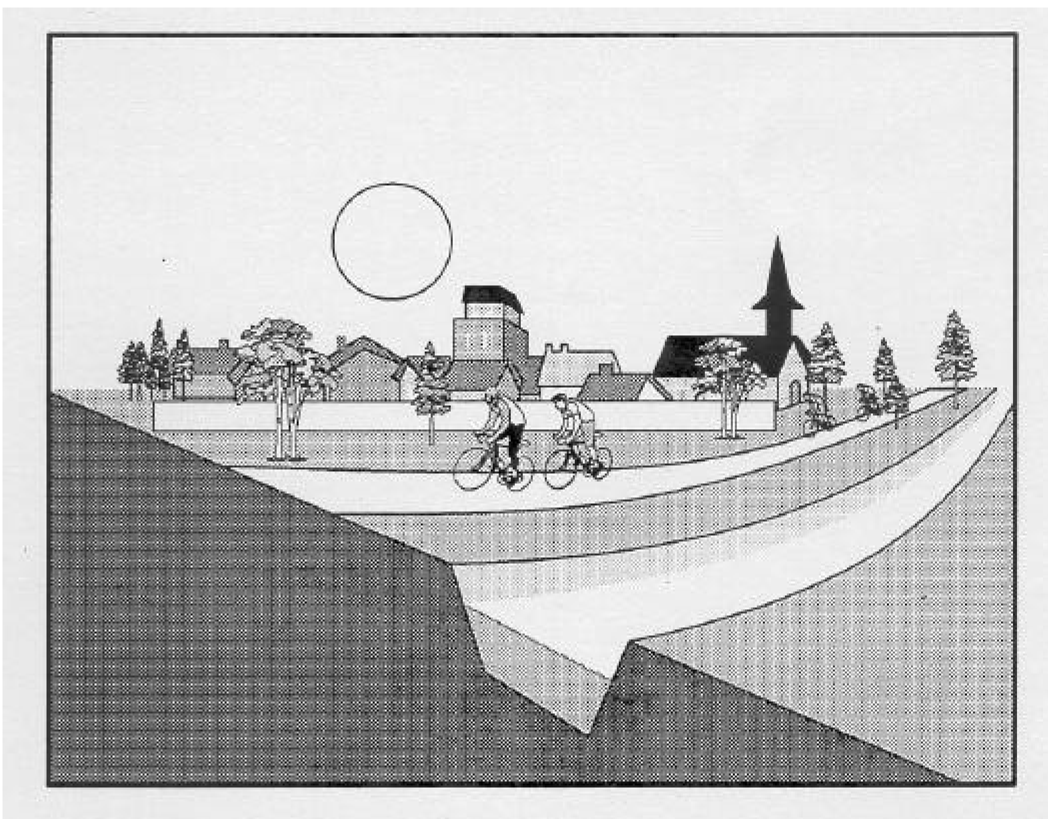
U.S. Army Corps of Engineers
New Orleans District
P.O. Box 60267
New Orleans, LA 70160-0267

Amite River and Tributaries, Louisiana

East Baton Rouge Parish Watershed
Flood Control Projects



Feasibility Study
Volume 1 of 5
Main Report **FINAL**
Environmental Impact Statement
July 1995

VOLUME 1

MAIN REPORT AND ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2

APPENDIX A FEASIBILITY COST-SHARING AGREEMENT

APPENDIX B EAST BATON ROUGE PARISH DRAINAGE PROJECTS

APPENDIX C ENGINEERING INVESTIGATIONS

VOLUME 3

APPENDIX D HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE SURVEY

APPENDIX E SUPPORTING ENVIRONMENTAL DATA

APPENDIX F DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

APPENDIX G CULTURAL RESOURCES CORRESPONDENCE

VOLUME 4

APPENDIX H ECONOMICS

APPENDIX I REAL ESTATE PLAN

APPENDIX J LAND USE ANALYSIS

APPENDIX K EAST BATON ROUGE PARISH FLOOD DAMAGE PREVENTION ORDINANCE

APPENDIX L PUBLIC INVOLVEMENT

SYLLABUS

The purpose of the overall Amite River and Tributaries study is to investigate the feasibility of providing flood protection for the residents in the Amite River Basin. This report documents the results of the feasibility phase studies for the East Baton Rouge Parish watershed. The goal of the study was to develop solutions to reduce flood damages along the tributary streams of the Amite and Comite Rivers in East Baton Rouge Parish. The study area encompasses about 560 square miles in southeastern Louisiana and contains the cities of Baton Rouge, Baker, and Zachary. Urban and built-up land comprise 40 percent of the existing land use. In 1991, the study area population was 384,000. East Baton Rouge Parish continues to grow with an expected 40 percent population increase by the year 2040. Numerous floods have occurred in the basin between 1973 and 1993. Flooding within the basin originates from excessive rainfall resulting in headwater and backwater overflow of the Amite River and tributary streams. The maximum flood of record occurred in 1983 and caused approximately $172 million in damages in the Amite River Basin. In the East Baton Rouge watershed, flood damages were estimated at $65 million.

Numerous structural and non-structural measures were considered to reduce flood damages in the East Baton Rouge Parish watershed. The Recommended Plan calls for channel modifications to five watersheds within the parish of East Baton Rouge. These watersheds are Blackwater Bayou and its main tributary, Beaver Bayou, Jones Creek and tributaries, Ward Creek and tributaries, and Bayou Fountain. The plan consists of modifying approximately 66 total miles of channel. Of this total, approximately 25 miles minimal channel clearing and snagging, 24 miles of earthen channel enlargement, and 17 miles of channel concrete lining are proposed. Included in the proposed construction are 60 miles of stream bank aesthetic tree planting. Fish and wildlife mitigation features consist of the reforestation of 397 acres of cleared land to compensate for an estimated 280 acres of bottomland hardwoods that would be lost to project construction. Recreation features include an 11-mile bicycle path. The total first cost of the plan, in October 1994 dollars, is estimated at $100,000,000 which translates into an average annual cost of $10,740,000 based on an interest rate of 8 percent, amortized over 50 years. This cost includes interest lost during construction and expected operation, maintenance, repair, and rehabilitation. The total average annual benefits attributed to the plan are estimated at $24,358,000. The benefit/cost ratio of the total plan is 2.42 to 1.

EAST BATON ROUGE PARISH TRIBUTARIES
FEASIBILITY STUDY

TABLE OF CONTENTS

EAST BATON ROUGE PARISH TRIBUTARIES
FEASIBILITY STUDY

TABLE OF CONTENTS (Continued)

EAST BATON ROUGE PARISH TRIBUTARIES FEASIBILITY STUDY

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

EAST BATON ROUGE PARISH TRIBUTARIES FEASIBILITY STUDY

LIST OF TABLES

LIST OF TABLES (CONTINUED)

EAST BATON ROUGE PARISH TRIBUTARIES
FEASIBILITY STUDY

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

EAST BATON ROUGE PARISH TRIBUTARIES
FEASIBILITY STUDY

LIST OF PLATES

EAST BATON ROUGE PARISH TRIBUTARIES FEASIBILITY STUDY

LIST OF PLATES (CONTINUED)

LIST OF PLATES (CONTINUED)

LIST OF PLATES (CONTINUED)

EAST BATON ROUGE PARISH TRIBUTARIES
FEASIBILITY STUDY

LIST OF FIGURES

LIST OF FIGURES

EAST BATON ROUGE PARISH TRIBUTARIES FEASIBILITY STUDY

STUDY AUTHORITY

The Amite River and Tributaries Study is being conducted in response to a resolution of the committee on Public Works of the United States Senate. The resolution, sponsored by the late Senator Allen J. Ellender and Senator Russell B. Long of Louisiana, was adopted on April 14, 1967, and reads as follows:

> "RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby requested to review the report of the chief of Engineers on Amite River and Tributaries, Louisiana, published as House Document Numbered 419, Eighty-fourth Congress, and other pertinent reports, with a view to determining whether the existing project should be modified in any way at this time with particular reference to additional improvements for flood control and related purposes on Amite River, Bayou Manchac, and Comite River and their tributaries."

STUDY PURPOSE AND SCOPE

The purpose of the study is to investigate the feasibility of providing flood protection for the residents in the Amite River Basin. This study is being conducted in two phases: a reconnaissance phase and a feasibility phase. The reconnaissance phase was initiated in September 1983 and completed in February 1985 with the signing of a feasibility cost-sharing agreement (FCSA). The cost-sharing partner is the Louisiana Department of Transportation and Development, Office of Public Works (DOTD). The feasibility phase was initiated in April 1985. In January 1986, notification was received from the Secretary of the Army Office that cost-sharing on Corps feasibility studies would be implemented on January 15, 1986. Specific terms of the Amite River and Tributaries study cost-sharing agreement stipulates that cost would be shared 50-50, commencing 60 days after the decision to proceed with cost-sharing. Therefore, all costs incurred after March 15, 1986, were cost-shared on this study. In February 1990, this cost-sharing agreement was modified to include the investigation of the Darlington Dam and Reservoir. The feasibility cost-sharing agreement is contained in Appendix A.

The Amite River Basin is shown on Plate 1. The basin encompasses about 2,200 square miles in southeastern Louisiana and southwestern Mississippi that is drained by the Amite River and tributaries. It includes portions of East Baton Rouge, Ascension, Livingston, East Feliciana, St. Helena, Iberville, St. James, and St. John the Baptist parishes in Louisiana and Wilkinson, Lincoln, Franklin and Amite counties in Mississippi. The 170-mile-long Amite River and its right bank tributary, the Comite River, rise in southwestern Mississippi and flow generally southward to their confluence east of Baton Rouge in the vicinity of Denham Springs. From that point, the Amite River continues in a southerly direction to a juncture with Bayou Manchac at about mile 36 and then southeasterly and easterly to Lake Maurepas. Bayou Manchac, a right bank tributary of the Amite River and a former distributary of the Mississippi River at Mile 215 above the Head of Passes (AHP), extends about 17 miles eastward between the Mississippi River and Amite River at Mile 36. Major urban centers in the basin include Baton Rouge, Baker, Zachary, Gonzales, Sorrento, and Denham Springs, Louisiana.

Due to the complex nature of the flood problem, feasibility phase studies were divided along hydrological and political boundaries to advance the study process. Studies have been completed for the following areas:

Comite River Basin (complete)
Darlington Reservoir (complete)
Ascension Parish (study terminated;
local program implemented)

Studies are being conducted for the following areas:

East Baton Rouge Parish (this report)
Livingston Parish

This report is written to describe study efforts in East Baton Rouge Parish. It is an interim response to the study authorizing resolution. The goal of the study was to develop solutions to reduce flood damages associated with headwater and backwater flooding from major drainage streams in East Baton Rouge Parish. These streams and their tributaries include Beaver Bayou, Blackwater Bayou, Jones Creek, Claycut Bayou, Ward Creek, Bayou Fountain, and Bayou Manchac. See Plate 2.

Seven watersheds in East Baton Rouge Parish were studied (see Plate 2). It was determined that the hydrology of 4 of the 7 watersheds is, for all practical purposes, independent and improvements proposed for one watershed in most cases would not have a major impact on the other. Consequently, the analysis of alternative plans was conducted on a watershed by watershed basis. Pertinent data on the 7 watersheds are shown in Table 1.

There are several streams that drain East Baton Rouge Parish but were not considered in this study because they are in the rural portion where flood damages are minimal or where flood protection has been recommended by the Corps of Engineers as part of the Comite River Diversion Plan. They include Bayou Baton Rouge, Cypress Bayou, White Bayou, Lily Bayou, Comite River, and Hurricane Creek.

Flooding problems in the Monte Sano Bayou watershed were initially evaluated in the reconnaissance phase of the study. It was determined that modifications to privately owned structures would significantly improve drainage in the basin. Such modifications have been implemented by the owners. Further study of this watershed was therefore not continued.

This report addresses the causes and impacts of flooding along streams in East Baton Rouge Parish and evaluates measures to alleviate flood damages. This report documents the results of field investigations; hydrologic and hydraulic studies; economic and environmental analyses; Federal, state, and local coordination; and public involvement activities. Studies were made in the detail necessary for the comparison of alternative plans, the identification of the NED plan, and the development of recommendations for implementation of a recommended plan. The study also addresses the protection of fish and wildlife habitat and the provision of regional recreational opportunities.

TABLE 1

WATERSHEDS OF EAST BATON ROUGE PARISH UNDER STUDY

Watershed	Basin Number	Total Acres
1. Beaver Bayou	14	7,927
2. Blackwater Bayou	13	9,341
3. Jones Creek	22	10,730
Lively Bayou Tributary	23	1,150
Lively Bayou	24	3,105
Weiper Creek	28	1,829
Total Jones Creek		**16,814**
4. Ward Creek		
Bayou Duplainter	25	4,771
Upper Druson Creek	26	2,905
North Branch of Ward Creek	27	4,344
Lower Dawson Creek	30	2,207
Lower Ward Creek	32	7,077
Upper Ward Creek	21	6,474
Total Ward Creek		**28,278**
5. Bayou Fountain	29	25,808
6. Claycut Bayou	31	9,634
7. Bayou Manchac	60	7,548

Source: U.S. Army Corps of Engineers, New Orleans District

PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS

The pertinent studies and reports on water resources development in or near the study area by the U. S. Army Corps of Engineers and other Federal, state, and local agencies are described in the following paragraphs.

A preliminary evaluation report was prepared by the Corps of Engineers in May 1972. The evaluation was conducted under the authorizing resolution for this study. Four reservoir plans, two plans to divert flood waters from the Amite River Basin to the Mississippi River, and four channel modification plans were investigated. All 10 plans were determined to be economically infeasible. This study was placed on the inactive status in February 1974.

A second reconnaissance study of the Amite River and Tributaries was initiated and subsequently completed by the Corps of Engineers in December 1984. In this initial evaluation report, a number of alternative solutions were developed to mitigate flood damages in the basin. A number of economically justified and environmentally acceptable plans were identified. The findings of this report provided the basis for the authorization of this feasibility study.

Section 206 of the 1960 Flood Control Act (PL 86-646), as amended by the 1960 and 1970 Flood Control acts, the Water Resources Development Act of 1974 and Executive Order 11296, August 10, 1966, authorizes the Corps of Engineers to establish and carry out a Floodplain Management Service Program. The objective of the program is comprehensive flood damage prevention planning that encourages wise use of the floodplain at all levels of government. Under the program, the Corps prepared five floodplain information reports for East Baton Rouge Parish. They are:

NAME OF STREAM	DATE PREPARED
Bayou Fountain	June 1971
Ward Creek and Tributaries	October 1972
Clay Cut Bayou, Jones Creek and Tributaries	September 1974

Hurricane Creek, Monte Sano Bayou and Tributaries	November 1976
Cypress Bayou and Tributaries	November 1976

The Corps of Engineers prepares flood insurance studies to map eligible communities by risk zones and to determine insurance rates. The studies are made under the provisions of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The program is administered by the Federal Insurance Administration of the Federal Emergency Management Agency. The flood insurance studies prepared for East Baton Rouge Parish are:

City of Baker; May 15, 1985
City of Zachary; August 3, 1982
East Baton Rouge Parish; May 17, 1993

The Department of Transportation and Development contracted with Brown and Butler Inc., to investigate the feasibility of a reservoir near Darlington, Louisiana. The proposed reservoir would have a maximum water surface area of about 19,500 acres and a normal water surface area or recreation pool of about 15,000 acres. The study, completed in March 1984, determined that the reservoir was economically feasible and recommended that the Amite River Basin Drainage and Conservation Commission investigate methods to fund the project.

The Department of Transportation and Development contracted with Brown and Butler, Inc. in May 1985 to investigate the hydraulic and hydrologic parameters in more detail than was in the previous study completed in March 1984. In the study, topographic surveys were taken of the Amite River valley from Interstate Highway 12 southward. Hydraulic models were developed and several reservoir designs were analyzed. The study was completed in August 1986. It concluded that the hydrologic and hydraulic analyses conducted as part of this study confirms the related findings of the previous study completed in March.

The Department of Transportation and Development (DOTD) applied to the U.S. Corps of Engineers for a Section 404 permit in April 1985 to construct the Darlington Reservoir. DOTD contracted with Espey Houston and Associates, Inc., in December

1987 to develop the necessary engineering and environmental information for the Corps of Engineers to prepare an environmental impact statement. The study was completed in January 1990. In early 1990, however, the State officially withdrew this permit application and requested Federal participation in this project.

The Corps of Engineers completed a feasibility study of flood control measures in the Comite River Basin in September 1990. Numerous structural and nonstructural measures were considered to reduce flood damages along the Comite River and lower tributary streams and to a lesser extent along the Amite River. The recommended plan consists of a 12-mile diversion channel from the Comite River to the Mississippi River. Major features of the plan include a Diversion Structure, a Comite River Stage Control Structure and a levee, a Channel Stage Control Structure, and an 8-mile levee along the southern bank of the diversion channel and recreation facilities. See Plate 3. Detailed design of the project is currently in progress and is expected to be completed in 1995. This project will be cost-shared with the State of Louisiana.

The Louisiana state legislature, in their 1982 regular session, created the Statewide Flood Control Program by Act 351. The purpose of the program is to provide assistance to the parish and local governments in reducing flood problems. Guidelines and procedures for participating in the program were completed and distributed by the flood control project evaluation committee in March 1983. Through 1988, one drainage project has been funded in the Amite River Basin. East Baton Rouge parish proposed to enlarge Beaver Bayou. Land acquisition for the project has been completed. Construction began in August 1988 and was expected to be completed in 200 working days. However, 1989 was a relatively wet year that slowed construction. Construction was completed in September 1990. The work is estimated to cost about $700,000. About 70 percent of the cost would be paid by the State-Wide Flood Control Program. East Baton Rouge Parish provided 30 percent of the cost including lands, easements, and rights-of-way.

In July 1990, Wilbur Smith Associates, Evans-Graves Engineers, and Chenevert-Soderberg Associates prepared a Comprehensive Land Use and Development Plan (known as the Horizon Plan) for the City of Baton Rouge and East Baton Rouge Parish. This study addresses current and future drainage and flood prevention needs of East Baton Rouge Parish and recommends parish-wide and specific watershed solutions to flooding problems. Recommendations include the following:

- implement a parish-wide drainage maintenance program
- implement local drainage improvements and support major drainage projects
- evaluate the potential of flood detention facilities within the Amite River Basin
- develop, maintain, and enforce a Master Drainage Plan and Drainage Criteria
- develop hydrologic and hydraulic modeling capabilities to predict drainage impacts of new development
- implement a public awareness program
- develop a long range plan for implementation and funding of a program to include other local agencies, the State, and Federal governments
- utilize subdivision requirements to secure drainage rights-of-way
- implement a parish-wide program to install and maintain survey benchmarks on a single datum.

The Metropolitan Council of the Parish of East Baton Rouge and the City of Baton Rouge officially approved the Horizon Plan, effective April 1992. Financing and implementation of various components of the plan are currently being developed.

On October 1, 1990, the Governor's Interagency Task Force on Flood Prevention and Mitigation completed an investigation to control and mitigate floods in the Amite River Basin. Flood control measures examined included floodplain management, stormwater retention, structural elevation and relocation, voluntary privately-owned retention ponds, zoning restrictions, habitat and ground cover preservation, and effective drainage improvements. Numerous short- and long-term recommendations were made including the following:

- implementation of floodplain regulatory standards
- implementation of a state-wide flood disclosure law
- a program for voluntary structure floodproofing, elevation relocation, or removal
- institution of a regional outreach awareness program
- improve existing flood forecasting and information
- implementation of a regional channel maintenance program
- assist the Federal Emergency Management Agency with their efforts
- assist local parishes and townships with the implementation of flood control projects
- assist with the implementation of the proposed Comite Diversion Canal
- pursue implementation of a full-size dry reservoir on the upper Amite River
- develop new, logical, cost-effective, and environmentally acceptable alternatives.

Under a cost-sharing agreement with the State of Louisiana, the Corps of Engineers completed feasibility studies for the Darlington Reservoir in September 1992. Findings indicated that construction of a reservoir, with or without a permanent recreation lake, was not economically feasible under Federal criteria. Federal participation in construction was therefore not recommended. The State is currently reviewing this report.

Under Section 22 of the Water Resources Development Act of 1974, as amended, the Corps of Engineers is currently conducting an initial evaluation investigation (reconnaissance study) of non-structural flood control measures for the Amite River Basin. Initial findings indicate that selected non-structural measures may be feasible in some locations.

Other Section 22 studies recently completed or in progress are:

- Development of a 2-foot contour map database of the Amite River Basin,

- Development of a digitized floodplain mapping of the Amite River Basin,

- Development of a digitized floodplain mapping of East Baton Rouge Parish,

- Study of erosion problems (solutions for the Baker Canal and Tributaries, East Baton Rouge Parish),

- Development of a drainage maintenance and construction program for East Baton Rouge Parish.

The existing Federal projects in or near the study area and their authorized features are:

The Amite River and Bayou Manchac navigation project, authorized 1927 and completed in 1928, provides for a 7- by 60-foot channel in the Amite River from its mouth at Lake Maurepas to mile 31 at Port Vincent (about 5 miles downstream of Bayou Manchac) and the clearing and snagging of the Amite River and Bayou Manchac from Port Vincent to the Kansas City Southern Railroad crossing at about mile 8.5 of Bayou Manchac.

The Amite River and Tributaries flood control project, authorized in 1955 and completed in 1964, provides for enlargement of the Comite River from Cypress Bayou (mile 10) to the mouth, clearing and snagging the Amite River from the Comite River (mile 54) to Bayou Manchac (mile 35.7), and enlarging and realigning the Amite River from Bayou Manchac to mile 25.3, a riprapped control weir on the south side of the Amite River at mile 25.3 and a diversion channel from the weir to Blind River at mile 4.8, snagging and clearing Blind River from mile 4.8 to Lake Maurepas, and snagging and clearing Bayou Manchac from the Amite River to Ward Creek (mile 8.4). A small navigation channel was provided around the weir between the Amite River and the diversion channel. Snagging and clearing Blind River from mile 4.8 to Lake Maurepas, although authorized, was found to be unnecessary after initial investigations. The Louisiana Department of Public Works enlarged the Comite River to dimensions considerably in excess of those to be provided under the project and extended the enlargement about 2 miles farther upstream.

The Federal Emergency Management Agency (FEMA) is currently in the process of instituting a floodway zone along Bayou Fountain. Once established, strict development requirements will be in place. Such requirements will include prohibiting soil fill and mitigation of lost floodplain volume. Such restrictions will highly discourage development within the floodway zone.

Improvements by others in or near the study area and their features are:

The Louisiana Department of Public Works elected to construct the Federal enlargement of the Comite River as "equivalent work" in lieu of a cash contribution toward the Federal modification of the Amite and Comite Rivers. That agency elected to excavate a much larger channel than provided in the Federal plan. The bottom width was increased from 60 to 90 feet the depth was increased about 4 feet in the lower river and about 10 feet between miles 8 and 10, and the enlargement was extended about 1.1 miles upstream of Cypress Bayou, the head of the Federal project.

The Louisiana Department of Public Works in 1967, under the State-Parish Drainage Plan, enlarged White Bayou for a distance of about 8 miles upstream of Louisiana Highway 64. The lower 4.5 miles was enlarged to a 30-foot bottom width at a depth of about 14 feet. A smaller channel was provided in the upstream area.

The Louisiana Department of Public Works in about 1956, under the State-Parish Drainage Plan, enlarged White Bayou from Louisiana State Highway 64 about 2.4 miles southward and excavated channel (Baker Canal) generally southwestward through the town of Baker to Bayou Baton Rouge, a tributary of the Mississippi River.

Bayou Fountain was enlarged from its mouth to Louisiana State Highway 42 by the City of Baton Rouge, Department of Public Works. This enlargement was completed in 1955 and lowered stages due to headwater flooding.

Lively Bayou tributary was enlarged from the Illinois Central Railroad to Florida Boulevard in 1966. Prior to then the Lively Bayou tributary was improved from its mouth to the Illinois Central Railroad.

Jones Creek was improved from its mouth to its headwater a distance of 12.6 miles, and Lively Bayou was improved from its mouth to the Illinois Central Railroad, a distance of 3.5 miles. More than 3.2 miles of Weiner Creek was improved, including a diversion adjacent to the Lake Sherwood Acres subdivision.

In 1982, the City of Baton Rouge and the Parish of East Baton Rouge, Department of Public Works proposed a three phase channel modification plan for Beaver Bayou. Phase I extends from the mouth of Beaver Bayou to Greenwell Springs Road. Phase II and III extend from Greenwell Springs Road to Wax Road and from Wax Road to Hooper Road, respectively. Phase I consists of channel modifications deepening, and straightening. Phase I was later broken into two parts, Phase IA and IB. Phase IA extends from the mouth of Beaver Bayou to Frenchtown Road, a distance of 2.3 miles. Phase IB extends from Frenchtown Road to Greenwell Springs Road.

Phase IA originally called for deepening the channel by 2.5 feet at the mouth of Beaver Bayou (elevation 15.5 ft NGVD) to 4.0 feet at Frenchtown Road (elevation 20.0 ft NGVD). The channel would have been enlarged to a trapezoidal channel with a 60 foot bottom width and 2.5 on 1 side slopes. The channel length would have been reduced 500 feet by straightening a portion of the stream. However, during construction of Phase IA, a large degree of bank sloughing and backwater siltation from the Comite River occurred. As a result, Phase IA was modified. The existing channel invert at the mouth (18.0 ft NGVD) was retained. The channel was then excavated to 18.0 feet NGVD from the mouth to the point upstream where it intersected the original proposed channel invert. The bottom width and side slopes remained unchanged. This modified Phase IA was completed in 1990.

Channel improvements on the lower portion of the Ward Creek watershed were made by the State of Louisiana, Department of Public Works between September 1953 and May 1957. Improvements included realignments of some parts of the Ward Creek and excavation of the channel into a trapezoidal cross-section. The realignment portion of Ward Creek is approximately 3.5 miles long. All following references to this reach of Ward Creek pertain to the diversion canal. In addition, North

Branch Ward Creek was improved from its mouth to Florida Blvd, Dawson Creek was improved from it mouth to College Drive (a distance of 5.8 miles), and Bayou Duplantier was improved from its mouth upstream a distance of 1.2 miles. Ward Creek was concrete-lined in 1966-67 from Clay Cut Road to Government Street. Later, the concrete lining was extended beginning at the corporate limits near College Drive to the Choctaw Village Shopping Center at its head waters. Also, from 1966 to 1967, North Branch Ward Creek had some additional channel modification and some channel realignment from its mouth to Jefferson Highway. In the early 1960's, Bayou Duplantier was deepened for Mile 1.2 to Standford Avenue.

Since January 1957, the State of Louisiana, Department of Public Works, the City of Baton Rouge, and the East Baton Rouge Parish Department of Public Works have made channel modifications on Clay Cut Bayou and Jacks Bayou. On Clay Cut Bayou, the modification channel extends from its mouth at the Amite River to Floynell Drive at about Mile 10. The Jacks Bayou channel modification extends from its mouth to Sherwood Forest Blvd, a distance of about 2 miles.

The drainage work that East Baton Rouge Parish Public Work department has completed since 1980 is shown in Appendix B.

PLAN FORMULATION

ASSESSMENT OF WATER AND RELATED LAND RESOURCES PROBLEMS AND OPPORTUNITIES

The planning process for the East Baton Rouge Parish Flood study was conducted in an organized and systematic manner to ensure that all reasonable alternative plans were considered. The process was conducted in accordance with U.S. Water Resources Council "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies." Plan Formulation for this study was an iterating and dynamic process. Plan formulation is directed at achieving the National Economic Development (NED) objective consistent with protecting the nation's environment in accord with national environmental statutes, applicable executive orders, and other Federal planning requirements, as well as being responsive to state and local concerns. The NED objective was achieved by increasing the value of the national output of goods and services and reasonably maximizing net economic benefits. Benefits were maximized while giving due consideration to environmental quality, regional development, and social concerns.

During the process, historical trends and existing conditions were used as a base for forecasting future conditions. In an assessment of the nature and extent of changing conditions, problems and needs were identified and specific planning objectives defined. Opportunities in the form of management measures that address the objectives were evaluated. The most feasible measures were incorporated into an array of plans. The plans were then assessed and evaluated in terms of their engineering feasibility and performance and their adverse and beneficial effects on the NED objective. The effects on environmental quality were also evaluated. Finally, the plans were compared and a trade-off analysis performed to select the plan that best addresses the NED objective and to provide the rationale for the tentatively selected plan.

EXISTING CONDITIONS

Physiography and Geology

The parish is in the Southern Pine Hills of the Eastern Gulf Coastal Plain. Topography in the northern portion of the parish is dominated by plateaus and ridgetops underlain by the Citronelle Formation. The southern portion is dominated by gently sloping Pleistocene terrace surfaces.

The maximum elevation within the parish is approximately 500 feet MSL. Elevations are between 35 feet and 40 feet MSL near the junction of the Comite River and Amite River near Denham Springs. Minimum elevations are between 5 and 10 feet MSL in the lower part of the basin near Lake Maurepas.

Although older sediments are found at depth in the parish only the Plio-Pleistocene, and Holocene sediments exposed at the surface and found near the surface are discussed. Four distinct geologic units are found within the parish: the Citronelle Formation, the Pleistocene terraces, the loess deposits and Holocene alluvium. The Citronelle Formation which varies in age from late Pliocene to Pleistocene, generally consists of a gradational sequence of fluvial gravels, cross bedded sands, silts and clays with the coarser grained material occurring at the base of this sequence. South of the outcrop of the Citronelle Formation are found the relatively flat Pleistocene terraces of less variable lithology than that of the Citronelle Formation. Generally, these terraces are comprised of sediments consisting of silt and sandy clay which grade downward into fine to coarse grained sand with some gravel. a thin veneer of loess deposits blankets much of the Comite River Basin. These loess deposits consist of silt with some clay and very fine sand which are irregular in occurrence and seldom exceed three feet in thickness. Holocene alluvium found along the Comite River and its tributaries consists of a sequence of fine sands and silts grading downward into coarse sands and gravels. The parish is located in a stable area of low seismicity. Earthquake activity is relatively rare and is usually less severe than average. Resulting damage to structures and levees (dikes) in the parish would be expected to be minor.

Economy

The economy of the parish is founded on a base of natural resources and government services. One of the largest oil refineries in the United States is located in Baton Rouge, Louisiana. The Port of Baton Rouge is the fifth largest in the United States and oil products and grains are the major products moved through the port. The city of Baton Rouge is the seat of the state capital and a large portion of the jobs are related to state government. Timber production in East Baton Rouge in 1992 accounted for less than one percent of the total stumpage value severed in Louisiana. The 1982 Census of Manufactures reported that eight percent of the state's manufacturing jobs are in East Baton Rouge Parish. The capital city of Baton Rouge is the center of economic activity. Of the 198,000 people employed in the parish, nine percent were employed in public administration. Thirty-seven percent were employed in the service sector with another seventeen percent employed in the retail trade. Manufacturing and construction accounted for eight and eleven percent, respectively. The remaining eighteen percent were spread throughout other sectors of the economy including agriculture, mining, wholesale trade, finances, and transportation.

Human Resources

The Parish population in 1991 was 383,983 an increase about 1.4 percent annually since 1970. Table 2 delineates the historic and existing population of the Parish and the Amite River Basin. The 1991 population of the city of Baton Rouge was 221,000 and represents over fifty-seven percent of the population in the Parish. Of the 380,000 inhabitants residing in the Parish in 1990, some were identified as being below established national poverty level. This represents 20 percent of the populace. In June 1993, the total workforce was 208,000 with 13,000 unemployed, unemployment rate of 6.4 percent.

TABLE 2

HISTORICAL POPULATION TRENDS IN EAST BATON ROUGE PARISH

	1940	1950	1960	1970	1980	1990	1991
East Baton Rouge	88,415	158,236	230,058	285,167	366,191	380,105	383,983

SOURCES: U.S. Army Corps of Engineers, New Orleans District Louisiana Tech University, College of Administration and Business, Research Division (1991 estimate)

In 1990, in East Baton Rouge Parish, there were some 161,700 identifiable households. The median income was $27,200.

The 1990 census reported that there were 157,000 year-round housing units in the Parish with 83,000 of the housing units owner occupied. The medial value of the owner occupied unit was $69,000.

Transportation

The parish is served by a fairly extensive transportation system. Deep-draft navigation access is provided to the Port of Baton Rouge by the Mississippi River. Shallow draft access is limited to the lower reach of the Amite River and Bayou Manchac. The shallow draft waterway is primarily used to transport dredged shell. An extensive network of highways serve the area. Interstate 12 and U.S. Highway 190 traverse the area east and west. Interstate 10 and U.S. Highway 61 run northeast and southeast. Several state and parish roads serve as transportation arteries between cities. They include 42, 30, 427, 37, 468, 64, 409, and 964. North-south rail transportation is provided primarily by the Louisiana-Arkansas Railway and the Illinois Gulf Central Railroad. The Illinois Gulf Central Railroad provides east-west transportation. Within the city of Baton Rouge and south along the Mississippi River, numerous local railway spurs serve the industries and manufacturers. Air transportation is provided at Ryan International Airport in Baton Rouge.

Climate

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

Temperature

Records of temperatures are available from "Climatological Data" for Louisiana, published by the National Climatic Center. The study area can be described by using the normal temperature data observed at Baton Rouge. This station is shown in Table 3 with the monthly and annual minimum, maximum, and mean normals which are based on the period 1951-1980. The annual mean normal temperature is 67.5°F, with monthly mean temperature normal varying from 82.1°F in July to 50.8°F in January.

A maximum extreme temperature of 110°F was recorded at Baton Rouge during August 1909 and a minimum extreme of 8°F was recorded during December 1989.

TABLE 3

MAXIMUM, MINIMUM, AND MEAN MONTHLY TEMPERATURE (°F)
30 Year Normals (1951-1980)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAXIMUM	61.1	64.5	71.6	79.2	85.2	90.6	91.4	90.8	87.4	80.1	70.1	63.8	78.00
MINIMUM	40.5	42.7	49.4	51.5	64.3	70.0	72.8	72.0	68.3	56.3	47.2	42.3	57.00
MEAN	50.8	53.6	60.5	68.4	74.8	80.3	82.1	81.4	77.9	68.2	58.7	53.1	67.50

SOURCE: National Climatic Center

Precipitation

Records of precipitation are also available in publications by the National Climatic Center. Eight stations were used to show the rainfall data for the study area (these stations are shown on Plate C-3 in Appendix C). Table 4 gives a list of stations with their period of record, and available extremes. Baton Rouge Airport is the only station with precipitation normals. The annual normal rainfall for Baton Rouge is 55.8 inches based over the period 1951-1980. Table 5 lists the monthly and annual normals. The wettest month is July with an average monthly normal of 7.07 inches. October is the driest month averaging 2.63 inches. The average annual rainfall since 1980 is 64.85. This average accounts for all eight stations. This ten year average is shown in Table 6 with the monthly and annual averages of each station.

TABLE 4
PRECIPITATION STATIONS

Station	Map No. Plate C-3	Period Of Record (to 1989)	Maximum Monthly (in.)	Date	Minimum Monthly (in.)	Date	Greatest 1-Day (in.)	Date
Baker	1	1980-Date	16.08	4/80	1.10	11/81	6.2	12/4/82
Baton Rouge Airport	2	1869-Date	15.94a	12/82	T	10/78	11.9	4/14/67
Baton Rouge Central	3	1980-Date	19.29	8/83	1.00	11/85	13.5	8/2/83
Baton Rouge Sherwood	4	1979-Date	21.67	8/83	0.44	11/85	14.43	8/2/83
Denham Springs	5	1978-Date	19.24	8/83	T	10/78	13.8	8/2/83
Greenwell Springs	6	1967-Date	17.05	4/80	0.11	6/79	11.42	8/2/83
LSU Ben Hur	7	1963-Date	16.22	2/66	0.0	10/78	8.13	10/4/64
Zachary	8	1975-Date	18.25	10/84	T	10/78	6.58	4/6/83

a From 1951
b And other dates
T Trace

Source: National Climatic Center

Table 5
BATON ROUGE AIRPORT
MONTHLY AND ANNUAL PRECIPITATION (inches)
(1951-1980)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
4.58	4.96	4.59	5.59	4.82	3.11	7.07	5.05	4.42	2.63	3.95	4.99	55.77

SOURCE: National Climatic Center

Table 6
Average Precipitation (inches)
(1980-1991)

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Baker	5.65	6.29	4.85	5.12	5.70	6.63	4.23	5.13	5.14	5.17	4.43	6.28	64.82
Baton Rouge Airport	5.04	6.30	4.58	5.16	5.90	6.88	5.78	6.75	4.61	4.52	4.27	5.99	65.78
Baton Rouge Central	5.51	6.31	5.29	5.83	6.06	5.99	5.15	7.30	4.05	4.46	4.98	6.01	66.89
Baton Rouge Sherwood	5.04	6.33	5.49	4.99	5.77	6.43	4.80	7.90	4.37	4.70	4.19	5.24	65.25
Denham Springs	4.85	6.19	5.63	5.14	5.60	6.64	5.73	7.49	3.51	4.69	3.88	5.04	64.90
Greenwell Springs	5.46	6.55	5.67	5.78	6.08	7.00	4.61	6.75	4.41	4.85	4.78	5.90	67.84
LSU Ben Hur	4.88	6.25	4.79	4.44	4.57	7.65	4.64	5.84	4.26	3.99	4.21	5.34	61.68
Zachary	5.02	6.43	5.08	5.32	6.28	6.59	4.62	5.99	4.34	5.34	3.95	6.10	66.93
AVERAGE	5.18	6.33	5.17	5.22	5.76	6.73	4.95	6.64	4.34	4.72	4.34	5.74	65.51

SOURCE: National Climatic Center

Wind

The average velocity of winds in the study area is 7.3 mph. This is based on 19 years of record (1973-1991) taken at Baton Rouge at Ryan Airport. Prevailing wind flow is from a southerly direction during much of the year. The maximum wind speed observed at this station since 1963 was 58 mph during September 1965 and was caused by Hurricane Betsy. Tables 7 and 8, respectively, give the monthly and annual wind speeds for Baton Rouge along with the resultant directions.

TABLE 7
AVERAGE MONTHLY AND ANNUAL WIND SPEEDS
1973-1989 (MPH)
BATON ROUGE AT RYAN AIRPORT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1973	9.3	9.0	10.2	9.9	9.6	6.1	6.7	5.9	7.5	5.9	8.5	9.8	8.2
1974	8.6	10.0	9.0	10.1	8.8	8.3	6.4	6.3	9.1	7.4	8.8	8.3	8.4
1975	8.4	9.7	11.7	10.2	7.6	6.9	5.3	5.0	6.1	6.5	7.8	7.6	7.7
1976	9.3	9.0	9.7	7.4	7.7	6.2	5.5	5.8	5.7	7.5	7.6	8.2	7.5
1977	9.2	9.3	9.6	7.9	7.2	6.5	4.6	5.8	6.3	6.8	7.9	9.2	7.5
1978	9.9	9.4	8.5	8.4	7.7	6.0	6.1	5.5	5.8	5.0	4.8	7.3	7.0
1979	8.4	8.0	8.8	7.8	6.7	5.9	6.6	3.9	6.4	5.9	6.5	6.0	6.7
1980	7.7	8.4	9.6	7.6	6.1	6.2	4.3	4.4	5.0	5.5	5.3	5.4	6.3
1981	5.6	7.1	7.7	5.8	6.5	5.8	4.7	3.9	5.5	6.9	6.8	7.9	6.2
1982	10.0	8.9	9.1	9.3	6.7	6.8	5.4	5.2	6.4	6.7	7.5	9.2	7.6
1983	7.5	9.2	8.5	9.8	8.2	6.3	5.2	5.3	5.5	5.5	7.6	9.1	7.3
1984	7.4	8.1	8.1	9.4	7.9	6.0	5.3	5.3	7.5	6.5	7.9	8.0	7.3
1985	7.9	8.9	8.7	7.8	6.8	6.5	5.8	6.2	7.0	8.1	7.4	7.1	7.4
1986	7.4	8.7	6.9	7.4	6.9	5.1	5.5	5.3	5.8	5.6	8.1	5.9	6.6
1986	7.6	8.5	7.8	7.3	5.9	6.1	5.4	4.8	5.6	6.9	8.9	8.6	7.0
1988	8.9	8.3	9.1	8.3	7.8	7.0	6.1	5.9	7.1	6.6	8.5	7.3	7.6
1989	8.1	9.7	9.9	8.4	8.2	8.0	7.0	5.7	7.6	7.4	8.1	9.6	N/A
AVG	8.3	8.8	9.0	8.4	7.5	6.4	5.6	5.3	6.4	6.5	7.5	7.9	7.2

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 8
RESULTANT DIRECTION
1973-1989
BATON ROUGE AT RYAN AIRPORT

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1973	05	01	16	17	19	15	26	07	11	08	15	21	13
1974	11	21	17	14	15	15	25	12	07	09	11	18	13
1975	13	16	14	12	13	15	26	12	03	05	10	05	11
1976	06	20	15	15	23	09	27	01	04	01	01	03	05
1977	01	20	14	15	12	22	23	12	14	05	11	15	13
1978	01	36	30	15	13	09	22	08	07	03	07	11	06
1979	01	06	16	12	14	12	14	18	03	13	02	04	08
1980	05	03	11	04	14	21	24	11	09	02	02	03	07
1981	01	36	03	15	13	17	23	10	05	07	08	05	09
1982	12	02	14	11	14	22	22	20	06	06	09	09	10
1983	02	03	27	17	15	07	07	05	05	05	11	34	05
1984	36	16	16	17	12	15	18	12	03	11	04	10	10
1985	32	03	14	11	22	21	25	08	07	07	11	02	07
1986	01	21	17	16	14	15	22	09	13	11	08	05	14
1987	29	08	03	28	12	11	13	26	01	04	06	11	06
1988	04	01	13	25	17	07	20	05	06	03	15	06	06
1989	08	36	18	13	15	14	22	02	02	05	07	34	N/A

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

SOURCE: National Climatic Center

Existing Land Use

Historical land use for East Baton Rouge Parish in 1954, 1972, 1978, and 1985, are shown in Table 9. A geographic information system (GIS) was used to map historical land use changes. The methodology used is described in detail in Appendix J. Land use in East baton Rouge Parish is largely Urban and built up land, agricultural, and forest lands. In 1985, these land uses made up 95 percent of the land use. Urban and built-up land make up 35 percent of the total land use. Forest and agricultural lands have declined since 1954 from about 94 percent of the total land use to about 60 percent in 1985. This decline is primarily due to the conversion of forest and/or agricultural lands to urban lands. Some forest lands have been converted to agricultural lands. Urban and built-up land have increased from less than 1 percent in 1954 to 35 percent in 1985. The Baton Rouge metropolitan area make up most of the urban land and built-up land.

TABLE 9
EAST BATON ROUGE PARISH
HISTORICAL LAND USE (ACRES)

YEAR	URBAN OR BUILT-UP LAND	AGRICULTURAL LAND	FOREST LAND	WATER	WETLANDS	BARREN
1954	16,183	NA	114,092	NA	NA	139,445*
1972	53,195	126,317	82,702	1,100	5,360	1,046
1978	79,298	92,514	83,343	809	7,013	6,743
1985	92,784	86,580	76,870	1,079	6,473	5,934

* Includes all categories where data was not available.

SOURCE: U.S. Army Corps of Engineers, New Orleans District

Waters, wetlands and barren land have been relatively constant making up about 5 percent of the land use. Parish land use maps are shown in Appendix J. The photo interpretation upon which land use in the Parish are based identifies Cypress tupelo swamps, shrubs, swamps, and other similar types as wetlands. Historical urban development trends within and outside the 100-year floodplain in East Baton Rouge Parish are shown in Tables 10 and 11. Existing urban land use in each watershed under study is listed in Table 12. The greatest increase in urban development within the 100-year floodplain occurred between 1972 and 1978. Growth declined during the 1978-1985 period. This decline in growth can probably be attributable to the general decrease in overall economic growth. Since 1985, economic growth has resumed in the metropolitan area and urbanization is again increasing. In addition, recent floods in the parish have placed more emphasis on the judicious use of the floodplain. The parish in April 1990 passed new ordnances to curtail development in the floodplain. The Ordnances are contained in Appendix K.

TABLE 10
HISTORICAL URBAN DEVELOPMENT TRENDS WITHIN AND OUTSIDE 100-YEAR FLOODPLAIN (ACRES)

(1972) PARISH	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN
East Baton Rouge	8,307	44,888
% Percent	16	84

(1978) PARISH	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN
East Baton Rouge	18,239	61,059
% Percent	23	77

(1985) PARISH	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN
East Baton Rouge	22,268	70,516
% Percent	24	76

SOURCE: U.S. Army Corps of Engineers, New Orleans District

TABLE 11

INCREASE IN URBAN DEVELOPMENT WITHIN AND OUTSIDE THE 100-YEAR FLOODPLAIN FOR SELECTED PARISHES

	1972-1978		1978-1985		1972-1985	
PARISH	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN	WITHIN 100-YEAR FLOODPLAIN	OUTSIDE 100-YEAR FLOODPLAIN
EAST BATON ROUGE	2.2	1.35	1.22	1.16	2.	1.57

Source: U.S. Army Corps of Engineers, New Orleans District

Biological Resources

The habitats of any of the basins of the area that would be impacted by any flood control measure are open lands and bottomland hardwood forests. The open lands along the channels are not considered to be as significant as are wooded lands in the area. Wooded lands along the channels provide habitat for several species of songbirds, as well as owls, squirrels, rabbits, mink, and others. These wooded lands provide values other than biological for which residents of the urban area indicate a need. Indicators of this include the development of wooded parks in the area, preservation of trees both on residential and commercial areas, preservation of areas of trees and shrubs as property boundaries, etc. The channels themselves also provide habitat in some areas for kingfishers and wading birds. Urban runoff constitutes a very poor source of waters for fish. The channels of the area almost exclusively provide very poor habitat for fish, except for those species that can survive in waters of very low dissolved oxygen. The upper reaches of Blackwater Bayou, and to a lesser extent Beaver Bayou, arise from agricultural and forested areas instead of urban areas and do provide a limited amount of better habitat in some of that area. However, with the receipt of runoff from the lower parts of those streams, aquatic habitat quality becomes very poor again. The inflated heelsplitter is a threatened species that occurs in the Amite River. The endangered bald eagle has nested in an area, not within but adjacent to, the Bayou Fountain area.

TABLE 12

EXISTING URBAN LAND USE BY WATERSHED

WATERSHED	Urban Land Use 1985 (in acres)	Urbanization As Percent of Total Land Use
Blackwater Bayou	2882	31%
Beaver Bayou	2798	35%
Ward Creek	20208	71%
Jones Creek	12963	77%
Bayou Fountain	6420	25%
Claycut Bayou	4932	51%
Bayou Manchac	2625	35%

Source: U.S. Army Corps of Engineers, New Orleans District

<u>Cultural Resources</u>

There are 51 properties currently listed on the National Register of Historic Places in East Baton Rouge Parish. Numerous archeological sites and historic structures also have been recorded throughout East Baton Rouge Parish (see Cultural Resources Correspondence Appendix G).

The culture history of the study area has been influenced by its geographic features, principally Pleistocene terraces, and proximity to the Mississippi River. Evidence of past human occupation and utilization of the study area is expected from Paleo-Indian times to the present. Adaptive strategies employed by the prehistoric inhabitants who occupied the area have resulted in a variety of site types which are identified within the study area; examples of these sites include campsites, extraction sites or procurement stations, ceremonial or village sites, and agricultural sites. Historic settlement initially occurred slowly in the study area. This trend continued into the American Period when the area became increasingly more settled and individual farmsteads were replaced by small communities. Economic and industrial developments which occurred in the study area have resulted in an increased range of historic site types located within the study area.

Recreation Resources

East Baton Rouge Parish has an aggressive recreation program providing recreational sites and programs for urban and rural areas alike. Existing recreational areas in East Baton Rouge Parish include numerous local parks, neighborhood playgrounds, country clubs, a zoo, state commemorative areas, etc. The Recreation and Parks Commission for the Parish of East Baton Rouge (BREC) in their most recent reporting year (1992), reports 136 BREC facilities on a total of 3,840 acres. Attendance at these sites is estimated at 8,309,801 annually. Many programs were expanded and new programs were added by BREC. Improvements include an Art Gallery at City Park, 15 new centers, 26 new day camps, the Velodrome bike facility, a horse activity center, the fairgrounds, Highland Road tennis center, and many others. Golf courses within the BREC System registered 200,000 rounds of golf played in 1992. The Greater Baton Rouge zoo experienced a total of 345,193 visitors as it observed its 20th anniversary. All of the 132 tennis courts were highly utilized with annual tournaments being held at most of the tennis centers. Other popular activities offered at BREC facilities include women's co-ed sports, basketball, baseball, football, and fun runs. BREC parks are generally located in neighborhoods within walking or biking distance from most of the potential users. These parks are equidistant from each other providing the opportunity for high neighborhood utilization. Few formal bicycle riding trails exist within the parish. Approximately 4.5 miles of Class I bikeways and 5.2 miles, Class II, bikeways are present in East Baton Rouge Parish. Class I bikeways are bikeways which have a separate path for the exclusive use of bicycles. Class II bikeways generally consist of a shoulder of a roadway designated for the preferential or exclusive use of bicycles.

Aesthetics

Within East Baton Rouge Parish, vegetation existing along the various drainage corridors provides a variety of aesthetic and ecological benefits. Erosion control, wildlife benefits, improvement of air quality, and providing a scenic buffer zone are positive attributes attributable to these vegetative linear green spaces. Vegetation existing along the stream banks also contributes to erosion control. The natural vegetative growth of horizontal root systems limits bank erosion and contributes to stable banks. The existing stream bank vegetation provides wildlife and bird habitats. In a world of concrete, gas fumes, industrial corridors, and shopping centers, the concept of encountering groups of wildlife and flocks of birds is quite unique for a city. These green stream bank corridors provide an opportunity to harbor wildlife and provide tree nesting areas for native fauna. These stream corridors increase the abundance and diversity of wildlife in the city contributing to an overall aesthetic neighborhood experience.

Another advantage of greenway corridors in the city is the reduction in pollution, creation of shade, and stimulating air movements. In summer vegetative stream bank areas can be as much as ten degrees cooler under tree cover. Air currents moving through the city over these forested areas would result in cooler air and lower humidity. By preserving these natural areas where trees and native shrubs are allowed to flourish, adjacent aesthetic conditions are maintained. These greenways along stream banks provide a buffer zone decreasing the nuisance of lights, noise, visual unsightliness, etc., from the view of adjacent residents. Throughout the city, the greenway screens non-compatible use from aesthetic degradation by providing a spacial separation between different use areas within the city and strengthens neighborhood identities.

Surface Water

The major rivers in the study area are the Amite River and the Comite River. The Amite River is used for recreation, propagation of fish and wildlife, and to a lesser extent, for water supply, navigation, and waste disposal. The Amite River has a drainage area of about 2,200 square miles and an average flow of about 2,000 cubic feet per second (cfs) at Denham

Springs. The Comite River has a drainage area of 334 square miles and an average flow of 457 cfs near Comite, Louisiana.

Groundwater

Fresh groundwater in the study area is obtained from the Pliocene, Miocene, and Quaternary Age deposits as well as undifferentiated aquifers that occur in alluvial coastal and upland deposits. Deposits of Pliocene age consist of medium to very fine grained sand beds alternating with silt and clay beds. These sediments thicken and dip steeply toward the Gulf of Mexico, reaching a thickness of about 2,200 feet near the southern limit of freshwater availability. Miocene age deposits consist mostly of lenticular deposits of fine- to medium-grained sand and beds of silt and clay. In some areas, very coarse sand and gravel are present. Individual sands may be as thick as 150 feet. These deposits are wedge-shaped and thicken greatly as they extend toward the Gulf of Mexico.

Quaternary deposits cover Miocene and Pliocene aquifers in nearly all of the study area. The Quaternary deposits range in thickness from less than 50 feet in the north to more than 3,500 feet near the coast. The maximum depth at which these deposits contain freshwater is about 1,000 feet.

Water Supply

Historical and existing water use in East Baton Rouge Parish and the entire Amite River Basin are shown in Table 13. Public water is entirely supplied by groundwater sources. Industrial water use is significantly higher than public use. In 1960, industrial water was mainly supplied from surface sources, i.e., the Mississippi River. Until very recently, there has been an increased use of groundwater usage by industry in the parish. This contributed to significant drawdowns in some of the parish's main supply aquifers. Through several groundwater management programs, this trend has been reversed with several large users converting to surface supply. The above mentioned aquifer drawdowns have also recovered and are closely monitored.

TABLE 13

HISTORICAL AND EXISTING WATER USE IN EAST BATON ROUGE PARISH

(million gallons per day)

	PUBLIC SUPPLY		INDUSTRIAL		POWER GENERATION		RURAL DOM.	LIVE STOCK		RICE		OTHER IRRIG.		AQUACULTURE		TOTAL		
YEAR	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	TOTAL
1960	19.20	0.00	67.73	366.62	7.52	7.58	1.45	0.02	0.46	0.00	0.00	0.00	0.00	0.00	0.00	95.92	374.66	470.58
1965	26.93	0.00	59.99	339.96	7.32	5.76	0.94	0.13	0.29	0.00	0.00	0.00	0.00	0.00	0.00	95.31	346.01	441.32
1970	32.40	0.00	99.59	361.53	7.48	7.63	0.35	0.28	0.38	0.00	0.00	0.35	0.05	0.00	0.00	140.45	369.59	510.04
1975	39.90	0.00	84.70	114.00	7.14	5.29	0.31	0.14	0.14	0.00	0.00	0.19	0.11	0.00	0.00	132.38	119.54	251.92
1980	53.50	0.00	86.50	69.00	7.07	4.03	1.73	0.14	0.02	0.00	0.00	0.14	0.00	0.06	0.00	149.54	73.05	222.59

Source: Louisiana Department of Transportation and Development

Water Quality

Water quality data on the stream segments in East Baton Rouge Parish under investigation for this study were either out-dated or non-existent. Therefore, water and sediment samples were collected by the New Orleans District U.S. Army Corps of Engineers on October 26, 1989. Thus, these samples are indicative of moderate air temperatures, dry weather, and low-flow conditions. See Appendix C for further details. Data for the Comite and Amite Rivers were compiled from the Environmental Protection Agency's computerized Storage and Retrieval Database (STORET) files.

Comite River

The Comite River, from Louisiana Highway 10 to White Bayou, has been designated a Louisiana Natural and Scenic stream by the Louisiana Department of Environmental Quality (LDEQ). The Comite River is categorized as an effluent limited stream; which is, by definition, any stream segment in which the best practicable treatment levels for point source discharges are required to maintain the stream's standards.

Of the parameters analyzed for the Comite River only pH values violated the state standards. The state standards indicate that pH should generally fall within the range of 6.0 to 8.5. Low pH values were observed in the Comite River near Olive Branch, Louisiana, and Comite, Louisiana. Near Olive Branch, Louisiana, only one pH value (6% of the total pH values) was below the minimum 6.0 (standard units) SU state standard. Two pH values or about 5% of the total pH observations near Comite, Louisiana, were below the state standard.

Though no DO concentrations are available at these three sampling locations on the Comite River, the Louisiana Department of Wildlife and Fisheries (LDWF) collected water quality samples on the lower Comite River in October 1973 and again in May 1980. The LDWF collected a total of six samples and reported that the DO levels were consistently between 7 and 9 mg/l. These values are well above the minimum 5.0 mg/l state standard. It should be noted that the above samples were collected at times of low flow conditions. Generally, lower DO values along a stream segment are found during low flow and warm weather conditions. Samples taken on Comite River tributaries on the same dates yield mean DO levels between 1.7 and 9.3 mg/l with 0.0 mg/l reported for one measurement on North Branch of Hurricane Creek. The EPA standard of 100 mg/l was violated for both of the two observation of total phosphorus along the Comite River.

Though no fecal coliform data was collected at the three stations on the Comite River, the LDWF collected water quality samples on the lower Comite River in October 1973 and May 1980. The LDWF collected a total of 6 samples and reported averages of 330 fecal coliform colonies/100 ml. This is in excess of the maximum 200/100 ml state standard. These violations are the result of the numerous package treatment plants that treat municipal waste from subdivisions along the Comite River and tributary streams. Samples taken on the same dates on Comite River tributaries yielded average fecal coliform counts of 7,000; 6,000; 22,000; 170,000; 500; and 8,000 colonies/100 ml.

The water conditions described in the above paragraphs are based on low flow conditions. The characterization is based upon limited data. At low flow conditions, water quality is likely low in dissolved oxygen (DO) and high on coliform bacteria. Recent water quality data collected for input into a water quality model is summarized below:

Date	Stream	Dissolved Oxygen (mg/l)	Coliform (Colonies/100ml)	Total Phosphorus (mg/l)	pH
9/10/90	Comite River	6.1	680	0.02	6.6
9/10/90	White Bayou	2.5	320	0.1	6.7
10/9/90	Comite River	6.2	106	0.16	6.1
10/9/90	White Bayou	3.7	96	0.12	6.5
4/1/91	Comite River	9.4	54	0.11	5.9
4/1/91	White Bayou	7.2	118	0.26	6.1
5/8/91	Comite River	5.2	2960	0.45	5.5
5/8/91	White Bayou	4.2	3160	0.34	5.5

In general, the water quality of the Comite River and Tributaries streams in the area during average flow conditions can be characterized as generally good.

Amite River

The Amite River, from the Louisiana-Mississippi state line to LA Highway 37 is designated a Louisiana Natural and Scenic stream. The Amite River is also an effluent limited stream segment. Standards for pH and total dissolved solids (TDS) were exceeded at all five sampling locations.

The station near Darlington, Louisiana, at Highway 10 had the greatest percentage of violations with respect to pH values, with 19% of the values below the pH standard of 6.0 SU. The minimum pH value recorded at this site was 5.2 SU. The station located near Magnolia had the lowest pH value which was 4.9 SU. However, only 6% of the total pH values measured at the Magnolia location were in violation of the state standard. Low pH values are of concern since many pollutants are known to become more toxic as pH becomes lower. It is interesting that, like the Comite River, the pH levels in the Amite River increase at the downstream locations. Since the northern portions of the river basins are mostly forested and agricultural lands, perhaps these lower pH values are the result of agricultural and silviocultural practices.

Although the state standard for total dissolved solids (TDS) was violated at all five locations, the maximum percent exceedance was 7% at the farthest downstream location near the Highway 42 Bridge. Except for this location, the mean TDS concentrations for the other sampling locations is about 54 mg/l; well below the maximum 150 mg/l state standard.

For the three station locations on the upper Amite River, there were no DO violations. The mean DO concentrations at these stations were about 8.3 mg/l. The station at the 4H Camp near Denham Springs had one DO violation in 131 observations. However, about 22% of the DO concentration observed at the Highway 42 bridge violated the minimum 5.0 mg/l state standard. The mean violation was about 4.1 mg/l with the violations equally distributed throughout the months of May through

October. Severe oxygen depletion has been reported in the Amite River below the Amite River Diversion Canal.

The mean chloride and sulfate concentrations are well within the state standards. The percent exceedance values are generally rare and much less than 5%. The furthest downstream location is the exception with a percent exceedance value of 6%. The exceedances at this downstream location are probably due to the influence of brackish water from Lakes Pontchartrain and Maurepas.

The LDEQ has set guidelines for maximum turbidity levels in the Amite River at 50 nephelometric turbidity unites (NTU). For the reach of the Amite River designated as scenic, the guideline is 25 NTU. Although, the mean turbidity levels measured at all of the stations are within these guidelines, there is about a 20 - 25% exceedance value at each of the stations. These high turbidity levels are the result of early storm runoff and sand and gravel mining operations in the Amite River. In the Amite River, 73% of the total phosphorus values exceeded the 50 mg/l EPA standard.

Generally, the quality of water, with regard to fecal coliforms, decreases as one progresses downstream. The log means range from 153 colonies/100 ml at the Grangeville Bridge location to 884 colonies/100ml at the Highway 42 Bridge location. The 90th percentile values for all five locations are well above the 400 colonies/100 ml state standard. These fecal coliform violations can be attributed to stormwater runoff and domestic wastewater discharges from Baton Rouge that enter the Amite River directly or via other tributaries.

There are consistent exceedances of the acute criteria for cadmium, copper, and lead. The acute criteria for mercury is exceeded only at the downstream location at the Highway 42 bridge. Mercury is of concern because of bioaccumulated effects. Zinc and nickel data were collected only at the 4H Camp location near Denham Springs, Louisiana, which has an exceedance ration of 69 percent for zinc and no exceedances for nickel.

As expected, the chronic exceedances at the five locations equalled or exceeded the acute criteria exceedances. Of particular significance are the much higher exceedance ratios for the trace metal mercury.

Streamflow Data

Streamflow data is available from major gaging stations in the study area. Many of these stations are maintained through cooperative agreement between the U.S. Army Corps of Engineers and the U.S. Geological Survey. Maximum records were set at 7 of the 12 stations in the study area from the April 1983 flood. The stations with their maximum and minimum stages and discharges are shown in Table 14.

TABLE 14
STREAMFLOW DATA

MAP NO.	STATION	PERIOD OF RECORD	MAXIMUM STAGE FT (NGVD)	MAXIMUM DATE	MAXIMUM DISCHARGE CFS	MAXIMUM DATE	MINIMUM STAGE FT (NGVD)	MINIMUM DATE	MINIMUM DISCHARGE CFS
1	AMITE RIVER PORT VINCENT	1964-89 1984-90	14.59	4/83	69500	1/90	-1.50	12/54	80
2	AMITE RIVER NEAR DENHAM SPRINGS	1938-89	41.50	4/83	112000	4/83	8.43	11/38	271
3	COMITE RIVER NEAR COMITE DATUM 23.85 FT	1944-90	54.40	5/83	37000	4/83	-	-	28
4	COMITE RIVER GREENWELL SPRINGS	1962-90	43.42	4/83	-	-	-	-	-
5	COMITE RIVER NEAR BAKER	1965-88	73.34	6/67	-	-	-	-	-
6	WHITE BAYOU SE ZACHARY DATUM 65.0 FT	1965-90	68.24	4/83	4730	4/83	2.66	11/66	0
7	WHITE BAYOU NEAR BATON ROUGE DATUM 62.0 FT	1965-90	[illegible]	4/77	1660	4/83	3.06	11/82	0
8	ALLIGATOR BAYOU SPANISH LAKE FLOODGATE UPPER	1955-73 1974-89	[illegible]	4/83	-	-	-4.40	7/64	-
9	ALLIGATOR BAYOU SPANISH LAKE FLOODGATE LOWER	1955-89	15.71	4/83	-	-	-2.42	4/80	-
10	BAYOU MANCHAC HOPE VILLA	1945-68 1980-89	[illegible]	4/83	-	-	-1.63	12/54	-
11	BAYOU MANCHAC NEAR PORT VINCENT	1972-88	[illegible]	4/83	-	-	-	-	-
12	MISSISSIPPI RIVER BATON ROUGE	1872-88 1931-45 1947-88	47.28	[illegible]	1473000	-	-3.07	11/94	73700

Source: U.S. Army Corps of Engineers, New Orleans District

Description of Flood Problems

Major Floods

Most streams in the Parish are subjected to backwater flooding along the lower reaches in the vicinity of the streams confluences with Comite River, Bayou Manchac, and Amite River. The upper reaches of these streams are subjected to headwater flooding. Headwater flooding is caused by high-intensity usually short duration rainfall that produces high flood elevations with very little warning. Flood occurrence within specific watersheds are shown in Table 15.

Major floods events that have affected most of the watershed in the East Baton Rouge Parish are described in subsequent paragraphs.

1953 Flood. The flood of May 1953 was caused by unusually heavy rains beginning on 27 April. During the period 22 April-9 May 1953 heavy rainfall produced generally high stages on most streams in the area and created favorable conditions for additional flooding following a second storm period between 10-21 May 1953. During the second storm period rainfall in the area ranged from 17.5 inches at New Roads to 7.0 inches at Baton Rouge. The average rainfall for the total storm period 22 April-21 May over the area was about 18 inches. Amite River near Denham Springs had a maximum stage of 36.37 ft. NGVD for this flood.

1962 Flood. The flood of April 1962 was caused by unusually heavy rains during the period 27-28 April 1962. Rainfall ranged from 4.0 inches at New Roads to 7.0 inches at Baton Rouge. The flood overflowed an area in excess of 114,000 acres along several streams in the basin.

1973 Flood. Headwater flooding occurred throughout the study area during the spring of 1973. During the period 23-25 March 1973, 7.3 and 7.7 inches of rainfall were recorded at Baton Rouge, and Greenwell Springs, respectively. Many streams overflowed their banks flooding adjoining areas.

TABLE 15
FLOOD OCCURRENCE WITHIN SPECIFIC WATERSHEDS

Watershed	Flood Events	
Bayou Fountain & Tributaries	April 1942	March 1973
	November 1947	April 1977
	May 1953	April 1979
	April 1962	April 1983
	March 1964	August 1987
	April 1967	June 1989
	April 1969	February 1992
		January 1993
Monte Sano Bayou	1962	April 1979
	March 1973	April 1980
	April 1975	
Claycut Bayou	April 1967	April 1977
	April 1969	May 1978
	March 1970	April 1979
	October 1970	April 1980
	December 1972	April 1983
	March 1973	August 1987
	April 1975	June 1989
		January 1990
		January 1993
Jones Creek & Tributaries	March 1947	April 1975
	September 1957	May 1976
	April 1962	September 1977
	October 1964	April 1977
	September 1965	April 1979
	February 1966	April 1983
	April 1967	August 1983
	March 1970	August 1987
	May 1972	June 1989
	March 1973	January 1990
		January 1993
Ward Creek & Tributaries	March 1947	March 1973
	May 1953	May 1976
	May 1954	April 1977
	April 1955	May 1978
	September 1957	April 1979
	January 1958	April 1983
	April 1962	October 1991
	October 1964	June 1992
	April 1967	June 1989
	April 1969	January 1993
Bayou Manchac	April 1967	April 1979
	March 1973	April 1983
	April 1975	January 1990
	April 1977	
Blackwater Bayou & Tributaries	April 1962	April 1975
	October 1964	April 1977
	April 1967	April 1983
	March 1973	
Beaver Bayou & Tributaries	April 1967	April 1980
	September 1973	April 1983
	April 1977	January 1990

Source: U.S. Army Corps of Engineers, New Orleans District

1977 Flood. Record flooding occurred in the Amite River Basin during the period 20-26 April. Rainfall amounts over this period ranged up to 15 inches with many reports of 6-13 inches. From 4-8 feet of flooding occurred along the Comite River with the maximum stage of 51.37 feet NGVD at Comite gage exceeding the 1973 record by 5.94 feet. Up to 12 feet of flooding occurred along the Amite River where the 41.08 feet NGVD, maximum stage at Denham Springs exceeded 1973's record by 4.6 feet. A new record occurred upstream at Darlington on the Amite River where the gage height peaked at 21.76.

1979 Flood. The 1979 flood was caused by headwater flooding on the Amite River and Tributaries and inadequate drainage facilities in the study area. High stages occurring along the Amite and New Rivers produced substantial flooding in and around Baker, Baton Rouge, Denham Springs, French Settlement, Gonzales, Port Vincent, Sorrento and Zachary. Maximum stage at Denham Springs was 36.36 feet NGVD.

1983 Floods. Heavy rains produced floods in April and August of 1983. During 5-8 April, severe thunder storms produced more than 10 inches of rain over the study area. Amite received nearly 9 inches on 6 April. Maximum stage records were exceeded at 9 gages. The record at Denham Springs was 41.5 feet NGVD which exceeded the 1977 flood record of 41.08 feet NGVD. Flash flooding occurred on 2 August in portions of the Baton Rouge and Vicinity when a weak tropical wave moved slowly over the area producing 24-hour rainfall amounts of 12-15 inches. Baton Rouge Sherwood (Woodlawn) and Denham Springs received 14.43 inches and 13.8 inches, respectively.

1989 Flood. Heavy rain from Tropical Storm Allison accounted for this flood. Seven to 10 inches of rain fell in a 12-hour period over east-central Louisiana during 27-28 June. Baton Rouge recorded a 24-hour rainfall total of 9.7 inches. Stages of Bayou Fountain were nearly 2 feet higher than those set in the 1983 flood.

1990 Flood. A cold front passage on 24-25 January, and the squall line ahead of the front, generated heavy rains and localized flooding over the study area. The most extensive flooding occurred to the east of Baton Rouge. Flooding was reported on the Amite and Comite Rivers. The 2-day storm rainfall ranged from 4-6 inches. Antecedent conditions, with saturated soils and elevated water tables, intensified flooding problems. Stages approached those of the 1983 flood.

1993 Flood. Similar to the 1990 flood, a heavy squall line ahead of a slow moving cold front on 22-23 January produced heavy, prolonged rains ranging from 7-8 inches in the south and east to 13-14 inches in the northwest part of the parish. Significant flooding occurred in the Comite River and its tributaries in and around Baker. Some moderate flooding occurred along the Amite River. Significant headwater and some backwater flooding occurred in the Bayou Fountain watershed, particularly, in the Siegen to Gardere Lane developments.

Flood Damage

Flood problems in northern and northeastern portion of the parish are due to headwater overflows from the Comite River, Cypress Bayou, White Bayou, Sandy Creek, Beaver Bayou, South Canal, Baker Canal, Monte Sano Bayou, and tributaries of these streams. Overflow from backwater flooding creates problems along Hurricane Creek, lower Comite River, and lower reaches of its tributaries streams. Flood problems in the southern and southeastern portion of the parish are caused by headwater overflow from Ward Creek and Tributaries, the Amite River, Clay Cut Bayou, Jones Creek and tributaries, and Bayou Fountain and tributaries. Backwater flooding occurs along lower Ward Creek from Bayou Manchac and the Amite River. The area along lower Clay Cut Bayou, Honey Cut Bayou, and Jones Creek from the Amite River. Backwater flooding occurs in the lower reaches of Bayou Fountain from Bayou Manchac and the Amite River. Comprehensive damage data are not available for most of the past flood events. Each flood event, along with all available damage data, are described below.

During the April 1977 flood, about 25,000 acres of land were inundated in the Baton Rouge area. A total of 1,500 urban residences and some of the business establishments were flooded. Inundated structures were flooded in depth over the floor from a few inches to about eight feet. Inundated structures were flooded from a few hours to several days.

Damages to structures and contents were estimated at about $20.7 million. Total damages in the parish were $24.0 million. Limited flooding occurred in April 1979, causing an estimated $1.4 million in damages to the Baton Rouge area.

East Baton Rouge Parish was severely flooded in 1983 along the Amite and Comite Rivers, Clay Cut Bayou, Cypress Bayou, Beaver Bayou, Sandy Creek and White Bayou. Amount 55,000 acres of land was flooded, and a total of 1558 urban residences, 20 rural residences, and 37 urban business establishments were damaged. Flood damages were estimated at $65.2 million. About 75 percent of the damages occurred along the Comite River and tributary streams. Flooding up to eight feet above the first floor was reported with inundation of structures lasting from a few hours to several days. Some streets and yards were reported flooded for a longer period of time. Agricultural flooding occurred; however, much of the land was fallow at the time of the flood. About 10,000 acres of improved pasture flooded. The pasture was damaged, but the water did not stay long enough to kill the grass. Approximately 30 tons of hay were reported lost.

Flood Damage Potential

East Baton Rouge Parish was subdivided into 7 hydrologic subbasins. Subbasin locations are shown on Plate 4. Plates 5-10 illustrate each subbasin and its 10- or 25-year frequency floodplain. The hydrologic and hydraulic analysis, land use, and the economic analysis were conducted on a subbasin level. This allowed damage centers to be more clearly identified as well as the cause of flooding. The flood damage potential was evaluated for each subbasin. This potential shows an indication of the level of flood protection that can be economically justified. Table 16 shows the number of structures located in various floodplains by subbasin. The existing average annual damage by subbasin is also shown.

Streambank Erosion

In several watersheds in the parish, streambank erosion is a significant problem. The problem is severe in several locations where residential and commercial improvements border the streambank. Fences, backyards, and in some instances, structures have been or are currently being affected by the on-going bank sloughing (See photos, Figure 1). Significant property losses caused by erosion problems are widespread throughout most of the Jones Creek watershed and on the North Branch Tributary of Ward Creek.

TABLE 16

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BLACKWATER BAYOU WATERSHED - TOTAL EQUIVALENT ANNUAL FLOOD DAMAGES - $5,581,000							
	BASIN NAME: BLACKWATER BAYOU							
13	1-STORY	198	72	332	182	62	110	956
	2-STORY	24	3	9	7	2	5	50
	MOBILE HOME	4	5	21	9	21	101	161
	COMMERCIAL	10	5	18	10	4	9	56
	TOTAL	236	85	380	208	89	225	1,223
	BEAVER BAYOU WATERSHED - TOTAL EQUIVALENT ANNUAL FLOOD DAMAGES - $10,407,000							
	BASIN NAME: BEAVER BAYOU							
14	1-STORY	315	72	39	112	69	640	1,247
	2-STORY	14	2	1	4	4	28	53
	MOBILE HOME	9	19	8	9	12	195	252
	COMMERCIAL	95	8	2	7	2	133	247
	TOTAL	433	101	50	132	87	996	1,799

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	WARD CREEK WATERSHED - TOTAL EQUIVALENT ANNUAL FLOOD DAMAGES - $4,074,000							
	BASIN NAME: WARD CREEK							
21	1-STORY	14	59	56	182	456	1,275	2,042
	2-STORY	1	0	5	2	3	25	38
	MOBILE HOME	0	0	0	0	1	0	1
	COMMERCIAL	3	13	17	48	91	220	392
	TOTAL	18	72	78	232	551	1,520	2,471
	BASIN NAME: BAYOU DUPLANTIER							
25	1-STORY	3	13	1	22	9	65	113
	2-STORY	2	6	6	6	6	15	41
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	12	2	2	4	13	13	46
	TOTAL	17	21	9	32	28	93	200

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	WARD CREEK WATERSHED (CONTINUED)							
	BASIN NAME: DAWSON CREEK							
26	1-STORY	51	50	20	14	24	72	231
	2-STORY	10	5	3	1	1	9	29
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	52	50	11	17	15	64	209
	TOTAL	113	105	34	32	40	145	469
	BASIN NAME: NORTH BRANCH - WARD CREEK							
27	1-STORY	17	84	41	161	167	366	836
	2-STORY	3	18	1	21	61	45	149
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	23	16	14	9	19	233	314
	TOTAL	43	118	56	191	247	644	1,299

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	WARD CREEK WATERSHED (CONTINUED)							
	BASIN NAME: DAWSON CREEK							
30	1-STORY	20	69	17	8	119	54	287
	2-STORY	0	2	2	10	18	19	51
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	19	20	3	5	12	82	141
	TOTAL	39	91	22	23	149	155	479
	BASIN NAME: **WARD CREEK**							
32	1-STORY	17	5	49	29	82	155	337
	2-STORY	3	2	3	2	2	15	27
	MOBILE HOME	4	0	0	0	1	71	76
	COMMERCIAL	25	4	19	15	2	13	78
	TOTAL	49	11	71	46	87	254	518

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	JONES CREEK WATERSHED - TOTAL EQUIVALENT ANNUAL FLOOD DAMAGES - $8,049,000							
	BASIN NAME: JONES CREEK							
22	1-STORY	57	28	123	92	141	1,062	1,503
	2-STORY	7	6	24	16	36	212	301
	MOBILE HOME	1	1	2	0	1	4	9
	COMMERCIAL	50	29	51	30	35	185	380
	TOTAL	115	64	200	138	213	1,463	2,193
	BASIN NAME: LIVELY BAYOU TRIBUTARY							
23	1-STORY	505	126	114	44	60	69	918
	2-STORY	20	10	4	3	5	13	55
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	2	1	0	0	0	0	3
	TOTAL	527	137	118	47	65	82	976

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	JONES CREEK WATERSHED (CONTINUED)							
	BASIN NAME: LIVELY BAYOU							
24	1-STORY	116	55	64	24	78	101	438
	2-STORY	10	58	5	0	8	18	99
	MOBILE HOME	0	0	1	0	11	25	37
	COMMERCIAL	31	10	19	2	9	3	74
	TOTAL	157	123	89	26	106	147	648
	BASIN NAME: WEINER CREEK							
28	1-STORY	8	0	13	0	45	229	295
	2-STORY	0	0	0	2	4	36	42
	MOBILE HOME	0	0	0	0	0	1	1
	COMMERCIAL	0	0	1	0	0	21	22
	TOTAL	8	0	14	2	49	287	360

TABLE 16 (Continued)

NUMBER OF STRUCTURES IN THE VARIOUS FLOODPLAINS OF EAST BATON ROUGE

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BAYOU FOUNTAIN WATERSHED - TOTAL EQUIVALENT ANNUAL DAMAGES - $1,655,000							
	BASIN NAME: BAYOU FOUNTAIN							
29	1-STORY	41	130	26	33	531	432	1,193
	2-STORY	7	50	113	5	196	133	504
	MOBILE HOME	0	0	0	0	0	6	6
	APT.BLDGS.	39	125	101	10	54	39	368
	COMMERCIAL	8	22	11	45	112	82	280
	TOTAL	95	327	251	93	893	692	2,351

SOURCE: U.S. **ARMY CORPS** OF **ENGINEERS**, NEW ORLEANS DISTRICT

FIGURE 1

NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED RIP-RAP REPAIR

NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED RIP-RAP AND FILL REPAIR

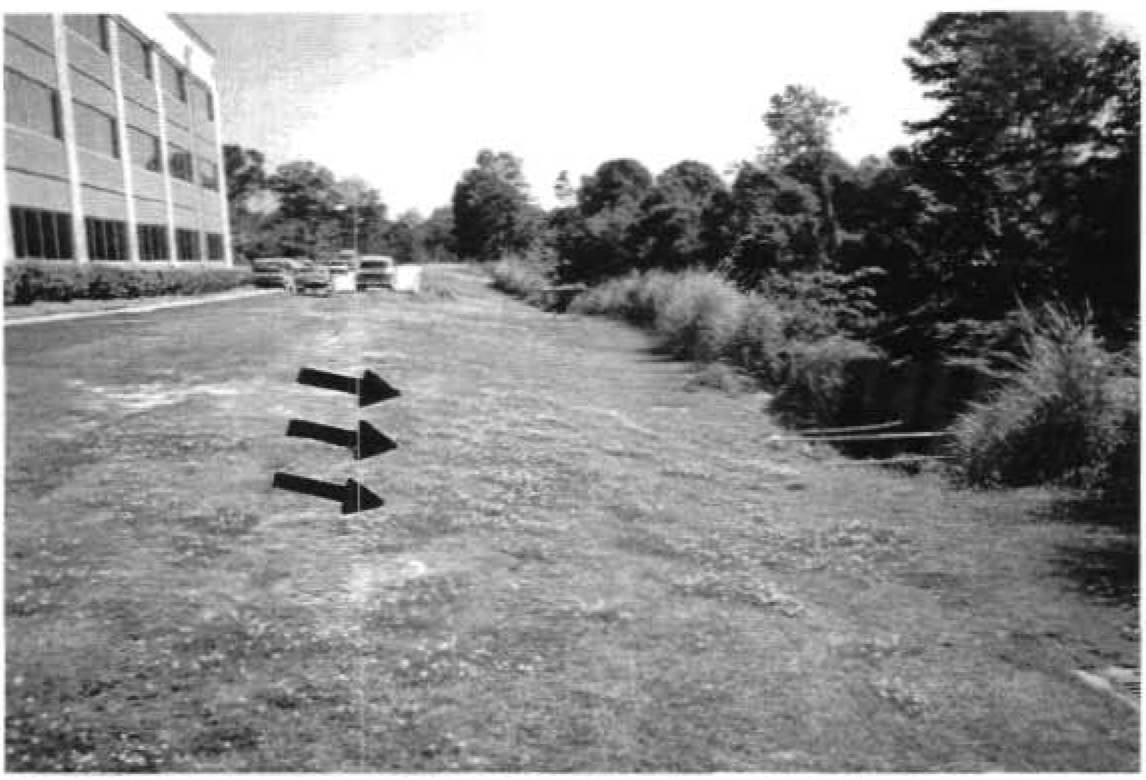
FIGURE 1 (CON'T)

NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED RIP-RAP AND FILL REPAIR

NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED RIP-RAP AND FILL REPAIR; NOTE NEW FAULT CLOSER TO STRUCTURE

FIGURE 1 (CON'T)

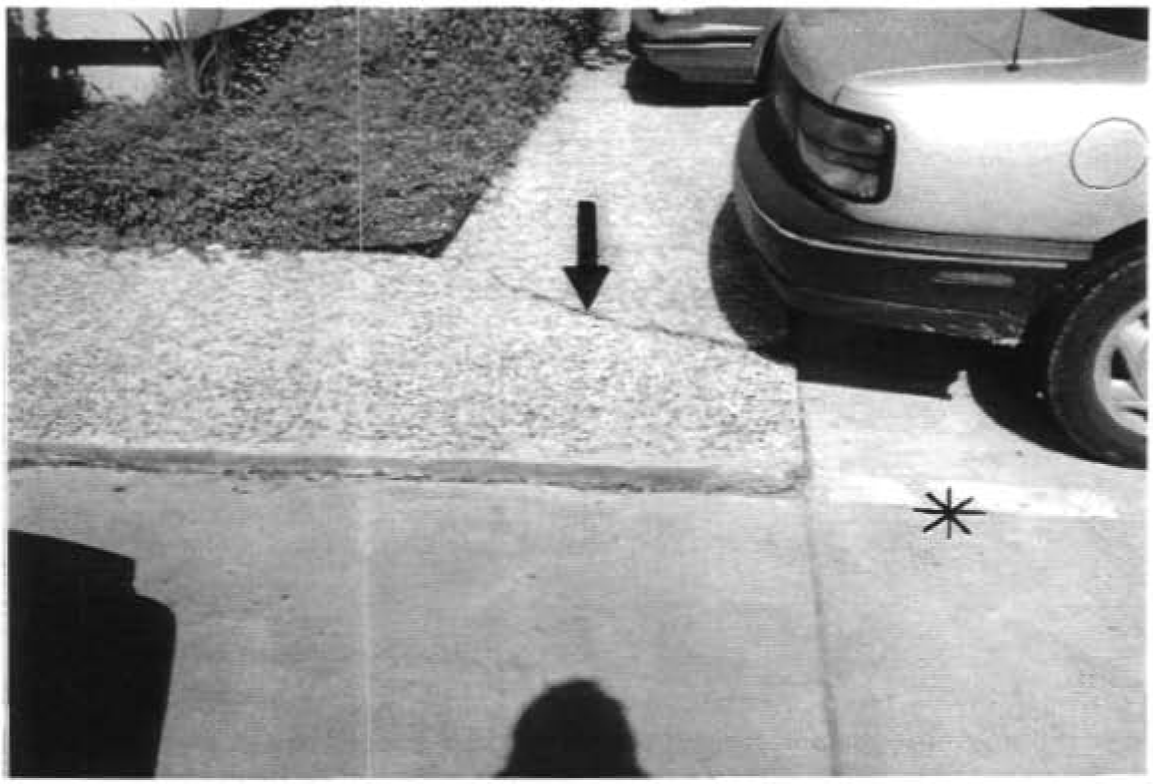
NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED SHEETPILE REPAIR



NORTH BRANCH WARD CREEK-BANK FAILURE AND ATTEMPTED SHEETPILE REPAIR; NOTE CONTINUED BANK MOVEMENT

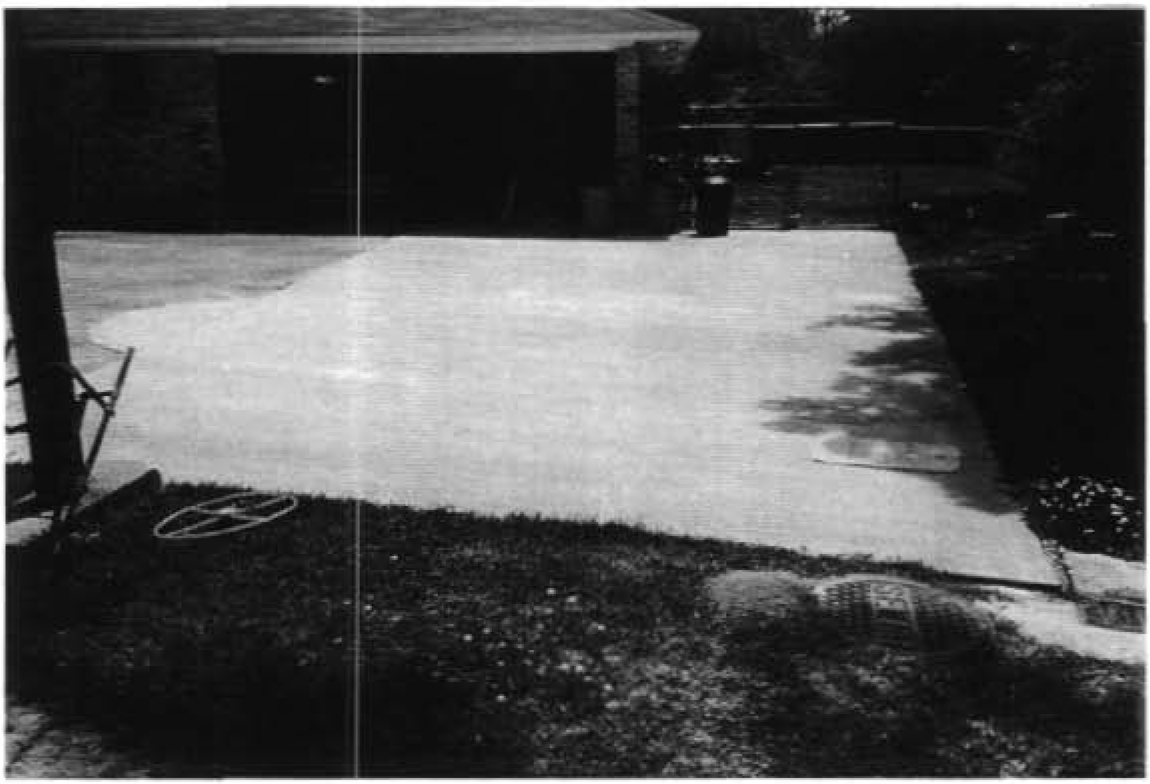
NORTH BRANCH WARD CREEK-SHEETPILE RETAINING WALL FAILURE

NORTH BRANCH WARD CREEK-BANK FAILURE; NOTE MOVEMENT
TRANSLATION (*REFERENCE POINT NEXT PHOTO)

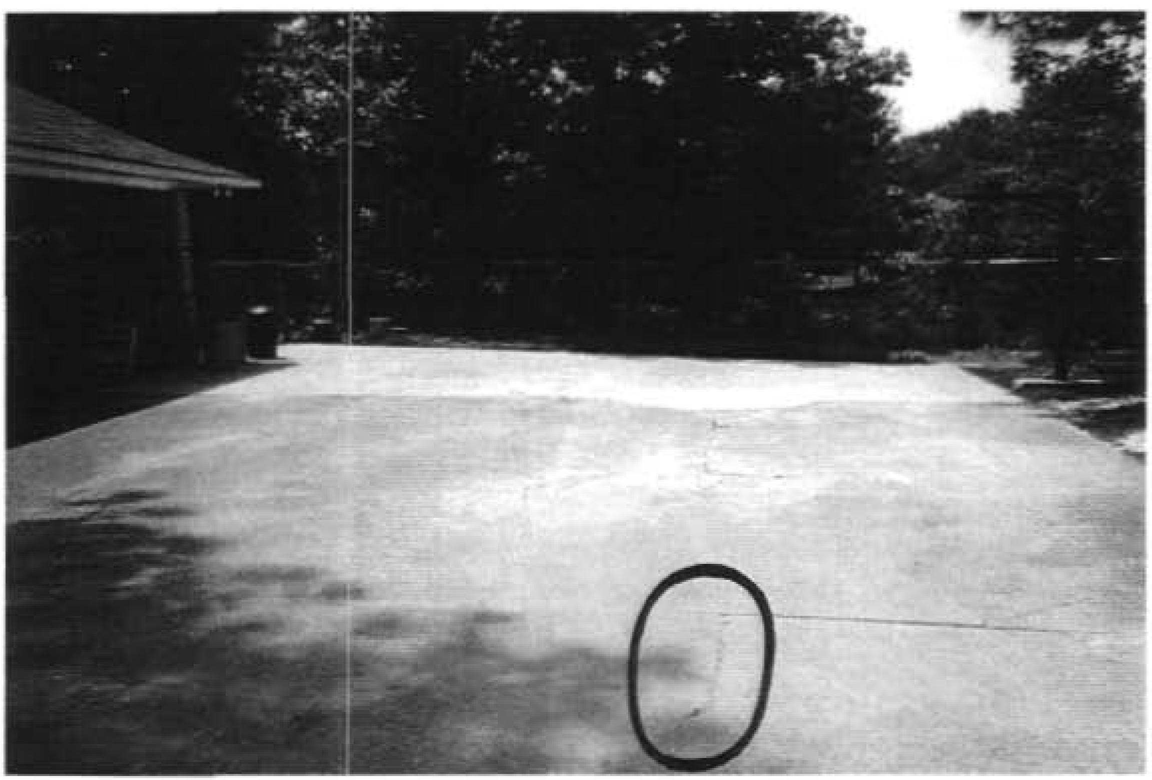


NORTH BRANCH WARD CREEK-EVIDENCE OF GROUND MOVEMENT
CLOSE TO BUILDING (*REFERENCE POINT PREVIOUS PHOTO)

FIGURE 1 (CON'T)



JONES CREEK-GRADE LEVEL, FENCE AND SLAB REPAIR (PARALLEL TO CREEK VIEW)



JONES CREEK-GRADE LEVEL, FENCE AND SLAB REPAIR (NORMAL TO CREEK VIEW); NOTE DAMAGE EXTENTION DISTANCE

FUTURE CONDITIONS (IF NO FEDERAL ACTION IS TAKEN)

The most probable future conditions in the study area if no Federal action is taken are determined by projection over the planning period 2000-2050. The conditions described are based on available information. This scenario serves as the base conditions to which all alternative plans were composed to assess the effect of each plan. For resources not described in this section, future conditions are not expected to be significantly different from existing conditions.

Economy and Human Resources

Population and economic growth in the area is expected to continue in the future. The exact locations of this growth would be influenced by many factors, including the availability of land throughout the area, construction costs, flood protection, environmental concerns, differences in lifestyles, and the proximity of housing to the work place and commercial centers. The economic potential of the area appears favorable in spite of recent declines in petrochemical industries. The area's mild climate, natural resources, port activities, and state government operations are major factors that would encourage growth. The population of East Baton Rouge Parish is expected to increase by about 170,000 people or 45 percent by the year 2047.

The growth rate between 1986 and 2047 is expected to average 0.6 percent annually. Table 17 shows the projected population for the parish. Tables 18 and 19 display pertinent data on anticipated population, earnings, and employment for the Baton Rouge Standard Metropolitan Area (SMSA). Statistical Area (SMSA). The Baton Rouge SMSA includes the parishes of East Baton Rouge, Ascension, Livingston, and West Baton Rouge.

Future Land Use

The projection of future land use was based upon three principles: knowledge of planned activities in the study area, awareness of constraints upon development, and the extension of

TABLE 17

PROJECTED POPULATION FOR EAST BATON ROUGE PARISH

1970	1980	1990	2000	2005	2015	2035	2040	2047
285,167	366,191	380,105	442,000	453,600	489,700	530,000	541,000	557,000

SOURCE: U.S. Army Corps of Engineers, New Orleans District

TABLE 18
POPULATION, PERSONAL INCOME, AND EARNINGS,
1969-1983, AND PROJECTED, 1990-2035
FOR BATON ROUGE, LA (MSA)

I.	1969	1972	1978	1983	1990	1995	2000	2005	2015	2035
Population as of July 1 (thousands)	371.0	407.4	466.8	531.1	572.3	599.5	622.0	643.1	693.2	751.0
				Millions of 1972 dollars						
Total personal income (place of residence)	1,350.8	1,601.4	2,337.4	2,798.1	3,373.4	4,065.0	4,532.6	4,956.3	5,689.0	7,545.9
By place of work										
Total earnings	1,106.2	1,282.1	1,859.9	2,005.9	2,462.9	3,049.7	3,430.0	3,795.0	4,389.9	5,444.7
Farm	11.7	17.5	8.7	9.5	12.0	11.3	11.0	10.9	11.1	12.2
Nonfarm	1,094.5	1,264.6	1,851.3	1,996.3	2,450.9	3,038.3	3,419.0	3,784.2	4,378.9	5,432.5
Private	885.1	995.5	1,517.0	1,599.7	2,161.8	2,489.7	2,807.5	3,107.2	3,597.3	4,471.3
Agricultural services, forestry, fisheries, and other	(D)	(D)	(D)	3.9	5.7	6.7	7.5	8.5	9.8	12.1
Mining	(D)	(D)	(D)	11.1	13.7	14.8	15.7	16.7	17.8	20.0
Construction	(D)	159.1	(D)	238.8	288.4	296.5	309.6	324.2	344.8	390.1
Manufacturing	262.0	282.8	378.1	377.0	508.9	581.3	646.3	708.9	816.3	1,016.6
Nondurable goods	227.5	244.1	325.8	333.1	434.7	487.0	534.7	578.2	661.9	815.1
Durable goods	34.5	38.6	52.3	43.9	75.2	94.2	111.6	127.7	154.3	201.5
Transportation and public utilities	64.1	82.0	116.9	133.5	182.0	210.6	241.4	272.1	322.4	408.1
Wholesale trade	(D)	(D)	(D)	123.4	169.4	195.3	221.4	248.5	290.3	339.1
Retail trade	117.5	138.5	194.4	213.5	267.0	305.5	344.4	378.9	430.7	538.0
Finance, insurance, and real estate	52.2	68.3	97.6	118.2	160.4	- 200.3	229.1	255.4	295.3	363.6
Service	(D)	(D)	(D)	381.3	556.1	678.7	792.1	896.9	1,069.6	1,362.7
Government and government enterprises	209.3	269.1	334.3	396.7	489.1	548.7	611.5	677.0	781.6	961.2
Federal, civilian	15.8	19.3	20.9	23.7	27.4	30.0	32.9	36.2	41.5	51.4
Federal, military	2.8	3.9	4.2	6.0	6.6	7.0	7.3	7.7	8.5	10.4
State and local	190.7	245.9	309.2	367.0	455.1	511.7	571.3	633.1	731.6	899.2

SOURCE: 1985 OBERS BEA REGIONAL PROJECTIONS, Volume 2, U.S. Department of Commerce, Bureau of Economic Analysis

TABLE 19

TABLE 19
EMPLOYMENT
1969-1983, AND PROJECTED, 1990-2035
FOR BATON ROUGE, LA (MSA)

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	1969	1973	1978	1983	1990	1995	2000	2005	2015	2035
Total employment	145.1	162.0	211.1	229.5	274.4	300.1	322.6	340.7	358.5	367.2
Farm	3.8	3.5	2.8	2.5	2.5	2.5	2.3	2.5	2.4	2.3
Nonfarm	141.3	157.6	208.4	227.0	271.9	297.6	320.1	338.3	356.1	364.9
Private	107.8	117.9	160.8	173.7	213.8	236.8	256.9	272.9	289.6	299.4
Agricultural services, forestry, fisheries, and other	(D)	(D)	(D)	.8	1.1	1.3	1.4	1.5	1.5	1.5
Mining	(D)	(D)	(D)	1.0	.9	.9	.9	.9	.8	.7
Construction	(D)	16.5	(D)	22.4	25.2	25.3	25.7	26.2	26.2	25.1
Manufacturing	21.7	21.5	24.7	22.4	26.0	27.4	28.8	29.7	30.6	30.9
Nondurable goods	17.8	17.6	19.8	18.5	20.4	21.2	21.9	22.3	22.8	22.8
Durable goods	3.9	4.0	4.9	4.0	5.6	6.2	6.9	7.3	7.7	8.0
Transportation and public utilities	7.3	8.0	10.0	10.6	12.3	13.2	14.2	15.0	15.9	16.2
Wholesale trade	(D)	(D)	(D)	11.4	14.4	16.0	17.3	18.6	19.9	20.8
Retail trade	21.9	25.1	35.0	40.5	50.6	56.9	62.6	67.2	72.0	75.5
Finance, insurance, and real estate	6.1	8.4	11.4	13.6	17.3	19.4	21.2	22.6	23.9	24.4
Service	(D)	(D)	(D)	50.1	66.0	76.3	84.8	91.3	96.8	104.3
Government and government enterprises	33.5	39.6	47.6	53.7	58.3	60.8	63.2	65.3	66.5	65.5
Federal, civilian	1.5	1.6	1.6	1.9	2.0	2.0	2.1	2.2	2.2	2.2
Federal, military	1.9	2.0	2.1	2.4	2.4	2.4	2.4	2.4	2.4	2.4
State and local	30.0	36.0	43.9	49.5	53.8	56.4	58.7	60.8	61.9	60.9

SOURCE: 1985 OBERS BEA REGIONAL PROJECTIONS, Volume 2, U.S. Department of Commerce, Bureau of Economic Analysis historical trends. The methodology used to project future land use is contained in Appendix B. The land use projections were made for the U.S. Army Corps of Engineers by the Louisiana State Planning Office.

Substantial urban growth is expected to occur in East Baton Rouge Parish. The future land use projections indicate a strong growth trend for the Baton Rouge urbanized area toward the east southeast. The transportation facility provided by Interstate 10 and Airline Highway is undoubtedly a major factor in directionality of this growth. A second area of growth toward the east along Interstate 12 is also highly significant. Growth to the north and northeast is weak, though the Zachary-Baker area appears to have the strongest history of development in the sector. Future growth patterns described above are supported by the East Baton Rouge City Parish Planning Commission.

East Baton Rouge Parish has plenty of available land for expansion in all directions of the city of Baton Rouge except the west. Factors such as highway improvements, changes in attitudes toward certain areas, and the location of major employers could influence variances from the patterns predicted by the historical trends used for the projections in the study area.

For the purpose of projecting future land use, the area was grouped into eight regions. East Baton Rouge Parish is located in portion on all of 6 of the 8 regions. Regions followed subbasin boundaries as shown in Plate 4. Table 20 summarizes future land use in the region. The northwest region is an area of generally slow growth. In the time period preceding the period of record for this study, the area experienced a more rapid expansion due to the "urban retreat" of many of the blue collar workers from the industrial facilities of north Baton Rouge. These facilities have decreased employment in recent years and the growth of the area has correspondingly declined. Within the study period most of the growth recorded occurred in the area around Zachary, Louisiana. This is probably due, in part, to the influx of workers for the construction of the River Bend Nuclear Generator several miles to the north. Subbasin 1, located to the west of Zachary is the most rapidly

TABLE 20

TABLE 20
FUTURE LAND USE BY GROWTH REGIONS, 1978-2047
(Acres)

	BATON ROUGE URBAN REGION							
YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	AGRICULTURE	FOREST	TRANSITION	WATER, WET LANDS, QUARRY	TOTAL
1978	26809	9941	7451	4563	10316	961	1173	61214
1985	30431	10783	7576	3258	7608	297	1261	61214
1990	31369	11459	7665	2531	6880	46	1261	61214
1995	32073	11930	7755	2034	6137	23	1261	61212
1996	32213	12024	7772	1935	5908	18	1261	61212
1997	32354	12118	7790	1835	5839	14	1261	61212
2000	32776	12401	7844	1637	5393	0	1261	61212
2007	33211	12684	7969	1193	4896	0	1261	61214
2010	33597	12805	8023	1046	4683	0	1261	61215
2017	33769	13047	8148	851	4158	0	1261	61214
2020	33929	13150	8202	739	3933	0	1261	61214
2027	34108	13266	8327	656	3596	0	1261	61215
2030	34185	13316	8381	621	3451	0	1261	61215
2037	34356	13428	8506	487	3178	0	1261	61216
2040	34429	13476	8560	430	3061	0	1261	61217
2047	34600	13588	8685	296	2788	0	1261	61218

growing area. In projected to be a rapid growth area in the future. About 7.8% of the total growth in the study area is slated for this area which makes up over 13% of the total acreage in the study area.

The northeast is an area of very slow growth. Transportation routes to the area are not well developed and the area is quite a distance from major employers. Much of the land in subbasins 55, 56, 57, and 58 is within the actual valley of the Amite River and is ill-suited for development. The remaining subbasin, 53, is projected for slow growth which might increase upon the modification of transportation to the area. This area is not likely to contribute greatly to the problems associated with development within the foreseeable future. The entire area is slated for only about 1.5% of the growth for the study area while it covers about 12% of the total area.

This central region, located to the northeast of urbanized Baton Rouge, is likely to experience moderate growth in the future. Though transportation routes are inadequate, the area is near enough to the urbanized area to be highly likely to receive continued development. Portions of the region are within the valleys of the Amite and Comite and not suitable for development, which fact has and will continue to limit the growth in the area. Improvements to the transportation facilities in the area would likely increase the growth potential. The central region, while away from the growth focus for the study area, is likely to experience development at a nearly average rate for the study area. This area, representing roughly 4% of the study area, is projected to receive 3.5% of the area growth.

The Baton Rouge urban region is already heavily urbanized. Several of the subbasins are virtually completely developed at the present time (11, 15, 20, 23, 26, 27). Areas in the southern and eastern parts of this area are projected to become fully developed early in the projection period. The only subbasins not projected to be fully developed by 2040 are 16 (to the north), 24, and 48. While subbasin 16 is not likely to grow rapidly, subbasins 24 and 48 will likely become fully urbanized in the near future. The model apparently mispredicted for these two subbasins in part due to their small size.

Subbasin 21 is not projected for full urbanization until 2030. This subbasin contains two large parcels of land, the Burden tract and the Whitter tract, which may not develop in the foreseeable future. The Burden tract is administered by the Louisiana State University College of Agriculture as a park area and a research farm. The Whitter tract is owned by an individual who wishes the area remain in farmland and forest. Most of the remainder of the subbasin is fully developed at the present time. This region is projected to experience 14.9% of all growth in the study area despite its present high degree of urbanization and small areal extent of less than 8% of the total study area.

This rapidly developing southern region located to the south and southeast of the urbanized area contains the major traffic arteries, I-10 and Airline Highway. Major industrial sites are located along the Mississippi River portion of this region. The area serves as the place of residence for workers in both Baton Rouge and the river industries. Commercial growth is strong in the northern portion of the area, as well. Subbasins 43 and 60 will probably never become densely developed because much of the land is divided into parcels of one to five acres with single family residences located upon them. Subbasin 29 has a very great potential for growth as it is located quite near the center city of Baton Rouge and to the Louisiana State University major employer. It also borders on the Mississippi River which provides opportunities for industrial expansion. The five subbasins in this region, comprising only 7% of the study area, are projected to receive 29.7% of all growth in the study area. This region will show the greatest transformation of land uses by far.

Future urbanization will directly affect streamflow rates and flooding potential in the parish. This is therefore an important factor in determining future flood control needs. Increases in urban development were projected for each watershed under study. Projected urban land use, along with its increase over existing conditions, is shown in Table 21.

TABLE 21

EXISTING AND PROJECTED LAND USE

WATERSHED	EXISTING URBAN LAND USE FOR 1985 (in acres)	URBANIZATION AS PERCENT OF TOTAL LAND USE	PROJECTED URBAN LAND USE FOR 2040 (in acres)	URBANIZATION AS PERCENT OF TOTAL LAND USE
Blackwater Bayou	2882	31%	3742	40%
Beaver Bayou	2798	35%	3932	50%
Ward Creek	20208	71%	24702	97%
Jones Creek	12963	77%	15926	95%
Bayou Fountain	6420	25%	14863	65%
Claycut Bayou	4932	51%	9048	90%
Bayou Manchac	2625	35%	7099	94%

Source: U.S. Army Corps of Engineers, New Orleans District

Biological Resources

Problems to biological resources consist primarily of the loss of wooded lands and its associated wildlife habitat and habitat quality caused by residential and commercial development. All upstream development contributes to aquatic habitat problems because of the resulting amount of runoff from urban areas and the deterioration of water quality. Development of the wooded zone adjacent to the streams is a problem of major concern.

Water Resources

Future water use for the Louisiana portion of the Amite River Basin is shown on Table 22. Water use is expected to significantly increase between 1980 and 2040. Water supply sources have been determined to be capable of meeting the projected requirements in East Baton Rouge Parish.

There is no indication that water quality in the Comite River, Amite River, or Lake Maurepas would worsen in the future. In fact, it seems that the water quality of the aforementioned water bodies would improve as a result of the implementation of the waste management practices set forth in the Louisiana water quality management plan. The East Baton Rouge Parish's plan is to divert a large portion of the municipal waste that is currently being discharged to tributaries of the Amite River to the Mississippi River. This should improve water quality in the future.

Cultural Resources

Six trends affect preservation of cultural resources in the study area. The first is urbanization encroaching on the central basin from its western and southern edges. The region's annual flooding pattern has limited twentieth century settlement choices. As a consequence, construction has been roughly contained within corridors along major highways, inadvertently protecting riverine oriented prehistoric sites and early homesteads from rezoning and large scale clearing usually associated with construction of tract housing or light industry. This trend is slowly changing as developmental

TABLE 22

FUTURE WATER USE IN THE LOUISIANA PORTION OF AMITE RIVER BASIN

(million gallons per day)

		PUBLIC SUPPLY		INDUSTRIAL		POWER GENERATION		RURAL DOM.	LIVE STOCK		RICE		OTHER IRRIG.		AQUACULTURE		TOTAL		
	YEAR	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	TOTAL
EAST	1990	58.60	0.00	93.54	128.34	6.80	3.87	2.43	0.19	0.03	0.00	0.00	0.15	0.00	0.15	0.00	162.06	132.74	294.80
BATON	2000	67.36	0.00	107.03	172.70	6.73	3.76	3.00	0.23	0.03	0.00	0.00	0.15	0.00	1.05	0.00	185.57	176.49	362.06
ROUGE	2010	85.21	0.00	120.52	216.56	6.67	3.65	3.57	0.27	0.03	0.00	0.00	0.14	0.00	1.10	0.00	217.48	220.24	437.72
	2020	102.50	0.00	134.01	260.42	6.60	3.54	4.15	0.31	0.03	0.00	0.00	0.14	0.00	1.16	0.00	248.87	263.99	512.86

Source: Louisiana Department of Transportation and Development corridors widen. Clearing removes sites which are close to the surface, then exposes remaining deposits to lateral erosion from increased localized run-off. Riverine sites are directly impacted by development of recreational camps along the Amite River. Camp building, a second trend, localizes construction impact without areal clearing. Campsite selection echoes prehistoric and eighteenth century site selection, disturbing and adding a modern component to sites on the natural levee. Vandalism, a third trend, has been identified by the State Archeologist as prevalent near urban areas where obvious sites, such as mounds or those exposed by construction, are at jeopardy because of their accessibility. A fourth trend, also associated with development and land use change, is insensitive alteration or modification of historic structures which otherwise might be eligible to the National Register of Historic Places. Fifth is agricultural cropping north and east of Baton Rouge which disturbs subsurface deposits during clearing, plowing, and deep tilling of the soil. The final trend is prolonged flooding, followed either by alluviation or scouring of sites adjacent to channels. Scouring, which destroys site integrity, is a factor of elevational slope and natural channel migration. By contrast, alluvial and colluvial deposition buffers sites from shallow surface disturbance and may be interpreted as having some positive preservation benefit. All six of these trends are active in the study area, and can be expected to continue at present rates.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Flood Control

Flooding is a reoccurring problem in East Baton Rouge Parish as indicated by data in Table 15. These floods have caused millions of dollars in damages.

There is a need to reduce or alleviate flood problems in East Baton Rouge Parish. Partial or full flood protection would reduce the financial risk involved to home owners and businesses. These opportunities could be realized by constructing storm water retention basins, channel modification, diversions levees, floodgates, pumping stations, floodplain management and nonstructural measures.

Streambank Erosion Problems

Soil conditions vary throughout the parish. In the south, streambanks generally consist of silts and clays and have only a moderate amount of erosion problems. In the central part of the parish combinations of clay, silt, loess, and sand occur along the streambanks. Where loess layers are significant, erosion rates are high, and in some locations extreme. In many locations, residential and commercial developments border these highly erodible streambanks and significant property losses have, and continue to occur. The northern part of the parish has far less loess on the streambanks, but numerous locations having loose sands exist. Erosion rates vary depending on the occurrence of these loose sands. Development in the north is less dense than the central part of the parish and few structures encroach on the streambanks. The opportunity exists to reduce streambank erosion problems where flood reduction measures are implemented.

Water Quality

Water quality in the basin has deteriorated in the lower basin due to municipal and industrial discharges, urban stormwater runoff, and to a lesser extent, agricultural runoff. The implementation of the state water quality management plan and East Baton Rouge Parish's plan to discharge most of municipal waste to the Mississippi River should improve water quality. The need to improve water quality of the Amite River and Tributaries extends beyond the expected benefits from the above and all opportunities to do so should be considered in plan development.

Biological Resources

There is a need to slow the trend of habitat and habitat quality reduction for both terrestrial and aquatic species. Mitigation opportunities for both terrestrial and aquatic species should be considered an essential part of any Federal action plan developed.

Recreation Resources

Population expansion in Baton Rouge would, in time, overload existing recreation facilities requiring additional park development to satisfy the greater demand. The Horizon Plan, a comprehensive land use plan developed by the East Baton Rouge City Planning Commission, and long range plans of BREC identify substantial recreational improvements, including bike trails, parks, and other features for future development.

PLANNING CONSTRAINTS

Legislative and executive authorities specify constraints and criteria that must be applied when evaluating alternative plans and the range of impacts to be assessed. In developing plans, tangible and intangible benefits and costs are considered as well as effects on the ecological, social, and economic well-being of the region. Federal participation in development requires that any plan be complete within itself, efficient and safe, economically feasible in terms of current prices, environmentally acceptable, and consistent with local, regional, and state plans.

The plan formulation goal for this study is to develop alternative plans to reduce flood damages caused by headwater and backwater flooding along major tributary streams in East Baton Rouge Parish. These tributary streams includes Jones Creed and tributaries, Ward Creek and Tributaries, Beaver Bayou and Tributaries, Blackwater Bayou and Tributaries, and Monte Sano Bayou. Flooding along with the Comite and Amite Rivers and lower tributary streams are being addressed in other studies.

Where possible, proposed improvements will be limited to the existing right-of-way owned by the parish adjacent to major drainage channels to minimize relocations of residents and businesses. Rights-of-way required for proposed channel modification could be extended, if necessary, beyond existing rights-of-way.

PLANNING OBJECTIVES

Planning objectives stem from national, state, and local water and related land resources management needs specific to the study area. These objectives have been developed through problem analysis and an intense public involvement program. They have provided the basis for plan formulation. The planning objectives are as follows:

a. Reduce flood damages associated with headwater and backwater flooding tributary streams in East Baton Rouge Parish.

b. Minimize adverse environmental and aesthetic impacts associated with the implementation of flood control measures.

c. Reduce streambank erosion in areas where channel modifications may be required.

d. Minimize to the extent possible the destruction of archaeological and historical resources.

e. Minimize particularly the loss of bottomland hardwood forest or if not possible, mitigate those losses "in kind" to the extent practicable.

f. Mitigate for all unavoidable impacts to significant fish, wildlife and wetland resources.

g. Locate mitigation sites inside the study area if practicable.

h. Incorporate to the extent possible recreation facilities in flood control plans to increase recreation opportunities.

DEVELOPMENT OF ALTERNATIVE PLANS

MANAGEMENT MEASURES

Structural measures considered for reducing flood damages includes the following:

Stormwater Retention Basins
Channel modification
Levees
Channel Diversion
Pump Station(s)

These measures would also address other planning objectives. Nonstructural measures considered included:

Floodplain Management
Raise Structures in Place
Build Small Earthen Levees or Floodwalls
Ring Levees around Selected Subdivisions
Flood Forecasting and Warning
Removal of Structures from Floodplain

PLAN FORMULATION RATIONALE

The Water Resources Council Principles and Guidelines require various alternative plans be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated. Each alternative is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Completeness is the extent to which a given alternative plan provides for all necessary investments or other actions to ensure the realization of the planned effects. Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment. Acceptability is the workability and viability of the alternative plan with respect for acceptance by state and local entities and the public, and compatibility with existing laws, regulations, and public policies. In addition, mitigation of adverse effects is to be an integral part of each plan. In general, when formulating alternative plans, an effort is made to include only increments that increase the net NED benefits on a first- and last-added basis.

Plan formulation for the East Baton Rouge Parish study was an iterating and dynamic process. Initial plans formulated were based on the results obtained in the Initial Evaluation Report published in November 1984, previous Corps and state studies, and the East Baton Rouge Parish Department of Public Works Drainage Plan contain in the capital outlay budget and the Horizon Plan. Alternative plans were formulated watershed by watershed because the hydrology, for all practical purposes, is independent and would not be influenced from watershed to another. The Plan Formulation process is described in subsequent paragraphs watershed by watershed.

The Comite River Diversion Plan was not considered in the evaluation of initial alternatives. The Diversion Plan's effect was considered in the final analysis of the Recommended Plan. From this analysis, it was determined that this project does not significantly affect the plan formulation in any watershed. Stage lowerings will be realized in each watershed's lower most reaches from the Diversion. This only affects backwater flooding which, for all practical purposes, does not affect the anticipated performance of the Recommended Plan.

BLACKWATER BAYOU

The Blackwater Bayou Watershed is located north of the City of Baton Rouge. See Plate 2. Blackwater Bayou is a tributary of the Comite River. Major tributaries of Blackwater Bayou include Blackwater Bayou Tributaries #1 and #2. This watershed encompasses about 15 square miles.

Land use in the watershed is mostly agricultural and forest with urban lands making up 31 percent of the watershed. Land use maps for 1972 and 1985 are shown on Plates 2 and 3 of Appendix J. There are approximately 1,223 residential and commercial structures located within all flood zones in the watershed. The distribution of structures within the various floodplains is shown in Table 23. The approximate 10-year floodplain boundary is shown on Plate 5. Calculated without project equivalent annual flood damages for all subbasins in this watershed are listed in Table 24. Methodology used in calculating these values can be found in the Economics Appendix H.

Flooding in this watershed is primarily headwater in nature. Some backwater problems occur, but only in close proximity to the bayou's confluence with the Comite River. Backwater flooding is not a significant factor in this watershed. Interbasin flow from the Comite River occurs for flooding events above the 25-year events. Flood events above the 25-year event are predominantly Comite River flows and were addressed by the Comite River Diversion project.

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Due to the lack of topographical relief in this watershed, detention/retention storage basins were determined to be impractical. Required basin containment structures, primarily earthen levees, in conjunction with land requirements would be excessive in order to achieve significant flow retention.

TABLE 23

BLACKWATER BAYOU - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BASIN NAME: BLACKWATER BAYOU WITHOUT PROJECT							
13	1-STORY	198	72	332	182	62	110	[illegible]
	2-STORY	24	3	9	7	2	5	50
	MOBILE HOME	4	5	21	9	21	101	161
	COMMERCIAL	10	5	18	10	4	9	56
	TOTAL	236	85	380	208	89	225	1,223

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 24

BLACKWATER BAYOU
CALCULATED WITHOUT PROJECT EQUIVALENT ANNUAL FLOOD DAMAGES

BASIN	REACH	EQUIVALENT ANNUAL DAMAGES WITHOUT PROJECT*
13	A	$ 294,000
	B	$ 284,000
	C	$ 168,000
	D	$ 301,000
	E	$ 23,000
	F	$3,492,000
	G	$ 478,000
	H	$ 13,000
	I	$ 523,000
	TOTAL	$5,581,000

* 2nd QUARTER 1994 PRICE LEVELS

Source: U.S. Army Corps of Engineers, New Orleans District

Channel Modifications

Channel improvements to the main stem and the large tributary of Blackwater Bayou were determined to be practical options and were investigated.

Hydrologic models indicate that inter-basin flow from the Comite River occurs for floods in excess of the 25-year event. It was therefore determined that channel modifications for Blackwater Bayou for larger flood events would be either ineffective and/or cost-prohibitive. Analysis was therefore limited to 25-year and 10-year channel designs, as well as a minimum scheme consisting of clearing and snagging the entire channel and tributaries. Alternative combinations that include or exclude both tributaries were considered for this analysis.

Hydraulic modelling and channel designs were performed to determine required channel modifications. Relocation of major channel obstructions (bridges and culverts) were also identified.

Although the presence of sands in some locations may necessitate some degree of erosion protection, general conditions in this watershed allow earthen channel design. The benefits of a concrete-lined channel were also considered and evaluated in these alternative plans.

A summary of initial structural alternative plans for Blackwater Bayou are shown in Table 25. Detailed alternative plan descriptions are listed in Table 26. Alternative plans are shown on Plates 11 through 15.

It was determined that the environmental impacts of channel modification alternative plans would generally be limited to the destruction of some bottomland hardwood forestation that occurs along the channel banks. These impacts can be readily mitigated by equivalent reforestation of existing cleared lands or by protecting equivalent areas of existing forested lands.

Existing disposal areas were investigated to avoid the adverse environmental impact. The East Baton Rouge Parish of Public Works identified the parish landfill as the place to haul excavated material. Therefore, the initial cost estimates were developed assuming that excavated material would be hauled to this location. See Plate 51.

Nonstructural Measures

Nonstructural solutions for the Blackwater Bayou area include elevating or floodproofing structures, ring levees around selected subdivisions, buy-out and relocation of structures subject to repetitive flooding. The majority (est. 75 percent) of existing residential and commercial structures in the area are constructed on slab foundation. Subdivisions in this watershed are not densely congested and are spaciously developed. Ring levees around selected subdivisions could be economically favorable in a few select areas. Buy-out and relocation were evaluated in conjunction with other floodproofing techniques. Preliminary cost data indicated the cost per (flooded) structure for nonstructural alternatives were significantly higher than the cost per structure for channel modification plans. No nonstructural alternatives were, therefore, identified for analysis in the initial alternatives for the watershed.

TABLE 25

BLACKWATER BAYOU - INITIAL ALTERNATIVE PLAN SUMMARY

ALTERNATIVE PLAN	DESCRIPTION
BW-P1	10-Year Earthen Channel Without Tributaries
BW-P2	10-Year Earthen Channel With Tributary #1
BW-P3	25-Year Earthen Channel Without Tributaries
BW-P4	25-Year Earthen Channel With Tributary #1
BW-P5	10-Year Concrete-Lined Channel Without Tributaries
BW-P6	10-Year Concrete-Lined Channel With Tributary #1
BW-P7	Minimum Clearing and Snagging of Main Channel and Tributary #1
--	No Action

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 26

BLACKWATER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BW-P1	**Blackwater Bayou**		Improvements from Mouth to Greenwell Springs Road. 10-year earthen channel design.
		varies	Mouth to Hooper Road
		35'BW	Hooper Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 50 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 112 ft)
		improve bridge	Carey Road (lengthen 50 ft)
		improve bridge	Dyer Road (lengthen 35 ft)
		improve bridge	Blackwater Road (lengthen 45 ft)
		improve bridge	McCullough Road (lengthen 35 ft)
		15'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1		No Work
	Tributary #2		No Work
BW-P2	**Blackwater Bayou**		Improvements from Mouth to Greenwell Springs Road. 10-year earthen channel design
		varies	Mouth to Hooper Road
		35'BW	Hooper Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 50 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 112 ft)
		improve bridge	Carey Road (lengthen 50 ft)
		improve bridge	Dyer Road (lengthen 35 ft)
		improve bridge	Blackwater Road (lengthen 45 ft)
		improve bridge	McCullough Road (lengthen 35 ft)
		15'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1	5' BW	Mouth to McCullough Road
		improve bridge	Core Lane (lengthen 16 ft)
	Tributary #2		No Work

TABLE 26 (CONTINUED)

BLACKWATER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BW-P3	**Blackwater Bayou**		Improvements from Mouth to Greenwell Springs Road. 25-year earthen channel design
		70'BW	Mouth to Hooper Road
		50'BW	Hooper Road to Dyer Road
		improve bridge	Blackwater Road (lengthen 65 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 127 ft)
		improve bridge	Carey Road (lengthen 65 ft)
		improve bridge	Dyer Road (lengthen 35 ft)
		35'BW	Dyer Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 45 ft)
		improve bridge	McCullough Road (lengthen 35 ft)
		15'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1		No Work
	Tributary #2		No Work
BW-P4	**Blackwater Bayou**		Improvements from Mouth to Greenwell Springs Road. 25-year earthen channel design
		70'BW	Mouth to Hooper Road
		50'BW	Hooper Road to Dyer Road
		improve bridge	Blackwater Road (lengthen 65 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 127 ft)
		improve bridge	Carey Road (lengthen 65 ft)
		improve bridge	Dyer Road (lengthen 35 ft)
		35'BW	Dyer Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 45 ft)
		improve bridge	McCullough Road (lengthen 35 ft)
		15'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1	5'BW	Mouth to McCullough Road
		improve bridge	Core Lane (lengthen 16 ft)
	Tributary #2		No Work

TABLE 26 (CONTINUED)

BLACKWATER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BW-P5	Blackwater Bayou		Improvements from Mouth to Greenwell Springs Road. 10-year channel design (concrete lined)
		varies	Mouth to Hooper Road (earthen channel) 3.5:1 ss
		varies	Hooper Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 15 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 68 ft)
		improve bridge	Carey Road (lengthen 10 ft)
		improve bridge	Dyer Road (lengthen 10 ft)
		improve bridge	Blackwater Road (lengthen 10 ft)
		improve bridge	McCullough Road (lengthen 10 ft)
		5'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1		No Work
	Tributary #2		No Work
BW-P6	Blackwater Bayou		Improvements from Mouth to Greenwell Springs Road. 10-year channel design (concrete lined)
		varies	Mouth to Hooper Road (earthen channel) 3.5:1 ss
		varies	Hooper Road to Old Settlement Road
		improve bridge	Blackwater Road (lengthen 15 ft)
		remove bridge	Abandoned bridge at Crumholt Road (remove)
		improve bridge	Crumholt Road (lengthen 68 ft)
		improve bridge	Carey Road (lengthen 10 ft)
		improve bridge	Dyer Road (lengthen 10 ft)
		improve bridge	Blackwater Road (lengthen 10 ft)
		improve bridge	McCullough Road (lengthen 10 ft)
		5'BW	Old Settlement Road to Greenwell Springs Road
		improve culvert	Greenwell Springs Road (clean existing culvert)
	Tributary #1	5'BW	Mouth to McCullough Road
		improve bridge	Core Lane (lengthen 16 ft)
	Tributary #2		No Work

TABLE 26 (CONTINUED)

BLACKWATER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
		improve culvert	Private Road (replace 4' circular culvert with three 10' x 6')
BW-P7		N/A	Minimal channel modification
	Blackwater Bayou		Mouth to Greenwell Springs Road - Clear and snag
	Tributary #1		Mouth to McCullough Road - Clear and snag
	Tributary #2		No Work

NOTE: All earthen channel design embankment slopes 3.5 H : 1.0 V; All concrete design slopes 3.0 H : 1.0 V

Source: U.S. Army Corps of Engineers, New Orleans District

Screening of Initial Alternative Plans

Project costs, benefits, and potential adverse environmental impacts were used as the screening mechanisms. In this iteration, only major cost items - construction, relocations, real estate, and annual operations and maintenance were developed. Benefits calculated in this part of the analyses were "direct" property inundation flood damage reductions plus an estimated percentage (20%) of "indirect" flood damage reduction benefits. "Indirect" items include such items as public agency emergency costs, flood insurance reductions, and lower construction costs within the floodplain.

Cost-benefit calculations for each alternative plan are shown in Table 27. A period of 50 years and an annual interest rate of 8.00% were used to calculate equivalent annual values. Costs and benefits shown are all relative to the base condition or "No Action" Plan. No mitigation cost was considered in the initial screening. However, methods to avoid adverse environmental impacts and mitigation measures were considered in plan formulation. It should be noted that costs and benefits were not calculated for Plan BW-P7, minimal clearing and snagging of the main channel and tributaries. Initial hydraulic analysis indicated that only minimal stage lowerings could be achieved and that flood reduction benefits would be minimal. No further analysis was done on this plan since it was determined that it would not be a comprehensive solution to flood damage in this watershed.

TABLE 27

BLACKWATER BAYOU
ECONOMIC ANALYSIS OF INITIAL ALTERNATIVE PLANS

PLAN	FIRST COST	ANNUAL COSTS	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
BW-P1	$7,141,000	$637,000	$683,000	$46,000	1.07
BW-P2	$9,130,000	$821,000	$3,306,000	$2,485,000	4.03
BW-P3	$10,336,000	$903,000	$828,000	($80,000)	0.91
BW-P4	$12,195,000	$1,081,000	$3,465,000	$2,384,000	3.21
BW-P5	$19,405,000	$1,714,000	$694,000	($1,020,000)	0.40
BW-P6	$30,750,000	$2,732,000	$3,986,000	$1,254,000	1.46
BW-P7	N/A	N/A	N/A	N/A	N/A

Source: U.S. Army Corps of Engineers, New Orleans District

The cost-benefit calculations revealed that four of the six plans have higher benefits relative to their costs. Both the 10-year and 25-year channel modification plans, that include Tributary, No. 1 have net benefits that are significantly higher than all other alternative plans. In addition to these two plans, only Plan BW-P6, concrete lined channel and Tributary, No. 1 had significant net benefits relative to base conditions. Net benefits for this plan were determined to be significantly less than the two earthen channel options. Since this concrete lined channel plan is significantly more costly, it was not considered further.

Analysis of Final Alternative Plans

Plans selected for final analyses are: BW-P2, 10-year earthen channel modification with Tributary No.1; BW-P4, 25-year earthen channel modification with Tributary No.1; and No Action. Since no alteration was made to either plan, details shown in the Initial Alternative Plans are the same. Final alternative plans were evaluated relative to National Economic Development, Environmental Quality, Regional Economic Development, and Social Effects. A summary of this analyses is shown in Table 28.

National Economic Development (NED)

In the final analyses, environmental mitigation costs were included in each alternative plan's cost. It should be noted that the mitigation plan combines all mitigation requirements from all watersheds. Consolidating mitigation sites was determined to be far more practical than establishing individual mitigation sites for each watershed in the study area. Costs were prorated to each watershed based on the amount of the alternative plan woodland habitat losses. A complete description of the mitigation plan and analysis can be found in Appendix E, Section 1.

Alternative plan benefits and costs are listed in Table 28. As in the initial screening, a period of 50 years and 8.00% annual interest were used. Alternative Plan BW-P2, the 10-year earthen channel, has the highest estimated net annual benefits of $2,419,000. This is just slightly higher than the $2,270,000 per year net benefits estimated for Plan BW-P4, the 25-year earthen channel. Both plans obviously have significant net economic benefits relative to No Action. Relative to each other, the estimated difference is very small and probably well within uncertainty and error margins, Plan BW-P2 does, however, have a significantly lower total first cost of $9,838,000 relative to the $13,409,000 for Plan BW-P4. This difference makes the 10-year earthen channel plan preferable relative to NED criteria.

TABLE 28

BLACKWATER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	BW-P2 (RECOMMENDED PLAN)	BW-P4	NO ACTION
I.	PLAN DESCRIPTION	10-YEAR EARTHEN CHANNEL WITH TRIBUTARY #1	25-YEAR EARTHEN CHANNEL WITH TRIBUTARY #1 #1 AND #2	
II.	NATIONAL ECONOMIC DEVELOPMENT			
	A. PROJECT FIRST COST	$9,838,000	$13,409,000	$0
	B. O&M COST	$51,000	$56,000	$0
	C. TOTAL AVERAGE ANNUAL COSTS	$887,000	$ 1,195,000	$0
	D. TOTAL AVERAGE ANNUAL BENEFITS	$3,306,000	$ 3,465,000	$0
	E. NET ANNUAL BENEFITS	$2,419,000	$ 2,270,000	$0
	F. BENEFIT-COST RATIO	3.70	2.90	N/A
III.	ENVIRONMENTAL QUALITY			
	A. AGRICULTURAL LANDS	127 ACRES DIRECTLY IMPACTED BY FOREST REPLANTING	217 ACRES DIRECTLY IMPACTED BY FOREST REPLANTING	SOME ADVERSE IMPACT DUE TO RECURRING FLOODING
	B. FORESTLANDS	77 ACRES AFFECTED BY PROJECT; 127 ACRES WOULD BE CREATED VIA MITIGATION	141 ACRES AFFECTED BY PROJECT; 217 ACRES WOULD BE CREATED VIA MITIGATION	MINISCULE REDUCTION
	C. THREATENED AND ENDANGERED SPECIES	NONE AFFECTED	NONE AFFECTED	NONE AFFECTED
	D. AQUATIC RESOURCES AND WATER QUALITY	SHORT-TERM ADVERSE IMPACT DURING CONSTRUCTION; LONG-TERM EFFECTS MINOR	(SAME AS BW-P2)	NO IMPACT

TABLE 28 (CONTINUED)
BLACKWATER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	BW-P2	BW-P4	NO ACTION
E. SEDIMENTATION	PROJECT WILL REDUCE STREAMBANK EROSION; LARGER CHANNEL WILL INCREASE DEPOSITION	(SAME AS BW-P2; SLIGHTLY WORSE)	NO IMPACT
F. AIR QUALITY	MINOR SHORT-TERM IMPACTS DURING CONSTRUCTION	(SAME AS BW-P2)	NO IMPACT
G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT	NO IMPACT	NO IMPACT
H. CULTURAL PROPERTIES	THREE SITES ARE KNOWN TO OR PROBABLY EXIST IN PROJECT AREA. MODERATE CHANCE OF UNCOVERING UNKNOWN SITES. EFFORT TO IDENTIFY SITES WILL BE MADE AND WORK CAN BE DESIGNED TO AVOID ANY SIGNIFICANT SITES.	(SAME AS BW-P2)	NO IMPACT
IV. REGIONAL ECONOMIC DEVELOPMENT			
A. REGIONAL INCOME AND EMPLOYMENT	IMPROVED VALUE WILL LIKELY FACILITATE URBAN GROWTH	(SAME AS BW-P2; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCREASED EMPLOYMENT FOR CONSTRUCTION; BETTER ECONOMIC CLIMATE DUE TO REDUCTION IN FLOOD THREAT	(SAME AS BW-P2; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
C. TAX REVENUE	IMPROVED FLOOD PROTECTION WILL STABILIZE TAX BASE	(SAME AS BW-P2; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
D. PROPERTY VALUE	IMPROVED FLOOD PROTECTION WILL LIKELY STABILIZE OR RAISE PROPERTY VALUES	(SAME AS BW-P2; SLIGHTLY BETTER)	PROPERTY VALUES MAY DECLINE DUE TO RECURRING FLOODING

TABLE 28 (CONTINUED)
BLACKWATER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	BW-P2	BW-P4	NO ACTION
V. SOCIAL EFFECTS			
A. URBAN AND COMMUNITY IMPACTS	POSITIVE IMPACTS DUE TO IMPROVED FLOOD PROTECTION	(SAME AS BW-P2; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
B. LIFE, HEALTH, AND SAFETY	THREAT TO LIFE, HEALTH, AND SAFETY REDUCED	(SAME AS BW-P2; SLIGHTLY BETTER)	RECURRING FLOODS THREATEN LIFE, HEALTH, AND SAFETY
C. DISPLACEMENT	SOME TAKING OF UNIMPROVED PRIVATE PROPERTY (260 acres)	(SAME AS BW-P2)	NO IMPACT
D. LONG-TERM PRODUCTIVITY	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BW-P2; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
E. LEISURE	NO IMPACT	NO IMPACT	NO IMPACT
F. AESTHETIC	SOME ADVERSE IMPACT BY REMOVING TREES FROM CHANNELS; MITIGATED WITH REPLANTED TREE LINE	(SAME AS BW-P2)	NO IMPACT
G. COMMUNITY COHESION	PRESERVED DUE TO REDUCED FLOOD THREAT	(SAME AS BW-P2; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
H. COMMUNITY GROWTH	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BW-P2; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
I. TRANSPORTATION	MINOR DISRUPTION DURING CONSTRUCTION; IMPROVED SITUATION BY REDUCING FLOODING	(SAME AS BW-P2; SLIGHTLY BETTER)	SOME ADVERSE IMPACTS DURING FLOOD EVENTS
J. NOISE	MINOR INCREASE IN NOISE DURING CONSTRUCTION	(SAME AS BW-P2)	NO IMPACT
K. QUALITY OF LIFE	REDUCED FLOODING WILL SUBSTANTIALLY IMPROVE THE QUALITY OF LIFE FOR THOSE AFFECTED	(SAME AS BW-P2; SLIGHTLY BETTER)	ADVERSE IMPACTS FOR THOSE AFFECTED BY FLOODING

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Environmental Quality

Impacts on the following environmental factors were evaluated for each final alternative plan:

- Agricultural Lands
- Forestlands
- Threatened and Endangered Species
- Aquatic Resources and Water Quality
- Sedimentation
- Air Quality
- Historic Places
- Cultural Properties

Detailed analyses of these factors can be found in the Environmental Impact Statement and in Appendix E. Impacts are listed in summary in Table 28.

The only significant and long-lasting environmental impacts produced by the final alternative plans affect agricultural lands, forestlands, and floodplains. Both Alternative Plans BW-P2 and BW-P4 directly impact forestlands, 77 acres and 141 acres, respectively. This in turn indirectly impacts less significant agricultural lands as they are proposed to be converted to forestlands as mitigation for same. Plan BW-P2 will require 129 acres and Plan BW-P4 217 acres for reforestation mitigation. The loss of these agricultural land acres is not considered to be significant for this area. Flood stage lowerings associated with Plans BW-P2 and BW-P4 reduce the size of the 100-year floodplain.

Relative to each other, Alternative Plans BW-P2, the 10-year earthen channel, impacts significantly less agricultural and floodplain acres than does Plan BW-P4, the 25-year earthen channel. Therefore, next to No Action, Alternative Plan BW-P2 is the preferable alternative from an environmental quality standpoint.

Regional Economic Development

Reducing flood damage frequency and cost will improve economic growth, employment, property valuation, and tax revenue in the region. Conversely, allowing flooding to continue to occur could likely result in decreasing same. Direct economic benefits to existing property is included in the NED estimates above. Induced economic benefits are speculative to a large degree and are not calculated directly into the benefit-cost analysis. These items are addressed in the Economics Appendix H and are listed in summary in Table 28.

Both Plans BW-P2 and BW-P4 will significantly reduce flooding frequency and cost and therefore are far preferable to No Action given economic development considerations. Relative to each other, construction of the 25-year earthen channel alternative plan, BW-P4, will result in less frequent flooding and lower flood damages versus BW-P2, the 10-year plan.

Social Effects

Social effects considered in evaluating each alternative plan are listed in Table 28. Health, safety, and the quality of community life will obviously be significantly improved by both channel modification plans. Homes and businesses would be flooded less frequently. While no homes or businesses will be displaced, construction of either channel modification plan will, however, require the permanent taking of some private property. It was estimated that 260 acres of land are required for proposed channel enlargements for both BW-P2 and BW-P4. Almost all of the property required to be taken is either agricultural, pasture, rural, or vacant. This property loss will be a significant impact to the specific owners. Additionally, some minor traffic disruptions will occur in both plans in association with required bridge relocations.

Relative to No Action, the beneficial social impacts of both channel modification plans appear to far outweigh their adverse effects. The higher level of flood reduction associated with Plan BW-P4 appears to outweigh its higher real estate requirements relative to BW-P2. Therefore, the 25-year earthen channel, BW-P4, is preferable in this category.

Trade-Off Analyses and Plan Selection

The economic and social benefits of both channel modification alternative plans are far more significant than the slight environmental quality advantage of No Action.

Relative to each other, Alternative Plan BW-P2, 10-year earthen channel modifications, has an advantage in NED and environmental quality categories while Plan BW-P4 has some relative advantages concerning regional economic development and, to a lesser extent, social effects.

There is no question that both channel modification plans would significantly reduce flooding in the watershed and will have significant positive net benefits. There is therefore no apparent risk of non-performance of either plan. There are, however, uncertainties associated with project costs and flood reduction damage estimates. Calculated flood stage-frequencies, structure and content valuation, and project construction costs are sensitive to a wide range of variables considered in this evaluation. While these uncertainties were not quantified, it is obvious that the relative advantage in net economic benefits is smaller than the range of uncertainty. The uncertainty range will, for the most part, affect each alternative plan in a similar way. That is to say, that any significant change in variables that results in changing net values in one plan will almost certainly affect the other in the same fashion, but perhaps with a slightly greater or lesser magnitude.

Within the range of uncertainty and in consideration of all factors, there is very little net difference between Plans BW-P2 and BW-P4. Independent of uncertainties is the significant relative first cost advantage of Alternative Plan BW-P2. Based on the above, the 10-year earthen channel modification plan, Alternative Plan BW-P2, is the preferred structural alternative for this watershed.

Due to the presence of sandy soils in the area, the possibility exists that some erosion control measures will be needed on portions of any proposed channel enlargement. A system of geosynthetic fabric and rock would be proposed for these reaches. It is estimated that such a system would be rather costly at approximately $800,000 per mile of channel.

Through field and aerial inspections, it was determined that about 30-35% of the main channel and its tributary would likely require erosion control measures. Conservatively, erosion control was added in for 50% of the proposed project length. Relative to other channel modifications alternatives, there would be no significant net difference, and plan BW-P2 would still be the preferred alternative.

With 50% erosion control measures included, the cost of plan BW-P2 increases to $15,000,000. Net benefits reduce to $1,828,000 per year and the revised benefit-to-cost ratio decreases to 2.11.

Comparison to Selected Nonstructural Measures

With the inclusion of proposed erosion control measures, the preferred channel modification plan for this watershed exhibits a relatively high cost per structure in the affected floodplains. For this reason, selected nonstructural alternatives were revisited and evaluated in further detail.

Buy-outs, structure elevation, individual structure and subdivision ring levees were examined for this watershed. For the majority of residential structures, structure elevation, while expensive, was determined to be the most cost-effective and practical non-structural option. In a few cases, a subdivision ring levee with internal drainage was determined to be only slightly favorable to house raising. Table 29 illustrates ring levee and interior drainage cost for selected subdivisions in both the Blackwater and Beaver Bayou watersheds. Elevating commercial structures was found to be impractical in most cases. Given the above, elevating residential structures in combination with constructing earthen ring levees around individual commercial structures was determined to be both the most practical and comprehensive nonstructural options for this watershed.

Elevating residential structures and installing ring levees around commercial structures in the 10-year and 25-year floodplains were evaluated. In both cases, structures would be elevated or protected up to the 100-year flood elevation plus one foot. (This elevation is consistent with the parish's ordinance on new construction.)

Structures in the 10 and 25-year floodplains were identified and the required height of elevation or levee protection for each was calculated. Structures were grouped by this requirement and, for residential, by construction type (pier or slab). Table 30 and 31 list these structure groupings for the 10- and 25-year floodplains. Estimates were obtained from the Corps' National Flood Proofing Committees' Study and recent pilot projects in the Baton Rouge area. Ring levee costs were also based on a generalized approach of considering a 600-foot-long levee around each commercial structure. No interior drainage costs were included for this analysis. Tables 32 and 33, respectively, illustrate these costs for residential structure raising and ring levee construction.

Many of the structures located in the floodplain would not be suited for elevation and/or ring levee given structure condition and space constraints. These structures were determined from aerial photography and field investigations conducted for the structure inventory. Also, many residents would likely not wish to participate in an elevation program for various reasons. Given these factors, it is estimated that probably no more than 75 percent of property owners could, or would, participate in this program. Overall plan costs and benefits were, therefore, calculated based on a 75 percent participation rate.

The cost of elevating/protecting 75 percent of all residential and commercial structures in the 10-year floodplain is estimated at $10,725,000. This cost includes added contract administration (10%) and contingencies (10%). Implementation of elevating/protecting 300 structures would take a relatively long period of time, an estimated 5 years. Thus, the estimated total gross investment cost of this plan (includes interest lost during construction) is $13,078,000. The estimated first and gross investment costs for elevating/protecting approximately 350 structures in the 25-year floodplain are $12,600,00 and $15,360,000, respectively.

Flood damage reduction benefits were calculated for both the 10-year and 25-year floodplain structure elevation/protection plans. In both cases, flood damage reductions would be quite extensive. For the 10-year plan approximately 58 percent, or $2,530,000 per year, of all flood damages would be eliminated in the entire watershed. This value increases to 62 percent, or $2,712,000 per year, for the 25-year nonstructural plan.

At 8 percent interest rate over a 50-year period, the net economic benefits for the 10-year plan are estimated at $1,430,000 per year with a benefit-to-cost ration of 2.3 to 1. Estimates net economic benefits for the 25-year plan are estimated at $1,420,000 per year with a benefit to cost ratio of 2.1 to 1. Based on this analysis, elevating/protecting all structures in either the 10- or 25-year floodplain yield virtually the same net benefits.

In comparison to the preferred channel modification plan, calculated net benefits are significantly higher ($1,828,000 per year) for the channel plan. The 10-year channel modification plan, BW-P2, is therefore the Recommended Plan for this watershed.

TABLE 29

BLACKWATER AND BEAVER BAYOUS - ESTIMATED COSTS FOR RING LEVEES AROUND SELECTED SUBDIVISIONS

SUBDIVISION	Boganvlla	Carmel Acres	Centerra	Central Gardens	Talmadge Crumholt	Tanglwd	Welcome Heights	Winchester
# of Homes	10	98	6	86	5	38	10	54
Req. levee ht.	3	7	2.5	5.5	4.5	6	4.5	5.5
Levee L.F.	11,000	11,000	3,000	10,000	3,000	17,000	6,000	12,000
Acres protected	135	150	20	260	15	100	40	140
Pump sta. size	160 cfs	180	25	310	20	120	50	170
Levee cost	$ 270,000	$ 935,000	$ 60,000	$ 625,000	$142,500	$1,190,000	$285,000	$ 750,000
Pump sta & outfll $	$1,113,600	$1,252,800	$107,500	$2,157,600	$ 86,000	$ 875,000	$215,000	$1,183,200
Real Estate $	$ 16,000	$ 28,000	$ 4,000	$ 22,000	$ 6,000	$ 39,000	$ 11,000	$ 26,000
SubTtl Constrc $	$1,399,600	$2,215,800	$171,500	$2,804,600	$234,500	$2,104,000	$511,000	$1,959,200
S&A (7%)	$ 97,972	$ 155,106	$ 12,005	$ 196,322	$ 16,415	$ 147,280	$ 35,770	$ 137,144
PW of O&M	$ 260,000	$ 285,000	$ 61,250	$ 447,500	$ 55,000	$ 210,000	$122,500	$ 272,500
Subtotal	$1,757,572	$2,655,906	$244,755	$3,448,422	$305,915	$2,461,280	$669,270	$2,368,844
Cont. (25%)	$ 439,393	$ 663,977	$ 61,189	$ 862,106	$ 76,479	$ 615,320	$167,318	$ 592,211
Total cost	$2,196,965	$3,319,883	$305,944	$4,310,528	$382,294	$3,076,600	$836,588	$2,961,055
Cost per home	$ 219,697	$ 33,876	$ 50,991	$ 50,122	$ 76,479	$ 80,963	$ 83,659	$ 54,834

TABLE 29 (Cont'd)

BLACKWATER AND BEAVER BAYOUS - ESTIMATED COSTS FOR RING LEVEES AROUND SELECTED SUBDIVISIONS

SUBDIVISION	Bon Dickey	Brandon	Bridlewood	Cimmaron	El Ranchitos	JacksonJE's Park	Countrole Estates	McDonal Farm
# of Homes	9	6	53	41	11	33	6	3
Req. levee ht.	4	4	7	5	3	4	4	5
Levee L.F.	5,000	4,000	12,000	4,000	8,000	5,000	14,000	10,000
Acres protected	30	40	320	50	50	70	270	130
Pump sta. size	36	48	385	60	60	85	325	155
Levee cost	$200,000	$160,000	$1,020,000	$220,000	$200,000	$200,000	$ 560,000	$ 550,000
Pump sta & outfll $	$154,800	$206,400	$2,679,600	$258,000	$258,000	$365,500	$2,262,000	$1,078,800
Real Estate $	$ 9,100	$ 7,300	$ 31,800	$ 80,000	$ 12,400	$ 9,100	$ 25,600	$ 21,000
SubTtl Constrc $	$363,900	$373,700	$3,731,400	$558,300	$470,400	$574,600	$2,847,600	$1,649,800
S&A (7%)	$ 25,473	$ 26,159	$ 261,198	$ 39,081	$ 32,928	$ 40,222	$ 199,332	$ 115,486
PW of O&M	$105,000	$ 90,000	$ 541,200	$105,000	$135,000	$166,300	$ 466,300	$ 253,800
Subtotal	$494,373	$489,859	$4,533,798	$702,381	$638,328	$781,122	$3,513,232	$2,019,086
Cont. (25%)	$123,593	$122,465	$1,133,450	$175,595	$159,582	$195,281	$ 878,308	$ 504,772
Total cost	$617,966	$612,324	$5,667,248	$877,976	$797,910	$976,403	$4,391,540	$2,523,858
Cost per home	$ 68,663	$102,054	$ 106,929	$ 21,414	$ 72,537	$ 29,588	$ 731,923	$ 841,286

TABLE 30

BLACKWATER BAYOU - ESTIMATED NUMBER OF STRUCTURES TYPE OF CONSTRUCTION AND RAISING REQUIREMENTS FOR THE 10-YEAR FLOODPLAIN

RESIDENTIAL STRUCTURES

HEIGHT TO BE RAISED (FT)*	NUMBER OF STRUCTURES	ESTIMATED NUMBER OF SLAB STRUCTURES	ESTIMATED NUMBER OF PIER STRUCTURES
2.5 - 3.5	110	83	27
3.5 - 4.5	60	45	15
4.5 - 5.5	13	10	3
5.5 - 6.5	11	8	3
>6.5	2	1	1
TOTAL	196	147	49
(75% of TOTAL)	(147)	(110)	(37)

COMMERCIAL STRUCTURES

REQUIRED RING LEVEE HEIGHT (FT)*	NUMBER OF STRUCTURES
2.5 - 3.5	1
3.5 - 4.5	2
4.5 - 5.5	1
5.5 - 6.5	1
>6.5	5
TOTAL	10
(75% of TOTAL)	(8)

* REQUIRED TO PROTECT STRUCTURE UP TO THE 100-YEAR FLOOD PLUS ONE FOOT.

TABLE 31

BLACKWATER BAYOU - ESTIMATED NUMBER OF STRUCTURES
TYPE OF CONSTRUCTION AND RAISING REQUIREMENTS
FOR THE 25-YEAR FLOODPLAIN

RESIDENTIAL STRUCTURES

HEIGHT TO BE RAISED (FT)*	NUMBER OF STRUCTURES	ESTIMATED NUMBER OF SLAB STRUCTURES	ESTIMATED NUMBER OF PIER STRUCTURES
2.5 - 3.5	60	45	15
3.5 - 4.5	127	95	32
4.5 - 5.5	16	12	4
5.5 - 6.5	13	10	3
>6.5	13	10	3
TOTAL	229	172	57
(75% of TOTAL)	(172)	(129)	(43)

COMMERCIAL STRUCTURES

REQUIRED RING LEVEE HEIGHT (FT)*	NUMBER OF STRUCTURES
2.5 - 3.5	2
3.5 - 4.5	3
4.5 - 5.5	0
5.5 - 6.5	4
>6.5	5
TOTAL	14
(75% OF TOTAL)	(8)

* REQUIRED TO PROTECT STRUCTURE UP TO THE 100-YEAR FLOOD PLUS ONE FOOT

TABLE 32

ESTIMATED COST PER SQUARE FOOT TO ELEVATE RESIDENTIAL STRUCTURES

	HEIGHT			
TYPE OF CONSTRUCTION	3 FT	4 FT	5 FT	6FT
SLAB	$37.00/S.F.	$38.00/S.F.	$39.00/S.F.	$40.00/S.F.
PIER	$15.00/S.F.	$16.00/S.F.	$17.00/S.F.	$18.00/S.F.

TABLE 33

ESTIMATED UNIT COST FOR EARTHEN RING LEVEES

Height Above Ground	CY/LF	$/LF
1 FT	0.22	$ 10.00
2 FT	0.74	$ 20.00
3 FT	1.56	$ 35.00
4 FT	2.67	$ 55.00
5 FT	4.07	$ 75.00
6 FT	5.78	$100.00

NOTE: The costs for the ring levees represents the following:

a) a levee cross-section with 1 on 4 side slopes
b) yardage per foot is in-place measurement
c) fill material is truck-hauled @ $75 per truckload
d) compaction effort by dozers
e) levee surface is sodded

The costs exclude the following:

a) contingencies
b) repairs to concrete drives/sidewalks
c) interior drainage and modifications to utilities

BEAVER BAYOU

The Beaver Bayou Watershed is located northeast of the City of Baton Rouge (see Plate 2). Beaver Bayou is a tributary of the Comite River. Major tributaries of Beaver Bayou include Beaver Bayou Lateral Tributary and Tributary #2. This watershed encompasses about 12 square miles. This watershed shares many of the same characteristics as the Blackwater Bayou watershed.

Land use in the watershed is mostly agricultural and forest with urban lands making up 36 percent of the watershed. Land use maps for 1972 and 1985 are shown on Plates 4 and 5 of Appendix J. There are approximately 1,800 residential and commercial structures located within all flood zones in the watershed. The distribution of structures within the various floodplains is shown in Table 34. The approximate 10-year floodplain boundary is shown on Plate 5. Calculated without project equivalent annual flood damages for all subbasins in this watershed are listed in Table 35. Methodology used in calculating these values can be found in the Economics Appendix H.

Flooding in this watershed is primarily headwater in nature. Some backwater problems occur, but only in close proximity to the bayou's confluence with the Comite River. Backwater flooding is not a significant factor in this watershed.

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Due to the lack of topographical relief in this area, detention/retention storage basins were determined to be impractical. Required basin containment structures, primarily earthen levees, in conjunction with land requirements would be excessive in order to achieve significant flow retention.

TABLE 34
BEAVER BAYOU
DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BASIN NAME: BEAVER BAYOU WITHOUT PROJECT							
14	1-STORY	315	72	39	112	69	640	[illegible]
	2-STORY	14	2	1	4	4	28	[illegible]
	MOBILE HOME	9	19	8	9	12	195	[illegible]
	COMMERCIAL	95	5	2	7	2	133	247
	TOTAL	433	101	50	132	87	996	[illegible]

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 35
BEAVER BAYOU
CALCULATED WITHOUT PROJECT EQUIVALENT ANNUAL FLOOD DAMAGES

BASIN	REACH	EQUIVALENT ANNUAL DAMAGES WITHOUT PROJECT*
14	A	$ 0
	B	$ 31,000
	C	$ 23,000
	D	$ 29,000
	E	$ 518,000
	F	$ 373,000
	G	$ 2,690,000
	H	$ 4,117,000
	I	$ 1,586,000
	J	$ 44,000
	K	$ 354,000
	L	$ 642,000
	TOTAL	$10,407,000

* 2ND QUARTER 1994 PRICE LEVELS

SOURCE: U.S. ARMY CORPS OF ENGINEERS

Channel Modifications

Channel modification of the main stem of Beaver Bayou was determined to be practical and was investigated. Modifications to the tributaries were not considered since flow rates are too low to qualify for federal flood control participation.

Because the backwater effects of the Comite River extend from the mouth of Beaver Bayou to a point approximately 2,500 feet downstream of Greenwell Springs Road, channel modification in this reach was limited to clearing and snagging. In general, the channel modification upstream of Greenwell Springs Road was designed to contain headwater flows to within banks for the design frequencies. Four levels of designs were initially developed for this watershed: the 10-year, 25-year, 50-year, and 100-year. Early hydrologic investigation indicated that it would not be practical to contain the 100-year event within banks. Even with extensive channel modifications, the 100-year event would be out of banks for the entire stream length and was therefore eliminated from further study. In addition, since the 10-year design required some channel enlargement, a minimum channel design alternative that required only clearing and snagging was analyzed. Right-of-way restrictions on Beaver Bayou Lateral from Hooper Road to just upstream of Devall Road prevented any earthen channel enlargement. As such, this reach was concrete-lined for the 10-year, 25-year, and 50-year designs.

Alternative combinations that include or exclude both tributaries were established for this analysis.

Hydraulic modelling and channel designs were performed to determine required channel modifications. Relocation of major channel obstructions (bridges and culverts) were also identified.

Although the presence of sands in some locations may necessitate some degree of erosion protection, general conditions in this watershed allow earthen channel design. The benefits of a concrete-lined channel were also considered and evaluated in these alternative plans. No initial screening was conducted for nonstructural measure. Nonstructural measures were evaluated against the preferred structural plan (see discussion below.

A summary of initial study alternative plans for Blackwater Bayou are shown in Table 36. Detailed alternative plan descriptions are listed in Table 37. Alternative plans are shown on Plates 11 through 15.

It was determined that the environmental impacts of channel modification alternative plans would generally be limited to the destruction of some bottomland hardwood forestation that occurs along the channel banks. These impacts can be readily mitigated by equivalent reforestation of existing cleared lands or by protecting equivalent areas of existing forested lands.

Existing disposal areas were investigated to avoid adverse environmental impacts. The East Baton Rouge Parish of Public Works identified the parish landfill as the place to haul excavated material. Therefore, the initial cost estimates were developed assuming that excavated material would be hauled to this location. See Plate 51.

Nonstructural Measures

Nonstructural solutions for the Beaver Bayou area include elevating or floodproofing structures, ring levees around selected subdivisions, buy-out and relocation of structures subject to repetitive flooding. The majority (est. 67 percent) of existing residential and commercial structures in the area are constructed on slab foundation. Subdivisions in this watershed are not densely congested and are spaciously developed. Ring levees around selected subdivision could be economically favorable in a few select areas. Buy-out and relocation were evaluated in conjunction with other flood proofing techniques. Preliminary cost data indicated the cost per (flooded) structure for nonstructural measures were significantly higher than the cost per structure associated with channel modification alternatives. No nonstructural alternatives were, therefore, included in the analysis of initial plans.

TABLE 36

BEAVER BAYOU - INITIAL ALTERNATIVE PLAN SUMMARY

ALTERNATIVE PLAN	DESCRIPTION
BBN-P1	10-Year Earthen Channel Without Tributaries
BBN-P2	25-Year Earthen Channel Without Tributaries
BBN-P3	50-Year Earthen Channel Without Tributaries
BBC-P4	10-Year Concrete-Lined Channel Without Tributaries
BBN-P5	Minimum Clearing and Snagging of the Main Channel
--	No Action

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 37

BEAVER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BBN-P1			
	Beaver Bayou	varies	Improvements from Frenchtown Road to Hubbs Road. 10-year earthen channel design.
		20'BW	Frenchtown Road to Greenwell Springs Road.
		50'BW	Greenwell Springs to Wax Road.
		improve bridge	Wax Road (lengthen 96 feet).
		30'BW	Wax Road to Hooper Road.
		20'BW	Hooper Road to Denham Road.
		5'BW	Denham Road to Hubbs Road.
	Lateral Trib.		No Work.
	Tributary #2		No Work.
BBN-P2			
	Beaver Bayou		Improvements from Frenchtown Road to Hubbs Road. 25-year earthen channel design.
		20'BW	Frenchtown Road to 2300' d/s Greenwell Springs Road.
		50'BW	2300' d/s Greenwell Springs Road to Greenwell Springs Road.
		improve bridge	Greenwell Springs Road (lengthen 90 feet).
		50'BW	Greenwell Springs to Wax Road.
		improve bridge	Wax Road (lengthen 115 feet).
		50'BW	Wax Road to Hooper Road.
		30'BW	Hooper Road to Denham Road.
		5'BW	Denham Road to Hubbs Road.
	Lateral Trib.		No Work.
	Tributary #2		No Work.

TABLE 37 (CONTINUED)

BEAVER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BBN-P3			
	Beaver Bayou	varies	Improvements from Frenchtown Road to Hubbs Road. 50-year earthen channel design.
		20'BW	Frenchtown Road to 2300' d/s Greenwell Springs Road.
		50'BW	2300' d/s Greenwell Springs Road to Greenwell Springs Road.
		improve bridge	Greenwell Springs Road (lengthen 90 feet).
		50'BW	Greenwell Springs to Wax Road.
		improve bridge	Wax Road (lengthen 115 feet).
		50'BW	Wax Road to Hooper Road.
		improve bridge	Hooper Road (lengthen 94 feet).
		40'BW	Hooper Road to Denham Road.
		5'BW	Denham Road to Hubbs Road.
	Lateral Trib.		No Work.
	Tributary #2		No Work.
BBC-P4			
	Beaver Bayou	varies	Improvements from Frenchtown Road to Hubbs Road. Minimum concrete-lined channel design.
		20'BW	(earthen channel) Frenchtown Road to 2300' d/s Greenwell Springs Road.
		10'BW	2300' d/s Greenwell Springs Road to Greenwell Springs Road.
		10'BW	Greenwell Springs Road to Wax Road.
		10'BW	Wax Road to Hooper Road.
		5'BW	Hooper Road to Denham Road.
		5'BW	Denham Road to Hubbs Road.
	Lateral Trib.		No Work.
	Tributary #2		No Work.

TABLE 37 (CONTINUED)

BEAVER BAYOU - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
BBN-P5			
	Beaver Bayou	N/A	Frenchtown to Hubbs Road-clearing and snagging.
	Lateral Trib		No Work
	Tributary #2		No Work

NOTE: All earthen channel design embankment slopes 3.5 H : 1.0 V; All concrete design slopes 3.0 H : 1.0 V

Source: U.S. Army Corps of Engineers, New Orleans District

Screening of Initial Alternative Plans

In this iteration, only major cost items - construction, relocations, real estate, and annual operations and maintenance were developed. Benefits calculated in this part of the analyses were "direct" property inundation flood damage reductions plus an estimated percentage (20%) of "indirect" flood damage reduction benefits. "Indirect" items include such items as public agency emergency costs, flood insurance reductions, and lower construction costs within the floodplain.

Cost-benefit calculations for each alternative plan are shown in Table 38. A period of 50 years and an annual interest rate of 8.00% were used to calculate equivalent annual values. Costs and benefits shown are all relative to the base condition or "No Action" Plan. No mitigation cost was considered in the initial screening. However, methods to avoid adverse environmental impacts and mitigation measures were considered in plan formulation. It should be noted that costs and benefits were not calculated for Plan BBN-P5, clearing and snagging of the main channel. Initial hydraulic analysis indicated that only minimal stage lowerings could be achieved and that flood reduction benefits would be minimal. No further analysis was done on this plan since it was determined that it would not be a comprehensive solution to flood damage in this watershed.

The cost-benefit calculations revealed that all earthen and concrete-lined channel modification alternatives have significantly higher net benefits relative to base conditions. Relative to the concrete-lined channel alternative, all earthen channel plans were determined to have both significantly higher net benefits and lower first costs. The concrete-lined channel alternative was therefore eliminated. The minimum clearing and snagging plan was determined to have limited net benefits and was also eliminated at this point of the analyses. Earthen channel alternatives were determined to have net benefits within 25 percent and were all selected for futher evaluation.

Analysis of Final Alternative Plans

Plans selected for final analyses are:

BBN-P1	10-Year Earthen Channel
BBN-P2	25-Year Earthen Channel
BBN-P3	50-Year Earthen Channel
NO ACTION	

Since no alteration was made to either plan, details shown in the Initial Alternative Plans are the same. Final alternative plans were evaluated relative to National Economic Development, Environmental Quality, Regional Economic Development, and Social Effects. A summary of this analyses is shown in Table 39.

TABLE 38

BEAVER BAYOU
ECONOMIC ANALYSIS OF INITIAL ALTERNATIVE PLANS

PLAN	FIRST COST	ANNUAL COST	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
BBN-P1	$12,060,000	$1,049,000	$6,081,000	$5,032,000	5.8
BBN-P2	$14,893,000	$1,290,000	$7,154,000	$5,864,000	5.5
BBN-P3	$16,317,000	$1,411,000	$7,209,000	$5,798,000	5.1
BBC-P4	$25,379,000	$2,252,000	$6,979,000	$4,727,000	3.01
BBN-P5	N/A	N/A	N/A	N/A	N/A

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

National Economic Development (NED)

In the final analyses, environmental mitigation costs were were included in each alternative plan's cost. It should be noted that the mitigation plan combines all mitigation requirements from all watersheds. Consolidating mitigation sites was determined to be far more practical than establishing individual mitigation sites for each watershed in the study area. Costs were prorated to each watershed based on alternative plan wooded habitat losses.

Alternative plan benefits and costs are listed in Table 38. As in the initial screening, a period of 50 years and 8.00% annual interest were used. Of the three earthen channel modification alternatives BBN-P2, the 25-year channel design plan, has the highest net economic benefits at $5,800,000 per year. This is about 20 percent higher than Alternative BBN-P1, the 10-year plan at $4,966,000 per year. There is apparently only a marginal difference in net economic benefits between BBN-P2 and BBN-P3, the 50-year channel design plan. This difference is well within relative uncertainty margins. The lower first cost of Alternative BBN-P2 does, however, give it a relative advantage to BBN-P3 in this category.

Environmental Quality

Impacts on the following environmental factors were evaluated for each final alternative plan:

- Agricultural Lands
- Forestlands
- Threatened and Endangered Species
- Aquatic Resources and Water Quality
- Sedimentation
- Air Quality
- Historic Places
- Cultural Properties

Detailed analyses of these factors can be found in the Environmental Appendix (E) and the Environmental Impact Statement. Impacts are listed in summary in Table 39.

TABLE 39

BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	BBN-P1	BBN-P2 (RECOMMENDED PLAN)	BBN-P3
I. PLAN DESCRIPTION	10-YEAR EARTHEN CHANNEL	25-YEAR EARTHEN CHANNEL	50-YEAR EARTHEN CHANNEL
II. NATIONAL ECONOMIC DEVELOPMENT			
A. PROJECT FIRST COST	$12,756,000	$15,577,000	$17,025,000
B. O&M COST	$ 31,000	$ 31,000	$ 31,000
C. TOTAL AVERAGE ANNUAL COSTS	$ 1,115,000	$ 1,354,000	$ 1,477,000
D. TOTAL AVERAGE ANNUAL BENEFITS	$ 6,081,000	$ 7,154,000	$ 7,209,000
E. NET ANNUAL BENEFITS	$ 4,966,000	$ 5,800,000	$ 5,732,000
F. BENEFIT-COST RATIO	5.45	5.28	4.88
III. ENVIRONMENTAL QUALITY			
A. AGRICULTURAL LANDS	125 ACRES DIRECTLY IMPACTED BY FOREST REPLANTING	122 ACRES DIRECTLY IMPACTED BY FOREST REPLANTING	127 ACRES DIRECTLY BY FOREST REPLANTING
B. FORESTLANDS	88 ACRES AFFECTED BY PROJECT; 125 ACRES WOULD BE CREATED BE CREATED VIA MITIGATION	86 ACRES AFFECTED BY PROJECT; 122 ACRES WOULD BE CREATED BE CREATED VIA MITIGATION	89 ACRES AFFECTED BY PROJECT; 127 ACRES WOULD BE CREATED VIA MITIGATION
C. THREATENED & ENDANGERED SPECIES	NONE AFFECTED	NONE AFFECTED	NONE AFFECTED
D. AQUATIC RESOURCES & WATER QUALITY	SHORT-TERM ADVERSE IMPACT DURING CONSTRUCTION; LONG-TERM EFFECTS MINOR	(SAME AS BBN-P1)	(SAME AS BBN-P1)

TABLE 39 (CONTINUED)
BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	BBN-P1	BBN-P2	BBN-P3
E. SEDIMENTATION	PROJECT WILL REDUCE STREAMBANK EROSION; LARGER CHANNEL WILL CAUSE SLIGHT INCREASE IN DEPOSITION	(SAME AS BBN-P1; SLIGHTLY WORSE)	(SAME AS BBN-P1; SLIGHTLY WORSE)
F. AIR QUALITY	MINOR SHORT-TERM IMPACTS DURING CONSTRUCTION	(SAME AS BBN-P1)	(SAME AS BBN-P1)
G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT	NO IMPACT	NO IMPACT
H. CULTURAL PROPERTIES	VERY SLIGHT CHANCE OF UNCOVERING UNKNOWN SITES DURING CONSTRUCTION	(SAME AS BBN-P1)	(SAME AS BBN-P1)
IV. REGIONAL ECONOMIC DEVELOPMENT			
A. REGIONAL INCOME AND EMPLOYMENT	IMPROVED VALUE WILL LIKELY FACILITATE URBAN GROWTH	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCREASED EMPLOYMENT FOR CONSTRUCTION; BETTER ECONOMIC CLIMATE DUE TO REDUCTION IN FLOOD THREAT	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
C. TAX REVENUE	IMPROVED FLOOD PROTECTION WILL STABILIZE TAX BASE	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
D. PROPERTY VALUE	IMPROVED FLOOD PROTECTION WILL LIKELY STABILIZE OR RAISE PROPERTY VALUES	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)

TABLE 39 (CONTINUED)
BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	BBN-P1	BBN-P2	BBN-P3
V. <u>OTHER SOCIAL EFFECTS</u>			
A. URBAN AND COMMUNITY IMPACTS	POSITIVE IMPACTS DUE TO IMPROVED FLOOD PROTECTION	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
B. LIFE, HEALTH, AND SAFETY	THREAT TO LIFE, HEALTH, AND SAFETY REDUCED	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
C. DISPLACEMENT	SOME TAKING OF UNIMPROVED PRIVATE PROPERTY; 110 acres	(SAME AS BBN-P1; SLIGHTLY WORSE, 115 acres)	(SAME AS BBN-P1; SLIGHTLY WORSE, 120 acres)
D. LONG-TERM PRODUCTIVITY	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
E. LEISURE	NO IMPACT	NO IMPACT	NO IMPACT
F. AESTHETIC	SOME ADVERSE IMPACT BY REMOVING TREES FROM CHANNELS; MITIGATED WITH REPLANTED TREE LINE	(SAME AS BBN-P1)	(SAME AS BBN-P1)
G. COMMUNITY COHESION	PRESERVED DUE TO REDUCED FLOOD THREAT	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
H. COMMUNITY GROWTH	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
I. TRANSPORTATION	MINOR DISRUPTION DURING CONSTRUCTION; IMPROVED SITUATION BY REDUCING FLOODING	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)
J. NOISE	MINOR INCREASE IN NOISE DURING CONSTRUCTION	(SAME AS BBN-P1)	(SAME AS BBN-P1)
K. QUALITY OF LIFE	REDUCED FLOODING WILL SUBSTANTIALLY IMPROVE THE QUALITY OF LIFE FOR THOSE AFFECTED	(SAME AS BBN-P1; SLIGHTLY BETTER)	(SAME AS BBN-P1; SLIGHTLY BETTER)

TABLE 39 (CONTINUED)
BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	NO ACTION
I. PLAN DESCRIPTION	
II. NATIONAL ECONOMIC DEVELOPMENT	
A. PROJECT FIRST COST	$ 0
B. O&M COST	$ 0
C. TOTAL AVERAGE ANNUAL COSTS	$ 0
D. TOTAL AVERAGE ANNUAL BENEFITS	$ 0
E. NET ANNUAL BENEFITS	$ 0
F. BENEFIT-COST RATIO	N/A
III. ENVIRONMENTAL QUALITY	
A. AGRICULTURAL LANDS	SOME ADVERSE IMPACT DUE TO RECURRING FLOODING
B. FORESTLANDS	MINOR LOSS TO DEVELOPMENT
C. THREATENED AND ENDANGERED SPECIES	NONE AFFECTED
D. AQUATIC RESOURCES AND WATER QUALITY	NO IMPACT
E. SEDIMENTATION	NO IMPACT
F. AIR QUALITY	NO IMPACT
G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT

TABLE 39 (CONTINUED)
BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	NO ACTION
H. CULTURAL PROPERTIES	NO IMPACT
IV. <u>REGIONAL ECONOMIC DEVELOPMENT</u>	
A. REGIONAL INCOME AND EMPLOYMENT	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
C. TAX REVENUE	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
D. PROPERTY VALUE	PROPERTY VALUES MAY DECLINE DUE TO RECURRING FLOODING
V. <u>OTHER SOCIAL EFFECTS</u>	
A. URBAN AND COMMUNITY IMPACTS	ADVERSE IMPACTS DUE TO FLOOD THREAT
B. LIFE, HEALTH, AND SAFETY	RECURRING FLOODS THREATEN LIFE, HEALTH, AND SAFETY
C. DISPLACEMENT	NO IMPACT
D. LONG-TERM PRODUCTIVITY	ADVERSE IMPACTS DUE TO FLOOD THREAT
E. LEISURE	NO IMPACT
F. AESTHETIC	NO IMPACT
G. COMMUNITY COHESION	ADVERSE IMPACTS DUE TO FLOOD THREAT
H. COMMUNITY GROWTH	ADVERSE IMPACTS DUE TO FLOOD THREAT

TABLE 39 (CONTINUED)
BEAVER BAYOU FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

ITEM	NO ACTION
I. TRANSPORTATION	SOME ADVERSE IMPACTS DURING FLOOD EVENTS
J. NOISE	NO IMPACT
K. QUALITY OF LIFE	ADVERSE IMPACTS FOR THOSE AFFECTED BY FLOODING

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

The only and long-lasting environmental impacts produced by the final alternative plans affect agricultural lands and forestlands. All channel modification plans directly impact forestlands. This in turn indirectly impacts agricultural lands as they are proposed to be converted to forestlands as mitigation for same. The loss of these agricultural land acres is not considered to be significant for this area. Flood stage lowerings associated with all channel modification alternatives reduce the size of the 100-year floodplain.

There is very little difference in the quantity of affected agricultural and forest lands for each of the channel modification plans. Therefore, there is no relative advantage for any plan in this category.

Regional Economic Development

Reducing flood damage frequency and cost will improve economic growth, employment, property valuation, and tax revenue in the region. Conversely, allowing flooding to continue to occur could likely result in decreasing same. Direct economic benefits to existing property is included in the NED estimates above. Induced economic benefits are speculative to a large degree and are not calculated directly into the benefit-cost analysis. These items are addressed in the Economic Appendix H and are listed in summary in Table 39.

All proposed channel improvement plans will significantly reduce flooding frequency and cost and therefore are far preferable to No Action given economic development considerations. Benefit calculations indicate that both the 25-year and 50-year earthen channel plans have significantly higher economic benefits relative to the 10-year plan. Relative to one another, however, there is very little estimated economic benefit difference between the 25-year and 50-year plans. Based on the above, both Alternatives BBN-P2, 25-year earthen channel with tributaries, and, BBN-P3, 50-year earthen channel with tributaries have the highest rating in this category.

Social Effects

Social effects considered in evaluating each alternative plan are listed in Table 39. Health, safety, and the quality of community life will obviously be significantly improved by all channel modification plans. While no homes or businesses will be displaced, construction of any channel modification plan will, however, require the permanent taking of some private property. Almost all of the property required to be taken is either agricultural, pasture, rural, or vacant. This property loss will adversely impact the specific owners. Additionally, some minor traffic disruptions will occur in both plans in association with required bridge relocations.

Relative to No Action, the beneficial social impacts of all channel modification plans appear to far outweigh their adverse effects. The higher level of flood reduction associated with all the channel modification plans appear to outweigh their real estate and bridge relocation disadvantages.

Trade-Off Analyses and Plan Selection

The economic and social benefits of all channel improvement alternatives are far more significant than the slight environmental quality advantage of No Action. Both the 25-year (BBN-P2) and 50-year (BBN-P3) earthen channel alternatives have significant economic benefits relative to the 10-year (BBN-P1) channel plan. Relative to each other, there are no significant net economic, environmental, or social impact differences between BBN-P2 and BBN-P3, but, BBN-P2 does have a significantly lower first cost. Alternative BBN-P2, the 25-year earthen channel modification with tributaries, is therefore, the preferred structural alternative for this watershed.

Uncertainty ranges in such items as flood stage-frequencies, structure and content values, and project construction costs were not quantified in this part of the analyses. These potential uncertainties were, however, taken into consideration relative to each final alternative. It was determined that, for the most part, uncertainty ranges would affect each alternative in a similar way with a slightly greater or lesser magnitude. Such effects would not likely change the relative advantages or disadvantages of each final alternative and, therefore, not affect the above plan selection.

Due to the presence of sandy soils in the area, the possibility exists that some erosion control measures will be needed on portions of any proposed channel enlargement. A system of geosynthetic fabric and rock would be proposed for these reaches. It is estimated that such a system would be rather costly at approximately over $800,000 per mile of channel.

Through field and aerial inspections, it was determined that about 30-35 percent of the main channel and its tributary would likely require erosion control measures. Conservatively, erosion control was added in for 50 percent of the proposed project length. Relative to other channel modifications alternatives, there would be no significant net difference and plan BBN-P2 would still be the preferred alternative.

With 50 percent erosion control measures included, the cost of plan BBN-P2 increases to $18,775,000. Net benefits reduce to $5,528,000 per year, and the revised benefit-to-cost ratio decreases to 4.40.

Comparison to Selected Nonstructural Measures

With the inclusion of proposed erosion control measures, the preferred channel modification plan for this watershed exhibits a relatively high cost per structure in the affected floodplains. For this reason, selected nonstructural alternatives were revisited and evaluated in further detail.

Buy-outs, structure elevation, individual structure and subdivision ring levees were examined for this watershed. For the majority of residential structures, structure elevation, while expensive, was determined to be the most cost-effective and practical non-structural option. In a few cases, a subdivision ring levee with internal drainage may be slightly favorable to house raising (see Table 29). Elevating commercial structures was found to be impractical in most cases. Given the above, elevating residential structures in combination with constructing earthen ring levees around individual commercial structures was determined to be both the most practical and comprehensive nonstructural options for this watershed.

Elevating residential structures and installing ring levees around commercial structures in the 10-year and 25-year floodplains were evaluated. In both cases, structures would be elevated or protected up to the 100-year flood elevation plus one foot. (This elevation is consistent with the parish's ordinance on new construction).

Structures in the 10- and 25-year floodplains were identified and the required height of elevation or levee protection for each was calculated. Structures were grouped by this requirement and, for residential, by construction type (pier or slab). Table 40 and 41 list these structure groupings for the 10- and 25-year floodplains. Costs estimates were obtained from the Corps' National Flood Proofing Committee, and recent pilot projects in the Baton Rouge Area. Ring levee costs were also based on a generalized approach of considering a 600-foot-long levee around each commercial structure. No interior drainage costs were included for this analysis. Tables 31 and 32, respectively, illustrate these costs for residential structure raising and ring levee construction.

Many of the structures located in the floodplain would not be suited for elevation and/or ring levee given structure condition and space constraints. These structures were determined from aerial photography and field investigations conducted for structure inventory. Also, many residents would likely not wish to participate in an elevation program for various reasons. Given these factors, it is estimated that probably no more than 75 percent of property owners could, or would, participate in this program. Overall plan costs and benefits were, therefore, calculated based on a 75 percent participation rate.

The cost of elevating/protecting 75 percent of all residential and commercial structures in the 10-year floodplain is estimated at $20,550,000. This cost includes added contract administration (10%) and contingencies (10%). Implementation of elevating/protecting almost 600 structures would take a relatively long period of time, an estimated four years. Thus, the estimated total gross investment cost of this plan (includes interest lost during construction) is $25,058,000. The estimated first and gross investment costs for elevating/protecting approximately 700 structures in the 25-year floodplain are $24,467,000 and $29,834,000, respectively.

Flood damage reduction benefits were calculated for both the 10-year and 25-year floodplain structure elevation/protection plans. In both cases, flood damage reductions would be quite extensive. For the 10-year plan approximately 64 percent, or $5,586,000 per year, of all flood damages would be eliminated in the entire watershed. This value increases to 71 percent, or $6,173,000 per year, for the 25-year nonstructural plan.

At 8 percent interest rate over a 50-year period, the net economic benefits for the 10-year plan are estimated at $3,479,000 per year with a benefit-to-cost ratio of 2.7 to 1. Estimates net economic benefits for the 25-year plan are estimated at $3,664,000 per year with a benefit to cost ratio of 2.5 to 1. Based on this analysis, elevating/protecting all structures in the 25-year floodplain is slightly more feasible.

In comparison to the preferred structural plan, calculated net benefits are significantly higher ($5,528,000 per year) for the channel plan. The 25-year channel modification plan, BBN-P2, is therefore the Recommended Plan for this watershed.

TABLE 40

BEAVER BAYOU - ESTIMATED NUMBER OF STRUCTURES, TYPE OF CONSTRUCTION AND RAISING REQUIREMENTS FOR THE 10-YEAR FLOODPLAIN

RESIDENTIAL STRUCTURES

HEIGHT TO BE RAISED (FT)*	NUMBER OF STRUCTURES	ESTIMATED NUMBER OF SLAB STRUCTURES	ESTIMATED NUMBER OF PIER STRUCTURES
2.5 - 3.5	95	64	31
3.5 - 4.5	203	136	67
4.5 - 5.5	36	24	12
5.5 - 6.5	0	0	0
>6.5	1	1	0
TOTAL	335	225	110
(75% OF TOTAL)	(251)	(169)	(83)

COMMERCIAL STRUCTURES

REQUIRED RING LEVEE HEIGHT (FT)*	NUMBER OF STRUCTURES
2.5 - 3.5	0
3.5 - 4.5	42
4.5 - 5.5	36
5.5 - 6.5	17
>6.5	0
TOTAL	94
(75% OF TOTAL)	(71)

* REQUIRED TO PROTECT STRUCTURE UP TO THE 100-YEAR FLOOD PLUS ONE FOOT.

TABLE 41

BEAVER BAYOU - ESTIMATED NUMBER OF STRUCTURES, TYPE OF CONSTRUCTION AND RAISING REQUIREMENTS FOR THE 25-YEAR FLOODPLAIN

RESIDENTIAL STRUCTURES

HEIGHT TO BE RAISED (FT)*	NUMBER OF STRUCTURES	ESTIMATED NUMBER OF SLAB STRUCTURES	ESTIMATED NUMBER OF PIER STRUCTURES
2.5 - 3.5	249	167	82
3.5 - 4.5	135	90	45
4.5 - 5.5	41	27	14
5.5 - 6.5	0	0	0
>6.5	1	1	0
TOTAL	426	285	141
(75% OF TOTAL)	(320)	(214)	(106)

COMMERCIAL STRUCTURES

REQUIRED RING LEVEE HEIGHT (FT)*	NUMBER OF STRUCTURES
2.5 - 3.5	0
3.5 - 4.5	76
4.5 - 5.5	15
5.5 - 6.5	10
>6.5	0
TOTAL	101
(75% OF TOTAL)	(75)

* REQUIRED TO PROTECT STRUCTURE UP TO THE 100-YEAR FLOOD PLUS ONE FOOT

JONES CREEK

The Jones Creek watershed is located in the eastern and southeastern portion of East Baton Rouge Parish. See Plate 2. Jones Creek is a tributary of the Amite River. Major tributaries of Jones Creek include Jones Creek Tributary, Lively Bayou, Lively Bayou Tributary, and Weiner Creek. Jones Creek and Tributaries drain about 26 square miles.

The Weiner Creek Tributary discharges into Jones Creek at about Mile 4.5. The stream has a drainage area of 2.8 square miles. Lively Bayou is the largest tributary to Jones Creek, with a drainage area of 6.0 square miles. Lively Bayou discharges into Jones Creek at about Mile 6.4. Its main tributary of Lively Bayou Tributary has a drainage area of 1.4 square miles which discharges into Lively Bayou about ½ mile above the mouth. Jones Creek Tributary enters Jones Creek at about Mile 9.8 and has a drainage area of 1.4 square miles.

The watershed is about 80 percent urbanized, consisting of residential and commercial development with some light industries. Land use maps for 1972 and 1985 are shown on Plates 6 through 13 of Appendix J. There are approximately 3,900 residential and commercial structures located within all flood zones in the watershed. The distribution of structures within the various floodplains is shown in Table 42. The approximate 10-year floodplain boundary is shown on Plate 6. Calculated without project equivalent annual flood damages for all subbasins in this watershed are listed in Table 43. Methods used in calculating these values can be found in Economics Appendix H.

Flooding in this watershed is primarily headwater in nature. Some backwater problems occur, but only in close proximity to the confluence with the Amite River. Backwater flooding is not a significant factor in this watershed.

TABLE 42

JONES CREEK
DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	JONES CREEK WATERSHED							
	BASIN NAME: JONES CREEK							
22	1-STORY	57	28	123	92	141	1,062	1,503
	2-STORY	7	6	24	16	36	212	301
	MOBILE HOME	1	1	2	0	1	4	9
	COMMERCIAL	50	29	51	30	35	185	380
	TOTAL	115	64	200	138	213	1,463	2,193
	BASIN NAME: LIVELY BAYOU TRIBUTARY							
23	1-STORY	505	126	114	44	60	69	918
	2-STORY	20	10	4	3	5	13	55
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	2	1	0	0	0	0	3
	TOTAL	527	137	118	47	65	82	976
	BASIN NAME: LIVELY BAYOU							
24	1-STORY	116	55	64	24	78	101	438
	2-STORY	10	58	5	0	8	18	99
	MOBILE HOME	0	0	1	0	11	25	37
	COMMERCIAL	31	10	19	2	9	3	74
	TOTAL	157	123	89	26	106	147	648
	BASIN NAME: WEINER CREEK							
28	1-STORY	8	0	13	0	45	229	295
	2-STORY	0	0	0	2	4	36	42
	MOBILE HOME	0	0	0	0	0	1	1
	COMMERCIAL	0	0	1	0	0	21	22
	TOTAL	8	0	14	2	49	287	360

SOURCE: U.S. ARMY CORPS OF ENGINEERS

TABLE 43

JONES CREEK
CALCULATED WITHOUT PROJECT EQUIVALENT ANNUAL FLOOD DAMAGES

BASIN	REACH		EQUIVALENT ANNUAL DAMAGES WITHOUT PROJECT*
22 - JONES CREEK	A		$ 33,000
	B		$ 13,000
	C		$ 882,000
	D		$ 45,000
		SUBTOTAL	$ 973,000
23 - LIVELY BAYOU TRIBUTARY	O		$2,440,000
	P		$2,225,000
		SUBTOTAL	$4,665,000
24 - LIVELY BAYOU BASIN	L		$ 333,000
	M		$ 172,000
	N		$1,681,000
	N2		$ 145,000
		SUBTOTAL	$2,331,000
28 - WEINER CREEK	G		$ 3,000
	H		$ 0
	I		$ 77,000
		SUBTOTAL	$ 80,000
		TOTAL	$8,049,000

* 2ND QUARTER 1994 PRICE LEVELS

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Detention storage was considered on Lively Bayou. The detention storage site was considered by the Baton Rouge Chamber of Commerce in a recent study. Hydraulic analysis indicates that detention storage would lower stages downstream for several miles. Additional channel modification would be required to provide lowering in the reaches where most of the structures are located. The lowerings provided by detention storage would be in reach of the bayou where about 200-300 structures exist. The detention storage would be located in a wooded area and clearing of those lands would be required to achieve the storage projected. Consequently, detention storage was eliminated from consideration. Detention storage would, however, provide opportunities to develop recreational facilities in the area.

Reservoirs in other locations throughout the watershed were also determined to be impractical due to excessive real estate and containment structure costs.

Channel Modifications

Channel modifications to the main stem and tributaries of Jones Creek were determined to be practical options and were investigated.

Several channel modification plans were developed for the Jones Creek and Tributaries watershed. Because the backwater effects of the Amite River extend from the mouth of Jones Creek to Jones Creek Road, channel modification in this reach was limited to clearing and snagging. In general, the plans were designed to contain headwater flows to within banks for the design frequencies. Initial designs considered widening the existing earthen channels to provide various levels of flood protection. Concrete lining in combination with less extensive channel widening was also considered. During the development of these alternatives, however, it became apparent that the combination of existing widespread highly erodible soils and limited rights-of-way would limit the number of viable channel modification plans.

Throughout the Jones Creek watershed, particularly above the Weiner-Jones Creek confluence, bank erosion is prevalent. Erosion rates are moderately high and are extreme in numerous stream reaches. A significant strata of loess soil is widespread and is the main factor in this process. See Engineering Appendix C. There has also been extensive urban development along the right-of-way boundary in most stream reaches. This combination has resulted in a major problem where progressive bank erosion has encroached and affected private property lands, and is some cases, structures. Photographs illustrating this problem on Jones Creek can be found in Figure 1.

In consideration of the above, it was determined that channels could not be cleared or widened and maintained with just grass bank cover. Concrete-lined channels were, therefore, determined to be the only viable option for proposed channel modifications. Existing rights-of-way were also determined to be limited in numerous reaches. Since these lands are improved, extensive right-of-way buy out was not considered to be practical. Only minimal channel widening was therefore considered further.

Reshaping and concrete lining the existing channel, plus, slightly widening to within right-of-way limits and concrete lining were selected alternatives for further evaluation. Alternative combinations that include or exclude all tributaries were also considered. A "10-year" and "25-year" design designation was given to the concrete-lined alternative plans corresponding to the earthen sized channels. Actual performance of the concrete-lined channels is substantially greater.

Nonstructural Measures

The Jones Creek watershed is highly urbanized with a very high percentage of slab foundation structures. Flood protection by means of levees and/or floodwalls would be very difficult to accomplish in such a congested area. Buy-outs in conjunction with structure elevation would likely be the only practical non-structural alternatives for this watershed. As shown in previous sections, this alternative would be preferable to a conventional structural plan only if the cost per (flooded) structure is very high. Preliminary cost data indicated that costs per (flooded) structure for this non-structural alternative were significantly higher than that for corresponding channel modification plans. No non-structural alternatives were, therefore, identified for analysis in the initial alternatives for this watershed.

A summary of initial alternatives for Jones Creek is shown in Table 44. Alternative details are listed in Table 45. Alternatives are shown on Plates 16 and 17.

It was determined that significant environmental impacts of channel modification alternative plans would generally be limited to the destruction of some bottomland hardwood forests that occur in a linear strip along the channel banks. These impacts can be readily mitigated by reforestation of existing cleared lands or by protecting areas of existing forested lands.

Existing disposal areas were investigated to avoid adverse environmental impacts. The East Baton Rouge Parish of Public Works identified the parish landfill as the place to haul excavated material. Therefore, the initial cost estimates were developed assuming that excavated material would be hauled to this location. See Plate 51.

TABLE 44
JONES CREEK - INITIAL ALTERNATIVES SUMMARY

ALTERNATIVE	DESCRIPTION
JCCL-P1	10-Year Concrete-Lined Channel With Tributaries Lively Bayou, Lively Bayou Tributary, and Weiner Creek
JCCL-P2	25-Year Concrete-Lined Channel With Tributaries Lively Bayou, Lively Bayou Tributary, and Weiner Creek
JCCL-P3	10-Year Concrete-Lined Channel Without Tributaries
JCCL-P4	25-Year Concrete-Lined Channel Without Tributaries
--	No Action

NOTE: "Year" design not based on actual alternative performance; performance is significantly enhanced by concrete lining.

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 45

JONES CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
JCCL-P1			
	Jones Creek	Clear & snag	Mouth to Jones Creek Road.
		5'BW	Jones Creek Road to Lobdell Blvd.
	Weiner Creek	5'BW	Mouth to Cedar Crest Ave.
	Lively Bayou	5'BW	Mouth to Illinois Central RR.
	Lively Bayou Trib	5'BW	Mouth to Tams Drive.
	Jones Creek Trib		No Work
JCCL-P2			
	Jones Creek	Clear & snag	Mouth to Jones Creek Road.
		10'BW	Jones Creek Road to S. Harrells Ferry Road
		15'BW	S. Harrells Ferry Road to Sherwood Forest Blvd.
		10'BW	Sherwood Forest Blvd. to Molly Lee Drive.
		15'BW	Molly Lee Drive to Sharp Rd.
		20'BW	Sharp Road to Cuyhanga Pkwy.
		5'BW	Cuyhanga Pkwy. to Lobdell Blvd.
	Weiner Creek	5'BW	Mouth to Sherwood Drive.
		30'BW	Sherwood Drive to Stanley Aubin Lane.
		20'BW	Stanley Aubin Lane to Cedar Crest Ave.
	Lively Bayou	20'BW	Mouth to Mile 2.3.
		30'BW	Mile 2.3 to Mile 3.2.
		35'BW	Mile 3.2 to Ill. Central RR.
	Lively Bayou Trib	5'BW	Mouth to Tams Drive.
	Jones Creek Trib		No Work
JCCL-P3			
	Jones Creek	Clear & snag	Mouth to Jones Creek Road.
		5'BW	Jones Creek Road to Lobdell Blvd.
	Weiner Creek		No Work.
	Lively Bayou		No Work.
	Lively Bayou Trib		No Work.
	Jones Creek Trib		No Work.

TABLE 45 (CONTINUED)

JONES CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
JCCL-P4			
	Jones Creek	Clear & snag	Mouth to Jones Creek Road.
		10'BW	Jones Creek Road to S. Harrells Ferry Road.
		15'BW	S. Harrells Ferry Road to Sherwood Forest Blvd.
		10'BW	Sherwood Forest Blvd. to Molly Lee Drive.
		15'BW	Molly Lee Drive to Sharp Rd.
		20'BW	Sharp Rd. to Cuyhanga Pkwy.
		5'BW	Cuyhanga Pkwy. to Lobdell Blvd.
	Weiner Creek		No Work.
	Lively Bayou		No Work.
	Lively Bayou Trib		No Work.
	Jones Creek Trib		No Work.

NOTE: All concrete-lined embankment design slopes 3.0H : 1.0V

Source: U.S. Army Corps of Engineers, New Orleans District

Screening of Initial Alternatives

In this iteration, only major cost items - construction, relocations, real estate, and annual operations and maintenance were developed. Benefits calculated in this part of the analyses were "direct" property inundation flood damage reductions plus an estimated percentage (20%) of "indirect" flood damage reduction benefits. "Indirect" items include such items as public agency emergency costs, flood insurance reductions, and lower construction costs within the floodplain.

Cost-benefit calculations for each alternative plan are shown in Table 46. A period of 50 years and an annual interest rate of 8.00% were used to calculate equivalent annual values. Costs and benefits shown are all relative to the base condition or "No Action" Plan. No mitigation cost was considered in the initial screening. However, methods to avoid adverse environmental impacts were investigated and the plan revised accordingly as previously indicated.

TABLE 46

JONES CREEK
ECONOMIC ANALYSIS OF INITIAL ALTERNATIVE PLANS

PLAN	FIRST COST	ANNUAL COST	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
JCCL-P1	$49,570,000	$4,389,000	$6,715,000	$2,326,000	1.5
JCCL-P2	$66,275,000	$5,865,000	$6,727,000	$ 862,000	1.1
JCCL-P3	$36,795,000	$3,259,000	$4,877,000	$1,618,000	1.5
JCCL-P4	$38,208,000	$3,384,000	$4,877,000	$1,493,000	1.4

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

The cost-benefit calculations revealed that while all channel modification plans yield significant net benefits, there is virtually no additional benefits in widening the existing channels. This is true with and without the inclusion of the tributaries. Therefore, only the "10-year" plans, i.e., reshaping and concrete lining the existing channels without widening, were considered further. (Again, note that performance is significantly greater than "10-year").

At this point a cursory investigation of whether or not modification of each tributary incrementally yields net benefits was conducted. It was determined that the proposed channel modifications produce flood damage reductions in a widespread fashion throughout the watershed. Since channel design sections change little in each reach, project costs were determined to be relatively uniform per section throughout the watershed. Therefore, there appears to be relatively uniform incremental net benefits on all tributaries. Separate alternative analyses with all possible combinations of the four tributaries were therefore not initiated.

Analysis of Final Alternatives

Plans selected for final analyses were JCCL-P1, JCCL-P3, and No Action. Since no alteration was made to either plan, details shown in the Initial Alternative Plans are the same.

Final alternative plans were evaluated relative to National Economic Development, Environmental Quality, Regional Economic Development, and Social Effects. A summary of this analyses is shown in Table 47.

National Economic Development (NED)

In the final analyses, environmental mitigation costs were included in each alternative plan's cost. It should be noted that the mitigation plan combines all mitigation requirements from all watersheds. Consolidating mitigation sites was determined to be far more practical than establishing individual mitigation sites for each watershed in the study area. Costs were prorated to each watershed based on the amount of alternative plan habitat losses.

Alternative plan benefits and costs are listed in Table 47. As in the initial screening, a period of 50 years and 8.00% annual interest were used. Alternative JCCL-P1 (with tributaries) was determined to have the highest estimated net annual benefits of $2,285,000. This is significantly higher than the $1,583,000 per year of Plan JCCL-P3 (without tributaries). Both plans obviously have significant net economic benefits relative to No Action.

Environmental Quality

Impacts on the following environmental factors were evaluated for each final alternative plan:

- Agricultural Lands
- Forestlands
- Threatened and Endangered Species
- Aquatic Resources and Water Quality
- Sedimentation
- Air Quality
- Historic Places
- Cultural Properties

Detailed analyses of these factors can be found in the Environmental Appendix E and the Environmental Impact Statement. Impacts are listed in summary in Table 47.

The final alternative plans affect agricultural and forestlands. Both Alternative Plans JCCL-P1 and JCCL-P3 directly impact forestlands. This in turn indirectly impacts agricultural lands as they are proposed to be converted to forestlands as mitigation for same. The loss of these agricultural land acres is not considered to be significant for this area. Flood stage lowerings associated with Plans JCCL-P1 and JCCL-P3 reduce the size of the 100-year floodplain.

Plan JCCL-P3 (excluding tributaries) results in less conversion of woodlands and the subsequent less significant resultant conversion of agricultural lands via the mitigation plan, than does Plan JCCL-P1 (including tributaries). Therefore, from an environmental standpoint, Plan JCCL-P3 is the preferable action alternative.

Regional Economic Development

Reducing flood damage frequency and cost will improve economic growth, employment, property valuation, and tax revenue in the region. Conversely, allowing flooding to continue to occur could likely result in decreasing same. Direct economic benefits to existing property is included in the NED estimates above. Induced economic benefits are speculative to a large degree and are not calculated directly into the benefit-cost analysis. These items are addressed in the Economic Appendix H and are listed in summary in Table 47.

Both Plans, JCCL-P1 and JCCL-P3, will significantly reduce flooding frequency and cost and therefore are far preferable to No Action given economic development considerations. Relative to each other, construction of the 10-year concrete-lined channel with tributaries alternative plan, JCCL-P1, will result in less frequent flooding and lower flood damages versus JCCL-P3, which does not include the tributaries.

Social Effects

Social effects considered in evaluating each alternative plan are listed in Table 47. Health, safety, and the quality of community life will obviously be significantly improved by both channel modification plans. Relative to No Action, the beneficial social impacts of both channel modification plans appear to far outweigh their adverse effects. The higher level of flood reduction associated with Plan JCCL-P1 is most preferable in this category.

Trade-Off Analyses and Plan Selection

The economic and social benefits of both channel modification alternative plans are far more significant than the slight environmental quality advantage of No Action. Relative to each other, Alternative Plan JCCL-P1 (with tributaries) has an advantage in NED, regional economic development and social effects. Plan JCCL-P3 (without tributaries) has a relative advantage with respect to environmental impacts.

The net economic benefits of Alternative Plan JCCL-P1 are significantly higher than JCCL-P3 and No Action. It is apparent that inclusion of all tributaries in the channel modification plan will produce significant economic benefits. In consideration of the possible effects of uncertainty factors, it appears that Plan JCCL-P1 would still have significant relative economic benefits. Alternative Plan JCCL-P1 (with tributaries) was therefore chosen as the Recommended Plan for this watershed.

Final Comparison to Non-Structural Measures

The recommended channel modification plan will significantly lower flood stages for an estimated 1,700 structures in the Jones Creek watershed. At a first cost of $50,141,000, the cost per affected structure is approximately $29,000. This is significantly less than that for relocating or elevating these structures. Most structures in this watershed are constructed on slabs. Elevation costs would likely exceed $70,000 per structure, on average. The channel modification plan, JCCL-P1, is therefore the Recommended Plan for this watershed.

TABLE 47

JONES CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	JCCP-P (RECOMMENDED PLAN)	JCCL-P3	NO ACTION
I.	<u>PLAN DESCRIPTION</u>	10-YEAR CONCRETE-LINED CHANNEL WITH TRIBUTARIES; LIVELY BAYOU, LIVELY BAYOU TRIBUTARY, AND WEINER CREEK	10-YEAR CONCRETE-LINED CHANNEL WITHOUT TRIBUTARIES	
II.	<u>NATIONAL ECONOMIC DEVELOPMENT</u>			
	A. PROJECT FIRST COST	$50,141,000	$37,164,000	$0
	B. O&M COST	$ 15,000	$ 11,000	$0
	C. TOTAL AVERAGE ANNUAL COSTS	$ 4,430,000	$ 3,294,000	$0
	D. TOTAL AVERAGE ANNUAL BENEFIT	$ 6,715,000	$ 4,877,000	$0
	E. NET ANNUAL BENEFITS	$ 2,285,000	$ 1,583,000	$0
	F. BENEFIT-COST RATIO	1.52	1.48	N/A
III.	<u>ENVIRONMENTAL QUALITY</u>			
	A. AGRICULTURAL LANDS	99 ACRES INDIRECTLY IMPACTED BY FOREST REPLANTING	66 ACRES INDIRECTLY IMPACTED BY FOREST REPLANTING	NO IMPACTS
	B. FORESTLANDS	78 ACRES AFFECTED BY PROJECT; 99 ACRES WOULD BE CREATED VIA MITIGATION	52 ACRES AFFECTED BY PROJECT; 66 ACRES WOULD BE CREATED VIA MITIGATION	SOME LOSS OF THESE RESOURCES
	C. THREATENED AND ENDANGERED SPECIES	NONE AFFECTED	NONE AFFECTED	NONE AFFECTED
	D. AQUATIC RESOURCES AND WATER QUALITY	SHORT-TERM ADVERSE IMPACT DURING CONSTRUCTION; REDUCED DIVERSITY; INCREASED TEMPERATURES	(SAME AS JCCL-P1)	NO IMPACT

TABLE 47 (CONTINUED)
JONES CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	JCCL-P1	JCCL-P3	NO ACTION
	E. SEDIMENTATION	PROJECT WILL REDUCE STREAMBANK EROSION AND WILL SLIGHTLY IMPROVE SEDIMENTATION	(SAME AS JCCL-P1)	NATIVE SOILS RESULT IN HIGH AMOUNT OF EROSION
	F. AIR QUALITY	MINOR SHORT-TERM IMPACTS DURING CONSTRUCTION	(SAME AS JCCL-P1)	NO IMPACT
	G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT	NO IMPACT	NO IMPACT
	H. CULTURAL PROPERTIES	VERY SLIGHT CHANCE OF UNCOVERING UNKNOWN SITES DURING CONSTRUCTION	(SAME AS JCCL-P1)	NO IMPACT
IV.	REGIONAL ECONOMIC DEVELOPMENT			
	A. REGIONAL INCOME AND EMPLOYMENT	IMPROVED VALUE WILL LIKELY FACILITATE URBAN GROWTH	(SAME AS JCCL-P1; SLIGHTLY WORSE)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCREASED EMPLOYMENT FOR CONSTRUCTION; BETTER ECONOMIC CLIMATE DUE TO REDUCTION IN FLOOD THREAT	(SAME AS JCCL-P1; SLIGHTLY WORSE)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	C. TAX REVENUE	IMPROVED FLOOD PROTECTION WILL STABILIZE TAX BASE	(SAME AS JCCL-P1; SLIGHTLY WORSE)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	D. PROPERTY VALUE	IMPROVED FLOOD PROTECTION WILL LIKELY STABILIZE OR RAISE PROPERTY VALUES	(SAME AS JCCL-P1; SLIGHTLY WORSE)	PROPERTY VALUES MAY DECLINE DUE TO RECURRING FLOODING

TABLE 47 (CONTINUED)
JONES CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	JCCL-P1	JCCL-P3	NO ACTION
V.	OTHER SOCIAL EFFECTS			
	A. URBAN AND COMMUNITY IMPACTS	POSITIVE IMPACTS DUE TO IMPROVED FLOOD PROTECTION	(SAME AS JCCL-P1; SLIGHTLY WORSE)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	B. LIFE, HEALTH, AND SAFETY	THREAT TO LIFE, HEALTH, AND SAFETY REDUCED	(SAME AS JCCL-P1; SLIGHTLY WORSE)	RECURRING FLOODS THREATEN LIFE, HEALTH, AND SAFETY
	C. DISPLACEMENT	NONE EXPECTED	NONE EXPECTED	NO IMPACT
	D. LONG-TERM PRODUCTIVITY	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS JCCL-P1; SLIGHTLY WORSE)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	E. LEISURE	POTENTIAL FOR BIKE PATH RECREATION AS PART OF FLOOD CONTROL PROJECT	(SAME AS JCCL-P1; SLIGHTLY WORSE)	NO IMPACT
	F. AESTHETIC	SOME ADVERSE IMPACT BY REMOVING TREES FROM CHANNELS; MITIGATED WITH REPLANTED TREE LINE	(SAME AS JCCL-P1)	NO IMPACT
	G. COMMUNITY COHESION	PRESERVED DUE TO REDUCED FLOOD THREAT	(SAME AS JCCL-P1; SLIGHTLY WORSE)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	H. COMMUNITY GROWTH	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS JCCL-P1; SLIGHTLY WORSE)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	I. TRANSPORTATION	MINOR DISRUPTION DURING CONSTRUCTION; IMPROVED SITUATION BY REDUCING FLOODING	(SAME AS JCCL-P1) DURING FLOOD EVENTS	SOME ADVERSE IMPACTS
	J. NOISE	MINOR INCREASE IN NOISE DURING CONSTRUCTION	(SAME AS JCCL-P1)	NO IMPACT
	K. QUALITY OF LIFE	REDUCED FLOODING WILL SUBSTANTIALLY IMPROVE THE QUALITY OF LIFE FOR THOSE AFFECTED	(SAME AS JCCL-P1; SLIGHTLY WORSE)	ADVERSE IMPACTS FOR THOSE AFFECTED BY FLOODING

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

CLAY CUT BAYOU

The Clay Cut Bayou Watershed is located in the southern part of the parish and generally flows west to east. See Plate 2. Clay Cut Bayou is a tributary of the Amite River and has one tributary - Jacks Bayou. This stream drains an area of about 15 square miles.

Land use in the watershed is about 50% urbanized. Land use maps for 1972 and 1985 are shown on Plates 14 and 15 of Appendix J. There are approximately 200 residential and commercial structures within the watershed. The distribution of structures within the various floodplains is shown in Table 48. The approximate 10-year floodplain boundary is shown on Plate 7. Calculated existing equivalent annual flood damages were estimated to be $1,015,000 per year in this watershed (Subbasin 31). Methodology used in calculating this figure can be found in the Economics Appendix H.

Both headwater and backwater flooding occurs in this watershed with the former predominant. Backwater flooding occurs from the bayou's mouth upstream to Elliot Road.

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Due to the lack of topographical relief in this watershed, detention/retention storage basins were determined to be impractical. Required basin containment structures, primarily earthen levees, in conjunction with land requirements would be excessive in order to achieve significant flow retention.

Channel Modifications

As stated above, backwater effects of the Amite River extend upstream to Elliot Road. The existing channel utilizes all of the available right-of-way with a 25-foot servitude on each side of the channel. These limitations restricted the amount of channel modification that could be studied for this channel to concrete lining of the existing channel with a minimum of shaping of the channel to a trapezoidal section. This modification extends from Elliot Road to Jacks Bayou. Recent modifications to Jack's Bayou have provided a 50-year level of protection. Therefore, no further channel modification was considered for Jacks Bayou. The benefit-to-cost ratio for the plan was to be 0.40 to 1. This plan was therefore not determined to be economically feasible.

As an alternative to concrete lining of the channel, channel enlargement by making a vertical cut at the top of banks was considered. This plan consisted of making a 3-foot deep gabion supported vertical cut at the top of banks. In addition, bank paving with gabions at a 1 on 3 sides slope extending from the toe of the vertical cut to a gabion-lined channel bottom was included in this plan. The gabions would be covered with an asphalt mastic to achieve Manning's 'n' value approximately equal to that of concrete. This option was determined to be slightly more costly than the concrete slope pavement and, therefore, was also determined to be infeasible.

Backwater Gate - Barrier Levee - Pumping Station

A culvert control structure and barrier levee located at the bayou's mouth was considered to reduce backwater flood damages. The first cost of this plan was determined to be in excess of $12.5 million. This cost, annualized, exceeds existing flood damage estimates for all of the watershed. Inclusion of a pumping station would substantially increase this cost further and would also be infeasible.

TABLE 48
CLAY CUT BAYOU - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	SUBBASIN NAME: CLAYCUT BAYOU							
31	1-STORY	121	377	86	251	97	108	1040
	2-STORY	19	21	13	16	17	21	107
	MOBILE HOME	4	15	47	5	4	40	119
	COMMERCIAL	31	5	2	19	20	28	105
	TOTAL	175	418	148	291	138	197	1367

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Nonstructural Measures

Nonstructural sclutions for the Clay Cut Bayou area include ring levees around selected subdivisions, buy-out and relocation of structures subject to repetitive flooding. Almost all existing residential and commercial structures in the area are constructed on concrete slab foundation. Although technically possible, it is not usually practical or economically feasible to elevate a large number of structures above flood levels. Ring levees around selected subdivision could be economically favorable but is not feasible to provide protection to a large number of subdivisions. Buy-out and relocation was also determined to be more costly than structural improvements providing comparable levels of flood damage reduction. Floodproofing individual structures requires analysis on a case-by-case basis. Because of the number of structures in the watershed, floodproofing individual structures was eliminated from consideration in this study. No non-structural plans were, therefore, developed for this watershed.

No structural or nonstructural plan was determined to be economically feasible. Federal participation in a flood control project is therefore not recommended for this watershed.

WARD CREEK

The Ward Creek watershed is located in the central and southeastern portion of East Baton Rouge Parish. Ward Creek begins in the north central portion of Baton Rouge and flows in a southeasterly direction into Bayou Manchac. Major tributaries of Ward Creek include: Dawson Creek, Bayou Duplantier, and North Branch of Ward Creek. Ward Creek and Tributaries drain about 45 square miles.

Ward Creek, with a drainage area of about 45 square miles, is a major tributary of Bayou Manchac. It originates in the north-central portion of Baton Rouge and flows in a southerly direction changing to a southeasterly direction as it approaches the corporate limits. The floodplain is rather narrow within the city, but broadens quickly downstream of the corporate limits (see Plate 8). Ward Creek's major tributaries include North Branch Ward Creek and Dawson Creek and its tributary of Bayou Duplantier.

The North Branch Ward Creek Tributary has a drainage area of 7.8 square miles and discharges into Ward Creek at about Mile 7.8. It drains the eastern portion of the watershed. Dawson Creek is the largest tributary to Ward Creek with a drainage area of about 16.0 square miles. It discharges into Ward Creek at about Mile 5.8. Dawson Creek drains the western portion of the watershed. Bayou Duplantier is the main tributary to Dawson Creek with a drainage area of about 7.7 square miles. It discharges into Dawson Creek at about Mile 4.0 and drains the western portion of the Dawson Creek waters portion of the Dawson Creek watershed.

The watershed is about 75% urbanized, consisting of residential and commercial development with some light industries. Land use maps for 1972 and 1985 are shown on Plates 16 through 27 of Appendix J. There are approximately 5,400 residential and commercial structures within various floodplains in the watershed. The distribution of structures within these floodplains is shown in Table 49. The approximate 10-year floodplain boundary is shown on Plate 8. Calculated without project equivalent annual flood damages for all subbasins in this watershed are listed in Table 50.

Methodology used in calculating these values can be found in Economics Appendix H.

Flooding in this watershed is primarily headwater in nature. Some backwater problems occur, but only in close proximity to the confluence with Bayou Manchac. Backwater flooding is not a significant factor in this watershed.

TABLE 49

WARD CREEK - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BASIN NAME: WARD CREEK							
21	1-STORY	14	59	56	182	456	1,275	2,042
	2-STORY	1	0	5	2	3	25	38
	MOBILE HOME	0	0	0	0	1	0	1
	COMMERCIAL	3	13	17	48	91	220	392
	TOTAL	18	72	78	232	551	1,520	2,471
	BASIN NAME: BAYOU DUPLANTIER							
25	1-STORY	3	13	1	22	9	65	113
	2-STORY	2	6	6	6	6	15	41
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	12	2	2	4	13	13	46
	TOTAL	17	21	9	32	28	93	200
	BASIN NAME: DAWSON CREEK							
26	1-STORY	51	50	20	14	24	72	231
	2-STORY	10	5	3	1	1	9	29
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	52	50	11	17	15	64	209
	TOTAL	113	105	34	32	40	145	469
	BASIN NAME: NORTH BRANCH - WARD CREEK							
27	1-STORY	17	84	41	161	167	366	836
	2-STORY	3	18	1	21	61	45	149
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	23	16	14	9	19	233	314
	TOTAL	43	118	56	191	247	644	1,299

TABLE 49 (CONTINUED)

WARD CREEK - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BASIN NAME: DAWSON CREEK							
30	1-STORY	20	69	17	8	119	54	287
	2-STORY	0	2	2	10	18	19	51
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	19	20	3	5	12	82	141
	TOTAL	39	91	22	23	149	155	479
	BASIN NAME: WARD CREEK							
32	1-STORY	17	5	49	29	82	155	337
	2-STORY	3	2	3	2	2	15	27
	MOBILE HOME	4	0	0	0	1	71	76
	COMMERCIAL	25	4	19	15	2	13	78
	TOTAL	49	11	71	46	87	254	518

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 50

WARD CREEK
CALCULATED WITHOUT PROJECT EQUIVALENT ANNUAL FLOOD DAMAGES

BASIN	REACH		EQUIVALENT ANNUAL DAMAGES WITHOUT PROJECT*
21 - WARD CREEK	B		$ 70,000
	C		$ 321,000
	D		$ 1,000
	E		$ 6,000
	F		$ 92,000
	G		$ 23,000
		SUBTOTAL	$ 513,000
25 - BAYOU DUPLANTIER	A		$ 227,000
26 - DAWSON CREEK	A		$ 835,000
27 - NORTH BRANCH - WARD CREEK	A		$ 446,000
	B		$ 126,000
	C		$ 210,000
		SUBTOTAL	$ 782,000
30 - DAWSON CREEK	A		$ 929,000
32 - WARD CREEK	A		$ 267,000
	B		$ 521,000
		SUBTOTAL	$ 788,000
TOTAL WATERSHED			$4,074,000

* 2ND QUARTER 1994 PRICE LEVELS

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Because the upper portion of Ward Creek is so highly urbanized, the only opportunity for flood detention storage was on Bayou Duplantier. Hydraulic analysis indicated that providing detention storage on Bayou Duplantier would only lower states 0.3 feet. Consequently, detention storage was eliminated from consideration.

Channel Modifications

Channel modifications to the main stem and tributaries of Ward Creek were determined to be practical options and were investigated.

Several channel modification plans were developed for the Ward Creek and Tributaries watershed. Because the backwater effects of the Amite River extend from the mouth of Ward Creek to about 4,000 feet upstream, channel modifications in this reach were limited to clearing and snagging. In general, the channel modifications were sized to contain headwater flows to within banks for the design frequencies. Because Bayou Duplantier acts as a sump area, channel modification would not be effective. As such, no channel improvement designs were considered for this stream. All the stage lowerings on Bayou Duplantier are strictly dependent on downstream modification on Dawson Creek and Ward Creek.

Initial designs considered widening the existing earthen channels to provide various levels of flood protection. Concrete lining in combination with less extensive channel widening was also considered. During the development of these alternatives, however, it became apparent that the existence of widespread highly erodible soils would limit the number of viable channel modification plans.

Throughout the Ward Creek watershed, particularly above Siegen Lane, bank erosion is prevalent. Erosion rates are moderately high and are extreme in some locations. A significant strata of loess soil is widespread and is the main factor in this process. See Engineering Appendix C. There has also been extensive urban development along the right-of-way boundary in some of these areas. This combination has resulted in a major problem where progressive bank erosion has encroached and affected private property lands, and is some cases, structures. This problem is severe in the North Branch Tributary. Photographs illustrating this problem on Ward Creek can be found in Figure 1.

In consideration of the above, it was determined that channels could not be widened and maintained with just grass bank cover. Concrete-lined channels were, therefore, determined to be the only viable option for proposed channel widenings.

Concrete-lined channel designs to contain storm events of 25, 50, and 100 years were determined to be possible for most of the watershed with the exception of the upper reaches of both the North Branch and Dawson Creek Tributaries where limited rights-of-way bordering developed areas exist. In these reaches, the existing right-of-way limit controlled the design. Alternative plan combinations that included or excluded all tributaries were also established.

Nonstructural Measures

The Ward Creek watershed is highly urbanized with a very high percentage of slab foundation structures. Flood protection by means of levees and/or floodwalls would be very difficult to accomplish in such a congested area. Buy-outs in conjunction with structure elevation would likely be the only practical non-structural alternatives for this watershed. As shown in previous sections, this alternative would be preferable to a conventional structural plan only if the cost per (flooded) structure is very high. Preliminary cost data indicated that costs per (flooded) structure for this non-structural alternative were significantly higher than that for corresponding channel modification plans. No non-structural alternatives were, therefore, identified for analysis in the initial alternatives for this watershed.

A summary of initial alternatives for Ward Creek is shown in Table 51. Detailed alternative plan descriptions are listed in Table 52. Alternative plans are shown on Plates 18 through 20.

It was determined that the significant environmental impacts of channel modification alternative plans would generally be limited to the destruction of some bottomland hardwood forests that occur in a linear strip along the channel banks. These impacts can be readily mitigated by reforestation of existing cleared lands or by protecting areas of existing forested lands.

Existing disposal areas were investigated to avoid the adverse environmental impact. The East Baton Rouge Parish of Public Works identified the parish landfill as the place to haul excavated material. Therefore, the initial cost estimates were developed assuming that excavated material would be hauled to this location. See Plate 51.

TABLE 51

WARD CREEK - SUMMARY OF INITIAL ALTERNATIVE PLANS

ALTERNATIVE	DESCRIPTION
WCC-P1	25-Year Concrete-Lined Channel Without Tributaries
WCC-P2	50-Year Concrete-Lined Channel Without Tributaries
WCC-P3	100-Year Concrete-Lined Channel Without Tributaries
WCC-P4	25-Year Concrete-Lined Channel With Tributaries; North Branch and Dawson Creek
WCC-P5	50-Year Concrete-Lined Channel With Tributaries; North Branch and Dawson Creek
WCC-P6	100-Year Concrete-Lined Channel With Tributaries; North Branch and Dawson Creek
--	No Action

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 52

WARD CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
WCC-P1			
	Ward Creek	varies	4000′ upstream of mouth to the corporate limits. Based on the 25-year concrete-lined channel design.
		60′BW	4000′ u/s to Highland Road.
		50′BW	Highland to Barringer Foreman Rd.
		improve bridge	Barringer Foreman Road.
		80′BW	Barringer Foreman to 1000′ u/s I-10.
		60′BW	1000′ u/s I-10 to Pecue Lane.
		30′BW	Pecue to 3300′ d/s Bluebonnet.
		40′BW	3300′ d/s Bluebonnet to Bluebonnet.
		30′BW	Bluebonnet to 3000′ u/s of Bluebonnet.
		5′BW	3000′ u/s Bluebonnet to u/s Burden.
		30′BW	u/s Burden to u/s I-10.
		15′BW	u/s I-10 to corporate limits.
	Dawson Creek		No work.
	North Branch		No work.
WCC-P2			
	Ward Creek	varies	4000′ upstream to mouth to the corporate limits. Based on the 50-year concrete-lined channel design.
		80′BW	4000′ u/s to Barringer Foreman.
		improve bridge	Barringer Foreman Road.
		80′BW	Barringer Foreman to 1000′ u/s I-10.
		60′BW	1000′ u/s I-10 to 3000′ u/s of Bluebonnet.
		10′BW	3000′ u/s Bluebonnet to u/s Burden.
		30′BW	u/s Burden to u/s I-10.
		15′BW	u/s I-10 to corporate limits.

TABLE 52 (Continued)
WARD CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
WCC-P2	**(Continued)**		
	Dawson Creek		No work.
	North Branch		No work.
WCC-P3			
	Ward Creek	varies	4000′ upstream of mouth to the corporate limits. Based on the 100-year concrete-lined channel design.
		90′BW	4000′ u/s to Barringer Foreman.
		improve bridge	Highland Road.
		improve bridge	Barringer Foreman Road.
		80′BW	Barringer Foreman to 1000′ u/s I-10.
		70′BW	1000′ u/s I-10 to 3000′ u/s of Bluebonnet.
		40′BW	3000′ u/s Bluebonnet to u/s Burden.
		30′BW	u/s Burden to u/s I-10.
		15′BW	u/s I-10 to corporate limits.
	Dawson Creek		No Work.
	North Branch		No Work.
WCC-P4			
	Ward Creek	varies	4000′ upstream of mouth to the corporate limits. Based on the 25-year concrete-lined channel design.
		60′BW	4000′ u/s to Highland Road.
		50′BW	Highland to Barringer Foreman Road.
		improve bridge	Barringer Foreman Road.
		80′BW	Barringer Foreman to 1000′ u/s I-10.
		60′BW	1000′ u/s I-10 to Pecue Lane.
		30′BW	Pecue to 3300′ u/s Bluebonnet.
		40′BW	3300′ d/s Bluebonnet to Bluebonnet.
		30′BW	Bluebonnet to 3000′ d/s of Bluebonnet.

TABLE 52 (Continued)
WARD CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
WCC-P4	**(Continued)**		
		5'BW	3000' d/s Bluebonnet to u/s Burden.
		30'BW	u/s Burden to u/s I-10.
		15'BW	u/s I-10 to corporate limits.
	Dawson Creek	20"BW	Mouth to College Drive.
		5'BW	College Drive to Hundred Oaks Drive.
	North Branch	20'BW	Mouth to Florida Blvd.
WCC-P5			
	Ward Creek	varies	4000' upstream of mouth to the corporate limits. Based on the 50-year concrete-lined channel design.
		80'BW	4000' u/s to Barringer Foreman.
		improve bridge	Barringer Foreman Road.
		80'BW	Barringer Foreman to 1000' u/s I-10.
		60'BW	1000' u/s I-10 to 3000' u/s of Bluebonnet.
		10'BW	3000' u/s Bluebonnet to u/s Burden.
		30'BW	u/s Burden to u/s I-10.
		15'BW	u/s I-10 to corporate limits.
	Dawson Creek	20'BW	Mouth to College Drive.
		5'BW	College Drive to Hundred Oaks Drive.
	North Branch	20'BW	Mouth to Florida Blvd.
WCC-P6			
	Ward Creek	varies	4000' upstream of mouth to the corporate limits. Based on the 100-year concrete-lined channel design. Modify Barringer Foreman and Highland Road bridges.
		90'BW	4000' u/s to Barringer Foreman Rd.
		improve bridge	Highland Road.
		improve bridge	Barringer Foreman Road.

TABLE 52 (Continued)
WARD CREEK - INITIAL ALTERNATIVE PLANS

PLAN	CHANNEL	BOTTOM WIDTH	LOCATION
WCC-P6	(Continued)		
		80'BW	Barringer Foreman to 1000' u/s I-10.
		70'BW	1000' u/s I-10 to 3000' u/s of Bluebonnet.
		40'BW	3000' u/s Bluebonnet to u/s Burden.
		30'BW	u/s Burden to u/s I-10.
		15'BW	u/s I-10 to corporate limits.
	Dawson Creek	20'BW	Mouth to College Drive.
		5'BW	College Drive to Hundred Oaks Drive.
	North Branch	20'BW	Mouth to Florida Blvd.

Note: All concrete-lined embankment design slopes 3.0H : 1.0V

Source: U.S. Army Corps of Engineers, New Orleans District

Screening of Initial Alternatives

Project costs, benefits, and potential adverse environmental impacts were used as the screening mechanisms. In this iteration, only major cost items - construction, relocations, real estate, and annual operations and maintenance were developed. Benefits calculated in this part of the analyses were "direct" property inundation flood damage reductions plus an estimated percentage (20%) of "indirect" flood damage reduction benefits. "Indirect" items include such items as public agency emergency costs, flood insurance reductions, and lower construction costs within the floodplain.

Cost-benefit calculations for each initial alternative plan are shown in Table 53. A period of 50 years and an annual interest rate of 8.00% were used to calculate equivalent annual values. Costs and benefits shown are all relative to the base condition or "No Action" Plan. No mitigation cost was considered in the initial screening. However, methods to avoid adverse environmental impacts and mitigation were considered in the plan formulation.

The cost-benefit calculations revealed that all six channel modification plans have costs that significantly exceed calculated benefits. Relative to each other, it was determined that there is no significant increase in benefits produced by the 50- or 100-year plans, both with and without inclusion of the tributaries.

Reformulation and Analyses of Alternative Plans

Reformulation of alternative plans was subsequently considered and two plans were developed. Each of these plans consists of concrete-lined 25-year designed channel for all tributaries and the main stem of Ward Creek only above Siegen Lane. One plan (WCC-P4A) includes minimal clearing and snagging downstream of Siegen Lane, while the other (WCC-P4B) includes the addition of replacing the Barringer Forman Road bridge with some channel widening immediately upstream and downstream of this crossing. In reformulating these plans, the replacement of the Siegen Lane bridge and downstream channel widening to 1200 feet above Pecue Lane were considered. These modifications have been recently constructed and were not considered in the screening of initial alternative plans. It was determined that these modifications have some significant effect on lowering flood stages in the lower Ward and lower Dawson Creeks' reaches. These effects were, therefore, incorporated into the without project conditions at this point of the analyses. Reformulated alternative plans are described in Table 54 and are shown on Plate 21.

TABLE 53

WARD CREEK - INITIAL ALTERNATIVE PLANS

CALCULATED BENEFITS AND COSTS

PLAN	FIRST COST	EQUIVALENT ANNUAL COST (INCLUDING O&M)	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
WCC-P1	$45,371,000	$4,350,000	$3,012,000	($1,338,000)	0.69
WCC-P2	$52,553,000	$5,037,000	$3,026,000	($2,011,000)	0.60
WCC-P3	$58,767,000	$5,632,000	$3,101,000	($2,531,000)	0.55
WCC-P4	$84,999,000	$8,144,000	$4,826,000	($3,318,000)	0.59
WCC-P5	$92,142,000	$8,828,000	$4,845,000	($3,983,000)	0.55
WCC-P6	$98,271,000	$9,414,000	$4,860,000	($4,554,000)	0.52

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Cost-benefit calculations for the reformulated plans are shown in Table 55. As with the initial alternative plans, the two reformulation plans were also determined to have higher costs relative to their benefits produced.

At this point of the analysis, plans were further reformulated scaling down project size. Examination of flood reduction benefits and estimated costs for incremental reaches in Plans WCC-P4A and WCC-P4B indicated the following:

- Paving the main stem of Ward Creek would not be cost-effective; clearing and snagging the main stem of Ward Creek may be cost-effective.

- Relocation of the Barringer Foreman Road bridge would likely produce only marginal net benefits.

- Paving the lower reach of the North Branch Tributary below I-12 would likely be cost-effective; paving above I-12 would not likely be cost-effective.

- Paving the lower one-half of Dawson Creek up to Kenilworth Parkway may be cost-effective; paving above this point would not likely be cost-effective.

TABLE 54

WARD CREEK AND TRIBUTARIES
CHANNEL MODIFICATION ALTERNATIVES: WCC-P4A AND WCC-P4B

Stream	Reach	Type of Improvement
PLAN WCC-P4A --	Earthen and Concrete Improvements	
Ward Creek	Mouth to 4000 ft. upstream	No Work.
	4000 ft upstream to 1200 ft upstream Pecue Lane	Minimal Clearing and Snagging.
	1200 ft. upstream Pecue Lane to Siegen Lane	No Work: 150′ BW by Developer made, Siegen Br replaced.
	Siegen Ln. to 3300 ft down-stream of Bluebonnet Rd.	Concrete-Line: 30′BW, 1V on 3H SS
	3300 ft. downstream Bluebonnet Rd. to Bluebonnet Rd.	Concrete-Line: 40′BW, 1V on 3H SS
	Bluebonnet Rd. to I-10	Concrete-Line: 30′BW, 1V on 3H SS
	I-10 to corporate limits	Concrete-Line: 15′BW, 1V on 3H SS
	Corporate limits to Choctaw Drive	Clear Existing Concrete Channels
North Branch Ward Creek	Mouth to Florida Blvd	Concrete-Line: 20′BW, 1V on 3H SS
Dawson Creek	Mouth to College (Lee) Dr	Concrete-Line: 20′BW, 1V on 3H SS
	College Dr to Hundred Oaks Drive	Concrete-Line: 5′BW, 1V on 3H SS

TABLE 54 (Continued)

WARD CREEK AND TRIBUTARIES
CHANNEL MODIFICATION ALTERNATIVES: WCC-P4A AND WCC-P4B

Channel	Reach	Type of Improvement
PLAN WCC-P4B --	Earthen and Concrete Improvements	
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to Barringer Foreman Rd	Minimal Clearing and Snagging
	Barringer Foreman Road Bridge	Replace Bridge; Improve Channel Immediately u/s and d/s of Bridge
	Barringer Foreman Rd to 1200 ft u/s Pecue Ln	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work: 150' BW by Developer made, Siegen Br replaced
	Siegen Ln to 3300 ft d/s of Bluebonnet Rd	Concrete-Line: 30'BW, 1V on 3H SS
	3300 ft d/s Bluebonnet Rd to Bluebonnet Rd	Concrete-Line: 40'BW, 1V on 3H SS
	Bluebonnet Rd to I-10	Concrete-Line: 30'BW, 1V on 3H SS
	I-10 to corporate limits	Concrete-Line: 15'BW, 1V on 3H SS
	Corporate limits to Choctaw Drive	Clear Existing Concrete Channels
North Branch	Mouth to Florida Blvd	Concrete-Line: 20'BW, 1V on 3H SS
Dawson Creek	Mouth to College (Lee) Blvd	Concrete-Line: 20'BW, 1V on 3H SS
	College Dr to Hundred Oaks Drive	Concrete-Line: 5'BW, 1V on 3H SS

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 55

WARD CREEK - ECONOMIC ANALYSIS OF PLANS P4A AND P4B

PLAN	FIRST COST	ANNUAL COST	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
WCC-P4A	$66,100,000	$6,106,000	$2,294,000	($3,812,000)	0.38
WCC-P4B	$68,000,000	$6,280,000	$2,472,000	($3,808,000)	0.39

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

In consideration of the above, Plan WCC-P4B was eliminated and Plan WCC-P4A was further reformulated. Four plans (WCC-P4A1 - WCC-P4A4) incorporating the above were developed and are listed in Table 56 and are shown on Plates 22 and 23. These plans consist of paving the North Branch Tributary to I-12 along with the four combinations of clearing and snagging the main stem of Ward Creek to its termination at Choctaw Drive or partially up to the North Branch Tributary confluence, and, paving or not paving, Dawson Creek from its mouth to Kenilworth Parkway. At this point, plans for the North Branch Tributary were changed to incorporate an existing 1,200-foot paved reach between I-10 and I-12. This section has a 32-foot wide bottom width and the proposed section for North Branch was enlarged to match this reach.

Clearing and snagging of the Dawson Creek and North Branch Tributaries were not included. Unlike the main stem of Ward Creek, existing rights-of-way on these tributaries are limited with significant property development bordering the streambanks. Clearing and snagging may accelerate existing bank erosion in these tributaries and have significant adverse effects on the bordering properties.

TABLE 56
WARD CREEK ALTERNATIVE PLANS
WCC-P4A1 - WCC-P4A4

Stream	Reach	Type of Improvement
PLAN WCC-P4A1 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work; 150′ BW by Developer made, Siegen Br replaced
	Siegen Lane to Choctaw Drive	Minimal Clearing and Snagging
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32" BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work
Dawson Creek	Mouth to Kenilworth Blvd	Concrete-Line: 20′ BW, 1V on 3H SS
	Kenilworth Blvd to Hundred Oaks Drive	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work
PLAN WCC-P4A2 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work: 150′ BW by Developer made, Siegen Br replaced
	Siegen Ln to Choctaw Dr	Minimal Clearing and Snagging
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32′ BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work
Dawson Creek	Mouth to Kenilworth Blvd	No Work
	Kenilworth Blvd to Hundred Oaks Drive	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work

TABLE 56 (Continued)
WARD CREEK ALTERNATIVE PLANS
WCC-P4A1 - WCC-P4A4

Stream	Reach	Type of Improvement
PLAN WCC-P4A3 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work: 150' BW by Developer made, Siegen Br replaced
	Siegen Ln to Mouth of North Br Ward Ck	Minimal Clearing and Snagging
	North Br Ward Ck to Choctaw Dr	No Work
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32' BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work
Dawson Creek	Mouth to Kenilworth Blvd	Concrete-Line: 20' BW, 1V on 3H SS
	Kenilworth Blvd to Hundred Oaks Dr	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work
PLAN WCC-P4A4 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work: 150 BW by Developer made, Siegen Br replaced
	Siegen Ln to Mouth of North Br Ward Ck	Minimal Clearing and Snagging
	North Br Ward Ck to Choctaw Dr	No Work
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32' BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work

TABLE 56 (Continued)
WARD CREEK ALTERNATIVE PLANS
WCC-P4A1 - WCC-P4A4

Stream	Reach	Type of Improvement
PLAN WCC-P4A4 -- Earthen and Concrete Improvements (Continued)		
Dawson Creek	Mouth to Kenilworth Blvd	No Work
	Kenilworth Blvd to Hundred Oaks Dr	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work

Source: U.S. Army Corps of Engineers, New Orleans District

Flood reduction benefits were calculated for the above four plans. From these figures, it was clear from only a cursory estimate of incremental costs, that clearing and snagging all of the main stem of Ward Creek is cost-effective and that paving the lower one-half of Dawson Creek is not cost-effective.

In addition to these findings, consideration was given to the East Baton Rouge Parish Department of Public Works' interest in paving North Branch up to 1,800 feet above Old Hammond Highway where large interceptor channels flow into this tributary.

In consideration of the above, two plans were developed for further analysis. Each plan included minimal channel clearing and snagging of all of the main stem of Ward Creek. Plan WCC-P4A5 calls for paving the North Branch Tributary to I-12 only. Plan WCC-P4A6 includes paving North Branch to 1,800 feet above Hammond Highway. Plan details are listed in Table 57 and are shown on Plate 24.

TABLE 57

WARD CREEK - ALTERNATIVE PLANS

WCC-P4A5 AND WCC-P4A6

Stream	Reach	Type of Improvement
PLAN WCC-P4A5 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work; 150' BW by Developer made, Siegen Br replaced
	Siegen Lane to Corporate Blvd	Minimal Clearing and Snagging
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32' BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work
Dawson Creek	Mouth to Bayou Duplantier	Minimal Clearing and Snagging
	Bayou Duplantier to Hundred Oaks Drive	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work
PLAN WCC-P4A6 -- Earthen and Concrete Improvements		
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Siegen Lane	No Work: 150' BW by Developer made, Siegen Br replaced
	Siegen Ln to Corporate Blvd	Minimal Clearing and Snagging
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32' BW, 1V on 3H SS
	I-12 to 1800 ft u/s of Old Hammond Hwy	Concrete-Line: 20' BW, 1V on 3H

TABLE 57 (Continued)

WARD CREEK - ALTERNATIVE PLANS

WCC-P4A5 AND WCC-P4A6

PLAN WCC-P4A6 -- Earthen and Concrete Improvements (Continued)

Stream	Reach	Type of Improvement
Dawson Creek	Mouth to Bayou Duplantier	Minimal Clearing and Snagging
	Bayou Duplantier to Hundred Oaks Drive	No Work
Bayou Duplantier	Mouth to Darymple Drive	No Work

Source: U.S. Army Corps of Engineers, New Orleans District

A detailed cost and flood reduction benefit analysis was performed on these two plans. The results of which are shown in Table 52. It was determined that only Plan WCC-P4A5 has positive net benefits. Plan WCC-P4A6 was not considered further.

TABLE 58
WARD CREEK - ECONOMIC ANALYSIS OF PLANS P4A5 AND P4A6

PLAN	FIRST COST	ANNUAL COST	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
WCC-P4A5	$ 9,434,000	$ 932,000	$1,032,000	$100,000	1.11
WCC-P4A6	$17,785,000	$1,704,000	$1,214,000	($490,000)	0.71

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Analysis of Final Alternatives

Plans selected for final evaluation were: WCC-P4A5 (see description above) and No Action. Final alternative plans were evaluated relative to National Economic Development, Environmental Quality, Regional Economic Development, and Social Effects. A summary of this analyses is shown in Table 59.

National Economic Development (NED)

In the final analysis, environmental mitigation costs were included in each alternative plan's cost. It should be noted that the mitigation plan combines all mitigation requirements from all watersheds. Consolidating mitigation sites was determined to be far more practical than establishing individual mitigation sites for each watershed in the study area. Costs were prorated to each watershed based on alternative plan habitat losses. A complete description of the mitigation plan can be found in the Environmental Appendix (E).

Alternative plan benefits and costs are listed in Table 59. As in the initial screenings, a period of 50 years and 8.00% annual interest were used. Relative to No Action, the single channel modification plan, WCC-P4A5 has significant net economic development benefits relative to No Action.

Environmental Quality

Impacts on the following environmental factors were evaluated for each final alternative plan:

- Agricultural Lands
- Forestlands
- Threatened and Endangered Species
- Aquatic Resources and Water Quality
- Sedimentation
- Air Quality
- Historic Places
- Cultural Properties

Detailed analyses of these factors can be found in the Environmental Impact Statement and Appendix E. Impacts are listed in summary in Table 59.

The only environmental impacts produced by the final alternative plans affect agricultural lands and forestlands. Alternative Plan WCC-P4A5 directly impacts a significant quantity of forestlands. This in turn indirectly impacts agricultural lands as they are proposed to be converted to forestlands as mitigation for same. The loss of these agricultural land acres is not considered to be significant for this area. Flood stage lowerings associated with Plan WCC-P4A5 reduces the size of the 100-year floodplain.

Plan WCC-P4A5 is the only action alternative included in the final array of alternatives. No other economically feasible action alternative was retained for comparison.

Regional Economic Development

Reducing flood damage frequency and cost will improve economic growth, employment, property valuation, and tax revenue in the region. Conversely, allowing flooding to continue to occur could likely result in decreasing same. Direct economic benefits to existing property is included in the NED estimates above. Induced economic benefits are speculative to a large degree and are not calculated directly into the benefit-cost analysis. These items are addressed in the Economic Appendix H and are listed in summary in Table 59.

Plan WCC-P4A5 will significantly reduce flooding frequency and cost and therefore is far preferable to No Action given economic development considerations.

Social Effects

Social effects considered in evaluating each alternative plan are listed in Table 58. Health, safety, and the quality of community life will obviously be significantly improved by the channel modification plan.

Trade-Off Analyses and Plan Selection

The economic and social benefits of the channel modification alternative plan are far more significant than the slight environmental quality advantage of No Action. In consideration of project uncertainties, Plan WCC-P4A5 appears to have a high probability of having economic benefits relative to No Action and was, therefore, chosen as the Recommended Plan for this watershed.

Final Comparison to Non-Structural Measures

The recommended channel modification plan will lower flood stages for an estimated 492 structures in the Ward Creek watershed. At a first cost of $9,434,000, the cost per affected structure is approximately $19,000. This is significantly less than that for relocating or elevating these structures. Most structures in this watershed are constructed on slabs. Elevation costs would likely exceed $70,000 per structure, on average. The channel modification plan, WCC-PA5, is therefore the Recommended Plan for this watershed.

TABLE 59
WARD CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	WCC-PA5 (RECOMMENDED PLAN)	NO ACTION
I.	PLAN DESCRIPTION	CONCRETE LINED NORTH BRANCH I-10 TO I-12; MINIMAL CLEARING AND SNAGGING MAIN CHANNEL AND DAWSON CREEK TO BAYOU DUPLANTIER	
II.	NATIONAL ECONOMIC DEVELOPMENT		
	A. PROJECT FIRST COST	\$ 9,434,000	\$0
	B. O&M COST	\$ 51,000	\$0
	C. TOTAL AVERAGE ANNUAL COSTS	\$ 932,000	\$0
	D. TOTAL AVERAGE ANNUAL BENEFITS	\$ 1,032,000	\$0
	E. NET ANNUAL BENEFITS	\$ 100,000	\$0
	F. BENEFIT-COST RATIO	1.11	N/A
III.	ENVIRONMENTAL QUALITY		
	A. AGRICULTURAL LANDS	28 ACRES DIRECTLY IMPACTED BY FOREST REPLANTING	SOME ADVERSE IMPACT DUE TO RECURRING FLOODING
	B. FORESTLANDS	22 ACRES AFFECTED BY PROJECT; 28 ACRES WOULD BE CREATED VIA MITIGATION	NO IMPACT
	C. THREATENED AND ENDANGERED SPECIES	NONE AFFECTED	NONE AFFECTED
	D. AQUATIC RESOURCES AND WATER QUALITY	SHORT-TERM ADVERSE IMPACT; REDUCED DIVERSITY; INCREASED TEMPERATURES	NO IMPACT

TABLE 59 (CONTINUED)
WARD CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	WCC-PA5	NO ACTION
	E. SEDIMENTATION	PROJECT WILL REDUCE STREAMBANK EROSION AND WILL SLIGHTLY IMPROVE SEDIMENTATION	EROSION RATES ARE HIGH IN THE UPPER REACHES
	F. AIR QUALITY	MINOR SHORT-TERM IMPACTS DURING CONSTRUCTION	NO IMPACT
	G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT	NO IMPACT
	H. CULTURAL PROPERTIES	VERY SLIGHT CHANCE OF UNCOVERING UNKNOWN SITES DURING CONSTRUCTION	NO IMPACT
IV.	REGIONAL ECONOMIC DEVELOPMENT		
	A. REGIONAL INCOME AND EMPLOYMENT	IMPROVED VALUE WILL LIKELY FACILITATE URBAN GROWTH	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCREASED EMPLOYMENT FOR CONSTRUCTION; BETTER ECONOMIC CLIMATE DUE TO REDUCTION IN FLOOD THREAT	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	C. TAX REVENUE	IMPROVED FLOOD PROTECTION WILL STABILIZE TAX BASE	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	D. PROPERTY VALUE	IMPROVED FLOOD PROTECTION WILL LIKELY STABILIZE OR RAISE PROPERTY VALUES	PROPERTY VALUES MAY DECLINE DUE TO RECURRING FLOODING

TABLE 59 (CONTINUED)
WARD CREEK FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	WCC-PA5	NO ACTION
V.	<u>OTHER SOCIAL EFFECTS</u>		
	A. URBAN AND COMMUNITY IMPACTS	POSITIVE IMPACTS DUE TO IMPROVED FLOOD PROTECTION	ADVERSE IMPACTS DUE TO FLOOD THREAT
	B. LIFE, HEALTH, AND SAFETY	THREAT TO LIFE, HEALTH, AND SAFETY REDUCED	RECURRING FLOODS THREATEN LIFE, HEALTH, AND SAFETY
	C. DISPLACEMENT	NONE EXPECTED	NO IMPACT
	D. LONG-TERM PRODUCTIVITY	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	ADVERSE IMPACTS DUE TO FLOOD THREAT
	E. LEISURE	NO IMPACT	NO IMPACT
	F. AESTHETIC	SOME ADVERSE IMPACT BY REMOVING TREES FROM CHANNELS; MITIGATED WITH REPLANTED TREE LINE	NO IMPACT
	G. COMMUNITY COHESION	PRESERVED DUE TO REDUCED FLOOD THREAT	ADVERSE IMPACTS DUE TO FLOOD THREAT
	H. COMMUNITY GROWTH	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	ADVERSE IMPACTS DUE TO FLOOD THREAT
	I. TRANSPORTATION	MINOR DISRUPTION DURING CONSTRUCTION; IMPROVED SITUATION BY REDUCING FLOODING	SOME ADVERSE IMPACTS DURING FLOOD EVENTS
	J. NOISE	MINOR INCREASE IN NOISE DURING CONSTRUCTION	NO IMPACT
	K. QUALITY OF LIFE	REDUCED FLOODING WILL SUBSTANTIALLY IMPROVE THE	ADVERSE IMPACTS FOR THOSE AFFECTED BY FLOODING

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

BAYOU FOUNTAIN

The Bayou Fountain Watershed is located in the southern portion of East Baton Rouge Parish (see Plate 9). Bayou Fountain originates on the Louisiana State University Campus and generally flows in a southeasterly direction into Bayou Manchac. The major tributaries to Bayou Fountain are Elbow Bayou, Bayou Fountain North Branch, Bayou Fountain South Branch, and Selene Bayou. Bayou Fountain and tributaries drain about 40 square miles.

The principal residential developments in the Bayou Fountain drainage area lie on the bluff adjacent to Louisiana State Highway 42 (Highland Road) and also in areas adjacent to Louisiana State Highway 30 (Nicholson Drive) just south of Louisiana State University. In recent years, developments have migrated to floodplain areas. Land use maps for 1972, 1978, and 1985 are shown on Plates 28, 29, and 30 of Appendix J. The watershed is largely agricultural and forestlands comprise about 72 percent of the watershed. The watershed is about 26 percent urban. It is located near major traffic arteries and industrial sites along the river. The watershed serves as a place of residence for workers in Baton Rouge and along the river. Commercial growth is strong in the area. The watershed has a very great potential for future growth as it is located near the center of the city of Baton Rouge and to the university. It also borders the Mississippi River, which provides opportunities for industrial expansion.

There are approximately 2,400 residential and commercial structures within various floodplains in the watershed. The distribution of structures within the various floodplains is shown in Table 60. The approximate 10-year floodplain boundary is shown on Plate 9. Calculated existing equivalent annual flood damages for all subbasins in this watershed are listed in Table 61. Methodology used in calculating these values can be found in Economics Appendix H.

Both headwater and backwater flooding occur in this basin. Most flood damage results from headwater conditions. Heavy rainfall inside the watershed itself often causes headwater flooding immediately above Siegen Lane where stage differentials of several feet occur upstream to Gardere Lane.

Significant headwater flooding also occurs in the upper basin on the Louisiana State University campus. Stages also rise to structure damaging levels when the Amite River rises to flood stage levels. Water from the Amite River backs into Bayou Manchac, which in turn backs into Bayou Fountain. Backwater flooding occurs from Bayou Fountain's mouth upstream to just above Siegen Lane. In January 1993, some residents close to Siegen Lane experienced a "two-phase" flood. Immediately following the rain event, headwaters passed through Bayou Fountain causing flooding, then subsiding. About 12 to 24 hours later, the rise in the Amite River from the same rainfall event upstream caused a rise in Bayou Fountain, which again caused flooding of some of the same structures near Siegen Lane.

TABLE 60

BAYOU FOUNTAIN - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
BASIN NAME: BAYOU FOUNTAIN								
29	1-STORY	41	130	26	33	531	432	1,193
	2-STORY	7	50	113	5	196	133	504
	MOBILE HOME	0	0	0	0	0	6	6
	APT.BLDGS.	39	125	101	10	54	39	368
	COMMERCIAL	8	22	11	45	112	82	280
	TOTAL	95	327	251	93	893	692	2,351

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 61

BAYOU FOUNTAIN
CALCULATED WITHOUT PROJECT EQUIVALENT ANNUAL FLOOD DAMAGES

BASIN	REACH	EQUIVALENT ANNUAL DAMAGES WITHOUT PROJECT*
29	A	$ 194,000
	B	$ 0
	C	$ 16,000
	D	$ 274,000
	D1	$ 117,000
	D2	$ 74,000
	E	$ 15,000
	G	$ 296,000
	H	$ 21,000
	I	$ 77,000
	I2	$ 221,000
	K	$ 2,000
	L	$ 63,000
	M	$ 285,000
	TOTAL	$1,655,000

* 2ND QUARTER 1994 PRICE LEVELS

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

(See Plates 25-41)

Detention/Retention Storage

Due to the lack of topographical relief in this watershed, detention/retention storage basins were determined to be impractical. Required basin containment structures, primarily earthen levees, in conjunction with land requirements would be excessive in order to achieve significant flow retention.

Channel Modifications

Channel improvements to the main stem and both tributaries of Bayou Fountain were determined to be practical options and were investigated.

Various channel modification plans were developed for the Bayou Fountain watershed. The plan generally consists of about 11 miles of channel modification along Bayou Fountain. Because backwater from Bayou Manchac extends from the mouth of Bayou Fountain to just upstream of the Siegen Lane bridge, the plans were designed to provide various levels of protection in the headwater reaches. In general, the channel modifications were sized to contain headwater flows within banks for the design frequencies. However, for the 100-year design, high backwater stages make it impractical to design a channel enlargement to put the flood stages within banks. In addition, because the 10-year design required upstream channel enlargement, a minimum channel design (clearing and snagging only) was also developed for this stream. Soil conditions along the channels will likely allow channel widening without special erosion protection. In addition, plans were developed where the earthen channel designs were concrete lined and the levels of protection were determined.

Pumping Stations

(Pumping Station at the Mouth of Bayou Fountain)

This pumping station scheme consists of a containment levee at the mouth of Bayou Fountain, gravity outlets for normal daily discharges, and a pumping station for flood events. The containment levee prevents Bayou Manchac's backwater flows from filling the large sump area on Bayou Fountain below the Siegen Lane bridge. The sump area is used to store Bayou Fountain discharges and, therefore, minimizes the required pumping station capacities.

The containment levee is located approximately 1,500 feet upstream of the mouth and runs generally in a northeast to southwest direction where it meets the natural ridge paralleling Bayou Manchac. It follows the ridge maintaining a crest elevation of 18.0 feet NGVD until it meets higher ground. The crest elevation was set at the 100-year flood elevation plus 2 feet of freeboard.

Pumping station capacities of 300, 600, and 900 cfs were considered for this alternative. Each design consisted of three pumps. The average daily stage of the sump area is 2.3 feet NGVD based on 35 years of daily stage recordings at the Spanish Lake floodgate on Alligator Bayou. For each of these alternatives, it was assumed that the first pump would be turned on when sump pool stages exceeded 3.5 feet NGVD.

Gravity outlets, three concrete box culverts, were designed to pass interior flows up to the 25-year discharges, minus the pumping station capacity, with a minimum of 3 feet of head. They were located in the containment levee with an invert elevation of 0.0 feet NGVD.

Hydraulic analyses indicate that this pumping station scheme produces stage lowerings of 0-5 feet in the sump area, however, the impact on upstream reaches becomes minimal. At Ben Hur Road, only 0.1 - 0.2 feet of lowering can be achieved.

(Pumping Station on Elbow Bayou)

Elbow Bayou, a tributary of Bayou Fountain, has a total drainage are of approximately 15 square miles. As such, an alternative was considered that would remove the majority of Elbow Bayou flows from Bayou Fountain. Openings along Highway 30 for Elbow Bayou drainage to Bayou Fountain would be closed and existing channels would be enlarged to convey Elbow Bayou drainage towards the Mississippi River levee, where a pumping station would pass the flows over the levee into the river.

The pumping station would be located at the Mississippi River levee near River Mile 220. This location would allow Elbow Bayou flows to be stored in the low area near this station. The pumping station would consist of five 250 cfs pumps. The pump capacity was sized such that interior stages would not exceed existing conditions on Elbow Bayou. The first pump would be turned on when interior stages in the sump exceeded 16.0 feet NGVD. The pumps would be required to lift discharges over the Mississippi River levee which has a design grade, at this location, of 47.5 feet NGVD. In addition, approximately 3.5 miles of channel enlargement and development would be required to convey the flows to the sump area and to the pumping station.

The results of this alternative indicate that peak stages on Bayou Fountain are not significantly reduced (0.2 feet) by removing the Elbow Bayou basin west of Highway 30. This occurs because the Elbow Bayou hydrograph is attenuated and its peak is reduced when routed through the natural sump area between Highway 30 and Burbank Drive. Because of the small impact on Bayou Fountain's flood stages, this alternative was eliminated from further consideration.

(Pumping Station Located on Upper Bayou Fountain)

Flood damages currently occur in a concentrated area on the Louisiana State University campus at the very upstream portion of the basin. An alternative plan to reduce these damages was developed. This plan consists of placing a pumping station on the South Branch Tributary and pumping either to the Mississippi River, or, in-line to South Branch Tributary. In both cases, upstream stages would be reduced. In diverting flow to the river, additional flood damage reduction occurs downstream.

Three pumping station capacities of 700, 525, and 350 cfs were analyzed. It was determined that existing upstream channel capacity limits the effectiveness of the proposed pumping stations. Upstream channel widening was therefore included in the pumping station plan. With or without the upstream channel modification, it was determined that the 350 cfs station has virtually the same effectiveness as the larger capacities. Designs and costs were, therefore, only developed for the 350 cfs station.

Diverting flood flow to the Mississippi River, or, blocking the main channel and pumping in-line back to the channel were considered. In diverting flow to the river, some downstream benefits are realized. Pumping in-line to the bayou can be accomplished without increasing downstream stages. The advantage of such a plan is a net lower cost associated with constructing a floodwall and levee across the bayou in lieu of effluent pipelines and outfall to the river. While some special operational procedures would be required under some flood scenarios, in-line pumping can be done without raising downstream stages. This is due to the fact that existing flow rates can be maintained while water levels immediately upstream of the station are lowered by the pumps. This plan would likely have, however, a public acceptance problem. Downstream residents would likely perceive that this station would increase flooding in their area and therefore not support the plan.

A significant uncertainty exists with these plans regarding seepage flows from the Mississippi River. Medium to high river levels currently cause moderate to severe seepage flows in the South Branch Tributary. This flow rate is not known, but may influence the effectiveness of the proposed pumping station. Channel maintenance is also a concern given artificial drawdowns induced by the proposed pumping station under high river conditions.

Floodgate

An alternative plan using a floodgate structure in the containment levee in place of a pumping station was considered. Like the pumping station alternatives, this alternative would prevent flows due to backwater from Bayou Manchac from entering the Bayou Fountain sump area. Historically, stages in Bayou Fountain will usually peak before the Bayou Manchac backwater, thereby allowing flood flows from Bayou Fountain to pass through the proposed floodgates. As stages rose on Bayou Manchac, the floodgates would close and Bayou Fountain flows would be stored in the sump area. The floodgate structure was sized to pass the 25-year flow with a head of 3 feet. Interior stages above the sump area would not exceed existing conditions stages. The floodgate would consist of two 8′ x 8′ concrete box culverts with flapgates placed in the containment levee with an invert elevation of 0.0 feet NGVD.

This plan, like the pumping station plan, provides additional storage capacity by preventing backwater from filling the sump area. However, upstream of the sump area, flood stages were only reduced by 0 to 0.5 feet.

Combination of Structural Plans

Additional alternatives were studied in which the pump station and floodgate plans located at the bayou's mouth were combined with selected earthen, concrete-lined, and minimum channel improvements. The addition of the pumping station or the floodgate provided additional stage lowerings over those provided by the channel improvements alone of about 1.0 to 5.0 feet in the sump area near the mouth of Bayou Fountain and of about 0.5 feet to 1.5 feet near the upper limit of the backwater effects near Siegen Lane. However, in the headwater reaches above Siegen Lane, where most flood damages occur, the additional stage lowerings are generally less than 0.2 feet. As a result, the addition of pump stations or floodgates to the channel modification plans provides minimal additional flood control benefits.

The pumping station alternative proposed for Upper Bayou Fountain was determined to produce some downstream benefits only if flow from the upper basin is diverted to the

Mississippi River. These benefits were determined to only occur independent of downstream channel modifications. With proposed downstream channel modifications in place, low frequency flood events remain within streambank and the beneficial effects of the diverted flow from the proposed upstream pumping station become negligible. The combination of the proposed Upper Bayou Fountain pumping station plan with other structural measures was, therefore, not considered further.

Nonstructural Measures

Nonstructural flood damage reduction measures are those which reduce or avoid flood damages without significantly altering either the nature or extent of flooding. Such measures reduce flood losses by either changing the use of the floodplain or by retaining existing floodplain use with modifications made to the structures or facilities susceptible to flood damages. Nonstructural measures for existing developed areas could include permanent evacuation and relocation of properties from the floodplain or flood proofing of structures by means of levees, floodwalls, barriers, or by elevating structures above flood levels. Such measures for future development could include floodplain zoning, fill of flood plain areas, or regulations to control future runoff from rainfall.

The Bayou Fountain watershed flood zones consist of a relatively high percentage of apartment and townhouse structures. Also, a high percentage of the single family homes and commercial structures in the watershed are constructed on slabs. Elevation of multi-family dwellings in many cases is not feasible and the cost of elevating a slab structure approaches the cost of a complete buy-out. Given this situation, structure elevation was not considered as it was determined that structure buy-outs would be far more comprehensive and practical in lieu of structure elevation in this watershed. Buy-out of all property in the 0-10 and 0-25-year frequency floodplain was evaluated. The number and types of structures in these floodplains are shown below:

	Floodplain	
	0-10	10-25
Residential	87	305
Commercial	8	22
Total	85	327

Ring levee plans were considered for two subdivisions along Bayou Fountain, Highland Park and Meadow Bend. On June 27-28, 1989, Tropical Storm Allison provided about 10 inches of rain in a 24-hour period on the Bayou Fountain watershed causing the two subdivisions to experience severe flooding. The ring levee crests were set at the 100-year flood elevation plus 2 feet of freeboard (19.8 feet NGVD for both subdivisions). The levee section has 1V on 4H side slopes with a 10-foot wide crown. The pumping stations and gravity outlets were designed to evacuate the 10-year, 24-hour rainfall within 48 hours. The pumping stations were sized to prevent interior stages from exceeding the damage elevation of 17.0 feet NGVD for the conditions stages for the range of frequencies studied. The gravity outlet culverts were sized to pass the 10-year flow with 1 foot of head.

Land use projections indicate that the watershed will be 65 percent urbanized by the year 2040. This significant increase in urbanization with the resulting increase in flood stages will substantially reduce the effectiveness of any proposed structural plan. In order not to reduce the level of flood protection provided by a structural plan, floodplain management is necessary. East Baton Rouge Parish will be required to implement a stormwater retention ordinance stating that additional runoff caused by changed soil or surface conditions after the new development must be retained on site so that runoff leaving the development site is maintained at or below predevelopment rates. Similar ordinances have been implemented in Shreveport and New Iberia, Louisiana.

In addition to the above, the Federal Emergency Management Agency is in the process of establishing a "floodway" along

Bayou Fountain. Once implemented, this floodway zone will curtail development adjacent to the bayou.

It was determined that the environmental impacts of channel modification alternative plans would generally be limited to the destruction of some bottomland hardwood forestation that occurs along the channel banks. These impacts can be readily mitigated by equivalent reforestation of existing cleared lands or by protecting equivalent areas of existing forested lands.

Existing disposal areas were investigated to avoid the adverse environmental impact. The East Baton Rouge Parish of Public Works identified the parish landfill as the place to haul excavated material. Therefore, the initial cost estimates were developed assuming that excavated material would be hauled to this location. See Plate 51.

Initial alternatives for this watershed are listed in Table 62 and are detailed in Table 63.

TABLE 62

BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS SUMMARY

ALTERNATIVE	DESCRIPTION
BF10	10-Year Earthen Channel
BF25	25-Year Earthen Channel
BF50	50-Year Earthen Channel
BF25C	25-Year Concrete-Lined Channel
BF50C	50-Year Concrete-Lined Channel
BFPS300	300 cfs Pumping Station Located at Bayou's Mouth
BFPS600	600 cfs Pumping Station Located at Bayou's Mouth
BFPS900	900 cfs Pumping Station Located at Bayou's Mouth
BFGATE	Backwater Flapgate Located at Bayou's Mouth
UBF350A	350 cfs Pumping Station Located on Upper Bayou Fountain with Diversion to the Mississippi River
UBF350B	350 cfs Pumping Station Located on Upper Bayou Fountain with In-Line Discharge
MEADRL	Ring Levee around Meadowland Subdivision
HLPKRL	Ring Levee around Highland Park Subdivision
BUYOUT10	Buyout of Properties Located in the 10-Year Floodplain
BUYOUT25	Buyout of Properties Located in the 25-Year Floodplain

TABLE 62 (Continued)

BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS SUMMARY

ALTERNATIVE	DESCRIPTION
(COMBINATION PLANS)	
BF10-BFGATE	10-Year Earthen Channel with Backwater Flapgate Located at Bayou's Mouth
BFPS300-C/S	300 cfs Pumping Station Located at Bayou's Mouth with Upstream Channel Clearing and Snagging
BFPS300-BF10	300 cfs Pumping Station Located at Bayou's Mouth with 10-Year Earthen Channel
BFPS600-BF10	600 cfs Pumping Station Located at Bayou's Mouth with 10-Year Earthen Channel
BFPS600-BF25C	600 cfs Pumping Station Located at Bayou's Mouth with 25-Year Concrete-Lined Channel
BFPS900-BF25C	900 cfs Pumping Station Located at Bayou's Mouth with 25-year Concrete-Lined Channel

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 63
BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
BF10 - 10-Year Earthen Channel		
	Mouth to Siegen Lane	Clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	Clearing and snagging
BF25 - 25-Year Earthen Channel		
	Mouth to Siegen Lane	Clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	20' BW, 1V on 3H SS
BF50 - 50-Year Earthen Channel		
	Mouth to Siegen Lane	Clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	40' BW, 1V on 3H SS
BF25C - 25-Year Concrete-Lined Channel		
	Mouth to Siegen Lane	Clearing and snagging
	Siegen to Gardere Lane	Concrete line existing channel
	Gardere Lane to E. Boyd Road	Concrete line existing channel
BF50C - 50-Year Concrete-Lined Channel		
	Mouth to Siegen Lane	Clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS concrete-lined channel
	Gardere Lane to E. Boyd Road	Concrete line existing channel

TABLE 63 (CONTINUED)
BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
BFPS300 - 300 cfs Pumping Station Located at Bayou's Mouth		
	Mouth to Siegen Lane	300 cfs pumping station and barrier levee
	Siegen to Gardere lane	No work
	Gardere Lane to E. Boyd Road	No work
BFPS600 - 600 cfs Pumping Station Located at Bayou's Mouth		
	Mouth to Siegen Lane	600 cfs pumping station and barrier levee
	Siegen to Gardere Lane	No work
	Gardere Lane to E. Boyd Road	No work
BFPS900 - 900 cfs Pumping Station Located at Bayou's Mouth		
	Mouth to Siegen Lane	900 cfs pumping station and barrier levee
	Siegen to Gardere Lane	No work
	Gardere Lane to E. Boyd Road	No work
BFGATE - Backwater Flapgate Located at Bayou's Mouth		
	Mouth to Siegen Lane	Flapgate and barrier levee
	Siegen to Gardere Lane	No work
	Gardere Lane to E. Boyd Road	No work

TABLE 63 (CONTINUED)

BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
UBF350A - 350 cfs Pumping Station on Upper Bayou Fountain with Discharge to the Mississippi River		
	Bayou Fountain/South Branch Confluence	New 0.8 mile diversion channel; 1V on 3H SS; earthen channel; 350 cfs pumping station with 2 66-inch discharge lines to the Mississippi River
	South Branch (all)	Widen to 20' BW, 1V on 3H SS earthen channel
		Replace 3 bridges
UBF350B - 350 cfs Pumping Station on Upper Bayou Fountain with Discharge into Bayou Fountain		
	Bayou Fountain/ South Branch Confluence	350 cfs pumping station and barrier wall/levee
	South Branch (all)	Widen to 20' BW, 1V on 3H SS earthen channel
		Replace 3 bridges
MEADRL - Ring Levee around Meadow Bend Subdivision		
	N/A	Construct ring levee around elevation 19.8' NGVD
		Install 120 cfs pumping station and 3 42-inch gravity culverts
HLPKRL - Ring Levee around Highland Park Subdivision		
	N/A	Construct ring levee around elevation 19.8' NGVD
		Install 30 cfs pumping station and 3 42-inch gravity culverts

TABLE 63 (CONTINUED)

BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
BUYOUT10 - Buyout of Properties Located in 10-Year Floodplain		
	N/A	Purchase 41 residential and 46 commercial properties
BUYOUT25 - Buyout of Properties Located in 25-Year Floodplain		
	N/A	Purchase 202 residential and 47 commercial properties
BF10-BFGATE - 10-Year Earthen Channel with Backwater Flapgate Located at Bayou's Mouth		
	Mouth to Siegen Lane	Flapgate and barrier levee; channel clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	Clearing and snagging
BFPS300-C/S - 300 cfs Pumping Station Located at Bayou's Mouth with Channel Clearing and Snagging		
	Mouth to Siegen Lane	300 cfs pumping station and barrier levee; channel clearing and snagging
	Siegen to Gardere Lane	Clearing and snagging
	Gardere Lane to E. Boyd Road	Clearing and snagging
BFPS300-BF10 - 300 cfs Pumping Station Located at Bayou's Mouth with 10-Year Earthen Channel		
	Mouth to Siegen Lane	350 cfs pumping station and barrier levee; channel clearing and snagging

TABLE 63 (CONTINUED)
BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
BFPS300-BF10 - 300 cfs Pumping Station Located at Bayou's Mouth with 10-Year Earthen Channel (Continued)		
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	Clearing and snagging
BFPS600-BF10 - 600 cfs Pumping Station Located at Bayou's Mouth with 10-Year Earthen Channel		
	Mouth to Siegen Lane	600 cfs pumping station and barrier levee; channel clearing and snagging
	Siegen to Gardere Lane	50' BW, 1V on 3H SS
	Gardere Lane to E. Boyd Road	Clearing and snagging
BFPS600-BF25C - 600 cfs Pumping Station Located at Bayou's Mouth with 25-Year Concrete-Lined Channel		
	Mouth to Siegen Lane	600 cfs pumping station and barrier levee; channel clearing and snagging
	Siegen to Gardere Lane	Concrete line existing channel
	Gardere Lane to E. Boyd Road	Concrete line existing channel
BFPS900-BF25C - 900 cfs Pumping Station Located at Bayou's Mouth with 25-Year Concrete-Lined Channel		
	Mouth to Siegen Lane	900 cfs pumping station and barrier levee; channel clearing and snagging
	Siegen to Gardere Lane	Concrete line existing channel
	Gardere Lane to E. Boyd Road	Concrete line existing channel

Source: U.S. Army Corps of Engineers, New Orleans District

Screening of Initial Alternatives

In this iteration, only major cost items - construction, relocations, real estate, and annual operations and maintenance were considered. Benefits included in this part of the analyses were calculated as "direct" property inundation flood damage reductions plus an estimated percentage (20%) of "indirect" flood damage reduction benefits. "Indirect" items include such things as public agency emergency costs, flood insurance reductions, and lower construction costs within the floodplain.

Cost-benefit calculations for each initial alternative are shown in Table 64. A period of 50 years and an annual interest rate of 8.00% were used to calculate equivalent annual values. Costs and benefits shown are all relative to the base condition or "No Action" Plan.

The initial benefit-cost calculations revealed that only four plans have a benefit-to-cost ratio greater than, or close to greater than 1.0. They are: BF10, BF25, and BF50 - the 10, 25, and 50-year earthen channels, and, BFGATE-C/S flapgate barrier levee at the bayou's mouth along with channel clearing and snagging. All pumping station plans, upstream and at the bayou's mouth, and in combination with channel modifications were not determined to be cost-effective and were eliminated from further consideration at this point. Also, the non-structural plans of property buy-outs and subdivision ring levees were not determined to be cost-effective and were also eliminated from further consideration.

At this point further "qualitative" screening was performed for each plan relative to each other. The channel modification plans have a relatively high degree of both performance and project cost certainty. These plan will significantly improve headwater flooding in the area where this problem frequently occurs. The backwater flapgate will have very little impact on headwater flooding, only providing some headwater benefit when a secondary rainfall occurs after the Amite River has risen. While backwater flooding is significant, it is not as frequent as the headwater events. Also, some relatively higher degree of cost uncertainty with the proposed structure is a factor. With the Comite River Diversion Canal plan in place, backwater lowerings of up to 0.5 feet will occur in the Bayou Fountain backwater area. This in turn reduces the calculated flood control benefits of the flapgate plan. Also, given relatively equal economics, East Baton Rouge's engineering staff expressed a strong preference for the channel improvement plan relative to the backwater flapgate. In consideration of the above, the backwater flapgate plan was eliminated from further evaluation.

It was also determined from stage-frequency calculations that proposed channel modifications of the upstream reaches of Bayou Fountain to East Boyd Road are only minimally effective. Thus, the remaining channel modification plans were scaled back and reformulated eliminating upstream modifications from Ben Hur Road up to East Boyd Road. Four intermediate plans were developed and evaluated. Two plans consist of a 10-year earthen channel modification with upstream limits at either mile 54.3 or Ben Hur Road (BF10A and BF10B). The other two plans consist of a 25-year earthen channel modification with two upstream limits identical to the 10-year plans (BF25A and BF25B). These plans were refined further by including a modification of a 60-inch sewerline crossing just upstream of Gardere Lane. Table 65 lists details of the four intermediate plans and they are also shown on Plates 40 and 41.

TABLE 64

BAYOU FOUNTAIN - INITIAL ALTERNATIVE PLANS

CALCULATED BENEFITS AND COSTS
($1,000)

PLAN	FIRST COST	EQUIVALENT ANNUAL COST (INCLUDING O&M)	INUNDATION REDUCTION BENEFITS	NET BENEFITS	B/C RATIO
BF-10	$ 2,457	$ 284	$ 298	$14	1.05
BF25	$ 5,358	$ 527	$ 541	$14	1.03
BF50	$ 6,632	$ 645	$ 634	($11)	0.98
BF25C	$26,448	$2,440	$ 693	($1,747)	0.28
BF50C	$31,456	$2,989	$ 700	($2,289)	0.23
BFPS 300	$ 9,684	$ 920	$ 214	($706)	0.23
BFPS 600	$17,431	$1,657	$ 214	($1,443)	0.13
BFPS 900	$29,052	$2,751	$ 214	($2,537)	0.08
BF GATE	$ 3,766	$ 381	$ 210	($171)	0.55
UBF 350A	$10,700	$1,034	$ 799	($235)	0.77
UBF 350B	$10,100	$ 978	$ 487	($491)	0.50
MEAD RL	$ 875	$ 118	$ 31	($87)	0.26
HLPK RL	$ 496	$ 67	$ 48	($19)	0.72
BUYOUT 10	$11,900	$1,094	$ 967	($127)	0.88
BUYOUT 25	$12,325	$1,133	$1,030	($103)	0.91
BF 10-BF GATE	$ 7,100	$ 750	$ 508	($242)	0.68
BFPS 300-C/S	$10,255	$1,006	$ 439	($567)	0.44
BFPS 300-BF10	$12,141	$1,204	$ 576	($628)	0.48
BFPS 600-BF10	$19,888	$1,941	$ 625	($1,316)	0.32
BFPS 600-BF25C	$26,577	$2,506	$ 849	($1,657)	0.34
BFPS 900-BF25C	$31,456	$2,989	$ 847	($2,142)	0.28
BFGATE-C/S	$ 4,297	$ 430	$ 439	($9)	1.02

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 65

BAYOU FOUNTAIN - INTERMEDIATE ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
BF10A - 10-Year Earthen Channel		
	Mouth to Siegen Lane	Clear and snag
	Siegen Lane to Gardere Lane	50′ BW, 1V on 3H SS earthen channel
	Gardere Lane to 4400′ upstream (Mile 54.3)	Clear and snag
	At Exist. Sewer Line Crossing Upstream of of Gardere Lane	Conc. U-Channel, 50′ BW, Inv. Elev. 4.0
BF10B - 10-Year Earthen Channel		
	Mouth to Siegen Lane	Clear and snag
	Siegen Lane to Gardere Lane	50′ BW, 1V on 3H SS earthen channel
	Gardere Lane to 4400′ upstream (Mile 54.3)	Clear and snag
	At Exist. Sewer Line Crossing Upstream of of Gardere Lane	Conc. U-Channel, 50′ BW; Inv. Elev. 4.0
	Mile 54.3 to Ben Hur Road Bridge	Clear and snag
BF25A - 25-Year Channel		
	Mouth to Siegen Lane	Clear and snag
	Siegen Lane to Gardere Lane	50′ BW, 1V on 3H SS earthen channel
	Gardere Lane to 4400′ upstream (Mile 54.3)	5′ BW, 1V on 3H SS concrete lined
	At Exist. Sewer Line crossing upstream of of Gardere Lane	Conc. U-Channel, 60′ BW; Inv. Elev. 3.0

TABLE 65 (CONTINUED)

BAYOU FOUNTAIN - INTERMEDIATE ALTERNATIVE PLANS

PLAN	REACH	TYPE OF IMPROVEMENT
<u>BF25B - 25-Year Channel</u>		
	Mouth to Siegen Lane	Clear and snag
	Siegen Lane to Gardere Lane	50′ BW, 1V on 3H SS earthen channel
	Gardere Lane to 4400′ upstream (Mile 54.3)	5′ BW, 1V on 3H SS concrete lined
	At Exist. Sewer Line crossing upstream of Gardere Lane	Conc. U-Channel, 60′ BW, Inv. Elev. 3.0
	Mile 54.3 to Ben Hur Road Bridge	20′ BW, 1V on 3H SS earthen channel

Source: U.S. Army Corps of Engineers, New Orleans District

Evaluation of Intermediate Alternative Plans

Calculated benefits and costs for the four intermediate plans are shown in Table 66. Only the 10-year earthen channel modification plans have benefits greater than estimated project costs. Both 25-year earthen channel modification plans were eliminated from consideration. Plan BF10B, 10-year channel modification to Ben Hur Road, was determined to have slightly higher net economic benefits relative to Plan BF10A, which has project limits downstream at mile 54.3.

Analysis of Final Alternatives

Three plans were selected for final evaluation: BF10A, 10-year earthen channel modifications to mile 54.3; BF10B, 10-year earthen channel modifications to Ben Hur Road; and No Action. Since no alteration was made with the exception of above, details shown in the Initial Alternatives are the same. Final alternatives were evaluated relative to National Economic Development, Environmental Quality, Regional Economic

Development, and Social Effects. A summary of this evaluation is shown in Table 67.

TABLE 66

BAYOU FOUNTAIN
ECONOMIC ANALYSIS OF PLANS BF10A, BF10B, BF25A, AND BF25B

PLAN	FIRST COST	ANNUAL COST	ANNUAL INUNDATION REDUCTION BENEFITS	ANNUAL NET BENEFITS	B/C RATIO
BF10A	$3,836,000	$356,000	$416,000	$60,000	1.17
BF10B	$3,912,000	$362,000	$434,000	$72,000	1.20
BF25A	$7,371,000	$708,000	$479,000	($229,000)	0.68
BF25B	$8,796,000	$839,000	$492,000	($347,000)	0.59

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

National Economic Development (NED)

In the final analyses, environmental mitigation costs were included in each alternative plan's cost. It should be noted that the mitigation plan combines all mitigation requirements from all watersheds. Consolidating mitigation sites was determined to be far more practical than establishing individual mitigation sites for each watershed in the study area. Costs were prorated to each watershed based on alternative plan habitat losses. A complete description of the mitigation plan can be found in Appendix E, Section 1.

Alternative plan benefits and costs are listed in Table 67. As in the initial screening, a period of 50 years and 8.00% annual interest were used. Alternative Plan BF10B, channel modifications to Ben Hur Road, has the highest estimated net annual benefits of $61,000. This is just slightly higher than the $51,000 per year net benefits estimated for Plan BF10A. Both plans have marginal net economic benefits relative to No Action. Relative to each other, the estimated difference is small, but it is clearly apparent that there exists net economic benefits in extending the upstream proposed channel clearing and snagging limits from Mile 54.3 up to Ben Hur Road.

Environmental Quality

Impacts on the following environmental factors were evaluated for each final alternative plan:

- Agricultural Lands
- Forestlands
- Threatened and Endangered Species
- Aquatic Resources and Water Quality
- Sedimentation
- Air Quality
- Historic Places
- Cultural Properties

Detailed analyses of these factors can be found in the Environmental Impact Statement and Appendix E. Impacts are listed in summary in Table 67.

The only long-lasting environmental impacts produced by the final alternative plans affect agricultural lands and forestlands. Both Alternative Plans BF10A and BF10B directly impact some forestlands. This in turn indirectly impacts agricultural lands as they are proposed to be converted to forestlands as mitigation for same. The loss of these agricultural land acres is not considered to be significant for this area. Flood stage lowerings associated with Plans BF10A and BF10B reduce the size of the 100-year floodplain. Again, this "loss" is not considered to be significant since no wetlands are impacted.

Plan BF-10A results in slightly less conversion of woodlands and the subsequent less significant resultant conversion of agricultural lands via the mitigation plan, than does Plan BF-10B. Therefore, from an environmental standpoint, Plan BF-10A is the preferable action alternative.

Regional Economic Development

Reducing flood damage frequency and cost will improve economic growth, employment, property valuation, and tax revenue in the region. Conversely, allowing flooding to continue to occur could likely result in decreasing same. Direct economic benefits to existing property is included in the NED estimates above. Induced economic benefits are speculative to a large degree and are not calculated directly into the benefit-cost analysis. These items are addressed in the Economic Appendix H and are listed in summary in Table 60.

Both Plans BF10A and BF10B will significantly reduce flooding frequency and cost and therefore are far preferable to No Action given economic development considerations. Relative to each other, Alternative BF10B will reduce flood damages in a slightly larger area than BF10A. This in turn will induce a slightly higher level of future economic development in the watershed, the extent of which is difficult to quantify.

Social Effects

Social effects considered in evaluating each alternative plan are listed in Table 67. Health, safety, and the quality of community life will be significantly improved by both channel modification plans. Relative to other areas in the parish, there is a very high frequency of flooding in this watershed. Numerous flooding occurrences, along with the constant threat of same, is a major social problem. Both channel modification plans will significantly reduce flooding frequency in this watershed and, therefore, are far preferable to No Action. It is required that 122 acres of private property be permanently taken for the channel widening proposed in Plans BF10A and BF10B. This land is limited to the adjacent streambank and no structures would be affected. Relative to each other, Plan BF10B will reduce flood damages in a slightly larger area and is preferable to Plan BF10A in this category.

Trade-Off Analyses and Plan Selection

While there exists no direct net economic benefits with both channel modification plans relative to No Action, their advantages relative to improving the social effects of flooding in the area make both plans far preferable to No Action. Construction of either plan will also have minimal adverse environmental impacts relative to No Action. These relative advantages to No Action are well within the range of uncertainty regarding costs and plan effectiveness of either channel modification plan.

Relative to each other, Alternative BF10B, channel modifications to Ben Hur Road, has slight advantages in regional economic development and social effects categories versus Plan BF10A, channel modifications to Mile 54.3. There is only a very slight environmental impact advantage for Plan BF10A relative to BF10B.

In consideration of all factors above, Alternative BF10B, 10-year earthen channel modifications to Ben Hur Road, was chosen as the Tentatively Selected Plan.

TABLE 67

BAYOU FOUNTAIN FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	BF10A	BF10B (RECOMMENDED PLAN)	NO ACTION
I.	PLAN DESCRIPTION	CHANNEL MODIFICATION AND CLEARING AND SNAGGING TO MILE 54.3	CHANNEL MODIFICATION AND CLEARING AND SNAGGING TO BEN HUR ROAD	
II.	NATIONAL ECONOMIC DEVELOPMENT			
	A. PROJECT FIRST COST	$ 3,937,000	$ 4,031,000	$0
	B. O&M COST	$ 31,000	$ 31,000	$0
	C. TOTAL AVERAGE ANNUAL COSTS	$ 365,000	$ 373,000	$0
	D. TOTAL AVERAGE ANNUAL BENEFITS	$ 416,000	$ 434,000	$0
	E. NET ANNUAL BENEFITS	$ 51,000	$ 61,000	$0
	F. BENEFIT-COST RATIO	1.14	1.16	N/A
III.	ENVIRONMENTAL QUALITY			
	A. AGRICULTURAL LANDS	19 ACRES INDIRECTLY IMPACTED BY FOREST REPLANTING	22 ACRES INDIRECTLY IMPACTED BY FOREST REPLANTING	SOME ADVERSE IMPACT DUE TO RECURRING FLOODING
	B. FORESTLANDS	15 ACRES AFFECTED BY PROJECT; 22 ACRES WOULD BE CREATED VIA MITIGATION	17 ACRES AFFECTED BY PROJECT; 22 ACRES WOULD BE CREATED VIA MITIGATION	SOME REDUCTION
	C. THREATENED AND ENDANGERED SPECIES	NONE AFFECTED; COORDINATION REQUIRED	NONE AFFECTED; (SAME AS BF10A)	NONE AFFECTED
	D. AQUATIC RESOURCES AND WATER QUALITY	LOSS OF DIVERSITY; REDUCED SHADING	(SAME AS BF10A)	NO IMPACT

TABLE 67 (CONTINUED)
BAYOU FOUNTAIN FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	BF10A	BF10B	NO ACTION
	E. SEDIMENTATION	PROJECT WILL REDUCE STREAMBANK EROSION AND WILL SLIGHTLY IMPROVE SEDIMENTATION	(SAME AS BF10A)	NO IMPACT
	F. AIR QUALITY	MINOR SHORT-TERM IMPACTS DURING CONSTRUCTION	(SAME AS BF10A)	NO IMPACT
	G. NATIONAL REGISTER OF HISTORIC PLACES	NO IMPACT	NO IMPACT	NO IMPACT
	H. CULTURAL PROPERTIES	FOUR POTENTIALLY SIGNIFICANT SITES ARE LIKELY TO OCCUR IN PROJECT AREA. MODERATE CHANCE OF UNCOVERING OTHER SITES. CHANNEL DESIGN CAN AVOID SITES IF NECESSARY.	(SAME AS BF10A)	NO IMPACT
IV.	REGIONAL ECONOMIC DEVELOPMENT			
	A. REGIONAL INCOME AND EMPLOYMENT	IMPROVED VALUE WILL LIKELY FACILITATE URBAN GROWTH	(SAME AS BF10A; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	B. REGIONAL GROWTH AND BUSINESS ACTIVITY	INCREASED EMPLOYMENT FOR CONSTRUCTION; BETTER ECONOMIC CLIMATE DUE TO REDUCTION IN FLOOD THREAT	(SAME AS BF10A; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	C. TAX REVENUE	IMPROVED FLOOD PROTECTION WILL STABILIZE TAX BASE	(SAME AS BF10A; SLIGHTLY BETTER)	INCOME AND BUSINESS MAY BE REDUCED DUE TO RECURRING FLOODING
	D. PROPERTY VALUE	IMPROVED FLOOD PROTECTION WILL LIKELY STABILIZE OR RAISE PROPERTY VALUES	(SAME AS BF10A; SLIGHTLY BETTER)	PROPERTY VALUES MAY DECLINE DUE TO RECURRING FLOODING

TABLE 67 (CONTINUED)
BAYOU FOUNTAIN FINAL ALTERNATIVES SUMMARY OF COMPARATIVE ITEMS

	ITEM	BF10A	BF10B	NO ACTION
V.	<u>OTHER SOCIAL EFFECTS</u>			
	A. URBAN AND COMMUNITY IMPACTS	POSITIVE IMPACTS DUE TO IMPROVED FLOOD PROTECTION	(SAME AS BF10A; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	B. LIFE, HEALTH, AND SAFETY	THREAT TO LIFE, HEALTH, AND SAFETY REDUCED	(SAME AS BF10A; SLIGHTLY BETTER)	RECURRING FLOODS THREATEN LIFE, HEALTH, AND SAFETY
	C. DISPLACEMENT	SOME TAKING OF UNIMPROVED PRIVATE PROPERTY	(SAME AS BF10A; SLIGHTLY WORSE)	NO IMPACT
	D. LONG-TERM PRODUCTIVITY	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BF10A; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	E. LEISURE	NO IMPACT	NO IMPACT	NO IMPACT
	F. AESTHETIC	SOME ADVERSE IMPACT BY REMOVING TREES FROM CHANNELS; MITIGATED WITH REPLANTED TREE LINE	(SAME AS BF10A)	NO IMPACT
	G. COMMUNITY COHESION	PRESERVED DUE TO REDUCED FLOOD THREAT	(SAME AS BF10A; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	H. COMMUNITY GROWTH	POSITIVE IMPACT DUE TO REDUCED FLOOD THREAT	(SAME AS BF10A; SLIGHTLY BETTER)	ADVERSE IMPACTS DUE TO FLOOD THREAT
	I. TRANSPORTATION	MINOR DISRUPTION DURING CONSTRUCTION; IMPROVED SITUATION BY REDUCING FLOODING	(SAME AS BF10A)	SOME ADVERSE IMPACTS DURING FLOOD EVENTS
	J. NOISE	MINOR INCREASE IN NOISE DURING CONSTRUCTION	(SAME AS BF10A)	NO IMPACT
	K. QUALITY OF LIFE	REDUCED FLOODING WILL SUBSTANTIALLY IMPROVE THE QUALITY OF LIFE FOR THOSE AFFECTED	(SAME AS BF10A; SLIGHTLY BETTER)	ADVERSE IMPACTS FOR THOSE AFFECTED BY FLOODING

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

BAYOU MANCHAC

The Bayou Manchac Watershed is located in the southeastern corner of the parish and is a tributary of the Amite River. See Plate 2. This watershed encompasses about 12 square miles.

The watershed is mostly undeveloped with urban lands making up less than 25 percent of the watershed. Land use maps for 1972 and 1985 are shown on Plates 31 and 32 of Appendix J. There are approximately 150 residential and commercial structures within the watershed. The distribution of structures within the various floodplains is shown in Table 68. The approximate 10-year floodplain boundary is shown on Plate 10. Calculated existing project equivalent annual flood damages were estimated to be $337,000 per year in this watershed (Subbasin 64).

Flooding in this watershed is mostly backwater in nature. Some headwater flooding occurs, but is usually in conjunction with backwater problems resulting from high water levels in the Amite River.

POSSIBLE OPTIONS TO REDUCE FLOOD DAMAGES

Structural Measures

Detention/Retention Storage

Due to the lack of topographical relief in this watershed, detention/retention storage basins were determined to be impractical. Required basin containment structures, primarily earthen levees, in conjunction with land requirements would be excessive in order to achieve significant flow retention.

Channel Modifications

Due to the significant backwater effects of the Amite River, simple channel enlargement would not be effective in reducing flood stages in this watershed.

TABLE 68

BAYOU MANCHAC - DISTRIBUTION OF STRUCTURES WITHIN VARIOUS FLOODPLAINS

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	BAYOU MANCHAC							
64	1-STORY	38	40	42	10	30	107	267
	2-STORY	11	3	4	4	5	15	42
	MOBILE HOME	23	14	49	11	26	31	154
	APT.BLDGS.	39	125	101	10	54	39	368
	COMMERCIAL	8	22	11	45	112	82	280
	TOTAL	95	327	251	93	893	692	2351

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Pumping Station/Diversion

Two pumping station options were investigated: one, blocking backwater flows by means of a levee and pumping through a barrier levee into Bayou Manchac; and two, diverting Bayou Manchac flows by pumping to the Mississippi River.

In the first option, the lack of topographic rise in this basin would require that the barrier levee be exceptionally long. That would make this plan very expensive and economically infeasible. The second plan, which would allow backwater into the basin and pump it to the Mississippi River, would require a very high capacity pumping station. This station would essentially have to pump down stages of the Amite River to be effective. A station of such capacity would also be cost prohibitive.

In addition to the above, a gravity flow diversion to the Mississippi River was considered. This plan would not be dependable since the Mississippi River water level is usually higher than the Amite River water level at Bayou Manchac even during Amite River flood events.

Nonstructural Measures

Nonstructural solutions for the Bayou Manchac area include ring levees around selected subdivisions, buy-out and relocation of structures subject to repetitive flooding. Almost all existing residential and commercial structures in the area are constructed on concrete slab foundation. Ring levees around selected subdivision could be economically favorable. Buy-out and relocation was also determined to be more costly than structural improvements providing comparable levels of flood damage reduction. While some nonstructural measures may be cost effective on an individual structure basis, a basis-wide plan was not developed for this watershed under the scope of this study.

No structural or nonstructural plans were developed for this watershed.

THE RECOMMENDED PLAN

GENERAL

The effects of the proposed Comite River Diversion Canal, see page 7, were considered and are incorporated below. Since most of this watershed's flooding occurs under headwater conditions, calculated flood reduction benefits are not significantly changed with the Comite project in place. A cursory examination of the previous plan formulation, screening and selection process, incorporating the canal's effects, was performed. This investigation revealed that the proposed canal has no significant impact on the plan selection analysis and conclusion for this watershed. Comparative stage frequency data and flood reduction benefits for each watershed's Recommended Plan are shown in the Engineering and Economics appendices.

BLACKWATER BAYOU

Description

The Recommended Plan for the Blackwater Bayou watershed consists of widening approximately 13 miles of the existing earthen channel of the main stem of Blackwater Bayou and its main tributary. Also included are proposed improvements to several bridges and culverts. Proposed modifications are designed to convey a 10-year storm event within streambank and reduce out-of-bank stages of larger flood events.

New channel slopes are designed 1 V on 3.5 H. Design bottom widths vary per stream reach. No significant changes are proposed to existing channel bottom elevation or slope. Proposed channel bottom width designs for each stream reach along with bridge and culvert modifications are listed in Table 69. Plates 42 and 43, respectively, show proposed channel modifications and relocations. Typical cross-sections for the plan are shown on Plate 47.

Plan Effectiveness

The Recommended Plan is designed to convey and contain a 10-year storm event within the streambank. Flood stages of greater storm events will also be reduced. Expected stage lowerings for various storm events at selected locations in the watershed are shown in Table 70 and Plate 55. Overflow maps, illustrating existing and with project floodplains are shown in the Engineering Appendix C. The expected reduction in floodstages will result in a substantial lowering in the number of structures located in a 0-50 year floodplain (see Table 71).

By the year 2040, urbanization in this watershed is projected to increase from 31 to 40 percent. Estimates from hydrologic modelling indicate that the 10-year with project average stage will be about 0.3 feet higher and that there will be no appreciable difference in average 100-year flood stages. Implementation of a floodplain management program, that would not allow future development to significantly increase flood stages, would likely reduce these projected stage increases. The continued implementation and enforcement of East Baton

Rouge Parish's current floodplain ordinance (see Appendix K) will be satisfactory in this watershed.

TABLE 69

BLACKWATER BAYOU - RECOMMENDED PLAN PROPOSED CHANNEL WIDTHS AND RELOCATIONS

CHANNEL	PROPOSED BOTTOM WIDTH	LOCATION
Blackwater Bayou		Improvements from Mouth to Greenwell Springs Road. 10 year earthen channel design
	varies	Mouth to Hooper Road (Minimal Work)
	35'BW	Hooper Road to Old Settlement Road
	improve bridge	Blackwater Road (lengthen 50 ft)
	remove bridge	Abandoned bridge at Crumholt Road (remove)
	improve bridge	Crumholt Road (lengthen 112 ft)
	improve bridge	Carey Road (lengthen 50 ft)
	improve bridge	Dyer Road (lengthen 35 ft)
	improve bridge	Blackwater Road (lengthen 45 ft)
	improve bridge	McCullough Road (lengthen 35 ft)
	15'BW	Old Settlement Road to Greenwell Springs Road
	improve culvert	Greenwell Springs Road (clean existing culvert)
Tributary #1	5' BW	Mouth to McCullough Road
	improve bridge	Core Lane (lengthen 16 ft)
Tributary #2	No Work	

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 70

BLACKWATER BAYOU - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BLACKWATER BAYOU

Event	Hooper Road	Crumholt Road	Carey Road	Blackwater Road	Old Settlement
1-YR	2.3	3.3	4.8	2.9	2.3
2-YR	2.3	3.6	4.1	2.3	2.0
5-YR	2.3	3.2	3.5	1.9	1.6
10-YR	2.2	2.7	3.3	1.4	1.4
25-YR	2.7	2.5	3.2	1.1	0.6
50-YR	1.7	1.2	1.2	1.1	0.3
100-YR	1.5	1.4	1.0	1.0	0.3
200-YR	1.4	1.4	1.0	0.9	0.3
500-YR	1.2	1.3	1.0	0.6	0.3

TRIBUTARIES #1 AND #2

	Tributary #1			Tributary #2	
Private Event	2400 ft U/S Mouth	Gurney Road	Core Lane	U/S Mouth	LA Hwy 410
1-YR	1.5	2.3	1.2	1.0	0.0
2-YR	1.7	1.9	1.5	0.8	0.0
5-YR	2.0	1.6	2.0	0.6	0.0
10-YR	2.5	1.4	2.2	0.6	0.0
25-YR	2.2	1.2	1.9	0.6	0.0
50-YR	2.0	1.2	1.0	0.6	0.0
100-YR	1.8	1.2	0.6	0.6	0.0
200-YR	1.7	1.2	0.6	0.6	0.0
500-YR	1.5	1.2	0.5	0.5	0.0

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 71

BLACKWATER BAYOU - NUMBER OF STRUCTURES LOCATED IN VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	WITHOUT PROJECT							
13	1-STORY	172	27	296	209	137	115	956
	2-STORY	20	2	12	9	2	5	50
	MOBILE HOME	4	4	20	10	15	108	161
	COMMERCIAL	10	4	16	8	7	11	56
	TOTAL	206	37	344	236	161	239	1,223
	WITH RECOMMENDED PLAN							
	1-STORY	66	12	191	182	273	232	956
	2-STORY	8	0	17	10	8	7	50
	MOBILE HOME	1	0	13	11	12	124	161
	COMMERCIAL	1	1	15	10	10	19	56
	TOTAL	76	13	236	213	303	382	1,223

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Design and Construction

Existing soils data from available sources were used in determining channel design slopes and possible erosion protection. A channel slope design of 1V on 3.5H was determined to be necessary to reasonably ensure bank stability. This design slope was determined to be applicable throughout the watershed.

Soils data reveal that some sands occur in scattered locations, and in varying layer thickness, throughout the watershed. From field investigations it was determined that where these sands occur, significant bank erosion is taking place. Proposed excavation in these locations would aggravate this condition without the addition of erosion protection. A preliminary erosion control system was designed and consists of a geosynthetic bank cover with toe-anchor rock (see detail on Plate 47). The extent of which this system is needed will not be known until site-specific soil borings are taken and analyzed. Changes to this design may also be warranted pending soil investigations. While erosion control may not be required for much of the channel, it is included in the design for 50 percent of the channel length as a conservative estimate.

Construction will basically consist of channel clearing and the excavation of approximately 518,000 cubic yards of material. This material will be disposed in the parish landfill located in the northwest corner of the parish about 9 miles, on average, from this watershed (see Plate 51). In some locations, the installation of the above described geosynthetic mat and rock will also be required.

The proposed work will likely be performed from the top of the bank and inside the channel by shovel and dragline heavy equipment. Once the purchase of required project right-of-way is complete, total accessibility along the top of the bank will be available. Overall, project constructability appears to be only moderately difficult.

It is estimated that project construction for this watershed will take about 2 years.

Relocations and Removals

Roadway and utility relocations required to implement the Recommended Plan were determined as follows:

Item	Number of Relocations
Railroads	0
Roads and Bridges	7
Pipelines	4
Power and Communication Lines	0
Other	0

There are no new lands, easements, and/or rights-of-way required for relocation of affected utilities and/or facilities since the relocation can be accomplished in existing facility or utility rights-of-way, proposed project lands, or by elevating the pipelines.

Real Estate

The Recommended Plan will require the purchase of 222 acres for channel construction, plus 127 acres for environmental mitigation. No real estate purchase is necessary for disposal since the parish landfill will be used. No structures or other improvements, with the exception of some private culverts and bridge crossings, will be taken for this project. Land purchased for channel modifications and aesthetic mitigation planting will be perpetual drainage easements and mitigation areas will be bought outright in fee, not including mineral rights. Trees planted on perpetual drainage easements will be subject to final approval by various landowners.

Several reaches of the main stem of Blackwater Bayou and its tributary cross private property tracts. In several locations, there exists some form of private access structure and few improvements on the tracts located across the stream. Land use is primarily pasture, agricultural, or vacant. Access structures connect to dirt roads and appear to be used mostly for tractor or on-foot crossings.

The proposed channel widening will, to some degree, sever or limit existing access to ten private property tracts that currently have bridge structures that cross the stream. As a means to cure this severance, either damage payments or installation of a replacement bridge will occur. For each severed tract, a comparison of severance damage payment requirements and bridge replacement cost was made. In only two cases, it was determined that a replacement bridge is the cheaper option. For the remaining eight tracts, property damage payments were determined to be the least expensive cost to cure severance.

Mitigation

The mitigation feature of the Recommended Plan consists of reforestation of 127 acres of existing cleared land. It was determined to be practicable to combine mitigation sites for the Recommended Plan for all watersheds. Two sites will be utilized for mitigation (see plates 52 and 53). The required 127 acres for this watershed's Recommended Plan will be included as a portion of the entire habitat mitigation package for all five watersheds.

Recreation

The Blackwater watershed does not lend itself to much recreational development in association with the Recommended Plan. While a bike path is a possibility along the widened channels, the fact that many of the channels go through individual private property tracts precludes this form of development. In addition, there is no point of destination, such as a park or scenic development to attract bikers.

Aesthetics

For aesthetic purposes, a top-of-bank tree planting plan is proposed and consists of 13.5 miles of tree planting along both sides of Blackwater Bayou for a total of 27 miles. These plantings occur in areas of high impact relative to channel improvement involving clearing of top-of-bank vegetation. Replacing trees and shrubs lost during construction will return aesthetic conditions to the pre-project condition. Since these trees are proposed on drainage easement land, further coordination with various landowners will be required prior to planting. Table 3 with Appendix E identifies tree and shrub requirements and costs.

Cultural Resources

Preliminary investigations have revealed that there exists one significant site (thought to be modified), one potentially significant recorded site, and one anticipated site located in the project area. There appears to be a moderate chance of uncovering other unknown sites. A more intensive investigation will be conducted prior to construction. Any sites found could likely be avoided by offsetting the proposed channel alignment. These efforts will be coordinated with the State Historic Preservation Office (SHPO).

Stream Gaging

The U.S. Geological Survey has an existing parish-wide stream gaging program that includes installations in this watershed. Improvements are proposed for gages at Hooper Road and Dyer Road. Data from these gages will be used in both the final project design and in monitoring the effectiveness of the project. Gages will be upgraded as part of this project construction and then will be maintained by the U.S. Geological Survey as part of their existing parish program.

Operation, Maintenance Repair, Replacement, and Rehab (O&M)

Required O&M for the channels consist of continuous inspection and debris removal, annual herbicide application, and clearing and snagging every 5 to 10 years, where necessary. Herbicide spraying would be conducted in accordance with the Environmental Protection Agency's guidelines. All vegetation removal/control will be done within the streambank and not affect top-of-bank aesthetic plantings. Maintenance of combined project mitigation areas is also necessary and such costs have been prorated to the overall O&M of this watershed's Recommended Plan. Operation and maintenance of the above listed stream gages is also required as part of this plan.

Environmental and Social Effects

The only significant long term environmental impact of the Recommended Plan is the destruction of 90 acres of bottomland hardwood forests. This loss will be mitigated with the planting and maintenance of 127 acres of existing cleared land. There will be minimal short term effects on stream water quality during construction only. Aquatic habitat will receive adverse impacts from loss of diversity and increased in-stream temperature. The loss of screening vegetation along the channel banks would result in a significant aesthetic loss. However, this loss would be mitigated by plantings of trees on both sides of 13.5 miles of channel.

The most significant beneficial social impacts of this plan would be the relief from flooding to those affected. Adverse social impacts include the taking of some unimproved private property. Temporary traffic rerouting for bridge relocations is also necessary during construction of the plan.

Cost and Economic Benefits

The Recommended Plan would generate significant economic benefits from flood damage reduction to existing, and, to some extent, projected future development. Benefits were only quantified, however, for existing development. It is estimated that annual average damages in this watershed would be reduced by about 70 percent. A breakdown of these anticipated benefits are shown in Table 72.

Final Costs, Net Benefits

Costs and benefits for the Recommended Plan were further developed and updated to include all features and items not included in the screening and selection process. In this estimate, a significant higher level of detail was given to construction considerations, real estate requirements, and indirect items such as project designs and management costs. The inclusion of potential erosion control measures and real estate severance and acquisition costs significantly increased the estimated project cost as compared to that used in the screening and selection process. Some reconsideration was given to the plan selection process, and it was determined that this cost increase would be relatively the same for all other plans considered. It was, therefore, determined that no change in the plan selection was warranted by the increased final costs.

Final costs and benefits for the Recommended Plan are shown in Table 72. Complete itemized costs, by account code feature, are shown in Table 73. The total first cost of the Recommended Plan, including all items, is estimated to be $16,340,000. Total Recommended Plan annual operation and maintenance costs, including all features, is estimated at $64,000 per year. Project first costs were converted to equivalent annual dollars using an interest rate of 8.00 percent over a 50-year period. It has been determined that the most likely estimate of equivalent annual costs and benefits indicates that the Recommended Plan will generate $2,447,000 per year net benefits. The benefit-cost ratio is 2.54 to 1.

Construction of each watershed's Recommended Plan will be phased. Construction of the Recommended Plan for Blackwater Bayou is scheduled to start in 2002. Fully-funded cost estimates in accordance with this construction schedule are shown in Plan Implementation.

Cost-Sharing

A breakdown of incremental and fully-funded cost-sharing requirements for the Recommended Plan is shown in Plan Implementation. The local sponsor will be responsible in providing and/or bearing the full costs of all required lands, easements, rights-of-way, relocations, and disposal areas for this project. The local sponsor will also bear 100 percent of annual operation and maintenance, rehabilitation, and all replacement costs.

TABLE 72
BLACKWATER BAYOU
PROJECT COSTS AND BENEFITS FOR THE RECOMMENDED PLAN
(1994 DOLLARS, 8.00% INTEREST, 50-YEAR PERIOD)

FIRST COSTS	
CONSTRUCTION FEATURE	$16,340,000
GROSS INVESTMENT (includes interest lost during construction)	$18,666,000
AVERAGE ANNUAL COSTS	
INTEREST/AMORTIZATION	$ 1,526,000
OPERATION/MAINTENANCE	$ 64,000
TOTAL AVERAGE ANNUAL COSTS	$ 1,590,000
AVERAGE ANNUAL BENEFITS*	
INUNDATION REDUCTION	$ 3,964,200
FIA COSTS SAVED	$ 8,350
REDUCED EMERGENCY COSTS	$ 34,200
FILL REDUCTION	$ 30,680
RECREATION	$ 0
EROSION CONTROL	$ 0
BENEFITS DURING CONSTRUCTION	$ 0
TOTAL AVERAGE ANNUAL BENEFITS	$ 4,037,430
BENEFIT/COST RATIO	2.54

* CALCULATED WITH PROPOSED COMITE RIVER DIVERSION CANAL IN PLACE

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 73
BLACKWATER BAYOU - RECOMMENDED PLAN
CHART OF ACCOUNTS

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	LANDS AND DAMAGES						
	Construction						
01B--	Acquisitions						
01B1-	By Government				7,580	1,900	9,480
01B2-	By Local Sponsor(LS)				103,820	25,960	129,780
01B4-	Review Of LS				6,120	1,530	7,650
01C--	Condemnations						
01C2	By LS				13,140	3,290	16,430
01C4-	Review of LS				3,480	870	4,350
01E--	Appraisals						
01E3-	By LS				103,000	25,710	128,710
01E5-	Review of LS				20,600	5,150	25,750
01G--	Temporary Permits						
01G1-	By Government				2,310	580	2,890
01G2-	By LS				8,360	2,070	10,430
01G4-	Review of LS				660	170	830
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				898,000	225,000	1,123,000
01T--	LERRD Credits						
01T1-	Land Payments				6,490	1,620	8,110
01T2-	Administrative Costs				5,870	1,470	7,340
01T4-	All Other				3,400	850	4,250
01---	Subtotal: Lands And Damages (Construction)						1,182,830
	Contingencies						296,170
01---	Subtotal: Lands And Damages (Construction)						1,479,000
	Mitigation						
01B1-	By Government				1,090	280	1,370
01B2-	By Local Sponsor(LS)				1,710	430	2,140
01B4-	Review Of LS				320	80	400
01C--	Condemnations						
01C2	By LS				340	90	430
01C4-	Review of LS				150	40	190
01E--	Appraisals						
01E3-	By LS				1,700	430	2,130
01E5-	Review of LS				430	110	540
01F--	PL 91-646 Assistance				150	40	190
01F1-	By Government				50	10	60
01F4-	Review Of LS						
01G--	Temporary Permits						
01G1-	By Government				480	120	600
01G2-	By LS				680	170	850
01G4-	Review of LS				140	40	180
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				283,250	71,320	354,570
01T--	LERRD Credits						
01T1-	Land Payments				770	190	960
01T3-	PL 91-646 Assistance				760	190	950

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01T2-	Administrative Costs				960	240	1,200
01T4-	Other				190	50	240
01---	Subtotal: Lands And Damages (Mitigation)						293,170
	Contingencies						73,830
01---	Subtotal: Lands And Damages (Mitigation)						367,000
01---	TOTAL: LANDS AND DAMAGES						1,846,000
02------	RELOCATIONS						
0201----	Roads, Construction Activities						
0201----	McCullough Road Bridge BW-2						
	2-Lane, Class-6 Road (Light Duty)						
	Permanent Relocation	1	LS	154,960.00	154,960	38,717	193,677
0201----	Blackwater Road Bridge BW-3						
	(Med Duty)						
	Permanent Relocation	1	LS	201,760.00	201,760	50,410	252,170
0201----	Dyer Road Bridge BW-4						
	2-Lane, Class-4 Road (Med Duty)						
	Permanent Relocation	1	LS	215,200.00	215,200	53,767	268,967
0201----	Carey Road Bridge BW-5						
	2-Lane, Class-4 Road (Light Duty)						
	Permanent Relocation	1	LS	167,840.00	167,840	41,934	209,774
0201----	Blackwater Road Bridge BW-6						
	2-Lane, Class-4 Road (Med Duty)						
	Permanent Relocation	1	LS	269,040.00	269,040	67,220	336,260
0201----	Crumholt Road Bridge BW-10						
	2-Lane, Class-6 Road (Light Duty)						
	Permanent Relocation	1	LS	176,480.00	176,480	44,094	220,574
0201----	Core Lane Bridge BW1-3						
	2-Lane, Class-6 Road (Light Duty)						
	Permanent Relocation	1	LS	138,880.00	138,880	34,698	173,578
0201----	SUBTOTAL: Roads						1,324,160
	Contingencies						330,840
0201----	SUBTOTAL: Roads						1,655,000
0203----	Cemeteries, Utilities And Structures						
020318--	Utilities						
02031815	12" Petroleum Products Pipeline BW-8						
	Permanent Relocation	1	LS	60,240.00	60,240	15,162	75,402
02031815	18" Petroleum Products Pipeline BW-8A						
	Permanent Relocation	1	LS	100,320.00	100,320	25,251	125,571
02031815	16" Petroleum Products Pipeline BW-9						
	Permanent Relocation	1	LS	88,480.00	88,480	22,270	110,750
02031815	16" Petroleum Products Pipeline BW1-6						
	Permanent Relocation	1	LS	102,480.00	102,480	25,797	128,277
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						351,520
	Contingencies						88,480
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						440,000
02------	TOTAL: RELOCATIONS						2,095,000
06------	FISH AND WILDLIFE FACILITIES						
0603----	Wildlife Facilities And Sanctuaries						
060301--	Mob And Demob						
060371--	Fences						
06037102	Fencing	6,203	LF	5.45	33,806	8,544	42,350

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
060373--	Habitat And Feeding Facilities						
06037302	Planting	107	AC	150.00	16,050	3,600	19,650
06------	Subtotal: Fish And Wildlife Facilities						49,856
	Contingencies						12,144
06------	TOTAL: FISH AND WILDLIFE FACILITIES						62,000
09------	CHANNELS AND CANALS						
0901----	Channels						
090101--	Mob & Demob	Lump Sum	LS	150,000.00	150,000	29,780	179,780
09011502	Clearing For Channel Dredging	164	AC	5,900.00	967,600	192,098	1,159,698
09011502	Excavation	517,600	CY	5.10	2,639,760	524,072	3,163,832
09013002	Geotextile Mat						
	Turf reinforcement	443,500	SY	6.00	2,661,000	528,280	3,189,280
	R-90 Stone	68,900	TN	19.50	1,343,550	266,735	1,610,285
	Hydromulch	551,500	SY	0.25	137,875	27,372	165,247
	Excavation For Stone	70,700	CY	5.10	360,570	71,584	432,154
09013002	Fuseplug dams	Lump Sum	LS	102,000.00	102,000	20,250	122,250
09019906	Aesthetic Plantings						
	Aesthetic Tree Planting	5,700	EA	15.00	85,500	16,974	102,474
09------	SUBTOTAL: Channels And Canals						8,447,855
	Contingencies						1,677,145
09------	TOTAL: CHANNELS AND CANALS						10,125,000
29---	PROJECT COOPERATION AGREEMENTS						
29A--	Draft PCA						
29A1-	Real Estate Activities				600	100	700
29A9-	All Other				800	200	1,000
29B--	Final PCA and Financial Plan						
29B1-	Real Estate Activities				600	100	700
29B9-	All Other				800	200	1,000
29C--	PCA Negotiations						
29C1-	Real Estate Activities				500	100	600
29C1-	All Other				800	200	1,000
29---	Subtotal: Project Cooperation Agreements						4,100
	Contingecies						900
29---	TOTAL: PROJECT COOPERATION AGREEMENTS						5,000
30---	ENGINEERING AND DESIGN						
30C--	Design Memorandum				693,000	139,000	832,000
30CD-	HTRW Studies				55,000	5,000	60,000
30CF-	Cost Estimates				18,000	4,000	22,000
30CN-	VE Studies				30,000	6,000	36,000
30DA-	P&S				171,000	34,000	205,000
30DF-	Cost Estimates				14,000	3,000	17,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S - Mitigation				23,000	5,000	28,000
30Q--	Construction And Supply Contract Award Activities				10,000	2,000	12,000
30DV-	Engineering During Construction				28,000	6,000	34,000
30E--	Engineering And Design Phase Project Management				86,000	17,000	103,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
30Z--	Misc. Activities						
	Monitoring						
	Install Gages				12,000	2,000	14,000
	Preconstruction O&M For Gages				43,000	9,000	52,000
	PMO				58,000	12,000	70,000
	LMVD				13,000	3,000	16,000
30---	SUBTOTAL: Engineering And Design						1,259,000
	Contingencies						248,000
30---	TOTAL: ENGINEERING AND DESIGN						1,507,000
31---	CONSTRUCTION MANAGEMENT						
31B--	Contract Administration						
31B3-	Review And Approval of Contract Payments				18,000	4,000	22,000
31B4-	Contract Modifications				62,000	12,000	74,000
31B5-	Progress And Completion Reports				27,000	5,000	32,000
31B9-	All Other				88,000	18,000	106,000
31D--	Review of Shop Drawings						
31D0-	Review of Shop Drawings				15,000	3,000	18,000
31E--	Inspection & Qual. Assur.						
31E1-	Schedule Compliance				14,000	3,000	17,000
31E2-	Compliance Sampling And Testing				12,000	2,000	14,000
31E3-	Quality Surveys				36,000	7,000	43,000
31E4-	Title II Services				38,000	8,000	46,000
31E9-	All Other				219,000	44,000	263,000
31T--	Construction Phase Project Management				54,000	11,000	65,000
31---	SUBTOTAL: Construction Management						583,000
	Contingencies						117,000
31---	TOTAL: CONSTRUCTION MANAGEMENT						700,000
	TOTAL: BLACKWATER BAYOU						16,340,000

Risk and Uncertainty

A modified risk and uncertainty analysis was performed on calculated benefits and costs of the Recommended Plan. In general, statistical ranges used in this analysis were broad and were established primarily for the purposes of identifying the direction of change that may be expected due to known uncertainties. The single value estimates calculated above were, therefore, used as the basis for determining the ultimate cost-effectiveness of the plan.

Five items were identified as having potential major variance on the overall project's feasibility. These items and their estimated variance ranges are discussed below. Additional detail of the analysis can be found in Economics Appendix H.

- Stage Frequency Values.

  Without project (existing) and with project floodstage frequency values directly affect existing and with project calculated damage dollar values. Variances on both existing and with project stages were determined to be practicably within plus or minus 1.0 feet for all storm frequency events, for without project conditions and plus or minus 0.5 feet for with project conditions. See Engineering Appendix C. Damage values were recalculated incorporating this range. Applying the results, it is estimated that without project flood damages vary from minus $2,773,000 to plus $4,409,000 per year from the estimate. With project flood damages are estimated to vary from minus $530,000 to plus $479,000 per year from the single value estimate. Note that it was determined that there is likely to be some correlation between existing and with project stage frequency variance. A correlation factor of 0.5 was applied to this item in the "risk analysis" calculations described below.

- Structure Elevations.

Variances in structure elevations directly affect both existing and with project calculated damage dollar values. Within practical limits, structure elevation variance was determined to be minus 0.5 to plus 0.5 feet. The calculated dollar value variance is minus $589,000 to plus $2,271,000 for existing annual damages, and, minus $530,000 to plus $479,000 for with project annual damages. Note that there is a direct correlation between existing and with project variances. A correlation factor of 1.0 was, therefore, applied to this item in the "risk analysis" calculations described below.

- Structure Valuation.

Variances in the estimate of structure values also affects both existing and with project calculated damage dollar value. Structure value variance range is estimated at plus or minus 10 percent from the single value estimate. Applying these results, it is estimated that existing flood damages vary from minus $496,000 to plus $431,000 per year. With project flood damages range from minus $142,000 to plus $125,000. A correlation factor of 1.0 was applied to with and without project variances.

- Construction Costs.

Estimated variances in calculated quantities, unit prices, constructability, and other factors were considered in calculating the channel construction cost estimate. The calculated cost range is from minus $3,250,000 to plus $1,110,000 relative to the single value estimate used for this item. Converting this range to equivalent annual dollars yields minus $325,000 to plus $111,000 per year.

- Erosion Control Measures.

As stated above, the extent that erosion control measures (geosynthetic mat and rock) are needed throughout the watershed is uncertain. For the purposes of this study, a conservative estimate of 50 percent was considered and used as the basis for the single value cost estimate for this item. Through field investigation, it has been determined, however, that the need for erosion control may be significantly less extensive. The total channel length that may require erosion control measures could be less than 15 percent of the total. Since this item is discounted to a degree in the variance estimate of construction cost, it was determined that the variance for this specific feature should be minus 25 percent to plus 5 percent from the single value cost estimate. In first cost, this range is from minus $2,500,000 to plus $500,000. Conversion to equivalent annual dollars yields a range of minus $250,000 to plus $50,000 per year.

The above uncertainty spreads were integrated with the single most likely value estimates for existing annual damages, with project damages and project costs. With the aid of "At Risk" computer software, probability ranges were calculated. The calculated probability distributions for project cost, benefits, net benefits, and benefit-to-cost ratio are illustrated in Figures 2 through 5.

The calculated expected values generated as compared to the single value estimates were determined as follows:

(EQUIVALENT ANNUAL)	SINGLE VALUE ESTIMATE	CALCULATED EXPECTED VALUE
PROJECT BENEFITS	$4,037,000	$5,153,000
PROJECT COSTS	$1,590,000	$1,356,000
NET BENEFITS	$2,447,000	$3,797,000
BENEFIT/COST RATIO	2.54	3.80
PROBABILITY OF PROJECT NET POSITIVE BENEFITS	N/A	99%

These results show an expected increase in project net benefits. This increase was due primarily to an expected reduction in project costs, specifically, costs for erosion control.

Figure 2
Blackwater Bayou
Probability Distribution

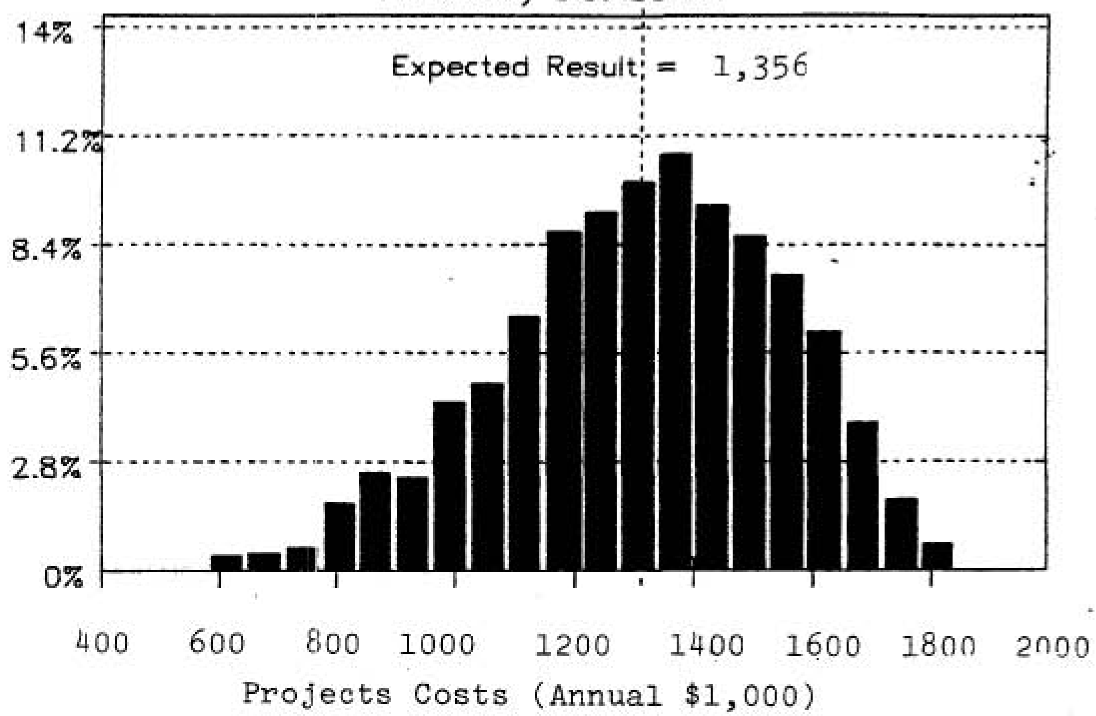


Figure 3
Blackwater Bayou
Probability Distribution

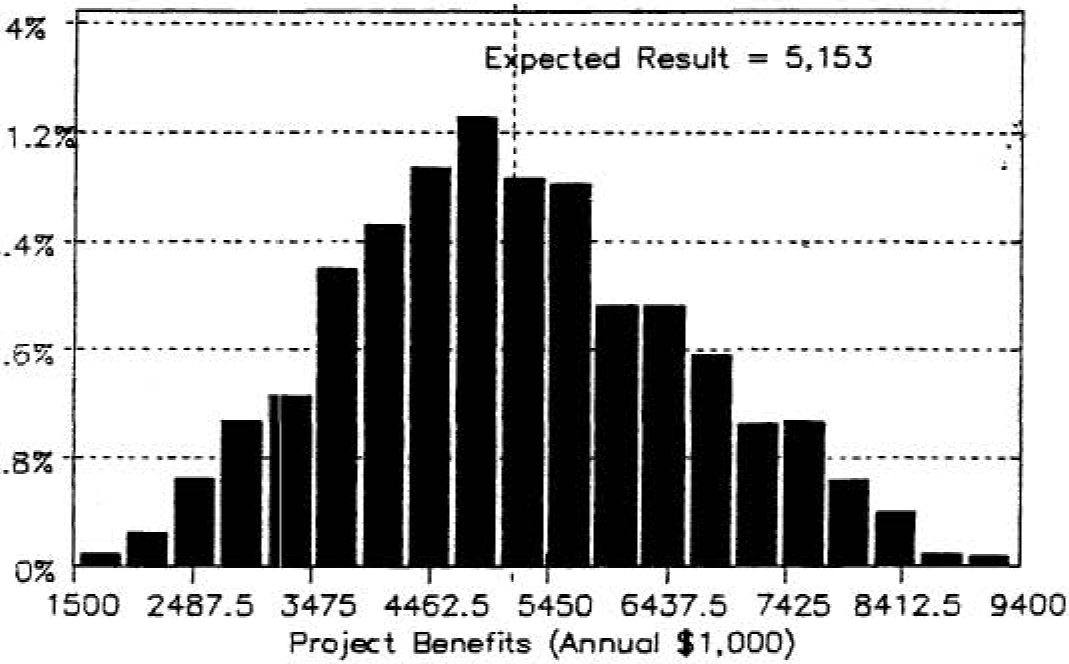


Figure 4
Blackwater Bayou
Probability Distribution

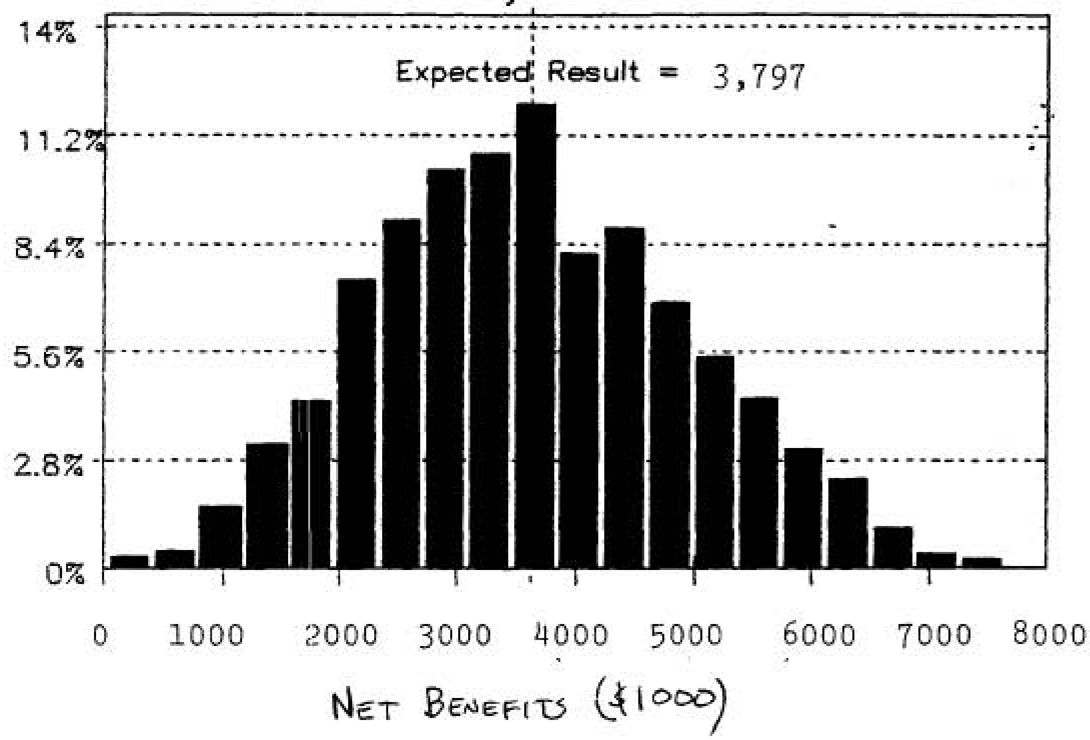
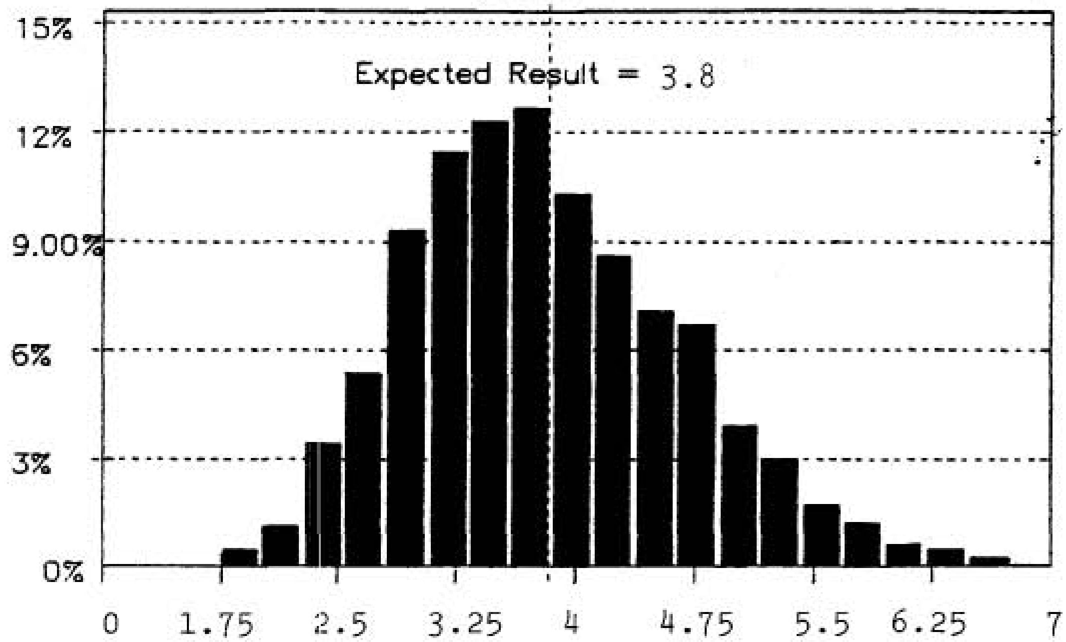


Figure 5
Blackwater Bayou
Probability Distribution



Benefit to Cost Ratio

BEAVER BAYOU

Description

The Recommended Plan for the Beaver Bayou watershed consists of widening approximately 8 miles of the existing earthen channel of the main stem of the Bayou. See Plate 3. Also included are proposed improvements to several bridges and culverts. Proposed modifications are designed to convey a 25-year storm event within streambank and reduce out-of-bank stages of larger flood events.

New channel slopes are designed 1V on 3.5H. Design bottom widths vary per stream reach. No significant changes are proposed to existing channel bottom elevation or slope. Proposed channel bottom width designs for each stream reach, along with bridge and culvert modifications, are listed in Table 74. Plates 42 and 43, respectively, show proposed channel modifications and relocations.

Plan Effectiveness

The Recommended Plan is designed to convey and contain a 25-year storm event within the streambank. Flood stages of greater storm events will also be reduced. Expected stage lowerings for various storm events at selected locations in the watershed are shown in Table 75 and Plate 56. Overflow maps, illustrating existing and with project floodplains are shown in the Engineering Appendix C. The expected reduction in floodstages will result in a substantial lowering in the number of structures located in 0- to 50-year floodplains (see Table 76).

By the year 2040, urbanization in this watershed is projected to increase from 36 to 50 percent. Estimates from hydrologic modelling indicate that the 10-year with project average stage will be about 0.2 feet higher, and that there will be about 0.1 feet added difference in average 100-year flood stages. Implementation of a floodplain management program, that would not allow future development to significantly increase flood stages, would likely reduce these projected stage increases. The continued implementation and enforcement of East Baton Rouge Parish's floodplain ordinance (see Appendix K) will be satisfactory for this watershed.

TABLE 74

BEAVER BAYOU - RECOMMENDED PLAN
PROPOSED CHANNEL WIDTHS AND RELOCATIONS

CHANNEL	PROPOSED BOTTOM WIDTH	LOCATION
Beaver Bayou		Improvements from Frenchtown Road to Hubbs Road. 25-year earthen channel design.
	20'BW	Frenchtown Road to 2300' d/s Greenwell Springs Road.
	50'BW	2300' d/s Greenwell Springs Road to Greenwell Springs Road.
	improve bridge	Greenwell Springs Road (lengthen 90 feet).
	50'BW	Greenwell Springs to Wax Road.
	improve bridge	Wax Road (lengthen 115 feet).
	50'BW	Wax Road to Hooper Road.
	30'BW	Hooper Road to Denham Road.
	5'BW	Denham Road to Hubbs Road.
Lateral Trib.	No Work	
Tributary #2	No Work	

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 75

BEAVER BAYOU - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

Beaver Bayou - Main Stem

Event	Frenchtown Road	Greenwell Springs Rd.	Wax Road	Hooper Road	Denham Road	Hubbs Road
1-YR	0.0	3.1	3.2	4.5	4.2	1.4
2-YR	0.0	3.1	3.0	4.1	3.8	1.4
5-YR	0.0	3.2	2.7	3.7	3.4	1.2
10-YR	0.0	3.0	2.7	3.2	3.1	1.1
25-YR	0.0	3.2	2.6	3.0	2.8	1.0
50-YR	0.0	3.0	2.6	2.6	2.5	0.8
100-YR	0.0	2.7	2.6	1.8	2.2	0.8
200-YR	0.0	2.6	2.3	1.3	2.1	0.8
500-YR	0.0	2.6	1.8	1.3	2.0	0.7

Beaver Bayou Lateral and Tributary #2

	Beaver Bayou Lateral			Tributary #2		
Event	Mouth	Devall Road	Near Puckett	Mouth	Devall Road	Near Core Ln
1-YR	3.0	0.7	0.0	3.7	0.0	0.0
2-YR	2.6	0.7	0.0	3.1	0.0	0.0
5-YR	2.5	0.6	0.0	2.7	0.0	0.0
10-YR	2.4	0.4	0.0	2.6	0.0	0.0
25-YR	2.3	0.3	0.0	1.2	0.0	0.0
50-YR	2.1	0.3	0.0	1.0	0.0	0.0
100-YR	1.8	0.3	0.0	0.9	0.0	0.0
200-YR	1.8	0.2	0.0	0.8	0.0	0.0
500-YR	1.5	0.1	0.0	0.8	0.0	0.0

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 76

BEAVER BAYOU
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
	WITHOUT PROJECT							
14	1-STORY	312	72	16	100	71	676	1,247
	2-STORY	14	2	1	1	7	28	53
	MOBILE HOME	9	17	6	9	14	197	252
	COMMERCIAL	94	7	2	4	5	135	247
	TOTAL	429	98	25	114	97	1,036	1,799
	WITH RECOMMENDED PLAN							
	1-STORY	133	22	71	49	151	821	1,247
	2-STORY	7	0	2	2	3	39	53
	MOBILE HOME	5	0	2	2	8	233	252
	COMMERCIAL	18	2	3	7	6	211	247
	TOTAL	163	26	78	60	168	1,304	1,799

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Design and Construction

Existing soils data from available sources were used in determining channel design slopes and possible erosion protection. A channel slope design of 1V on 3.5H was determined to be necessary to reasonably ensure bank stability. This design slope was determined to be applicable throughout the watershed.

Soils data reveal that some sands occur in scattered locations, and in varying layer thickness, throughout the watershed. From field investigations, it was determined that where these sands occur, significant bank erosion is taking place. Proposed excavation in these locations would aggravate this condition without the addition of erosion protection. A preliminary erosion control system was designed and consists of a geosynthetic bank cover with toe-anchor rock (see detail on Plate 47). The extent of which this system is needed will not be known until site-specific soil borings are taken and analyzed. Changes to this design may also be warranted, pending soil investigations. While erosion control may not be required for much of the channel, it is included in the design for 50 percent of the channel length as a conservative estimate.

Construction will basically consist of channel clearing and the excavation of approximately 695,000 cubic yards of material. This material will be disposed in the parish landfill located in the northwest corner of the parish about 14 miles, on average, from this watershed. In some locations, the installation of the above described geosynthetic mat and rock will also be required.

The proposed work will likely be performed from the top of the bank and inside the channel by shovel and dragline heavy equipment. Once the purchase of required project right-of-way is complete, total accessibility along the top of the bank will be available. Overall, project constructability appears to be only moderately difficult.

It is estimated that project construction for this watershed will take about 2 years.

Relocations and Removals

Roadway and utility relocations required to implement the Recommended Plan were determined as follows:

Item	Number of Relocations
Railroads	0
Roads and Bridges	3
Pipelines	8
Power and Communication Lines	0
Other	0

There are no new lands, easements, and/or rights-of-way required for relocation of affected utilities and/or facilities since the relocation can be accomplished in existing facility or utility rights-of-way, proposed project lands, or by elevating the pipelines.

Real Estate

The Recommended Plan will require the purchase of 148 acres for channel construction, plus 122 acres for environmental mitigation. No real estate purchase is necessary for disposal since the parish landfill will be used. No structures or other improvements, with the exception of some private culverts, bridge crossings, and one bulkhead, will be taken for this project. Land purchased for channel modifications and aesthetic mitigation planting will be perpetual drainage easements and mitigation areas will be bought outright in fee, excluding mineral rights. Trees planted on perpetual drainage easements will be subject to final approval by various landowners.

Much of the main stem of Beaver Bayou segments private property tracts. In several locations, there exists some form of private access structure and few improvements on the tracts located across the stream. Land use is primarily pasture, agricultural, or vacant. Access structures connect to dirt roads and appear to be used for tractor or on-foot crossings.

The proposed channel widening will, to some degree, sever or limit existing access to nine private property tracts that currently have bridge structures that cross the stream. As a means to cure this severance, either damage payments or installation of a replacement bridge will occur. For each severed tract, a comparison of severance damage payment requirements and bridge replacement cost was made. In four cases, it was determined that a replacement bridge is the cheaper option. For the remaining five tracts, property damage payments were determined to be the least expensive cost to cure severance.

Mitigation

The mitigation feature of the Recommended Plan consists of reforestation of 122 acres of existing cleared land. It was determined to be practicable to combine mitigation sites for the Recommended Plan for all watersheds. Two sites will be used for mitigation (see Plates 52 and 53). The required 122 acres for this watershed's Recommended Plan will be included as a portion of the entire mitigation package for all five watersheds.

Recreation

The Beaver Bayou watershed does not lend itself to much recreational development in association with the Recommended Plan. While a bike path is a possibility along the widened channels, the fact that many of the channels go through individual private property tracts precludes this form of development. In addition, there is no point of destination, such as a park or scenic development to attract bikers.

Aesthetics

For aesthetic purposes, a top-of-bank tree replanting plan is proposed and consists of 7.8 miles of tree and shrub line planting along both sides of Beaver Bayou for a total of 15.6 miles. These plantings occur in areas of impact relative to channel improvement involving clearing of top-of-bank vegetation. Replacing trees and shrubs lost during construction will return aesthetic conditions to the pre-project condition. Since these trees are proposed on drainage easement lands, further coordination with various landowners will be required prior to planting. See Table 3 of the Environmental Appendix, which identifies tree and shrub requirements and cost per watershed.

Cultural Resources

Previous channel work on Beaver Bayou impacted two sites. Preliminary investigations indicate that no other significant cultural resources will likely be impacted by the Recommended Plan, and that the project area is considered to have a low probability for containing such sites. A more intensive investigation prior to construction is required however. Any sites found could likely be avoided by offsetting the proposed channel alignment. These efforts will be coordinated with the State Historic Preservation Officer (SHPO).

Stream Gaging

The U.S. Geological Survey has an existing parish-wide stream gaging program that includes installations in this watershed. Improvements are proposed for gages located at Hooper, Wax, and Frenchtown Roads. Data from these gages will be used in both the final project design and in monitoring the effectiveness of the project. Gages will be upgraded as part of this projects's construction and then will be maintained by the U.S. Geological Survey as part of their existing parish program.

Operation, Maintenance Repair, Replacement, and Rehab (O&M)

Required O&M for the channels consist of continuous inspection and debris removal, annual herbicide application, and clearing and snagging every 5 to 10 years, where necessary. Herbicide spraying would be conducted in accordance with the Environmental Protection Agency's guidelines. All vegetation removal/control will be done within the streambank and not affect top-of-bank aesthetic plantings. Maintenance of combined project mitigation areas is also necessary and such costs have been prorated to the overall O&M of this watershed's Recommended Plan. Operation and maintenance of the above listed stream gages is also required as part of this plan.

Environmental and Social Effects

The only significant long-term environmental impact of the Recommended Plan is the destruction of 86 acres of bottomland hardwood forestation. This loss will be mitigated with the planting and maintenance of 122 acres of existing cleared land, which in turn, are permanently lost. There will be minimal short-term effects on stream water quality during construction only. Aquatic habitat will receive adverse impacts from reduced diversity and increased in-stream temperatures. The loss of screening vegetation along the channel banks would result in a significant aesthetic loss. However, this loss would be mitigated by plantings of trees on both sides of 7.6 miles of channel.

The most significant beneficial social impacts of this plan would be the relief from flooding to those affected. Adverse social impacts include the taking of some unimproved private property. Temporary traffic rerouting for bridge relocations is also necessary during construction of the plan.

Economic Benefits

The Recommended Plan would generate significant economic benefits from flood damage reduction to existing, and, to some extent, projected future development. Benefits were only quantified, however, for existing development. It is estimated that annual average damages in this watershed would be reduced by about 85 percent. A breakdown of these anticipated benefits are shown in Table 77.

Final Costs, Net Benefits

Costs and benefits for the Recommended Plan were further developed and updated to include all features and items not included in the screening and selection process. In this estimate, a significant higher level of detail was given to construction considerations, real estate requirements, and indirect items such as project designs and management costs. The inclusion of potential erosion control measures and real estate severance and acquisition costs significantly increased the estimated project cost as compared to that used in the screening and selection process. Some reconsideration was given to the plan selection process and it was determined that this cost increase would be relatively the same for all other plans considered. It was, therefore, determined that no change in the plan selection was warranted by the increased final costs.

Final costs and benefits for the Recommended Plan are shown in Table 77. Complete itemized costs by account code feature are shown in Table 78. The total first cost of the Recommended Plan, including all items, is estimated to be $16,840,000. Total Recommended Plan annual operation and maintenance costs, including all features, is estimated at $64,000 per year.

Project first costs were converted to equivalent annual dollars using an interest rate of 8.00 percent over a 50-year period. It has been determined that the estimated annual costs and benefits indicates that the Recommended Plan will generate $7,146,000 per year net benefits. The benefit-cost ratio is 5.38 to 1.

Construction of each watershed's Recommended Plan will be phased. Construction of the Recommended Plan for Beaver Bayou is scheduled to start in 2002. Fully-funded cost estimates in accordance with this construction schedule are shown in Plan Implementation.

Cost-Sharing

A breakdown of incremental and fully-funded cost-sharing requirements for the Recommended Plan is shown in Plan Implementation. The local sponsor will be responsible in providing and/or bearing the full costs of all required lands, easements, rights-of-way, relocations, and disposal areas for this project. The local sponsor will also bear 100 percent of annual operation and maintenance, and, all replacement costs.

TABLE 77

BEAVER BAYOU

PROJECT COSTS AND BENEFITS FOR THE RECOMMENDED PLAN (1994 DOLLARS, 8.00% INTEREST, 50-YEAR PERIOD)

FIRST COSTS	
CONSTRUCTION FEATURE	$16,840,000
GROSS INVESTMENT (includes interest lost during construction)	$19,197,000
AVERAGE ANNUAL COSTS	
INTEREST/AMORTIZATION	$ 1,564,000
OPERATION/MAINTENANCE	$ 64,000
TOTAL AVERAGE ANNUAL COSTS	$ 1,633,000
AVERAGE ANNUAL BENEFITS*	
INUNDATION REDUCTION	$ 8,521,900
FIA COSTS SAVED	$ 18,610
REDUCED EMERGENCY COSTS	$ 58,600
FILL REDUCTION	$ 180,140
RECREATION	$ 0
EROSION CONTROL	$ 0
BENEFITS DURING CONSTRUCTION	$ 0
TOTAL AVERAGE ANNUAL BENEFITS	$ 8,779,250
BENEFIT/COST RATIO	5.38

* CALCULATED WITH PROPOSED COMITE RIVER DIVERSION CANAL IN PLACE

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 78
BEAVER BAYOU - RECOMMENDED PLAN
CHART OF ACCOUNTS

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	LANDS AND DAMAGES						
	Construction						
01B--	Acquisitions						
01B1-	By Government				7,580	1,900	9,480
01B2-	By Local Sponsor(LS)				103,820	25,850	129,670
01B4-	Review Of LS				6,180	1,550	7,730
01C--	Condemnations						
01C2	By LS				12,220	3,040	15,260
01C4-	Review of LS				3,610	900	4,510
01E--	Appraisals						
01E3-	By LS				103,000	25,750	128,750
01E5-	Review of LS				20,600	5,130	25,730
01G--	Temporary Permits						
01G1-	By Government				2,310	580	2,890
01G2-	By LS				8,360	2,090	10,450
01G4-	Review of LS				660	170	830
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				898,000	225,000	1,123,000
01T--	LERRD Credits						
01T1-	Land Payments				6,490	1,620	8,110
01T2-	Administrative Costs				5,870	1,470	7,340
01T4-	Other				3,400	850	4,250
01---	Subtotal: Lands And Damages (Construction)						1,182,100
	Contingencies						295,900
01---	Subtotal: Lands And Damages (Construction)						1,478,000
	Mitigation						
01B1-	By Government				1,230	310	1,540
01B2-	By Local Sponsor(LS)				1,930	480	2,410
01B4-	Review Of LS				360	90	450
01C--	Condemnations						
01C2	By LS				380	100	480
01C4-	Review of LS				170	40	210
01E--	Appraisals						
01E3-	By LS				1,920	480	2,400
01E5-	Review of LS				480	120	600
01F--	PL 91-646 Assistance						
01F1-	By Government				170	40	210
01F4-	Review Of LS				70	20	90
01G--	Temporary Permits						
01G1-	By Government				540	140	680
01G2-	By LS				770	190	960
01G4-	Review of LS				150	40	190
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				319,300	79,700	399,000
01T--	LERRD Credits						
01T1-	Land Payments				860	220	1,080
01T3-	PL 91-646 Assistance				860	220	1,080

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01T2-	Administrative Costs				1,080	270	1,350
01T4-	Other				220	50	270
01---	Subtotal: Lands And Damages (Mitigation)						330,490
	Contingencies						82,510
01---	Subtotal: Lands And Damages (Mitigation)						413,000
01---	TOTAL: LANDS AND DAMAGES						1,891,000
02------	RELOCATIONS						
0201----	Roads, Construction Activities						
0201----	La Hwy #408 (Hooper Road) BB-10 2-Lane, Class-4 Road (Med Duty) Permanent Relocation	1	LS	325,000.00	325,000	81,569	406,569
0201----	Wax Road Culverts BB-14 2-Lane, Class-4 Road (Med Duty) Permanent Relocation	1	LS	315,000.00	315,000	79,059	394,059
0201----	La Hwy #37 Bridge BB-19 2-Lane, Class-4 Road (Med Duty) Permanent Relocation	1	LS	380,000.00	380,000	95,372	475,372
0201----	SUBTOTAL: Roads						1,020,000
	Contingencies						256,000
0201----	SUBTOTAL: Roads						1,276,000
0203----	Cemeteries, Utilities And Structures						
020318--	Utilities						
02031815	3" Gas Pipeline BB-9 Permanent Relocation	1	LS	75,200.00	75,200	18,929	94,129
02031815	4" Gas Pipeline BB-12 Permanent Relocation	1	LS	84,000.00	84,000	21,144	105,144
02031815	5" Water Line BB-13 Permanent Relocation	1	LS	67,200.00	67,200	16,916	84,116
02031815	4" Gas Pipeline BB-16 Permanent Relocation	1	LS	80,000.00	80,000	20,138	100,138
02031815	6" Gas Pipeline BB-17 Permanent Relocation	1	LS	80,800.00	80,800	20,339	101,139
02031815	8" Water Line BB-18 Permanent Relocation	1	LS	66,400.00	66,400	16,714	83,114
02031815	5" Water Line BB-21 Permanent Relocation	1	LS	96,640.00	96,640	24,326	120,966
02031815	4" Gas Pipeline BB-22 Permanent Relocation	1	LS	112,000.00	112,000	28,254	140,254
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						662,240
	Contingencies						166,760
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						829,000
02------	TOTAL: RELOCATIONS						2,105,000
06------	FISH AND WILDLIFE FACILITIES						
0603----	Wildlife Facilities And Sanctuaries						
060301--	Mob And Demob						
060371--	Fences						
06037102	Fencing	7,121	LF	5.45	38,809	9,999	48,808
060373--	Habitat And Feeding Facilities						
06037302	Planting	123	AC	150.00	18,450	4,742	23,192

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
06------	Subtotal: Fish And Wildlife Facilities						57,259
	Contingencies						14,741
06------	TOTAL: FISH AND WILDLIFE FACILITIES						72,000
09------	CHANNELS AND CANALS						
0901----	Channels						
090101--	Mob & Demob	Lump Sum	LS	220,000.00	220,000	43,484	263,484
09011502	Clearing For Channel Dredging	220	AC	5,900.00	1,298,000	256,556	1,554,556
09011502	Excavation	695,000	CY	5.60	3,892,000	769,273	4,661,273
09013002	Geotextile Mat						
	Turf Reinforcement	272,550	SY	6.00	1,635,300	323,209	1,958,509
	R-90 Stone	65,100	TN	18.50	1,204,350	238,046	1,442,396
	Hydromulch	322,400	SY	0.25	80,600	15,931	96,531
	Excavation For Stone	57,850	CY	5.60	323,960	64,032	387,992
09013002	Fuseplug dams	Lump Sum	LS	78,000.00	78,000	15,417	93,417
09019906	Aesthetic Plantings						
	Tree Planting	4,500	EA	15.00	67,500	13,342	80,842
09------	SUBTOTAL: Channels And Canals						8,799,710
	Contingencies						1,739,290
09------	TOTAL: CHANNELS AND CANALS						10,539,000
29---	PROJECT COOPERATION AGREEMENTS						
29A--	Draft PCA						
29A1-	Real Estate Activities				600	100	700
29A9-	All Other				800	200	1000
29B--	Final PCA and Financial Plan						
29B1-	Real Estate Activities				600	100	700
29B9-	All Other				800	200	1,000
29C--	PCA Negotiations						
29C1-	Real Estate Activities				500	100	600
29C9-	All Other				800	200	1,000
29---	Subtotal: Project Cooperation Agreements						4,100
	Contingecies						900
29---	TOTAL: PROJECT COOPERATION AGREEMENTS						5,000
30---	ENGINEERING AND DESIGN						
30C--	Design Memorandum				605,000	120,000	725,000
30CD-	HTRW Studies				136,000	14,000	150,000
30CF-	Cost Estimates				18,000	4,000	22,000
30GD-	VE Studies				30,000	6,000	36,000
30DA-	P&S				174,000	35,000	209,000
30DF-	Cost Estimates				14,000	3,000	17,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S - Mitigation				29,000	6,000	35,000
30DS-	Construction Contract Award Activities				10,000	2,000	12,000
30DV-	Engineering During Construction				30,000	6,000	36,000
30E--	Engineering And Design Phase Project Management				87,000	17,000	104,000
30Z--	Misc. Activities						
	Monitoring						
	Install Gages				15,000	3,000	18,000
	Preconstruction O&M For Gages				63,000	13,000	76,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
	PMO				58,000	12,000	70,000
	LMVD				10,000	2,000	12,000
30---	SUBTOTAL: Engineering And Design						1,284,000
	Contingencies						244,000
30---	TOTAL: ENGINEERING AND DESIGN						1,528,000
31---	CONSTRUCTION MANAGEMENT						
31B--	Contract Administration						
31B3-	Review And Approval of Contract Payments				18,000	4,000	22,000
31B4-	Contract Modifications				62,000	12,000	74,000
31B5-	Progress And Completion Reports				27,000	5,000	32,000
31B9-	All Other				88,000	18,000	106,000
31D--	Review of Shop Drawings						
31D0-	Review of Shop Drawings				15,000	3,000	18,000
31E--	Inspection & Qual. Assur.						
31E1-	Schedule Compliance				14,000	3,000	17,000
31E2-	Compliance Sampling And Testing				12,000	2,000	14,000
31E3-	Quality Surveys				36,000	7,000	43,000
31E4-	Title II Services				38,000	8,000	46,000
31E9-	All Other				219,000	44,000	263,000
31T--	Construction Phase Project Management				54,000	11,000	65,000
31---	SUBTOTAL: Construction Management						583,000
	Contingencies						117,000
31---	TOTAL: CONSTRUCTION MANAGEMENT						700,000
	TOTAL: BEAVER BAYOU						16,840,000

Risk and Uncertainty

A modified risk and uncertainty analysis was performed on calculated benefits and costs of the Recommended Plan. In general, statistical ranges used in this analysis were broad and were established primarily for the purposes of identifying the direction of change that may be expected due to known uncertainties. The single value estimates calculated above were, therefore, used as the basis for determining the ultimate cost-effectiveness of the plan.

Five items were identified as having potential major variance on the overall project's feasibility. These items and their estimated variance ranges are discussed below. Additional detail of the analysis can be found in the Economics Appendix H.

- Stage Frequency Values.

  Without project (existing) and with project floodstage frequency values directly affect existing and with project calculated damage dollar values. Variances on both existing and with project stages were determined to be practicably within plus or minus 1.0 feet for all storm frequency events for without project conditions, and, plus or minus 0.5 feet for with project conditions. See Engineering Appendix C. Damage values were recalculated incorporating this range. Applying the results, it is estimated that without project flood damages vary from minus $4,798,000 to plus $6,606,000 per year from the estimate. With project flood damages are estimated to vary from minus $535,000 to plus $536,000 per year from the single value estimate. Note that it was determined that there is likely to be some correlation between existing and with project stage frequency variance. A correlation factor of 0.5 was applied to this item in the "risk analysis" calculations described below.

- Structure Elevations.

  Variances in structure elevations directly affect both existing and with project calculated damage dollar values. Within practical limits, structure elevation variance was determined to be minus 0.5 to plus 0.5 feet. The calculated dollar value variance is minus $2,350,000 to plus $3,305,000 for existing annual damages, and, minus $536,000 to plus $535,000 for with project annual damages. Note that there is a direct correlation between existing and with project variances. A correlation factor of 1.0 was, therefore, applied to this item in the "risk analysis" calculations described below.

- Structure Valuations.

  Variances in the estimate of structure values also affect both existing and with project calculated damage dollar value. Structure value variance range is estimated at plus or minus 10 percent from the single vaule estimate. Applying these results, it is estimated that existing flood damages vary from minus $881,000 to plus $876,000 per year. With project flood damages range from minus $107,000 to plus $106,000. A correlation factor of 1.0 is applicable to this set of values.

- Construction Costs.

  Estimated variances in calculated quantities, unit prices, constructability, and other factors were considered in calculating the channel construction cost estimate. The calculated cost range is from minus $3,690,000 to plus $1,035,000 relative to the single value estimate used for this item. Converting this range to equivalent annual dollars yields minus $369,000 to plus $104,000 per year.

- Erosion Control Measures.

  As stated above, the extent that erosion control measures (geosynthetic mat and rock) is needed throughout the watershed is uncertain. For the purposes of this study, a conservative estimate of 50 percent was considered and used as the basis for the most likely cost estimate for this item. Through field investigation it has been determined, however, that the need for erosion control may be significantly less extensive. The total channel length that may require erosion control measures could be less than 15 percent of the total. Since this item is discounted to a degree in the variance estimate of construction cost, it was determined that the variance for this specific feature should be minus 25 percent to plus 5 percent from the single value cost estimate. In first cost this range is from minus $1,500,000 to plus $300,000. Conversion to equivalent annual dollars yields a range of minus $150,000 to plus $30,000 per year.

The above uncertainty spreads were integrated with the single most likely value estimates for existing annual damages, with project damages and project costs. With the aid of "At Risk" computer software, probability ranges were calculated. See Risk Analysis calculations in Economics Appendix H. The calculated probability distributions for project cost, benefits, net benefits, and benefit-to-cost ratio are illustrated in Figures 6 through 9.

The calculated expected values generated as compared to the single value estimates were determined as follows:

(EQUIVALENT ANNUAL)	SINGLE VALUE ESTIMATE	CALCULATED EXPECTED VALUE
PROJECT BENEFITS	$8,779,000	$9,719,000
PROJECT COSTS	$1,633,000	$1,267,000
NET BENEFITS	$7,146,000	$8,452,000
BENEFIT/COST RATIO	5.38	7.7
PROBABILITY OF PROJECT NET POSITIVE BENEFITS	N/A	99%

These results show an expected increase in project net benefits. This increase was due primarily to an expected reduction in project costs, specifically, costs for erosion control.

Figure 6
Beaver Bayou
Probability Distribution

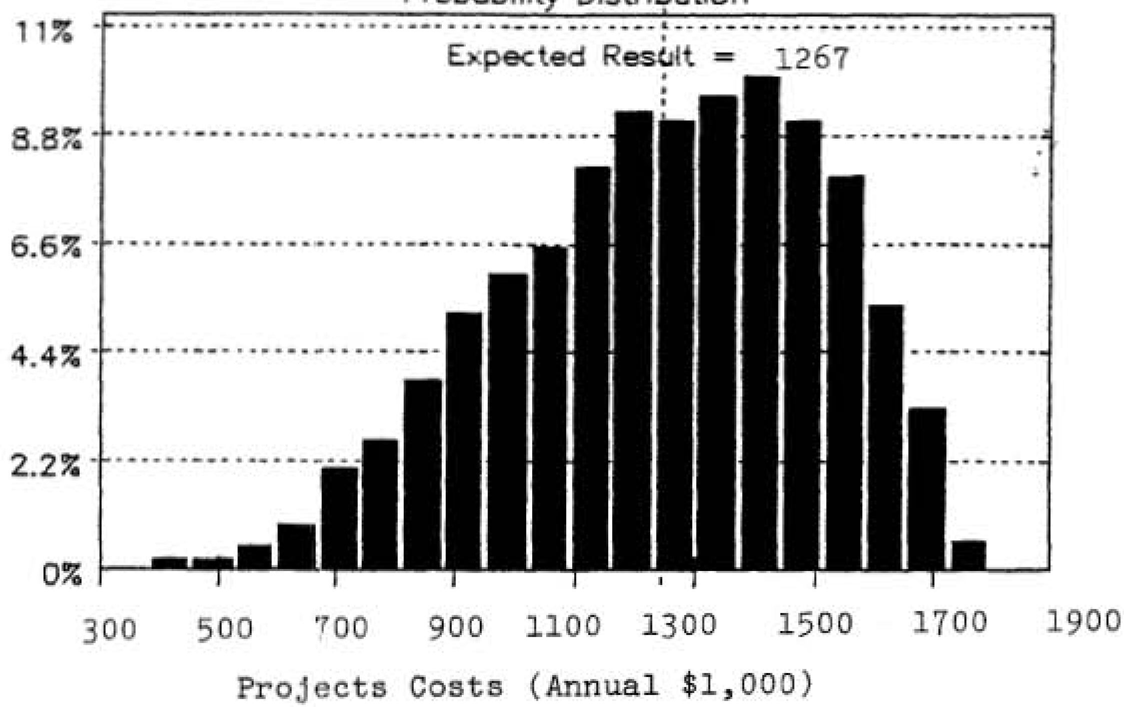


Figure 7
Beaver Bayou
Probability Distribution

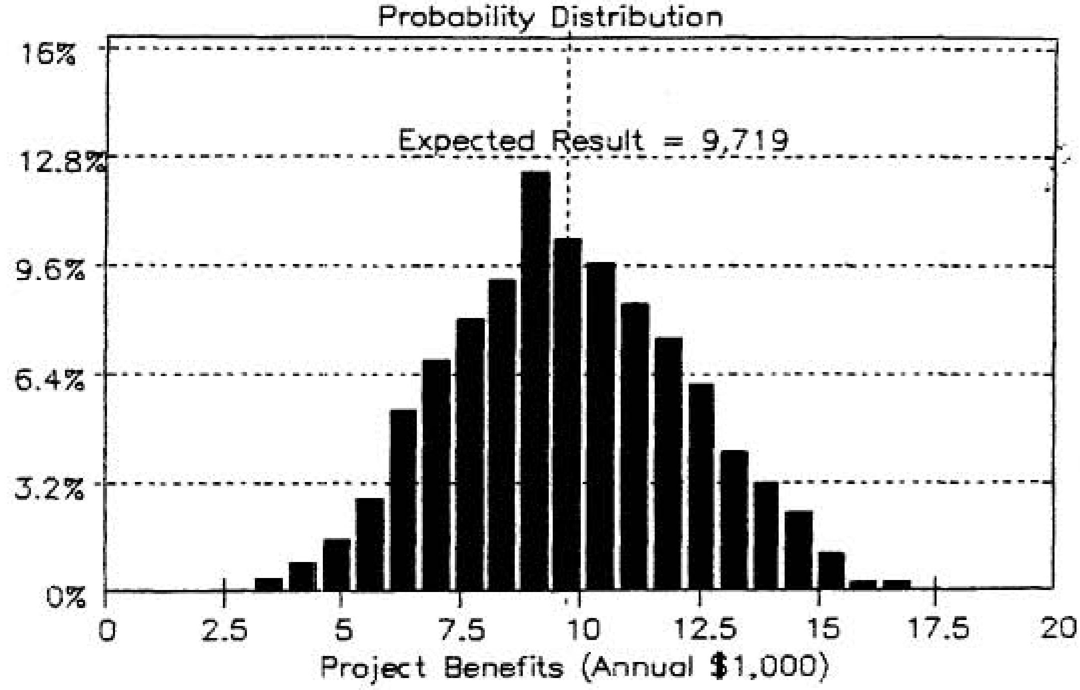
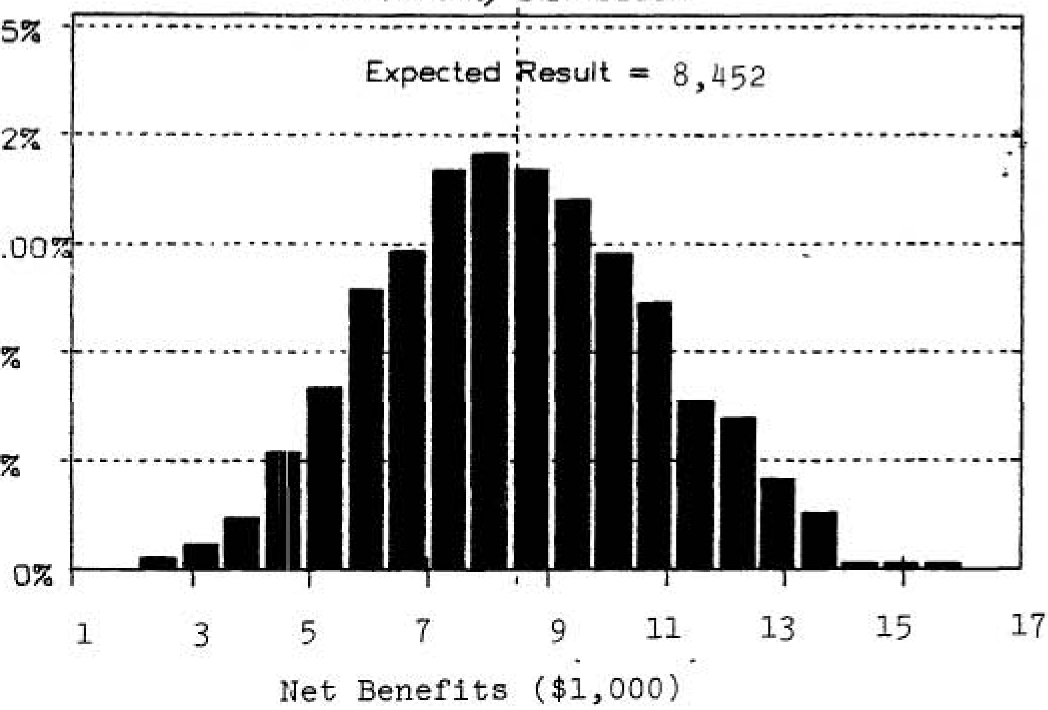


Figure 8
Beaver Bayou
Probability Distribution



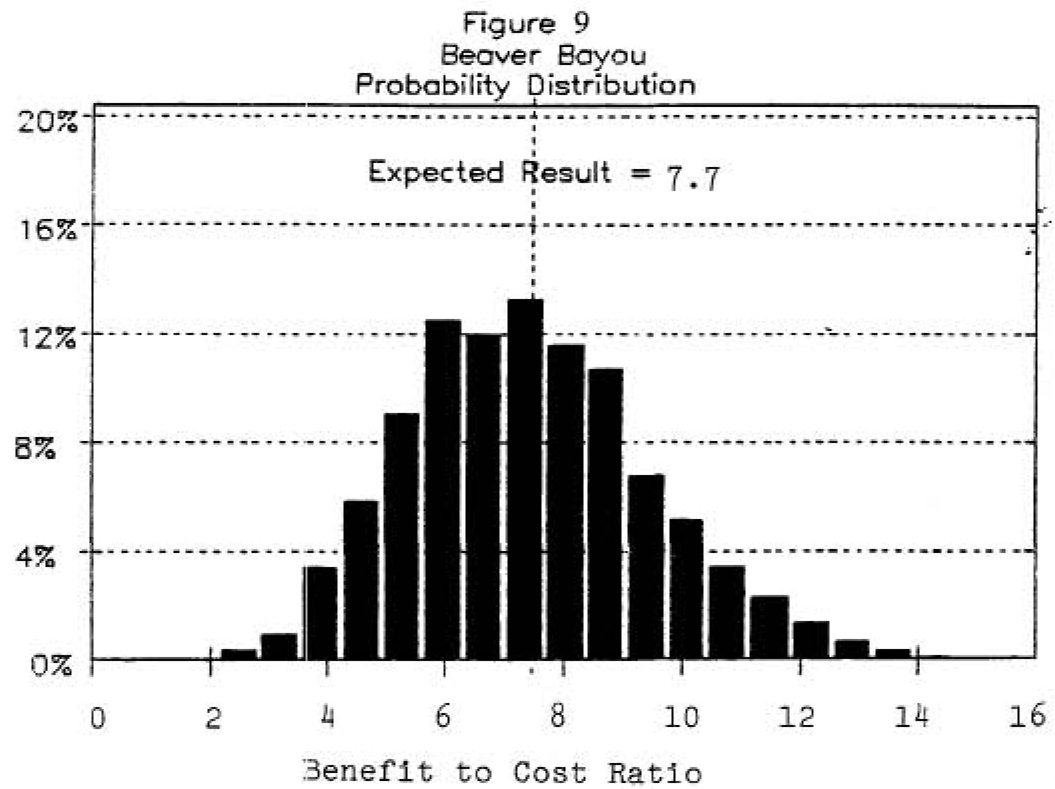


Figure 9
Beaver Bayou
Probability Distribution
20%
16%
12%
8%
4%
0%
Expected Result = 7.7
0
2
4
6
8
10
12
14
16
Benefit to Cost Ratio

JONES CREEK

Description

The Recommended Plan for the Jones Creek watershed consists of clearing, reshaping, and concrete lining approximately 19 miles of the main stem of Jones Creek and its main tributaries - Lively Bayou, Lively Bayou Tributary, and Weiner Creek. See Plate 5. Clearing and snagging of lower Jones Creek, below Jones Creek Road to the channel's mouth is also included. Proposed modifications are designed to convey in excess of a 50-year storm event within streambank and reduce out-of-bank stages of larger flood events.

New channel slopes are designed 1V on 3.0H. Design channel bottom widths are 5 feet throughout the watershed above Jones Creek Road. No significant changes are proposed to existing channel bottom elevation or slope. The plan is summarized in Table 79 and illustrated on Plate 44.

Plan Effectiveness

The Recommended Plan is designed to convey and contain a 25-year plus storm event within the streambank. Flood stages of greater storm events will also be reduced. Expected stage lowerings for various storm events at selected locations in the watershed are shown in Table 79 and Plate 57. Overflow maps, illustrating existing and with project floodplains are shown in the Engineering Appendix C. The expected reduction in floodstages will result in a substantial lowering in the number of structures located in 0- to 100-year floodplains (see Table 81).

By the year 2040, urbanization in the lower watershed is projected to increase from 77 to 97 percent. Estimates from hydrologic modelling indicate that both the 10-year and 100-year with project average stage will be about 0.3 feet higher.

Urbanization is projected to increase from 90 to 99 percent at Weiner Creek. This is expected to produce a rise of 0.1 and 0.2 feet, respectively, in the with project 10-year and 100-year stages. Lively Bayou's urban development is projected to increase from 70 to 94 percent. This is expected to increase both the 10-year and 100-year with project stages by 0.2 feet. The Lively Bayou Tributary area is virtually completely urbanized and no difference in the future with project stages is expected. Implementation of a floodplain management program, that would nct allow future development to significantly increase flood stages, would likely reduce these projected stage increases. The continued implementation and enforcement of East Baton Rouge Parish's floodplain ordinance (see Appendix K) will be satisfactory in this watershed.

TABLE 79

JONES CREEK - RECOMMENDED PLAN

CHANNEL	PROPOSED BOTTOM WIDTH	LOCATION
Jones Creek	Clear & snag	Mouth to Jones Creek Road
	5'BW	Jones Creek Road to Lobdell Blvd
Weiner Creek	5'BW	Mouth to Cedar Crest Ave
Lively Bayou	5'BW	Mouth to Illinois Central RR
Lively Bayou Tributary	5'BW	Mouth to Tams Drive
Jones Creek Tributary	5'BW	Mouth to Darryl Drive

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 80
JONES CREEK - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

Jones Creek

Event	Jones Creek Road	S. Harrells Ferry Road	US 190	Airway Drive	Woodlake Blvd.
1-YR	4.0	6.5	4.8	6.8	4.5
2-YR	3.5	6.7	5.0	6.9	4.0
5-YR	2.9	6.8	5.6	7.1	3.6
10-YR	2.5	6.6	5.8	7.2	2.7
25-YR	2.2	6.3	6.1	7.4	2.1
50-YR	1.8	6.0	6.0	6.9	1.6
100-YR	1.9	5.7	6.0	6.6	1.3
200-YR	1.6	4.9	5.7	6.1	1.1
500-YR	1.6	4.5	5.0	5.3	1.0

Weiner Creek and Jones Creek Tributary

	Weiner Creek		Jones Creek Trib	
Event	Stanley Aubin Ln	Cedar Crest Ave	W. Tams Drive	Darryl Drive
1-YR	3.9	3.6	5.5	3.5
2-YR	4.1	3.4	5.8	4.3
5-YR	4.2	3.2	6.2	5.2
10-YR	4.2	3.1	6.8	5.9
25-YR	4.2	3.1	6.9	6.2
50-YR	4.3	2.9	6.9	6.4
100-YR	4.3	2.8	6.7	6.1
200-YR	4.4	2.7	6.4	5.8
500-YR	4.5	2.7	5.7	4.9

Lively Bayou and Tributary

	Lively Bayou		Lively Bayou Tributary		
Event	Old Hammond Highway	Plannery Road (near ILC RR)	Goodwood Blvd	Florida US 190	Tams Dr
1-YR	6.4	2.6	4.0	4.3	3.1
2-YR	6.8	3.0	4.7	4.7	3.6
5-YR	6.7	3.5	5.2	5.2	4.5
10-YR	6.4	3.8	5.5	5.6	5.2
25-YR	6.1	3.9	5.4	5.9	5.3
50-YR	5.4	3.8	5.3	5.7	5.3
100-YR	4.9	3.6	5.0	5.3	5.3
200-YR	4.2	3.3	4.5	4.9	5.2
500-YR	3.6	2.6	3.8	3.9	5.0

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 81

JONES CREEK
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
JONES CREEK								
	WITHOUT PROJECT							
22	1-STORY	57	23	91	113	148	1,066	1,503
	2-STORY	7	6	19	15	38	216	301
	MOBILE HOME	1	1	0	2	0	5	9
	COMMERCIAL	50	29	51	28	36	186	380
	TOTAL	115	64	161	158	222	1,473	2,193
	WITH RECOMMENDED PLAN							
	1-STORY	1	1	1	1	21	1,478	1,503
	2-STORY	0	0	0	0	9	292	301
	MOBILE HOME	0	0	0	1	1	7	9
	COMMERCIAL	5	0	2	0	22	351	380
	TOTAL	6	1	3	2	53	2,128	2,193
LIVELY BAYOU TRIBUTARY								
	WITHOUT PROJECT							
23	1-STORY	505	126	114	44	60	69	918
	2-STORY	20	10	4	3	5	13	55
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	2	1	0	0	0	0	3
	TOTAL	527	137	118	47	65	82	976
	WITH RECOMMENDED PLAN							
	1-STORY	0	0	0	7	172	739	918
	2-STORY	0	0	0	1	16	38	55
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	0	0	0	0	0	3	3
	TOTAL	0	0	0	8	188	780	976

TABLE 81 (CONTINUED)

JONES CREEK
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
LIVELY BAYOU								
	WITHOUT PROJECT							
24	1-STORY	116	55	64	24	78	101	438
	2-STORY	10	58	5	0	8	18	99
	MOBILE HOME	0	0	1	0	11	25	37
	COMMERCIAL	31	10	19	2	9	3	74
	TOTAL	157	123	89	26	106	147	648
	WITH RECOMMENDED PLAN							
	1-STORY	0	0	17	2	102	317	438
	2-STORY	0	0	0	0	11	88	99
	MOBILE HOME	0	0	0	0	0	37	37
	COMMERCIAL	0	0	0	0	38	36	74
	TOTAL	0	0	17	2	151	478	648
WEINER CREEK								
	WITHOUT PROJECT							
28	1-STORY	8	0	13	0	45	229	295
	2-STORY	0	0	0	2	4	36	42
	MOBILE HOME	0	0	0	0	0	1	1
	COMMERCIAL	0	0	1	0	0	21	22
	TOTAL	8	0	14	2	49	287	360
	WITH RECOMMENDED PLAN							
	1-STORY	0	0	0	0	0	295	295
	2-STORY	0	0	0	0	0	42	42
	MOBILE HOME	0	0	0	0	0	1	1
	COMMERCIAL	0	0	0	0	0	22	22
	TOTAL	8	0	0	0	0	360	360

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Design and Construction

Structural improvements to this watershed consist of incorporating approximately 84,000 linear feet of reinforced concrete-lined trapezoidal channel. An improved stable section with a 5-foot bottom width and 1V on 3H side slopes will be established through excavation and backfilling. Excavated material will be disposed at the parish's Devil's Swamp landfill located about 15 miles away. The channel bottom will be paved with an 8-inch thick layer of reinforced concrete. The channel side slope paving thickness will vary. Only 4 inches of reinforced concrete will be placed in the upper two-thirds of the channel slope, with 6 inches placed in the lower one-third. Reinforced concrete cutoff walls will be located at the top-of-bank and at the bottom slope interface beneath the paving to prevent undermining of the foundation materials. A drainage system that would dissipate any excess hydrostatic pressure will be required. The system will consist of weep holes, filter fabric, and filter sand placed beneath both the 6-inch side slope and 8-inch bottom paving. A reinforced concrete-lined drainage ditch will be constructed on each side of the finished top of bank to intercept excess runoff. Also included, as required by local ordinance, is a chain link fence along both sides of the paved reaches. This fence will likely be placed at the public right-of-way line. See Plate 48. Additionally, 3 miles of channel clearing and snagging is proposed from Jones Creek Road to the Amite River. Further details can be found in the Engineering Appendix C.

The proposed work will be performed immediately adjacent to developed residential properties. Narrow rights-of-way and limited access points will affect construction. Much of the work access will be from inside the channel itself. Temporary fuseplug dams will also be required to dewater sections to facilitate the placement of concrete. Overall, project constructability appears to be fairly difficult.

It was determined that it would be practical to separate construction of this watershed's project into four segments: Lower Jones Creek, Upper Jones Creek and Tributary, Lively Bayou and Tributary, and Weiner Creek. Construction would be phased, first with Lower Jones Creek followed by the remaining three sections. The total construction duration for the entire Jones Creek watershed project is estimated at six years.

Relocations and Removals

There are no roadway or utility relocations proposed for the Jones Creek project. The channel paving final design will accommodate existing facilities.

Real Estate

The Recommended Plan will require the purchase of less than one acre for channel construction. No structures or improvements will be taken for this portion of the project. No land purchase is required for disposal since the parish landfill will be used. Construction access will be obtained from publicly-owned bridge crossing rights-of-way. Some additional access may be required in some locations and additional construction easements may be required. Mitigation needs will require the purchase of 99 acres of cleared land for reforestation. Land purchase for channel modifications with the proposed bike path (see below) will be fee title, excluding mineral rights. Mitigation purchases will be the same. To facilitate the proposed bike path (see below), 13 acres of existing perpetual servitude must be converted to fee title. Trees planted for the purpose of aesthetic mitigation will be subject to final approval by various landowners.

Mitigation

The mitigation feature of the Recommended Plan consists of reforestation of 99 acres of existing cleared land. It was determined to be practicable to combine mitigation sites for the Recommended Plan for all watersheds. Two sites will be utilized for mitigation. See Plates 52 and 53. The required 99 acres for this watershed's Recommended Plan will be included as a portion of the entire habitat mitigation package for all five watersheds.

Recreation

A bike path is proposed as part of the project in this watershed. See Environmental Appendix E. The total length of the proposed bike path is about 11 miles alongside the channels, plus, 3 miles of connecting streets. The proposed path will utilize the top of bank drainage structure on one side of the channel. See Plate 6. Where the path is located, the proposed chain link fence is required as part of the channel design, will be placed between the bike path and the channel slope for safety. A wooden fence will be installed outside the bike path, along the right-of-way line. This fence is necessary to provide security and privacy to residents living along the proposed bike path which will be open to public access. Additionally, some aesthetic tree and shrub plantings are proposed along the path. Two bridge structures are also proposed in order to connect the path across the stream. All bike path items necessary for the connecting streets (signage and street marking) will be provided solely by the parish and are not included in the Federal cost sharing of this project.

Aesthetics

For aesthetic purposes, a top-of-bank tree replanting plan is proposed and consists of 4.25 miles of tree and shrub line planting along both sides of Jones Creek for a total of 8.5 miles. These plantings occur in areas of impact relative to channel improvement involving clearing of top-of-bank vegetation. Replacing trees and shrubs lost during construction will return aesthetic conditions to the pre-project condition. For trees proposed on drainage easement lands, further coordination with various landowners will be required prior to planting. See Table 3 of the Environmental Appendix which identifies tree and shrub requirements and cost per watershed.

Cultural Resources

Three recorded sites have received previous impacts. One of which has been evaluated as part of this project. Preliminary investigations, which have been coordinated with the State Historic Preservation Officer, indicate that no significant cultural resources will likely be impacted by the Recommended Plan. The project area is considered to have a very low probability for containing any sites. Final preconstruction surveys may, however, be conducted. Such efforts will be coordinated with the State Historic Preservation Officer.

Stream Gaging

The U.S. Geological Survey has an existing parish-wide stream gaging program that includes installations in this watershed. Improvements are proposed for five gages at the following locations: Jones Creek at Woodland Ridge Drive, Woodlake Drive and Goodwood Boulevard, Weiner Creek at Sherwood Forest Boulevard, and Lively Bayou at Old Hammond Highway. Data from these gages will be used in both the final project design and in monitoring the effectiveness of the project. Gages will be upgraded as part of this project's construction and then will be maintained by the U.S. Geological Survey as part of their existing parish program.

Operation and Maintenance, Repair, Replacement, and Rehab (O&M)

Required O&M for the channels consist of continuous inspection and debris removal, annual herbicide application, and pavement repair when necessary. All vegetation removal/control will be done within the streambank only and not affect top-of-bank aesthetic plantings. Maintenance of combined project mitigation areas is also necessary and such costs have been prorated to the overall O&M of this watershed's Recommended Plan.

Herbicide spraying would be conducted in accordance with the Environmental Protection Agency's guidelines.

Environmental and Social Effects

The only significant long term environmental impact of the Recommended Plan is the destruction of 78 acres of bottomland hardwood forestation. This loss will be mitigated with the planting and maintenance of 99 acres of existing cleared land. There will be short-term turbidity effects on stream water quality during construction. Aquatic habitat will receive adverse impacts from reduced diversity and increased in-stream temperatures. The loss of screening vegetation along the channel banks would result in a significant aesthetic loss.

However, this loss would be mitigated by the planting with both trees and shrubs on both sides of 4.25 miles of channel.

The most significant beneficial social impact of this plan would be the relief from flooding to those affected. Also, major property erosion problems would be mitigated by this plan

Economic Benefits

The Recommended Plan would generate significant economic benefits from flood damage reduction to existing, and, to some extent, projected future development. Benefits were only quantified, however, for existing development. It is estimated that annual average damages in this watershed would be reduced by about 95 percent. A breakdown of these anticipated benefits are shown in Table 82.

In addition to the above direct and indirect flood damage reduction benefits, the proposed paving of channels in this watershed will have a significant beneficial impact on existing property erosion problems. As stated above, streambank erosion is widespread in this watershed. In some reaches, the problem is severe where large sections of private property are sloughing down into the channel banks. There are several instances where private structures, such as garages, patios, and driveways, have been damaged. See photos, Figure 1. There are numerous areas where the continuation of this process will certainly damage private structures and severely devalue these properties. There are several major litigations filed by private owners against East Baton Rouge Parish claiming damage relief from this problem. Short-term efforts to mitigate the erosion problem have been ineffective (see photos).

Several factors were considered in developing a methodology to quantify the benefits associated with abating the erosion problem. A conservative approach was developed that consisted of estimating the erosion rate of each stream reach and combining it with the average land square foot real estate value of the area. See Engineering and Economic Appendix. While the actual soils directly eroded are within the existing channel right-of-way and have little value, there is almost an immediate "translation" of the soils loss as the top of bank section, well beyond the public right-of-way, creeps and/or sloughs down the stream embankment.

Applying estimated erosion rates in conjunction with estimated property land values, equivalent annual damages were calculated. The proposed paving of the channels will abate these damages and this value was therefore included as an economic benefit produced by this project.

Final Costs, Net Benefits

Final costs and benefits for the Recommended Plan by feature are shown in Table 82. Complete itemized costs by account code feature breakdown are shown in Table 83. The total first cost of the Recommended Plan, including all items, is estimated to be $52,590,000. Total Recommended Plan annual operation and maintenance costs, including all features, is estimated at $67,000 per year. Project first costs were converted to equivalent annual dollars using an interest rate of 8.00 percent over a 50-year project life. It has been determined that the estimated equivalent annual costs and benefits will generate $4,469,000 per year net benefits. The benefit-cost ratio is 1.82 to 1. Removing the recreation feature from the plan results in the following adjustments: first cost $51,275,000, annual O&M $33,000, net annual benefits $3,988,000, and B/C ratio of 1.75 to 1.

Construction of each watershed's Recommended Plan will be phased. Construction of the Recommended Plan for Jones Creek is scheduled to start in 2000. Fully-funded cost estimates in accordance with this construction schedule are shown in Plan Implementation.

Cost-Sharing

A breakdown of incremental and fully-funded cost-sharing requirements for the Recommended Plan is shown in Plan Implementation. The local sponsor will be responsible in providing and/or bearing the full costs of all required lands, easements, rights-of-way, relocations, and disposal areas for this project. The local sponsor will also bear 100 percent of annual operation and maintenance, and, all replacement costs.

TABLE 82
JONES CREEK
PROJECT COSTS AND BENEFITS FOR THE RECOMMENDED PLAN
(1994 DOLLARS, 8.00% INTEREST, 50-YEAR PERIOD)

FIRST COSTS	
CONSTRUCTION FEATURE	$52,590,000
GROSS INVESTMENT (includes interest lost during construction)	$65,614,000
AVERAGE ANNUAL COSTS	
INTEREST/AMORTIZATION	$ 5,363,000
OPERATION/MAINTENANCE	$ 67,000
TOTAL AVERAGE ANNUAL COSTS	$ 5,430,000
AVERAGE ANNUAL BENEFITS*	
INUNDATION REDUCTION	$ 7,931,400
FIA COSTS SAVED	$ 102,140
REDUCED EMERGENCY COSTS	$ 140,600
FILL REDUCTION	$ 96,050
RECREATION	$ 577,000
EROSION CONTROL	$ 362,700
BENEFITS DURING CONSTRUCTION	$ 689,000
TOTAL AVERAGE ANNUAL BENEFITS	$ 9,898,890
BENEFIT/COST RATIO	1.82

* CALCULATED WITH PROPOSED COMITE RIVER DIVERSION CANAL IN PLACE

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 83
JONES CREEK - RECOMMENDED PLAN
CHART OF ACCOUNTS

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	LANDS AND DAMAGES						
	Construction						
01B--	Acquisitions						
01B1-	By Government				18,460	4,710	23,170
01B2-	By Local Sponsor(LS)				19,800	5,050	24,850
01B4-	Review Of LS				5,270	1,340	6,610
						0	
01E--	Appraisals					0	
01E3-	By LS				1,000	250	1,250
01E5-	Review of LS				800	200	1,000
						0	
01G--	Temporary Permits					0	
01G1-	By Government				9,230	2,340	11,570
01G2-	By LS				13,840	3,530	17,370
01G5-	Other				2,640	670	3,310
						0	
01R--	Real Estate Payments					0	
01R1-	Land Payments					0	
01R1B	By LS				1,000	1,000	2,000
						0	
01T--	LERRD Credits					0	
01T1-	Land Payments				11,120	2,820	13,940
01T2-	Administrative Costs				13,290	3,380	16,670
01T4-	Other				3,400	860	4,260
01---	Subtotal: Lands And Damages (Construction)						99,850
	Contingencies						26,150
01---	Subtotal: Lands And Damages (Construction)						126,000
	Mitigation						
01B1-	By Government				1,090	270	1,360
01B2-	By Local Sponsor(LS)				1,710	440	2,150
01B4-	Review Of LS				320	80	400
01C--	Condemnations						
01C2	By LS				340	90	430
01C4-	Review of LS				150	40	190
01E--	Appraisals						
01E3-	By LS				1,700	430	2,130
01E5-	Review of LS				430	110	540
01F--	PL 91-646 Assistance						
01F1-	By Government				150	40	190
01F4-	Review Of LS				50	10	60
01G--	Temporary Permits						
01G1-	By Government				480	120	600
01G2-	By LS				680	170	850
01G4-	Review of LS				140	40	180
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				283,250	71,320	354,570
01T--	LERRD Credits						
01T1-	Land Payments				770	190	960
01T3-	PL 91-646 Assistance				760	190	950
01T2-	Administrative Costs				960	240	1,200
01T4-	Other				190	50	240

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	Subtotal: Lands And Damages (Mitigation)						293,170
	Contingencies						73,830
01---	Subtotal: Lands And Damages (Mitigation)						367,000
01---	TOTAL: LANDS AND DAMAGES						493,000
06------	FISH AND WILDLIFE FACILITIES						
0603----	Wildlife Facilities And Sanctuaries						
060301--	Mob And Demob						
060371--	Fences						
06037102	Fencing	6,432	LF	5.45	35,054	9,016	44,070
060373--	Habitat And Feeding Facilities						
06037302	Planting	111	AC	150.00	16,650	4,280	20,930
06------	Subtotal: Fish And Wildlife Facilities						51,704
	Contingencies						13,296
06------	TOTAL: FISH AND WILDLIFE FACILITIES						65,000
09------	CHANNELS AND CANALS						
0901----	Channels						
090101--	Mob & Demob	Lump Sum	LS	470,000.00	470,000	117,500	587,500
09011502	Clearing For Channel Dredging	272	AC	3,100.00	843,200	210,800	1,054,000
09011502	Degrading, Hauling, Shaping (16 Miles)	162,000	CY	10.00	1,620,000	810,000	2,430,000
09011502	Clearing and Snagging	3	MI	19,000.00	57,000	14,250	71,250
09013002	Sand (8" Thick)	84,000	CY	11.60	974,400	243,600	1,218,000
09013002	Filter Drain Fabric	418,700	SY	7.50	3,140,250	785,062	3,925,312
09013002	Fuseplug Dams	Lump Sum	LS	108,000.00	108,000	27,000	135,000
09013003	Concrete Lining						
	Cutoff Wall	6,150	CY	150.00	922,500	230,625	1,153,125
	Channel Slope Pavement (4")	82,300	CY	130.00	10,699,000	2,670,000	13,369,000
	Channel Slope Pavement (6")	61,300	CY	150.00	9,195,000	2,300,000	11,495,000
	Channel Slab Pavement (8")	11,000	CY	150.00	1,650,000	412,500	2,062,500
	Drain Ditch	33,100	CY	130.00	4,303,000	1,080,000	5,383,000
09019905	Fencing (chain link)	171,000	LF	8.25	1,410,750	352,563	1,763,313
09019906	Aesthetic Planting						
	Aesthetic Tree Planting	1,800	EA	15.00	27,000	6,500	33,500
	Aesthetic Shrub Planting	3,000	EA	11.00	33,000	8,500	41,500
09------	SUBTOTAL: Channels And Canals						35,453,100
	Contingencies						9,268,900
09------	TOTAL: CHANNELS AND CANALS						44,722,000
14------	RECREATION FACILITIES						
14002202	Bridge - 10' X 50'	Lump Sum	LS	23,500.00	23,500	5,500	29,000
14002202	Bridge - 10' X 150'	Lump Sum	LS	106,000.00	106,000	26,500	132,500
14002202	Signs & Markers	20	EA	160.00	3,200	800	4,000
14002202	Trees	4,431	EA	15.00	66,465	16,600	83,065
14002202	Fence (6' Wooden)	55,440.0	LF	12.80	709,632	177,803	887,435
14------	SUBTOTAL: Recreation Facilities						908,797
	Contingencies						227,203
14------	TOTAL: RECREATION FACILITIES						1,136,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
29---	PROJECT COOPERATION AGREEMENTS						
29A--	Draft PCA						
29A9-	All Other				600	100	700
29B--	Final PCA and Financial Plan						
29B9-	All Other				600	100	700
29C--	PCA Negotiations						
29C9-	All Other				500	100	600
29---	Subtotal: Project Cooperation Agreements						1,700
	Contingecies						300
29---	TOTAL: PROJECT COOPERATION AGREEMENTS						2,000
30---	ENGINEERING AND DESIGN						
30C--	Design Memorandum				878,000	176,000	1,054,000
30CD-	HTRW Studies				125,000	12,000	137,000
30CF-	Cost Estimates				21,000	4,000	25,000
30CN-	VE Studies				30,000	6,000	36,000
30DA-	P&S #1 -				200,000	40,000	240,000
30DF-	Cost Estimates				14,000	3,000	17,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S #2 -				205,000	41,000	246,000
30DF-	Cost Estimates				14,000	3,000	17,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S #3 -				162,000	32,000	194,000
30DF-	Cost Estimates				12,000	2,000	14,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S #4 -				110,000	22,000	132,000
30DF-	Cost Estimates				10,000	2,000	12,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S - Mitigation				20,000	4,000	24,000
30DS-	Construction Contract Award Activities				40,000	8,000	48,000
30DV-	Engineering During Construction				115,000	23,000	138,000
30E--	Engineering And Design Phase Project Management				144,000	29,000	173,000
30Z--	Misc. Activities						
	Monitoring						
	Install Gages				35,000	7,000	42,000
	Preconstruction O&M For Gages				158,000	32,000	190,000
	PMO				179,000	36,000	215,000
	LMVD				12,000	2,000	14,000
30---	SUBTOTAL: Engineering And Design						2,504,000
	Contingencies						488,000
30---	TOTAL: ENGINEERING AND DESIGN						2,992,000
31---	CONSTRUCTION MANAGEMENT						
31B--	Contract Administration						
31B3-	Review And Approval of Contract Payments				94,000	19,000	113,000
31B4-	Contract Modifications				279,000	56,000	335,000
31B5-	Progress And Completion Reports				115,000	23,000	138,000
31B9-	All Other				398,000	80,000	478,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
31D--	Review of Shop Drawings						
31D0-	Review of Shop Drawings				75,000	15,000	90,000
31E--	Inspection & Qual. Assur.						
31E1-	Schedule Compliance				73,000	15,000	88,000
31E2-	Compliance Sampling And Testing				79,000	16,000	95,000
31E3-	Quality Surveys				180,000	36,000	216,000
31E4-	Title II Services				151,000	30,000	181,000
31E9-	All Other				1,063,000	213,000	1,276,000
31T--	Construction Phase Project Management				142,000	28,000	170,000
31---	SUBTOTAL: Construction Management						2,649,000
	Contingencies						531,000
31---	TOTAL: CONSTRUCTION MANAGEMENT						3,180,000
	TOTAL: JONES CREEK						52,590,000

Risk and Uncertainty

A modified risk and uncertainty analysis was performed on calculated benefits and costs of the Recommended Plan. In general, statistical ranges used in this analysis were broad and were established primarily for the purposes of identifying the direction of change that may be expected due to known uncertainties. The single value estimates calculated above were, therefore, used as the basis for determining the ultimate cost-effectiveness of the plan.

Six items were identified as having potential major variance on the overall project's feasibility. These items and their estimated variance ranges are discussed below. Additional detail of the analysis can be found in the Economics Appendix H.

- Stage Frequency Values.

  Without project (existing) and with project floodstage frequency values directly affect existing and with project calculated damage dollar values. Variances on stages were determined to be practicably within plus or minus 1.0 feet for all storm frequency events for without project conditions, and, plus or minus 0.5 feet for with project conditions. See Engineering Appendix C. Damage values were recalculated incorporating this range. Applying the results, it is estimated that without project flood damages vary from minus $4,721,000 to plus $10,231,000 per year from the single value estimate. With project flood damages are estimated to vary from minus $42,000 to plus $45,000 per year from the single value estimate. Note that it was determined that there is likely to be some correlation between existing and with project stage frequency variance. A correlation factor of 0.5 was applied to this item in the "risk analysis" calculations described below.

- Structure Elevations.

  Variances in structure elevations directly affect both existing and with project calculated damage dollar values. Within practical limits, structure elevation variance was determined to be minus 0.5 to plus 0.5 feet. The calculated dollar value variance is minus $3,772,000 to plus $1,901,000 for existing annual damages, and, minus $42,000 to plus $45,000 for with project annual damages. Note that there is a direct correlation between existing and with project variances. A correlation factor of 1.0 was therefore applied to this item in the "risk analysis" calculations described below.

- Structure Valuations.

  Variances in the estimate of structure values also affect both existing and with project calculated damage dollar value. Structure value variance range is estimated at plus or minus 10 percent from the single vaule estimate. Damage values were recalculated incorporating this range. Applying these results, it is estimated that existing flood damages vary from minus $758,000 to plus $784,000 per year. With project flood damages range from minus $9,000 to plus $9,000. A correlation factor of 1.0 is applicable to this set of values.

- Construction Costs.

  Estimated variances in calculated quantities, unit prices, constructability, and other factors were considered in calculating the channel construction cost estimate. The calculated cost range is from minus $20,805,000 to plus $2,660,000 relative to the single value estimate used for this item. Converting this range to equivalent annual dollars yields minus $2,080,000 to plus $266,000 per year.

- Erosion Abatement Benefits.

  The estimated annual benefits calculated for erosion abatement are quite speculative. A plus or minus range of 50 percent should be considered for this item. This adjustment range is minus $196,000 to plus $196,000 per year.

- Property Utility Values

  In addition to the loss of "land" property, the strong probability exists that significant or entire property utility values will be lost over time if the channels in this watershed are not paved. That is to say, for example, that an existing home purchased at $85,000 may not be able to be sold at any price if the backyard has sloughed into the channel. Furthermore, it is quite likely that unabated erosion will result in direct damage to structures, given time. Through field investigation, it is estimated that up to 50 properties could lose their utility values within five years given present conditions. These properties consist of residential and a small number of small commercial sites. It is therefore estimated that a potential loss of $33,000 per each property ($3.25 million) could possibly occur in five years. Discounting over the five year period and conversion to annual dollars yields $111,000 per year. Since this item was not considered in the most likely estimate of benefits for this plan, a range of minus $0 to plus $111,000 per year was considered for this additional item.

The above uncertainty spreads were integrated with the single most likely value estimates for existing annual damages, with project damages and project costs. With the aid of "At Risk" computer software, probability ranges were calculated. See Risk Analysis calculations in Economic Appendix H. The calculated probability distributions for project cost, benefits, net benefits, and benefit-to-cost ratio are illustrated in Figures 10 through 13.

The calculated expected values generated as compared to the single value estimates were determined as follows:

(EQUIVALENT ANNUAL)	SINGLE VALUE ESTIMATE	CALCULATED EXPECTED VALUE
PROJECT BENEFITS	$9,899,000	$11,160,000
PROJECT COSTS	$5,430,000	$ 4,729,000
NET BENEFITS	$4,464,000	$ 6,431,000
BENEFIT/COST RATIO	1.82	2.39
PROBABILITY OF PROJECT NET POSITIVE BENEFITS	N/A	99%

These results show an expected increase in project net benefits. This increase was due primarily to the sensitivity of calculated existing damages given a flood stage frequency variance of plus or minus 1.0 feet.

Figure 10
Jones Creek
Probability Distribution

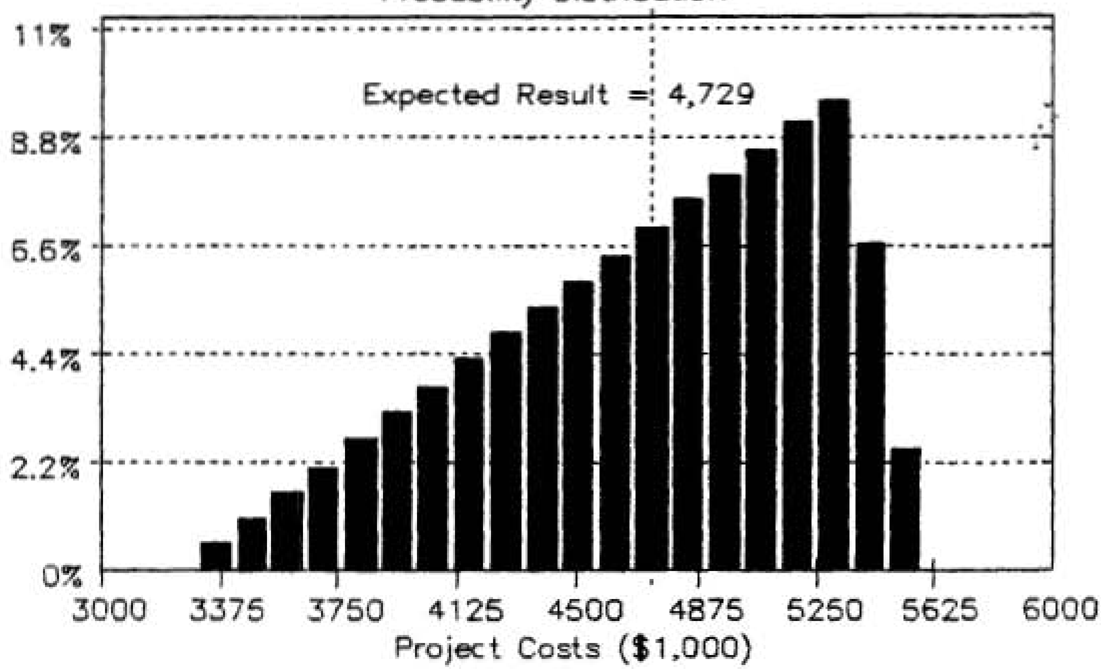


Figure 11
Jones Creek
Probability Distribution

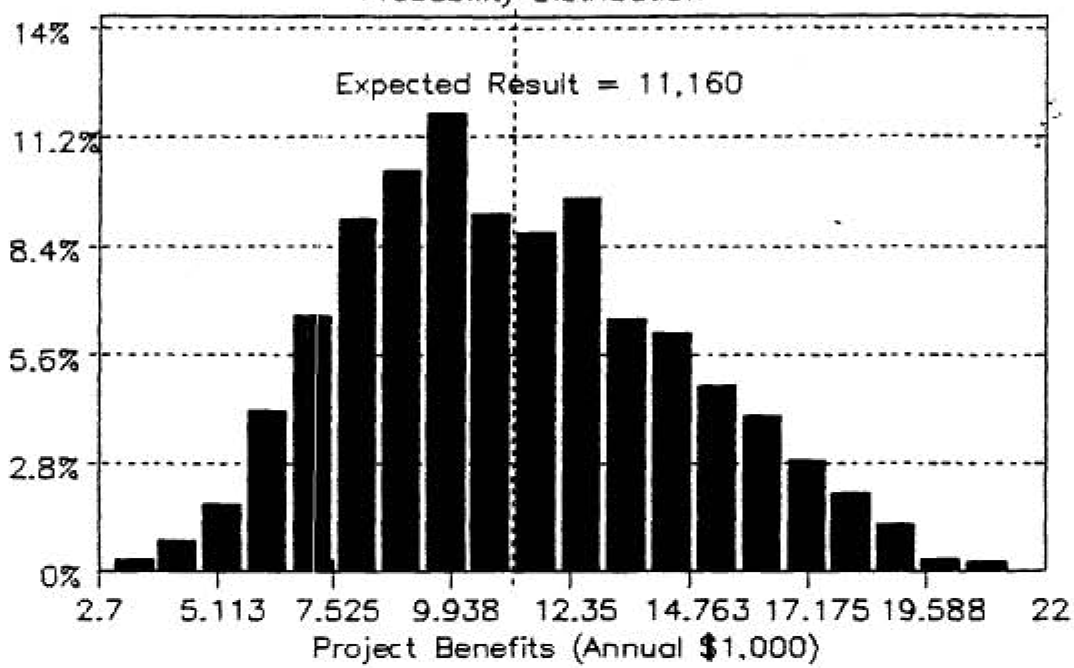


Figure 12
Jones Creek
Probability Distribution

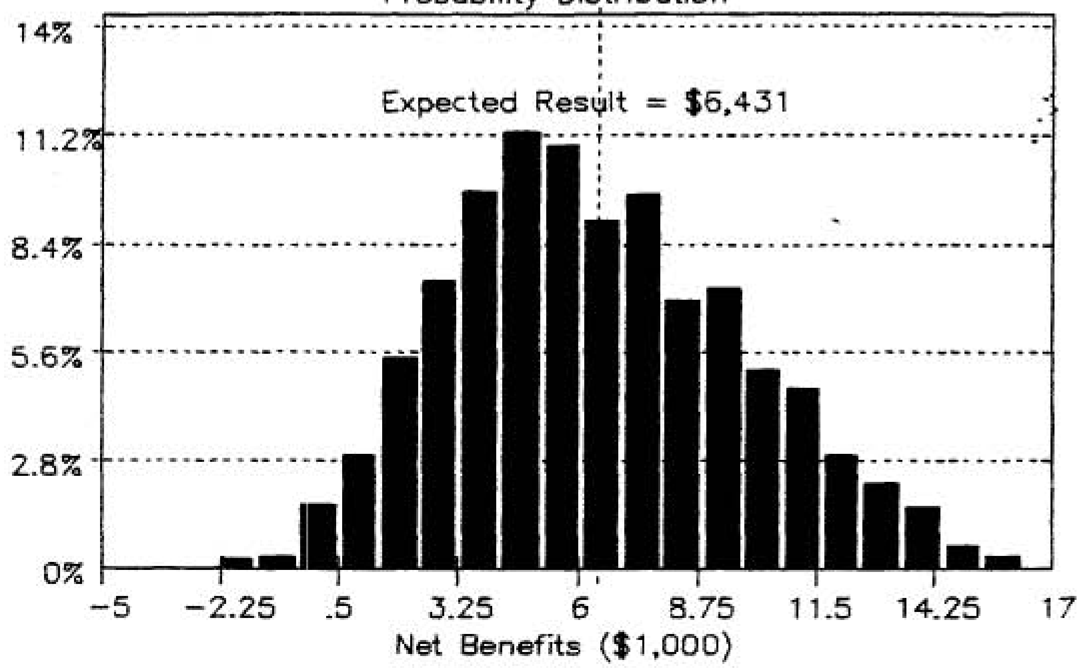
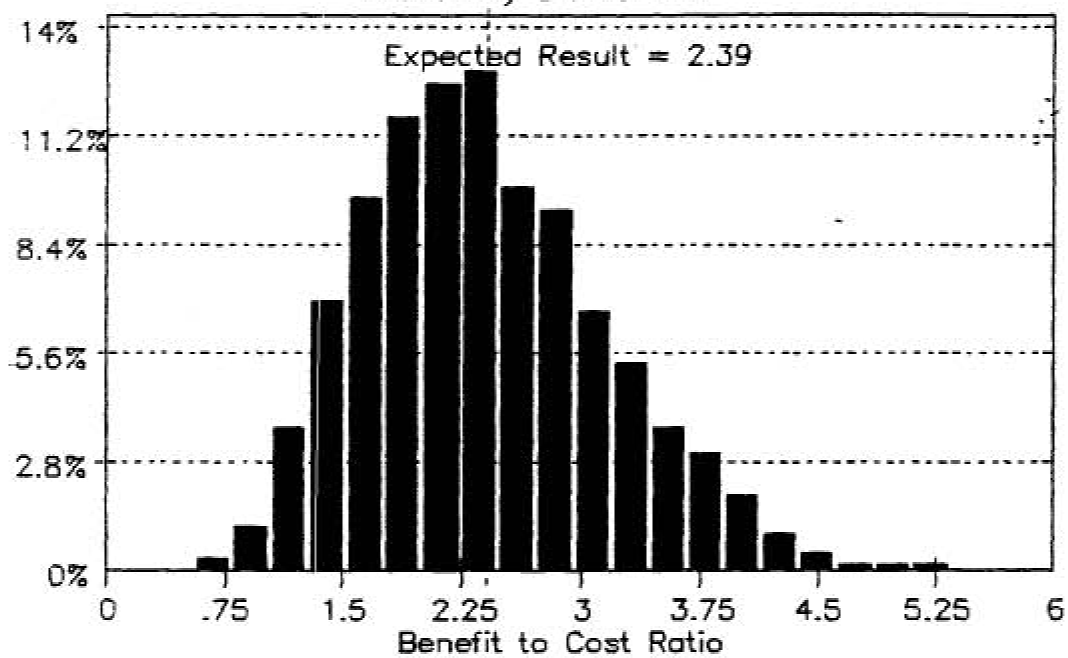


Figure 13
Jones Creek
Probability Distribution



WARD CREEK

Description

The Recommended Plan for Ward Creek consists of clearing and/or concrete lining approximately 14 miles of channel. Minimal clearing and snagging of the main stem of Ward Creek is proposed from its mouth upstream to Corporate Boulevard, not including the newly enlarged and relocated section between Pecue and Siegen Lanes. Also included are proposed improvements to the bayou's two main tributaries. Proposed minimal clearing and snagging of Dawson Creek begins from its mouth upstream to its confluence with Bayou Duplantier just above Kenilworth Boulevard. Concrete lining of North Branch of Ward Creek is proposed from immediately downstream of I-10 to immediately downstream of I-12 with a design channel section consisting of a 32-foot bottom and 3:1 side slopes. An existing paved section in this reach of approximately 1,250 feet with an established side slope of 2:1 shall remain which the proposed concrete section will be tied into with the 3:1 side slope. Plan details are listed in Table 84. This plan is shown on Plate 45.

TABLE 84

WARD CREEK - RECOMMENDED PLAN

Stream	Reach	Type of Improvement
	Earthen and Concrete Improvements	
Ward Creek	Mouth to 4000 ft upstream	No Work
	4000 ft upstream to 1200 ft u/s Pecue Lane	Minimal Clearing and Snagging
	1200 ft u/s Pecue Lane to Seigen Lane	No Work: 150' BW by Developer made,
	Siegen Ln to Corporate Blvd	Minimal Clearing and Snagging
North Branch Ward Creek	Mouth to I-12	Concrete-Line: 32' BW, 1V on 3H SS
	I-12 to Florida Blvd	No Work
Dawson Creek	Mouth to Bayou Duplantier	Minimal Clearing and Snagging
	Bayou Duplantier to Hundred Oaks Dr	No Work
Bayou Duplantier	Mouth to Darymple Dr	No Work

Source: U.S. Army Corps of Engineers, New Orleans District

Plan Effectiveness

Expected stage lowering for various storm events at selected locations in the watershed are shown in Table 85 and Plate 57. Overflow maps, illustrating existing and with project floodplains are shown in the Engineering Appendix C. The expected reduction in floodstages will result in a substantial lowering in the number of structures located in the 0- to 10-year floodplain basinwide. In the North Branch Tributary area, it is expected that the project will substantially reduce the number of structures in the 0- to 50-year floodplain. See Table 86.

Table 87 illustrates the effects of projected urbanization on the Ward Creek watershed with the Recommended Plan in place. Moderate stage increases are expected on the main stem of Ward Creek. Implementation of a floodplain management program, that would not allow future development to significantly increase flood stages, would likely reduce these projected stage increases. The continued implementation and enforcement of East Baton Rouge Parish's current floodplain ordinance (see Appendix K) will be satisfactory in this watershed.

TABLE 85
WARD CREEK - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

Ward Creek

Event	Barringer Foreman Rd	Siegen Lane	N. Branch Ward Creek	Corporate Blvd.	Government Street
1-YR	0.0	0.0	0.6	0.9	0.0
2-YR	0.0	0.0	0.6	0.8	0.0
5-YR	0.0	0.0	0.6	0.7	0.0
10-YR	0.0	0.0	0.6	0.6	0.0
25-YR	0.0	0.0	0.4	0.5	0.0
50-YR	0.0	0.0	0.4	0.5	0.0
100-YR	0.0	0.0	0.3	0.4	0.0
200-YR	0.0	0.0	0.2	0.4	0.0
500-YR	0.0	0.0	0.2	0.3	0.0

North Branch Ward Creek

Event	Mouth	I-12	Old Hammond Highway	Florida Blvd
1-YR	0.6	5.8	5.6	0.0
2-YR	0.6	5.4	6.0	0.0
5-YR	0.6	4.9	6.5	0.0
10-YR	0.6	4.7	6.9	0.0
25-YR	0.4	4.6	7.3	0.0
50-YR	0.4	4.5	7.5	0.0
100-YR	0.3	4.5	7.3	0.0
200-YR	0.2	4.4	7.1	0.0
500-YR	0.2	4.2	6.6	0.0

Dawson Creek

Event	Mouth	Bluebonnet Street	Moss Side Lane
1-YR	0.5	0.2	0.2
2-YR	0.5	0.2	0.2
5-YR	0.4	0.2	0.1
10-YR	0.3	0.2	0.1
25-YR	0.3	0.2	0.0
50-YR	0.3	0.2	0.0
100-YR	0.2	0.2	0.0
200-YR	0.2	0.2	0.0
500-YR	0.2	0.2	0.0

TABLE 85 (CONTINUED)
WARD CREEK - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

Bayou Duplantier

Event	Mouth	College (Lee) Drive	Stanford Avenue
1-YR	0.4	0.4	0.4
2-YR	0.4	0.4	0.4
5-YR	0.4	0.4	0.4
10-YR	0.3	0.3	0.3
25-YR	0.3	0.3	0.3
50-YR	0.3	0.3	0.3
100-YR	0.2	0.2	0.2
200-YR	0.2	0.2	0.2
500-YR	0.2	0.2	0.2

Source: U.S. Army Corps of Engineers, New Orleans District

Design and Construction

Minimal clearing and snagging work will be performed within the low top of bank contour. It is anticipated that the work will be accomplished using chain saws and transloaders. Approximately 300,000 cubic yards of excavation spoil will be disposed of by truck hauling to borrow pits on the Mississippi River batture about 6 miles, on average, from the watershed (see Plate 50). This disposal location is located closer to the project area versus the parish landfill and, therefore, was changed from the initial plan to reduce construction cost. Non-vegetative "trash" removed from the channels will, however, be hauled to Devil's Swamp. Structural improvements to this watershed consist of incorporating approximately 5,600 linear feet of reinforced concrete-lined trapezoidal channel. An improved stable section with a 32-foot bottom width and 1V on 3H side slopes will be established through excavating and backfilling.

TABLE 86

WARD CREEK
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
WARD CREEK								
	WITHOUT PROJECT							
21	1-STORY	14	59	56	182	456	1,275	2,042
	2-STORY	1	0	5	2	3	25	36
	MOBILE HOME	0	0	0	0	1	0	1
	COMMERCIAL	3	13	17	48	91	220	392
	TOTAL	18	72	78	232	551	1,520	2,471
	WITH RECOMMENDED PLAN							
	1-STORY	1	16	61	205	481	1,278	2,042
	2-STORY	1	0	2	5	3	25	36
	MOBILE HOME	0	0	0	0	1	0	1
	COMMERCIAL	2	5	18	34	116	217	392
	TOTAL	4	21	81	244	601	1,520	2,471
BAYOU DUPLANTIER								
	WITHOUT PROJECT							
25	1-STORY	3	13	1	22	9	65	113
	2-STORY	2	6	6	6	6	15	41
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	12	2	2	4	13	13	46
	TOTAL	17	21	9	32	28	93	200
	WITH RECOMMENDED PLAN							
	1-STORY	2	14	1	13	18	65	113
	2-STORY	1	6	7	2	10	15	41
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	12	2	2	2	14	14	46
	TOTAL	15	22	10	17	42	94	200

TABLE 86 (CONTINUED)

WARD CREEK
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
DAWSON CREEK								
	WITHOUT PROJECT							
26	1-STORY	51	50	20	14	24	72	231
	2-STORY	10	5	3	1	1	9	29
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	52	50	11	17	15	64	209
	TOTAL	113	105	34	32	40	145	469
	WITH RECOMMENDED PLAN							
	1-STORY	51	50	20	14	24	72	231
	2-STORY	10	5	3	1	1	9	29
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	52	50	11	17	15	64	209
	TOTAL	113	105	34	32	40	145	469
NORTH BRANCH - WARD CREEK								
	WITHOUT PROJECT							
27	1-STORY	17	84	41	161	167	366	836
	2-STORY	3	18	1	21	61	45	149
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	23	16	14	9	19	233	314
	TOTAL	43	118	56	191	247	644	1,299
	WITH RECOMMENDED PLAN							
	1-STORY	2	20	10	4	36	764	836
	2-STORY	1	10	1	10	9	118	149
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	18	6	14	3	11	262	314
	TOTAL	21	36	25	17	56	1,144	1,299

TABLE 86 (CONTINUED)

WARD CREEK
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
DAWSON CREEK								
	WITHOUT PROJECT							
30	1-STORY	20	69	17	8	119	54	287
	2-STORY	0	2	2	10	18	19	51
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	19	20	3	5	12	82	141
	TOTAL	39	91	22	23	149	155	479
	WITH RECOMMENDED PLAN							
	1-STORY	20	69	3	21	108	66	287
	2-STORY	0	2	0	9	20	20	51
	MOBILE HOME	0	0	0	0	0	0	0
	COMMERCIAL	17	22	2	5	13	82	141
	TOTAL	37	93	5	35	141	168	479
WARD CREEK								
	WITHOUT PROJECT							
32	1-STORY	17	5	49	29	82	155	337
	2-STORY	3	2	3	2	2	15	27
	MOBILE HOME	4	0	0	0	1	71	76
	COMMERCIAL	23	6	19	15	2	13	78
	TOTAL	47	13	71	46	87	254	518
	WITH RECOMMENDED PLAN							
	1-STORY	17	5	49	29	82	155	337
	2-STORY	3	2	3	2	2	15	27
	MOBILE HOME	4	0	0	0	1	71	76
	COMMERCIAL	23	6	19	3	14	13	78
	TOTAL	47	13	71	34	99	254	518

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 87

STAGE FREQUENCY EFFECTS OF PROJECTED URBANIZATION
FOR THE RECOMMENDED PLAN FOR WARD CREEK

Reach	Existing (1985) Percent Urbanization	Projected (2040) Percent Urbanization	Projected Increase in Stage (Ft.) 10-yr	100-yr
Ward Creek (Lower)	40	100	0.6	0.3
Upper Ward Creek	75	98	0.4	0.3
North Br. Ward Creek	97	100	0.1	0.1
Dawson Creek (Lower)	72	96	0.3	0.3
Upper Dawson Creek	92	96	0.1	0.1
Bayou Duplantier	82	91	0.1	0.1

Source: U.S. Army Corps of Engineers, New Orleans District

The channel bottom will be paved with an 8-inch thick layer of reinforced concrete. The channel side slope paving thickness will vary. Only 4 inches of reinforced concrete will be placed in the upper two-thirds of the channel slope, with 6 inches placed in the lower one-third. Reinforced concrete cutoff walls will be located at the top-of-bank and at the bottom slope interface beneath the paving to prevent undermining of the foundation materials. A drainage system that would dissipate any excess hydrostatic pressure will be required. The system will consist of weep holes, filter fabric, and filter sand placed beneath both the 6-inch side slope and 8-inch bottom paving. A reinforced concrete-lined drainage ditch will be constructed on each side of the finished top of bank to intercept excess runoff (see Plate 48).

The clearing and snagging work will be performed well within existing public rights-of-way. It is anticipated that access to this work may be somewhat limited in some locations. The proposed widening and paving of the North Branch Tributary will be done immediately adjacent to developed residential and commercial properties. While an existing right-of-way on this reach is adequate to accommodate the proposed project, the adjacent property boundaries will limit accessibility. Much of the work access will be from inside the tributary itself. Temporary fuseplug dams will also be required to dewater section to facilitate the placement of concrete. Overall project constructability appears to be moderately-to-fairly difficult.

The total construction duration of the Recommended Plan for Ward Creek is 1-1/2 years.

Relocations and Removals

There are no roadway or utility relocations proposed for the Ward Creek project. The channel paving final design for the North Branch Tributary will accommodate existing facilities.

Real Estate

All proposed channel work will be within existing rights-of-way suitable for construction of the project. Construction access will be obtained from publicly owned bridge crossing rights-of-way. The possibility exists that some additional access may be required in a few locations and additional temporary construction easements may be required. Mitigation needs will require the purchase of 28 acres of cleared land for reforestation. Mitigation lands will be purchased in fee, excluding mineral rights. Trees planted for the purpose of aesthetic mitigation will be planted on perpetual easements and will be subject to final approval by various landowners. Approximately 7 acres of existing open borrow pits are needed for spoil disposal. East Baton Rouge Parish will obtain a disposal easement from the landowners in order to use these pits. This area is also controlled by the Pontchartrain Levee District. The parish will obtain a permit (Letter of No Objection) from the Levee District once they have obtained the easement from the landowners.

Mitigation

The mitigation feature of the Recommended Plan consists of reforestation of 28 acres of existing cleared land. It was determined to be practicable to combine mitigation sites for the Recommended Plan for all watersheds. Two sites will be utilized. See Plates 52 and 53. The required 28 acres for this watershed's Recommended Plan will be included as a portion of the entire habitat mitigation package for all five watersheds.

Recreation

No recreational features were determined to be suitable for inclusion on this watershed of the project.

Aesthetics

For aesthetic purposes, a top-of-bank tree replanting plan is proposed and consists of 1.5 miles of tree and shrub line planting along both sides of Ward Creek for a total of 3 miles. These plantings occur in areas of impact relative to channel improvement involving clearing of top-of-bank vegetation. Since these trees are proposed on drainage easement land, further coordination with various landowners will be required prior to planting. Replacing trees and shrubs lost during construction will return aesthetic conditions to the pre-project condition. See Table 3 of the Environmental Appendix, which identifies tree and shrub requirements and cost per watershed.

Cultural Resources

Preliminary investigations indicate that no significant cultural resources will be impacted by the Recommended Plan and that the project area is considered to have a very low probability for containing such sites.

Stream Gaging

The U.S. Geological Survey has an existing parish-wide stream gaging program that includes installations in this watershed. Improvements are proposed for 7 gages as listed in Table 16. Data from these gages will be used in both the final project design and in monitoring the effectiveness of the project. Gages will be upgraded as part of this project's construction and then will be maintained by the U.S. Geological Survey as part of their existing parish program.

Operation, Maintenance, Repair, Replacement, and Rehab (O&M)

Required O&M for the channels consist of continuous inspection and debris removal, annual herbicide application, and pavement repair when necessary. Clearing and snagging of the earthen channels will be performed every 5 to 10 years as needed. All vegetation removal/control will be done within the streambank only and not affect top-of-bank aesthetic plantings. Maintenance of combined project mitigation areas is also necessary and such costs have been prorated to the overall O&M of this watershed's Recommended Plan. Herbicide spraying would be conducted in accordance with the Environmental Protection Agency's guidelines. Operation and maintenance of the above listed stream gages is also required as part of this plan.

TABLE 88

PROPOSED STREAM GAGING PROGRAM ADDITIONS FOR WARD CREEK

Location	Description
Ward Creek at Siegen Lane	Add peak discharge & rain gage
Ward Creek at Burden Drive	Stage recorder & peak discharge
Ward Creek at Bluebonnet Road	Crest-stage gage
N. Br. Ward Creek at Jefferson Hwy	Stage recorder & peak discharge
Dawson Creek at Quail Drive	Crest-stage gage
Dawson Creek at Staring Lane	Crest-stage gage
Bayou Duplantier at Lee Drive	Add peak discharge

Source: U.S. Army Corps of Engineers, New Orleans District

Environmental and Social Effects

The only significant long-term environmental impact of the Recommended Plan is the destruction of 22 acres of bottomland hardwood forests. This loss will be mitigated with the planting and maintenance of 28 acres of existing cleared land. There will be short term effects on stream water quality during construction. Aquatic habitat will receive adverse impacts from reduced diversity and increased in-stream temperatures. The loss of screening vegetation along the channel banks would result in a significant aesthetic loss. However, this loss would be mitigated by the planting with both trees and shrubs on both sides of 1.5 miles of channel.

The most significant beneficial social impact of this plan would be the relief from flooding to those affected. Also, some major property erosion problems would be mitigated by this plan (see discussion below).

Economic Benefits

The Recommended Plan would generate significant economic benefits from flood damage reduction to existing, and, to some extent, projected future development. Benefits were only quantified, however, for existing development. It is estimated that average annual damages would be reduced by about 60 percent in the North Branch Tributary basin. Damage reduction of about 15 percent is anticipated throughout the remaining watershed. A breakdown of these anticipated benefits are shown in Table 89.

In addition to the above direct and indirect flood damage reduction benefits, the proposed paving of channels in this watershed will have a significant beneficial impact on existing property erosion problems on the North Branch Tributary. As stated above, streambank erosion is severe on the North Branch Tributary. In some locations, large sections of private property are sloughing down into the channel banks (see photos, Figure 1). Continuation of this process will certainly damage private structures and severely devalue these properties. There are several major litigations filed by private owners against East Baton Rouge Parish claiming damage relief from this problem. Short-term efforts to mitigate the erosion problem have been ineffective (see photos, Figure 1).

As discussed above for Jones Creek, several factors were considered in developing a methodology to quantify the benefits associated with abating the erosion problem. A conservative approach was developed that consisted of estimating the erosion rate of each stream reach and combining it with the average land square foot real estate value of the area. See Engineering and Economic Appendix. While the actual soils directly eroded are within the existing channel right-of-way and have little value, there is almost an immediate "translation" of the soils loss as the top-of-bank section, well beyond the public right-of-way, creeps and/or sloughs down the stream embankment.

Applying estimated erosion rates in conjunction with estimated property land values, equivalent annual damages were calculated. The proposed paving of North Branch will abate these damages and this value was, therefore, included as an economic benefit produced by this project.

Final Costs, Net Benefits

Final costs and benefits for the Recommended Plan by feature are shown in Table 89. Complete itemized costs by account code feature are shown in Table 90. The total first cost of the Recommended Plan, including all items, is estimated to be $9,470,000. Total Recommended Plan annual operation and maintenance costs, including all features, is estimated at $76,000 per year. Project first costs were converted to equivalent annual dollars, using an interest rate of 8.00 percent over a 50-year period. It has been determined that estimated equivalent annual costs and benefits will generate $148,000 per year net benefits. The benefit-cost ratio is 1.16 to 1.

Construction of each watershed's Recommended Plan will be phased. Construction of the Recommended Plan for Ward Creek is scheduled to start in 2000. Fully-funded cost estimates in accordance with this construction schedule are shown in Plan Implementation.

Cost-Sharing

A breakdown of incremental and fully-funded cost-sharing requirements for the Recommended Plan is shown in Plan Implementation. The local sponsor will be responsible in providing and/or bearing the full costs of all required lands, easements, rights-of-way, relocations, and disposal areas for this project. The local sponsor will also bear 100 percent of annual operation and maintenance, and, all replacement costs.

TABLE 89

WARD CREEK

PROJECT COSTS AND BENEFITS FOR THE RECOMMENDED PLAN

(1994 DOLLARS, 8.00% INTEREST, 50-YEAR PERIOD)

FIRST COSTS	
CONSTRUCTION FEATURE	$ 9,470,000
GROSS INVESTMENT (includes interest lost during construction)	$10,538,000
AVERAGE ANNUAL COSTS	
INTEREST/AMORTIZATION	$ 861,000
OPERATION/MAINTENANCE	$ 76,000
TOTAL AVERAGE ANNUAL COSTS	$ 937,000
AVERAGE ANNUAL BENEFITS*	
INUNDATION REDUCTION	$ 881,000
FIA COSTS SAVED	$ 18,000
REDUCED EMERGENCY COSTS	$ 32,000
FILL REDUCTION	$ 2,000
RECREATION	$ 0
EROSION CONTROL	$ 88,000
BENEFITS DURING CONSTRUCTION	$ 64,000
TOTAL AVERAGE ANNUAL BENEFITS	$ 1,085,000
BENEFIT/COST RATIO	1.16

* CALCULATED WITH PROPOSED COMITE RIVER DIVERSION CANAL IN PLACE

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 90
WARD CREEK - RECOMMENDED PLAN
CHART OF ACCOUNTS

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	LANDS AND DAMAGES						
	Construction						
	Acquisitions						
01B1-	By Government				5,060	1,330	6,390
01B2-	By Local Sponsor(LS)				1,940	510	2,450
01B4-	Review Of LS				2,260	590	2,850
01G--	Temporary Permits						
01G1-	By Government				2,310	610	2,920
01G2-	By LS				3,460	910	4,370
01G4-	Review of LS				490	130	620
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				1,330	1,330	2,660
01T--	LERRD Credits						
01T1-	Land Payments				11,120	2,920	14,040
01T2-	Administrative Costs				5,870	1,540	7,410
01T4-	Other				3,400	890	4,290
01---	Subtotal: Lands And Damages (Construction)						37,240
	Contingencies						10,760
01---	Subtotal: Lands And Damages (Construction)						48,000
	Mitigation						
01B1-	By Government				320	80	400
01B2-	By Local Sponsor(LS)				500	130	630
01B4-	Review Of LS				90	20	110
01C--	Condemnations						
01C2	By LS				100	30	130
01C4-	Review of LS				50	10	60
01E--	Appraisals						
01E3-	By LS				490	130	620
01E5-	Review of LS				120	30	150
01F--	PL 91-646 Assistance						
01F1-	By Government				50	10	60
01F4-	Review Of LS				20	10	30
01G--	Temporary Permits						
01G1-	By Government				140	40	180
01G2-	By LS				200	50	250
01G4-	Review of LS				40	10	50
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				82,400	20,940	103,340
01T--	LERRD Credits						
01T1-	Land Payments				220	60	280
01T3-	PL 91-646 Assistance				220	60	280
01T2-	Administrative Costs				280	70	350
01T4-	Other				60	20	80
01---	Subtotal: Lands And Damages (Mitigation)						85,300
	Contingencies						21,700
01---	Subtotal: Lands And Damages (Mitigation)						107,000
01---	TOTAL: LANDS AND DAMAGES						155,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
06------	FISH AND WILDLIFE FACILITIES						
0603----	Wildlife Facilities And Sanctuaries						
060301--	Mob And Demob						
060371--	Fences						
06037102	Fencing	1,838	LF	5.45	10,017	2,828	12,845
060373--	Habitat And Feeding Facilities						
06037302	Planting	32	AC	150.00	4,800	1,355	6,155
06------	Subtotal: Fish And Wildlife Facilities						14,817
	Contingencies						4,183
06------	TOTAL: FISH AND WILDLIFE FACILITIES						19,000
09------	CHANNELS AND CANALS						
0901----	Channels						
090101--	Mob & Demob	Lump Sum	LS	150,000.00	150,000	36,806	186,806
09011502	Clearing For Channel Dredging	20	AC	5,900.00	118,000	28,954	146,954
09011502	Excavation	143,000	CY	6.75	965,250	236,850	1,202,100
09011502	Clearing and Snagging	13	MI	19,000.00	247,000	60,608	307,608
09013002	Sand (8" Thick)	13,200	CY	10.50	138,600	34,009	172,609
09013002	Filter Drain Fabric	59,300	SY	7.50	444,750	109,131	553,881
09013002	Fuseplug Dams	Lump Sum	LS	40,000.00	40,000	9,815	49,815
09013003	Concrete Lining						
	Cutoff Wall	400	CY	150.00	60,000	14,723	74,723
	Channel Slope Pavement (4")	8,800	CY	130.00	1,144,000	284,810	1,428,810
	Channel Slope Pavement (6")	6,600	CY	150.00	990,000	246,510	1,236,510
	Channel Slab Pavement (8")	4,500	CY	150.00	675,000	165,629	840,629
	Drain Ditch	2,200	CY	130.00	286,000	70,178	356,178
09019902	Construction Access						
	Excavation	6,500	CY	7.25	47,125	11,563	58,688
	Filter Fabric	19,400	SY	3.50	67,900	16,661	84,561
	Crushed Stone	9,000	TN	24.00	216,000	53,001	269,001
	Obstruction Removal	5,600	LF	10.00	56,000	13,741	69,741
09019905	Fencing (chain link)	11,200	LF	8.25	92,400	22,673	115,073
09019906	Aesthetic Plantings						
	Tree Planting	650	EA	15.00	9,750	2,438	12,188
	Shrub Planting	1,100	EA	11.00	12,100	3,025	15,125
09------	SUBTOTAL: Channels And Canals						5,759,875
	Contingencies						1,421,125
09------	TOTAL: CHANNELS AND CANALS						7,181,000
29---	PROJECT COOPERATION AGREEMENTS						
29A--	Draft PCA						
29A9-	All Other				800	200	1,000
29B--	Final PCA and Financial Plan						
29B9-	All Other				800	200	1,000
29C--	PCA Negotiations						
29C9-	All Other				800	200	1,000
29---	Subtotal: Project Cooperation Agreements						2,400
	Contingecies						600
29---	TOTAL: PROJECT COOPERATION AGREEMENTS						3,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
30---	ENGINEERING AND DESIGN						
30C--	Design Memorandum				595,000	118,000	713,000
30CD-	HTRW Studies				123,000	12,000	135,000
30CF-	Cost Estimates				18,000	4,000	22,000
30CN-	VE Studies				30,000	6,000	36,000
30DA-	P&S				187,000	37,000	224,000
30DF-	Cost Estimates				14,000	3,000	17,000
30DN-	VE Studies				5,000	1,000	6,000
30DA-	P&S - Mitigation				7,000	2,000	9,000
30DS-	Construction Contract Award Activities				10,000	2,000	12,000
30DV-	Engineering During Construction				28,000	6,000	34,000
30E--	Engineering And Design Phase Project Management				81,000	16,000	97,000
30Z--	Misc. Activities						
	Monitoring						
	Install Gages				22,000	4,000	26,000
	Preconstruction O&M For Gages				120,000	24,000	144,000
	PMO				50,000	10,000	60,000
	LMVD				13,000	3,000	16,000
30---	SUBTOTAL: Engineering And Design						1,303,000
	Contingencies						248,000
30---	TOTAL: ENGINEERING AND DESIGN						1,551,000
31---	CONSTRUCTION MANAGEMENT						
31B--	Contract Administration						
31B3-	Review And Approval of Contract Payments				19,000	4,000	23,000
31B4-	Contract Modifications				45,000	9,000	54,000
31B5-	Progress And Completion Reports				15,000	3,000	18,000
31B9-	All Other				65,000	13,000	78,000
31D--	Review of Shop Drawings						
31D0-	Review of Shop Drawings				15,000	3,000	18,000
31E--	Inspection & Qual. Assur.						
31E1-	Schedule Compliance				15,000	3,000	18,000
31E2-	Compliance Sampling And Testing				14,000	3,000	17,000
31E3-	Quality Surveys				30,000	6,000	36,000
31E4-	Title II Services				17,000	3,000	20,000
31E9-	All Other				199,000	40,000	239,000
31T--	Construction Phase Project Management				33,000	7,000	40,000
31---	SUBTOTAL: Construction Management						467,000
	Contingencies						94,000
31---	TOTAL: CONSTRUCTION MANAGEMENT						561,000
	TOTAL: WARD CREEK						9,470,000

Risk and Uncertainty

A modified risk and uncertainty analysis was performed on calculated benefits and costs of the Recommended Plan. In general, statistical ranges used in this analysis were broad and were established primarily for the purposes of identifying the direction of change that may be expected due to known uncertainties. The single value estimates calculated above were, therefore, used as the basis for determining the ultimate cost-effectiveness of the plan.

Six items were identified as having potential major variance on the overall project's feasibility. These items and their estimated variance ranges are discussed below. Additional detail of the analysis can be found in Economics Appendix H.

- Stage Frequency Values.

  Without project (existing) and with project floodstage frequency values directly affect existing and with project calculated damage dollar values. Variances on both existing and with project stages were determined to be practicably within plus or minus 1.0 feet for all storm frequency events, and, for both without and with project conditions. See Engineering Appendix C. Damage values were recalculated incorporating this range. Applying the results, it is estimated that without project flood damages vary from minus $1,953,000 to plus $4,950,000 per year from the most likely estimate. With project flood damages are estimated to vary from minus $1,462,000 to plus $3,469,000 per year from the most likely estimate. Note that it was determined that there is likely to be a very high correlation between existing and with project stage frequency variance. This is due to the fact that the majority of the project calls for clearing and snagging only, which will not significantly alter channel configuration. A correlation factor of 0.95 was applied to this item in the "risk analysis" calculations described below.

- Structure Elevations.

Variances in structure elevations directly affect both existing and with project calculated damage dollar values. Within practical limits, structure elevation variance was determined to be minus 0.5 to plus 0.5 feet. The calculated dollar value variance is minus $975,000 to plus $2,480,000 for existing annual damages, and, minus $730,000 to plus $1,740,000 for with project annual damages. Note that there is a direct correlation between existing and with project variances. A correlation factor of 1.0 was therefore applied to this item in the "risk analysis" calculations described below.

- Structure Valuations.

Variances in the estimate of structure values also affect both existing and with project calculated damage dollar value. Structure value variance range is estimated at minus 10 percent to plus 10 percent from the single value estimate. Damage values were recalculated incorporating this range. Applying these results, it is estimated that existing flood damages vary from minus $277,000 to plus $260,000 per year. With project flood damages range from minus $203,000 to plus $191,000. As in the case of structure elevation variance, there is a one-to-one correlation between existing and with project probability ranges.

- Construction Costs.

Estimated variances in calculated quantities, unit prices, constructability, and other factors were considered in calculating the channel construction cost estimate. The calculated cost range is from minus $3,600,000 to plus $430,000 per year relative to the single value estimate used for this item. Converting this range to equivalent annual dollars yields minus $360,000 to plus $43,000 per year.

- Erosion Abatement Benefits.

  The estimated annual benefits calculated for erosion abatement are quite speculative. A plus or minus range of 50 percent should be considered for this item. This adjustment range is minus $45,000 to plus $45,000 per year.

- Property Utility Values.

  In addition to the loss of "land" property, the strong probability exists that significant or entire property utility values will be lost over time if the channels in this watershed are not paved. That is to say, for example, that an existing home purchased at $75,000 may not be able to be sold at any price if the backyard has sloughed into the channel. Furthermore, it is quite likely that unabated erosion will result in direct damage to structures, given time. Through field investigation, it is estimated that up to ten residential and one 3-story office building properties could lose their utility values within five years given present conditions. It was estimated that a potential loss of $33,000 per each residential property ($330,000), plus a $2,000,000 loss for the office building could occur in five years. Discounting over the five year period and conversion to annual dollars yields $158,000 per year. Since this item was not considered in the most likely estimate of benefits for this plan, a range of minus $0 to plus $158,000 per year was considered for this additional item.

The above uncertainty spreads were integrated with the single most likely value estimates for existing annual damages, with project damages and project costs. With the aid of "At Risk" computer software, probability ranges were calculated. See Risk Analysis calculations in Economics Appendix H. The calculated probability distributions for project cost, benefits, net benefits, and benefit-to-cost ratio are illustrated in Figures 14 through 17.

The calculated expected values generated as compared to the single value estimates were determined as follows:

(EQUIVALENT ANNUAL)	SINGLE VALUE ESTIMATE	CALCULATED EXPECTED VALUE
PROJECT BENEFITS	$1,085,000	$1,631,000
PROJECT COSTS	$ 937,000	$ 818,000
NET BENEFITS	$ 148,000	$ 813,000
BENEFIT/COST RATIO	1.16	2.0
PROBABILITY OF PROJECT NET POSITIVE BENEFITS	N/A	97%

These results show an expected substantial increase in project benefits. This increase was due primarily to the high sensitivity of both calculated existing and with project damages, given a flood stage frequency or structure elevation variance of plus or minus 1.0 foot. This effect is somewhat compounded given the fact that a relatively high percentage of flood damages remains in the watershed with the Recommended Plan in place.

While there appears to be some heavier flooding on the North Branch Tributary than that calculated, there is no substantial evidence that flooding in the remaining watershed is grossly underestimated as the sensitivity analysis indicates as probable. It is, therefore, believed that the large increase in the expected value of property benefits is not truly indicative of the actual situation. These results do, however, indicate that the expected net benefits for this watershed's Recommended Plan is likely to be significantly higher than the calculated single value estimate.

Figure 14
Ward Creek
Probability Distribution

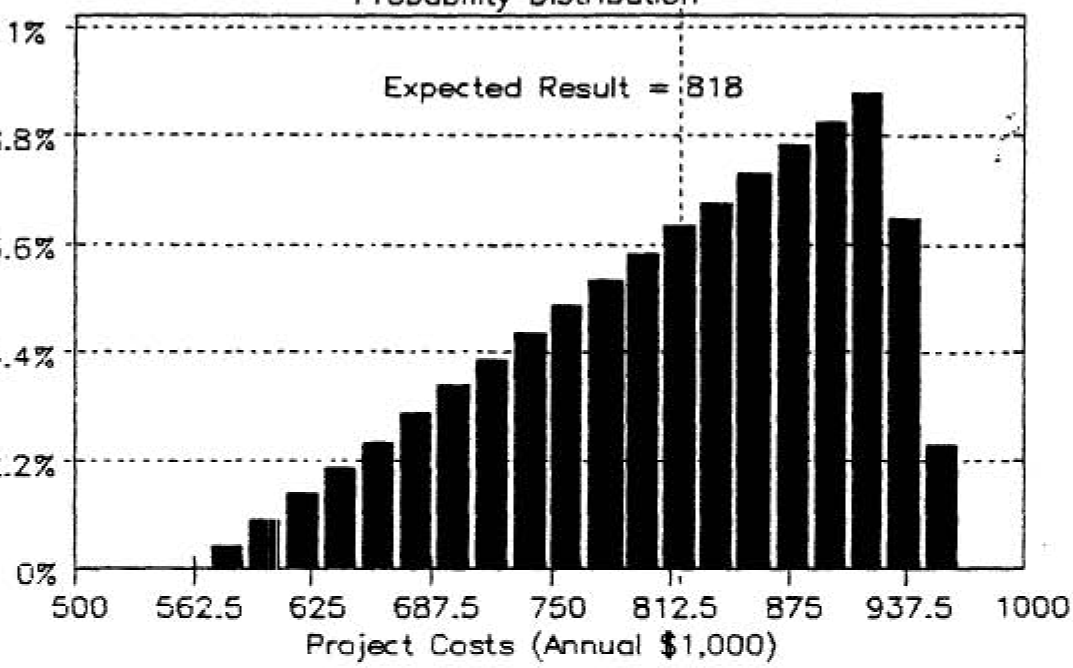


Figure 15
Ward Creek
Probability Result

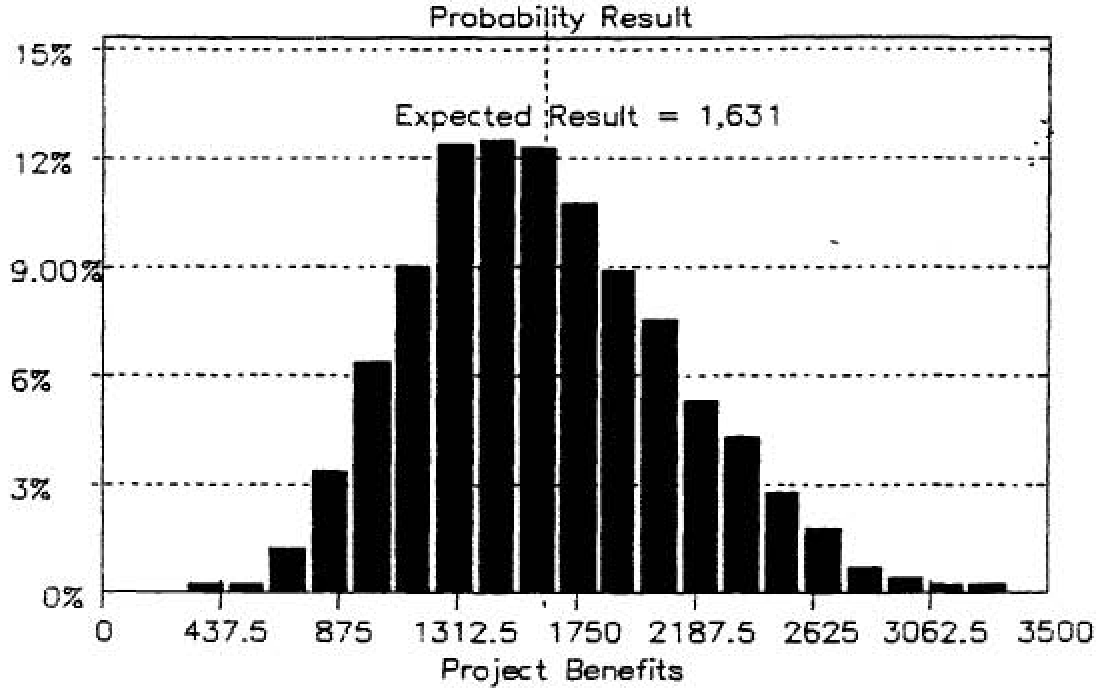


Figure 16
Ward Creek
Probability Distribution

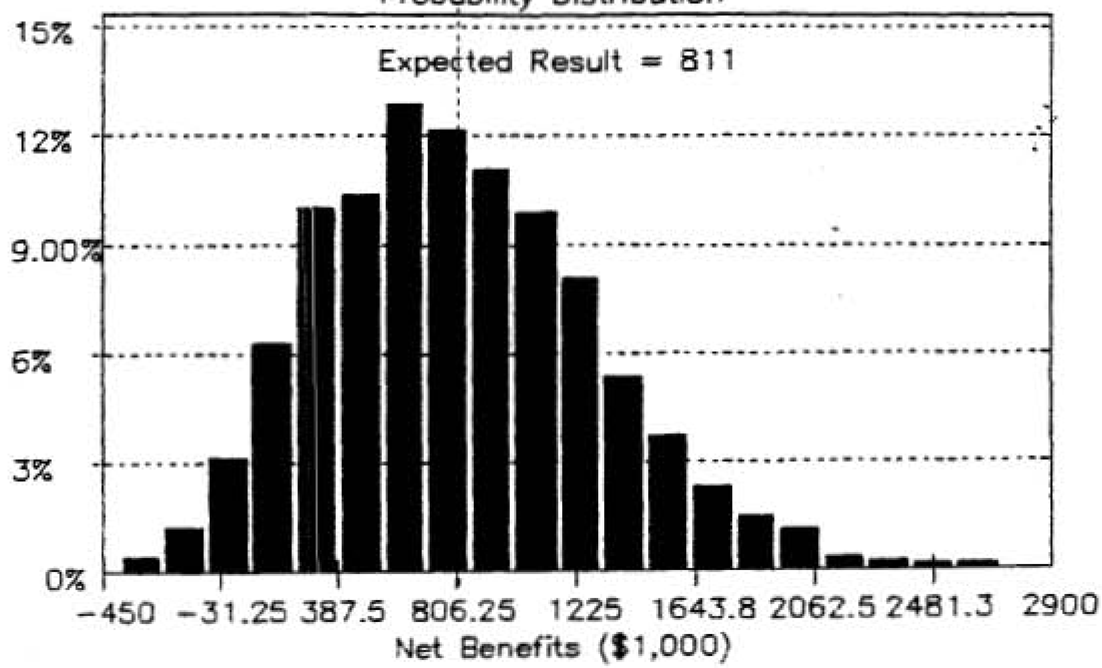
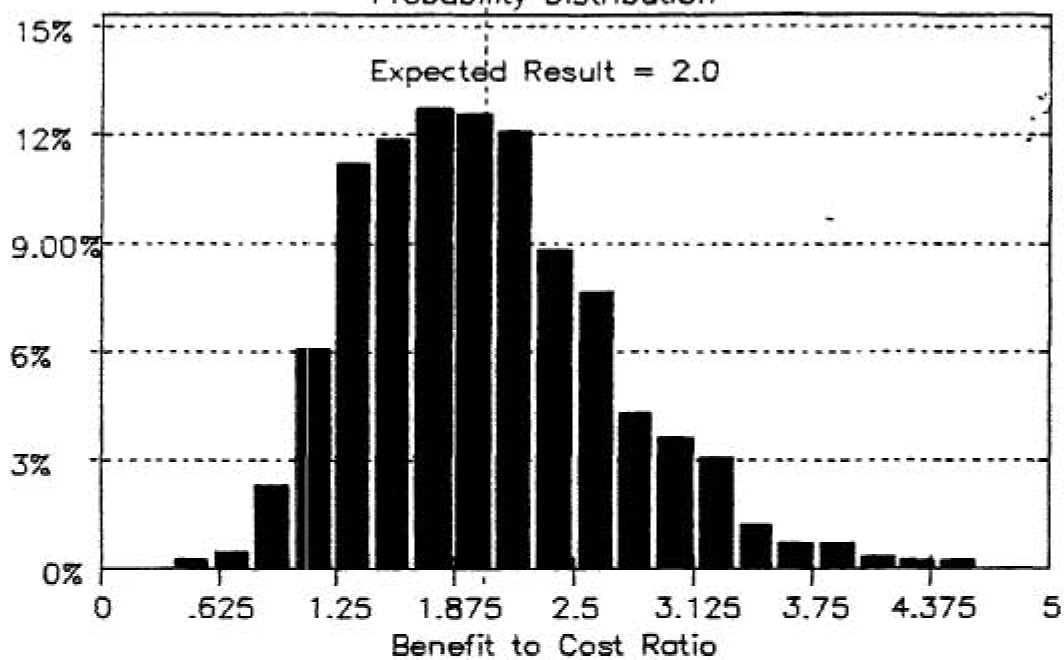


Figure 17
Ward Creek
Probability Distribution



BAYOU FOUNTAIN

Description

The Recommended Plan for Bayou Fountain consists of clearing and/or widening approximately 11 miles of channel. Proposed modifications are designed to convey a 10-year storm event within streambank and reduce out-of-bank stages of larger flood events. Improvements are proposed from the bayou's mouth at Bayou Manchac upstream to Ben Hur Road.

Clearing and snagging is proposed from the bayou's mouth upstream to Siegen Lane and again from Gardere Lane upstream to Ben Hur Road. Between Siegen and Gardere Lanes, channel widening is proposed and consists of a 50-foot wide bottom with 3:1 bank slopes. Proposed channel modifications are listed in summary in Table 91 and are shown on Plate 46.

TABLE 91

BAYOU FOUNTAIN - RECOMMENDED PLAN
PROPOSED CHANNEL MODIFICATIONS

Reach	Proposed Modifications
Mouth to Siegen Lane	Channel clearing and snagging
Siegen Lane to Gardere Lane	Channel widening - (earthen) 50-ft bottom width with 3:1 bank slopes
Gardere Lane to Ben Hur Road	Channel clearing and snagging
	Construct concrete "U"-channel at 60-inch sewer line; 50-ft bottom width

Source: U.S. Army Corps of Engineers, New Orleans District

Plan Effectiveness

The Recommended Plan is designed to convey and contain a 10-year storm event within the streambank. Flood stages of greater storm events will also be reduced. Expected stage lowerings for various storm events at selected locations in the watershed are shown in Table 92 and Plate 59. Overflow maps, illustrating existing and with project floodplains are shown in the Engineering Appendix C. The expected reduction in floodstages will result in a substantial lowering in the number of structures located in the 0- to 25-year floodplain (see Table 92).

Development in this watershed is occurring at a rapid pace. By the year 2040, urbanization in this watershed is projected to increase from 26 to 65 percent. Estimates from hydrologic modelling indicate that the 10-year with project average stage will be about 1.1 feet higher and the average 100-year flood stages about 0.3 feet higher. This increase in urbanization will seriously impact the effectiveness of the proposed channel modifications and also significantly increase existing flooding conditions without the proposed project.

To ensure the effectiveness of the Recommended Plan for this watershed, it will, therefore, be required that the parish continue strict implementation of their comprehensive floodplain management plan in conjunction with the proposed channel modifications. Specifics of this floodplain management plan are discussed below at the end of this section.

TABLE 92

BAYOU FOUNTAIN - RECOMMENDED PLAN
EXPECTED PROJECT STAGE REDUCTIONS (FT)

Event	Siegen Lane	Gardere Lane	Ben Hur Road
1-YR	0.7	2.4	1.0
2-YR	0.3	2.3	1.0
5-YR	0.0	1.9	0.7
10-YR	0.0	1.7	0.7
25-YR	0.0	1.6	0.6
50-YR	0.0	1.4	0.5
100-YR	0.0	1.1	0.5
200-YR	0.0	1.1	0.3
500-YR	0.0	0.9	0.0

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 93

BAYOU FOUNTAIN
NUMBER OF STRUCTURES LOCATED IN THE VARIOUS FLOODPLAINS
WITH AND WITHOUT THE RECOMMENDED PLAN
(WITH COMITE RIVER DIVERSION CANAL IN PLACE)

BASIN NO.	STRUCTURE CATEGORY	0-10 YEAR	10-25 YEAR	25-50 YEAR	50-100 YEAR	100-500 YEAR	ABOVE 500 YEAR	ALL FLOOD ZONES
BAYOU FOUNTAIN								
	WITHOUT PROJECT							
29	1-STORY	41	121	34	34	531	432	1,193
	2-STORY	7	50	112	6	196	133	504
	MOBILE HOME	0	0	0	0	0	6	6
	APT.BLDGS.	39	125	101	10	54	39	368
	COMMERCIAL	8	21	12	45	112	82	280
	TOTAL	95	317	259	95	893	692	2,351
	WITH RECOMMENDED PLAN							
	1-STORY	25	40	26	136	490	476	1,193
	2-STORY	1	14	0	156	115	218	504
	MOBILE HOME	0	0	0	0	0	6	6
	APT.BLDGS.	37	127	76	33	56	39	368
	COMMERCIAL	7	18	11	46	99	99	280
	TOTAL	70	199	113	371	760	838	2,351

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Design and Construction

Existing soils data from available sources were used in determining channel design slopes and possible erosion protection (see Engineering Appendix C). A channel slope design of 1V on 3.0H was determined to be necessary to reasonably ensure bank stability in the Siegen Lane to Gardere Lane reach. All new streambanks will remain earthen with grass cover.

It is proposed that improvements be made to one major obstruction, a 60-inch sewer main crossing located at Mile 53.8. The proposed design calls for the construction of a concrete "U-channel" with a 50-foot bottom width. Construction of the channel will be performed by mechanical dredge (bucket) with approximately 283,000 cubic yards of material to be excavated. The excavated material will be disposed of by truck hauling to abandoned borrow pits on the Mississippi River batture close to this watershed (about 4 miles on average). This disposal location is located closer to the project area versus the parish landfill and, therefore, was changed from the initial plans to significantly reduce construction cost. See Plate 50. Non-vegetative "trash" removed from the channels will, however, still be hauled to the parish landfill. Clearing and snagging work will be performed within the low top-of-bank contour. It is anticipated that the work will be accomplished using chain saws and transloaders. Debris removed will be disposed of by truck to the above noted river batture site. Structural improvements will be required at an existing 60-inch sewer main crossing. A soil founded reinforced concrete U-shaped monolith, used in conjunction with reinforced concrete wing walls, will be utilized.

All proposed work will likely be performed from the top of the bank and inside the channel. Once the purchase of required project right-of-way is complete, total accessibility along the top of the bank will be available. Overall, project constructability appears to be only moderately difficult.

It is estimated that project construction for this watershed will take about 2 years.

Relocations and Removals

There is one 4-inch petroleum products pipeline relocation required to implement the Recommended Plan.

Real Estate

The Recommended Plan will require the permanent purchase of 122 acres and 30 acres of temporary easement for channel construction, plus 21 acres for mitigation. No structures or other improvements will be taken for this project. Land purchased for channel widening (122 acres) will be perpetual drainage easements. Temporary construction easements (30 acres) will be acquired (purchased) for proposed clearing and snagging reaches. Mitigation areas will be bought in fee, excluding mineral rights. Trees planted for the purpose of aesthetic mitigation will be planted on perpetual easements and will be subject to final approval by various landowners. Approximately 14 acres of existing open borrow pits are needed for spoil disposal. East Baton Rouge Parish will obtain a disposal easement from the landowner(s) in order to use these pits. This area is also controlled by the Pontchartrain Levee District. The parish will obtain a permit (Letter of No Objection) from the Levee District once they have obtained easements from the landowner(s).

Mitigation

The mitigation feature of the Recommended Plan consists of reforestation of 21 acres of existing cleared land. It was determined to be practicable to combine mitigation sites for the Recommended Plan for all watersheds. Two sites will be utilized. See Page . The required 22 acres for this watershed's Recommended Plan will be included as a portion of the entire habitat mitigation package for all five watersheds.

Recreation

The Bayou Fountain watershed does not lend itself to recreational development in association with the Recommended Plan.

Aesthetics

For aesthetic purposes, a top-of-bank tree replanting plan is proposed and consists of 2.5 miles of tree and shrub line planting along both sides of Bayou Fountain for a total of 5 miles. These plantings occur in areas of impact relative to channel improvement involving clearing of top-of-bank vegetation. Replacing trees and shrubs lost during construction will return aesthetic conditions to the pre-project condition. Since these trees are proposed on drainage easement land, further coordination with various landowners will be required prior to planting. See Table 3 of the Environmental Appendix, which identifies tree and shrub requirements and cost per watershed.

Cultural Resources

Preliminary investigations indicate that four potentially significant sites are likely to occur in the project area and that there is some chance of uncovering unknown sites. Impacts from the proposed channel enlargement reach will likely be more significant than those occurring in the proposed clearing and snagging areas. A detailed survey will be conducted during the preconstruction design phase. If necessary, channel designs can likely be altered in order to not disturb any located sites. These efforts will be coordinated with the State Historic Preservation Officer (SHPO).

Stream Gaging

The U.S. Geological Survey has an existing parish-wide stream gaging program that includes installations in this watershed. Improvements are proposed for the gage at Gardere Lane. Data from these gages will be used in both the final project design and in monitoring the effectiveness of the project. Gages will be upgraded as part of this project's construction and then will be maintained by the U.S. Geological Survey as part of their existing parish program.

Operation, Maintenance, Repair, and Rehab (O&M)

Required O&M for the channels consist of continuous inspection and debris removal, annual herbicide application, and clearing and snagging every 5 to 10 years, where necessary. Herbicide spraying would be conducted in accordance with the Environmental Protection Agency's guidelines (see Appendix E). All vegetation removal/control will be done within the streambank only and not affect top-of-bank aesthetic plantings. Maintenance of combined project mitigation areas is also necessary and such costs have been prorated to the overall O&M of this watershed's Recommended Plan. Operation and maintenance of the above listed stream gages to also required as part of this plan.

Environmental and Social Effects

The only significant long-term environmental impact of the Recommended Plan is the destruction of 17 acres of bottomland hardwood forests. This loss will be mitigated with the planting and maintenance of 21 acres of existing cleared land. There will be short-term effects on stream water quality during construction. Aquatic habitat will receive adverse impacts from reduced diversity and increased in-stream temperatures. The loss of screening vegetation along the channel banks would result in a significant aesthetic loss. However, this loss would be mitigated by the planting with both trees and shrubs on both sides of 2.5 miles of channel.

The most significant beneficial social impacts of this plan would be the relief from flooding to those affected. Adverse social impacts include the taking of some unimproved private property. Temporary traffic rerouting for a bridge relocation is also necessary during construction of the plan.

Economic Benefits

The Recommended Plan would generate significant economic benefits from flood damage reduction to existing, and, to some extent, projected future development. Benefits were only quantified, however, for existing development. It is estimated that annual average damages in this watershed would be reduced by about 50 percent. A breakdown of these anticipated benefits are shown in Table 94.

Final Costs, Net Benefits

Final costs and benefits for the Recommended Plan by feature are shown in Table 94. Complete itemized costs by account code feature are shown in Table 95. The total first cost of the Recommended Plan, including all items, is estimated to be $4,760,00. Total Recommended Plan annual operation and maintenance costs, including all features, is estimated at $37,000 per year. Project first costs were converted to equivalent annual dollars using an interest rate of 8.00 percent over a 50-year period. It has been determined that estimated equivalent annual costs and benefits of the Recommended Plan will generate $74,000 per year net benefits. The benefit-cost ration is 1.15 to 1.

Construction of each watershed's Recommended Plan will be phased. Construction of the Recommended Plan for Bayou

Fountain is scheduled to start in 1998. Fully-funded cost estimates, in accordance with this construction schedule, are shown in the Plan Implementation section below.

Cost-Sharing

A breakdown of incremental and fully-funded cost-sharing requirements for the Recommended Plan is shown in Plan Implementation. The local sponsor will be responsible in providing and/or bearing the full costs of all required lands, easements, rights-of-way, relocations, and disposal areas for this project. The local sponsor will also bear 100 percent of annual operation and maintenance, and, all replacement costs.

Floodplain Management

As stated above, the anticipated rapid urbanization of this watershed basin will significantly and adversely affect flooding conditions with or without the proposed project. It is therefore necessary that the parish implement a comprehensive plan that will control this process.

Currently, East Baton Rouge has in place a parish-wide ordinance that includes the prohibiting of floodplain displacement (see Appendix K). This means that no fill material can be brought into the floodplain unless an equal amount of fill is removed, thus maintaining holding volume. Additionally, the Federal Emergency Management Agency will institute a "floodway" along Bayou Fountain. This will severely inhibit development within a zone immediately adjacent to the bayou.

While both existing programs will help reduce additional future flooding, they do not address the impending effects of future land use conversion from forested land to urban (paved). This transaction will increase peak flow rates in Bayou Fountain as stormwater will travel faster to the stream given the anticipated substantial increase in deforested-paved areas. To limit this effect, the parish must institute a basin-wide (Bayou Fountain) ordinance that requires developers to "maintain the existing run-off status" of their existing property tracts. This can readily be achieved by including some form of stormwater storage (detention ponds). This management plan is essential to the overall comprehensiveness of the Recommended Plan in the Bayou Fountain watershed. <u>Ultimate approval of Federal participation for the Bayou Fountain portion of the Recommended Plan is contingent on the parish's commitment to implementing the above floodplain management policy in this watershed</u>.

TABLE 94

BAYOU FOUNTAIN

PROJECT COSTS AND BENEFITS FOR THE RECOMMENDED PLAN

(1994 DOLLARS, 8.00% INTEREST, 50-YEAR PERIOD)

FIRST COSTS	
CONSTRUCTION FEATURE	$4,760,000
GROSS INVESTMENT (includes interest lost during construction)	$5,474,000
AVERAGE ANNUAL COSTS	
INTEREST/AMORTIZATION	$ 447,000
OPERATION/MAINTENANCE	$ 37,000
TOTAL AVERAGE ANNUAL COSTS	$ 484,000
AVERAGE ANNUAL BENEFITS*	
INUNDATION REDUCTION	$ 506,000
FIA COSTS SAVED	$ 0
REDUCED EMERGENCY COSTS	$ 41,000
FILL REDUCTION	$ 10,000
RECREATION	$ 0
EROSION CONTROL	$ 0
BENEFITS DURING CONSTRUCTION	$ 0
TOTAL AVERAGE ANNUAL BENEFITS	$ 557,000
BENEFIT/COST RATIO	1.15

* CALCULATED WITH PROPOSED COMITE RIVER DIVERSION CANAL IN PLACE

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

TABLE 95
BAYOU FOUNTAIN - RECOMMENDED PLAN
CHART OF ACCOUNTS

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01---	LANDS AND DAMAGES						
	Construction						
01B--	Acquisitions						
01B1-	By Government				9,230	2,310	11,540
01B2-	By Local Sponsor(LS)				264,090	66,050	330,140
01B4-	Review Of LS				14,910	3,740	18,650
01C--	Condemnations						
01C2	By LS				10,570	2,650	13,220
01C4-	Review of LS				8,200	2,060	10,260
01E--	Appraisals						
01E3-	By LS				283,250	71,080	354,330
01E5-	Review of LS				51,500	12,930	64,430
01G--	Temporary Permits						
01G1-	By Government				2,970	740	3,710
01G2-	By LS				21,590	5,420	27,010
01G4-	Review of LS				660	170	830
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				263,670	66,670	330,340
01T--	LERRD Credits						
01T1-	Land Payments				12,050	3,020	15,070
01T2-	Administrative Costs				8,030	2,020	10,050
01T4-	Other				4,330	1,090	5,420
01---	Subtotal: Lands And Damages (Construction)						955,050
	Contingencies						239,950
01---	Subtotal: Lands And Damages (Construction)						1,195,000
	Mitigation						
01B--	Acquisitions						
01B1-	By Government				240	60	300
01B2-	By Local Sponsor(LS)				370	100	470
01B4-	Review Of LS				70	20	90
01C--	Condemnations						
01C2	By LS				70	20	90
01C4-	Review of LS				30	10	40
01E--	Appraisals						
01E3-	By LS				370	100	470
01E5-	Review of LS				90	20	110
01F--	PL 91-646 Assistance						
01F1-	By Government				30	10	40
01F4-	Review Of LS				10	0	10
01G--	Temporary Permits						
01G1-	By Government				100	30	130
01G2-	By LS				150	40	190
01G4-	Review of LS				30	10	40
01R--	Real Estate Payments						
01R1-	Land Payments						
01R1B	By LS				61,800	15,490	77,290

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
01T--	LERRD Credits						
01T1-	Land Payments				170	40	210
01T3-	PL 91-646 Assistance				170	40	210
01T2-	Administrative Costs				210	50	260
01T4-	Other				40	10	50
01---	Subtotal: Lands And Damages (Mitigation)						63,950
	Contingencies						16,050
01---	Subtotal: Lands And Damages (Mitigation)						80,000
01---	TOTAL: LANDS AND DAMAGES						1,275,000
02------	RELOCATIONS						
0203----	Cemeteries, Utilities And Structures						
020318--	Utilities						
02031815	4" Petroleum Products Pipeline BF-2 Permanent Relocation	1	LS	3,000.00	3,000	1,000	4,000
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						3,000
	Contingencies						1,000
0203----	SUBTOTAL: Cemeteries, Utilities And Structures						4,000
02------	TOTAL: RELOCATIONS						4,000
06------	FISH AND WILDLIFE FACILITIES						
0603----	Wildlife Facilities And Sanctuaries						
060301--	Mob And Demob						
060371--	Fences						
06037102	Fencing	1,378	LF	5.45	7,510	1,954	9,464
060373--	Habitat And Feeding Facilities						
06037302	Planting	24	AC	150.00	3,600	936	4,536
06------	Subtotal: Fish And Wildlife Facilities						11,110
	Contingencies						2,890
06------	TOTAL: FISH AND WILDLIFE FACILITIES						14,000
09------	CHANNELS AND CANALS						
0901----	Channels						
090101--	Mob & Demob	Lump Sum	LS	100,000.00	100,000	19,570	119,570
09011502	Clearing and Snagging	8	MI	19,000.00	152,000	29,747	181,747
09011502	Clearing For Channel Dredging	47	AC	5,900.00	277,300	54,268	331,568
09011502	Excavation	283,000	CY	3.90	1,103,700	215,941	1,319,641
09013002	Filter Drain Fabric	6,460	SY	7.50	48,450	9,482	57,932
09013002	Sand (8" Thick)	160	CY	7.50	1,200	235	1,435
09013002	Riprap 16" - Dry Placement	890	TN	23.00	20,470	4,006	24,476
09013003	Concrete U-Channel						
	1 Ft. U-Frame Base Slab	67	CY	180.00	12,060	2,360	14,420
	1 Ft. U-Frame Wall	100	CY	300.00	30,000	5,871	35,871
	Channel Slope Pavement (4")	55	CY	130.00	7,150	1,399	8,549
	Channel Slope Pavement (6")	43	CY	150.00	6,450	1,262	7,712
	Channel Slab Pavement (8")	62	CY	150.00	9,300	1,820	11,120
09019905	Fence (chain link)	300	LF	8.25	2,475	484	2,959
09019906	Aesthetic Plantings						
	Tree Planting	1,050	EA	15.00	15,750	3,250	19,000
	Shrub Planting	1,760	EA	11.00	19,360	3,640	23,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
09------	SUBTOTAL: Channels And Canals						1,805,665
	Contingencies						353,335
09------	TOTAL: CHANNELS AND CANALS						2,159,000
29---	PROJECT COOPERATION AGREEMENTS						
29A--	Draft PCA						
29A1-	Real Estate Activities				600	100	700
29A9-	All Other				800	200	1,000
29B--	Final PCA and Financial Plan						
29B1-	Real Estate Activities				600	100	700
29B9-	All Other				800	200	1,000
29C--	PCA Negotiations						
29C1-	Real Estate Activities				500	100	600
29C9-	All Other				800	200	1,000
29---	Subtotal: Project Cooperation Agreements						4,100
	Contingecies						900
29---	TOTAL: PROJECT COOPERATION AGREEMENTS						5,000
30---	ENGINEERING AND DESIGN						
30DA-	Design Report & P&S				509,000	51,000	560,000
30DD-	HTRW Studies				105,000	10,000	115,000
30DF-	Cost Estimates				19,000	2,000	21,000
30DN-	VE Studies				5,000	1,000	6,000
30DS-	Construction Contract Award Activities				10,000	1,000	11,000
30DV-	Engineering During Construction				22,000	2,000	24,000
30DA-	P&S - Mitigation				4,000	1,000	5,000
30E--	Engineering And Design Phase Project Management				87,000	9,000	96,000
30Z--	Misc. Activities						
	Monitoring						
	Install Gages				5,000	1,000	6,000
	Preconstruction O&M For Gages				25,000	3,000	28,000
	PMO				50,000	5,000	55,000
	LMVD				10,000	1,000	11,000
30---	SUBTOTAL: Engineering And Design						851,000
	Contingencies						87,000
30---	TOTAL: ENGINEERING AND DESIGN						938,000
31---	CONSTRUCTION MANAGEMENT						
31B--	Contract Administration						
31B3-	Review And Approval of Contract Payments				13,000	3,000	16,000
31B4-	Contract Modifications				27,000	5,000	32,000
31B5-	Progress And Completion Reports				9,000	2,000	11,000
31B9-	All Other				40,000	8,000	48,000
31D--	Review of Shop Drawings						
31D0-	Review of Shop Drawings				10,000	2,000	12,000
31E--	Inspection & Qual. Assur.						
31E1-	Schedule Compliance				10,000	2,000	12,000
31E2-	Compliance Sampling And Testing				7,000	1,000	8,000
31E3-	Quality Surveys				28,000	6,000	34,000
31E4-	Title II Services				8,000	2,000	10,000
31E9-	All Other				131,000	26,000	157,000
31T--	Construction Phase Project Management				21,000	4,000	25,000

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingencies	Project Cost
31---	SUBTOTAL: Construction Management						304,000
	Contingencies						61,000
31---	TOTAL: CONSTRUCTION MANAGEMENT						365,000
	TOTAL: BAYOU FOUNTAIN						4,760,000

Risk and Uncertainty

A modified risk and uncertainty analysis was performed on calculated benefits and costs of the Recommended Plan. In general, statistical ranges used in this analysis were broad and were established primarily for the purposes of identifying the direction of change that may be expected due to known uncertainties. The single value estimates calculated above were, therefore, used as the basis for determining the ultimate cost-effectiveness of the plan.

Four items were identified as having potential major variance on the overall project's feasibility. These items and their estimated variance ranges are discussed below. Additional detail of the analysis can be found in the Economics Appendix H.

- Stage Frequency Values.

  Without project (existing) and with project floodstage frequency values directly affect existing and with project calculated damage dollar values. Variances on both existing and with project stages were determined to be practicably within plus or minus 0.5 feet for all storm frequency events, and, for both without and with project conditions. See Engineering Appendix C. Damage values were recalculated incorporating this range. Applying the results, it is estimated that without project flood damages vary from minus $934,000 to plus $914,000 per year from the single value estimate. With project flood damages are estimated to vary from minus $627,000 to plus $883,000 per year from the single value estimate. Note that it was determined that there is likely to be a high correlation between without and with project stage frequency variance. This is due to the fact that the majority of the project calls for only clearing and snagging which will not significantly alter channel configuration. A correlation factor of 0.75 was applied to this item in the "risk analysis" calculations described below.

- Structure Elevations.

  Variances in structure elevations directly affect both existing and with project calculated damage dollar values. Within practical limits, structure elevation variance was determined to be minus 0.5 to plus 0.5 feet. The calculated dollar value variance is minus $934,000 to plus $914,000 for existing annual damages, and, minus $627,000 to plus $883,000 for with project annual damages. Note that there is a direct correlation between existing and with project variances. A correlation factor of 1.0 was therefore applied to this item in the "risk analysis" calculations described below.

- Structure Valuations.

  Variances in the estimate of structure values also affect both existing and with project calculated damage dollar value. Structure value variance range is estimated at minus 10 percent to plus 10 percent from the calculated single value. Damage values were recalculated incorporating this range. Applying these results, it is estimated that existing flood damages vary from minus $226,000 to plus $92,000 per year. With project flood damages range from minus $177,000 to plus $45,000.

- Construction Costs.

  Estimated variances in calculated quantities, unit prices, constructability, and other factors were considered in calculating the channel construction cost estimate. The calculated cost range is minus $850,000 to plus $210,000 relative to the single value estimate used for this item. Converting this range to equivalent annual dollars yields minus $85,000 to plus $21,000 per year.

The above uncertainty spreads were integrated with the single value estimates for existing annual damages, with project damages and project costs. With the aid of "At Risk" computer software, probability ranges were calculated. See

Risk Analysis calculations in Economics Appendix H. The calculated probability distributions for project cost, benefits, net benefits, and benefit-to-cost ratio are illustrated in Figures 18 through 21.

The calculated expected values generated as compared to the single value estimates were determined as follows:

(EQUIVALENT ANNUAL)	SINGLE VALUE ESTIMATE	CALCULATED EXPECTED VALUE
PROJECT BENEFITS	$558,000	$376,000
PROJECT COSTS	$484,000	$464,000
NET BENEFITS	$ 74,000	($88,000)
BENEFIT/COST RATIO	1.15	0.81
PROBABILITY OF PROJECT NET POSITIVE BENEFITS	N/A	29%

These results show a substantial decrease in project benefits. This decrease was due primarily to the high sensitivity of both calculated existing and with project damages given a flood stage frequency or structure elevation variance of plus or minus 0.5 feet. This high sensitivity was not surprising given the relatively flat floodplain area. These results do not, however, appear indicative of the actual flooding situation in this watershed. Survey verification of structure elevations and actual flood damage data obtained in three recent floods indicate that the single value estimate has a high degree of confidence.

Figure 18
Bayou Fountain
Probability Distribution

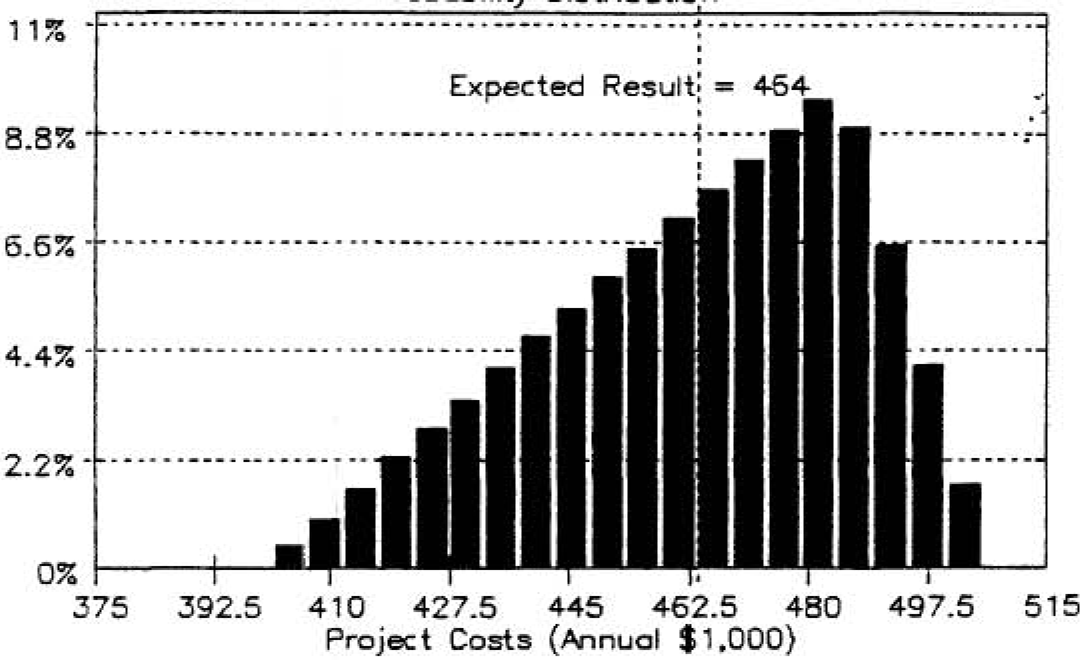


Figure 19
Bayou Fountain
Probability Distribution

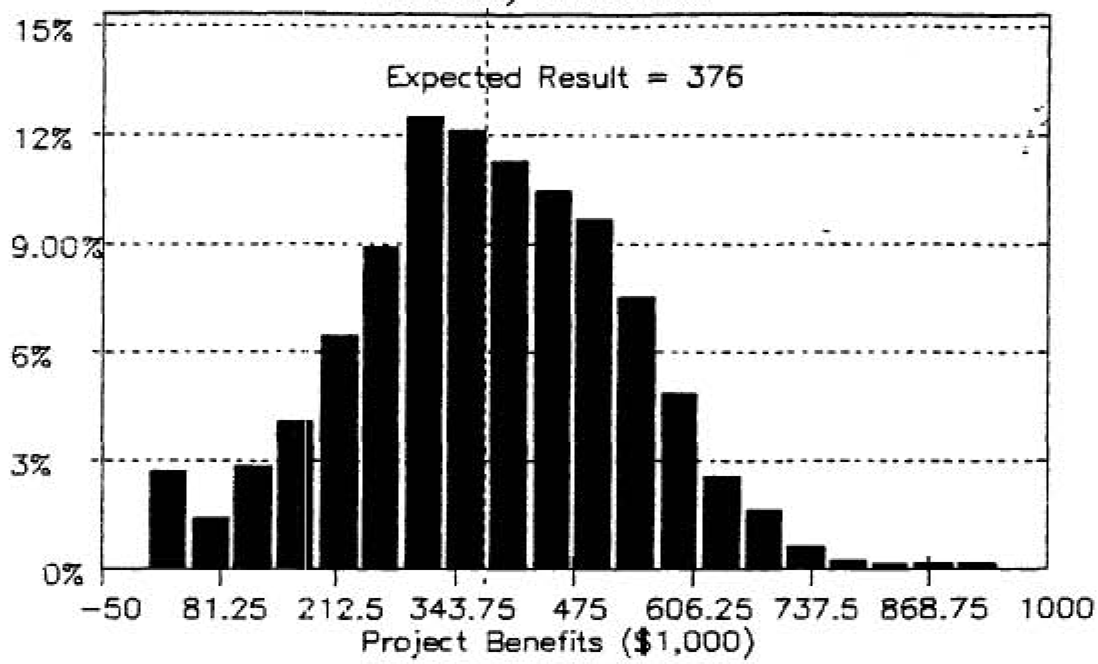


Figure 20
Bayou Fountain
Probability Distribution

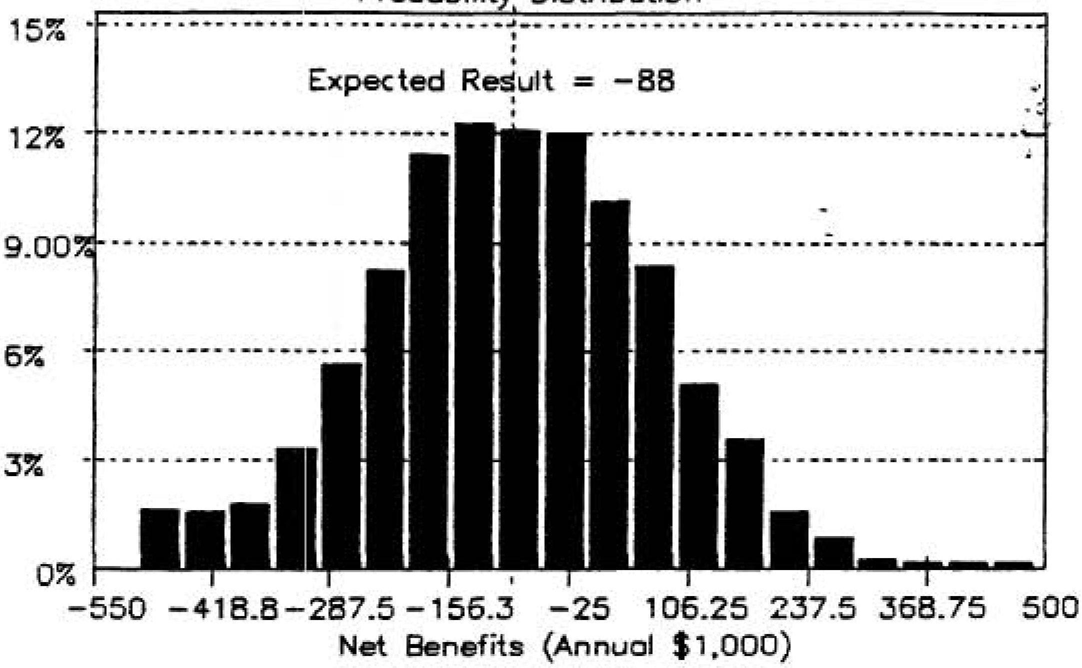
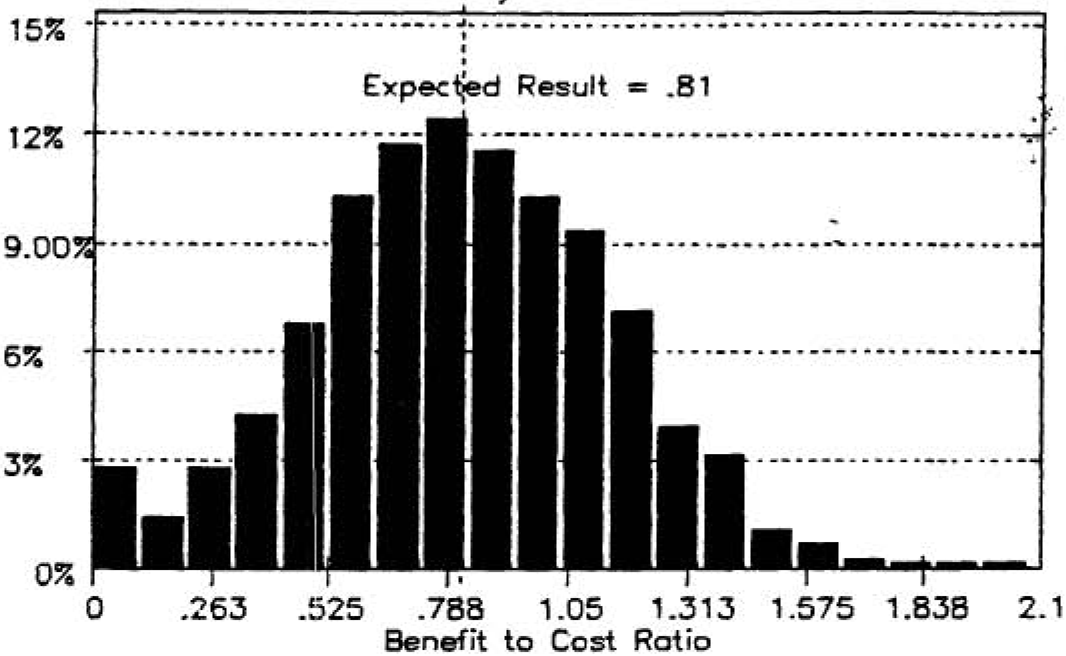


Figure 21
Bayou Fountain
Probability Distribution



MITIGATION PLAN

It was determined that combining the mitigation needs of the five Recommended Plans and developing an integrated mitigation plan was far more practical than developing a separate plan for each. Significant cost savings can be realized by acquiring and developing a minimum number of sites with their total combined acreage mitigating combined needs as opposed to acquiring and developing five sites with specific acreage in accordance with each Recommended Plan.

The mitigation plan recommended consists of acquisition and development of bottomland hardwood habitat upon 397 acres of land in East Baton Rouge Parish. This would be made up of the combined 282 acres of land located at a site in the northern part of the parish off Joor Road and 115 acres of land at a site in the southern part of the parish adjacent to a BREC park site in the Bayou Fountain area. See Plates 10 and 11. Locating mitigation sites in the metropolitan area and adjacent to these public parks will provide the opportunity for some public interaction and enjoyment of the areas. Such interaction can be accomplished by means of suitably designed nature trails. Alternative sites may be used given the availability of the above sites and/or other site opportunities. The estimated first cost of the combined mitigation plan is $2,072,000. Annual operation, maintenance, and replacement costs are estimated at $22,000 per year.

An alternate mitigation plan was developed utilizing existing forested areas along Bayou Duplantier in the Ward Creek watershed. This plan calls for the preservation and maintenance, as well as reforesting of 115 acres of all available existing forest along Bayou Duplantier in combination with reforestation of 153 acres of existing open land along Joor Road. This plan requires a longer land purchase since more areas of "existing" forest are needed versus replanting open land to achieve mitigation needs. Also, land prices in the Bayou Duplantier area were determined to be significantly higher than the other proposed mitigation sties. The combination of the above makes this plan approximately $2.5 million more expensive than the base plan above. This alternate plan, while suitable, was therefore, not recommended. Local interests have expressed a desire to preserve the Bayou

Duplantier area as part of a nature park, of which this mitigation area can be an integral part. Should the non-Federal sponsor decide to use this area for project mitigation purposes, it will be acceptable. The non-Federal sponsor would, however, bear the full excess cost difference of $3 million.

Operation and maintenance would be the responsibility of the non-Federal sponsor. The Recreation and Parks Commission for the Parish of East Baton rouge has indicated a definite interest in and willingness to assume responsibility of the day-to-day operation and maintenance of the areas. This organization would be a logical operator of the facilities. Maintenance includes continuous protection of the land and plantings.

Hazardous, Toxic, and Radioactive Waste (HTRW)

Through visual site survey, record review at various agencies, and discussions with knowledgeable personnel, significant sites were identified as possible or probable sources of HTRW contamination. Individual sampling plans will be developed, depending upon the suspended contaminant(s), to determine the nature and extent of contamination (see Appendix D for further detail). The non-Federal sponsor will bear the full cost and responsibility for remediation of any confirmed waste contaminated sites.

Clean Water Act. A Section 404(b)(1) Evaluation has been prepared for the portions of each of the watersheds of the overall project for which materials would be deposited into waters of the United States. Project compliance with Section 404(r) requirements has been achieved, however, the District will pursue State of Louisiana Water Quality Certification, Section 401, instead. Application has been made to the Louisiana Department of Environmental Quality for certification of the Recommended Plan for each of the watersheds.

PLAN IMPLEMENTATION

GENERAL

The purpose of this sectionis to present pertinent information concerning the Federal and non-Federal responsibilities regarding cost apportionment and the diversion of responsibilities for construction and subsequent operation, maintenance, and rehabilitation of the project. Such cost apportionment is based on Federal legislature and administrative policies. No institutional changes are necessary for plan implementation.

SUMMARY

A descriptive summary of each element of the Recommended Plan is shown in Table 96.

TABLE 96

RECOMMENDED PLAN SUMMARY
(1994$)

ELEMENT DESCRIPTION	FIRST COST	ANNUAL O&M COSTS	TOTAL EQUIVALENT UNIFORM ANNUAL COST (Includes interest lost during construction)	CALCULATED TOTAL EQUIVALENT ANNUAL BENEFITS	BENEFIT TO COST RATIO
BLACKWATER BAYOU	$16,340,000	$64,000	$1,590,000	$4,037,000	2.54
Earthen channel enlargement of the main stem of Blackwater Bayou (above Frenchtown Road) and its main tributary; design to contain 10-year storm event within bank; 13 miles total project length					
BEAVER BAYOU	$16,840,000	$64,000	$1,633,000	$8,779,000	5.30
Earthen channel enlargement of the main stem of Beaver Bayou; design to contain 25-year storm event within bank; 8 miles total project length					
JONES CREEK	$52,590,000	$67,000	$5,430,000	$9,899,000	1.82
Concrete lining of the main stem of Jones Creek (above Jones Creek Road) and its three main tributaries - Weiner Creek, and Lively Bayou; minimal channel clearing and snagging of the main stem of Jones Creek below Jones Creek Road; design to contain 50-year storm event within bank; 19 miles total project length; includes an 11-mile bike path recreation feature					

TABLE 96 (CONTINUED)

RECOMMENDED PLAN
SUMMARY
(1994$)

ELEMENT DESCRIPTION	FIRST COST	ANNUAL O&M COSTS	TOTAL EQUIVALENT UNIFORM ANNUAL COST (includes interest lost during construction)	CALCULATED TOTAL EQUIVALENT ANNUAL BENEFITS	BENEFIT TO COST RATIO
WARD CREEK	$9,470,000	$76,000	$937,000	$1,085,000	1.16
Minimal channel clearing and snagging of the main stem of Ward Creek up to Corporate Blvd.; minimal clearing and snagging of Dawson Creek up to Bayou Duplantier; concrete lining of North Branch Tributary up to Interstate 12; 14 miles total project total project length; designed to contain 10-year storm event within bank (25-year event on North Branch Tributary)					
BAYOU FOUNTAIN	$4,760,000	$37,000	$484,000	$ 558,000	1.15
Earthen channel enlargement of Bayou Fountain between Siegen Lane and Gardere Lane; minimal channel clearing and snagging below Siegen Lane and above Gardere Lane up to Ben Hur Rd.; designed to contain 10-year storm event within bank; 11 miles total project length					
COMBINED HABITAT MITIGATION	($2,072,000)	($22,000)	N/A	N/A	N/A
Acquisition and development of bottomland hardwood habitat on 397 total acres of land on two sites in East Baton Rouge Parish	(Mitigation costs included in the above elements)				
TOTAL PROJECT COSTS	$100,000,000	$308,000	$10,074,000	$24,358,000	2.42

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

DIVISION OF PLAN RESPONSIBILITIES

FEDERAL RESPONSIBILITIES

The Federal government will be responsible for preconstruction, engineering, design, and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986).

NON-FEDERAL RESPONSIBILITIES

a. Provide all lands, easements, servitudes, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, that the Government determines to be necessary for construction, operation, and maintenance of the project.

b. Perform or ensure performance at no cost to the Government, all relocations as determined by the Government to be necessary for construction, operation, and maintenance of the project.

c. Provide during the period of construction a cash contribution equal to 5 percent of total project cost assigned to structural flood control.

d. At the non-Federal sponsor's option, in order to provide interim flood relief and expedite project completion, perform the following work-in-kind to satisfy a portion of the non-Federal share of the total project cost assigned to structural flood control:

(1) Design, construct and manage the construction of all proposed channel modifications, clearing and snagging (all work except migitation) for the Bayou Fountain Watershed.

(2) Perform all necessary clearing for channel dredging of Beaver Bayou from Greenwell Springs Road to Hooper Road.

(3) Perform all necessary clearing for channel dredging of Blackwater Bayou from the Comite River to Carey Road, and, its main tributary from Blackwater Bayou to Gurney Road.

(4) Perform all necessary clearing for channel dredging of Weiner Creek (tributary of Jones Creek) and channel excavation of Weiner Creek between Sherwood Forest Boulevard and Cedar Crest Drive (upstream limit of project).

(5) Perform all necessary clearing and snagging (all work except mitigation) for Dawson Creek (tributary of Ward Creek).

e. Should the Government project that the value of contributions provided under paragraphs a, b, c, and d above will be less than 25 percent of the total project cost allocated to structural flood control, the non-Federal sponsor shall provide, during the period of construction, an additional cash contribution to bring the non-Federal sponsor total contribution to 25 percent of the total project cost assigned to structural flood control.

f. Provide during the period of construction a cash contribution equal to 50 percent of the total project cost assigned to recreation.

g. Hold and save the Federal Government free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, except where such damages are due to the fault or negligence of the Federal Government or its contractors.

h. Assume responsibility for any legal liabilities resulting from transfer of water from one watershed to another.

i. Assume responsibility for operating, maintaining, replacing, repairing and rehabilitating the project or completed functional portions of the project, including mitigation and recreation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R Manual and any subsequent amendments thereto.

j. No less than once each year inform affected interests of the limitations of the protection afforded by the project.

k. Participate in and comply with applicable Federal floodplain management and flood insurance programs.

l. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

m. Implement and enforce existing and required supplemental flood damage prevention ordinances in the Bayou Fountain watershed.

n. Enact ordinances and promulgate regulations prior to initiation of construction to prevent construction and encroachment on the proposed project works that would reduce their flood-carrying capacity or hinder maintenance and operation, and control development in the project area to prevent an undue increase in the flood damage potential.

o. Comply with the applicable provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocations Act of 1987, Public Law 100-17, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, servitude, and rights-of-way for the construction, operation, and maintenance of the project, including those necessary for relocations, removals, borrow materials, and dredged or excavated material disposal, and shall inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

p. Assume complete responsibility for the clean up of any hazardous material located on project lands and regulated under Federal, state, and/or local laws or ordinances, including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. Sections 9601-9675, and the non-Federal sponsor shall assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating the project in a manner such that liability will not arise under

CERCLA or other Federal, state, and/or local laws, ordinances or guidelines.

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

r. Comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separate element.

s. Assure that construction, operation, and maintenance of any non-Federal flood control features do not diminish the flood protection provided by the authorized project plan or, in case the authorized project plan is affected, the non-Federal sponsor shall provide for compensation.

Construction Cost-Sharing Requirements

This project will be funded under terms of a single Project Cooperation Agreement (PCA) with five separable elements, namely, the proposed projects for each of the five watersheds. Although the watersheds will be treated as separable elements, the overall plan is a comprehensive one for the study area. Cost sharing will, therefore, be based on the overall plan; i.e., non-Federal sponsor credits, in excess of the minimum on one watershed, will be applied toward the minimum requirements for other watersheds. Consistent with the above, during the period of construction, a cash contribution equal to 5 percent of the total project cost assigned to structural flood control is to be provided by the non-Federal sponsor. Should the Government project that the value of contributions provided under paragraphs a, b, c, and d above will be less than 25 percent of the total project cost allocated to structural flood control, the non-Federal sponsor shall provide during the period of construction, an additional cash contribution to bring the non-Federal sponsor total contribution to 25 percent of the total project cost assigned to structural flood control. The recreation features are to be cost-shared independently on a 50-50 basis.

The non-Federal sponsor has requested authorization for work-in-kind. A letter was submitted by the City-Parish Government of East Baton Rouge Parish listing the specific project features for which the non-Federal interests have requested to receive credit for work-in-kind (see letter of intent, Exhibit 1). The non-Federal sponsor has requested authority to perform work-in-kind in order to expedite the completion of the overall project and provide interim flood relief to some areas. If the work-in-kind is authorized for the project, the work-in-kind can substitute for the additional cash required in the cost-sharing tables. Specifically, the non-Federal sponsor proposes the following work-in-kind:

(1) Design, construct and manage the construction of all proposed channel modifications, clearing and snagging (all work except mitigation) for the Bayou Fountain Watershed; Estimated cost of $3,047,000.

(2) Perform all necessary clearing for channel dredging of Beaver Bayou from Greenwell Springs Road to Hooper Road; Estimated cost of $715,000.

(3) Perform all necessary clearing for channel dredging of Blackwater Bayou from Comite River to Carey Road, and, its main tributary from Blackwater Bayou to Gurney Road; Estimated cost of $510,000.

(4) Perform all necessary clearing for channel dredging of Weiner Creek (tributary of Jones Creek) and channel excavation of Weiner Creek between Sherwood Forest Boulevard and Cedar Crest Drive (upstream limit of project); Estimated cost of $237,000.

(5) Perform all necessary clearing and snagging (all work except mitigation) for Dawson Creek (tributary of Ward Creek); Estimated cost of $68,000.

Total estimated cost of proposed work-in-kind: $4,577,000.

Based on the above, local sponsor cost-sharing requirements were determined for the project. This cost breakdown, by feature and in 1994 dollars, is shown in Table 97 (incremental estimate). Overall, the total project cost is estimated at $100,000,000 with a Federal share of 74.7% or $74,700,000 and a non-Federal share of 25.3% or $25,300,000.

Construction Schedule

Due to the overall project size, construction will be phased. Watershed project schedule order was determined in consideration of the non-Federal sponsor's preference. Project construction schedules are shown in Table 98. In accordance with this schedule is the acquisition and development of mitigation sites which will be combined for all the projects. The proposed mitigation site acquisition and development schedule is shown in Table 99. Overall, the project construction will take 9 years and begin with land acquisition on Bayou Fountain in Fiscal Year 1998 and finish with completion of the fourth segment of the Jones Creek watershed in Fiscal Year 2006.

TABLE 97

RECOMMENDED PLAN

Incremental Federal and Non-Federal Costs (X$1,000)

Feature	Total Cost	Federal Cost	Non-Federal Sponsor Cost	
01 Lands and Damages	$ 5,660	$ 278	$ 5,382	
02 Relocations	$ 4,204	$ 0	$ 4,204	
06 Fish and Wildlife Facilities	$ 232	$ 232	$ 0	
09 Channels and Canals	$ 74,726	$ 60,065	$ 14,661	1/
14 Recreation Facilities	$ 1,136	$ 568	$ 568	2/
29 Project Cooperation Agreement	$ 20	$ 20	$ 0	
30 Planning, Engineering and Design	$ 8,516	$ 8,047	$ 469	3/
31 Construction Management	$ 5,506	$ 5,506	$ 0	
Project Total	$ 100,000	$ 74,716	$ 25,284	
Project Total Rounded	$ 100,000	$ 74,700	$ 25,300	

Non-Federal Cash:	
Recreation (50% of Total)	$ 568
Other (5% of Project W/O Recreation)	$ 4,943
Additional Cash Required to Meet (Min) 25% Non-Fed Share	$ 10,187
Total Non-Federal Cash	$ 15,698
Non-Federal LERRD's:	
Lands, Easements, Rights-of-Way & Disposal Areas	$ 5,382
Relocations	$ 4,204
Total Non-Federal LERRD's	$ 9,586

1/ Non-Federal cash from 5% minimum cash, plus additional cash requirement, scheduled in 09 Feature

2/ Non-Federal 50% of Recreation Facilities must be cash

3/ First year (FY98) Non-Federal cash received after execution of PCA scheduled in 30 Feature

TABLE 98

RECOMMENDED PLAN
PROPOSED CONSTRUCTION SCHEDULES

WATERSHED (CONTRACT-ITEM)	FY *START	FY COMPLETE
BAYOU FOUNTAIN (ALL)	1998	2000
WARD CREEK (ALL)	2000	2003
JONES CREEK		
(1 - LOWER JONES CREEK)	2000	2003
(2 - UPPER JONES CREEK)	2003	2005
(3 - LIVELY BAYOU AND TRIBUTARY)	2004	2006
(4 - WEINER CREEK)	2005	2006
BEAVER BAYOU (ALL)	2002	2004
BLACKWATER BAYOU (ALL)	2002	2005

* CONSTRUCTION PERIOD STARTS WITH LAND ACQUISITION

SOURCE: U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Construction Funding Requirements

In accordance with the above construction cost-sharing and phased schedule, project required yearly construction costs, in 1994 dollars, are shown by year in Table 100 (incremental estimate). Applying anticipated annual inflation rates to these figures, inflated project construction costs are shown by year in Table 101 (fully-funded estimate). This fully-funded estimate is broken down by Federal and non-Federal cost share in Table 102. Overall, the total project cost, in inflated dollars, is estimated at $133,300,000 with a Federal share of 74.7% or $99,600,000 and a non-Federal share of 25.3% or $33,700,000.

Operation and Maintenance Funding Requirements

As stated above, the local sponsor must bear the entire project annual operation and maintenance costs. Included is all necessary repair, replacement, and rehabilitation of all project elements and features. In 1993, East Baton Rouge Parish spent about $7,500,000 for operation and maintenance for the drainage system parish-wide. Construction of proposed channel modifications, recreation items, and mitigation site developments will require additional operation and maintenance funding. Table 103 lists required operation and maintenance dollars for each watershed including recreational items, and, the combined mitigation sites. The total additional system annual operation and maintenance cost is estimated to be $308,000 per year in 1994 dollars. This operation and maintenance amount will not be fully needed until all projects are completed. For all practical purposes, this additional operation and maintenance would be uniformally phased in the beginning from close to the end of the first construction phase to the end of the last. Table 104 illustrates this phase-in of additional operation and maintenance costs and shows estimated fully-funded (cost-inflated) values.

TABLE 99

MITIGATION SITE ACQUISITION AND DEVELOPMENT SCHEDULE

SITE LOCATION	ACRES	ACQUISITION AND DEVELOPMENT START DATE
Burbank Drive	115	FY 2000
Joor Road	282	FY 2001

Source: U.S. Army Corps of Engineers, New Orleans District

TABLE 100

RECOMMENDED PLAN - COST SCHEDULE (INCREMENTAL)

FEATURE	Costs by Fiscal Year (X$1,000) FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	TOTAL
01 LANDS	0	0	649	546	680	48	2,258	1,479	0	0	0	5,660
NON-FEDERAL	0	0	567	519	633	35	2,200	1,428	0	0	0	5,382
FEDERAL	0	0	82	27	47	13	58	51	0	0	0	278
02 RELOCATIONS	0	0	0	4	0	0	2,105	2,095		0	0	4,204
06 FISH & WILDLIFE FACILITIES	0	0	0	0	0	0	0	0	232	0	0	232
09 CHANNELS & CANALS	0	0	0	1,060	1,099	2,677	9,344	12,641	23,340	20,549	4,016	74,726
14 RECREATION FACILITIES	0	0	0	0	0	0	0	284		284	568	1,136
29 PROJ COOPERATION AGRMNT	0	20	0		0			0	0	0	0	20
30 PLAN, ENGR & DESIGN	897	828	943	1,155	1,350	1,190	1,040	654	289	130	40	8,516
31 CONST MANAGEMENT	0	0	0	180	185	191	694	898	1,622	1,450	286	5,506
TOTAL PROJECT	897	848	1,592	2,945	3,314	4,106	15,441	18,051	25,483	22,413	4,910	100,000
TOTAL PROJECT WITHOUT RECREATION	897	848	1,592	2,945	3,314	4,106	15,441	17,767	25,483	22,129	4,342	98,864
CONSTRUCTION SCHEDULE (% BY YEAR)			3.1%	2.7%	3.0%	4.6%	12.5%	16.0%	28.5%	24.8%	4.8%	100.0%

(5% cash and 25% minimum Non-Federal contribution are based on Total Project, excluding Recreation. Recreation is cost-shared 50%-50%.

("Construction" for this purpose is everything but Non-Federal LERRD's and all Recreation. Percent is % of Total and represents rate at which Non-Federal cash is paid. Non-Federal cash is not due until Project Cooperation Agreement is signed.)

TABLE 100 (Continued)

RECOMMENDED PLAN - COST SCHEDULE (INCREMENTAL)

Cost Breakdowns	Costs by Fiscal Year (X$1,000)											
	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	TOTAL
FEDERAL COSTS												
Construction	897	848	556	2,013	2,227	3,375	9,245	11,823	21,171	18,377	3,616	74,148
(Federal construction includes everything but Non-Fed LERRDS, Non-Fed cash and all Recreation.)												
50% of Recreation	0	0	0	0	0	0	0	142	0	142	284	568
Total Federal Cost	897	848	556	2,013	2,227	3,375	9,245	11,965	21,171	18,519	3,900	74,716
NON-FEDERAL COSTS												
LERRD's	0	0	567	523	633	35	4,305	3,523	0	0	0	9,586
(Non-Federal LERRD's are Lands, Easements, Rights-of-Way, Relocations, and Disposal areas required for project construction and mitigation.)												
50% of Recreation	0	0	0	0	0	0	0	142	0	142	284	568
5% Minimum Cash Contribution	0	0	153	133	148	227	618	791	1,409	1,226	238	4,943
Non-Fed cash based on 5% of Total Project, excluding Recreation, and paid at the rate of Construction Schedule (see first page of table).												
Additional Cash for 25% Min.	0	0	316	276	306	469	1,273	1,630	2,903	2,526	488	10,187
Non-Fed cash based on 25% of Total Project, excluding Recreation, less 5% Minimum Cash Contribution, and paid at the rate of Construction Schedule (see first page of table).												
Total Non-Federal Cash	0	0	469	409	454	696	1,891	2,563	4,312	3,894	1,010	15,698
Total Non-Federal Cost	0	0	1,036	932	1,087	731	6,196	6,086	4,312	3,894	1,010	25,284
Non-Federal % By Year			31.0%	31.6%	32.8%	17.8%	40.1%	33.7%	16.9%	17.4%	20.6%	25.3%

TABLE 101

RECOMMENDED PLAN - COST SCHEDULE (FULLY-FUNDED)

FEATURE	Costs by Fiscal Year (X$1,000)											
	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	TOTAL
01 LANDS	0	0	736	636	818	60	2,879	1,945	0	0	0	7,074
NON-FEDERAL	0	0	639	603	758	43	2,801	1,874	0	0	0	6,718
FEDERAL	0	0	97	33	60	17	78	71	0	0	0	356
02 RELOCATIONS	0	0	0	5	0	0	2,680	2,749	0	0	0	5,434
06 FISH & WILDLIFE FACILITIES	0	0	0	0	0	0	0	0	314	0	0	314
09 CHANNELS & CANALS	0	0	0	1,232	1,317	3,306	11,895	16,585	31,579	28,666	5,775	100,355
14 RECREATION FACILITIES	0	0	0	0	0	0	0	374	0	396	816	1,586
29 PROJ COOPERATION AGRMNT	0	23	0	0	0	0	0	0	0	0	0	23
30 PLAN, ENGR & DESIGN	974	938	1,115	1,422	1,715	1,559	1,404	910	414	192	61	10,704
31 CONST MANAGEMENT	0	0	0	222	235	250	937	1,250	2,326	2,142	435	7,797
TOTAL PROJECT	974	961	1,851	3,517	4,085	5,175	19,795	23,813	34,633	31,396	7,087	133,287
TOTAL PROJECT WITHOUT RECREATION	974	961	1,851	3,517	4,085	5,175	19,795	23,439	34,633	31,000	6,271	131,701
CONSTRUCTION SCHEDULE (% BY YEAR)			2.6%	2.4%	2.8%	4.3%	12.0%	15.7%	29.0%	25.9%	5.3%	100.0%

(5% cash and 25% minimum Non-Federal contribution are based on Total Project, excluding Recreation. Recreation is cost-shared 50%-50%.

("Construction" for this purpose is everything but Non-Federal LERRD's and all Recreation. Percent is % of Total and represents rate at which Non-Federal cash is paid. Non-Federal cash is not due until Project Cooperation Agreement is signed.)

TABLE 101 (Continued)

RECOMMENDED PLAN - COST SCHEDULE (FULLY-FUNDED)

Cost Breakdowns	Costs by Fiscal Year (X$1,000)											
	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	TOTAL
FEDERAL COSTS												
Construction	974	961	672	2,410	2,745	4,239	11,821	15,555	28,609	25,620	5,170	98,776
(Federal construction includes everything but Non-Fed LERRDS, Non-Fed cash and all Recreation.)												
50% of Recreation	0	0	0	0	0	0	0	187	0	198	408	793
Total Federal Cost	974	961	672	2,410	2,745	4,239	11,821	15,742	28,609	25,818	5,578	99,569
NON-FEDERAL COSTS												
LERRD's	0	0	639	608	758	43	5,481	4,623	0	0	0	12,152
(Non-Federal LERRD's are Lands, Easements, Rights-of-Way, Relocations, and Disposal areas required for project construction and mitigation.)												
50% of Recreation	0	0	0	0	0	0	0	187	0	198	408	793
5% Minimum Cash Contribution	0	0	171	158	184	283	790	1,034	1,910	1,706	349	6,585
Non-Fed cash based on 5% of Total Project, excluding Recreation, and paid at the rate of Construction Schedule (see first page of table).												
Additional Cash for 25% Min.	0	0	369	341	398	610	1,703	2,227	4,114	3,674	752	14,188
Non-Fed cash based on 25% of Total Project, excluding Recreation, less 5% Minimum Cash Contribution, and paid at the rate of Construction Schedule (see first page of table).												
Total Non-Federal Cash	0	0	540	499	582	893	2,493	3,448	6,024	5,578	1,509	21,566
Total Non-Federal Cost	0	0	1,179	1,107	1,340	936	7,974	8,071	6,024	5,578	1,509	33,718
Non-Federal % By Year			31.1%	31.5%	32.8%	18.1%	40.3%	33.9%	17.4%	17.8%	21.3%	25.3%

TABLE 102

RECOMMENDED PLAN

Fully-Funded Federal and Non-Federal Costs (X$1,000)

Feature	Total Cost	Federal Cost	Non-Federal Sponsor Cost	
01 Lands and Damages	$ 7,074	$ 356	$ 6,718	
02 Relocations	$ 5,434	$ 0	$ 5,434	
06 Fish and Wildlife Facilities	$ 314	$ 314	$ 0	
09 Channels and Canals	$ 100,355	$ 80,122	$ 20,233	1/
14 Recreation Facilities	$ 1,586	$ 793	$ 793	2/
29 Project Cooperation Agreement	$ 23	$ 23	$ 0	
30 Planning, Engineering and Design	$ 10,704	$ 10,164	$ 540	3/
31 Construction Management	$ 7,797	$ 7,797	$ 0	
Project Total	$ 133,287	$ 99,569	$ 33,718	
Project Total Rounded	$ 133,300	$ 99,600	$ 33,700	

Non-Federal Cash:	
Recreation (50% of Total)	$ 793
Other (5% of Project W/O Recreation)	$ 6,585
Additional Cash Required to Meet (Min) 25% Non-Fed Share	$ 14,188
Total Non-Federal Cash	$ 21,566
Non-Federal LERRD's:	
Lands, Easements, Rights-of-Way & Disposal Areas	$ 6,718
Relocations	$ 5,434
Total Non-Federal LERRD's	$ 12,152

1/ Non-Federal cash from 5% minimum cash, plus additional cash requirement, scheduled in 09 Feature
2/ Non-Federal 50% of Recreation Facilities must be cash
3/ First year (FY98) Non-Federal cash received after execution of PCA scheduled in 30 Feature

TABLE 103

REQUIRE PROJECT ANNUAL OPERATION, MAINTENANCE*, AND EQUIVALENT ANNUAL REPLACEMENT COSTS (1994 $)

WATERSHED	CHANNELS	**MITIGATION SITES	RECREATION ITEMS	TOTAL
BAYOU FOUNTAIN	$ 36,000	$ 1,000	$ 0	$ 37,000
WARD CREEK	$ 74,000	$ 2,000	$ 0	$ 76,000
JONES CREEK	$ 27,000	$ 6,000	$34,000	$ 67,000
BEAVER BAYOU	$ 57,000	$ 7,000	$ 0	$ 64,000
BLACKWATER BAYOU	$ 58,000	$ 6,000	$	$ 64,000
TOTAL PROJECT	$252,000	$22,000	$34,000	$308,000

** PRORATED COSTS OF COMBINED MITIGATION PLAN

SOURCE: U.S. ARMY CORPS OF ENGINEER, NEW ORLEANS DISTRICT

TABLE 104
TOTAL SYSTEM OPERATIONS AND MAINTENANCE* COST INCREASE FOR PROPOSED PROJECT

(1,000's)

YEAR	2001	2002	2003	2004	2005	2006	2007	2008
1994 $	$36	$36	$36	$124	$203	$280	$308	$308
FULLY FUNDED $ (INFLATED)	$47	$49	$50	$178	$299	$427	$481	$496

Includes all operation and maintenance for channels, mitigation areas, bike paths, and new trees. Operation and maintenance requirements continue beyond 2006 at $308,000 (1994 $).

* Includes all repair, replacement, and rehabilitation of all project elements and features.

Source: U.S. Army Corps of Engineers, New Orleans District

Preliminary Capability Statement

The City of Baton Rouge, Parish of East Baton Rouge, is the non-Federal sponsor for the recommended plan. The Department of Public Works will likely manage and maintain the channels and proposed bike path. The Recreation and Park Commission (BREC) will likely manage and maintain the proposed mitigation sites. See Letters of Intent, Exhibit 1. East Baton Rouge Parish proposes to finance their share of the project by means of either an ad valorem tax or sales tax, with or possibly without the sale of bonds. Their preferred plan is to utilize a sales tax without a bond issue. Their complete financing plan can be found in the Economics Appendix H.

This project does not qualify for a revision to the non-Federal cost-share for flood control based on estimated flood control benefits and costs and on application of guidelines published on flood control cost-sharing requirements under the Ability to Pay Provision; interim fund rule (Vol. 52, Federal Register Pages 35872-35892, 1989 to be codified at (33 CFR Sections 241.1-.6)), implementing Section 103(m) of the Water Resources Development Act of 1986.

SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

The initial public meeting on the Amite River and Tributaries Study was held on October 30, 1984. At that meeting local interests expressed their views on alternative plans that were identified as being potentially feasible and should be studied in further detail.

Between 1984 and 1993, numerous meetings were held with representatives of Federal, state, and local agencies. The meetings provided forums to discuss the status and direction of the study. Very close coordination through telephone conversations and meetings was maintained with study locals and the potential project sponsor, East Baton Rouge Parish, Department of Public Works. Among the meetings that the Corps has participated in on this study include meetings with the Mayor of Baton Rouge, Metro Council Members of Baton Rouge, state legislators, City of Baton Rouge Chamber of Commerce, Amite River Basin Drainage and Conservation Commission, U.S. Fish and Wildlife Service, Louisiana Wildlife and Fisheries, East Baton Rouge Parish Department of Public Works, Recreation and Park Commission for the Parish of East Baton Rouge, Department of Natural Resources, Department of Environmental

Quality, Department of Transportation and Development, and Louisiana State University.

A public meeting presenting the Tentatively Selected (Recommended) Plan was conducted on March 21, 1995, at the East Baton Rouge Metro Council. Additionally, the draft report and/or report summary was sent to approximately 150 Federal, state, local, and private interests for review and comment. The public meeting notice, public meeting minutes, letters of comment, and responses to the issues raised are illustrated in Appendix L.

Dates of recent major meetings are listed below.

FEDERAL/STATE/LOCAL AGENCY/INTERESTED GROUP	DATE
STATUS MEETING City of Baton Rouge Chamber of Commerce	May 1992
STATUS MEETING U.S. Senator J. Bennett Johnston Louisiana State Area Legislators Louisiana Department of Transportation and Development (DOTD) Amite River Basin Drainage and Conservation Commission (ARBDCC)	June 1992
MITIGATION AREA SELECTION MEETING East Baton Rouge Parish Department of Public Works (EBRDPW) Recreation and Park Commission of East Baton Rouge Parish Louisiana State University U.S. Fish and Wildlife Service	February 4, 1993
STATUS MEETING Baton Rouge Metro Council	March 10, 1993
COST-SHARING MEETING WITH POTENTIAL LOCAL SPONSOR Mayor of the City of Baton Rouge EBRDPW Louisiana DOTD	March 12, 1993
STATUS MEETING Citizens of Baton Rouge Council District 3	March 30, 1993

STATUS MEETING Citizens of Baton Rouge Council District 3	June 10, 1993
COST-SHARING MEETING WITH POTENTIAL LOCAL SPONSOR Mayor of the City of Baton Rouge EBRDPW Louisiana DOTD	August 20, 1993
COST-SHARING MEETING WITH LOCAL SPONSOR Mayor of the City of Baton Rouge EBRDPW	August 14, 1993
COST-SHARING MEETING WITH LOCAL SPONSOR Mayor of the City of Baton Rouge Baton Rouge Metro Council EBRDPW	September 1, 1993
STATUS MEETING Citizens of Baton Rouge Council District 1	September 7, 1993
STATUS MEETING Citizens of Baton Rouge Council District 12	September 14, 1993
FEASIBILITY REVIEW CONFERENCE EBRDPW Louisiana DOTD U.S. Fish and Wildlife Service Louisiana Department of Wildlife and Fisheries Louisiana Department of Natural Resources	December 12, 1993 December 13, 1993
STATUS MEETING EBRDPW Mayor of the City of Baton Rouge Louisiana DOTD	April 12, 1994
STATUS MEETING EBRDPW Mayor of the City of Baton Rouge Louisiana State Area Legislators	April 15, 1994
STATUS MEETING EBRDPW Louisiana DOTD	July 25, 1994

STATUS MEETING EBRDPW Citizens of Baton Rouge Council District 3 Louisiana State University	September 13, 1994
STATUS MEETING EBRDPW Citizens of Baton Rouge Council District 3	October 8, 1994
STATUS MEETING EBRDPW Citizens of Baton Rouge Council District 12	October 11, 1994
STATUS MEETING EBRDPW Federation of Civic Associations	October 13, 1994
PUBLIC MEETING	March 21, 1995

The Amite River Basin Drainage and Conservation Commission was created by Act 896 of the 1981 Louisiana regular legislative session. The Commission is empowered by the State of Louisiana to incur debt, issue bonds to secure funds, and expropriate lands to accommodate water resources projects. The Commission has had approximately 80 meetings since its creation in 1981. The Corps of Engineers has attended most every meeting and discussed study status and study results.

The project non-Federal sponsor, East Baton Rouge Parish, Department of Public Works (EBRDPW), has been actively involved in the study. Numerous meetings, correspondence, and phone conversations have taken place with EBRDPW. They have contributed greatly in plan formulation and the development of accurate project cost estimates. EBRDPW has reviewed the preliminary draft cost-sharing agreement and has provided the Corps with a letter of intent indicating that the agency understands the responsibilities that are incumbent on the local sponsor and the agency intends to enter into a binding agreement with the Corps of Engineers at the appropriate time. Their letter of intent along with a resolution from the Metropolitan Council of the Parish of East Baton Rouge and the City of Baton Rouge, and, a letter of intent from the

Recreation and Park Commission for the Parish of East Baton Rouge are contained in Exhibit 1.