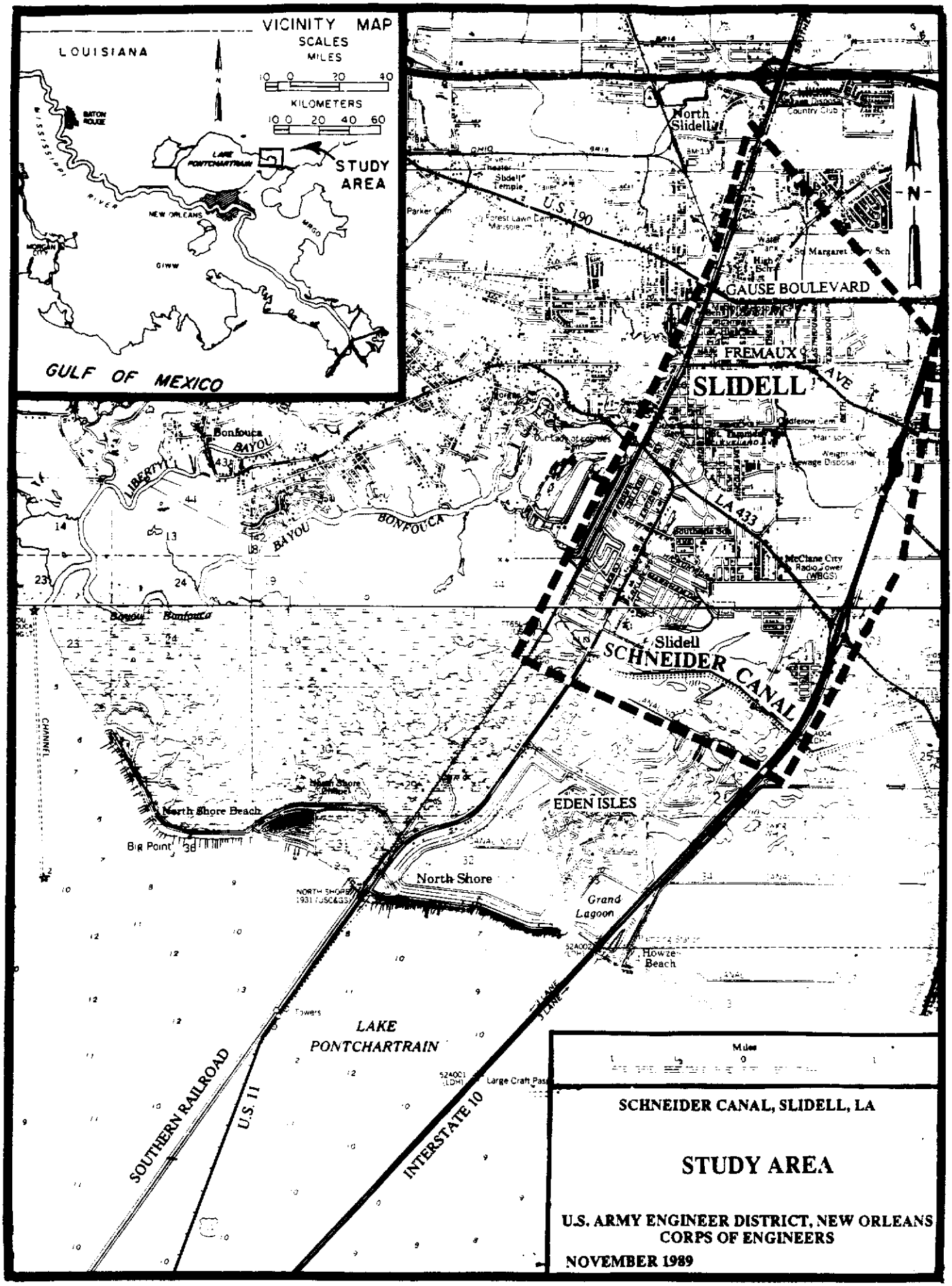
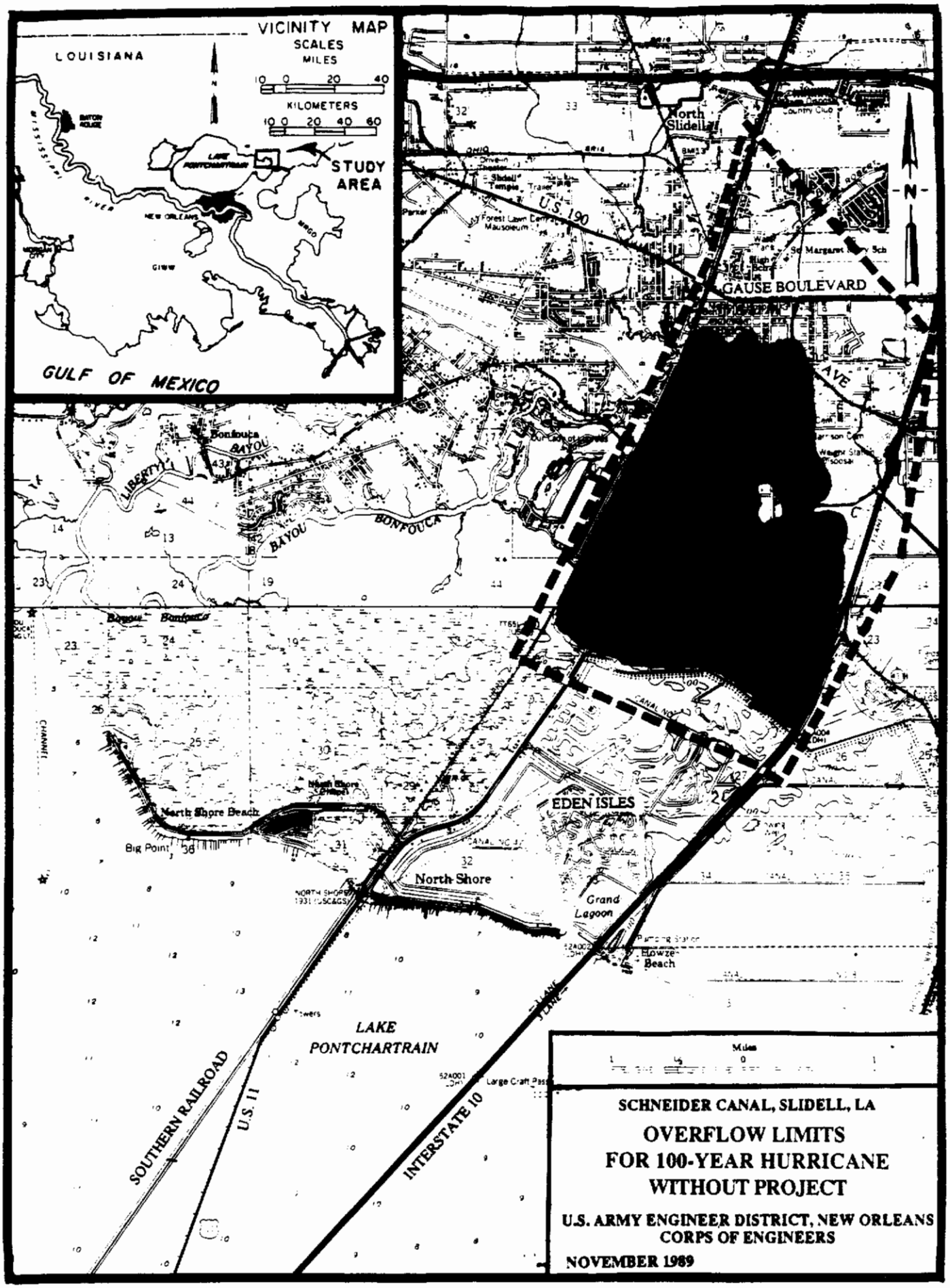

VICINITY MAP
SCALES
MILES
KILOMETERS
LOUISIANA
STUDY AREA
GULF OF MEXICO
North Slidell
GAUSE BOULEVARD
FREMAUX AVE
SLIDELL
LA 433
Bonfouca BAYOU
LIBERTY
BONFOUCA
Slidell
SCHNEIDER CANAL
EDEN ISLES
North Shore Beach
Big Point
North Shore
Grand Lagoon
Howze Beach
LAKE PONTCHARTRAIN
SOUTHERN RAILROAD
U.S. 11
INTERSTATE 10
U.S. 190
Miles
SCHNEIDER CANAL, SLIDELL, LA
STUDY AREA
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 2


VICINITY MAP
SCALES
MILES
KILOMETERS
LOUISIANA
STUDY AREA
GULF OF MEXICO
NEW ORLEANS
LAKE PONTCHARTRAIN
MISSISSIPPI RIVER
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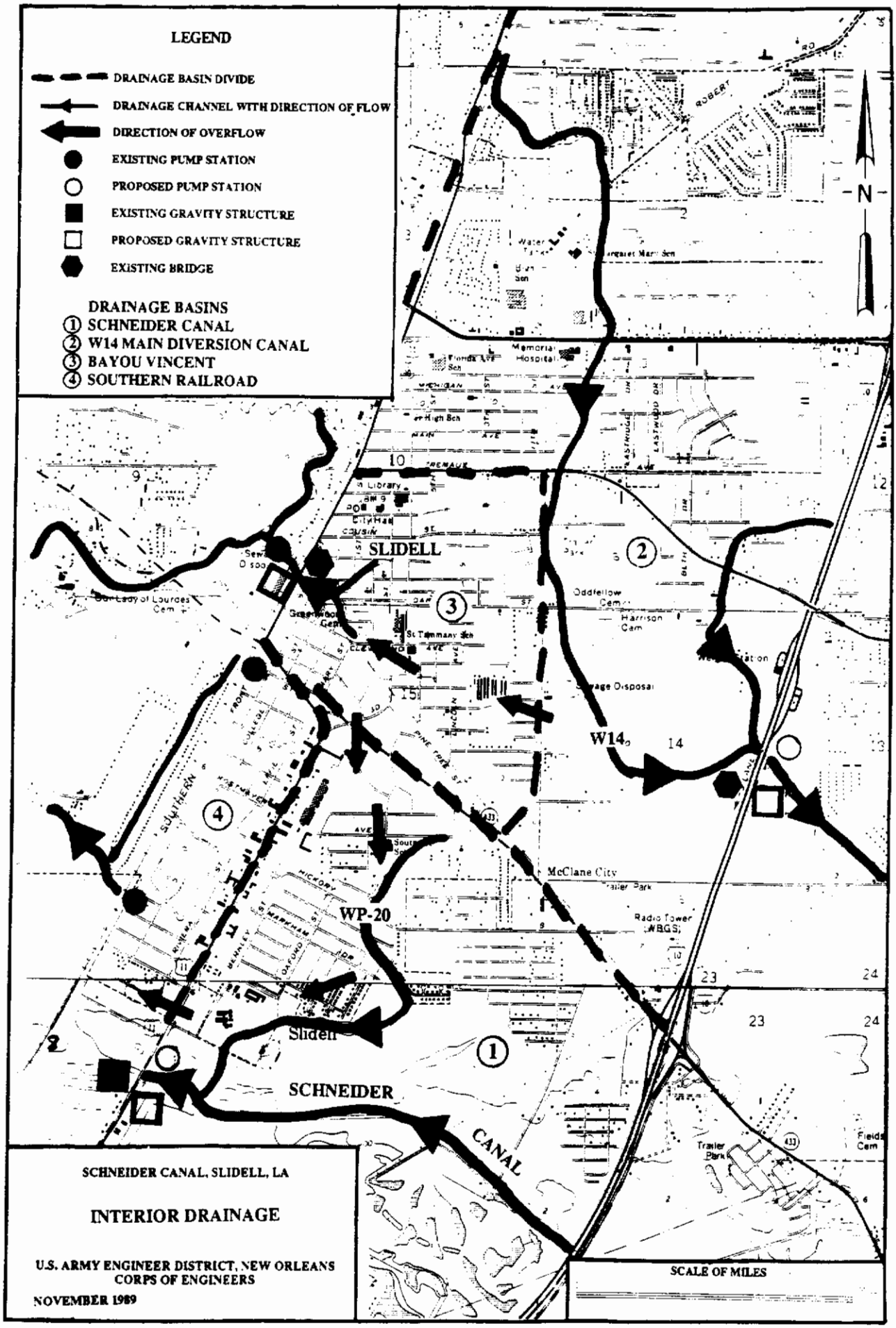
North Slidell
U.S. 190
GAUSE BOULEVARD
Bonfouca
BAYOU
LIBERTY
BONFOUCA
BAYOU
North Shore Beach
Big Point
North Shore
EDEN ISLES
Grand Lagoon
Howze Beach
LAKE PONTCHARTRAIN
SOUTHERN RAILROAD
U.S. 11
INTERSTATE 10
Large Craft Pass
Miles
SCHNEIDER CANAL, SLIDELL, LA
OVERFLOW LIMITS
FOR 100-YEAR HURRICANE
WITHOUT PROJECT
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 3



SCHNEIDER CANAL, SLIDELL, LA

INTERIOR DRAINAGE

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

NOVEMBER 1989

PLATE 4

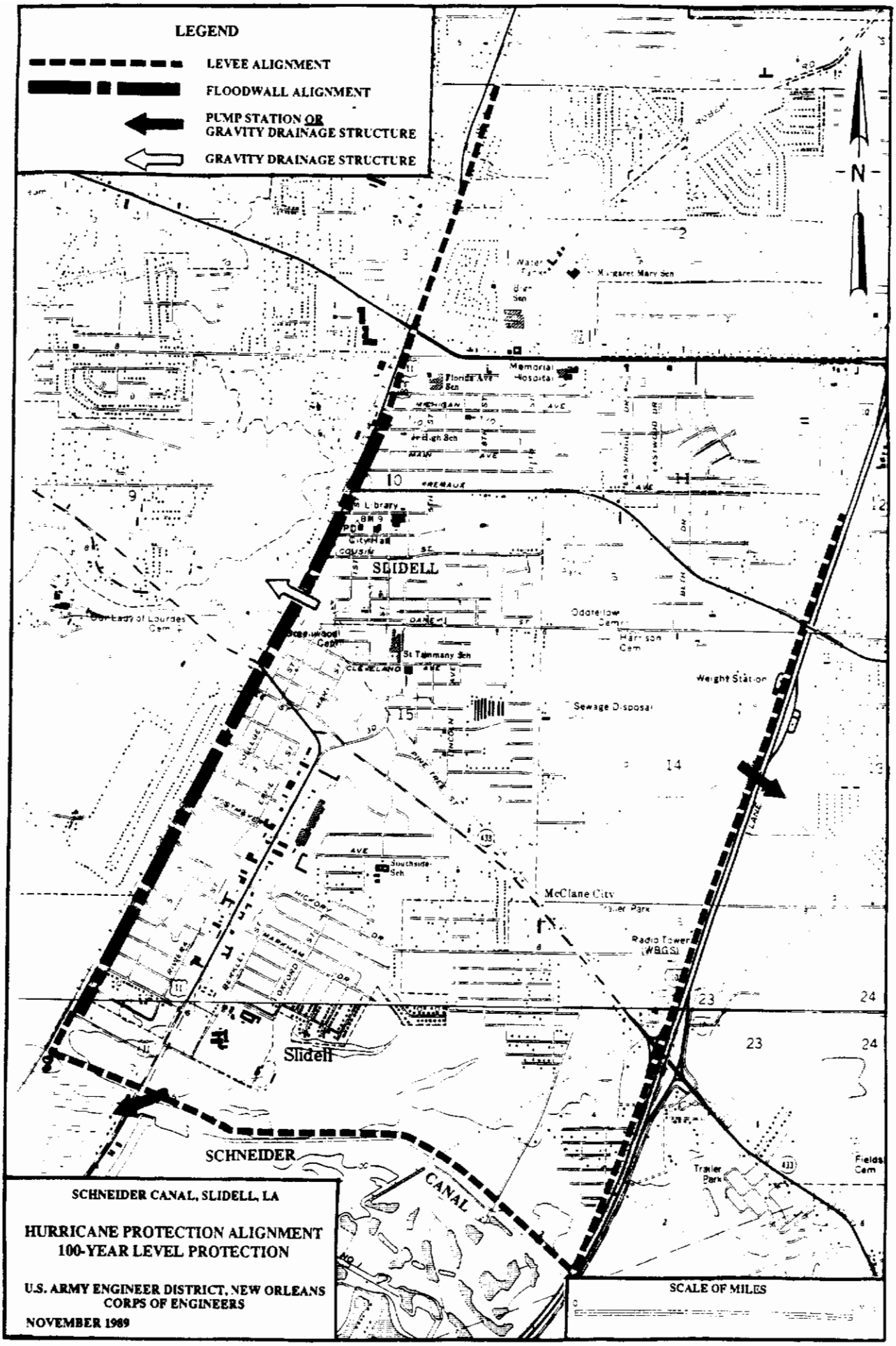

LEGEND
LEVEE ALIGNMENT
FLOODWALL ALIGNMENT
PUMP STATION OR GRAVITY DRAINAGE STRUCTURE
GRAVITY DRAINAGE STRUCTURE
N
SLIDELL
Slidell
SCHNEIDER
CANAL
McClane City
Weight Station
Sewage Disposal
Memorial Hospital
Our Lady of Lourdes Cem
Oddefellow Cem
Harrison Cem
Fields Cem
Radio Tower (WBGS)
SCHNEIDER CANAL, SLIDELL, LA
HURRICANE PROTECTION ALIGNMENT
100-YEAR LEVEL PROTECTION
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989
SCALE OF MILES

PLATE 5

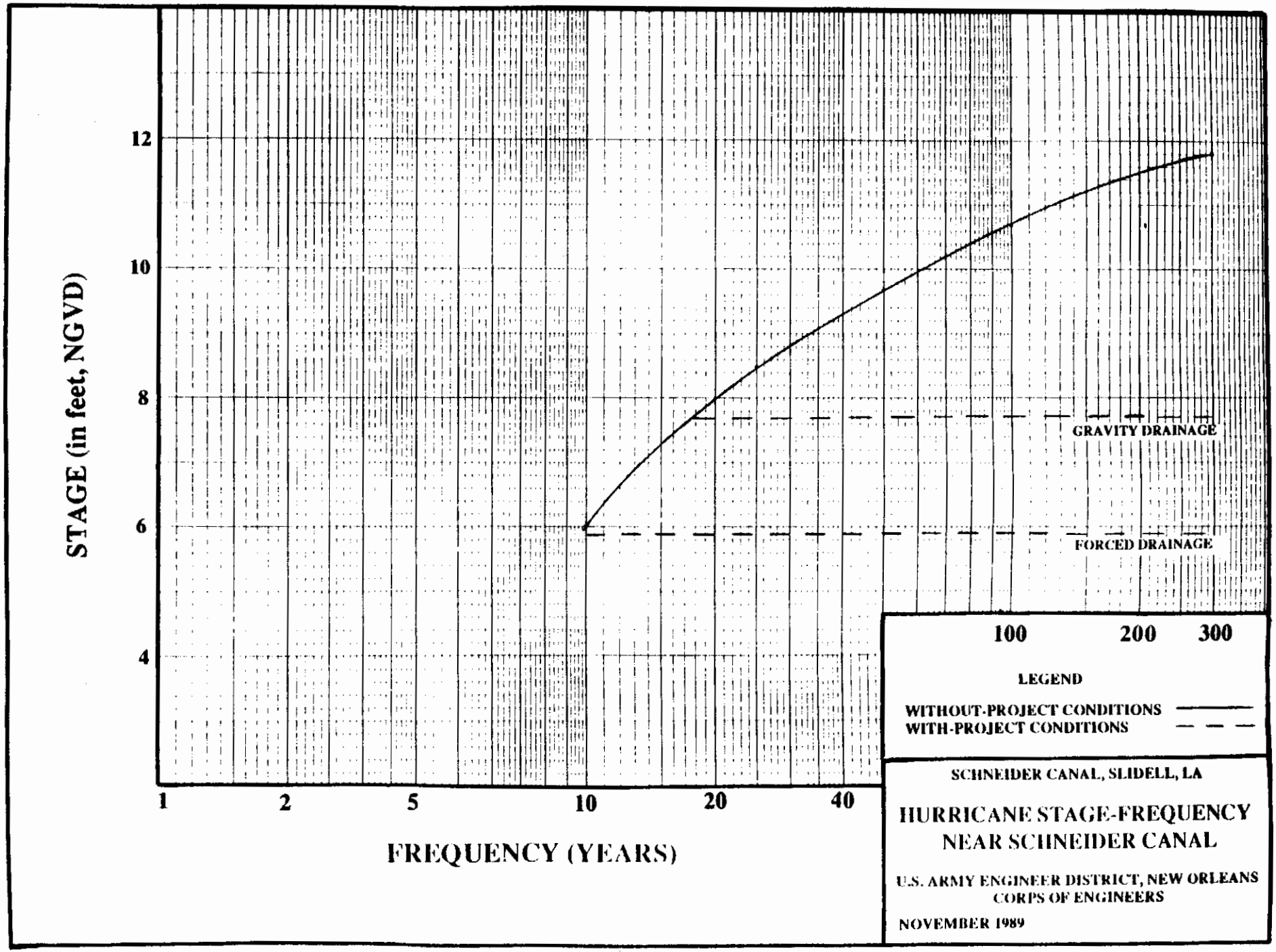

STAGE (in feet, NGVD)
12
10
8
6
4
1
2
5
10
20
40
100
200
300
FREQUENCY (YEARS)
GRAVITY DRAINAGE
FORCED DRAINAGE
LEGEND
WITHOUT-PROJECT CONDITIONS
WITH-PROJECT CONDITIONS
SCHNEIDER CANAL, SLIDELL, LA
HURRICANE STAGE-FREQUENCY
NEAR SCHNEIDER CANAL
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 6

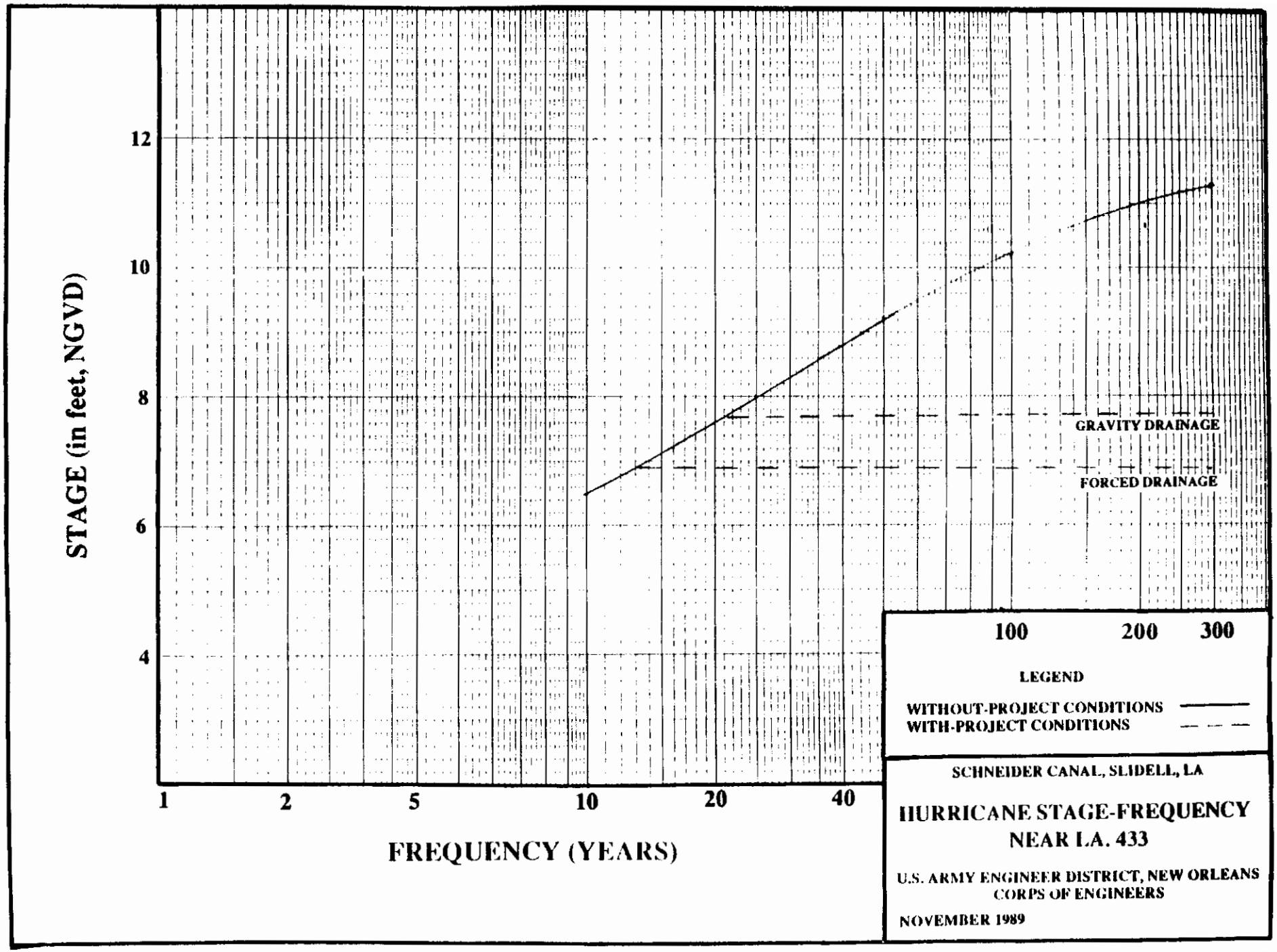

STAGE (in feet, NGVD)
12
10
8
6
4
1
2
5
10
20
40
100
200
300
FREQUENCY (YEARS)
GRAVITY DRAINAGE
FORCED DRAINAGE
LEGEND
WITHOUT-PROJECT CONDITIONS
WITH-PROJECT CONDITIONS
SCHNEIDER CANAL, SLIDELL, LA
HURRICANE STAGE-FREQUENCY
NEAR LA. 433
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 7

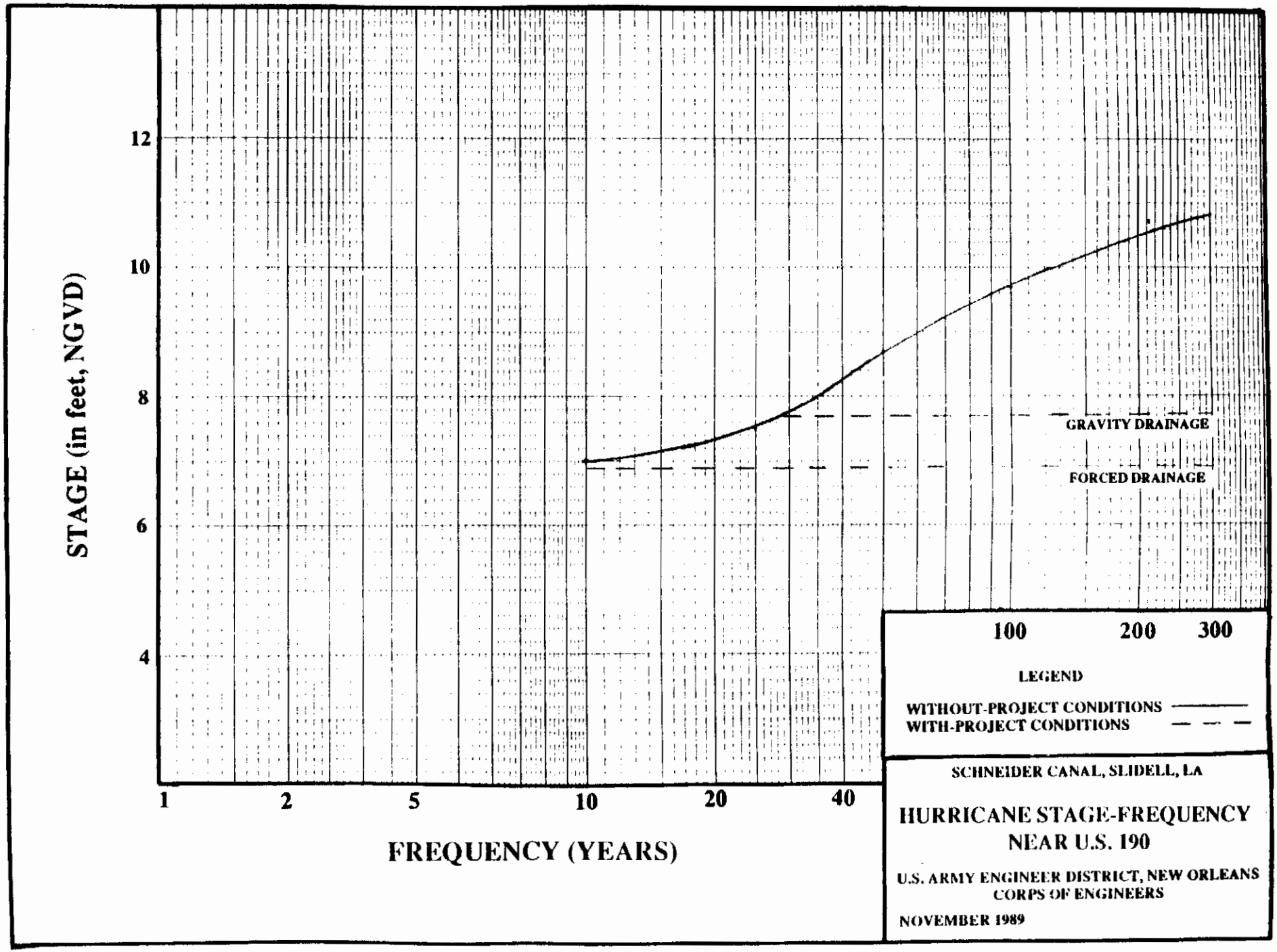
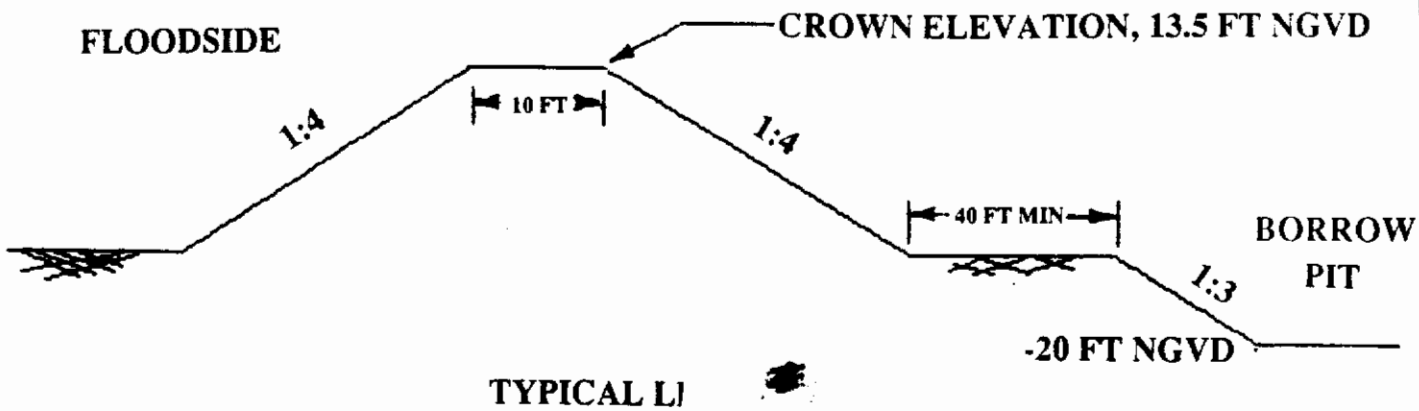

STAGE (in feet, NGVD)
12
10
8
6
4
1
2
5
10
20
40
100
200
300
FREQUENCY (YEARS)
GRAVITY DRAINAGE
FORCED DRAINAGE
LEGEND
WITHOUT-PROJECT CONDITIONS
WITH-PROJECT CONDITIONS
SCHNEIDER CANAL, SLIDELL, LA
HURRICANE STAGE-FREQUENCY
NEAR U.S. 190
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1989

PLATE 8



TYPICAL LI

SHEET PILE TIP PENETRATION FOR I-WALLS
(ELEVATIONS IN FT, NGVD)

NATURAL GROUND ELEVATION	TIP ELEVATION
4.0-5.5	-15 *
5.5-7.0	-10
>7.0	-4

*** A T-WALL MAY BE NEEDED IF EXCESSIVE DEFLECTION IS FOUND**

SCHNEIDER CANAL, SLIDELL, LA

TYPICAL LEVEE SECTION AND I-WALL PENETRATION

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

NOVEMBER 1989

PLATE 9

Appendix A
Letters from Local Sponsor

ST. TAMMANY PARISH POLICE JURY
P. O. BOX 628
COVINGTON, LOUISIANA 70434
(504) 898-2362

August 11, 1988

Mr. Barry Bagert, President
St. Tammany Parish Police Jury
P. O. Box 628
Covington, LA 70434

RE: Schneider Canal

Dear Mr. Bagert:

Reference Corps of Engineers letter of August 5, 1988 regarding preliminary evaluation for hurricane protection, a meeting was held in Slidell, Louisiana with Mr. Stan Polivick, Slidell City Engineer; Mr. Tom Podany and Mr. Remie Kliebert, Corps of Engineers; Mr. Andre' De Haan, Burk and Associates; and myself in attendance. The feasibility of a hurricane protection levee was discussed as a possibility. The levee currently being constructed by Landmark, Incorporated in conjunction with the Eden Isles project was discussed.

Mr. Shelby LaSalle of J. J. Krebs & Sons, Inc. who is the project engineer on the Landmark project has been asked to contact the Corps of Engineers to determine to what extent the Landmark levee could incorporate with a Corps of Engineers levee.

If I may be of any further assistance, please feel free to contact me.

Sincerely,

William L. Yeates, Jr.
Director of Public Works

WLYJR/kkk

cc: Honorable Kevin Davis, Police Juror, District 12
Mr. Allan Cariter, Chief of Staff
Mr. Shelby LaSalle, J. J. Krebs & Sons, Inc.
Mr. Stan Polivick, Slidell City Engineer
Mr. Andre' De Haan, Burk And Associates
Mr. Remie Kliebert, Corps of Engineers
Mr. Tom Podany, Corps of Engineers

ST. TAMMANY PARISH POLICE JURY
P. O. BOX 628
COVINGTON, LOUISIANA 70434
(504) 892-2911

October 16, 1986

Department of the Army
U.S. Corps of Engineers
New Orleans District
Post Office Box 60267
New Orleans, Louisiana 70160

Attention: Col. Lloyd K. Brown
District Engineer
Planning Division

Dear Col. Brown:

The St. Tammany Parish Police Jury requests that your office review the proposed Schneider Canal Pumping Station in St. Tammany Parish for possible funding under the Corps of Engineers' Section 205 Program. The project appears to fit within the requirements of this program. Construction of the Schneider Canal Pumping Station will prove beneficial in reducing the flooding problems in an area subject to high lake levels.

Enclosed you will find Resolution P.J.S. No. 86-2572, requesting this pumping station adopted on the 16th day of October, 1986 by the St. Tammany Parish Police Jury.

We appreciate your assistance with this matter.

Sincerely,

Elizabeth M. Teague
President
St. Tammany Parish Police Jury

EMT/kaz

Enc.: As Above

cc: Hon. Earl Broom, Police Juror District No. 12
Burke and Associates, Attention: Mr. George Klienpeter

C E R T I F I C A T E

I, BARBARA S. JENKINS, CLERK of the St. Tammany Parish Police Jury certify that the above and foregoing is a true and exact copy of Resolution Police Jury Series No. 86-2572 adopted on the 16th day of October, 1986, a quorum of the members being present.

Covington, Louisiana this 20th day of October, 1986.

Barbara S. Jenkins

BARBARA S. JENKINS, CLERK
ST. TAMMANY PARISH POLICE JURY

ST. TAMMANY PARISH POLICE JURY

RESOLUTION

RESOLUTION POLICE JURY SERIES NO. 86-2572

AUTHOR: HON. EARL BROOM

A RESOLUTION REQUESTING THE CORP OF ENGINEERS, NEW ORLEANS DISTRICT TO COMPLETE AN ANALYSIS ON THE SCHNEIDER CANAL PUMPING STATION PROJECT IN ST. TAMMANY PARISH FOR POSSIBLE FUNDING UNDER THE CORPS OF ENGINEERS, SECTION 205 PROGRAM.

WHEREAS, St. Tammany Parish is in the process of undertaking certain improvements for flood control problems on the Schneider Canal, and

WHEREAS, the Department of Army, Corps of Engineers under the Section 205 Program, commonly known as the "Small Projects Program" will share construction cost for projects to improve flood control if suitable.

NOW THEREFORE BE IT RESOLVED BY THE ST. TAMMANY PARISH POLICE JURY, that this request for an analysis of the Schneider Canal Pumping Station Project in St. Tammany Parish be forwarded to the Department of Army, Corps of Engineers, New Orleans District upon approval.

THIS RESOLUTION HAVING BEEN SUBMITTED TO A VOTE, THE VOTE THEREON WAS AS FOLLOWS: MOVED FOR ADOPTION ON CONSENT CALENDAR BY MR. SHARP: SECONDED BY MR. GRIFFIN.

YEAS: 13

NAYS: NONE

ABSTAINING: NONE

ABSENT: 1 (RICHARDSON)

AND, THIS RESOLUTION WAS DECLARED ADOPTED ON THIS THE 16TH DAY OF OCTOBER 1986, AT A REGULAR MEETING OF THE POLICE JURY, A QUORUM OF THE MEMBERS BEING PRESENT.

S/ELIZABETH M. TEAGUE
ELIZABETH M. TEAGUE, PRESIDENT
ST. TAMMANY PARISH POLICE JURY

ATTEST:

S/ BARBARA S. JENKINS
BARBARA S. JENKINS, CLERK
ST. TAMMANY PARISH POLICE JURY

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

United States Department of the Interior

825 Kaliste Saloom Rd.
Brandywine Bldg. II, Suite 102
Lafayette, Louisiana 70508

April 27, 1989

Colonel Richard V. Gorski
District Engineer
U.S. Army Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Dear Colonel Gorski:

Reference is made to the Schneider Canal, Slidell, Louisiana, Reconnaissance Study, being conducted under the authority of Section 205 of the Flood Control Act of 1948. The purpose of the study is to determine if it is feasible to provide flood control to that portion of Slidell located south of U.S. Highway 190, between Interstate Highway 10 and the Southern Railroad embankment, and if Federal participation in providing such action is warranted. This report is provided on a planning-aid basis; it does not constitute the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act.

DESCRIPTION OF STUDY AREA

The study area, totaling 4,096 acres, is located near the northeastern shore of Lake Pontchartrain in St. Tammany Parish, Louisiana. The study area is bounded by the Southern Railroad embankment to the west, U.S. Highway 190 (Gause Boulevard) to the north, Interstate Highway 10 to the east, and the Schneider Canal spoil bank to the south. A large portion of the City of Slidell is contained within the study-area. Storm water runoff from the study area is currently via natural gravity drainage. Schneider Canal is the principal collection channel for stormwater runoff in this area. Most of the runoff enters Schneider Canal by way of the WP-20, a drainage ditch located in the southern half of the project area. Schneider Canal slopes downward from Interstate Highway 10 to U.S. Highway 11, where it connects, via three box culverts, with the Highway 11 borrow ditch. Water then flows within the borrow ditch in a southerly direction and ultimately drains into Lake Pontchartrain. Some water within Schneider Canal may flow out of the project area in an easterly direction by way of a culvert beneath Interstate Highway 10. Runoff in the northeastern portion of the project area drains into the WP-14 Canal and flows out of the study area in a southeasterly direction under Interstate Highway 10. Existing drainage culverts are not equipped with gates to prevent tidal inflow from Lake Pontchartrain into the study area. Hurricane tides could flood the study area via the existing flow-through drainage system, and by overtopping the Schneider Canal spoil bank and inundating the non-leveed wooded area located in the extreme southwestern corner of the study area.

DESCRIPTION OF FISH AND WILDLIFE RESOURCE CONDITIONS

The developed portion of the study area (comprising approximately 72 percent of the total study area) has no fishery value and provides only minimal value to wildlife species tolerant of human disturbance (e.g., songbirds, raccoon, opossum, squirrels, etc.). The remaining undeveloped portion of the study area (1,152 acres) is composed, for the most part, of an interspersion of mixed pine/hardwood forest and seasonally flooded bottomland hardwood forest (palustrine forested wetland according to Cowardin et al. 1979). Dominant vegetation within the upland area consists of loblolly pine, water oak, southern red oak, sweetgum, and sweetbay. The bottomland area is predominantly vegetated with red maple, green ash, slash pine, Nuttall oak, overcup oak, water oak, and redbay. A small scrub/shrub (palustrine scrub/shrub wetland) area located near the southeastern corner of the study area is vegetated with scrub live oak, wax myrtle, loblolly pine, saltmeadow cordgrass, broomsedge, and switchgrass.

Mammals known to occur within undeveloped portions of the study area include the fox squirrel, gray squirrel, swamp rabbit, eastern cottontail, mink, opossum, raccoon, nutria, and nine-banded armadillo. The area is also expected to support a variety of birds including wood ducks, American woodcock, wading birds, raptors, woodpeckers, and various songbirds. Amphibians and reptiles such as the green treefrog, Southern leopard frog, bullfrog, green anole, Gulf Coast box turtle, red-eared turtle, eastern hognose snake, and speckled kingsnake are also expected to occur within the study area. During periods of inundation, the study-area's bottomland hardwoods provide feeding and nursery habitat for a variety of freshwater fish.

Under current drainage capabilities, the remaining low-lying portions of the study area act as sumps, providing floodwater storage for the Slidell area. Study-area wetlands also perform important water quality functions; they reduce excessive dissolved nutrient levels and filter suspended sediment contained in urban runoff. By acting as natural filtration systems, the study-area wetlands curtail the adverse effects of non-point source pollution. The study-area wetlands also provide detritus to adjacent coastal waters and, thereby, contribute to the production of commercially and recreationally important fish and shellfish within the Lake Pontchartrain estuary.

No endangered species are known to inhabit the study area. The American alligator may occur in project area drainage canals. That species is classified as threatened under the Similarity of Appearance clause of the Endangered Species Act of 1973.

FISH AND WILDLIFE RELATED PROBLEMS, OPPORTUNITIES, AND PLANNING OBJECTIVES

Commercial and urban development within the Schneider Canal study area will probably continue despite the area's inadequate drainage capabilities. Therefore, it is likely that, even without Federal intervention to provide additional flood control, some development of the above-referenced wetland areas would occur. A Department of the Army Public Notice, dated December 12, 1988, described a proposal by the City of Slidell to increase area flood control by installing a pumping station. The pumping station would be located adjacent to Schneider Canal and would serve to increase drainage

within the southern half of the study area. The wetland functional values (i.e., floodwater storage and water quality maintenance) of remaining undeveloped low-lying areas within the southern half of the study area would be severely limited by implementation of the proposed pumping station. Increased drainage would lead to the conversion of these low-lying areas to urban development, and would in turn eliminate their fish and wildlife resource values.

Because the study area's remaining wetland tracts provide valuable fish and wildlife habitat, floodwater storage, and water quality functions, preservation of those areas should be pursued as a priority planning objective. This could be accomplished by restricting (via water level management) drainage of existing wetland areas, and by acquiring nondevelopment easements, zoning ordinances by the local sponsor, or related techniques. If, due to project implementation, subsequent development of the remaining wetland areas proves unavoidable, every effort should be made to fully offset, in-kind, all project-related losses of wetland habitat values. Habitat values and associated losses would be quantified via the use of the Fish and Wildlife Service's Habitat Evaluation Procedures during any subsequent feasibility studies. The goal of no net loss of in-kind habitat value would be achieved by managing and/or restoring wetlands in a manner sufficient to fully offset unavoidable project-related habitat losses. Such management and/or restoration, along with any associated acquisition costs, should be implemented as an integral project expense.

In view of the foregoing discussion, it is recommended that the following planning objectives be established for this study:

1. Avoid or minimize project-related habitat losses of the remaining wetland tracts within the study area.

2. Fully offset, on an in-kind basis, unavoidable project-related losses of wildlife habitat values associated with the remaining wetland tracts in the study area.

ALTERNATIVES UNDER CONSIDERATION

Based on discussions with your staff, we understand that the following alternatives are under consideration:

- No Federal action.

- Plan 1: a 25-year level hurricane protection system; involves the construction of 2.7 miles of levee, 2.3 miles of floodwall, 8 floodgates, 3 drainage structures, and a number of small culverts.

- Plan 1a: This plan is the same as Plan 1 above, except that two pumping stations are substituted for two of the drainage structures. The pumping stations would have a capacity of 1,200 and 100 cubic feet per second (cfs), respectively.

- Plan 2: a 100-year level hurricane protection system; involves the construction of 5.7 miles of levee, 2.4 miles of floodwall, 8 floodgates, 3 drainage structures, and a number of small culverts.

- Plan 2a: This plan is the same as Plan 2, except that two pumping stations (1,200 and 100 cfs) are substituted for the drainage structures.

- Plan 3: a SPH-level hurricane protection system; involves the construction of 6.5 miles of levee, 2.5 miles of floodwall, 8 floodgates, 3 drainage structures, and a number of small culverts.

- Plan 3a: This plan is the same as Plan 3, except that two pumping stations (1,200 and 100 cfs) are substituted for the drainage structures.

POTENTIAL SIGNIFICANT IMPACTS

The negative project impact of greatest potential significance for wildlife is the accelerated drainage (via pumping) and development of the remaining forested wetlands in the study area. Such action would virtually eliminate the remaining fish and wildlife resource values associated with that area.

Another potentially significant impact associated with increased drainage and accelerated development of study-area wetlands is the degradation of water quality within those areas receiving runoff from the proposed pumping facilities. Emergent wetlands within sump areas serve to reduce pollutants found in the urban runoff. Thus, the development of those wetlands would result in higher nutrient and other pollutant levels being transported into receiving areas. Such action could adversely effect water quality as well as fish and shellfish populations in downstream receiving areas. Preserving the existing sump areas would help to minimize the adverse project effects of increased drainage capacity on area water quality.

FISH AND WILDLIFE COORDINATION ACTIVITIES FOR THE FEASIBILITY PHASE

Data Needs

Should a feasibility study be conducted for this project, the following data will be needed by the Service for its analysis of project impacts on fish and wildlife resources and the formulation of measures to conserve those resources.

1. A list of alternatives being considered during the feasibility phase.

2. A breakdown of the proposed pumping stations' operational schedules and drawdown capabilities.

3. An estimate of the acreage of each wetland habitat type, for baseline and 10-year intervals over the period of analysis, for both future without-project and future with-project conditions (for each alternative considered).

Tasks and Associated Cost Estimates

Should the study advance to the feasibility phase, the Service will require additional funding to carry out its review and reporting responsibilities under

the Fish and Wildlife Coordination Act. It is estimated that $6,000 will be required to produce a planning-aid report evaluating the impacts of alternatives considered during the plan formulation stage. An additional $18,000 will be required to prepare a draft and a final Fish and Wildlife Coordination Act report. A detailed Scope of Work defining specific tasks and associated funding requirements for Fish and Wildlife Service participation in the feasibility study should be prepared jointly by our respective staffs, should your study conclude that further Federal participation is warranted.

RECOMMENDATIONS

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

1. Any action plans recommended for further investigation should assure preservation of the remaining sump areas. These areas would serve as temporary floodwater storage areas and would help to minimize the impact of the accelerated discharge (via the proposed pump stations) of urban runoff into downstream estuarine waters.

2. Further project planning should incorporate nondevelopment easements, zoning ordinances by the local sponsor, or related techniques to minimize wetland habitat loss.

3. Every effort should be taken to fully offset, in-kind, any unavoidable loss of wetland habitat.

Should your staff have any questions regarding this report, please have them contact Mrs. Patti Holland of this office.

Sincerely yours,

David M. Smith
Acting Field Supervisor

PVH/pl

LITERATURE CITED

Cowardin, Lewis M., Virginia Carter, Francis C. Golet, and Edward T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Fish and Wildlife Service, Office of Biological Services, Washington, D.C., 103 pp.

Appendix C
Cost Estimates

SCHNEIDER CANAL RECONNAISSANCE STUDY -- COST ESTIMATE SUMMARY TOTAL FIRST COST INCLUDING REAL ESTATE	
100-YEAR HURRICANE PROTECTION SYSTEM, WITH PUMPS	$26,686,000
100-YEAR HURRICANE PROTECTION SYSTEM, WITH GRAVITY DRAINAGE	$18,907,000

SCHNEIDER CANAL RECONNAISSANCE STUDY -- COST ESTIMATE SUMMARY TOTAL COST EXCLUDING REAL ESTATE 100-YEAR PROTECTION, WITHOUT PUMP STATIONS	
LEVEES	$3,099,000
FLOODWALLS AND FLOODGATES	$11,439,000
DRAINAGE STRUCTURES	$4,218,000
TOTAL COSTS	$18,756,000

PRELIMINARY COST ESTIMATE Levee Construction 100-Year Level Protection					
Item	Description	Quantity	Unit	Unit Price	Amount
	1st LIFT				
1	MOB & DEMOB	L.S.	L.S.	$70,000.00	$70,000
2	CLEAR & GRUBB	86	AC	$1,500.00	$129,000
3	EMBANKMENT- UNCOMPACTED FILL				
	ADJACENT- 170 FT CAST	272,400	CY	$1.40	$381,360
	HAUL- 3 MI ONE WAY	165,450	CY	$4.00	$661,800
4	INSPECTION DITCH	13,650	LF	$5.00	$68,250
5	SEED & FERTILIZE	35	AC	$500.00	$17,500
6	HWY. 11 RELOCATION	1,600	LF	$150.00	$240,000
	2nd LIFT				
1	MOB & DEMOB	L.S.	L.S.	$50,000.00	$50,000
2	CLEARING	45	AC	$500.00	$22,500
3	EMBANKMENT- UNCOMPACTED FILL				
	ADJACENT- 130 FT CAST	68,100	CY	$1.30	$88,530
4	SEED & FERTILIZE	32	AC	$500.00	$16,000
	RELOCATIONS - 7000 ft of 8" gas pipeline with hot tap	L.S.	L.S.	$267,000.00	$267,000
	RIGHTS - OF - WAY	100	AC		
		SUBTOTAL			$2,011,940
		25% CONTINGENCIES			$502,985
		TOTAL CONSTRUCTION (R)			$2,515,000
		ENGINEERING & DESIGN 12%			$302,000
		SUPERVISION & ADMIN. 10%			$282,000
		TOTAL CONSTRUCTION COSTS			$3,099,000

SCHNEIDER CANAL, SLIDELL LOUISIANA
RECONNAISSANCE STUDY- **100-YEAR** LEVEL PROTECTION
WITHOUT PUMPING STATIONS

Item	Description	Quantity	Unit	Unit Price	Amount
	I FLOODWALLS AND FLOODGATES				
1	I-WALL 8.5 FOOT HIGH	5,200	LF	554.20	$2,881,840
2	I-WALL 5.75 FOOT HIGH	8,400	LF	395.00	$3,318,000
3	EARTHWORK ASSOCIATED WITH I-WALL CONSTRUCTION ONLY	6,207	C.Y.	4.00	$24,828
4	BOTTOM ROLLER GATE HALL ST.	1	LS	63000.00	$63,000
5	BOTTOM ROLLER GATE PENNSYLVANIA	1	LS	47000.00	$47,000
6	BOTTOM ROLLER GATE SOUTH OF AMTRAK STATION	1	LS	52000.00	$52,000
7	BOTTOM ROLLER GATE ERLINGER	1	LS	52000.00	$52,000
8	BOTTOM ROLLER GATE COUSIN	1	LS	70000.00	$70,000
9	BOTTOM ROLLER GATE CLEVELAND	1	LS	75000.00	$75,000
10	BOTTOM ROLLER GATE HWY 11 & HWY 433	1	LS	127000.00	$127,000
11	BOTTOM ROLLER GATE I-10 & HWY 433	1	LS	112000.00 87000.00 114090.00	$112,000 $87,000 $114,090
12	LATERAL DRAINAGE PARALLEL TO RAILROAD TRACKS & 4 VALVES	1	LS	437000.00	$437,000
13	STORAGE SLAB FOR ALL BOTTOM ROLLER GATES	200	CY	200.00	$40,000
		SUBTOTAL			$7,500,758
		25% CONTINGENCIES			$1,875,190
		TOTAL CONSTRUCTION (R)			$9,376,000
		ENGINEERING & DESIGN 12%			$1,125,000
		SUPERVISION & ADMIN. 10%			$938,000
	TOTAL COSTS FOR FLOODWALLS AND FLOODGATES				$11,439,000

ENCL 6

SCHNEIDER CANAL, SLIDELL LOUISIANA
RECONNAISSANCE STUDY-100-YEAR LEVEL PROTECTION
WITHOUT PUMPING STATIONS

Item	Description	Quantity	Unit	Unit Price	Amount
	II DRAINAGE STRUCTURES				
1	KNIFE VALVES 18", 36", 42" DELWOOD PUMP STA.	1	LS	85000.00	$85,000
2	LEE ST. PUMP STA TWO-18 & TWO-36 KNIFE VALVES	1	LS	65000.00	$65,000
3	BAYOU VINCENT-T-WALL WITH TWO SLUICE GATES	1	LS	361550.00	$361,550
4	LIZANA ST.(NEAR DELWOOD) 36" KNIFE VALVE TO STEEL PIPE	1	LS	12000.00	$12,000
5	ERLINGER ST.(STORM DRAIN) 24" KNIFE VALVE TO CONC CUL.	1	LS	13500.00	$13,500
6	TWO 24" CONC. CULVERTS NO WORK	1	LS	.00	$.00
*7	HWY 11 & SCHNEIDER CANAL CONC. CULV WITH SLUICE GATES	1	LS	1063500.00	$1,063,500
8	I-10 & PINE ST TWO-24 KNIFE VALVES CONC PIP	1	LS	12000.00	$12,000
9	I-10 & LUCILLE ST.(SOUTH) ONE-4' x 3' CBC SLUICE GATE	1	LS	8000.00	$8,000
10	I-10 & ALGIERS AVE(NORTH) TWO 36 KNIFE VALVES TO CONC	1	LS	23000.00	$23,000
11	THREE-24" KNIFE VALVES INDIVDUAL CONC. CULVERT I-10	1	LS	15000.00	$15,000
*12	I-10 & W-14 CANAL T-WALL WITH SLUICE GATE	1	LS	1105000.00	$1,105,000
13	1-10 & NORTH OF OVERPASS BY WEIGH STATION-VERTICAL LIFT	1	LS	.00	$.00
14	STEEL COVER PLATES/SEALS 36x36, I-10 MEDIAN	5	EA	400.00	$2,000
				SUBTOTAL	$2,765,550
				25% CONTINGENCIES	$691,388
				TOTAL CONSTRUCTION (R)	$3,457,000
				ENGINEERING & DESIGN 12%	$415,000
				SUPERVISION & ADMIN. 10%	$346,000
	TOTAL COSTS FOR DRAINAGE STRUCTURES				$4,218,000

* INDICATES ITEM CHANGE RESULTING FROM WITH/WITHOUT PUMPING STATION OPTION.

SCHNEIDER CANAL RECONNAISSANCE STUDY -- COST ESTIMATE SUMMARY TOTAL COST EXCLUDING REAL ESTATE 100-YEAR PROTECTION, WITH PUMP STATIONS	
LEVEES	$3,099,000
FLOODWALLS AND FLOODGATES	$11,439,000
DRAINAGE STRUCTURES	$11,997,000
TOTAL COSTS	$26,535,000

PRELIMINARY COST ESTIMATE		Levee Construction 100-Year Level Protection			
Item	Description	Quantity	Unit	Unit Price	Amount
	1st LIFT				
1	MOB & DEMOB	L.S.	L.S.	$70,000.00	$70,000
2	CLEAR & GRUBB	86	AC	$1,500.00	$129,000
3	EMBANKMENT- UNCOMPACTED FILL				
	ADJACENT- 170 FT CAST	272,400	CY	$1.40	$381,360
	HAUL- 3 MI ONE WAY	165,450	CY	$4.00	$661,800
4	INSPECTION DITCH	13,650	LF	$5.00	$68,250
5	SEED & FERTILIZE	35	AC	$500.00	$17,500
6	HWY. 11 RELOCATION	1,600	LF	$150.00	$240,000
	2nd LIFT				
1	MOB & DEMOB	L.S.	L.S.	$50,000.00	$50,000
2	CLEARING	45	AC	$500.00	$22,500
3	EMBANKMENT- UNCOMPACTED FILL				
	ADJACENT- 130 FT CAST	68,100	CY	$1.30	$88,530
4	SEED & FERTILIZE	32	AC	$500.00	$16,000
	RELOCATIONS - 7000 ft of 8" gas pipeline with hot tap	L.S.	L.S.	$267,000.00	$267,000
	RIGHTS - OF - WAY	100	AC		
		SUBTOTAL			$2,011,940
		25% CONTINGENCIES			$502,985
		TOTAL CONSTRUCTION (R)			$2,515,000
		ENGINEERING & DESIGN 12%			$302,000
		SUPERVISION & ADMIN. 10%			$282,000
		TOTAL CONSTRUCTION COSTS			$3,099,000

SCHNEIDER CANAL, SLIDELL LOUISIANA
RECONNAISSANCE STUDY- **100-YEAR** LEVEL PROTECTION
WITH PUMPING STATIONS

Item	Description	Quantity	Unit	Unit Price	Amount
	II DRAINAGE STRUCTURES				
1	KNIFE VALVES 18", 36", 42" DELWOOD PUMP STA.	1	LS	85000.00	$85,000
2	LEE ST. PUMP STA TWO-18 & TWO-36 KNIFE VALVES	1	LS	65000.00	$65,000
3	BAYOU VINCENT-T-WALL WITH TWO SLUICE GATES	1	LS	361600.00	$361,600
4	LIZANA ST.(NEAR DELWOOD) 36" KNIFE VALVE TO STEEL PIPE	1	LS	12000.00	$12,000
5	ERLINGER ST.(STORM DRAIN) 24" KNIFE VALVE TO CONC CUL.	1	LS	13500.00	$13,500
6	TWO 24" CONC. CULVERTS NO WORK	1	LS	.00	$.00
*7	HWY 11 & SCHNEIDER CANAL CONC. CULV/ 100 CFS PUMP STA	1	LS	2304000.00	$2,304,000
8	I-10 & PINE ST TWO-24 KNIFE VALVES CONC PIP	1	LS	12000.00	$12,000
9	I-10 & LUCILLE ST.(SOUTH) ONE-4' x 3' CBC SLUICE GATE	1	LS	8000.00	$8,000
10	I-10 & ALGIERS AVE(NORTH) TWO 36 KNIFE VALVES TO CONC	1	LS	23000.00	$23,000
11	THREE-24" KNIFE VALVES INDIVDUAL CONC. CULVERT I-10	1	LS	15000.00	$15,000
*12	I-10 & W-14 CANAL 1200 CFS PUMP STA	1	LS	4966000.00	$4,966,000
13	I-10 & NORTH OF OVERPASS BY WEIGH STATION-VERTICAL LIFT	1	LS	.00	$.00
14	STEEL COVER PLATES/SEALS 36x36, I-10 MEDIAN	5	EA	400.00	$2,000
		SUBTOTAL			$7,867,100
		25% CONTINGENCIES			$1,966,775
		TOTAL CONSTRUCTION (R)			$9,834,000
		ENGINEERING & DESIGN 12%			$1,180,000
		SUPERVISION & ADMIN. 10%			$983,000
	TOTAL COSTS FOR DRAINAGE STRUCTURES				$11,997,000

SCHNEIDER CANAL, SLIDELL LOUISIANA
RECONNAISSANCE STUDY-100-YEAR LEVEL PROTECTION
WITH PUMPING STATIONS

Item	Description	Quantity	Unit	Unit Price	Amount
	I FLOODWALLS AND FLOODGATES				
1	I-WALL 8.5 FOOT HIGH	5,200	LF	554.20	$2,881,840
2	I-WALL 5.75 FOOT HIGH	8,400	LF	395.00	$3,318,000
3	EARTHWORK ASSOCIATED WITH I-WALL CONSTRUCTION ONLY	6,207	C.Y.	4.00	$24,828
4	BOTTOM ROLLER GATE HALL ST.	1	LS	63000.00	$63,000
5	BOTTOM ROLLER GATE PENNSYLVANIA	1	LS	47000.00	$47,000
6	BOTTOM ROLLER GATE SOUTH OF AMTRAK STATION	1	LS	52000.00	$52,000
7	BOTTOM ROLLER GATE ERLINGER	1	LS	52000.00	$52,000
8	BOTTOM ROLLER GATE COUSIN	1	LS	70000.00	$70,000
9	BOTTOM ROLLER GATE CLEVELAND	1	LS	75000.00	$75,000
10	BOTTOM ROLLER GATE HWY 11 & HWY 433	1	LS	127000.00	$127,000
11	BOTTOM ROLLER GATE I-10 & HWY 433	1	LS	112000.00 87000.00 114090.00	$112,000 $87,000 $114,090
12	LATERAL DRAINAGE PARALLEL TO RAILROAD TRACKS & 4 VALVES	1	LS	437000.00	$437,000
13	STORAGE SLAB FOR ALL BOTTOM ROLLER GATES	200	CY	200.00	$40,000
		SUBTOTAL			$7,500,758
		25% CONTINGENCIES			$1,875,190
		TOTAL CONSTRUCTION (R)			$9,376,000
		ENGINEERING & DESIGN 12%			$1,125,000
		SUPERVISION & ADMIN. 10%			$938,000
	TOTAL COSTS FOR FLOODWALLS AND FLOODGATES				$11,439,000

Real Estate Costs

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.