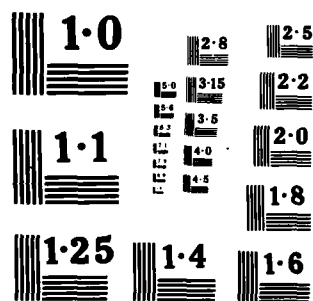




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US Army Corps
of Engineers
New Orleans District

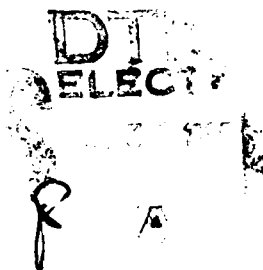
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Aloha - Rigolette Area, Louisiana

Agricultural Flood Control

Feasibility Study

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distribution.

Volume 1
Draft Main Report
Draft Environmental Impact Statement
June 1985

ALOHA - RIGOLETTE AREA,
LOUISIANA

FEASIBILITY STUDY

VOLUME INDEX

- VOLUME 1 - MAIN REPORT AND ENVIRONMENTAL IMPACT STATEMENT
- VOLUME 2 - APPENDIX A - FORMULATION, ASSESSMENT, AND
EVALUATION OF DETAILED PLANS
- APPENDIX B - NATURAL RESOURCES
- APPENDIX C - ENGINEERING INVESTIGATION
- APPENDIX D - ECONOMIC ANALYSIS
- APPENDIX E - DECEMBER 1982 POST FLOOD
INVESTIGATION



REPLY TO
ATTENTION OF

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

June 1985

ALOHA - RIGOLETTE AREA, LOUISIANA

FEASIBILITY REPORT ON AGRICULTURAL FLOOD CONTROL



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SYLLABUS

This report gives the findings of detailed feasibility studies of additional flood protection in the Aloha-Rigolette area. This rural area is located in north-central Louisiana on the left descending bank of the Red River, and includes portions of Winn, Rapides, and Grant Parishes. The drainage basin is approximately 418 square miles and is composed of two distinct areas that differ in topography, biological resources, and economic activities. The northern and eastern portions of the basin are mostly gently rolling wooded hills and the major economic activities are mining and timber harvesting. This area accounts for nearly 77 percent of the total basin. The southern and western portions of the basin are relatively flat and agricultural activities predominate.

Flooding in the basin occurs largely in the agricultural region of the Aloha-Rigolette area and is caused by interior runoff. Previously, the basin also sustained flooding from Red River overflow. In the mid-1950's, flooding from this source was alleviated by construction of a levee along Red River and floodgates in the levee at the mouth of Bayou Rigolette. The floodgates serve as the only means of evacuating water from the basin. Since the mid-50's, agricultural development in the basin has increased dramatically. Concurrently, the amount of rainfall runoff increased. The streams in the agricultural area and the existing floodgates are now overtaxed by basin runoff. To address this problem, 22 alternative plans including a no-action plan were developed, assessed, and evaluated in this study.

The tentatively selected plan consists of six additional floodgates constructed adjacent to the existing Bayou Rigolette structure and mitigation measures that include purchase of flowage easements to facilitate the periodic drawdown of Iatt Lake to improve fisheries. The total first cost of the plan is estimated at \$6,900,000 with annual charges of \$731,000 based on an interest rate of 8-3/8 percent, a 50-year amortization period, and operation and maintenance expenditures.

The average annual benefits attributable to the plan are estimated at \$1,225,000. The benefit-to-cost ratio is 1.7.

This plan would reduce flooding in the agricultural area and would create favorable conditions for intensified agricultural land use. The plan would reduce overbank flooding and fish spawning opportunities. Other environmental and social impacts associated with this plan are minimal. Local interests expressed support for the concept of additional floodgates during the conduct of this study.

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REPLY TO
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DEPARTMENT OF THE ARMY
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P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

ALOHA-RIGOLETTE AREA, LOUISIANA

DRAFT MAIN REPORT

AND

DRAFT ENVIRONMENTAL IMPACT STATEMENT

This report presents the findings of a feasibility study of additional flood protection in the Aloha-Rigolette area. Agriculture, the major activity in the basin, frequently sustains flooding from stream overflow. The losses that occur adversely impact the economy of the area. Volume 1 contains the Draft Main Report, a concise, nontechnical summary of study results, and the Draft Environmental Impact Statement (DEIS). The main report provides an overview of the water and related land resources problems in the area, the plan formulation process, the assessment and evaluation results, and a discussion on the tentatively selected plan. The DEIS contains a description of the significant resources and the impacts on those resources of plans considered in the detailed analysis. Volume 2 contains the technical appendices that document and support study findings. Included are detailed data on the plan formulation studies, environmental analysis, economic analysis, and engineering investigations, and a summary of the damages sustained in the Aloha-Rigolette area during the December 1982 flood.

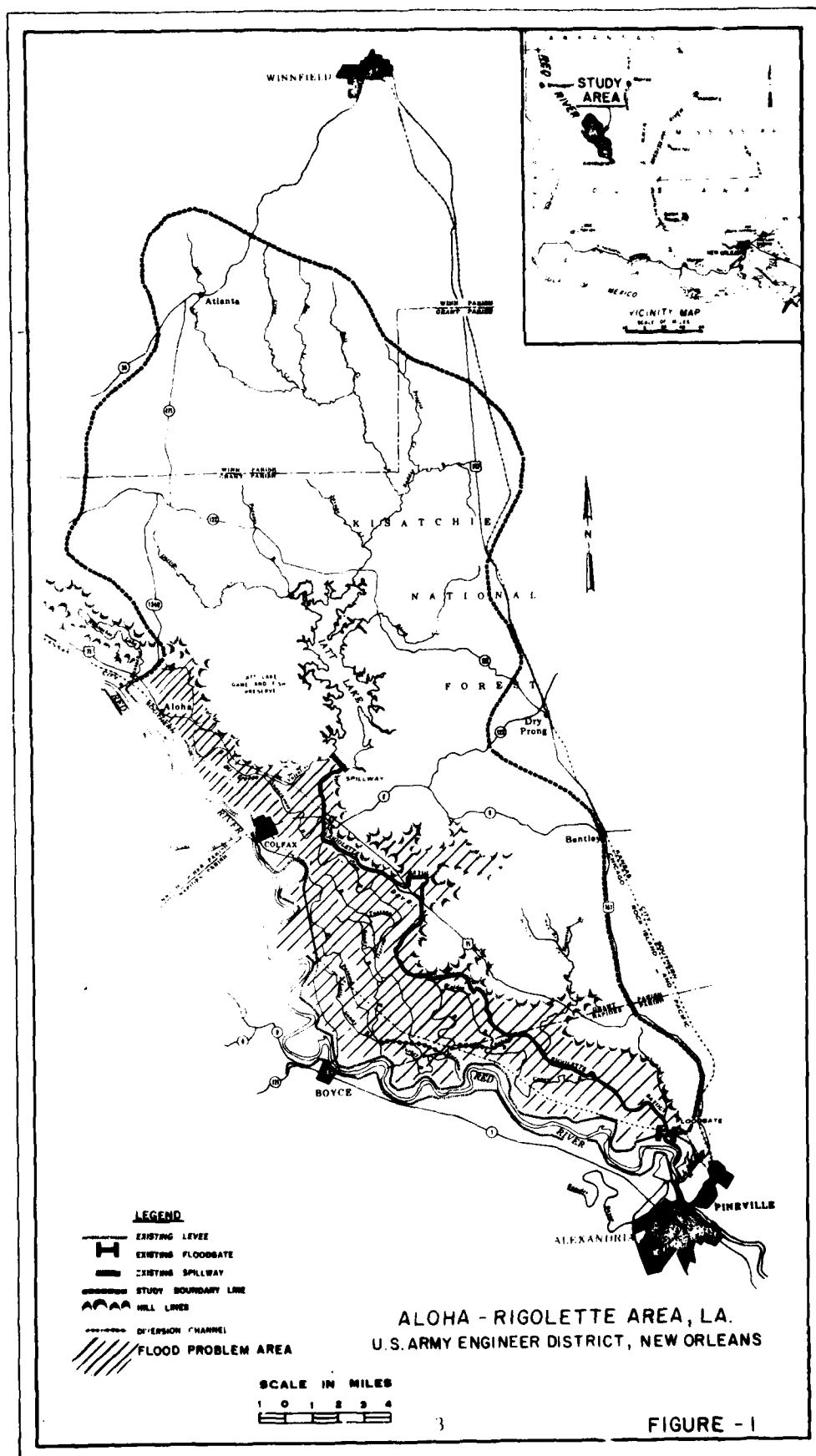
STUDY AUTHORITY

This study was authorized by a resolution of the United States Senate Committee on Public Works and Environment adopted on 22 May 1974 at the request of U.S. Senators Russell B. Long and J. Bennett Johnston from Louisiana. The resolution is quoted below:

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors be and is hereby required to review the report on Red River and Tributaries, Texas, Oklahoma, Arkansas and Louisiana, downstream from Denison Dam, submitted in House Document Numbered 602, 79th Congress, 2nd Session, and subsequent reports with a view to determining the advisability of providing additional flood protection in the Aloha-Rigolette area.

PURPOSE AND SCOPE OF STUDY

This is a survey scope report and represents the final response to the study authority. The purpose of the study was to assess the economic, environmental, and engineering feasibility of providing additional flood protection in the Aloha-Rigolette area. Other related water resources were also investigated including water quality, recreation, and fish and wildlife. The basin is located in north-central Louisiana between the towns of Winnfield and Pineville on the left descending bank of the Red River. The area encompasses approximately 418 square miles (267,400 acres) and includes portions of Grant, Rapides, and Winn Parishes (see Plate 1). The basin is generally characterized by two distinct topographic areas. The northern and eastern portion of the basin is mostly gently rolling hills (approximately 206,700 acres or 77 percent of the total basin) and is preponderantly wooded. The remaining area (approximately 60,700 acres or 23 percent of the basin) is mostly alluvial plains used primarily for agriculture. The flood problem is confined to the alluvial plain and is confined to the alluvial plain and is delineated on Figure 1.



The Aloha-Rigolette area study included but was not limited to:

- o Analysis of the extent of flooding in the basin.
- o Formulation of possible alternative plans to reduce flooding.
- o Determination of the economic feasibility of various plans.
- o Analysis of the environmental resources and impacts of various plans on those resources of the area.

STUDY PARTICIPANTS AND COORDINATION

The New Orleans District, Corps of Engineers, had the principal responsibility for conducting and coordinating this study, formulating plans, consolidating information from previous Corps of Engineers studies and those of other agencies, and preparing the report and the Environmental Impact Statement. During the study, the Corps sought participation through distribution of public notices, public meetings, numerous working meetings with local agencies, interviews with residents of the basin, and formal written contracts with agencies.

Direct coordination was established with the following agencies and organization:

Louisiana Department of Transportation and Development
U.S. Department of Agriculture, Soil Conservation Service
Grant Soil and Water Conservation District
Rapides Soil and Water Conservation District
Grant Parish Police Jury
Rapides Parish Police Jury
19 Louisiana Levee District

Red River, Atchafalaya and Bayou Boeuf Levee District
U.S. Department of the Interior, Fish and Wildlife Service
Louisiana Department of Wildlife and Fisheries
Rigolette Water Relief Association

An initial public meeting was held in Colfax, Louisiana, on 16 May 1979 to establish communication among the New Orleans District and all those interested in the study, and to obtain the views of the general public on water resource problems and needs of the area. Concerned individuals made statements about the flood problem and possible solutions at the meeting. From field discussions with several local agencies and contacts with Federal and state agencies, general information was obtained on crop acreage, cleared and wooded areas, and fish and wildlife resources.

In November 1980, a draft reconnaissance report was prepared as part of this study. After the draft report was released, the Grant Soil and Water Conservation District and concerned residents held a meeting in Colfax on 10 February 1981 to discuss report data and results. Representatives from the New Orleans District were also present at the meeting.

In February, March, and November 1983, meetings were held with local agencies and groups to discuss the status of the study and future planning efforts and to solicit comments, recommendations, and remaining concerns. In October 1983, meetings were held with state and Federal agencies to discuss various study-related subjects. In January 1985, a meeting was held with the state, the Rapides parish Policed jurors and local land owners in Alexandria, to discuss the status of the feasibility study and the impacts the Red River Waterway project will have on the existing Aloha-Rigolette project. After the draft feasibility report and the DEIS is distributed, future meetings will be scheduled.

PRIOR STUDIES AND OTHER PROJECTS

U. S. Army Corps of Engineers studies of flooding in the Aloha-Rigolette area have resulted in construction of several projects. In 1936, the project "Colfax Cutoff, Louisiana," was completed. This project was authorized by the Flood Control Act of 13 May 1928 and provided an emergency cutoff channel in the vicinity of Colfax, Louisiana, to prevent further caving of Red River banks in that area. In 1941, the project "Grant Parish Below Colfax" authorized by the Flood Control Act of 28 June 1938 was completed. Protection from Red River flooding was provided for Grant Parish by construction of a levee on the left descending bank of the Red River between Colfax and the mouth of Bayou Darrow. In 1951, the project "Pineville, Red River, Louisiana," was completed, and in 1956, the project "Aloha-Rigolette Area, Grant and Rapides Parishes, Louisiana," was completed. Both projects were authorized by the Flood Control Act of 18 August 1941. The Pineville project afforded local protection to the City of Pineville from Red River flooding and improved interior drainage by means of levees, floodgates, a pumping plant, and new drainage canals. The Aloha-Rigolette project provided similar protection to the lower portion of the Bayou Rigolette basin through levees, clearing and snagging, diversion channels, and a gated flood control structure. These projects, which resulted from U. S. Army Corps of Engineers studies, combine to provide nearly complete protection from Red River flooding and improved drainage within the basin. A major project that affects the Aloha-Rigolette area is the "Red River Waterway, Louisiana, Texas, Arkansas, and Oklahoma, Mississippi River to Shreveport, Louisiana, Reach." This project was authorized by the River and Harabor Act of 13 August 1968. It provides for a navigation route in Red River with a series of locks and dams. This project is currently under construction.

In addition to improvements within the Aloha-Rigolette area, several studies have been conducted to address interior flooding in the basin

but no projects have been constructed. In 1947, a comprehensive report entitled "Development of Water and Land Resources of the Arkansas-White and Red River Basins" (AWRB report), was printed as Senate Document No. 13, 85th Congress, 1st Session. The purpose of the report was to identify basin water resources, appraise their potential, and provide a framework for preparation of detailed studies. A study of flood and drainage problems in the Bayou Du Grappe area (a tributary watershed of Bayou Rigolette) was contained in the report. A reconnaissance scope plan for the Du Grappe area that provided for enlargement and realignment of the existing channels of Bayou Du Grappe and Sugarhouse Bayou was determined to be feasible. However, the report was not an authorizing document and contained no recommendation for construction.

To advance the reconnaissance scope plan of improvement for the Bayou Du Grappe area contained in the AWRB report, a companion report, dated February 1960, was prepared by the New Orleans District, Corps of Engineers. The report concluded that a plan for channel improvements, substantially as outlined in the AWRB report, was economically justified. Construction was not recommended because local interests were unwilling or unable to meet the terms of local cooperation.

In 1968, a report entitled "Comprehensive Basin Study, Red River Below Denison Dam, Arkansas, Louisiana, Oklahoma, and Texas," prepared by an ad hoc committee of Federal and state agencies (chaired by the U. S. Army Corps of Engineers), was published. Several alternative plans to reduce flooding in the Bayou Du Grappe and Bayou Rigolette areas were considered by the Corps and the U. S. Department of Agriculture, Soil Conservation Service (SCS). Corps studies did not result in development of an economically feasible plan. The Soil Conservation Service developed a more comprehensive plan that was economically feasible and it was proposed in the early-action plan of development for the Red River Basin. Action to conduct detailed studies was initiated by SCS, but after several meetings with local interests, it was determined that the required non-Federal cost sharing could not be obtained. Further study by SCS was suspended.

In August 1968, the Louisiana Department of Transportation and Development, Soil and Water Conservation Committee, approved applications for assistance under the Small Watershed and Flood Prevention Act (PL-566) for the Bayou Rigolette and Bayou Du Grappe watersheds. Work on these applications has not been initiated and is currently unscheduled.

PLAN FORMULATION

The plan formulation process was conducted in an organized and systematic manner to ensure that all reasonable alternative plans were considered. The alternative plans addressed study planning objectives and included a plan that would maximize net national economic development benefits. The plan formulation process was conducted in accord with the U. S. Water Resources Council principles and guidelines for planning water and related land resources that were established pursuant to Sections 103 of the Water Resources Planning Act, as amended (Public Law 89-80, amended by Public Law 94-112). The principles and guidelines prescribe a single Federal objective, national economic development (NED), consistent with protecting the nation's environment. Contributions to the NED objective increase the net value of the national output of goods and services. These contributions are direct net benefits that accrue in the study area and the rest of the nation. Benefits are maximized with consideration for enhancing environmental quality, regional development, and social concerns.

Analyzing historical trends and existing conditions was essential to evaluating and determining the extent of water resource problems in the Aloha-Rigolette area. This formed 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 planning objectives were then identified. These

measures were incorporated into an array of alternative plans that were 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.

ASSESSMENT OF WATER AND RELATED LAND RESOURCES PROBLEMS

EXISTING CONDITIONS

Climate. The Aloha-Rigolette area is characterized by mild temperatures and abundant rainfall. The summers are usually long with relatively high temperatures, and the winters are short and moderate with occasional temperatures below freezing. The average winter temperature is 50.3 degrees Fahrenheit, the average summer temperature 81.6 degrees. Maximum temperatures occur when the prevailing winds are from the south, usually during the months of July and August. Minimum temperatures occur when the winds are from the north and northwest, usually during January. Between 1951 and 1980, temperature extremes of 104 degrees in August 1962 and 1980 and 5 degrees in January 1962 were recorded in Alexandria, Louisiana, a major city just south of the Aloha-Rigolette area.

Annual precipitation in the basin, based on U. S. Weather Bureau records from 1887 to 1977 at Alexandria, varies from a maximum of 88.0 inches to a minimum of 36.1 inches with an average of 56 inches. The heaviest rainfalls over the basin generally occur from January to June. This is also the period in which high stages on the Red River usually occur. During the floods of March-May 1945, April-May 1953, and December 1982, the rainfall was 16.5, 30.5, and 20.0 inches, respectively. Rainfall records for the last 25 years show that 1957, 1961, and 1973 were years

high precipitation. Annual rainfalls of 73.1, 79.3, and 72.6 inches, respectively, were recorded for those years at Alexandria.

Water Resources. The major water bodies in the Aloha-Rigolette area are Iatt Lake, Bayou Rigolette, Bayou Du Grappe and Sugarhouse Bayou. Tributaries of Iatt Lake drain the forested hills in the north and northeast portions of the basin, approximately 154,900 acres (58 percent of the total basin). The lake was formed when the State of Louisiana constructed a small dam in 1947 for wildlife conservation and recreation purposes. The spillway crest at elevation 83 feet^{1/} creates an impoundment that has a surface area of 7,100 acres and an average depth of about 4.5 feet. The major tributaries of Iatt Lake are Iatt Creek, Black Creek, and Dartigo Creek. Bayou Rigolette originates at the dam.

Approximately two miles below the Iatt Lake dam, the Bayou Du Grappe watershed intervenes. Bayou Du Grappe is located in the midwestern portion of the basin and originates about 1.5 miles above the town of Aloha, Louisiana. This bayou and its tributaries drain approximately 20,900 acres (8 percent of the total basin), mainly alluvial plains. Bayou Du Grappe follows a southeasterly course 7 miles to the point where it joins Sugarhouse and Valentine Bayous. From this juncture, Bayou Du Grappe becomes Sugarhouse Bayou and continues 4.5 miles where it joins Bayou Rigolette.

Bayou Rigolette and its other tributaries drain the remaining 91,600 acres of the basin (34 percent of the total basin). Following a southeasterly course, Bayou Rigolette is the primary channel funneling the basin waters approximately 26 miles to the Red River. The topography east of Bayou Rigolette is mostly forested hills and west of the bayou is mostly alluvial

^{1/} All elevations in this report refer to the National Geodetic Vertical Datum (NGVD).

plain. Numerous interconnecting bayous in the alluvial plain serve as drainage canals to transport runoff from the agricultural lands in the area. Major tributaries are Bayous Darrow, Patassa, Marteau, Sandy, Walden, Caney, and Saline. All these water courses have a low gradient, normally low velocity, and variable stages.

Bayou Rigolette and associated tributaries have been designated by the Louisiana Department of Natural Resources, Division of Water Pollution Control, as "effluent limited." This designation means that the water quality now meets and will continue to meet applicable water quality standards, or that it has been adequately demonstrated that the applicable standards will be met after the application of the effluent limitations required by the Federal Water Quality Act, as amended (1972). Iatt Lake and Bayou Rigolette are classified as suitable for secondary contact recreation (fishing, wading, boating, or other activities where ingestion of and total immersion in water is not probable) and propagation of fish and wildlife.

Generally, the water quality above Iatt Lake dam is good. The lack of agricultural activities, sparseness of rural communities, and abundance of forested areas contributes to the good water quality. Downstream of Iatt Lake, the water quality of streams is considered moderate to poor and becomes increasingly turbid moving through the alluvial plain to the mouth of Bayou Rigolette. Decreased water quality in this area is most likely due to the movement of sediment and chemicals from the extensive agricultural lands into nearby bayous. Water levels in Bayou Rigolette fluctuate dramatically on a yearly cycle. Typically, water levels are high during the winter and spring months, and are nearly level with the base of the floodgate during the fall and summer months. During the months of low water, Bayou Rigolette is a sluggish stream.

Land Resources. The study area lies entirely within the alluvial valley of the Red River. The topography consists of flat alluvial plains and gently rolling hills. The fertile alluvial plain, approximately 60,700 acres, owes its presence to the shifting courses of the Red River and the deposits of river sediment. This area has been extensively used for agricultural pursuits (see Table 1 for land use distribution). Elevations in the alluvial plain average less than 90 feet.

TABLE 1
EXISTING LAND USE IN ALLUVIAL PLAIN
1982

Aloha-Rigolette Area

Reach	Cleared	Wooded	Surface Water	Total
Bayou Du Grappe	9,219	4,330	151	13,700
Bayou Rigolette	32,170	14,124	706	47,000
TOTAL	41,389	18,454	857	60,700

The uplands area consists of approximately 206,700 acres. This area includes 51,000 acres in the Kisatchie National Forest. Elevations in this area are generally greater than 100 feet and occasionally exceed 250 feet.

Biological Resources. Habitat types found in the basin include mixed uplands, swamps, bottomland hardwoods, riparian lands, and waterbodies. The mixed uplands are characterized by mixed pine and hardwood trees. Shortleaf pine is present but is gradually being replaced by the faster

growing loblolly pine as a result of commercial lumber activities. The dominant hardwoods are hickories and various oaks such as white, southern red, post, and blackjack. Willow and water oaks, blackgum, and red maple are common species on poorly drained sites within this area. The most notable animal species in the area include white-tailed deer, gray and fox squirrels, cottontail rabbit, gray fox, bobcat, and several other small mammals and avian species.

The forested areas of the alluvial plain are primarily bottomland hardwoods. This forest type is rapidly disappearing from the nation's major flood plains due to agricultural expansion. Since these woodlands are highly productive in terms of wildlife, preserving them is of significant concern. Tree species that typify this forest include several oaks, pecan, American elm, hackberry, and bitter pecan. The most common forest-dwelling wildlife species using this area are white-tailed deer, gray and fox squirrels, raccoon, red-shouldered hawk, and numerous passerine birds. Flooding of these forested areas during the spring months (March 1 - June 15) creates valuable fish spawning habitat.

Bottomland hardwood swamps are located in the low lying areas within hilly uplands and in the alluvial plain. Upland swamps have generally been unaffected by land use conversion while swamps in the alluvial plain have been slightly reduced. In 1957, approximately 1,100 acres of swamp existed in the alluvial plain compared to approximately 1,000 acres in 1974. The minor reduction is attributed to expansion of agricultural activities. The swamps serve as habitat for many animal species including raccoon, mink, egrets, herons, wood ducks, prothonotary warblers, numerous insects and aquatic arthropods, and several amphibians and reptiles.

Riparian lands located along stream banks are characterized by bald cypress, buttonbush, black willow, and smartweed. The riparian vegetation helps stabilize stream banks, provides cover and food for fish and wildlife, and intercepts solar radiation. This habitat is quite productive and serves as the primary interface for nutrient release between riparian

plains and the adjacent water bodies. It is estimated that 2,122 acres of riparian habitat are present in the alluvial plain, of which 987 acres are cleared and 1,135 acres are wooded. Most animal species found in the upland and bottomland hardwood areas are also found in this habitat.

The water bodies provide habitat for many amphibians and reptiles and support a moderate population of sport and commercial fish. Typical sport fish are largemouth bass, bluegill, and other sun fishes. Typical commercial and forage species are catfish, bowfin, gars, freshwater drum, and gizzard shad.

Cultural Resources. There are eleven recorded cultural resources within the flood problem area. Two of these, the McNeely House in the town of Colfax and Kateland, a dogtrot house located northwest of Boyce, Louisiana, are listed in the National Register of Historic Places. One of the remaining sites (16GR4) has no recorded information. It is located on a short relict channel in the vicinity of the confluence of Sam Bayou and Bayou Darrow. Sites 16RA8 and 16RA317 are prehistoric mounds associated with artifact scatters. Both sites are located at the lower end of the drainage basin near the mouth of Bayou Rigolette. Four prehistoric lithic scatters (16GR 5, 6, 11, and 12) and two additional prehistoric mounds (16GR 2 and 7) are located in close proximity to the Iatt Lake bankline. The small number of sites recorded in the Aloha-Rigolette Basin is misleading and may be more indicative of the area's complicated geomorphology than its settlement history. It is hypothesized that if additional prehistoric sites are present, they are buried. Historic records and maps indicate that numerous 19th century plantations were developed along the present Red River channel. Slightly earlier plantations and several small settlements existed in the upper Rigolette Basin along portions of Bayous Du Grappe, Sugarhouse, Sam, and Rigolette. These bayous occupy a relict Red River channel which was active until the mid-1830's.

Recreational Resources. The major recreational activities in the basin are hunting and fishing. In the upper basin area, the Kisatchie National Forest offers extensive hunting opportunities and potential for other land-related recreation. Fishing opportunities are provided by Iatt Lake, Iatt Creek, and Nantaches Lake (adjacent to the basin). Iatt Lake area is designated as a state game and fish preserve and is governed by the Iatt lake Water Conservation Board.

In the lower basin, fishing and hunting also occur but to a lesser degree than in the upper basin. The primary resource for fishing in this area is Bayou Rigolette. However, use of Bayou Rigolette is limited due to extensive private land holdings and limited public access. Adjacent to this reach is the Red River. The use of this resource will be greatly expanded when the Red River Waterway navigation project is complete. Hunting in this area is mostly on large tracts of private lands that have been leased to hunting clubs.

Economy. The cities of Alexandria and Pineville are the primary marketing, commercial, and transportation centers of the area. Colfax, the parish seat of Grant Parish, is the only significant trade center in the Aloha-Rigolette Basin. In the three-parish area of Rapides, Grant, and Winn Parishes, mineral production of stone, gypsum, sand, and gravel had a 1976 value of approximately \$10 million as compared to \$8.5 billion in mineral production for the entire state. Total stumpage value of cut timber for the three-parish area in 1976 was \$21.3 million, which represents nearly 18 percent of the state total of \$119.0 million.

Total employment in the three-parish area in 1980 was 58,388, most of which was in the Alexandria metropolitan area. Major employment sources were retail and wholesale trade, manufacturing, and the service sector. Per capita income in 1980 was \$6,485 for Rapides Parish, \$5,010 for Grant Parish, and \$5,613 for Winn Parish.

Within the wooded uplands of the Aloha-Rigolette Basin, the primary economic activities are associated with timber harvesting and mining.

The main economic activity of the alluvial plain, historically and presently, is agriculture.

The generally adequate rainfall, fertile soil, and long growing season in the basin has helped to create an environment that is highly favorable for agricultural development. Principal crops grown include soybeans, grain sorghum, cotton, and wheat. Besides grazing, some pasturelands are used for hay or pecan production. The 1970 net returns from farm production within the Aloha-Rigolette area were approximately \$8.0 million, nearly all of which was from soybean production.

Human Resources. The resident population of the Aloha-Rigolette area is primarily rural, scattered over a large area in low density patterns. The city of Colfax is the only urban-type development in the Bayou Rigolette basin with a 1980 population of 1,680. The total basin population in 1980 was 8,561. Over the past 50 years (1930-1980), the population has increased at an annual rate of 0.4 percent (see Table 2). *This slow growth rate* is primarily due to high outmigration rates between 1940 and 1960. Since 1960, the annual growth rate has been 1.0 percent. Since 1950, the population of Grant and Winn Parishes has remained nearly static, whereas Rapides Parish (mainly the Alexandria metropolitan area) grew from 90,650 to 151,985 in 1980.

FUTURE CONDITIONS

The most probable future conditions, if no Federal action is taken, are determined by projecting conditions that would prevail in the study area over the planning period, 1990 to 2040. This scenario serves as the base condition to which all alternative plans were compared to assess each plan's affects.

TABLE 2
HISTORICAL POPULATION AND ANNUAL GROWTH RATES
Aloha-Rigolette Area

Year	Parish			Total	Annual Growth Rate (%)
	Grant	Rapides	Winn		
1930	5,969	356	677	7,002	0.83
1940	6,456	478	668	7,602	-0.51
1950	5,975	714	535	7,224	-0.30
1960	5,480	1,046	483	7,010	0.41
1970	5,373	1,412	516	7,301	1.60
1980	5,966	2,066	529	8,561	

SOURCE: Bureau of the Census.

The Aloha-Rigolette basin has had a stable agricultural economy in the past and that economy is expected to continue in the future. The population is expected to increase only slightly over the next 50 years. The growth rate between 1980 and 2040 is expected to average 0.51 percent annually. Table 3 delineates projected population and growth rate statistics for the basin from 1980-2040.

TABLE 3
PROJECTED POPULATION AND ANNUAL GROWTH RATES
Aloha-Rigolette Area

Year	Parish			Total	Annual Growth Rate
	Grant ^{3/}	Rapides ^{4/}	Winn ^{5/}		
1980	5,966 ^{1/}	2,066 ^{1/}	529 ^{1/}	8,561	
1990 ^{2/}	6,470	2,300	500	9,270	0.80
2000 ^{2/}	6,910	2,500	490	9,900	0.66
2010 ^{2/}	7,290	2,640	480	10,410	0.50
2020 ^{2/}	7,680	2,800	480	10,960	0.52
2030 ^{2/}	8,100	2,960	470	11,530	0.51
2040 ^{2/}	8,530	3,130	470	12,130	0.51

^{1/} Source: Bureau of the Census

^{2/} Source: MOD estimates based on 1980 OBERS BEA Regional Projections.

^{3/} Based on Alexandria SMSA population projections for moderate change-in-share.

^{4/} Based on Alexandria SMSA population projections for no change-in-share.

^{5/} Based on Alexandria SMSA agricultural employment annual growth rate projections for no change-in-share.

In the last several decades, the principal crops have changed from cotton and corn to soybeans. Along with this change, clearing of bottomland hardwoods for agriculture increased. The incentive to clear was the high market value for soybeans during that period and the technological advances in cultivating equipment. While the price of soybeans has stabilized, soybeans are expected to remain the primary crop grown in the basin. In recent years, the annual acreage cleared has decreased. Further clearing of bottomland hardwoods for agricultural activities is expected to be minimal with or without flood control improvements because of the extensive clearing that has occurred. Several large tracts of bottomland hardwoods still remain in the alluvial plain. These tracts are used for hunting and this use is expected to continue.

In the absence of further flood control improvements, the bottomland hardwoods and agricultural lands would continue to experience flooding during moderate and heavy rainfall over the basin. Underutilization of fertile and potentially more productive farm lands will continue as a result of frequent flooding and the high soil moisture content.

The wildlife resources of the alluvial plain are expected to change only nominally due to forest maturation and the associated increase in hard mast production. The projected periodic timber harvest would result in an increase in ground cover and understory vegetation. Water quality should continue to decline. Fishery resources in the project area are expected to increase slightly with the implementation of the Red River Waterway Project.

A major water resource improvement now underway is the Red River Waterway Navigation Project authorized by the River and Harbor Act of August 1968. This improvement would be adjacent to the western boundary of the Aloha-Rigolette area and is expected to have a favorable impact on the economy of the study area during construction and after the project is completed. The water resource conditions projected to exist with

of the Red River Waterway Project in place were taken as part of existing and future conditions for this study. The waterway project provides for a 200-foot by 200-foot navigation channel extending from the Mississippi River to Threaveport, Louisiana. Five locks and dams on the Red River are planned. The Aloha-Rigolette Basin is adjacent to the pools created by locks and dams 2 and 3. Construction of lock and dam 2 was initiated in 1984. Construction of lock and dam 3 is scheduled to be initiated in September 1985.

Extensive recreation plans have also been developed as part of the Red River Waterway Project and are to be implemented jointly by Federal and local interests. Several sites to be developed along the Red River for recreational use are located at Boyce, Colfax, Pineville, and Alexandria. Planned developments at these sites will vary from intensively developed sites to low density recreational areas. The Aloha-Rigolette area is within the recreation market area for the Red River Waterway Project and will be affected when these facilities are implemented.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Flood Problems. Flooding in the alluvial plain of the Aloha-Rigolette area is a result of overbank flooding. Prior to 1956, overflow from the Red River was a major cause of flooding in the basin. The project "Aloha-Rigolette Area, Grant and Rapides Parishes, Louisiana," completed in 1956, addressed both interior stream overbank flooding and Red River overflow flooding. The major aspect of this project was that it prevented flooding from the Red River by constructing a levee parallel to the river and channeled the entire basin runoff to two floodgates at the mouth of Bayou Rigolette. When stages are higher in the Red River than in Bayou Rigolette, the two 10- by 10-foot floodgates must be closed to prevent backwater flooding. During this condition, temporary storage of the water is required until the Red River stages recede. The area is then drained by opening the floodgates. The floodgates have been closed four times since construction.

When conditions on the Red River permit leaving the gates open, areas below elevation 82 feet are expected to be flooded more often than once in 35 years and would serve as a sump area. While no dedication or acquisition of the sump area was made as part of the 1956 project, virtually all the area was wooded. Since the 1956 project was completed, land use in the alluvial plain has changed greatly. Farmers, spurred by high returns on soybeans, have cleared 18,800 acres below elevation 82 feet for agricultural purposes. This clearing has resulted in increased runoff and stream siltation from the agriculture lands. Thus, the bayous that traverse the basin are taxed with larger volumes of water and the capacity of the bayous themselves has been slightly reduced by the added sediment load. The capacity of the bayous has been further reduced by channel vegetation growth. The existing floodgates were not designed to handle the volume of runoff now being generated in the basin. Consequently, runoff from moderate floods such as occur every 2 or 3 years causes streambank overflow in the alluvial plain and headwater ponding at the floodgates. While the flood problem is greatest near the lower alluvial plain, streambank overflow occurs throughout the middle and upper alluvial plains as well.

To estimate the average annual flood damages sustained in the alluvial plain, a hydrologic and hydraulic analysis and an economic analysis were performed. The result of these analyses indicated that on an average annual basis approximately 6,575 acres of cleared land are flooded. The average annual crop damages were estimated to be \$195,000 under existing conditions and the average annual noncrop damages were estimated to be \$109,000. No flood damages beyond those presently occurring were attributable to any future woodland conversion because the alluvial plain is extensively cleared and further clearing is not expected.

Flood Reduction Needs. There is a need to reduce or alleviate flood problems in the agricultural region of the Aloha-Rigolette area. Partial or full flood protection would reduce the financial risks involved in agricultural enterprises in the area. Agricultural lands could be used more efficiently and other noncrop flood damages could be reduced or eliminated.

Fish and Wildlife Needs. The most valuable wildlife habitat types in the study area are bottomland hardwoods and riparian (streamside) habitat. Due to the increasing nationwide scarcity of bottomland hardwood forests, a concerted effort should be made to avoid destruction of this significant resource. Destruction of riparian habitat should also be avoided because of its high value as wildlife habitat.

Recreational Needs. Within the alluvial plain, there is limited recreational potential due to the extensive private land holdings, extensive clearing, and limited public access. Population in the alluvial plain as well as in the overall study area is relatively low, which tends to reduce the level of recreational demands. Major activities for which needs exist include fishing, boating, and camping. Most of these activities can, however, be satisfied by resources within the wooded upland areas of the basin and by areas immediately adjacent to the study area. Latt Lake, Nantaches Lake, and the Kisatchie National Forest provide a resource that can adequately satisfy many of these needs. The Red River also offers a potential resource that will be greatly expanded on completion of the Red River Waterway project. These areas adequately support existing use and offer the best opportunities for facility development to accommodate future use levels.

Water Quality. Within the alluvial plain, the water quality is considered moderate to poor. The quality of the water decreases as it moves downstream through the agricultural alluvial plain. This is most likely due to the movement of sediment and chemicals from crop lands into the nearby bayous. The U. S. Department of Agriculture Soil Conservation Service (SCS) works with farmers in this area to control erosion of agricultural lands. Numerous measures such as crop residue management, tree planting, conservation tillage, cover, and green manure crops are presently being used in the area. While approximately 40 percent of the private landowners within the alluvial plain are cooperators with SCS and have developed conservation plans on their land, participation is expected

to increase. The problems of water quality as related to agricultural erosion are being addressed through SCS efforts. In this study, only the need to minimize the effects of each alternative plan on water quality were considered.

Summary of Stated Public Needs and Concerns. The concerns of the public were identified through correspondence, interviews with area residents, small working meetings with local agencies, and at a public meeting held at the beginning of this study. By far, the major concern was for agricultural flooding and the inadequate outlet capacity through the existing Bayou Rigolette floodgate. The concerns are summarized below:

- o The Louisiana Department of Transportation and Development, Office of Public Works (OPW), stated that the drainage system for the area has been taxed as a result of changed land use conditions and is unable to meet current needs. There are occasions after only moderate rainfall when large areas of land adjacent to Bayou Rigolette and its tributaries are flooded and excessive heads occur at the existing floodgate.

- o The Rapides Wildlife Association expressed concern that any improvements constructed by the Federal government to relieve flooding in the area would promote further clearing of wetlands. They also urged incorporation of project features to address the planning objective of maintaining fish and wildlife resources.

- o Numerous concerns were expressed that clearing and snagging without enlargement of the existing floodgate would cause greater flooding in the lower portion of the basin.

- o To address flooding near the existing floodgate, residents suggested reopening Bayou Darrow at Red River and installing a floodgate as a possible solution. The use of a pumping station at the site of the existing floodgate was also offered as a solution.

The prospective sponsors for a project in this area are the 19th Louisiana Levee District and the Red River, Atchafalaya, and Bayou Boeuf Levee District. Their jurisdiction is separated by the Grant-Rapides parish line that nearly bisects the alluvial plain. The concerns of residents residing within the jurisdiction of the 19th Louisiana Levee District (Grant Parish residents) generally differ from those of residents within the jurisdiction of the Red River, Atchafalaya, and Bayou Boeuf Levee District (Rapides Parish residents). Residents in Rapides Parish expressed concern that channel improvement would cause more water to enter the lower area and worsen the flood situation. Therefore, they preferred alternatives that increased the outlet capacity only at the existing floodgates. Residents in Grant Parish, however, expressed concern about both improvements in channel efficiency and additional outlet capacity into Red River. The preferences of both groups of parish residents were considered throughout the study process.

PLANNING CONSTRAINTS

Legislative and executive authorities specify planning 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.

PLANNING OBJECTIVES

Planning objectives are the national, state, and local water and related land resource management needs specific to study area that may be addressed under a given study authority. Below is a list of planning objectives for the Aloha-Rigolette area study based on identified and expressed water

resource problems, needs, and opportunities. The order of the listing should not be interpreted as an indication of priority although providing flood protection was the primary basis for the study authority.

- o Reduce flood losses in the alluvial plain of the Aloha-Rigolette area to increase agricultural production.

- o Avoid, where possible, destruction of bottomland hardwoods, riparian habitat, and wetlands in the alluvial plain of the Aloha-Rigolette area in order to maintain these resources as valuable habitat.

- o Minimize adverse environmental impacts associated with implementation of flood control improvements in order to maintain existing water quality and fish and wildlife resources in the alluvial plain of the Aloha-Rigolette area.

- o Avoid contributing to the destruction of archeological, historical, and paleontological resources in the Aloha-Rigolette area to preserve existing conditions.

ALTERNATIVE PLANS

MANAGEMENT MEASURES

To address the planning objectives, a list of resource management measures was developed. The measures include those suggested by the public and interested Federal, state, and local agencies. Both structural and nonstructural measures were included. Table 4 lists the management measures considered in this study.

TABLE 4
MANAGEMENT MEASURES
Aloha-Rigolette Area

1. Channel Enlargement	7. New Channels
2. Pumping Station (s)	8. Flood Plain Management
3. Floodgate (s)	9. Flood Retardation Structures
4. Reservoir (s)	10. Sediment Retention Basins
5. Modify Dam (Iatt Lake)	11. Clearing and Snagging
6. Flood Plain Acquisition	

DEVELOPMENT OF ALTERNATIVE PLANS

Based on the management measures identified and the planning objectives that each measure meets, 21 alternative plans were identified including a no-action alternative. The alternative plans used one or more of the management measures, which resulted in varying emphasis on the different economic, social, and environmental components of the planning objectives. Formulation of alternative plans that addressed flooding was guided by several concepts:

- o Control a greater amount of the large runoff above Iatt Lake.
- o Divert basin runoff to Red River upstream of the existing floodgate.
- o Improve the efficiency of evacuating runoff at the site of the existing floodgate.
- o Improve the capacity of bayous within the alluvial plain.
- o Allow flooding to continue and acquire flooded lands.

Using these concepts, plans were formulated on the basis of perceived effectiveness and for two flood conditions. One condition exists when the floodgates are open, and another exists when the floodgates are closed. The conceptual plans are listed below:

- Plan 1 Control large runoff above Iatt Lake by increasing lake storage capacity. This would be accomplished by raising height of the dam and providing for controlled release.
- Plan 2 Clear and snag Bayous Rigolette, Darrow, Marteau, Du Grappe, Sugarhouse, Caney, Saline, and Walden, diversion channel constructed as part of existing Aloha-Rigolette area project, and other bayous within basin as determined necessary to increase basin storage capacity.
- Plan 3 Enlarge bayous identified in Plan 2 in lieu of clearing and snagging, thereby providing greater basin storage capacity than Plan 2.
- Plan 4 Increase storage capacity of Iatt Lake and provide for controlled release (Plan 1). Clear and snag bayous identified in Plan 2.
- Plan 5 Increase outlet capacity by providing additional floodgates at site of existing Bayou Rigolette floodgate.
- Plan 6 Reopen closure of Bayou Darrow at Red River and install floodgates, evacuating headwater before lower basin areas are reached.
- Plan 7 Reopen closure of Bayou Darrow at Red River and install pumping station at the junction of Bayou Darrow and the Red River levee.
- Plan 8 Improve efficiency of major bayous identified in Plan 2 by clearing and snagging. Increase outlet capacity by installing a pumping station near the existing Bayou Rigolette floodgate.
- Plan 9 Same as Plan 8, but install additional floodgates adjacent to the Bayou Rigolette floodgate instead of pumping station.
- Plan 10 Redirect most of flow from Bayou Rigolette via Sam Bayou to new channel extending to Red River and provide for pumping station in the Red River levee two miles south of Colfax, Louisiana.
- Plan 11 Same as Plan 10, but provide a floodgate instead of pumping station two miles south of Colfax, Louisiana.

- Plan 12 Control runoff from wooded upland areas by providing a series of upstream reservoirs serving as small flood-retarding structures.
- Plan 13 Purchase lands frequently flooded in fee or title.
- Plan 14 Purchase flowage easement over lands frequently flooded.
- Plan 15 Institute program that encourages erosion-controlling agricultural practices through structural or non-structural measures (i.e., sediment retention basin).
- Plan 16 Zone flood plain (e.g., agricultural use, farmland, recreation use, wetlands, green border).
- Plan 17 Periodically draw down water of Iatt Lake for aquatic weed control to improve fishing resources.
- Plan 18 Clear and snag bayous identified in Plan 2 and acquire in fee or acquire an easement over lands subject to flooding when floodgates must be closed.
- Plan 19 Provide additional floodgates adjacent to the existing structure and acquire in fee or acquire an easement over lands subject to flooding when the floodgates are closed.
- Plan 20 Improve outflow to Red River by installing pumping station near existing floodgates.
- Plan 21 No action.

PRELIMINARY SCREENING OF ALTERNATIVE PLANS

As a result of preliminary assessment and evaluation of the 20 action plans, 8 plans were eliminated. The Aloha-Rigolette Area. Louisiana, Reconnaissance Report provides a detailed discussion of the assessment and evaluation of the conceptual plans. A summary of conceptual plans eliminated and the rationale are given in Table 5. The remaining 12 action plans and the no-action alternative were further developed, assessed, and evaluated in intermediate studies.

TABLE 5
CONCEPTUAL PLANS ELIMINATED AND RATIONALE
Aloha-Rigolette Area

Plan Nos.	Ineffective Overall Solution	Extremely Costly	Inefficient Solution	Publicly Unacceptable Unimplementable
2	X			
7		X	X	
10		X	X	
13				X
14	X			
15	X			
16	X			
17	X			

INITIAL INTERMEDIATE SCREENING OF ALTERNATIVE PLANS

In intermediate studies, plan formulation, evaluation, and assessment were conducted in two phases: initial intermediate and final intermediate. In each phase, the plans were developed in greater detail and screened against progressively stringent criteria. The initial intermediate phase focused

the formulation concepts from which the plans were developed to determine whether the study objective of reducing agricultural flood damage could be satisfied. Plans developed from concepts determined to be ineffective were eliminated from further study. The hydrologic and hydraulic models developed from engineering data gathered subsequent to the preliminary studies served as the basis of evaluation in this phase. The criterion used to evaluate the conceptual plans was the degree of stage lowering for the 3- and 5-year frequency events throughout the alluvial plain. The U. S. Soil Conservation Service has stated that projects in agricultural areas that provide protection between the 3- and 5-year events usually achieve the greatest benefits for the project investment. Environmental and economic impacts were considered but were not quantified in this phase. As a result of the analyses conducted in the initial intermediate phase, 6 of the 12 action plans were eliminated. The results are summarized in Table 6. A more detailed description of the initial intermediate screening is contained in Appendix A, Plan Formulation

FINAL INTERMEDIATE SCREENING OF ALTERNATIVE PLANS

The six action alternatives that remained after the initial intermediate phase were next analyzed for their technical and economic feasibility. Environmental impacts were considered but no mitigation measures were formulated. In addition to these six alternatives, a new plan was added to be assessed in the final intermediate phase. The new plan was designated the "no-structure" alternative and was developed because the existing Bayou Rigolette structure had been closed only four times since its construction in 1956. The plan would consist of removing the Bayou Rigolette structure and leaving a gap in the Red River Levee.

The major tasks in this phase were to size each plan and determine costs and benefits. The initial size of all plan components (floodgates, channel, pumps, etc.) was selected based on the magnitude of the flood program probable stage lowerings to be achieved, and the professional experience and judgment gained from studying other agricultural flood plains. A smaller and a larger option to the initial sizes were devised

TABLE 6
INITIAL INTERMEDIATE SCREENING
Aloha-Ripiolette Area

Conceptual Plans	Formulation Indices	3, 6, 5 Year Events			Environmental Feasibility Severe Impacts	Severe Social Impacts	Relative Cost	Likely Public Support	Considered Further
		Upper Alluvial Plain	Middle Alluvial Plain	Lower Alluvial Plain					
Plan 1 Increase Iatt Lake storage	1	Yes	No	No	Flooded uplands destroyed	Camps relocated	High	No	No
Plan 3 Modify major channels	4	2/	2/	2/	Riparian habitat destroyed	Highways and bridges relocated	Moderate	No	Yes
Plan 4 Increase Iatt Lake storage and clear 6 snap major bayous	1, 4	Yes	Yes	No	Flooded uplands and riparian habitat destroyed	Camp relocated	High	No	No
Plan 5 Additional floodgates on B. Ripiolette	3	Yes	Yes	Yes	None	None	Low	Yes	Yes
Plan 6 Floodgates on R. Darrow	2	Yes	Yes	Yes	Riparian habitat destroyed	Sum area created at Bayou Darrow	Moderate	Yes	Yes
Plan 8 Pumping station on B. Ripiolette and clear 6 snap major bayous	3, 4	Yes	Yes	Yes	Riparian habitat destroyed	None	High	Yes	No
Plan 9 Additional floodgates on B. Ripiolette and clear 6 snap major bayous	1, 4	Yes	Yes	Yes	Riparian habitat destroyed	None	Moderate	Yes	Yes
Plan 11 Floodgates on new channel via San B.	1, 2	Yes	No	No	Agricultural lands and woodlands destroyed	None	Moderate	Yes	No
Plan 12 Upstream reservoirs	1	Yes	No	No	Flooded uplands destroyed	Located in Washburne National Forest	Moderate	Yes	No
Plan 18 Clear 6 snap major bayous with fee or easement acquisition	4, 5	Yes	No	No	Riparian habitat destroyed	None	High	No	No
Plan 19 Additional floodgate on Bayou Ripiolette with fee or easement acquisition	1, 5	Yes	Yes	Yes	None	None	Moderate	No	Yes
Plan 20 Pumping station on B. Ripiolette	3	Yes	Yes	Yes	None	None	High	Yes	Yes
Plan 21 No Action	-	No	No	No	None	Permanent farm and pasture	-	-	-

- 1/ 1. Control a greater amount of the large runoff above late 1970s.
2. Divert basin runoff to Red River upstream of the existing floodgate.
3. Increase capacity to evacuate runoff at the site of the existing floodgate.
4. Improve the capability of bayous within the alluvial plain.
5. Allow floodgates, continue and acquire flooded lands.

2/ The project is considered a high priority for further study.
Initial intermediate planning will be done for further study.

3/ A water control plan will be developed for the existing floodgate, and a study will be conducted to determine the feasibility of a new floodgate. However, the project is not a high priority for further study.

for each plan. Engineering studies were then performed to determine the cost and degree of stage lowerings achieved with each option. The option of each plan that represented the median in terms of stage lowerings was then evaluated for its beneficial and adverse contributions.^{1/} Generally in agricultural areas, the primary benefits are directly associated with inundation reduction and intensification and the major adverse impacts are acres affected through direct construction and project-induced habitat alteration. The criteria used to assess the responsiveness of each median option were:

- o Acceptability - the workability of the alternative plan with respect to acceptance by state and local entities and the public.

- o Completeness - the extent to which an alternative provides and accounts for all necessary investments.

- o Effectiveness - the extent to which an alternative plan is technically feasible and alleviates the identified problems.

- o Efficiency - the extent to which an alternative plan is the most cost effective means of alleviating the problems identified and is consistent with protecting the nation's environment.

The contributions of those remaining options not evaluated further were inferred by comparing them to the median options. A detailed discussion of the evaluation process for all options is in Appendix A, Plan Formulation. Following is a summary of the median options:

^{1/} The median option is discussed as the "B" option in the appendixes to this report.

Plan 3 - Channel Modification. In this plan, channel modification would be required for Bayous Rigolette (including a portion of Walden Bayou), Darrow, Marteau, Du Grappe, Sugarhouse, Sam, and Saline. The degree of modification differed with each bayou and bayou segment. The channels to be cleared and snagged totalled 26.3 miles and those to be enlarged totalled 33.7 miles. A total of 1,400 acres would be affected by this plan. The estimated cost of this plan is \$10.3 million. Though measures to reduce environmental impacts were incorporated in the development of this plan, significant unavoidable impacts remain that would require mitigation. Mitigation costs were not estimated during the final intermediate phase of this plan or the other five plans.

The economic analysis for Plan 3 was completely negative. While the plan would produce moderate stage lowerings in the upper portions of the basins in the vicinity of Colfax, Louisiana, all options of Plan 3 would actually induce additional flooding in the lower basin near Pineville. The overall effect of the plan would be to increase flooding in the basin. All options of Plan 3 were dropped from consideration and annual cost and benefits were not computed.

Residents of the basin and local agencies have expressed the view that without additional means of evacuating the water into Red River, improvements in the efficiency and capacity of the channels would be unacceptable. The lack of support for this concept would probably make this plan unimplementable.

In summary, this plan is not economically feasible, is ineffective as a complete solution, would cause greater environmental impacts than other plans being considered, and appears to lack public support. Therefore, the plan was eliminated from further study.

Plan 5 - Bayou Rigolette Floodgates. There are at present two 10- by 10-foot gated culverts at the mouth of Bayou Rigolette. This plan would add four more 10- by 10-foot gated culverts. The additional floodgates

will require an inflow and outflow channel located just east of the existing structure. Approximately 20 acres would be required. The estimated cost of this plan is \$5.6 million. Based on economic studies, the average annual acres flooded would be reduced 43 percent, resulting in flood damage reduction and intensification benefits of \$966,000 annually. The average annual cost would be \$561,000, not including environmental costs, giving a benefit-to-cost ratio of 1.7.

The concept of additional floodgates is generally acceptable to residents throughout the basin and to local and state agencies. This plan appears to be an effective and efficient solution to the flood problem that would cause few environmental impacts. Therefore, further study of the plan is warranted.

Plan 6 - Bayou Darrow Floodgates. This plan was reformulated to be more responsive to the desires of area citizens. In the proposed initial plan, runoff would be diverted from the Bayou Darrow-Saline watershed (44 square miles) through a floodgate on Bayou Darrow. The relief from flooding under this proposal was only minimal. To respond to local interests' request for further analysis of this plan, diversison of the watershed runoff above the juncture of Bayous Darrow and Rigolette (300 square miles) was considered. Features of this plan include an earthern closure on Bayou Rigolette and Bayou Saline, removal of the closure that now exists between Bayous Darrow and Rigolette, channel modification, and five 10- by 10-foot gated culverts.

A total of 12.4 miles of channel would be cleared and snagged and 10.8 miles would be enlarged. An estimated 323 acres of land would be required. The cost of this plan would be \$11.0 million. Based on economic studies, this plan would reduce the average annual acres flooded by 81 percent, resulting in flood damage reduction and intensification benefits of \$1,704,000. With an average annual cost of \$1,244,000, not including environmental costs, the benefit-to-cost ratio is 1.4.

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This plan would probably be acceptable to the public. The environmental impacts, though not quantified, would be moderate to significant in comparison to other plans. At the proposed Bayou Darrow floodgates, a sump area would be necessary, possibly causing institutional problems. Based on these considerations, further study of the plan is warranted.

Plan 9 - Bayou Rigolette Floodgates and Clearing and Snagging. This plan proposes installation of four 10- by 10-foot gated culverts adjacent to the existing structure and clearing and snagging 60 miles of channels. The bayous affected by channel modification are Rigolette, (including a portion of Walden Bayou), Darrow, Marteau, Du Grappe, Sugarhouse, Sam, and Saline. The plan would affect approximately 1,124 acres through construction and disposal activities. The estimated cost is \$9.4 million. With this plan, the average annual acres flooded would be reduced by 56 percent, yielding flood reduction and intensification benefits of \$1,126,000. The annual charges would be \$980,000, yielding a benefit-to-cost ratio of 1.15.

The benefit-to-cost ratio for Plan 9B appears positive, but it does not include mitigation costs. Though the mitigation plans have not been finalized, initial studies show that the least costly plan would be \$2.3 million. Adding \$2.3 million to the cost side of Plan 9B would bring the B/C ratio down to 0.9. Plan 9A, 9C, and 9D would also have the same mitigation requirements and would be marginal at best. Plan 9A involved adding two 10- by 10-foot floodgates adjacent to the two existing 10- by 10-foot floodgates. Plan 9B involved the addition of four 10- by 10-foot floodgates and Plan 9C involved the addition of six 10- by 10-foot floodgates. A fourth option, Plan 9D, involved adding 8 more 10- by 10-foot floodgates adjacent to the existing structure. Throughout the study period, local residents have advanced the concept of additional floodgates plus channel modification as an acceptable alternative. In an attempt to give upstream channel improvements every possible opportunity for inclusion in a final plan, three additional alternatives were formulated and tested in this phase. Three of the plans involved incremental clearing and snagging and the third involved selective clearing

Plan 9B1 would consist of four 10- by 10-foot floodgates and clearing of one-third of the major streams in the flood plain. In Plan 9B1, Bayou Rigolette would be cleared and snagged. Plan 9B2 would consist of four 10- by 10-foot floodgates and clearing of two-thirds of the major streams. In Plan 9B2, all major streams except Bayous Du Grappe and Sugarhouse would be cleared. Plan 9B3 would include a four-culvert floodgate and clearing and snagging of all major streams in the flood plain, including Bayous Du Grappe and Sugarhouse. Plan 9B4 would consist of four additional culverts and selective clearing and snagging of the entire 60 miles of major streams in the flood plain. Selective clearing involves only the removal of in-stream obstructions and overhanging trees. In the analysis of 9B1 thru 9B4, Plan 9B3 emerged as the most efficient and had the highest B/C ratio. However, when mitigation costs were included, the B/C ratio was less than 1.

This plan does not provide an effective and efficient solution to the flood problem. The environmental impacts would appear to be moderate to significant in comparison to other plans, but none of the plan options are economically justified. Therefore, no further study on these plans is warranted.

Plan 19 - Bayou Rigolette Floodgates and Fee Acquisition or Easement. This plan provides for installing four 10- by 10-foot gated culverts adjacent to the existing structure as in Plans 5 and 9. However, to address the condition that exists when the floodgates are closed, acquisition in fee or a flowage easement was considered. Analysis of this concept determined that approximately 30,800 acres would flood from a 3-year event when the floodgates were closed. To acquire any ownership rights over this magnitude of land is contrary to the NED objective, would be unacceptable to the public, and counterproductive to the national economy.

This plan was reformulated to better address the study planning objectives. In cooperation with the U.S. Fish and Wildlife Service, the concept of a "no-development" easement was explored as a means of

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preserving bottomland hardwoods. Induced clearing was considered a possibility at this stage of planning because of past experience with other agricultural projects, namely, McKinney Bayou and Posten Bayou. Studies indicated that in both of these projects, induced clearing would have occurred. It was proposed that wooded lands within the 5-year, with-project flood plain be acquired (2,181 acres). This feature, combined with the floodgates, was then analyzed. The results indicated that the plan would cost \$7.0 million and yield benefits equal to Plan 5 (\$966,000 in average annual benefits). Based on annual charges of \$705,000, not including environmental costs, the benefit-to-cost ratio is 1.4.

Plan 19 appears to provide an effective and efficient solution to the flood problem. Further study of this plan is warranted.

Plan 20 - Pumping Station. This plan provides for installation of a 2,000-cfs-capacity pumping station just west of the existing floodgates. The pumping station would require an inflow and outflow channel. An estimated 18 acres would be required for the channel and structure rights-of-way. The cost of this facility would be approximately \$35.4 million. Based on the hydraulic and economic studies, the average annual flooded acres would be reduced 65 percent. The flood damage reduction and intensification benefits would be \$678,000 annually. With annual charges of \$3,999,000, the benefit-to-cost ratio was 0.15. Since the cost of this plan was substantially greater than the benefits derived, further study was not warranted.

Plan 21 - No Action. Flood damage, presently estimated at \$304,000 per year, will continue to occur if improvements in basin drainage are not implemented. The main concern of local residents at the public meeting and in correspondence was for additional flood control. The no-action plan will not address the flood problems in the basin and is unacceptable to local interests. The no-action plan, which in reality is existing conditions, was retained through the screening process for comparison purposes.

PLAN 22 - "No-Structure" Plan

This plan consists of removal of the existing Bayou Rigolette structure at Red River, leaving a gap in the existing levee. The gap would be sized so as to convey the Bayou Rigolette design flow without causing additional flooding along Bayous Rigolette and Du Grappe. This plan was considered because the existing Bayou Rigolette has been used to control Red River flooding only four times since 1956. The plan would allow free discharge of Bayou Rigolette into Red River and also free access of the Red River into the Bayou Rigolette Basin. Hydraulic studies show that 6,200, 24,000, and in excess of 36,500 acres of cleared land in the Bayou Rigolette Basin would be flooded during a return of the 5-, 25-, or 100-year-frequency floods, respectively. The 100-year-frequency flood would produce a stage in the basin 1.7 feet in excess of the maximum stages of record and 77 percent of the cleared land in the basin would be flooded. Detailed benefits and costs were not computed. While this plan could be effective during low flow on the Red River, it would be disastrous during high Red River floods. For this reason, further study was not warranted.

Summary of Final Intermediate Screening. Based on the analysis in this screening phase, Plans 5, 6, and 19 were found to warrant further study. Plan 5 provides for additional floodgates adjacent to the existing Bayou Rigolette structure. Plan 6 provides for similar floodgates at Bayou Darrow and moderate channel improvements. Plan 19 provides for additional floodgates as in Plan 5 and "no-development" easements to protect the bottomland hardwoods against clearing. Plans 3, 9, 20, and the "no-structure" plan (Plan 22) were eliminated because they were not economically feasible, not publicly acceptable, or not effective or efficient solutions to the flood problem.

PRESENTATION AND EVALUATION OF PLANS SELECTED FOR DETAILED STUDY

During the intermediate studies, several optional sizes were developed but only the median option was analyzed. In this detailed study phase, the objective was to determine the optimum size for Plans 5, 6, and 19 by

further assessing and evaluating all options. The environmental costs to offset unavoidable adverse impacts were fully explored in this phase and were incorporated into each plan as appropriate.

DEVELOPMENT OF DETAILED PLANS

Plan 5 - Bayou Rigolette Floodgates. In addition to the option of adding four 10- by 10-foot floodgates, options adding two, six, and eight floodgates were studied in detail. These options were termed Plan 5A, Plan 5B, Plan 5C, and Plan 5D to correspond to 2, 4, 6, and 8 floodgates, respectively. Each option would affect approximately 20 acres, and would require a 680-foot inflow channel and a 1,010-foot outflow channel.

Plan 6 - Bayou Darrow Floodgate. Optional sizes for Plan 6 were developed by varying the number of floodgates and combining them with channel modification, channel closures, and removal of an earthen closure. Plan 6A, 6B, 6C, and 6D included four, five, six, and seven 10- by 10-foot floodgates, respectively. A total of 12.4 miles of channel would be cleared and snagged and 10.8 miles enlarged under Plans 6A and 6B. The enlargement under Plan 6A is, however, greater than the enlargement proposed under Plan 6B. Plans 6C and 6D incorporated only clearing and snagging of 23.2 miles. The land requirement for Plan 6A is 366 acres, for Plan 6B is 323 acres, and for Plans 6C and 6D is 302 acres.

Plan 19 - Bayou Rigolette Floodgates and Fee Acquisition or Easements.

This plan combines the floodgates described in Plan 5 with "no-development" easements over lands subject to induced clearing.

For each of the three plan options, an estimate was made of the wooded lands that would be affected. Plan 19A would require an easement over 3,178 acres, Plan 19B requires an easement over 2,180 acres, and Plan 19C requires an easement over 1,963 acres.

Subsequent to evaluation of this plan, studies were completed on project-induced clearing. The conclusion from these studies was that little, if any, additional clearing would be induced by implementation of a flood control project. Therefore, the need to prevent further clearing of bottomland hardwood was dismissed and this plan was not studied further.

Mitigation Planning. During the planning process for Plans 5, 6, and 19, care was taken to minimize environmental impacts. Where unavoidable adverse environmental impacts would still result, various mitigation measures were considered. The floodgates in Plan 5 and 6 would affect 20 and 35 acres, respectively, of a non-unique habitat type. The adverse impacts on this habitat area would be minimal and did not warrant development of a mitigation plan.

The three plans would not induce the clearing of any bottomland hardwoods. However, the reduction of overbank flooding during the fish spawning season is considered significant. In addition, Plan 6 would cause significant adverse environmental impacts on riparian habitat and fishery resources because of the channel improvement.

To compensate for Plans 5 and 19, which would produce identical fish spawning impacts, two mitigation options were explored. The first of these was to create a spawning area that could be used on a yearly basis. This option required the construction of both a water control structure and a low levee. The second option was less costly and better satisfied the planning objectives. In this option, the periodic drawdown of Iatt Lake was facilitated to help control the aquatic plant growth problem. This option would require the purchase of a flowage easement on 100 acres of woodlands and 70 acres of cropland. Because of the low cost and the beneficial effect on Iatt Lake, the second option was selected for inclusion in Plans 5 and 19. The actual acreages, costs, and benefits for each option of Plans 5 and 19 are shown below:

MITIGATION FOR PLANS 5 AND 19

<u>Plan</u>	<u>Flowage easements on:</u>		<u>Annual</u>	<u>Annual</u>
	<u>Agricultural (AC)</u>	<u>Woodland (AC)</u>	<u>Cost</u>	<u>Benefits</u>
5A, 5B, 5C, 5D, 19A, 19B, and 19C	70	100	\$16,000	\$74,000

Since Plan 6 would adversely affect riparian habitat and fishing resources and would reduce fish spawning opportunities, compensation of a greater scope was considered. To negate the unavoidable adverse impacts of Plan 6 several mitigation measures were evaluated. The preferred plan consists of the purchase in fee and reforestation of about 700 acres of agricultural lands and the acquisition of a flowage easement on about 70 acres of woodlands. Some of these areas are subject to flooding with the drawdown of Iatt Lake. This mitigation option would fully compensate for project losses by creating suitable wildlife habitat and by substantially increasing the fishery resources in Iatt Lake. The actual acreages, costs, and benefits of each Plan 6 option are shown below:

MITIGATION PLANS

<u>Plan</u>	<u>Agricultural lands</u>	<u>Flowage easements</u>	<u>Annual</u>	<u>Annual</u>
	<u>Purchased in fee (AC)</u>	<u>On woodland (AC)</u>	<u>Costs</u>	<u>Benefits</u>
6A	705	100	\$145,000	\$81,000
6B	645	100	\$134,000	\$81,000
6C	615	100	\$128,000	\$81,000
6D	615	100	\$128,000	\$81,000

Biological and Water Quality Impacts. Implementing any option of Plans 5 and 19 would result in significant adverse environmental impacts because of the reduction in overbank flooding during fish spawning season. Implementation would result in only minimal loss of wildlife habitat (18 acres of forest habitat and 2 acres of open water). These plans would, however, slightly increase the fishery resources by creating the inflow and outflow channels and mitigate for reduction in overbank flooding by facilitating the periodic drawdown of Iatt Lake. Temporary increases in turbidity and lowered dissolved oxygen may occur in the immediate vicinity of the existing floodgates and for a short distance downstream during construction.

Implementing any option of Plan 6 would result in significant adverse impacts, primarily because of the channel improvement feature and the reduction of overbank flooding during spawning season. Impacts associated with the floodgate feature of this plan and subsequent reduction of flooding are similar to the impacts of Plan 5. Adverse impacts of the channel improvement can be divided into those affecting terrestrial resources and those affecting aquatic resources. Impacts associated with terrestrial resources would result from clearing the 267 acres of wooded habitat within the 427 acres of riparian habitat affected by this alternative. These riparian lands are highly valuable for wildlife. The adverse impacts on aquatic resources are associated with the removal of in-stream vegetation and the change in water quality. The in-stream vegetation provides food and cover for fish and shades the water from solar radiation. Clearing and snagging and erosion from the denuded banks adversely affect the water quality by resuspending sediments into the water column. Water quality impacts will occur during construction and for several years until the channel banks revegetate.

Cultural Resource Impacts. There are presently no recorded sites or National Register of Historic Places properties in the 20-acre and 35-acre

areas proposed for floodgate construction with Plans 5 and 6, respectively. There are no sites in the 427 acres affected by channel improvement in Plan 6. However, the probability is very high that additional, unrecorded historic sites are present in the upper Bayou Rigolette Basin along Bayous Rigolette, Du Grappe, Sugarhouse, and Sam and the mouths of Bayous Darrow and Marteau, which could be affected by channel improvements. Seasonal elevation changes in Iatt Lake may adversely affect four prehistoric lithic scatters (16GR 5, 6, 11, and 12) and two prehistoric mounds (16GR 2 and 7) by increasing erosion and bank slumping. Additional similar sites can be expected to be exposed along the bankline during low water seasons.

Recreational Impacts. Recreational hunting impacts associated with Plans 5 and 19 are minimal. The plan would cause a reduction of 40 annual man-days of hunting (less than one percent of the total) with an annual estimated value of \$1,000. Impacts on recreational fishing are potentially great because of the reduction of overbank flooding during fish spawning season. Without a good deal of research, these impacts could not be quantified.

With the implementation of Plan 6, a total of 517 hunting acres would be affected. This would reduce annual man-days of hunting by 456 man-days. The estimated annual value of the reduction is \$4,000. The adverse impacts on potential sport and commercial fisheries from clearing and snagging were estimated at \$32,000 annually by the U.S. Fish and Wildlife Service.

To compensate for the fishery habitat loss associated with Plans 5 and 19, Iatt Lake would be rejuvenated by management techniques, including periodic lowering of the lake. The lowering would flood about 100 acres of woodlands and 70 acres of croplands. Based upon limited access to the lake and competitive fishing areas in the region, an increase in man-days of fishing is not expected. However, the quality of fishing would be greatly enhanced by the elimination of aquatic weeds and an increase in the fish population. Iatt Lake currently supports an estimated 45,000 annual man-days of fishing with an annual value of \$147,000. With improved

to losses due to drawdowns, the quality and value of the experience would be increased to \$221,000, a \$74,000 increase over the base condition. The total benefits attributable to the mitigation measure for Plans 5 and 19 are \$74,000.

To compensate for the hunting, fishing, and habitat losses associated with drawdown, a mitigation plan was formulated. To compensate for the riparian loss, between 615 and 705 acres of agricultural land would be acquired in fee with a floodage easement on 100 acres of woodland. This land will be managed and converted into a forested area, part of which would be periodically flooded by the lowering of Iatt Lake. An annual potential for 100 man-days of waterfowl hunting, 270 man-days of large game hunting, and 100 man-days of small game hunting with a total value of \$7,000 will be created with this plan.

As compensation for the fisheries loss, including the reduction of spawning area, Iatt Lake will be rejuvenated as described in Plan 5.

Economic Impacts. The economic impacts of alternative Plans 5A through 5D and 6A through 6C are discussed in detail in Appendix D, Economic Analysis. The construction costs, average annual costs, average annual benefits, and benefit-to-cost ratios for all options are summarized in Table 7. The costs are based on 1985 price levels and are amortized at 8-3/8 percent over a 50-year period. The first cost of mitigation for Plans 5A through 5D and Plans 19A through 19C is \$80,000. The first costs for Plan 6 are: 6A-\$1,720,000, 6B-\$1,580,000, and 6C and 6D-\$1,500,000 for mitigation measures. The benefit categories common to all options were crop and noncrop damage reduction, intensification, and mitigation. Damage reduction benefits accrue on lands where there is no change in cropping patterns between the with- and without-project conditions. The benefits represent the reduction in average annual crop and noncrop flood damages and increases in net income due to an alternative plan. Intensification benefits accrue on lands where there is a change in cropping patterns as a result of project installation. These benefits are from increased acreages of basic crops and are measured as the net value of the increased

TABLE 7

ECONOMIC IMPACTS OF PLANS

January 1985 Prices
(8-3/8 Percent)

Items	Floodgates				Floodgates and Channel Improvement			
	5A	5B	5C	5D	6A	6B	6C	6D
(\$000)								
Total First Cost ^{2/}	\$4,500	\$5,700	\$6,900	\$8,120	\$13,320 ^{1/}	\$12,580 ^{1/}	\$12,200 ^{1/}	\$13,200 ^{1/}
Average Annual Cost	474	577	731	846	1,467	1,414	1,370	1,481
Interest (8-3/8%)	(412)	(507)	(652)	(759)	(1,194)	(1,144)	(1,104)	(1,207)
Amortization (50 yrs)	(8)	(9)	(12)	(14)	(22)	(21)	(20)	(22)
Operation & Maintenance	(6)	(13)	(19)	(25)	(39)	(48)	(51)	(57)
On-Farm Drainage	(31)	(31)	(31)	(31)	(31)	(31)	(31)	(31)
Environmental Losses	(1)	(1)	(1)	(1)	(36)	(36)	(36)	(36)
Mitigation Costs	(16)	(16)	(16)	(16)	(145)	(134)	(128)	(128)
Average Annual Benefits	844	1,041	1,225	1,317	1,798	1,785	1,749	1,749
Damage Reduction								
Crop	(535)	(686)	(833)	(906)	(1,249)	(1,240)	(1,217)	(1,217)
Non-Crop	(96)	(100)	(102)	(103)	(105)	(105)	(104)	(104)
Intensification	(139)	(181)	(216)	(234)	(363)	(359)	(347)	(347)
Mitigation	(74)	(74)	(74)	(74)	(81)	(81)	(81)	(81)
Net Economic benefits	370	464	494	471	331	371	379	268
Benefit-Cost Ratio	1.8	1.8	1.7	1.6	1.2	1.3	1.3	1.2

^{1/} Includes mitigation as follows: Plan 6A - \$1,720,000, Plan 6B - \$1,580,000, and Plans 6C and 6D - \$1,500,000.^{2/} Does not include preauthorization study cost of \$845,000.

mitigation benefits represent the value of additional man-days of hunting and fishing gained with the mitigation measures.

The estimated annual charges include the interest and amortization of the project fixed cost and mitigation cost, operation and maintenance, environmental losses and on-farm drainage cost. The environmental losses are in two areas: hunting resources and fishery resources. With Plan 5, there are \$1,000 in hunting losses plus fish spawning, which could not be quantified. With Plan 6, annual hunting and fisheries losses were estimated to be \$36,000.

The on-farm drainage cost (\$31,000) represents an estimate of the expenses private land owners would incur after project implementation in order to obtain increased agricultural crop yields.

Water Conservation. In addition to assessing and evaluating the environmental and economic impacts of each plan, the plans were reviewed for water conservation opportunities. Water conservation has been defined as any beneficial reduction in water use or in water losses. It was determined that water use or losses would not be affected by the plans and that the improvements necessary for flood control do not provide practical opportunities for water conservation.

EVALUATION AND TRADE-OFF ANALYSIS

System of Accounts. The significant impacts of each plan were evaluated to establish the contributions to National Economic Development (NED), Environmental Quality (EQ), Regional Development (RD), and Social Well-Being (SWB). The impacts of the plans on these four accounts were evaluated against existing and future conditions in the Aloha-Rigolette area. A detailed display of the impacts by account is presented in Table A-3-4, Appendix A, Plan Formulation. A summary of the significant impacts and those that were determining factors in selecting a plan are presented in Table 8.

Alpha-Rigolite Area

C. Regional Economic Development 1/
D. Social Well-being 1/

Aloha-Rigolette Area

1/ All costs on this table are shown as \$1,000.
2/ Includes the cost of the U.S. Fish and Wildlife Service.
3/ Includes SWS impact assessment and evaluation were not crucial to plan selection and therefore, not displayed. See Table A-3-4, Appendix A, Impact Assessment, for display of ID and SWS impacts.

2/ Fisheries losses were estimated by the U. S. Fish and Wildlife Service.

3/ RD and SWB impact assessment and evaluation were not crucial to plan selection and therefore, not displayed. See Table A-3-4, Appendix A, Plan Formulation, for display of RD and SWB impacts.

Trade-Off Analysis. The information presented in the systems of accounts provides the basic framework for the trade-off analysis. Contributions to NED benefits are only a part of the trade-off analysis. Other aspects involve the quantitative information on the social and environmental values of each plan. The plan with the greatest net economic benefits consistent with protecting the nation's environment is selected unless deviation is justified on the basis of trading-off contributions of the other plans.

Plans 5A through 5D and 6A through 6D would all reduce agricultural flooding in the alluvial plain, though not to the same degree. Floodgates, which were determined to be a necessary component in developing effective and efficient plans, are contained in all Plans 5 and 6 options. The floodgates in Plan 5 would be located at Bayou Rigolette and the floodgates of Plan 6 would be at Bayou Darrow. The incremental difference in degree of protection between Plans 5 and 6 ranges between 25 and 55 percent. The difference in first costs, however, ranges between 38 and 66 percent. Thus, the added increments of protection are obtained at much higher increments of cost. New excess benefits are all greater with the options of Plan 5.

Plan 5A is the least expensive of all plans and is fourth in terms of net benefits. The most expensive is Plan 6A, which is seventh in terms of excess benefits. Plan 5C, approximately \$2.4 million more expensive than 5A and approximately \$6.4 million less expensive than 6A, provides the greatest excess benefits of all plans. The optimal option of Plan 5 is 5C and the optimal option of Plan 6 is 6C.

The environmental impacts of Plan 6 are much more severe than Plan 5. Plan 5 would affect 20 acres of woodland in constructing the floodgates and reduce the fish spawning season. Mitigation for Plan 5 would include the periodic drawdown for Iatt Lake plus flowage easements of 170 acres of land, 70 acres of which would be agricultural. Plans 6A, 6B, 6C, and 6D would affect 441, 448, and 427 acres of riparian habitat through channel modifications in addition to the 35 acres, 9 cleared, needed for the

floodgates. All the Plan 6 options would require the acquisition of 615 and 705 acres of agricultural lands for reforestation as mitigation of environmental losses along with flowage easements on 100 acres of woodland. The social impacts of the eight plan options are minimal and are essentially equal. All options are acceptable to local interests.

Therefore, the choice of alternative plans is between 5C and 6C. The average annual acres flooded are reduced 49 percent with Plan 5C and 78 percent with Plan 6C. The cost of Plan 5C is \$6,900,000 and the cost of Plan 6C is \$12,200,000. The environmental impacts are much greater with Plan 6C. Local interests would support either plan.

SELECTION OF FINAL PLAN

National Economic Development Plan. The NED plan is defined as the plan that provides the greatest net benefits consistent with protecting the nation's environment. Plan 5C, which provides for installation of six additional floodgates, has the greatest net benefits and is, therefore, the NED plan. The average annual costs are \$731,000 and the average annual benefits are \$1,225,000, resulting in net economic benefits of \$496,000. The benefit-cost ratio of Plan 5C is 1.7 to 1.

Rationale For Tentatively Selected Plan. The options developed for Plan 5 are the most desirable from a national economic development and environmental quality perspective. The options developed for Plan 6 provide greater degrees of protection but at a disproportionate increase in cost. The selection of a plan would represent a trade-off among cost, degree of protection, and environmental quality.

The two plans worthy of final consideration are Plan 5C and Plan 6C. Of these, the tentatively selected plan is 5C. This plan has greater excess benefits over cost than Plan 6C and far fewer environmental damages. Further, the cost to achieve an additional 32 percent reduction in average annual acres flooded would increase the total cost of the project 93 percent.

TENTATIVELY SELECTED PLAN

DESCRIPTION OF PLAN

The tentatively selected plan consists of six additional floodgates installed adjacent to the existing Bayou Rigolette structure (see Plates 2 and 3). The six gates would each be 10 feet by 10 feet wide and 210 feet long and would be constructed of reinforced concrete. An electrically operated vertical lift gate would control the flow through each boxed opening. The floodgates would be located approximately 600 feet east of the existing structure. An inflow and an outflow channel would convey flow away from Bayou Rigolette just south of the Kansas City Southern Railway. The inflow channel would be 680 feet and the outflow channel 1,010 feet. The bottom width for both channels would be 100 feet with the banks sloped 1V on 3H. The floodgates would reduce overbank flooding during fish spawning season. Mitigation includes purchase of 170 acres of flowage easements to facilitate the periodic drawdown of Iatt lake to improve fisheries.

DESIGN AND CONSTRUCTION CONSIDERATIONS

The design criteria for the six additional floodgates are:

- o To provide maximum stage lowerings consistent with that economically supported by damages prevented.
- o To function in concert with the existing structure to reduce flood levels and minimize the duration of flooding.

The dimensions for the new floodgate were selected so that proper submergence could be maintained on the structure. The location of the structure was selected to minimize the inflow channel length and to avoid relocation of the Kansas City Southern Railway just upstream of the existing structure.

OPERATION AND MAINTENANCE CONSIDERATIONS

The operation and maintenance cost of the floodgate structure is estimated at \$19,000 annually. Operation and maintenance for the mitigation measure is estimated at \$10,000 annually. The mechanical replacement interval is 50 years, which is the same as the project life. Therefore, no major replacement cost would be required. The annual cost reflects general maintenance (i.e., painting, minor repairs, lubrication) and anticipated labor costs for operation.

While it is not the purpose of this report to prescribe detailed operation procedures, some observations relative to the floodgate structure operation are appropriate. The operation of the structure must be tailored to meet two general objectives: the prevention of backwater flooding from Red River and the discharge of flood flows from the protected area. To meet these objectives, the floodgates will be kept open at all times until conditions on the Red River restrict flow from the basin. Operation of the six proposed floodgates should be consistent with operation of the two existing floodgates. Detailed criteria for the structure operation will be developed in post-authorization studies. It should be noted that nothing in this report is to be construed as removing or altering local interests responsibilities for operating and maintaining the improvements of the existing Aloha-Rigolette, Grant and Rapides project, authorized by the Flood Control Act of 18 August 1941.

PLAN IMPLEMENTATION

The division of responsibility for implementation of the tentatively selected plan between Federal and non-Federal interests is based on current Federal legislation (traditional policy). The present administration has proposed changes in this policy, favoring greater participation by non-Federal interests. Costs for the tentatively selected plan will be discussed in a manner consistent with approved legislation, but will be displayed under the traditional and proposed policy.

COST-SHARING POLICY

Cost-sharing policies for water resources projects under the jurisdiction of the Corps of Engineers have evolved over the years through various acts of Congress. Legislative authorization has defined general rules for cost sharing or has prescribed percentages of cost required by non-Federal entities depending on the purpose of the project. The purpose of the Aloha-Rigolette project is that of local flood protection. The traditional cost-sharing policy for this purpose is that 100 percent of the construction first cost is to be borne by the Federal government and non-Federal interests are required to provide all lands, easements, and rights-of-way, and all alterations and relocations to utilities, streets, bridges (except railroad bridges), buildings, storm drains, and other structures and improvements; to hold and save the United States free of damages due to the construction works; and assure operation and maintenance of the works after completion in accordance with regulations prescribed by the Secretary of the Army.

The present administration is reviewing project cost sharing and financing across the entire spectrum of water resources development and has proposed revised policy. The basic principle governing the

development of specific cost-sharing recommendations is that, whenever possible, the cost of services produced by water projects should be paid for by their direct beneficiaries. It is also recognized that the Federal government can no longer bear the major portion of water project financing. New sources of project financing, both public and private, will have to be found. While policy specifically applicable to this project has not yet been established, non-Federal interests can expect that under the present administration's financing and cost-sharing principles the level of their financial participation will need to be significantly greater than in the past. The administration has proposed that cost sharing for flood control be 65 percent Federal and 35 percent non-Federal (see Table 9).

FEDERAL RESPONSIBILITIES

After congressional authorization and funding, the Federal government would design and prepare plans for the authorized project. After execution of the required non-Federal responsibilities, the United States would implement and supervise the work until completion of the project.

The presently estimated Federal share of the total first cost of the tentatively selected plan is \$6,886,800. There would be no Federal share for annual operation and maintenance of the project.

NON-FEDERAL RESPONSIBILITIES

Under the traditional cost-sharing policy, there is no non-Federal share of the construction costs. However, provisions for greater cost sharing are under review by the present administration. Prior to construction of this project, non-Federal interests would be required to:

- Provide without cost to the United States all lands, easements,

TABLE 9
COMPARISON OF COST SHARING

January 1985 Prices
8-3/8 Percent

Item	Traditional Policy	Present Admini- stration Initiative
	(\$000)	
Total First Cost	\$6,900.0	\$6,900.0
Federal	6,886.8	4,485.0
Non-Federal	13.2	2,415.0
Average Annual	\$ 731.0	\$ 731.0
Federal	670.0	475.0
Non-Federal	61.0 ^{1/}	256.0 ^{1/}

^{1/} Includes \$19,000 for project operation and maintenance, \$10,000 for mitigation operation and maintenance, \$31,000 for on-farm drainage, and \$1,000 for interest and amortization on first cost.

rights-of-way, disposal areas, and the relocation of bridges (except railroad bridges) and roads, pipelines, and utilities that may be required for construction of the project, presently estimated at \$13,000;

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

- o Operate and maintain the works, including mitigation, after completion in accordance with regulations prescribed by the Secretary of the Army.

- o Provide in the form of cash or contributions equal in value as may be agreed upon the costs of mitigation in the same proportions as the total costs for flood control, presently estimated at \$200;

In addition, the non-Federal entity must agree to comply with the following:

- o Section 221, Public Law 91-611, approved 31 December 1970, as amended, provides that the construction of any water resource project by the Corps of Engineers shall not be started until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project;

- o Section 601 of Title VI of the Civil Rights Act of 1964 (PL 88-352) that no person shall be excluded from participation in, denied the benefits of, or subjected to discrimination in connection with the project on the grounds of race, creed, or national origin; and

- o The applicable provisions of the Uniform Relocation Assistance Policies Act of 1970, Public Law 91-646.

**DRAFT
ENVIRONMENTAL IMPACT STATEMENT**

ALOHA - RIGOLETTE AREA, LOUISIANA

Grant and Rapides Parishes, Louisiana

June 1985

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

ABSTRACT: Bayou Rigolette is located entirely within the Red River floodplain and flows southeasterly from the Iatt Lake Dam to Red River. The original Federal project, completed in 1956, provided adequate flood protection to the area through levees, clearing and snagging, diversion channels, and floodgates. The current study was authorized in 1974 as a result of public concern for continued agricultural flood damages experienced in the study area. The primary purpose of this study, therefore, is to develop a plan which would reduce those agricultural damages. Of the 22 alternatives proposed, only three were carried into final consideration. Plan 5C consists of the construction of six new floodgates and the purchase of flowage easements on 170 acres of land to facilitate the periodic drawdown of Iatt Lake to improve fisheries; Plan 19C consists of the same features as 5C, but also includes the acquisition of a "no development easement" over 1,963 acres of wooded lands; and Plan 6C consists of the reconnection of Bayou Darrow to the Red River and some channel improvements. It also includes flowage easements to facilitate the drawdown of Iatt Lake and purchase of 615 acres of agricultural land which would be reforested to mitigate for impacts of channel improvement. The net excess benefits and the benefit-to-cost ratios differ substantially for those plans. Plan 5C has the greatest net economic benefits and fully addresses the goal of National Economic Development; therefore, it is tentatively selected for recommendation.

DATE: SEP 14 1985

Send your comments by the date stamped above to the District Engineer, U.S. Army Corps of Engineers, New Orleans District, LMNPD-RE, P.O. Box 60267, New Orleans, Louisiana, 70160-0267. For further information regarding this statement, please contact Dr. Steve Mathies, LMNPD-RE, at the address above, or by commercial telephone (504) 838-2525.

NOTE: Information, displays, maps, etc., discussed in the Aloha-Rigolette Main Report are incorporated by reference in this Draft Environmental Impact Statement.

1. SUMMARY

1.1. MAJOR CONCLUSIONS AND FINDINGS

The primary purpose of this study was to develop a plan which would reduce agricultural flood damages consistent with protecting the nation's environment. Twenty-two alternatives were proposed for study including a no-action alternative. The no-action alternative represents conditions that are expected to occur in the absence of any Federal action. It is carried throughout the planning process and serves as the base for comparing all alternatives. Through a process of evaluation and assessment, 18 of the 22 alternatives were eliminated from further consideration on the basis of engineering, economic, environmental, and institutional criteria. The first remaining alternative, Plan 5, involves the construction of additional floodgates adjacent to the existing Bayou Rigolette structure and the purchase of 170 acres of flowage easements to facilitate the periodic drawdown of Iatt Lake. Another remaining alternative, Plan 19, involves the construction of the floodgates and purchase of flowage easements as in Plan 5 and the purchase of a "no development easement" over all wooded lands between the with project and without project 5-year overflow areas (1,963 acres). The final remaining alternative, Plan 6, involves the reconnection of Bayou Darrow to the Red River via a floodgate and improvement of 23.2 miles of channel. It also includes the flowage easements to facilitate the periodic drawdown of Iatt Lake and the purchase of 615 acres of agricultural land which would be reforested to mitigate for impacts of channel improvements. After considering options of adding varying numbers of floodgates in all plans, the plan proposing six floodgates (Plan 5C) was identified as the National Economic Development (NED) Plan and the Tentatively Selected Plan (TSP). Plan 5C has only minor adverse impacts upon terrestrial resources, but has significant adverse impacts upon aquatic resources. The TSP is in full compliance with Executive Orders 11988 and 11990. A Section 404(b)(1) Evaluation is required with implementation of the TSP because some excavated material would be deposited into

waters of the United States (see Appendix B). We consulted with EPA Region VI to determine the extent of waters of the U.S. for purposes of Section 404. A State Water Quality Certificate also will be obtained. In order to achieve the full range of project benefits, local beneficiaries are expected to improve drainage facilities on existing agricultural lands which would not require Department of the Army permits.

1.2. AREA OF CONTROVERSY AND UNRESOLVED ISSUES

The only unresolved area of controversy involves induced clearing predictions. The U.S. Fish and Wildlife Service does not concur with the methodology used in deriving those predictions. In their Coordination Act Report, they use an alternative methodology. The use of these different methodologies resulted in varying mitigation recommendations. Our responses to the recommendations made by the Fish and Wildlife Service in their Coordination Act Report can be found in Section 8.4.

1.3. RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

The following table displays the relationship of each plan to various environmental statutes, Executive Orders, etc.

TABLE 1. 1. - RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REGULATIONS

Federal Statutes	Plans 1/19	
	(TSP)	Plan 1
Archaeological Resources Protection Act of 1979, 16 U.S.C. 470 as-470 e, et seq.	N/A	N/A
Antiquities Act, as amended, 42 U.S.C. 14151-14157, et seq.	Full ¹⁴	Full ¹⁴
Clean Air Act, as amended (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Partial ¹	Partial ¹
Clean Water Act, as amended (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq.	Partial ²	Partial ²
Coastal Zone Management Act, as amended, 16 U.S.C. 1451, et seq.	N/A	N/A
Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.	Full	Full
Estuary Protection Act, 16 U.S.C. 1221, et seq.	N/A	N/A
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1 (12), et seq.	Full	Full
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq.	Partial ³	Partial ³
Land and Water Conservation Fund Act, as amended, 16 U.S.C. 4601 - 4601-11, et seq.	Full	Full
Marine Protection, Research and Sanctuaries Act, 33 U.S.C. 1401, et seq.	N/A	N/A
National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq.	Full ⁴	Full ⁴
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq.	Partial ⁵	Partial ⁵
National Harbor Act, 3 U.S.C. 401, et seq.	Full	Full
River and Harbor and Flood Control Act of 1970, Sect. 122	Full	Full
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1601, et seq.	Full	Full
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq.	Full	Full
Farmland Protection Policy Act of 1981	Full	Full
Executive Orders, Memoranda, etc.		
Floodplain Management (E.O. 11988)	Full	Full
Protection of Wetlands (E.O. 11990)	Full	Full
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	N/A	N/A
Analysis of Impacts on Prime and Unique Farmlands (OIA Memorandum, 11 Aug 80)	Full ⁴	Full ⁴
Protection and Enhancement of the Cultural Environment (E.O. 11593)	Full ⁴	Full ⁴
Intergovernmental Review of Federal Programs (E.O. 12372)	Full ⁴	Full ⁴
State and Local Policies		
Louisiana Air Control Law	Full	Full
Louisiana Archeological Treasure Act	Full	Full
Louisiana Historic Preservation District	N/A	N/A
Louisiana Scenic Streams Act	Full	Full
Louisiana Water Control Law	Full	Full
Protection of Cypress Trees (E.O. 1980-3)	Full	Full

1. Review of the draft EIS by EPA will bring plan into full compliance.
2. Publication of the 404(b)(1) Evaluation and procurement of a State of Louisiana Water Quality Certificate will bring full compliance.
3. Publication of the Final Fish and Wildlife Coordination Act Report and adequate responses to all U.S. Fish and Wildlife Service recommendations will bring full compliance.
4. The Agency's responsibilities to inventory all sites within the right-of-way, assess site significance, and complete Section 106 coordination will be fulfilled during the Phase II General Design Memorandum stage.
5. Signature of the Record of Decision will bring full compliance.

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3. NEED FOR AND OBJECTIVES OF STUDY

3.1. INTRODUCTION

The original project was authorized by the Flood Control Act of 18 August 1941 and completed in 1956. The project provided protection from Red River flooding by extension of the Red River protection levee and construction of two floodgates at the intersection of Bayou Rigolette and the extended levee. The project also improved interior drainage by the construction of levees and diversion channels, and 31 miles of clearing and snagging.

3.2. STUDY AUTHORITY

The present study was authorized by a resolution adopted by the United States Senate Committee on Public Works and Environment on 22 May 1974 at the request of U.S. Senators Russell B. Long and J. Bennett Johnston from Louisiana. The resolution is quoted below:

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors be and is hereby required to review the report on Red River and Tributaries, Texas, Oklahoma, Arkansas and Louisiana, downstream from Denison Dam, submitted in House Document Numbered 602, 79th Congress, 2nd Session, and subsequent reports with a view to determining the advisability of providing additional flood protection in the Aloha-Rigolette area.

3.3. PUBLIC CONCERNS

The floodplain portion of the study area historically has experienced seasonal flooding. Substantial concern has been expressed since practically the entire floodplain is used for agricultural production. Subsequent to the original project in 1956, additional land clearing and agricultural intensification have resulted in increased flooding problems and, thus, authorization of the present study.

3.4. PLANNING OBJECTIVES

The Federal objective considered for the study was that of national economic development, consistent with protecting the nation's environment. The specific planning objectives formulated to address expressed concerns and opportunities were as follows: to reduce flood losses in the alluvial plain of in the Aloha-Rigolette area to increase agricultural production; to avoid, where possible, destruction of bottomland hardwoods, riparian habitat, and wetlands in the alluvial plain of the Aloha-Rigolette area in order to maintain these resources as valuable habitat; to minimize adverse environmental impacts associated with implementation of flood control improvements in order to maintain existing water quality and fish and wildlife resources in the alluvial plain of the Aloha-Rigolette area; and to avoid contributing to the destruction of archeological, historical, and paleontological resources in the Aloha-Rigolette area to preserve existing conditions.

4. ALTERNATIVES

4.1. PLANS ELIMINATED FROM FURTHER STUDY DURING INTERMEDIATE EVALUATION

4.1.1. The April 1981 Reconnaissance Report for the Aloha-Rigolette Area presented 20 action alternative plans and the no-action alternative for achieving the study objectives. Upon initial evaluation of those 20 plans, eight were determined to be ineffective as overall solutions to the expressed problems and needs. These eight plans eliminated from further study in the Reconnaissance Report were Plans 2, 7, 10, 13, 14, 15, 16, and 17. See Appendix A to the main report for a description of the eight plans eliminated. During initial intermediate evaluation, Plans 1, 4, 8, 11, 12, and 18 were eliminated from further consideration. During the final intermediate evaluation, one additional plan was added for consideration. The added alternative, Plan 22 consisted of the elimination of the existing Bayou Rigolette floodgate and leaving an opening in the levee. Final intermediate evaluation of plans resulted in the elimination of Plans 3, 9, 20, and 22.

4.1.2. Plan 1. Modifying Iatt Lake dam to provide additional storage capacity and controlled releases would permit outflows to be regulated to lower peak stages at the Rigolette floodgates. Some economic benefits would accrue to the plan from decreased flood damages and increased agricultural yields. The additional storage capacity of the lake could improve the fishery and water quality in and below the lake. However, this plan provides very little flood protection in the middle and lower basin areas and is extremely costly. It was, therefore, eliminated.

4.1.3. Plan 3. Channel modification (including enlargement and clearing and snagging) of Bayou Rigolette and its major tributaries would reduce flooding but would cause severe impacts on fish and wildlife resources. The magnitude of these impacts would depend on the degree of channel enlargement. This plan was eliminated because it was not economically feasible, was ineffective as a complete solution, caused significant adverse environmental impacts, and was considered unacceptable to local interests.

4.1.5. Plan 7. Modifying Iatt Lake and clearing and snagging major bayous to improve drainage and lower stages in the upper region of the alluvial basin. However, for a substantial portion of Bayous Darrow and Rigolette, the 5-year event would be above banks. In comparison to other plans, this plan was less effective and more costly and was, therefore, eliminated from further study.

4.1.6. Plan 8. With clearing and snagging of major bayous in the basin and installation of a pumping station near the existing floodgates, flooding could be reduced effectively throughout the basin. Clearing and snagging would decrease recreational opportunities, reduce habitat for wildlife species that depend on woodlands for survival, disturb archeological sites on newly cleared land, and increase sediment and pollutant loading in streams. This plan was eliminated due to its unfavorable benefit-to-cost ratio.

4.1.6. Plan 9. This plan would provide for clearing and snagging of 60 miles of channel and increments thereof along Bayous Rigolette, Saline (diversion channel), Darrow, Marteau, Sam, DuGrappe, and Sugarhouse, and installing additional floodgates near the existing structure. Several options also were developed for this plan by varying the number of floodgates from two to four to six and to eight, by varying the stream segments to be cleared and snagged, and by utilizing different techniques for clearing and snagging. The floodgate sizes are the same as for options of Plan 5. Improvement of interior drainage and greater outflow capacity at the Rigolette floodgate would effectively reduce flooding in the basin. This plan was eliminated due to its unfavorable benefit-to-cost ratio. For more information concerning the variations evaluated, see Appendix A, Page A-41.

4.1.7. Plan 11. This plan would provide for diverting most of the flow from Bayou Rigolette via Sam Bayou and a new channel to Red River, and installing floodgates at the Red River levee. This plan would not provide satisfactory flood protection throughout the basin and was thus eliminated.

4.1.8. Plan 12. The use of a series of small upstream reservoirs in the upland areas of the basin would serve to control upland runoff, but would not significantly improve flood protection in the middle and lower basin areas. The type and extent of impacts would be dependent on the location and size of the reservoirs, whether permanent pools would be maintained, and whether multipurpose reservoirs are provided. This plan was eliminated from further study due to its inability to provide adequate flood protection and its high cost.

4.1.9. Plan 18. This plan would provide for clearing and snagging and land acquisition. Clearing and snagging would improve the efficiency in area bayous, provide minor reduction in flood stages in the upper portion of the alluvial floodplain, and cause peak stages to be reached sooner and last longer at the Rigolette floodgate. During the period when the floodgates must be closed, interior runoff would pond near the floodgate. Lands that would be flooded would be purchased in fee, or an easement would be acquired. Purchased land then would be managed to limit future damages in the alluvial floodplain and enhance environmental resources. Adverse wildlife and fishery impacts would occur due to the clearing and snagging feature of this plan. The acquisition component of the plan would produce beneficial impacts on biological resources but would reduce agricultural production on those lands. Impacts beneficial to cultural resources and water quality also would occur. This plan would not provide significant flood protection and was prohibitively expensive, and was thus eliminated.

4.1.10. Plan 20. The installation of a pumping station adjacent to the existing floodgate would increase the outlet capacity of Bayou Rigolette into Red River and would reduce flood stages in the basin. The pumping

Station would be operated when intense flooding is anticipated in the basin during high stages on Red River when the floodgates must be closed.

The plan was eliminated due to an unfavorable benefit-to-cost ratio.

4.1.11. Plan 22. This plan would provide for the removal of the existing structure at the Red River, leaving a gap in the Red River Protection levee. The gap would be sized so as to convey the Bayou Rigolette design flow without causing flooding along Bayous Rigolette and DuGrappe. The plan would allow free discharge of Bayou Rigolette, Red River permitting, and free access of the Red River to the Bayou Rigolette Basin. The plan was eliminated due to its inability to provide adequate flood protection.

4.2. FUTURE WITHOUT PROJECT (NO ACTION)

Without the project, current land uses are not expected to change. Those lands which are presently used for agricultural purposes would remain in production and their value as wildlife habitat is expected to remain at current levels. Water quality trends are not expected to change in the future without the project. With implementation of the Red River Waterway project, fishery resources would be increased due to the increased exchange of Red River and Bayou Rigolette waters. This exchange would be facilitated by the increased Red River pool elevation which could raise minimum water levels in Bayou Rigolette by as much as 5 feet, though all would be within banks. Present socioeconomic trends are expected to continue in the future. For more information, see Appendix A, page A-45.

4.3. PLANS CONSIDERED IN DETAIL

4.3.1.1. The relationship of the plans carried in detailed consideration in this document to environmental protection statutes and other environmental requirements is outlined in Table 1.4.

4.3.1.2. Plan 5. This plan would provide for increasing the outlet capacity of the floodgate on Bayou Rigolette. Options analyzed for this plan included adding two, four, six, or eight box culverts (10 feet by 10 feet). Those options were respectively identified as 5A, 5B, 5C, and 5D. The new floodgate(s) would be located approximately 600 feet east of the existing floodgate. The inflow channel would divert just south of the Kansas City Southern Railway and extend 680 feet to the floodgate. The box culverts for all options would be 210 feet in length. The outflow channel would extend 1,010 feet and connect with the existing structure outlet channel. Riprap would be placed on both the inlet and outlet apron of the box culverts and also at the beginning of the inflow channel where it veers away from the existing channel. The rights-of-way required for all options would be essentially equal. The inflow and outflow channels would require approximately 11 acres and the construction cofferdam (temporary easement) would require 9 acres. Material for the cofferdam would come from the inflow and outflow channels and the portion of the levee where the box culverts are to be placed. Included in the nine acres would be two acres of existing borrow pits. Upon completion of construction, the cofferdams would be degraded. Approximately half the material would be used to bring the levee back to grade and the remainder would be used to build a landside berm. This latter action would require about six acres of woods. For the floodgate with two culverts, an estimated 121,000 cubic yards of material would have to be excavated, inclusive of excavation for the structure and the channel. For floodgates with four, six, and eight box culverts, 133,000, 145,000, and 180,000 cubic yards, respectively, of excavated material would be required. Some of the excavated material would be disposed into waters of the United States.

4.3.1.3. With implementation of this plan, the protection provided should not induce the clearing of any bottomland hardwoods for agricultural pursuits. This conclusion was reached after comparison of clearing rates within various flood zones, evaluation of clearing patterns in the lower basin, and interviews with numerous landowners within the project area (see

(see Appendix A for details). Significant adverse environmental impacts are anticipated due to the reduction of overbank flooding during the fish spawning season. Mitigation recommended for this impact would be to facilitate the periodic drawdown of Iatt Lake to increase its fishery resources. This would require the purchase of a flowage easement on 100 acres of woodlands and 70 acres of croplands. For more information concerning mitigation calculations, see Appendix A to the main report.

4.3.1.4. The plan option which provides the greatest net excess benefits consistent with protecting the nation's environment consists of the addition of six floodgates. Therefore, Plan 5C is the only option evaluated in this report. Operation and maintenance would involve general maintenance of the structure.

4.3.1.5. Plan 6. This plan would provide for reopening the mouth of Bayou Darrow to Red River, installing floodgates, and diverting Bayou Rigolette flows to Red River via Bayou Darrow. Features of this plan include earthen closures on Bayou Rigolette and Saline Bayou, channel improvements (channel enlargement and clearing and snagging), removal of the closure that now exists between Bayous Darrow and Rigolette, and the reconnection of Bayou Darrow to Red River via a varying number of 10- by 10-foot gated culverts. Environmental impacts due to floodgate construction are considered minimal. However, this plan would also cause significant adverse impacts due to the reduction of overbank flooding during the fish spawning season. No induced clearing of bottomland hardwoods to agricultural pursuits is expected with implementation of this plan. For more information concerning induced clearing calculation, see Appendix B to the main report. However, significant adverse environmental impacts are associated with the channel improvement features of this plan. These impacts are the loss of valuable riparian habitat and fishery resources. The recommended mitigation feature is the purchase in fee of certain agricultural lands and woodlands. Some of these lands are subject to flooding during the drawdown while others

would be purchased and reforested to mitigate the impacts associated with channel improvement. The four plan options evaluated are presented in Table 4.3.

TABLE 4.3. Plan Options

Plan Option	Number of Floodgates	Impacted Acres	Mitigation Agricultural Lands Purchased in Fee	Flowage Easement on Woodlands
6A	4	536	705	100
6B	5	493	645	100
6C	6	472	615	100
6D	7	472	615	100

Of the four plan options evaluated, Plan 6C has the greatest net excess benefits over costs and is, therefore, the only plan option evaluated in this report. A sump area would be necessary at the Bayou Darrow floodgates.

4.3.1.6. Plan 19. This plan incorporates floodgates adjacent to the existing floodgates on Bayou Rigolette and the flowage easement to facilitate the drawdown of Iatt Lake as proposed in Plan 5 and also includes the acquisition of a no-development easement on all woodlands between the with-project and without-project 5-year floodplains. Late in alternative evaluation, induced clearing of bottomland hardwoods was calculated using several different methods. This analysis resulted in our prediction that no induced clearing should occur with the project. Since the "no-development" easement feature of this plan was specifically developed to compensate any anticipated losses due to induced clearing and because without the easement plan feature, this plan is identical to Plan 5, Plan 19 will not be evaluated further in this report.

4.4. COMPARATIVE IMPACTS OF ALTERNATIVES

The following Table 4.4, "Comparative Impacts of Alternatives," describes for each significant resource in the environmental study area the base condition, future without the project, and impacts of the plans considered in detail. More detailed information on the significant resources is given in Chapter 5, "Affected Environment," and Chapter 6, "Environmental Effects."

Table 4.4. Comparative Impacts of Alternatives

Resource	Base Condition (YR - 0)	Future Without Project (YR - 50)	Plan 5C	Plan 6C
Terrestrial Resources of Agricultural Lands (Acres)	Available 24,051 6,575 acres flooded on average annual basis	Net Change 0 Available 24,051 6,575 acres flooded on average annual basis	Net Change 0 Available 24,051 3,264 acres would no longer be flooded on average annual basis	-615 23,436 (615 acres will be reforested) 5,414 acres would no longer be flooded on an average annual basis
Terrestrial Resources of Bottomland Hardwoods (Acres)	Available 15,027	Net Change 0 Available 15,027	Net Change -24 Available 15,006	+589 15,616
Terrestrial Resources of Riparian Habitat	Available 2,122	Net Change 0 Available 2,122	Net Change +15 Available 2,137 170 acres flooded periodically by Iatt Lake drawdown	Net Change is significant loss. Loss of 267 wooded riparian. Greatly reduced value of resource. Impacted by project 427 Available 2,146 Less than 50 acres of mitigation lands within riparian zone
Aquatic Resources of Environmental Study Area (Acres)	Available 857	Net Change 0 Available 857	Net Change +3 Available 860	Net Change +2 Impacted 300 Available 859
a. Water Quality	Moderate to poor	Moderately good	Minor short term adverse	Major during construction and until banks are revegetated.
b. Sport Fish Per Acre	50 lbs.	50 lbs.	50 lbs.	10 lbs. on impacted areas 50 lbs. on nonimpacted areas Iatt Lake would increase from 36 lbs. to 54 lbs.
c. Acres Flooded During Spawning Season	9,400 acres	Net Change 0 9,400 acres	Net Change - 5,500 3,900 acres	Net Change - 6,650 2,750 acres

Table 4.4. Comparative Impacts of Alternatives (Continued)

Resource	Base Condition (YR - 0)	Future Without Project (YR - 50)	Plan 5C	Plan 6C
Threatened and Endangered Species (Number of Species)	0	0	0	
Recreational Resources (Man-days)	Available 60,600	Available 60,600	Net Change +145 Available 60,785	Net change -9,680 Available 50,920
National Register of Historic Places (Sites)	2	2 Impacted 0	2 Impacted 0	
Cultural Resources (Sites)	9 ^{1/}	9 Impacted 0	9 Impacted 6	9 Impacted 6
Section 122 Items				
a. Air and Noise	Air quality and noise levels are acceptable	No change	Temporary air and noise pollution during construction	Temporary air and noise pollution during construction and maintenance
b. Esthetics	Derived mainly from the appreciation of woodlands and waterways	No change	Minor degradation	Net enhancement
c. Community Cohesion	Improved flood protection is supported	No change	Enhance community cohesion	Enhance community cohesion

^{1/} Includes sites in Iatt Lake

Table 4.4. Comparative Impacts of Alternatives (Continued)

Resource	Base Condition (YR - 0)	Future Without Project (YR - 50)	Plan 5C	Plan 6C
d. Population and Employment	Lower population growth than state and nation, same unemployment rate	Limited growth	Moderately improve employment and reduce outmigration	Moderately improve employment and reduce outmigration
e. Personal Income	Per-capita income significantly below that of state	Limited growth	Gradual improvement	Gradual improvement
f. Tax revenues, property values, and public facilities and services	Present decline of economic base causes deterioration of these items	Limited growth	Minor improvement	Minor improvement
g. Development of people, businesses, and farms	Outmigration of young people is trend, business and farm development has declined in recent years	Limited growth	Minor improvement	Minor improvement
h. Desirable community and regional growth	Growth rate is relatively slow	Limited growth	Minor improvement	Minor improvement
Plan Economics (Average Annual)	N/A N/A	N/A N/A	1/ Benefits \$1,225,000 1/ Costs \$731,000 B/C Ratio 1.7 Net excess Benefits \$494,000	1/ Benefits \$1,749,000 1/ Costs \$1,370,000 B/C Ratio 1.3 Net excess Benefits \$379,000

1/ On an average annual basis.

5. AFFECTED ENVIRONMENT

5.1. ENVIRONMENTAL CONDITIONS

5.1.1. The Aloha-Rigolette area encompasses approximately 267,400 acres, including about 51,000 acres in the Catahoula Ranger District of Kisatchie National Forest, and is divided into two distinct topographic areas which are separated generally by Bayou Rigolette. Approximately 77 percent of the basin (206,700 acres) is located north of Bayou Rigolette and is comprised mostly of gently rolling forested hills. Elevations in this area are generally greater than 100 feet National Geodetic Vertical Datum (NGVD). The remaining basin area (60,700 acres) is mainly alluvial flatlands which are used primarily for agriculture, and constitutes the economic study area for this study (see Plate 1).

5.1.2. The north and northeast portions of the basin are forested hills that drain into Iatt Lake, which was formed by the construction of a weir in 1947 by the State of Louisiana for wildlife conservation and recreation. The northwestern portion of the basin is drained by Bayou Du Grappe, which originates in the vicinity of Aloha, Louisiana. Bayou Du Grappe discharges into Bayou Rigolette about 2 miles south from the latter's origin at the Iatt Lake Dam. The combined flows of Bayou Du Grappe, Iatt Lake, Bayou Rigolette, and their smaller tributaries exit the basin via floodgates at Bayou Rigolette and the Red River protection levee.

5.1.3. The environmental study area is limited to that area impacted by the occurrence of the 100-year storm event under existing conditions (42,057 acres). Originally, bottomland hardwoods predominated in the environmental study area, but these are now limited primarily to the southern part of the basin. Presently, 60% of the study area has been converted to agricultural pursuits. Forested lands occupy 38% of the study area and the remaining 2% is watercourses. The higher quality wildlife habitats within the study area are the remaining bottomland hardwoods and

the riparian habitat along main watercourses. Agricultural lands are lower quality as wildlife habitat.

5.2. SIGNIFICANT RESOURCES AND SECTION 122 ITEMS

5.2.1. General. A given resource is considered to be significant if it is identified in the laws, regulations, guidelines, or other institutional standards of national, regional, and local public agencies; it is specifically identified as a concern by local public interests; or it is judged by the responsible Federal agency to be of sufficient importance to be designated as significant (see Table 5.2). This section discusses each significant resource occurring in the environmental study area and listed previously in Table 4.4, "Comparative Impacts of Alternatives."

5.2.2. Terrestrial Resources of Agricultural Lands.

5.2.2.1. There are approximately 24,051 acres of cleared lands in the environmental study area. An additional 1,135 cleared acres are within the riparian zone and are discussed in that section of the report. These agricultural lands are used primarily for pasture and crops. Major crop types include soybeans, wheat, and sorghum. Besides grazing, some pasturelands are used for hay or pecan production. Soil types in the environmental study area are Moreland, Moreland-Latanier, and Norwood-Gallion. These soil types are classified as prime farmlands which are defined by the Council on Environmental Quality as "those lands whose value derives from their general advantage as croplands due to soil and water conditions." Expansion of agricultural pursuits in the study area is not expected if crop prices remain at present levels. Common open-land wildlife species to inhabit the area include migratory hawks, cattle egrets, meadowlarks, striped skunks, and coyotes. Game species that use open-land habitat provided by agricultural lands include the mourning dove, bobwhite quail, eastern cottontail, raccoon, and white-tailed deer. Waterfowl species known to use flooded grain fields include mallard,

Table 3.2. Identification of Significant Resources

Resource	Ecological Attributes	Cultural Attributes	Aesthetic Attributes	Institutional Recognition	Technical Recognition	Public Recognition	Resource is Significant	Likely to be Affected	To be Evaluated in EIS
Terrestrial Resources of Agricultural Land	Minor wildlife value	---	Views of open land	QSO memorandum of Aug. 11, 1980. Farmland Protection Policy Act of 1981	Habitat for 3 species of Special Buphasia (1980)	The value of productive agricultural lands is of public concern	Yes	No	Yes
Terrestrial Resources of Pastureland	Very valuable habitat for wildlife including game and nongame species	Protects archaeological and historic sites	Typical Louisiana modified landscape	EO 11989, EO 11990, Fish and Wildlife Coordination Act Report	Habitat for 7 species of Special Buphasia being lost at the rate of 100,000 acres per year. The lower Mississippi valley	Environmental groups and general public desire the preservation of this habitat	Yes	Yes	Yes
Terrestrial Resources of Riparian Habitat	Very valuable for wildlife	---	The meandering water-courses provide scenic appeal	Fish and Wildlife Coordination Act Report	Habitat for 8 species of Special Buphasia	Environmental groups and general public desire the preservation of this habitat	Yes	Yes	Yes
Aquatic Resources of Environmental Study Area	Harbored commercial and sport fish utilize the study area	---	Harboring water-courses provide scenic appeal	Fish and Wildlife Coordination Act Report	---	Recreational fishing occurs in study area	Yes	Yes	Yes
Threatened and Endangered Species	---	These species are valuable part of our cultural heritage	Wildlife in its natural setting is sought after for its single beauty	Endangered Species Act	---	Environmental groups and general public desire the preservation of these species	Yes	No	Yes
Recreational Resources	Habitat for wildlife, potential for increased hunting and interacting with nature	Hunting and fishing are an integral part of the rural culture in the area	Typical modified landscape with existing vegetation enhance experience	Land and Water Conservation Fund Act of 1965	Existing conditions support 60,000 man-days of recreation	Hunting and fishing are highly valued forms of public recreation	Yes	Yes	Yes
Sites on the National Register of Historic Places	None	Properties worthy of preservation for significance in American history, architecture, archeology, and culture	---	National Historic Preservation Act of 1966, as amended; The National Historic Preservation Act of 1966, as amended; EO 11593; Archeological Resources Protection Act of 1979	The National Register	Public recognition and support of historic preservation is strong, reflecting national trends	Yes	No	Yes
Cultural Resources	None	These resources generally are towns indicators of previous residents	None	EO 11593; National Environmental Policy Act; National Historic Preservation Act of 1966, as amended	Archaeological sites have been documented in study area	Appreciation of past cultures is of public concern	Yes	No	Yes
Section 122 Items	N/A	N/A	N/A	Steel and Harbor Flood Control Act of 1970, Section 122	N/A	Public recognition of these items is strong	Yes	Yes	Yes

gadwall, teal, and wood duck (U.S. Army Corps of Engineers, 1983). Although not a desirable species to farmers, various blackbirds use grain fields extensively.

5.2.2.2. Currently, some 60 percent of the land in the study area is devoted to agricultural production. Major land clearing occurred during the mid-60's and 70's due to technological advances which allowed preparation of clay soils which previously had been considered uncultivable and to the favorable economic return received on soybeans. Currently, the land clearing rate has nearly ceased and, barring any change in the profitability of farm production, is expected to remain very low in the future (personal communication with Mr. Max Johnston, SCS, Alexandria, 1984).

5.2.3. Terrestrial Resources of Bottomland Hardwoods.

5.2.3.1. The primary forest type present in the environmental study area is bottomland hardwoods which comprises 15,027 acres. This forest type is rapidly disappearing from the nation's major floodplains due to agricultural expansion. There was an overall 63% reduction in bottomland hardwoods from the implementation of the original project through 1979. Tree species which characterize this forest type are water, overcup, Nuttall, and willow oaks, as well as pecan, American elm, hackberry, and bitter pecan. Common understory and ground-cover species include water elm, green ash, boxelder, poison ivy, Carex sp., and rattan vine. Wetland areas characterized by bald cypress and buttonbush occur sporatically in the study area. Bottomland hardwoods are highly productive in terms of wildlife. The most common wildlife species to use this forest habitat are white-tailed deer, gray and fox squirrels, raccoon, red fox, opossum, bobcat, various small mammals, barred owl, wood duck, red-shouldered hawk, and numerous passerine birds. Heavy mast production by mature hardwoods provide an abundant food supply for both gray and fox squirrels, deer, mallards, and wood ducks. Intermittent flooding of these lands makes the

...valuable to the waterfowl species (McCabe, 1982). In general, forest dwelling species are the most important wildlife species to the local inhabitants, because forest game species traditionally have been hunted extensively by rural residents since childhood.

5.2.3.2. The continued conversion of floodplain forest to agricultural pursuits had resulted in the increased concern for, and importance of, habitat provided to forest wildlife species in the study area, the region, and the nation. If the prices of agricultural products remain low, wildlife resources of the study area are not expected to change significantly. If prices rise, the feasibility of converting existing forest to agricultural pursuits would increase.

5.2.4. Terrestrial Resources of Riparian Habitat. There are approximately 2,122 acres of terrestrial riparian habitat along major streams in the study area. This habitat is defined as a band located within 200 feet from the center of the major watercourses and is composed of both agricultural lands (987 acres) and bottomland hardwoods (1,135 acres). Riparian vegetation helps stabilize the streambanks, provides cover and food for both fish and wildlife, and intercepts solar radiation (Shields, 1984). Plant species which characterize this habitat type are bald cypress, buttonbush, black willow, water locusts, smartweed, and peppervine. The majority of riparian habitat occurring adjacent to the major watercourses is forested and affords direct access to open pasture or crop land, making this habitat extremely valuable to a variety of wildlife. Riparian habitat is used by a variety of wildlife including raccoon, mink, wood duck, prothonotary warblers, and several amphibians and reptiles. This habitat is particularly important as a cover and roost for wildlife during feeding and watering. The most important game species using the interface of forest and open areas are bobwhite and cottontail rabbit.

5.2.5. Aquatic Resources of Environmental Study Area.

5.2.5.1. Bayou Rigolette originates about 4 miles northeast of Colfax, Louisiana, in Grant Parish at the Iatt Lake Dam. It meanders near the edge of the hill line and ultimately flows nearly 26 miles into the Red River about 2 miles upriver from Alexandria, Louisiana. In addition to Bayou Rigolette, the study area includes approximately 34 miles of other major watercourses. These include Bayous Darrow, Marteau, and Du Grappe, as well as Sam and Saline Bayous and the two diversion channels. All of these watercourses have a low gradient, normally low velocity, and variable stages. The stream substrate consists of sands and silts, and the stream beds are relatively flat. These watercourses are considered significant resources due to their function as major outlets that provide relief to the project area and to their support of fishery resources. Water levels in Bayou Rigolette fluctuate dramatically on a yearly cycle, as is documented by stage readings at the Pineville and Colfax stream-gauging stations. Typically, water levels are higher during the winter and spring months, and are nearly level with the bottom of the floodgate during the fall and summer months. During the latter months, Bayou Rigolette is a sluggish stream which becomes increasingly turbid, due to runoff from adjacent cultivated fields, as it approaches the floodgates.

5.2.5.2. Information collected from the U.S. Environmental Protection Agency STORET data base had indicated that Bayou Du Grappe water quality did not exceed state standards or Federal criteria. Data from Bayou Darrow indicated that total dissolved solids exceeded the state standard (Louisiana Stream Control Commission, 1977). No metal data were collected at Bayou Darrow. Pesticides and PCB's were not detected, although minimum detection limits were in some cases above Federal chronic criteria (Environmental Protection Agency, 1980).

5.2.5.3. Water quality data for Bayou Rigolette indicated a general trend for increasing levels in a downstream direction from the Iatt Lake weir for hardness, alkalinity, conductivity, turbidity, sulfate, ammonia, nitrogen, and phosphorus (Environmental Protection Agency, STORET). Arsenic, zinc,

and mercury in water samples did not exceed Federal acute or chronic criteria. Six other metals (chromium, copper, lead, manganese, nickel, and iron) were below Federal acute levels but exceeded chronic criteria (Environmental Protection Agency, 1980). Total dissolved solids exceeded state standards (Louisiana Stream Control Commission, 1977). Temperature and dissolved oxygen values did not generally exceed state standards; however, because of the sluggish flow regime of the bayou, isolated instances may occur where the standard is violated during certain time periods.

5.2.5.4. Plant species characteristic of this habitat are duckweed, water primrose, and smartweed. The most important fishery resource within the environmental study area are associated with Bayou Rigolette and the other main watercourses, as well as seasonally inundated woodlands. When flooded for periods of at least 30 consecutive days between March 1 and June 15, woodlands are valuable feeding, spawning, and nursery areas for several species of fish. During flood events, organic matter is transported from these inundated woodlands to downstream waterbodies, thereby forming a detritus-based food web. Numerous invertebrates feed upon this detrital material and they, in turn, are eaten by fishes (McCabe, 1982). Channel obstructions, such as fallen trees and branches, create pooling areas which provide in-stream cover. Fish species documented as occurring in the study area include longnose, spotted, and shortnose gars; gizzard shad; white crappie; river carpsucker; carp; bowfin; freshwater drum; flat-head and channel catfishes; and largemouth bass. Local residents reported that during the summer months, fish kills occasionally occur. These events are probably due to a combination of low-flow and high water temperatures which, combined with high organic loading, contribute to a reduction in dissolved oxygen in the water.

5.2.5.5. Iatt Lake was not considered as part of the Environmental Study Area but, due to mitigation recommendations which would include periodic drawdown of the lake, it will be addressed in this report. Iatt Lake was

formed by construction of dam in 1947 by the State of Louisiana for wildlife conservation and recreation purposes. Iatt Lake drains approximately 154,900 acres (58 percent of the basin total). Iatt Lake at the dam crest (elevation 85 feet) has a surface area of 7,100 acres, a volume of 31,000 acre-feet, and an average depth of about 4.5 feet. The major tributaries of Iatt Lake are Iatt Creek, Black Creek, and Dartigo Creek, (U.S. Army Corps of Engineers, 1981). The lake is classified as suitable for secondary contact recreation (fishing, wading, boating, or other activities where ingestion of and total immersion in water is not probable) and propagation of fish and wildlife. According to the State Department of Wildlife and Fisheries (Richardson, personal communication) Iatt Lake is presently more than 90% covered with aquatic weeds. The plant species of greatest abundance include American lotus, Egeria sp., Cabomba sp., coontail, and bladderwort. It is, however, a moderately productive lake in spite of its aquatic weed problem. According to fish population surveys done by the State Department of Wildlife and Fisheries, the average sport fish population is estimated to be about 36 pounds per acre.

5.2.6. Threatened and Endangered Species. No present or proposed endangered and threatened species, nor their critical habitats, occur in the environmental study area, according to the U.S. Department of the Interior.

5.2.7. Recreational Resources.

5.2.7.1. Significant recreational resources in the study area include hunting and, to a lesser degree, fishing. Currently, hunting and fishing activities total 60,600 annual man-days (31,640 fishing, 28,960 hunting) with an associated annual combined value of \$318,166. Developed recreational facilities for such activities as boating, picnicking, tent and trailer camping, nature hiking, and horse trails in the study area are limited. For additional information, see Appendix A.

5.2.7.2. Recreational fishing in the Aloha-Rigolette area is minimal due to inadequate public access. Fishing occurring in the vicinity of the study area is most notably on the Red River, Iatt Lake, and Nantaches Lake. There are limited existing recreational facilities on Bayou Rigolette. Fishing below Iatt Lake is restricted by access. Fishing that does occur in the bayou relies primarily on the one boat ramp below Iatt Lake and five road crossings. Iatt Lake has the potential to be a productive fishery resource, however, limited boat ramp access and excessive aquatic weed growth is a deterrent to the fishing experience. The remainder of all adjoining lands are privately owned and are usually posted.

5.2.8. Sites on the National Register of Historic Places. The National Register of Historic Places listings for Grant and Rapides Parishes through April 16, 1985 were consulted. There are two National Register properties within the study area boundary. These are the McNeely House (built circa. 1883-1885) located in the town of Colfax, Louisiana, and Kateland, a pre-Civil War dogtrot house (built circa. 1830) located off Highway 8, northwest of Boyce, Louisiana.

5.2.9. Cultural Resources.

5.2.9.1. There are three recorded sites within the boundaries of the environmental study area. These are: site 16GR4, located on a short relict channel west of the confluence of Sandy Bayou with Bayou Darrow; site 16RA8, located adjacent to a relict Red River meander which was active in the late 19th century, west of the mouth of Bayou Rigolette; and site 16RA317, located on a Pleistocene period Prairie Terrace remnant 1 to 4 miles above the mouth of Bayou Rigolette. Site 16GR4 is known only by its location. Site 16RA8, found in the 1930's, is recorded as a mound. No other information is available about either of these two sites. Site 16RA317, located on a slightly elevated Prairie Terrace remnant between

Bayou Rigolette and the adjacent upland, is a mound in close proximity to a Late Archaic (ca. 1,000 B.C.) lithic scatter.

5.2.9.2. In preparation of this Environmental Impact Statement, the U.S. Army Corps of Engineers, New Orleans District staff reviewed relevant published and unpublished literature, historic maps, site file data recorded with the Louisiana State Archeologist, and the National Register of Historic Places. A stratified, random sample survey of approximately five percent of the proposed channel rights-of-way and selected alternative areas was conducted by the district staff. The survey was a reconnaissance level effort augmented by some shovel testing. The survey did not locate any sites within alternative areas. A full report of these investigations was prepared and submitted to the State Historic Preservation Officer for review and is available to the public upon request. The report concludes that the lack of sites within the sample and the small number of previously recorded sites is misleading and more indicative of the area's complicated geomorphology than its settlement history.

5.2.10. Section 122 Items.

5.2.10.1. Air and Noise. Air quality and noise levels are generally acceptable due to the rural nature of the study area.

5.2.10.2. Esthetics. Appreciation of natural woodlands and waterways are the attending esthetic values common in the area.

5.2.10.3. Community Cohesion. The economic study area encompasses some 64,097 acres lying within portions of the three Louisiana parishes of Grant, Rapides, and Winn. The level of community cohesion is reflected by the community's ability to solve local problems collectively. Although portions of the basin are technically within the Alexandria Metropolitan Statistical Area, timber and agricultural production remain important

sources of employment in the immediate basin. The 1980 census of population for Rapides Parish (essentially below the affected area) was 135,282, while population of Grant Parish was 24,141. Winn Parish had a total population of 17,233. About 8,600 people were living within the economic area.

5.2.10.4. Population and Employment. Population growth rates throughout the area have been significantly lower than those for the state and the nation. The annual growth rate for the economic area from 1940 to 1980 was 0.30 percent, while for the state it was 1.45 percent and for the nation, 1.35 percent. Outmigration rates in the area remain high as agricultural employment stagnates, with employment in other sectors failing to provide sufficient additional employment to resist present outmigration rates. The overall unemployment rate in the area in September 1983 was 12.0 percent, approximately the same as that for the State of Louisiana. This was significantly higher than the unemployment rate for the nation (less than 10%).

5.2.10.5. Personal Income. Within the three-parish area, some 19 percent of the population have incomes below the poverty level. Outmigration in the basin indicates the probability of even higher poverty levels. Additionally, the 1980 per capita income throughout the study area was significantly below the \$8,456 state per capita income (\$5,010 in Grant Parish, \$6,845 in Rapides Parish, and \$5,613 in Winn Parish).

5.2.10.6. Tax Revenues, Property Values, Public Facilities and Services. The tax revenues collected in the study area, including those generated by the agricultural sector, are part of the funds needed to maintain flood protection and necessary public facilities and services. Overall, the value of property in the area, including the value of agricultural lands, is significantly linked to the level of flood protection. The average net return from agricultural lands in the study area is \$72.73 per acre (Appendix D, Table D-4-3) and is reflected in the property values.

5.2.10.7. Development of People, Businesses, and Farms. Outmigration of the young population has adversely affected economic development in the area. Development of businesses in the basin is generally supportive of the agrarian economy. Farm development in the area has declined in recent years because of the decline in soybean prices as well as the high cost of land development for agricultural pursuits. The high cost is partially due to the abundance of swales in most lands which have not been cleared. Farm development is generally related to available land and capital, interest rates, a ready market for production, soil suitability, and level of flood protection.

5.2.10.8. Desirable Community and Regional Growth. Factors normally associated with desirable community growth include reduced unemployment, higher incomes, increased productivity, and stable economic growth sufficient to generate tax revenues for maintaining improved public facilities and services.

6. ENVIRONMENTAL EFFECTS

6.1. GENERAL

This section briefly describes the effects of each detailed plan on the previously described significant resources. It supplements Table 4.4, "Comparative Impacts of Alternatives," with a more detailed description of the impacts noted in the table. Operation and maintenance (O&M) impacts associated with the additional floodgates in both plans were considered insignificant and, therefore, not quantified. O&M impacts of the channel improvement feature of Plan 6C are the same as those discussed for each significant resource due to initial construction.

6.2. TERRESTRIAL RESOURCES OF AGRICULTURAL LANDS

6.2.1. Plan 5C. Implementation of this alternative would beneficially impact 22,691 acres due to reduced flooding. This benefit would be attributable to the reduction in flood frequency and duration by allowed increased drainage capabilities. Currently, 6,575 acres of cleared lands are subject to overflow flooding on an average annual basis. Overflow from the three-year frequency flood would be reduced from 6,496 cleared acres to 2,495 acres of cleared lands, thus removing 4,001 acres from the three-year flood frequency. Increased production is expected on those lands which are afforded protection from the average annual or three-year events. Minimal change in cropping patterns on the cleared lands afforded protection by this alternative are expected to occur. This change would primarily be a shift from soybeans and pasture to double-cropped soybeans and wheat. No agricultural lands would be adversely impacted by floodgate construction; however, approximately 70 acres would be periodically flooded with the drawdown of Iatt Lake (40 of which are in the riparian zone).

6.2.2. Plan 6C. Implementation of this alternative would beneficially impact 24,986 acres due to the reduction in flood frequency and duration.

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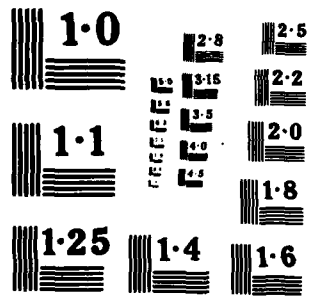
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The three-year flood frequency event would be reduced from 6,496 cleared acres presently to 200 acres. Floodgate construction would temporarily impact nine acres of cropland. Expected land uses are similar to Plan 5C. Some agricultural lands that would be affected by project construction are within the riparian zone and are therefore discussed in that portion of this report. Recommended mitigation for the adverse impacts of clearing and snagging on terrestrial and aquatic resources would include the purchase, reforestation, and management of about 615 acres of agricultural lands.

6.2.3. Future Without Project (FWO). Current flooding problems are expected to continue with the no-action alternative. Agricultural lands within the impact area would continue to be inundated by heavy winter and spring rains. This seasonal inundation frequently would prohibit the planting of crops at their typical time of year. Land usages would essentially not change. The value of these lands as wildlife habitat would remain at current levels.

6.3. TERRESTRIAL RESOURCES OF BOTTOMLAND HARDWOODS

6.3.1. Plan 5C. Implementation of this alternative would adversely impact 18 acres of forested habitat and two acres of the existing borrow pit by the construction of inflow and outflow channels for the proposed additional floodgates. Approximately 15 acres of the impacted habitat would revegetate and be classified as altered riparian habitat. The remaining five acres would become open water. Use of material from the degraded cofferdam to build a landside berm for the Red River levee would destroy approximately six acres of bottomland hardwoods. The area north of the proposed floodgates site is composed of mixed pine upland and bottomland hardwoods. The area south of that site is primarily bottomland hardwoods. Also, 100 acres of bottomland hardwoods (57 of which are in the riparian zone) would be flooded by the periodic drawdown of Iatt Lake. Using the methodologies outlined earlier in this document and described to a greater degree in

Appendix B, we concluded that no induced clearing of bottomland hardwoods for agricultural pursuits should result from the flood protection provided by this plan.

6.3.1.2. Broadfoot (1967) documented the importance of standing water in bottomland hardwoods for the late fall and winter months. This standing water increases the amount of moisture stored in the soil for use by the trees during the dry summer months. The standing water does not damage most hardwood species if it is removed by early spring. This reduction would decrease the growth rate of most hardwood species.

6.3.2. Plan 6C.

6.3.2.1. Implementation of this alternative would adversely impact 26 acres of forested habitat by construction of the inflow and outflow channels for the proposed floodgates. Of these impacted acres, 24 would develop as altered riparian habitat and 2 would be permanently changed to open-water area. Using the same methodologies as those for Plan 5C, we propose that implementation of this plan would not induce the clearing of any bottomland hardwoods for agricultural pursuits due to the flood protection provided by this plan. Impacts of reduced flooding during different periods of the year discussed with Plan 5C are applicable with this plan also.

6.3.2.2. The cropland that would be reforested for mitigation would provide good habitat for forest dwelling species, as well as provide those species a corridor for movement between adjacent croplands and woodlands. The edge effect created by the periphery of these lands would provide shelter and cover for open-land species. Nesting habitat and hunting perches would be provided for numerous birds. During periods of inundation, these lands would be valuable also to waterfowl.

6.3.3. FWO. Due to the maturation of existing woodlands and periodic timber harvest, the overall value of these woodlands as wildlife habitat to both game and nongame species is expected to increase somewhat. The increase would be due to the increased ground cover and understory vegetation density typically resulting from timber harvest and the increasing mast production of a maturing forest.

6.4. TERRESTRIAL RESOURCES OF RIPARIAN HABITAT

6.4.1. Plan 5C. Implementation of this alternative would impact a very small amount of riparian habitat. Project implementation would, however, establish 15 acres of altered terrestrial riparian habitat at the floodgate. Mitigation recommended for the reduction of overbank flooding during the fish spawning season would result in the periodic flooding of 97 acres of the riparian lands between the Iatt Lake Dam and Highway 71.

6.4.2. Plan 6C.

6.4.2.1. Impacts of floodgate construction would establish 24 acres of altered riparian habitat. Implementation of the channel improvement feature of this plan would adversely impact 427 acres of terrestrial riparian habitat. Significant adverse impacts are associated with this feature of the plan. All vegetation and obstructions would be removed from the existing channels, channel slopes, and a 40-foot-wide berm adjacent to the channel top. Of the total acres that would be impacted, 267 are wooded and 151 are cleared. By removing the woodlands adjacent to the channel, not only would there be a loss of habitat used by forest dwelling species, but also there would be a loss of cover provided by that habitat for open-land species which use the stream as the primary source of water. As the area impacted by direct construction begins to revegetate, it also would begin to accrue value as wildlife habitat. However, prior to any tree species, becoming of age to begin producing mast, required project maintenance would necessitate clearing and snagging of the originally impacted area.

Therefore, prior to the impacted area becoming valuable as wildlife habitat, it would be obstructive to flood flows and the removal of vegetation would be necessary.

6.4.3. FWO. With the exception of natural succession, the no-action alternative would result in riparian habitat remaining unchanged, barring major maintenance work on Bayou Rigolette in Grant Parish as required by the maintenance agreement given by the assuring agency for the original project in 1956.

6.5. AQUATIC RESOURCES OF ENVIRONMENTAL STUDY AREA

6.5.1. Plan 5C. Implementation of this alternative would result in short-term water quality impacts confined to the construction phase. Temporary increases in turbidity and decreases in dissolved oxygen might occur in the vicinity of the existing floodgates and a short distance downstream. In addition to a reduction in light penetration, a slight increase in nutrients, pesticides, and heavy metals might occur as a result of Bayou Rigolette sediments being resuspended in the water column. Altered water quality parameters should return to preconstruction levels upon completion of the project. Increased application of pesticides, herbicides, and fertilizers would be expected due to increased double-cropping of soybeans and wheat. This would degrade water quality. Due to the establishment of five additional acres of open-water habitat by the construction of the inflow and outflow channels, potential fishery values would increase very slightly. However, overbank flooding of bottomland hardwoods during the spawning season, presently occurring once every 3 years on the average, would be reduced from 9,400 acres to 3,900 acres. Overbank flooding of bottomland hardwoods makes valuable fish spawning area if the flooding occurs for at least 30 consecutive days during the spawning season (March 1 - June 15). This condition has occurred on the average of once in three years in the environmental study area. We have concluded that the reduction of this flooding is significant to mitigate for this loss, we

have recommended that a flowage easement be purchased on those lands subject to flooding with the drawdown of Iatt Lake. The periodic drawdown would increase the lake fishery from 36 pounds of sportfish per acre to 54 pounds per acre, improve water quality in Bayou Rigolette, and better satisfy the planning objectives. Likewise, overbank flooding is valuable to overwintering waterfowl if that flooding occurs during the overwintering period (November 1 - March 1). Under existing conditions, this flooding occurs for an average duration of only 11 days in the DuGrappe reach and 18 days in the Rigolette reach. Due to the relatively short duration of flooding, we have considered the reduction of this flooding to have an insignificant impact upon migratory waterfowl. However, the survival of resident waterfowl, specifically the wood duck, is linked to bottomland hardwood forest with trees of sufficient size to contain usable nest cavities and water areas that satisfy food and cover requirements. (McCabe, 1982). The drawdown of Iatt Lake would flood approximately 170 acres of open land and woodland for an extended period. These flooded areas would be of increased value to overwintering waterfowl as well as the resident wood duck population. For this reason, we do not recommend mitigation for the reduced flooding during the waterfowl wintering period.

6.5.2. Plan 6C.

6.5.2.1. Implementation of this alternative would have significant adverse impacts on aquatic resources. Impacts of the floodgate feature of this plan as well as the reduced flooding during the fish spawning season, would be similar to those of Plan 5C. The impacts due to increased pesticides, herbicides, and fertilizers would be slightly more severe than Plan 5C. Water quality impacts of Plan 6C would occur during construction and several years hence until the channel banks revegetate. The clearing and snagging feature of this plan would impact 300 acres of open water by resuspending sediments, pesticides, nutrients, and heavy metals in the water column. The removal of streamside vegetation, which provides shade from solar radiation, would allow greater fluctuation of water tempera-

tures. The total denuding of stream banks would increase the erosion rate on those impact areas. This increased erosion would increase turbidity in the water column and sedimentation within the stream channel. This increased sedimentation would facilitate the formation of sediment plugs, which, in turn, might necessitate more frequent maintenance clearing and snagging of the channels. Low dissolved oxygen could be expected due to increases in water temperature, turbidity, and nutrients. Increased turbidity also would decrease light penetration, which, in turn, would tend to reduce algal populations which serve as an important component of the aquatic food chain. Removal of obstructions and debris from the stream channels would greatly reduce, if not completely destroy, in-stream cover necessary for fish. The combination of in-stream cover losses, turbidity increases, and dissolved oxygen decreases would result in drastic adverse impact on potential fishery resources.

6.5.2.2. Projected turbidity and sedimentation levels would be reduced by the planting of impacted areas with various perennial grasses and herbs. This mitigative action would reduce the erosion rate on some of the impacted lands and also would serve as a buffer zone to prevent sediments, transported from adjacent agricultural lands, from entering the bayous. These actions would benefit fish and enhance water quality. Additional mitigative measures recommended for the fishery losses due to clearing and snagging and reduced flooding during the spawning season include the seasonal drawdown of Iatt Lake. This drawdown would be accomplished to help control aquatic plant growth and thus stimulate a more balanced predator-prey ratio.

6.5.3. FWQ. Without the project, water quality would continue to be affected by the prevailing land use. Generally, future water quality north of Highway 71 should remain good. South of the highway, the water quality should continue to decline. The sluggish flow regime of creeks and bayous below Highway 71, especially Bayou Rigolette, would continue. As a result of this reduced flow pattern, low dissolved oxygen values would continue to

be present during the summer months. Fishery resources would be increased by implementation of the Red River Waterway Project. The sill of the existing floodgates is five feet below the designed pool elevation of the Red River at Bayou Rigolette; thus, a direct exchange of their waters and fish populations would be facilitated.

6.6. THREATENED AND ENDANGERED SPECIES

All Plans. No threatened or endangered species, or their critical habitats, exist within the environmental study area. Therefore, the proposed project would have no impact on any threatened and endangered species.

6.7. RECREATIONAL RESOURCES

6.7.1. Plan 5C.

6.7.1.1. Recreational hunting impacts associated with implementation of this alternative are minimal. Construction of the floodgates would convert 18 acres of existing forest habitat and 2 acres of existing borrow pit to 15 acres of altered terrestrial habitat and 5 acres of open water. This transfer of land use would slightly reduce potential man-days of hunting. In the existing without project condition, there are 60,000 annual man-days of hunting and fishing. With this plan, there would be 60,560 annual man-days, representing a reduction of 40 man-days which corresponds to a \$1,000 annual loss. Impacts on potential man-days of recreational fishing due to the reduction of overbank flooding during the fish spawning season are potentially large. These potential man-days have not been quantified.

6.7.1.2. To compensate for the fishery habitat loss, Iatt Lake would be rejuvenated by management techniques including periodic lowering of the lake. This lowering would flood about 100 acres of woodlands and 70 acres of croplands. Based upon limited access into the lake and competitive

fishing areas in the region, an increase in man-days of fishing is not expected; however, the quality of fishing would be greatly enhanced by the elimination of the aquatic weeds and an increase in the fish population. An estimated 45,000 annual man-days of fishing currently exist with an annual value of \$147,000. With improved conditions due to drawdowns, the quality and value of the experience would increase to \$221,000, a \$74,000 increase over the base condition.

6.7.2. Plan 6C.

6.7.2.1. With implementation of Plan 6C, a total of 517 hunting acres and 25 miles of fishing stream would be impacted. Development of this plan would reduce annual man-days of hunting by 450 from the existing condition. The estimated annual dollar value of the reduction is \$4,000. Adverse impacts of clearing and snagging on potential sport fisheries were quantified by the U.S. Fish and Wildlife Service. Based upon the disruption of clearing and snagging to the fisheries resource, the annual potential loss is estimated to be 10,000 man-days, valued at \$32,000. Combined losses to fishing and hunting total 10,450 man-days with an associated dollar value of \$36,000. Increased turbidity would exist after construction. Water temperatures would rise due to the removal of overhanging trees and brush which provide shade to the bayou. During and after clearing and snagging, the recreational fishing potential and desire by local fishermen to use the bayou would be reduced.

6.7.2.2. Based upon a modified Habitat Evaluation Procedure, a two-phase mitigation plan has been established. To compensate for the riparian loss, 615 acres of agricultural land would be acquired in fee. This land would be managed and converted into a forested area, part of which would be periodically flooded by the lowering of Iatt Lake. An annual potential for 180 man-days of waterfowl hunting, 270 man-days of large game hunting, and 320 man-days of small game hunting with a total value of \$7,000 would be

created with this land acquisition. To compensate for the fishery loss, Iatt Lake would be rejuvenated as described for Plan 5.

6.7.3. FWO. The demand for additional recreational opportunities within the Aloha-Rigolette basin is relatively low when compared to the needs of concentrated population centers in the Central Louisiana region. Populations within the basin are anticipated to increase in the future. Increased demands generated within the study area by the population growth would be satisfied by increased usage in Iatt Lake, Nantachie Lake, and the Red River areas.

6.8. SITES ON THE NATIONAL REGISTER OF HISTORIC PLACES

6.8.1. Plan 5C. The proposed construction of floodgates at the mouth of Bayou Rigolette would not impact any sites that are currently listed in or that have been found eligible for listing in the National Register of Historic Places.

6.8.2. Plan 6C. Same as for Plan 5C.

6.8.3. FWO. Same as for Plan 5C.

6.9. CULTURAL RESOURCES

6.9.1. Plan 5C.

6.9.1.1. There are no recorded cultural resources in the 20-acre area in which floodgate construction is proposed. The probability of finding buried prehistoric occupational strata at the floodgate site seems extremely low. The probability of locating buried 19th century ship wreckage is somewhat higher because the impacted acreage is the partially filled channel of an early to mid-19th century Red River meander at the former mouth of Bayou Rigolette. Although Plan 5C appears to have no impact on cultural resources, further consideration prior to construction

will be given to the potential for buried ship wreckage, including additional records research and a magnetometer survey of the impact area.

6.9.1.2. Seasonal raising and lowering of Lake Iatt associated with the flooding of mitigation lands has potential for adverse impact on four prehistoric lithic scatters (16GR5, 6, 11, and 12), two prehistoric mound sites (16GR2 and 7), and an unknown number of similar unrecorded sites. Each of the six was located very near the bankline. Seasonal water elevation fluctuation has been shown in Federal reservoir research to erode bankline sites, contribute to bank slumping where grades are unaltered, and accelerate leaching of cultural floral and faunal remains from sites which are alternately inundated and drained.

6.9.1.3. These and similar sites may be subject to vandalism as recreational use of the lake increases. A survey of the lake margin at maximum low water shall be conducted in consultation with the State of Louisiana as landowner to inventory all sites located within the fluctuating pool. Site significance shall be established and steps taken to protect those which are determined eligible for the National Register of Historic Places.

6.9.1.4. Prior to construction, an intensive survey of the final easement and the area impacted by mitigation would be executed to record all sites. Sufficient historical data are present to reliably find and identify historic features.

6.9.2. Plan 6C.

6.9.2.1. Site 16GR4 is located on a small channel west of Bayou Darrow and would not be impacted by this alternative. There are no other recorded sites within the proposed channel modification and closure construction easements. There are insufficient data about the cultural history of the study area and the relative age of individual channels and relict Red River courses to reliably comment on the location of unrecorded prehistoric sites

on the floodplain. The alluvial history of the area suggests that any floodplain prehistoric sites are buried, if present. The probability is very high, however, that unrecorded historic sites exist along Bayou Rigolette and Sam Bayou, in particular. These bayous occupy a relict Red River channel which was active until the clearing of the Great Raft in the 1830's led to the westward shifting of the main channel away from the upland escarpment. The natural levee of the relict channel attracted settlement prior to 1800. Channel modification, clearing and snagging, and disposal may impact such sites. The closure of Bayou Rigolette is located within the boundaries of the former Bynum Plantation. The floodgate site at the confluence of Bayou Darrow and Red River borders the former Thorn Bush Plantation. The closure on Saline Bayou does not appear to impact any historic settlement.

6.9.2.2. Channel modification, clearing and snagging, and disposal would impact only sites located directly on or in the bankline. Secondary impacts on sites close to, but not adjacent to, these channels are not anticipated. The proposed method of bulldozing trees and other obstacles, and extracting stumps, would be extremely destructive to any site exposed in the bankline. The effects of movement of heavy equipment, grubbing tree roots, and subsequent exposure of the bank to sheet erosion prior to the regrowth of annual vegetation must be repeated every decade for the project to succeed.

6.9.2.3. Impacts to Iatt Lake would be similar to those described for Plan 5C.

6.9.3. FWO. The flooding which the proposed project is designed to alleviate may have limited impact on cultural resources because there appear to be few sites in the lower study area where alluvial deposition is most acute. Additional alluvium is not detrimental by itself. Over time, however, unrecorded buried sites are susceptible to destruction from exposure by channel migration and seasonal bank caving caused by fluctuating stage levels. The majority of sites in the study area are the remains of

historic plantations, isolated structures, and small settlements located along the present Red River course and a relict Red River course near the upland escarpment, active in the mid-1830's. The principal detrimental force acting on these sites is deterioration due to lack of maintenance. Whether or not the Aloha-Rigolette project is implemented, deterioration can be expected to continue unabated.

6.10 SECTION 122 ITEMS

6.10.1. Air and Noise.

6.10.1.1. Plan 5C. Project implementation would create temporary air and noise pollution at the time of construction and during maintenance periods. Impacts would be minimal.

6.10.1.2. Plan 6C. Same as Plan 5C.

6.10.1.3. FWO. No significant adverse impacts on air and noise levels are expected to occur in the future without the project.

6.10.2. Esthetic Values.

6.10.2.1. Plan 5C. Implementation of this alternative would result in some minor degradation of esthetic values due to the conversion of wooded lands to inflow and outflow channels.

6.10.2.2. Plan 6C. Implementation of this alternative would result in degradation of esthetic values due to the removal of streamside vegetation and conversion of wooded lands to inflow and outflow channels.

6.10.2.3. FWO. In the future without the project, esthetic values would probably change gradually.

6.10.3. Community Cohesion.

6.10.3.1. Plan 5C. The expressed need for improved flood control and drainage would be satisfied by project installation. This could enhance the potential for greater community cohesion and help reduce the trend of a declining economic base which causes economic problems associated with high outmigration rates.

6.10.3.2. Plan 6C. Same as Plan 5C.

6.10.3.3. FWO. In the future without the project, or similar drainage program, the same level of community cohesion that presently exists may continue.

6.10.4. Population and Employment.

6.10.4.1. Plan 5C. Project implementation would improve employment opportunities in the study area, and, thereby, help to reduce both the problem of outmigration rates and agricultural sector of the unemployment rates. The increased employment would be brought about by increased productivity which, subsequently, would stimulate the agricultural service sector and other economic activity. Employment on project construction of otherwise unemployed labor also would be realized.

6.10.4.2. Plan 6C. Same as Plan 5C.

6.10.4.3. FWO. Population growth rates are expected to remain significantly lower than those of the state and the nation with the no-action alternative. Without economic growth, the unemployment rate would probably remain higher than that of the state and the nation.

6.10.5. Personal Income.

6.10.5.1. Plan 5C. Increases in income expected after project installation could help to improve the overall economic outlook for the area and produce corresponding improvement in the personal economic well-being of the area's population.

6.10.5.2. Plan 6C. Same as Plan 5C.

6.10.5.3. FWO. Historical data indicate that per capita income will continue to remain below the national average without economic stimuli.

6.10.6. Tax Revenues, Property Values, and Public Facilities and Services.

6.10.6.1. Plan 5C. Implementation of Plan 5C would provide improved flood protection and agricultural productivity with related employment opportunities in the study area. A more prosperous region would create a potentially greater local tax base, as the productivity and value of properties are enhanced by project installation. The additional income generated from increased agricultural production could help to improve public facilities and services.

6.10.6.2. Plan 6C. Same as Plan 5C.

6.10.6.3. FWO. With the no-action alternative, a continued decline of the economic base in the immediate economic area would cause continued deterioration of tax revenues, property values, and the availability of public facilities and services.

6.10.7. Development of People, Businesses, and Farms.

6.10.7.1. Plan 5C. Implementation of Plan 5C would not displace any people, businesses, or farms. Improved economic conditions would help stem the outflow of population from the area. As the flood threat declines, agriculture would become more intensive, and thereby, would increase the

opportunities for additional economic development within the rural economic study area.

6.10.7.2. Plan 6C. Similar to Plan 5C, except that it would displace about 700 acres of agriculture development due to mitigation.

6.10.7.3. FWO. With the no-action alternative, the continued outmigration of the young populace would negatively affect the economic base of the study area. Without an alternative economic base, development of people, businesses, and farms would be affected detrimentally by continued outmigration.

6.10.8. Desirable Community and Regional Growth.

6.10.8.1. Plan 5C. Implementation of Plan 5C would encourage desirable economic development in the communities within the study area. Associated with desirable socioeconomic improvement would be higher living standards, better educational opportunities, and improved lifestyles.

6.10.8.2. Plan 6C. Same as Plan 5C.

6.10.8.3. FWO. A stagnation in agricultural employment is anticipated throughout the study area in the future without the project. This would be offset minimally by increases in manufacturing and related employment in the region.

7. LIST OF PREPARERS

The following people were primarily responsible for preparing this Environmental Impact Statement.

NAME	DISCIPLINE/ EXPERTISE	EXPERIENCE	ROLL IN PREPARING EIS
Dr. Peter S. (Steve) Mathies	Botany/Biology	3 years, Graduate Teaching Assistant, Mississippi State University; 1 year Environmental Quality Specialist, Jefferson Parish Environmental Department, Louisiana; 3 years, planning and EIS studies, New Orleans District	EIS Coordinator, Effects on Agricultural Lands Bottomland Hardwoods, Riparian Habitat, Aquatic Resources and Threatened and Endangered Species
Mr. Norman C. Haydel	Engineer/Civil Engineer	19 years, Planner, New Orleans District	Study Manager, Engineering
Mr. Wilbert V. Paynes	Civil Engineer/Water Resource Planner	1 year, Research Associate Transportation and Economic Development Research Center, Southern University; 9 years, Planning Division, New Orleans District	Study Manager, Engineering Input to EIS.
Ms. Carroll H. Kleinhans	Archeology	4 years, Field & Analysis; 2 years, NPS, Department of Interior; 5 years, Corps of Engineers, Memphis and New Orleans Districts	Effects on Cultural Resources
Mr. Stephen Finnegan	Landscape Architect/ Recreational Planning	8 years, Corps of Engineers, New Orleans District	Effects on Recreational Resources

7. LIST OF PREPARERS (Continued)

The following people were primarily responsible for preparing this Environmental Impact Statement.

NAME	DISCIPLINE/ EXPERTISE	EXPERIENCE	ROLL IN PREPARING EIS
Mr. Kenneth J. Froehlich	Environmental Resources Specialist	3 years, Hydrologist, Department of the Interior; 1 year Water Quality Studies, New Orleans District	Effects on Water Quality
Mrs. Judith Z. Gordon	Economics/Socioeconomics	12 years, Economist, Corps of Engineers, New Orleans District	Coordinated Contractor Economic Analysis and Compilation of Economic Appendix, Plan Economics, Effects on Socioeconomics
Mr. Robert Lacy	Socioeconomics	13 years, Regional Economist, Corps of Engineers, New Orleans	Section 122 Items
Mrs. Suzanne Hawes	Botany/Fisheries	1 year, Lab Associate, LSU Medical School; 13 years Environmental Studies, New Orleans District	Review and Technical Assistance
Mr. Henry P. Glaviano	English/Technical	4 years, Technical Writer/Editor The Boeing Company; 14 years, Technical Writer/Editor, Corps of Engineers, New Orleans District	Review and Editorial Assistance

8. PUBLIC INVOLVEMENT

8.1. PUBLIC INVOLVEMENT PROGRAM

8.1.1. The initial public meeting on this project was held in Colfax, Louisiana, on May 16, 1979. The purpose of the meeting was to allow the public an opportunity to express views about the problems and needs of the study area and possible solutions considered appropriate for investigation.

8.1.2. Prior to the publication of the final Aloha-Rigolette Area Reconnaissance Report in April 1981, a meeting was held on February 10, 1981, with the Grant Soil and Water Conservation District and concerned area residents in Colfax. This meeting was held to discuss data and results stated in the draft reconnaissance report.

8.1.3. In February, March, and November 1983, meetings were held with interested parties to discuss the status of the study and future planning efforts; as well as to solicit responses, recommendations, and remaining concerns. In October 1983, meetings were held with state and Federal agencies to discuss various study-related subjects. A public meeting is tentatively scheduled for August 1985 in Alexandria, Louisiana, to discuss the Draft Environmental Impact Statement (DEIS) and TSP.

8.2. REQUIRED COORDINATION

This DEIS is being furnished to Federal agencies, state agencies, and other interested parties for their review.

8.3. STATEMENT RECIPIENTS

MEMBERS OF CONGRESS

Honorable J. Bennett Johnston
Honorable Russell B. Long
Honorable Jerry Huckaby
Honorable Kathy (Mrs. Gillis) Long

FEDERAL AGENCIES

Department of the Interior, Office of Environmental Project Review
U.S. Fish and Wildlife Service, Field Supervisor, Lafayette, Louisiana
U.S. Environmental Protection Agency, Regional EIS Coordinator, Region VI
U.S. Environmental Protection Agency, the Administrator
U.S. Department of Commerce, Joyce M. Wood, Director, Office of Ecology and Conservation
U.S. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Southeast Region
U.S. Fish and Wildlife Service, Office of Endangered Species, Jackson, Mississippi
U.S. Department of Agriculture, Washington, D.C.
U.S. Department of Agriculture, Southern Region, Regional Forester, Forest Service
U.S. Department of Energy, Director, Office of Environmental Compliance, Washington, D.C.
Federal Emergency Management Administration, Washington, D.C.
Soil Conservation Service, Harry S. Rucker, State Conservationist
U.S. Department of Energy, Office of Environmental Compliance, Washington, D.C.
Federal Emergency Management Administration, Washington, D.C.

Federal Highway Administration, Division Administrator, Baton Rouge,
Louisiana

U.S. Department of Health and Human Services, Washington, D.C.

U.S. Department of Health and Human Services, Atlanta, Georgia,
Stephen Margolis, Ph.D.

U.S. Department of Housing and Urban Development, Regional Administrator,
Region VI

Advisory Council on Historic Preservation, Washington, D.C.

Advisory Council on Historic Preservation, Golden, Colorado

STATE AGENCIES

Louisiana Department of Health and Human Resources, Office of Health
Services and Environmental Quality

Louisiana Department of Transportation and Development, Office of Public
Works, Deputy Chief Engineer

Louisiana Department of Highways, Mr. Vincent Pizzolato, Public Hearings
and Environmental Impact Engineer

Louisiana Department of Wildlife and Fisheries, Mr. Maurice B. Watson,
Ecological Studies Section

Louisiana Department of Wildlife and Fisheries, Secretary

Louisiana Department of Natural Resources, Office of Environmental Affairs,
Water Pollution Control Division

Louisiana Department of Natural Resources, Division of State Lands

Louisiana Department of Commerce, Research Division, Mrs. Nancy P. Jensen

Louisiana Department of Culture, Recreation, and Tourism, State Historic
Preservation Officer

Louisiana Department of Culture, Recreation, and Tourism, Office of
State Parks

Louisiana Department of Natural Resources, Office of Forestry

Louisiana State Planning Office, Ms. Joy Bartholomew, Policy Planner

Louisiana State University, Center for Wetland Resources,
Dr. Jack R. Van Lopik

Louisiana State University, Department of Geography and Anthropology,
Curator of Anthropology

Louisiana State University, Coastal Studies Institute, Library

Governors Coastal Protection Task Force, Gerald Bordelon

STATE OFFICIALS

Honorable Edwin Edwards, Governor
Honorable Robert Freeman, Lieutenant Governor
Honorable Jim Brown, Secretary of State
Honorable Bob Odom, Commissioner of Agriculture
Honorable William Guste, Jr., Attorney General
Honorable Joe McPherson, Senator
Honorable Donald Kelly, Senator
Honorable Mike Tinnerello, Representative
Honorable Thomas Brady, Representative
Honorable Charlie Dewitt, Representative
Honorable Carl Gunter, Sr., Representative
Honorable John Scott, Representative

STATE LIBRARIES

Louisiana Department of Public Works Library
Louisiana Department of Commerce and Industry Library
Huey P. Long Memorial Law Library
Northwestern State University Library
Louisiana State University Library at Alexandria
University of New Orleans Library
Tulane University Library
Avoyelles Parish Library
Grant Parish Library
Natchitoches Parish Library
Rapides Parish Library
New Orleans Public Library
Winn Parish Library

ENVIRONMENTAL

Louisiana Wildlife Federation
Ecology Center of Louisiana, Inc., J. Vincent, President
Orleans Audubon Society, c/o Mr. Barry Kohl
Environmental Defense Fund
Mr. Oliver Houck, Tulane Law School
Rapides Wildlife Association
Delta Chapter, Sierra Club

OTHERS

19th Louisiana Levee District
Red River, Atchafalaya, and Bayou Boeuf Levee District
The Kansas City Southern Railway Company
Grant Parish Police Jury
Winn Parish Police Jury
Rapides Parish Police Jury
Iatt Lake Conservation Board
Red River Valley Association
City of Pineville, Office of the Mayor
Town of Colfax, Office of the Mayor
City of Alexandria, Office of the Mayor
Grant Fishing and Hunting Club

8.4. PUBLIC VIEWS AND RESPONSES

The view expressed by state and local governing agencies to this agency that influenced decision making and the preparation of this report was the need for reduction of flood damages to the agricultural lands of the Aloha-Rigolette area. Potential issues of concern may arise in response to this report. These public views and responses will be presented in the final EIS.

8.5. U.S. FISH AND WILDLIFE SERVICE (FWS) RECOMMENDATIONS

The FWS has expressed differing views on several subjects covered by this EIS. These differing views led to the prediction of differing project impacts and, thus, differing recommendations. The recommendations set forth in their Draft Fish and Wildlife Coordination Report are stated below along with our response to those recommendations.

FWS recommendation 1:

Plan 19C should be the alternative selected for implementation, and should be modified to provide for 40,374 acre-days of flooding during the waterfowl wintering period (November 1 to March 1) to compensate for project-induced losses of waterfowl wintering habitat.

Response:

Plan 19C is not the NED plan and is, therefore, not recommended for implementation.

FWS recommendation 2:

If Plan 5C is selected, mitigation should include the purchase and management of 1,425 acres of cleared and riparian habitats. At least 337 of those acres should be flooded for 120 days during November 1 to March 1 to provide at least 40,374 acre-days of flooding for wintering waterfowl.

Response:

We have recommended Plan 5C as the Tentatively Selected Plan. Full mitigation is recommended for quantifiable impacts on fish and wildlife resources as we determined them. Our greatly differing mitigation plans stem from our greatly differing predictions of induced clearing. The New

Orleans District developed and utilized a methodology for predicting induced clearing which closely resembled a methodology used by the Vicksburg District and the FWS, Vicksburg Office (Gulf South Research Development Corporation, 1984). The FWS, Lafayette Area Office, chose to use a different methodology, which is described in their report.

FWS recommendation 3:

If Plan 6A is selected, mitigation should include the purchase and management of an estimated 2,752 acres of cleared and riparian habitats, as well as the purchase of flowage easements to facilitate water-level management in Iatt Lake and to improve aquatic habitat quality in Bayou Rigolette. At least 642 of those acres should be flooded for 120 days during November 1 to March 1 in order to provide for a minimum of 77,076 acre-days of flooding for wintering waterfowl.

Response:

Plan 6A is not selected for recommendation.

FWS recommendation 4:

Mitigation measures should be implemented simultaneously with other project features.

Response:

We concur.

FWS recommendation 5:

Administration and management of lands acquired in fee simple should be in accordance with the General Plan process contained in Section 3b. of the Fish and Wildlife Coordination Act.

Response:

We have not recommended that any lands be acquired in fee.

FWS recommendation 6:

The initial development, replacement, and annual operation and maintenance costs for the mitigation lands shall be provided by the Corps as an integral project expense.

Response:

We have recommended the purchase of a flowage easement on lands subject to flooding with the drawdown of Iatt Lake. Therefore, none of these costs would apply.

TABLE 9. INDEX

Subject	STUDY DOCUMENTATION		
	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Affected Environment	pp. EIS-18-29	pp. 9, 42-47	---
Alternatives	pp. EIS-7-17	pp. 25-37	App. A, p. A-5-11
Area of Controversy and Unresolved Issues	p. EIS-2	---	---
Comparative Impacts of Alternatives	p. EIS-14	pp. 42-47	---
Coast Fish and Wildlife Coordination Act Report	---	---	App. B, p. B-18
Economics	p. EIS-17	pp. 54-58	App. A, p. A-58; App. C, p. C-32-108; App. D
Environmental Conditions	pp. EIS-18-19	pp. 9-16	---
Environmental Effects	pp. EIS-30-45	pp. 16-19	App. A, pp. A-55-56
Future Without Project (No Action)	p. EIS-10	---	App. A, p. A-45
Introduction	p. EIS-5	---	---
List of Preparers	pp. EIS-46-47	---	---
Major Conclusions and Findings	p. EIS-1	---	---
Mitigation	pp. EIS-12-13, 34-36	---	App. A, pp. A-47-52; App. C, pp. C-103-108
Need for and Objectives of Action	pp. EIS-5-6	pp. 20-23	App. A, pp. A-12-16
Planning Objectives	p. EIS-6	pp. 2-4	App. A, pp. A-2, 17
Plans Considered in Detail	p. EIS-10	pp. 39-42	App. A, pp. A-47-74

TABLE 9. INDEX (Continued)

Subject	STUDY DOCUMENTATION		
	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Plans eliminated from further study during Intermediate Evaluation	pp. EIS-7-10	pp. 29-37	App. A, p. A-46
Public concerns	p. EIS-5	pp. 2-4	---
Public involvement	p. EIS-48	pp. 4-5	---
Public views and responses	p. EIS-52	pp. 4-5	---
Relationship of plans to environmental protection statutes and other environmental requirements	p. EIS-3	---	---
Required coordination	p. EIS-48	pp. 4-5	---
Section 404(b)(1) Evaluation	---	---	App. B, pp. B-11-14
Significant resources and Section 122 items	pp. EIS-19-45		
a. Aquatic resources of Environmental Study Area	pp. EIS-22-25, 34-37	pp. 42-45	App. A, pp. A-55-56
b. Cultural Resources	pp. EIS-26-27, 39-42	pp. 42-45	App. A, p. A-56

TABLE 9. INDEX (Continued)

Subject	STUDY DOCUMENTATION		
	Environmental Impact Statement	Main Report (References Incorporated)	Report Appendixes (References Incorporated)
c. Recreational resources	pp. EIS-25-26, 37-39	pp. 42-45	App. A, pp. A-56-58
d. Section 122 items	pp. EIS-27-29, 42-45	---	---
e. Sites on the National Register of Historic Places	pp. EIS-26, 39	---	---
f. Terrestrial Resources of Agricultural Lands	pp. EIS-19-21, 30-31	pp. 42-45	App. A, pp. A-55-56
g. Terrestrial Resources of Bottomland Hardwood Forests	pp. EIS-21-22, 31-33	pp. 42-45	App. A, pp. A-55-56
h. Terrestrial Resources of Riparian Habitat	pp. EIS-22, 33-34	pp. 42-45	App. A, pp. A-55-56
i. Threatened and Endangered Species	pp. EIS-25, 37	---	App. B, pp. B-2-3
Statement recipients	pp. EIS-49-52	---	---
Study authority	p. EIS-5	p. 2	---
Table of Contents	p. EIS-4	pp. 1 & 11	App. A, p. 1; App. C, p. 1-111
Unresolved issues	p. EIS-2	---	---
U.S. Fish and Wildlife Service Recommendations	p. EIS-53-54	---	App. B, p. B-12

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TENTATIVE RECOMMENDATION

In my capacity as District Engineer, I find that the tentatively selected plan of improvement as developed in this report is based on a thorough analysis and evaluation of all practicable alternative courses of action. The plan produces net excess benefits over cost and has a favorable benefit-to-cost ratio. I have considered the significant environmental, social, and economic effects, the engineering feasibility, and the input received from the public and have determined that the plan is in the public interest.

I recommend that the existing project "Red River below Denison Dam," authorized by the Flood Control Act of 1946, as it pertains to the Aloha-Rigolette area, Grant and Rapides Parishes, be modified to provide additional flood protection by construction of six 10- by 10-foot gated culverts and purchase of 170 acres of flowage easements to facilitate the periodic drawdown of Iatt Lake to improve fisheries as described in this report, and with such modification thereof as in the discretion of the Chief of Engineers may be advisable; at an estimated Federal first cost of \$6,886,800 and an estimated annual operation and maintenance cost of \$19,000. Further, I recommend construction of the six floodgates subject to cost-sharing and financing arrangements with the responsible non-Federal agencies sponsoring the project that are satisfactory to the President and the Congress. The non-Federal share of the project first cost is currently estimated at \$13,200.

Non-Federal sponsors shall, prior to implementation, agree to perform the following required items of cooperation:

- a. Provide without cost to the United States all lands, easements, rights-of-way, disposal areas, and the relocation of bridges (except railroad bridges) and roads, pipelines, and utilities that may be required for construction of the project, presently estimated at \$13,000;

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

c. Operate and maintain the works, including mitigation, after completion in accordance with regulations prescribed by the Secretary of the Army;

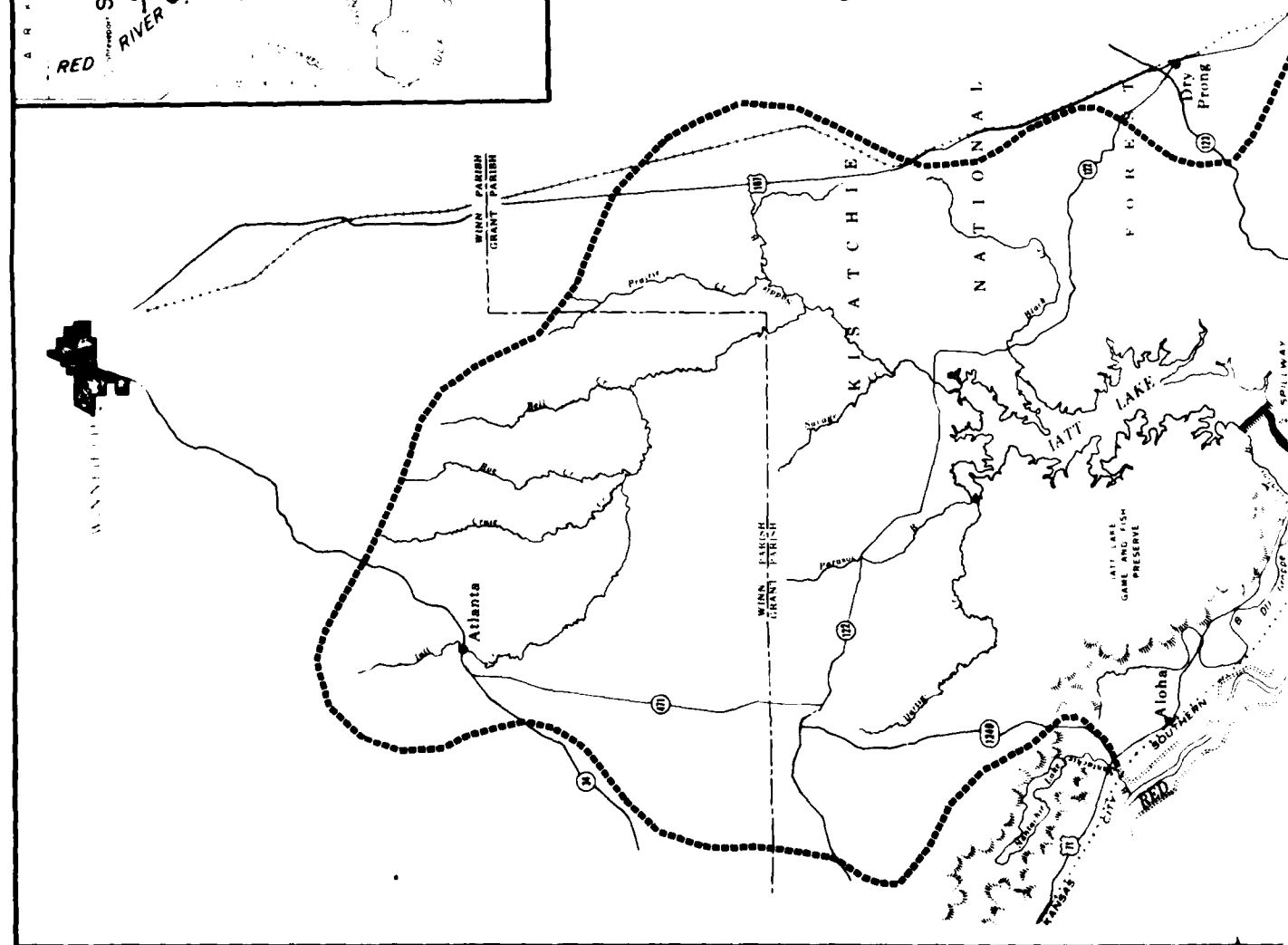
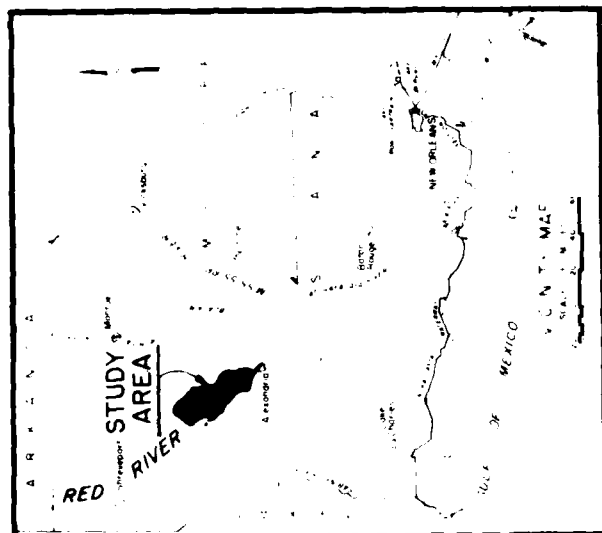
d. Provide in the form of cash or contributions equal in value as may be agreed upon the costs of mitigation in the same proportions as the total costs for flood control, presently estimated at \$200;

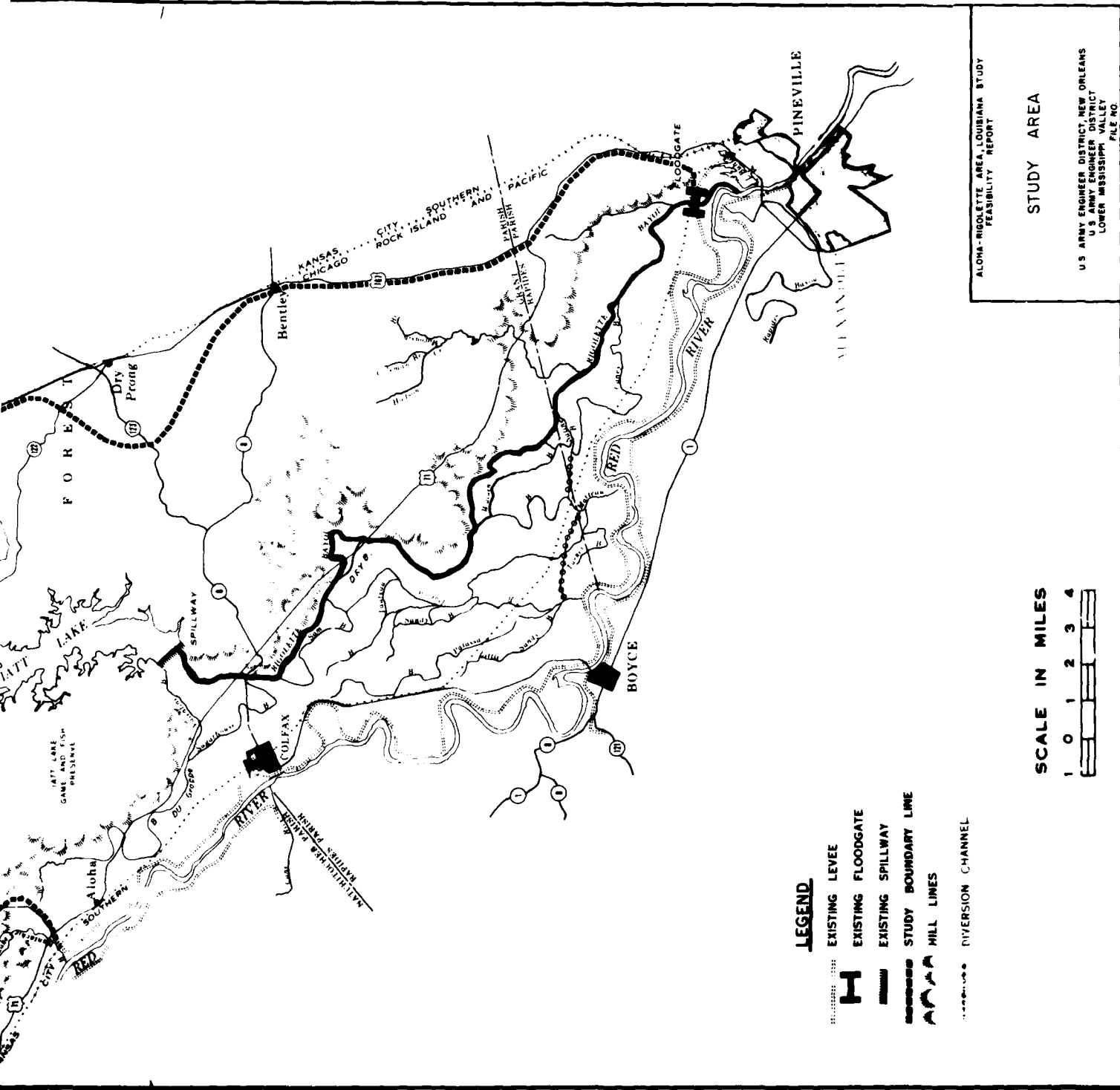
e. Comply with Section 221, Public Law 91-611, approved 31 December 1970, as amended;

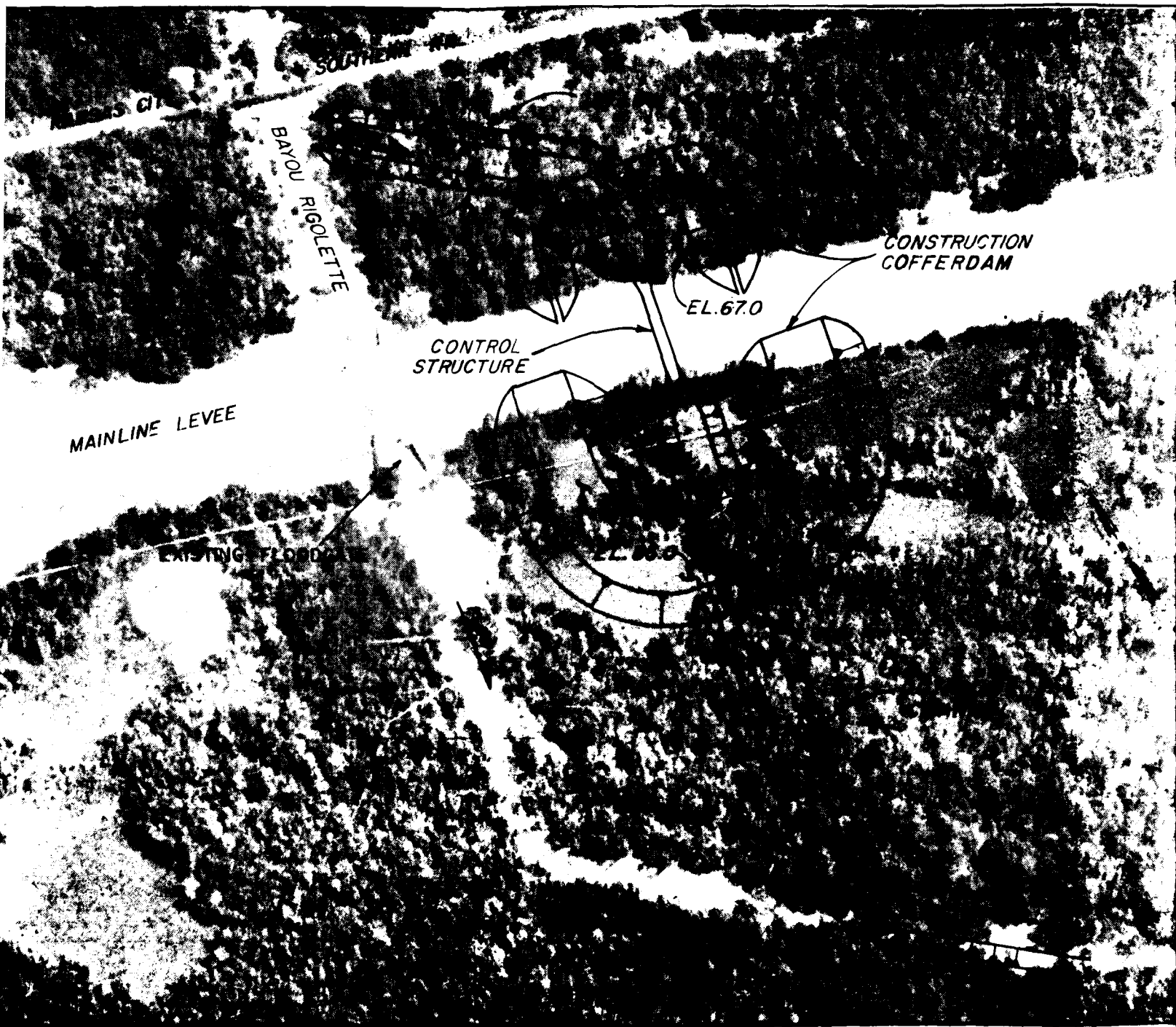
f. Section 601 of Title VI of the Civil Rights Act of 1964 (PL 88-352) that no person shall be excluded from participation in, denied the benefits of, or subjected to discrimination in connection with the project on the grounds of race, creed, or national origin; and

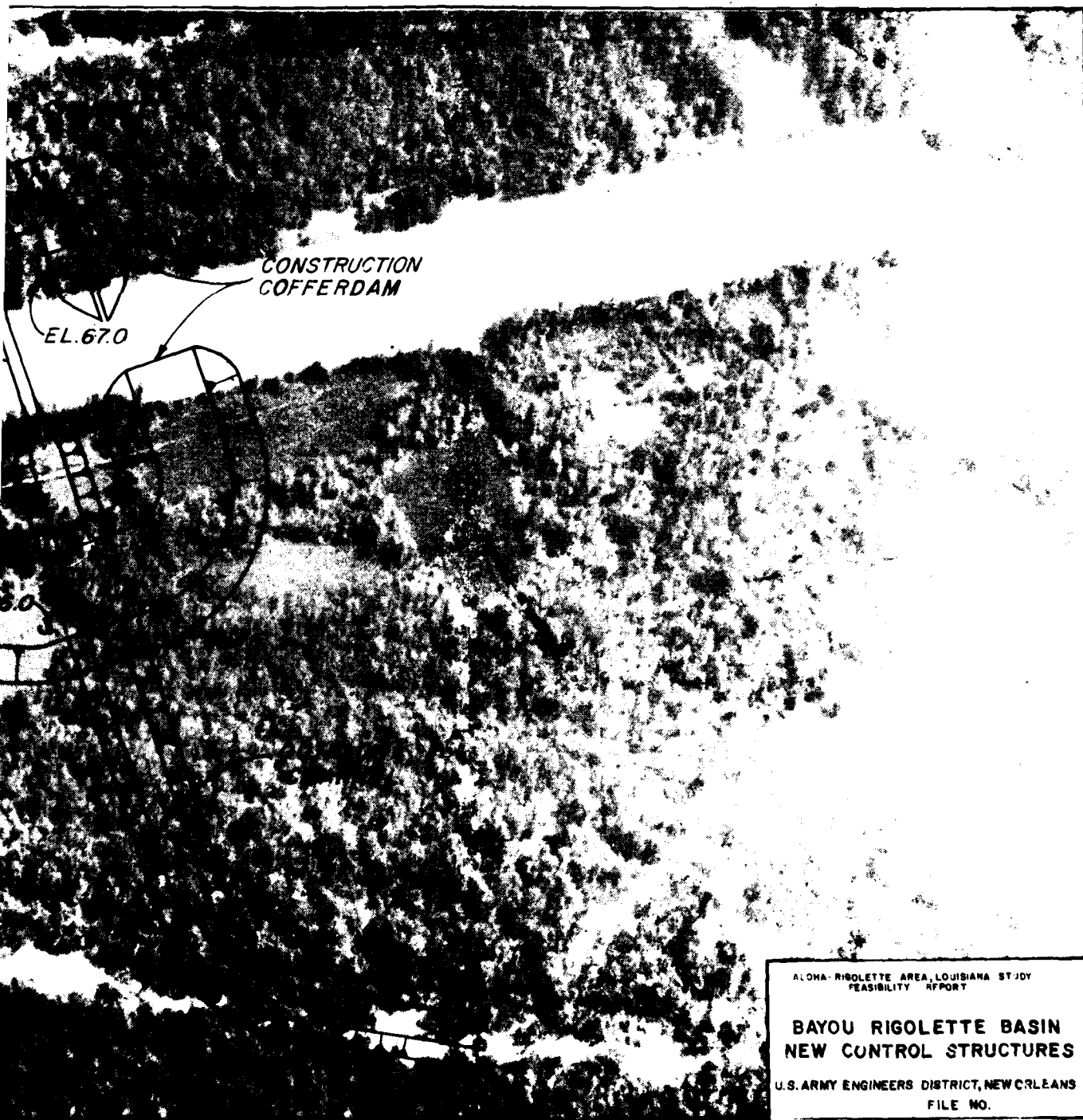
g. The applicable provisions of the Uniform Relocation Assistance and Real Policies Act of 1970, Public Law 91-646.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the prospect of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress.









CONSTRUCTION
COFFERDAM

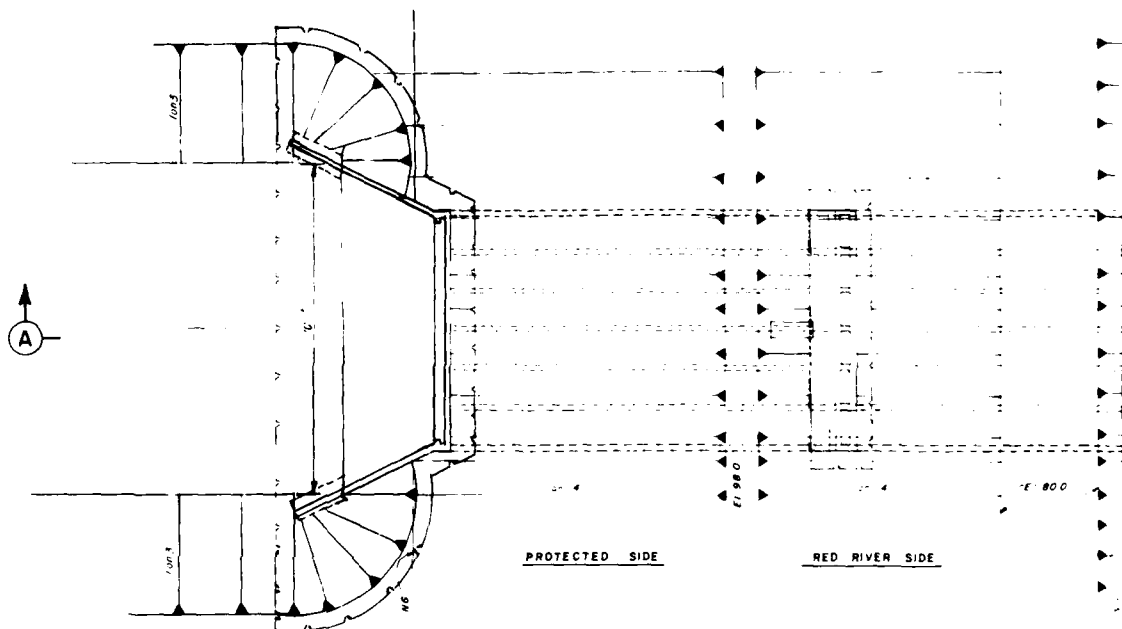
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ALOMA RIGOLETTE AREA, LOUISIANA STUDY
FEASIBILITY REPORT

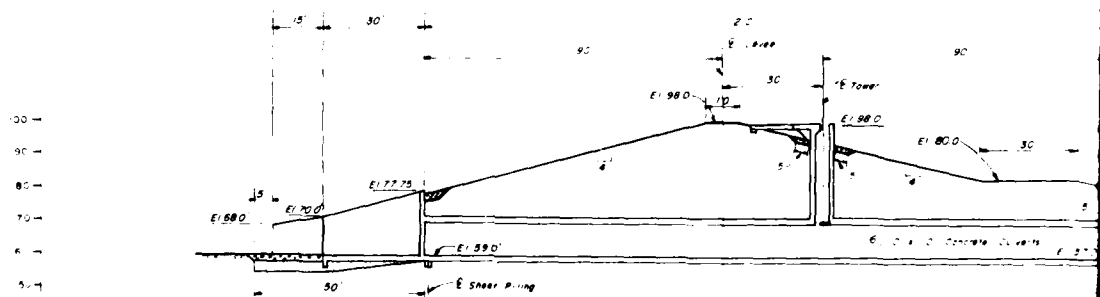
BAYOU RIGOLETTE BASIN
NEW CONTROL STRUCTURES

U.S. ARMY ENGINEERS DISTRICT, NEW ORLEANS
FILE NO.

PLATE 2

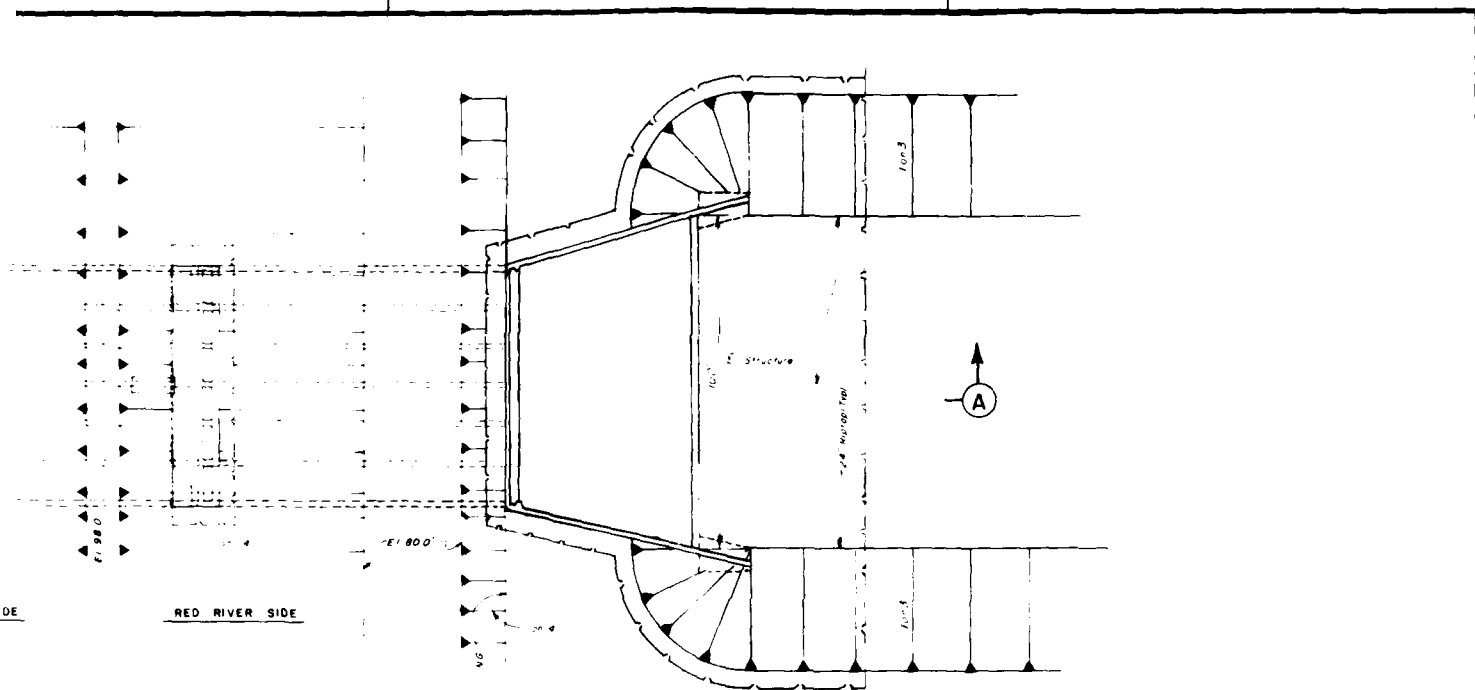


PLAN



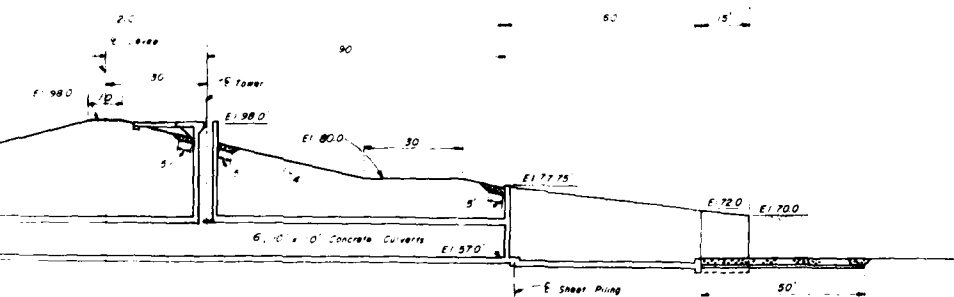
SECTION A-A

SCALE 1" = 20'



PLAN

NOTE ALL RIPRAP 18" DEPTH EXCEPT AS SHOWN



SECTION A-A

SCALE 1" = 20'

ALOMA-RIGOLETTE AREA, LOUISIANA STUDY
FEASIBILITY REPORT

**BAYOU RIGOLETTE BASIN
NEW CONTROL STRUCTURE**

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

FIG. 20.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM								
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A160 790	3. RECIPIENT'S CATALOG NUMBER								
4. TITLE (and Subtitle) ALOHA - RIGOLETTE AREA, LOUISIANA Agricultural Flood Control		5. TYPE OF REPORT & PERIOD COVERED Draft Environmental Impact Statement								
		6. PERFORMING ORG. REPORT NUMBER								
7. AUTHOR(s) DR. STEVE MATHIES		8. CONTRACT OR GRANT NUMBER(s)								
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Corps of Engineers New Orleans District P. O. Box 60267 New Orleans, La. 70160-0267		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS LMNPD-RE								
11. CONTROLLING OFFICE NAME AND ADDRESS Office, Chief of Engineers, U.S. Army Washington, D.C. 20314		12. REPORT DATE JUNE, 1985								
		13. NUMBER OF PAGES 59+3 Plates								
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED								
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE								
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release; Distribution Unlimited										
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)										
18. SUPPLEMENTARY NOTES										
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <table border="0"><tr><td>Agricultural flood damages</td><td>Flood protection</td></tr><tr><td>Agricultural land</td><td>Mitigation</td></tr><tr><td>Fisheries</td><td>Reparian habitat</td></tr><tr><td>Floodgates</td><td>Wooded lands</td></tr></table>			Agricultural flood damages	Flood protection	Agricultural land	Mitigation	Fisheries	Reparian habitat	Floodgates	Wooded lands
Agricultural flood damages	Flood protection									
Agricultural land	Mitigation									
Fisheries	Reparian habitat									
Floodgates	Wooded lands									
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Bayou Rigolette is located entirely within the Red River floodplain and flows southeasterly from the Iatt Lake Dam to Red River. The original Federal project, completed in 1956, provided adequate flood protection to the area through levees, clearing and snagging, diversion channels, and floodgates. The current study was authorized in 1974 as a result of public concern for continued agricultural flood damages experienced in the study area. The primary purpose of this study, therefore, is to develop a plan which would reduce those agricultural damages. <u>Of the 22 alternatives proposed, only three were carried</u>										

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20. ABSTRACT (Continued)

into final consideration. Plan 5C consists of the construction of six new floodgates and the purchase of flowage easements on 170 acres of land to facilitate the periodic drawdown of Iatt Lake to improve fisheries; Plan 19C consists of the same features as 5C, but also includes the acquisition of a "no development easement" over 1,963 acres of wooded lands; and Plan 6C consists of the reconnection of Bayou Darrow to the Red River and some channel improvements. It also includes flowage easements to facilitate the drawdown of Iatt Lake and purchase of 615 acres of agricultural land which would be reforested to mitigate for impacts of channel improvement. The net excess benefits and the benefit-to-cost ratios differ substantially for those plans. Plan 5C has the greatest net economic benefits and fully addresses the goal of National Economic Development; therefore, it is tentatively selected for recommendation.

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