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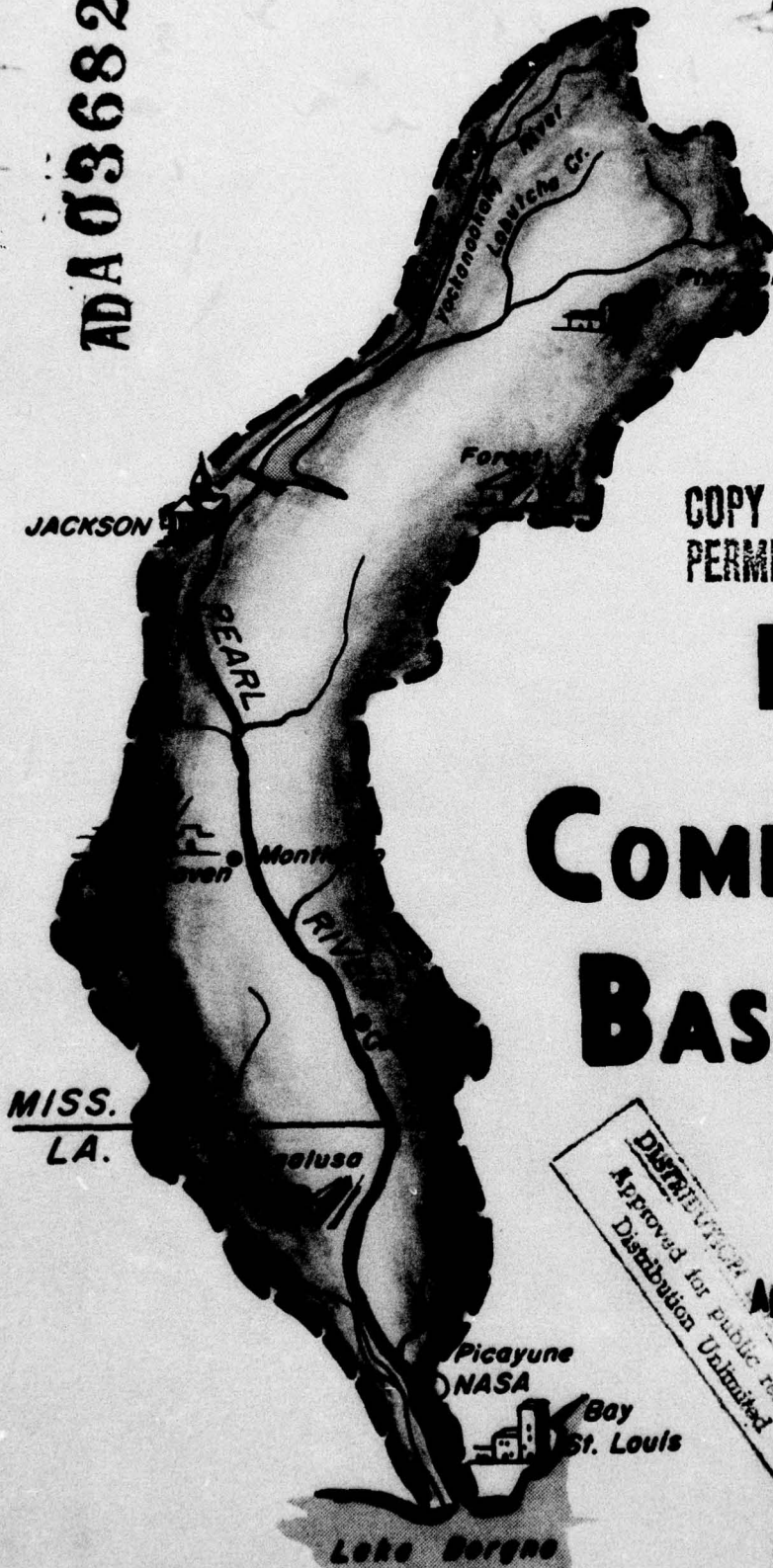
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PEARL RIVER COMPREHENSIVE BASIN STUDY

VOLUME IV

Appendix E Plan Formulation

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Comprehensive Plan**

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PEARL RIVER COMPREHENSIVE BASIN STUDY .
Volume IV .
 APPENDIX E .

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PLAN FORMULATION

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Prepared for the Pearl River Basin Coordinating Committee
 by the Mobile District, Corps of Engineers, and the
 Soil Conservation Service, Department of Agriculture

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APPENDIX E - PLAN FORMULATION

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APPENDIX E

PLAN FORMULATION

SECTION 1 - INTRODUCTION

OBJECTIVES OF STUDY

The basic objective in the formulation of a comprehensive plan of development of the water and related land resources of the Pearl River Basin is to provide the best use or combination of uses of these resources to meet the foreseeable short- and long-term needs within the study area. Plan formulation studies must consider water and related land problems and the interrelation of project purposes and projects, both existing and proposed, in order to fully develop the potentials of the basin, to foster economic development, and to enhance the conditions of health and welfare of the people and the quality of their environment.

SCOPE

The plan formulation appendix represents the focal point of accumulation, analysis, evaluation, and presentation of comparative physical and economic data leading to the recommended comprehensive plan of development for the Pearl River Basin. Therefore, included are present and projected needs for water and related land resource development in the basin; reasonable alternatives for meeting those needs; plan formulation concepts and considerations; and a comprehensive plan including a framework for long-range planning and an early-action program for development of projects that are needed now, are economically justified and should be built within the next 10 to 15 years.

Plan formulation procedures were accomplished through the integration and analysis of data collected and generated in other appendixes of the report. This appendix was compiled cooperatively by the Corps of Engineers and the Soil Conservation Service with input from all Federal and State agencies participating in the study. Table 1 lists the technical appendixes of the report and the primary Federal and State agencies responsible for their preparation. As indicated by their titles, these appendixes present the detailed investigations of all facets of water resource planning considered for the Pearl River Basin.

Table 1

Technical Appendixes

Appendix	Responsible agency ¹
A Views of Federal and State Agencies on Comprehensive Plan -----	CE
B Assurances of Local Cooperation -----	CE, SCS
C Digest of Public Hearings -----	CE
D Economic Base Study -----	CE, SCS, ERS, FS
E Plan Formulation -----	CE, SCS
F Engineering Studies for Main Stem and Major Tributaries -----	CE
G Agricultural Requirements and Upstream Watershed Development -----	SCS, ERS, FS
H Municipal and Industrial Water Supply and Water Quality Control -----	FWQA
I Outdoor Recreation -----	BOR
J Fish and Wildlife Resources -----	BSF&W
K Archeological, Historical and Natural Resources-----	NPS
L Geohydrologic Summary-----	USGS
M Mineral Resources -----	BOM
N Public Health Aspects -----	PHS
O Role of States of Mississippi and Louisiana ----	PRBDD, LDPW

- ¹CE = Corps of Engineers
SCS = Soil Conservation Service
ERS = Economic Research Service
FS = Forest Service
FWQA = Federal Water Quality Administration
BOR = Bureau of Outdoor Recreation
BSF&W = Bureau of Sport Fisheries and Wildlife
NPS = National Park Service
USGS = United States Geological Survey
BOM = Bureau of Mines
PHS = Public Health Service
PRBDD = Pearl River Basin Development District
LDPW = Louisiana Department of Public Works

SECTION 2 — PRESENT WATER AND RELATED LAND RESOURCE DEVELOPMENTS

INTRODUCTION

The water and related land resources of the Pearl River Basin are largely undeveloped. The few principal water resource developments, either constructed or under construction by the Federal Government, include channel developments for navigation and improvements for flood control. Non-Federal developments include a large reservoir for recreation and water supply for the Jackson, Mississippi, area and several lakes, parks and related recreational areas. Existing and authorized developments within the basin are shown on Figure 1.

Municipal and industrial use of freshwater in the basin in 1965 was approximately 82 million gallons per day. Of this total, groundwater supplied an estimated 32 million gallons per day.

EXISTING AND AUTHORIZED FEDERAL DEVELOPMENTS

Corps of Engineers. Existing or authorized projects of the Corps of Engineers in the basin include navigation facilities in the lower portion and a flood control project along the Pearl River at Jackson.

The principal existing project for navigation provides a 58-mile-long channel 7 feet deep at mean low water from the mouth of West Pearl River to Richardson's Landing on the Pearl River at Bogalusa, Louisiana. It consists of a 100-foot-wide channel and cutoffs in the lower 28.5 miles of West Pearl River; an 80-foot-wide and 20.3-mile-long lateral canal which contains 3 locks with a total lift of 54.5 feet; and a 100-foot-wide channel and cutoffs in a 9.2-mile-long reach of the Pearl River from the head of the canal to Bogalusa. Pertinent data on the project are given in Table 2.

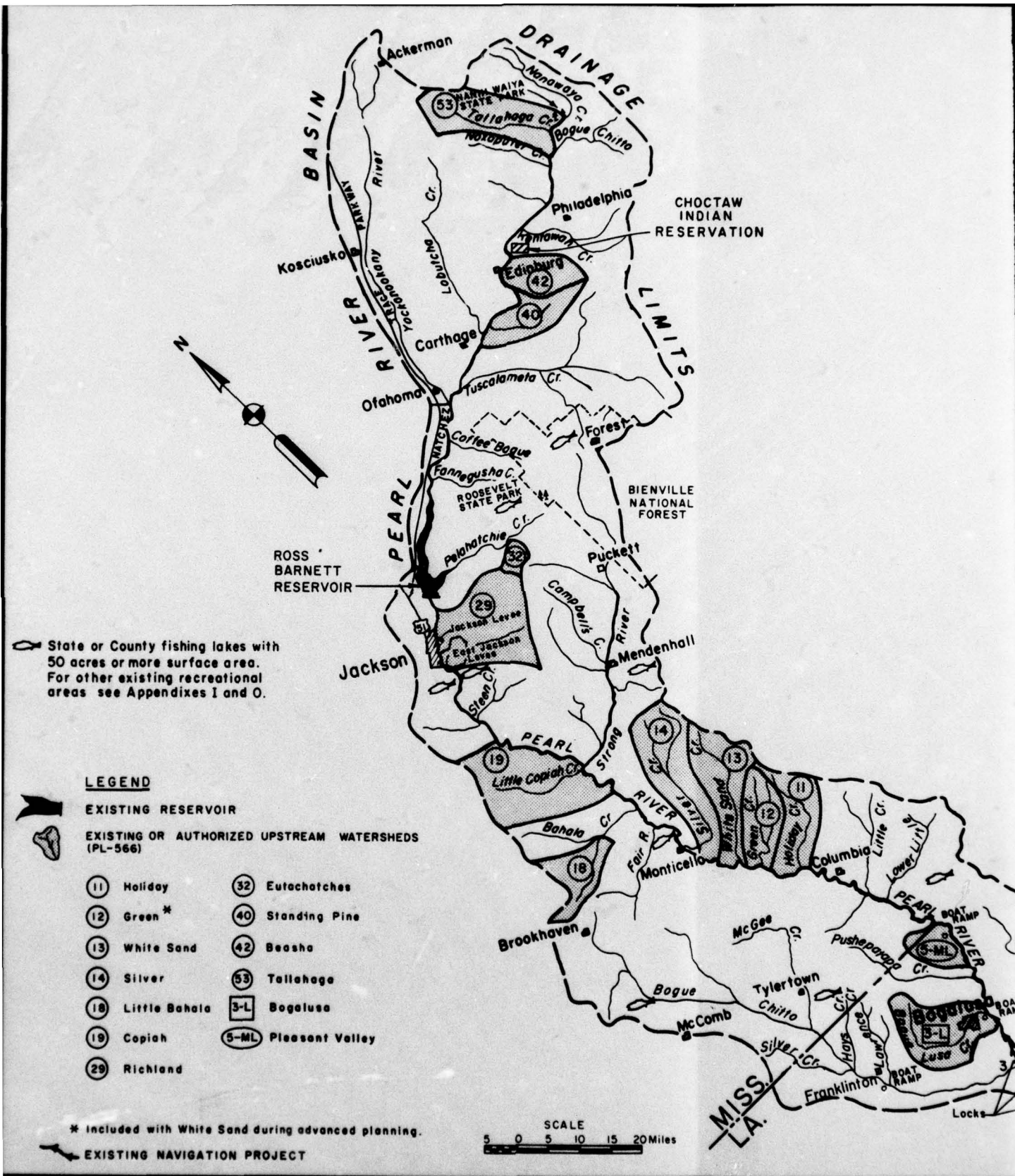
The River and Harbor Act of 1966 authorized the modification of the existing project to include cutoffs and the easement of bends at 8 locations along the West Pearl River portion of the waterway below Lock 1 in the reach from its mouth to mile 26. Other existing navigation projects of the Corps of Engineers include a 9-foot-deep channel from the Intracoastal Waterway to the mouth of the East Pearl River. Two other navigation projects in the basin, which are presently inactive, consist of a 3-foot channel along lower Bogue Chitto to a point near Summit, Mississippi, and a 2-foot channel along Pearl River from Jackson to Edinburg, Mississippi.

The only Corps of Engineers flood control project in the basin is a levee project (Jackson-East Jackson Levee) along Pearl River at Jackson. This project consists of levees along both banks and development of the river channel to provide protection for 6,290 acres of land. The project was authorized by the Flood Control Act of 1960 and construction was completed in 1968. Pertinent data on the project are shown in Table 3.

Table 2

Pertinent data on existing Corps of Engineers
navigation project, West Pearl River

Item	
Total length of waterway, miles -----	58
Length of river section below lateral canal, miles -----	28.5
Length of lateral canal, miles -----	20.3
Length of river section above lateral canal, miles -----	9.2
Project channel dimensions:	
Depth of river sections, feet below low water -----	7
Minimum width of river sections, feet -----	100
Depth of lateral canal, feet below normal pools -----	7
Minimum width of lateral canal, feet -----	80
Locks:	
Number -----	3
Location, miles above mouth of West Pearl along lateral canal:	
Lock 1 -----	29.7
Lock 2 -----	40.8
Lock 3 -----	44.0
Maximum lift, feet:	
Lock 1 -----	26.5
Lock 2 -----	15.9
Lock 3 -----	12.1
Total -----	54.5
Nominal size of lock chambers, feet -----	65 x 310
Depth over sills, feet -----	10



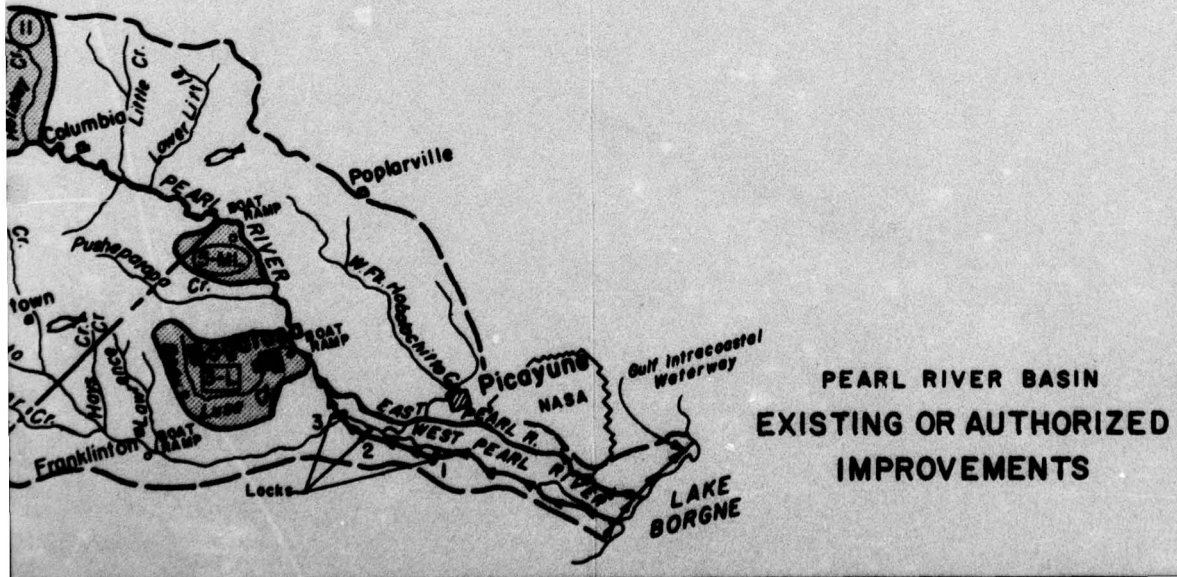
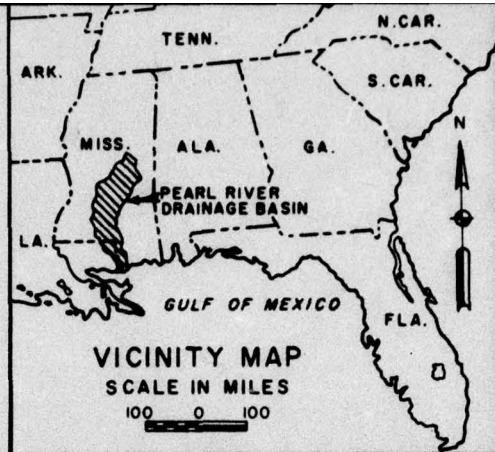


Table 3

Pertinent data for existing Corps of Engineers flood control project at Jackson, Mississippi

	<u>Fairgrounds</u>	<u>East Jackson</u>
LEVEES		
Length, miles -----	1.8	11.2
Average height, feet -----	21	14
Top width, feet -----	10	10
Number of sandbag closures -----	--	6
DRAINAGE STRUCTURES		
Length of drainage canals, miles -----	1.4	12
Number of gated outlets through levee ---	2	3
Number of pumping stations -----	1	1
Total capacity of pumps, gallons per minute -----	20,000	200,000
CHANNEL RECTIFICATION		
Number of cutoffs -----		3
Total length of cutoffs, miles -----		2.3
Total length of existing river channel improved, miles-		3
Bottom width of rectified channel, feet -----		150

Department of Agriculture. All of the counties and parishes in the basin are within organized Soil Conservation Districts and are actively engaged in carrying out soil and water conservation practices. Detailed soil surveys have been completed on 60 percent of the agricultural land. Farm plans have been prepared for 40 percent of the farms comprising 41 percent of the agricultural land. Practices carried out to date through Soil Conservation Districts, agricultural conservation programs, the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566), the Clarke-McNary and Cooperative Forest Management Acts and other programs include conservation cropping systems, pasture planting and improvements, farm ponds, drainage, terracing, contour farming, critical land area treatment, tree planting, and woodland management practices.

The first local water management district organized in the basin under Public Law 566, as amended, was the Pleasant Valley Watershed located in Washington Parish, Louisiana. The work plan for this watershed was approved for operation in December 1958. Since that time, 13 other watersheds have been organized and others are in the process of organizing. Of the 14 organized watersheds, 12 have been approved for operations (Tallahaga, Beasha, Standing Pine, Pleasant Valley, Eutaucutaches, Richland, Copiah, Silver, Whitesand, Holiday, Little Bahala, and Bogue Lusa). The remaining 2 (Carthage and Hanging Moss) are presently being planned. Most of the land treatment measures, 5 floodwater retarding structures and 1.08 miles of channel development have been installed in the Pleasant Valley Watershed. Some of the land treatment measures

have been installed in the Standing Pine Watershed.

Measures to be installed in the 12 watersheds approved for operation include land treatment for watershed protection, critical land area stabilization and structural measures. Structural measures include 94 floodwater retarding structures, 6 multiple-purpose structures, and 390 miles of channel development. Two of the multiple-purpose structures will contain storage for industrial water supply and 5 will have storage for recreation. Also, 3,959 acres of critical land area are to be planted to grasses and legumes and 4,280 acres to trees. Erosion control measures are expected to be applied on 550 miles of road banks.

The U. S. Forest Service administers about 85,800 acres in the Bienville National Forest, 100 acres in the Tombigbee National Forest and 1,200 acres in the DeSoto National Forest in the Pearl River Basin. These areas are managed for outdoor recreation, range, timber, watershed and wildlife and fish purposes and provide developed sites for camping, picnicking, boating and fishing. "Green tree" reservoirs are planned which will provide feeding areas for waterfowl. One of the recently opened areas in the Bienville National Forest is the Bienville Pines Scenic Area, a 189-acre tract with virgin loblolly pine. A walk through this area gives an idea of how some of the coastal plain forests looked when the early settlers arrived.

Department of the Interior. The National Park Service is responsible for the development of the Natchez Trace Parkway of which about 83 miles are in the Pearl River Basin above Jackson. The Parkway was authorized by Congress in 1934 in commemoration of the Old Natchez Trace which was originally a series of Indian paths that later became a wilderness roadway and, from 1800 to 1930, a post road and highway between Natchez, Mississippi, and Nashville, Tennessee. It is a scenic motor road with access to historic sites, natural areas and recreational areas.

The Bureau of Sports Fisheries and Wildlife has in its care the Noxubee National Wildlife Refuge, located just outside the extreme northern end of the basin, which supports waterfowl and forest-dwelling wildlife in a flatwoods environment, including a 1,200-acre lake.

The Bureau of Indian Affairs is responsible for a Choctaw Indian reservation that includes approximately 17,000 acres of land in the northern portion of the basin near Philadelphia, Mississippi. This land was reserved for the Choctaw Indians who refused settlement to permanent reservations in Oklahoma provided by treaty.

Other Federal development. The National Aeronautics and Space Administration (N.A.S.A.) has constructed a 20-mile-long navigation channel 12 feet deep and 150 feet wide in the East Pearl River from the Gulf Intracoastal Canal to an excavated harbor near Gainesville, Mississippi. A dredged canal with a lock 600 feet long and 110 feet wide to provide a maximum lift of 18 feet extends eastward from the harbor into the work area of the Mississippi Test Facility.

EXISTING NON-FEDERAL DEVELOPMENTS

Pearl River Basin Development District. The Pearl River Basin Development District was created by an act of the Mississippi Legislature in 1964 as a management tool to help facilitate the coordinated and comprehensive development of Mississippi through improved use of the water and land resources of the Pearl River Basin. Under sponsorship of this agency, the snags have been removed from the Pearl River between Bogalusa, Louisiana, and Columbia, Mississippi, and planning has been completed for a marina and park at Columbia.

Pearl River Valley Water Supply District. The Mississippi State Legislature, in 1958, passed enabling legislation to create the Pearl River Valley Water Supply District. The District, an autonomous agency of the State, is empowered to construct, operate and maintain a reservoir on the Pearl River. The District completed construction of the Ross Barnett Reservoir project on the Pearl River about 6 miles northeast of Jackson in 1964. The project provides water supply and recreation for the Jackson area but its operation is not integrated with any basin-wide system. Pertinent data for the project are given in Table 4.

Table 4

Pertinent data for Ross Barnett Reservoir

Drainage area at damsite, square miles -----	2,970
Reservoir area, acres -----	30,000
Reservoir shoreline length (Elev. 296.0), miles -----	105
Reservoir length, miles -----	43
Reservoir elevation, normal maximum, feet m.s.l. -----	297.0
Reservoir elevation, normal minimum, feet m.s.l. -----	294.0
Reservoir elevation, extreme maximum, feet m.s.l. -----	300.0
Maximum height of dam, feet -----	64
Length of dam, miles -----	3
Type of dam -----	earthfill
Size of spillway gates -----	21 feet high x 40 feet wide
Number of spillway gates -----	10

Louisiana Department of Public Works. The Department of Public Works, an agency of the State of Louisiana, has the legal authority to work with local, State and Federal agencies in planning and developing water and related land resources within its jurisdiction. Developments by the Department in the Pearl River Basin, Louisiana, include channel development and drainage projects and stream access. Approximately 10 miles of channel development work was done in St. Tammany Parish east of Slidell from 8 to 10 years ago and a small amount has been done in Washington Parish, mostly around Bogalusa. Seven drainage projects with about 26 miles of drainage channels and involving about 334,000 cubic yards of earthwork have been completed in the study area. Three boat launching ramps have been constructed for public use.

Other non-Federal developments. Local interests in the Pearl River Basin have made many improvements for flood control through organized drainage districts. Sixteen of these districts were formed between 1912 and 1927 for tributary streams in the upper part of the basin. These districts constructed about 168 miles of canals along 10 streams. The drainage districts have for the most part been inactive in recent years.

Local interests also constructed levees to protect about 770 acres of land south of and adjacent to the Gulf, Mobile and Ohio Railroad in the East Jackson area. This area is now protected by the Jackson-East Jackson Levee project recently completed by the Corps of Engineers.

The two States, Mississippi and Louisiana, administer numerous State parks, public hunting areas and game management areas in the basin. A tabulation of these areas is shown in Appendix I. In addition, there are also numerous private developments such as cabins and hunting areas in the basin.

SECTION 3 - WATER AND RELATED LAND RESOURCE
PROBLEMS AND NEEDS

GENERAL

The ultimate goal of comprehensive river basin planning and the resultant projects and programs is to satisfy human needs and to improve the social and economic well-being of the people. Therefore, the first step toward this goal must be identification of these needs. Evaluation of the needs involves consideration of past and present water and related land resource uses as related to economic activity in the study area and future uses as related to broad projections of economic growth as depicted in the Economic Base Study.

Resource problems and needs are discussed briefly in the following paragraphs.

FLOOD CONTROL

The flood problem is of pressing importance within the Pearl River Basin. Flooding is experienced annually in the basin and may occur at any time during the year. However, historical information and recorded stages and discharges show that floods occur most frequently during the winter and early spring months. Flooding in the upper and middle portions of the basin is caused by excessive rainfall runoff, while in the coastal area it may be caused by either excessive rainfall runoff or hurricane-driven tides.

For study purposes, the evaluation of flood damages was divided geographically between upstream watershed areas and the Pearl River and its major tributaries. Investigations showed that there are approximately 1,041,750 acres of land subject to flooding in the Pearl River Basin, of which 352,700 acres are located along the main stem and lower reaches of the major tributaries and 689,000 acres are along upstream tributaries. Of the total flood plain, 1,036,630 acres are rural and 5,120 acres are urban.

Approximately 256,100 acres, or 24.7 percent of the rural flood plain, are cleared for agricultural uses. Principal crops in these areas include cotton, corn, hay, soybeans, and pasture. The estimated gross annual value of the crops, based on adjusted normalized prices and 1966 crop yields and distribution, is \$8,887,000.

Urban areas which have flood problems are Jackson, Columbia, and Picayune, Mississippi, and Bogalusa, Louisiana. In addition, there are several other smaller urban areas which do not presently have a flood problem but face situations where future expansion into the flood plains could result in serious problems. The estimated value of urban property in the flood plain on the basis of average 1968 prices is \$195,000,000.

For project and plan evaluation purposes flood control needs have been estimated in terms of average annual flood damages using adjusted normalized prices for crops and average 1968 prices for other damage components and a 100-year evaluation period beginning in 1980, the assumed year benefits could begin accruing to any proposed plan of protection. The projected economic growth in the flood plain area was based on information contained in Appendix D, "Economic Base Study."

The 689,000 acres of land subject to overflow in the upstream watersheds sustain a total average annual damage of \$3,714,000. Approximately \$2,662,000 of this total is classified as agricultural damage, consisting principally of crop and pasture losses. The balance is related primarily to roads, bridges and major improvements. The average annual flood damage to areas along the main stem and lower reaches of the major tributaries is estimated to be \$4,790,000, of which \$3,770,000 is to rural developments and \$1,020,000 is to urban developments.

The total average annual flood damage in the basin is estimated to be \$8,504,000. This estimate is indicative of the immediate need for flood control in the basin.

AGRICULTURAL LAND AND WATER MANAGEMENT

Many problems exist concerning the conservation, treatment and management of land in the Pearl River Basin. Some of these problems are discussed in the following paragraphs. Others are discussed under LAND TREATMENT AND WATERSHED PROTECTION.

Many farms within the basin, because of size, are not efficient economic units. In many instances, the owner must seek part-time employment in town to supplement his farm earnings. Even if he desired to place all needed conservation and management practices into use on his farm, he could not afford them. In other instances, after proper application of conservation measures, the landowners and operators fail to provide adequate maintenance and management. This is often the case with absentee landowners.

Twenty-eight percent of the forest land in the basin is presently under good forestry practices. The demand on the timber resource can be met through 1980 but by 2015 the total cut will exceed growth by 127 million cubic feet. If the projected needs are to be satisfied, a high level of protection from fire, insect, disease, and grazing damages must be afforded all forest lands. Also the remaining 72 percent of forest land that is being mistreated or ignored completely will need to be put under forestry practices. For the future more scientific management must be applied to all the forest land.

Historical and projected agricultural output of specific products show the importance of food and fiber needs in context with other identified needs in the basin. This importance is presented in detail in

Appendix G. The difference between current production in the basin and its assigned share of the projected requirements provides a guide to the need for development of water and related land resources of the basin to meet future requirements. Total agricultural output in the Pearl River Study Area is projected to increase in the aggregate - some individual commodities will decrease. The area potential exceeds the projected needs for agricultural products. Land is not now nor will it be in the future a limiting factor in the development and growth of the Pearl River Study Area. While much of the land is of low natural fertility, it will respond to proper treatment and management. Idle and partially used land is found throughout the Study Area. Yields of crops, livestock and timber are low per acre or per animal. Resource conservation and development are needed to upgrade the area by putting to use idle or under-developed resources if the area is to realize its economic potential.

Only a small portion of the feed grain or other feeds used in the Study Area is produced by the feeder. For a number of years utilization of feeds has exceeded production and this situation is expected to prevail in the future, resulting in an increasing amount of feed to be shipped in from out-of-basin sources.

Irrigation as a management practice in the basin has shown little growth up to the present time. However, there is a place for supplemental irrigation in the management of the farm business in order to maintain and increase yields, reduce crop failures, and increase farm income. The use of irrigation as a management practice in the future should increase due to such factors as improved methods of irrigation, higher management levels and other technological advancements.

LAND TREATMENT AND WATERSHED PROTECTION

Studies made in the upstream watersheds indicate an immediate need for flood prevention and watershed protection measures. The magnitude of the flood problem in these areas has been discussed previously under FLOOD CONTROL. The first need is for land treatment measures for watershed protection and for critical area land stabilization.

Although changes in the agricultural economy in recent years have resulted in shifts of land from crops to grassland and pasture, erosion is a problem in the Pearl River Basin. There are 3,210,000 acres of land that have an erosion problem or are susceptible to erosion. Approximately 1,143,400 acres of open land are slightly to very severely eroded. Of this amount, sheet erosion is moderately to severely active on 595,300 acres of cropland and slightly to moderately active on 548,100 acres of pasture and idle land.

There are approximately 32,210 acres of forest land and 183,840 acres of open land deemed moderately to severely critical and in need of treatment. In addition, there are an estimated 8,226 acres of gullies, pits and abandoned roads on open land and 34,592 acres of logging roads and trails on forest land that are actively yielding sediment.

The basin has an estimated 12,000 miles of farm to market, county, State and other roads in its highway system. Erosion on 7,690 miles of roadbank has caused moderate to severe deposition in road ditches, culverts and channels.

Damages from soil deposition are relatively minor. However, soil deposition contributes to the flooding problem by filling road ditches, culverts, and stream channels and causing added damage to crops, pastures, fixed improvements, and in some cases, fishery resources. Sediment in the streams also causes water quality problems. Some scour damage occurs on the flood plain, but this damage is limited and does not appreciably affect the productivity of the land.

Surface drainage is a problem on 943,000 acres of land in the Pearl River Basin. Excessive runoff, due to the hydrologic cover condition of the land, does occur from some of the upland areas of the basin.

WATER SUPPLY

In 1965, the urban areas of the Pearl River Basin used an average of 44 million gallons of water per day (mgd) for domestic, service and commercial business, and small industrial water supply needs, representing approximately 54 percent of the total water used in the basin. Based on the expected increase of population in the area and an expanding per capita water use, it is estimated that the water requirements for municipal purposes will increase to about 128 mgd by 2015.

Water-using industries in the basin used an average of 38 mgd in 1965. Water demands for these industries, not generally supplied by public water supply systems, are expected to approach 152 mgd by the year 2015.

Most of the water used in the basin for water supply purposes comes from abundant groundwater aquifers. There are, however, several large surface water drafts, including the municipal demand at Jackson, Mississippi, supplied from Ross Barnett Reservoir, and withdrawals from the Pearl River and Bogalusa Creek in the southern portion of the basin by two large paper industries. In the future, the majority of domestic demands will continue to be met from groundwater sources; the large concentrated demands of water-oriented industries will probably be met from surface supplies. No major problems of water supply deficiencies are envisioned so long as the existing resources are managed properly. Estimates of total future municipal and industrial water supply requirements for the basin are delineated in Appendix H.

Water for agricultural and rural domestic needs is not a problem insofar as supply is concerned. Adequate water is available from wells, springs and streams in all parts of the basin to meet present and projected needs. In addition, farm ponds, mainly for livestock water, either have been or can be constructed on most farms in the basin. Water for household use is mostly from wells located near the farm or rural

residences. In some cases, community water systems have been developed that use deep wells as a source of water supply. The rural water supply requirements are discussed in Appendix G.

WATER QUALITY

One of the more serious water resource problems which exists to some extent in all parts of the Nation today is stream pollution. The use of water for municipal and industrial purposes inevitably results in the production of some liquid wastes which, even after a high degree of treatment, can degrade the quality of the receiving stream and limit downstream water uses. The maintenance of the water quality of the streams at levels satisfactory for multiple-use is required for the full economic development of the Pearl River Basin.

Pollution of streams in the Pearl River Basin at the present time is not extensive or widespread. Some pollution problems do exist, however, in several locations. The most severe cases are the Pearl River below Jackson, Mississippi, and Bogalusa, Louisiana; the East Pearl River below Picayune, Mississippi; and Bogue Chitto below Brookhaven, Mississippi. They are caused by the discharge of untreated or inadequately treated municipal and industrial wastes into the streams. Problems of less severity exist throughout the basin where treated wastes are discharged to streams having extremely small or intermittent flow. However, the only major problem area expected to remain after installation of secondary (85 percent BOD removal) waste treatment facilities is at Jackson where the stream would still be unable to assimilate the waste load. Therefore, something more than conventional treatment will be required to maintain water quality in the Pearl River at and below Jackson equal to that recommended by the State of Mississippi. Water quality control needs in terms of supplemented flow requirements for this location are shown in Table 5.

Table 5

Water quality control needs in the Pearl River Basin
 Pearl River downstream from Jackson, Mississippi
 (Monthly flow requirements in c.f.s. - Year 2015¹)

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
183	183	330	330	380	525	525	525	525	340	340	183

¹Flows include 173 c.f.s. regulated lowflow from Ross Barnett Reservoir.

The estimated supplemented flow requirements were based on projected waste discharges to the stream from urban areas and industries expected to have extensive expansion and development in the future, as reflected in the Economic Base Study and assuming secondary treatment for all waste.

The State of Mississippi submitted water quality standards to the Secretary of the Interior on June 22, 1967. The Secretary approved these standards on May 6, 1968, with exceptions to D.O. and temperature criteria, and asked for a joint review of the bacteriological parameter and for a clause relative to the nondegradation of high quality waters in Mississippi. Rationale for determining the stream flow requirements to maintain acceptable water quality was based on the water quality standards adopted by the State of Mississippi and approved by the Secretary of the Interior which included criteria for the protection of future uses of the streams as designated by the States.

GENERAL RECREATION

Demand for outdoor recreation is defined as the types and quantity of outdoor recreational activities that people desire. True demand tends to lie somewhere between what people desire and what they are willing to accept. The estimated total annual demand in activity occasions for the four major water-related activities of swimming, boating, camping, and picnicking in the basin is about 10.7 million in 1965, 18.3 million in 1980, and 59.1 million in 2015.

Taking into consideration data on existing public and private recreation facilities in the basin, a quantitative estimate was made of the number of activity occasions that could be accommodated annually. It was found that in 1965 about 3.7 million activity occasions for swimming, boating, camping and picnicking could be accommodated annually. By considering programmed expansion of public recreation areas, the supply for 1970 showed that about 4.6 million activity occasions for swimming, boating, camping, and picnicking could be accommodated annually at that time.

An estimate of the facilities required to satisfy the average summer Sunday demand for recreation opportunities for the four major water-related activities in the basin is shown in Table 6. Details are contained in Appendix I.

FISH AND WILDLIFE ENHANCEMENT

The fish and wildlife resources of the Pearl River Basin constitute a major recreation potential for residents of the area. The streams and other bodies of water in the basin provide excellent opportunity for sport fishing. It is estimated that the present 85,000 acres of fresh water surface in the basin have an annual fishing capacity of approximately 1,859,000 man-days.

Areas in the basin open to public hunting include about 427,245 acres under public ownership or under lease to the Mississippi State Game and Fish Commission. These lands supply hunter opportunity for about 22 percent of the existing demand at the 1965 level, and with intensive management can meet about 23 percent of the projected 2015 demand. Hunter demand, however, cannot be entirely satisfied with public-owned or State-managed lands. Private land holdings contribute and will continue to contribute to hunter opportunity, provided their use is of mutual benefit to both the landowner and sportsman.

The recreational value of fish and wildlife is of profound significance to the well-being of people in the basin, possibly even more so than the food value of this resource. The opportunity to hunt, fish and enjoy wildlife will not automatically remain. Therefore, fish and wildlife needs must be provided for in the comprehensive plan of improvement for the Pearl River Basin. The need or market for providing additional fish and wildlife opportunities for the basin was measured in terms of man-days of fishing and hunting. The present and projected levels of man-days for sport fishing and hunting by the 12-years-and-older segment of the population in the basin are given in Table 7. These projections were based upon projections of service area population contained in the Economic Base Study and per capita demand factors from unpublished Census South data compiled by the Bureau of the Census during the 1965 Survey of Fishing and Hunting. The projections show an overall increase of about 131 percent in the number of residents, 12 years old and over, who will engage in these activities. These resident fishermen and hunters will account for a 102 percent increase in the total number of man-days of participation in hunting and fresh- and salt-water fishing between the years 1965 and 2015.

COMMERCIAL FISHING

The fresh-water commercial fishery within the Pearl River Basin is small. A survey of the Mississippi portion of the river and its tributaries, conducted by the Mississippi Game and Fish Commission in 1960-1961, showed that 6 regular and 69 casual fishermen caught 170,000 pounds of finfish valued at \$32,640 (ex-vessel). The two principal groups taken, buffalo fish and catfish (blue and channel), made up approximately 78 percent of the catch by weight and 82 percent of the total value. The 1960 Louisiana catch, represented by St. Tammany Parish landings within fresh-water, consisted of 1,300 pounds of buffalo fish, with a reported value (ex-vessel) of \$152.

The marine commercial fisheries of Louisiana and Mississippi are a very important segment of their economy. In 1964, landings creditable to the Pearl River Basin (Eastern Coastal District of Louisiana and 10 percent of the Mississippi landings) approximated 271 million pounds of finfish and shellfish, worth more than \$12 million (ex-vessel) to the fishermen. Of these, approximately 270.6 million pounds were estuarine dependent at least during part of their life cycle and were valued at about \$12 million. Since the Pearl River is the major contributor of

Table 6

Pearl River Basin
Existing and Projected Average Summer Sunday Demand and Needs
For Selected Outdoor Recreation Activities Expressed in Activity Occasions

Item	Swimming	Boating	Camping	Picnicking
UPPER SUBAREA				
1965 Average Summer Sunday Demand	16,400	14,200	6,700	16,200
1965 Supply (Public and Private)	11,208	16,766	1,245	2,170
1965 Needs	5,192	0	5,455	14,030
1965 Resource Requirements ¹	8 ¹	0	1,091 ²	1,400 ³
1980 Average Summer Sunday Demand	30,000	26,000	12,300	29,700
1970 Supply (Public and Private)	16,008	17,066	5,595	5,920
1980 Needs	13,992	8,934	6,705	23,780
1980 Resource Requirements	23 ¹	17,868 ¹	1,341 ²	2,300 ³
2015 Average Summer Sunday Demand	108,100	93,800	44,300	107,100
1970 Supply (Public and Private)	16,008	17,066	5,595	5,920
2015 Needs	92,092	76,734	38,705	101,180
2015 Resource Requirements	153 ¹	153,468 ¹	7,741 ²	10,100 ³
MIDDLE SUBAREA				
1965 Average Summer Sunday Demand	8,600	7,500	3,500	8,600
1965 Supply (Public and Private)	15,270	3,459	550	2,710
1965 Needs	0	4,041	2,950	5,890
1965 Resource Requirements	0	4,082 ¹	590 ²	500 ³
1980 Average Summer Sunday Demand	10,900	9,400	4,400	10,800
1970 Supply (Public and Private)	16,470	3,496	925	3,350
1980 Needs	0	5,904	3,475	7,450
1980 Resource Requirements	0	11,808 ¹	695 ²	700 ³
2015 Average Summer Sunday Demand	26,400	22,900	10,800	26,100
1970 Supply (Public and Private)	16,470	3,496	925	3,350
2015 Needs	9,930	19,404	9,875	22,750
2015 Resource Requirements	16 ¹	38,808 ¹	1,975 ²	2,200 ³
LOWER SUBAREA				
1965 Average Summer Sunday Demand	33,000	28,600	13,500	32,800
1965 Supply (Public and Private)	8,438	4,050	825	2,220
1965 Needs	24,562	24,550	12,675	30,580
1965 Resource Requirements	41 ¹	49,100 ¹	2,535 ²	3,000 ³
1980 Average Summer Sunday Demand	57,900	50,100	23,800	57,300
1970 Supply (Public and Private)	8,438	4,780	825	2,520
1980 Needs	49,462	45,320	22,975	54,780
1980 Resource Requirements	82 ¹	90,640 ¹	4,595 ²	5,400 ³
2015 Average Summer Sunday Demand	185,300	160,800	75,900	183,600
1970 Supply (Public and Private)	8,438	4,780	825	2,520
2015 Needs	176,862	156,020	75,075	181,080
2015 Resource Requirements	295 ¹	312,040 ¹	15,015 ²	18,100 ³
TOTAL BASIN				
1965 Average Summer Sunday Demand	58,000	50,300	23,700	57,600
1965 Supply (Public and Private)	34,916	24,275	2,620	7,100
1965 Needs	23,084	26,025	21,080	50,500
1965 Resource Requirements	38.5 ¹	52,050 ¹	4,216 ²	5,000 ³
1980 Average Summer Sunday Demand	98,800	85,500	40,500	97,800
1970 Supply (Public and Private)	40,916	25,342	7,345	11,790
1980 Needs	57,884	60,158	33,155	86,010
1980 Resource Requirements	96.5 ¹	120,316 ¹	6,631 ²	8,600 ³
2015 Average Summer Sunday Demand	319,800	277,500	131,000	316,800
1970 Supply (Public and Private)	40,916	25,342	7,345	11,790
2015 Needs	278,884	252,158	123,655	305,000
2015 Resource Requirements	465 ¹	504,316 ¹	24,731 ²	30,500 ³

¹Acres

²Camping units

³Picnic tables

Table 7

Present and projected sport fishing and hunting demand
Pearl River Basin

Area	Population - 12 yrs. & older			Fishing demand* (man-days)			Hunting demand (man-days)		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
UPPER PEARL SUBAREA									
1965	137,500	67,600	205,100	407,000	348,800	755,800	189,800	216,300	406,100
1980	204,600	64,800	269,400	605,600	334,400	940,000	282,300	207,400	489,700
2015	400,200	86,100	486,300	1,184,600	444,300	1,628,900	552,300	275,400	827,700
MIDDLE PEARL SUBAREA									
1965	28,700	90,900	119,600	84,900	469,000	553,900	39,600	290,900	330,500
1980	36,600	93,500	130,100	108,300	482,500	590,800	50,500	299,200	349,700
2015	70,900	109,000	179,900	209,800	562,400	772,200	97,800	348,800	446,600
LOWER PEARL SUBAREA									
1965	41,100	50,000	91,100	121,700	258,000	379,700	56,700	160,000	216,700
1980	66,800	54,700	121,500	197,700	282,300	480,000	92,200	175,000	267,200
2015	197,600	97,000	294,600	584,900	500,500	1,085,400	272,700	310,400	583,100
PEARL BASIN									
1965	207,300	208,500	415,800	613,600	1,075,800	1,689,400	286,100	667,200	953,300
1980	308,000	213,000	521,000	911,600	1,099,200	2,010,800	425,000	681,600	1,106,600
2015	668,700	292,100	960,800	1,979,300	1,507,200	3,486,500	922,800	934,600	1,857,400

Man-Days Fishing Demand per capita 12 years and older. Man-Days Hunting Demand per capita 12 years and older
 Urban - 2.96 man-days annually Urban - 1.38 man-days annually
 Rural - 5.16 man-days annually Rural - 3.20 man-days annually

*Represents total sport fishing demand for fresh-water and salt-water resources.

fresh water to the estuarine complex of southeast Louisiana, modification of river flows, increased pollution loads, and other factors could affect the survival and economic importance of the marine fisheries. Therefore, means of maintaining and enhancing the estuarine environment are considered an important part of the overall fish and wildlife requirements.

NAVIGATION

The economic development of an area is greatly stimulated by a complete transportation complex that consists of all forms of transportation, including navigation. The need for a navigable waterway is dependent upon a sufficient volume of those commodities that can be moved at a savings by this form of transportation. The prime requisite for efficiency in barge transportation is consolidation of large volumes of freight at central points. Waterway service is generally restricted to a fairly limited range of commodities which are mostly bulky and, in many instances, unprocessed items. Typical commodities particularly adaptable to low-cost waterway transportation include bulk grains, chemicals and related products, and unprocessed non-metallic minerals. Some of the more important natural resources in the Pearl River Basin are petroleum, natural gas, sand and gravel, water, timber and clays. The availability of barge transportation would encourage the construction of plants in various portions of the basin, utilizing one or more of these natural resources as raw material in the manufacturing process.

While the Pearl River was once an important transportation artery, it now supports commercial navigation only in the reach between Bogalusa and the mouth. Channel depths and lock sizes on the existing project in this reach are incompatible with modern shipping requirements and with dimensions on other major feeders to the Gulf Intracoastal Waterway. From Bogalusa to Columbia the river was improved by a snagging program for use by recreational craft but no commercial traffic can navigate the reach. From Columbia to Jackson, there has been no active project for navigation since 1916 and in its present condition this reach is not navigable by commercial craft. The area that would contribute waterborne commerce to a navigation project on the Pearl River is apparently entering a period of urban growth and industrialization which will place growing demands on all transportation systems.

In view of the above and the desires of local interests, investigations were made to determine the justification of providing suitable channels for modern barge transportation from the Gulf Intracoastal Waterway to Jackson on the Pearl River. Studies included a review of previous navigation reports, a canvass of shippers and receivers of freight in the tributary area to determine the present traffic flow pattern, a freight rate analysis to develop information on commerce that could reasonably be expected to move on the waterways at a savings in transportation charges, and preliminary cost estimates for barge navigation.

The total potential waterborne commerce developed by canvass and study amounted to about 3,652,000 tons in 1965, of which 2,741,000 tons were inbound and 911,000 tons outbound. The commodities comprising the potential commerce were analyzed and all items were eliminated which obviously could not move over the waterway because of the nature of the particular commodity, the circuitry of routing or for other reasons. The remaining potential traffic amounted to 3,350,000 tons, of which 2,562,000 tons were inbound and 788,000 tons outbound. This traffic after analysis with respect to present and prospective transportation charges was reduced to 1,326,300 tons. The 1965 traffic accepted for movement on the proposed waterway is shown by commodity groups in Table 8. Studies indicate that this traffic would increase to 2,618,000 tons by 1980 and to 10,680,000 tons by 2030. Details of the analysis are given in Appendix F.

Table 8

Prospective waterborne commerce in the
Pearl River Basin (1965 traffic)

Commodity and commodity group	Tonnage		
	Inbound	Outbound	Total
Vegetable food products	7,700	25,000	32,700
Vegetable products, inedible	3,000	0	3,000
Wood and paper	0	47,700	47,700
Non-metallic minerals	792,500	418,000	1,210,500
Chemicals and related products	32,400	0	32,400
Total	835,600	490,700	1,326,300

HYDROELECTRIC POWER

The needs for power in the area are such that hydroelectric developments in the Pearl River Basin could be readily utilized. However, there are no facilities of this type in the basin and the potential for providing them is limited. Studies by the Corps of Engineers in 1940, 1944 and 1948 showed that development of hydroelectric power projects in the basin was not then economically feasible. The head and runoff at prospective damsites in the basin are sufficient only for the installation of small capacity plants and the wide valleys and poor foundation conditions result in high costs for the dam and powerplant facilities. Additional studies made for this report confirm the previous conclusions that

development of hydroelectric power is not economical at this time. However, the sites afford opportunities for future development. The studies are given in Appendix F.

HEALTH ASPECTS

Protecting the public from disease and injury and preserving water resources are basic to the objectives of comprehensive river basin planning. Health aspects involve water use and water quality, sanitary facilities at recreation areas, air pollution and solid waste control, injury control, and vector control.

Planning is not complete until the water reaches the point of use -- the consumer. Therefore, the protection and safety of water supplies from the source through treatment, storage, and distribution are logical functions of planning and development of water resources. A program for development of adequate water treatment and distribution systems along with necessary quality and safety surveillance is needed to insure that each citizen in the basin area has drinking water that meets the Public Health Service Drinking Water Standards.

The vast growth in recreation facilities and their use will place more emphasis on water quality and safety for contact use, and on provision of adequate sanitary facilities - potable water supply, toilet facilities, waste water disposal, and solid waste disposal. Programs of surveillance and monitoring of these facilities will be needed.

The principal reasons for the consideration of vector problems associated with the Pearl River Basin water and related land resource developments are: (1) to prevent conditions suitable for transmission of vector-borne diseases, and (2) to safeguard the comfort and well-being of the public.

ENVIRONMENTAL PRESERVATION AND ENHANCEMENT

The economic development of the United States has reached a stage which makes it possible for the Nation to channel an increasing proportion of its material and human resources into activities which help satisfy the intellectual, emotional and aesthetic aspirations of its people. The Nation's economic development has been accompanied by rapid increases in population, industrialization and urbanization, and all of these factors have generated increased pressures upon a contracting reserve of lands and waters suitable for outdoor recreation and the enjoyment of nature. The result has been an increasing public interest in the preservation of natural beauty. This interest has been reflected in laws which set aside wilderness areas, place more land in public ownership, and establish more parks.

An index of past indifference of the majority of the population to the natural beauty and aesthetic values of the landscape may be found in the sources of pollution in the streams and reservoirs. Discharge of untreated or inadequately treated waste from urban and industrial areas,

erosion of farmlands, roadbanks, gravel pits, and burning and over-grazing of woodlands all contribute to stream and reservoir pollution. These are not only the principal pollutants of the streams but their damages may be measured in terms of increased costs of purifying water for domestic use, reduction in channel and reservoir storage, increased damages to crops, destruction of the fishery resources, and making streams and lakes unsuitable for public enjoyment.

Physical abuse to the landscape, rapid changes in industrial and urban development, new innovations in farming technology, and major changes in farm enterprises are creating physical, economical and social problems.

Some types of improperly managed farm enterprise, as well as urban areas, may contribute organic wastes, fertilizers, and insecticides and thus pollute streams and reservoirs. Feed lots and intensive dairy and poultry farming are sources of solid and liquid wastes harmful to existing and potential water resource development projects. Constant vigilance must be maintained to protect existing projects and assure suitability of future projects for public use.

In the Pearl River Basin, a number of environmental quality needs would be satisfied with provision for needs of other types previously cited. Creation of reservoirs properly planned and operated for multiple uses, including general recreation and fish and wildlife enhancement, would provide scenic and other aesthetic values associated with the impoundments and adjoining project lands, particularly desirable in a basin with few natural lakes of significant size. Similar values would accrue from restoration of polluted water areas, such as the Pearl River below Jackson, and from restoration of watershed areas scarred by gully and sheet erosion. In addition, consideration should be given to the preservation of streams or selected reaches of streams in their natural state as scenic or free-flowing waters for general recreation and environmental purposes, expansion of existing recreational areas, and acquisition or lease of additional wildlife lands in order to assure public access.

OTHER WATER ASSOCIATED NEEDS

The tidal section of the Pearl River is subject to occasional flooding by wind tides, particularly those caused by hurricanes. In compliance with authorization contained in Public Law 71, 84th Congress, 1st Session, approved 15 June 1955, studies were made in this region by the Corps of Engineers as part of the Hurricane Survey. A report entitled, "Report on Hurricane Survey of Mississippi Coast," was issued in January 1965. Protection by structural means was not found to be economically feasible. It was recommended, however, that local authorities give consideration to:

a. Examination of building codes with a view to establishment of appropriate standards to insure that future structures will be more resistant to hurricane forces.

b. Adoption of zoning regulations restricting the type of developments permitted within areas subject to hurricane tides.

c. Development of comprehensive hurricane preparedness plans and review thereof prior to each hurricane season.

In view of the loss of life and destruction of property caused by Hurricane Camille along the Mississippi and Louisiana Gulf Coast in August 1969, local authorities should act on the above recommendations without further delay.

SECTION 4 - SOLUTIONS CONSIDERED

INTRODUCTION

The water and related land resource needs of the Pearl River Basin may be met by a variety of methods, including single- and multiple-purpose structures and nonstructural measures. Consideration of the various alternatives provided an insight into resource availability and capability and a basis for formulating a comprehensive plan which would serve as a guide for the best use of the water and related land resources of the basin, including a specific early-action program and a framework for future planning.

For each specific problem, all practicable solutions were weighed and tested for applicability, effectiveness, relative economy, and total physical impact. The following paragraphs discuss the solutions considered for each of the aspects of water and related land resources development.

FLOOD CONTROL

The solutions considered for the flood problem in the basin included channel development, levees, flood control reservoirs, upstream flood water retarding structures, stream diversion, flood plain evaluation and other tools of flood plain management, and an improved flood forecast and warning system.

The possibility of providing local protection projects such as channel development and levees and floodwalls with provisions for interior drainage systems and pumping plants was investigated at various locations throughout the basin. Improvements of this type were not feasible in the rural areas due to the distribution of agricultural losses over long reaches and the high cost of protection. For the urban areas, 5 projects were evaluated. Three of these projects were eliminated during early-screening studies due to the small amounts of concentrated damages in the area to be protected and the excessive cost of protection. Of the two remaining projects, one, Bogalusa, Louisiana, was evaluated in 1969 and found not warranted by the Corps of Engineers under Section 205 of the Flood Control Act of 1948, as amended. The remaining problem area at Jackson, Mississippi, was considered in a separate study by the Corps of Engineers under the authority of resolutions adopted by the Committee on Public Works of the United States Senate on 1 April 1963 and 27 June 1967. The most practicable plan of improvement was found to be a system of levees and floodwalls, with appurtenant drainage structures, to protect the lower flood plain reaches of Town Creek and small adjacent areas along Lynch Creek from inundation by backwater from the Pearl River. Although the report presenting the results of the study has not been finalized, the economic evaluations show that the improvements are not warranted at this time.

9. The local flood protection projects considered are listed in Table 9.

Table 9

Local flood protection projects considered in
the Pearl River Basin

Location	Principal stream	Remarks
Jackson, Miss.	Pearl River & Town Creek	Alternative to reservoir.
Columbia, Miss.	Pearl River	Eliminated during early screening studies
Picayune, Miss.	Hobolochitto Creek	Eliminated during early screening studies
Bogalusa, La.	Bogue Lusa & Coburn Creeks	Corps of Engineers made separate study under Sec. 205 of Flood Control Act of 1948, as amended.
Tylertown, Miss.	McGee Creek	Eliminated during early screening study

Flood control storage as a single-purpose solution was investigated for both headwater and downstream areas. Analyses of 63 upstream watersheds covering the basin showed that in 42 of them flood water detention and channel development measures are economically feasible and need to be initiated within the next 10 to 15 years. An additional 16 upstream watersheds were determined to be potentially feasible for future development. Floodwater retarding structures would reduce flood damages in the 42 watersheds by about \$2,179,000 annually. On the major streams and other tributaries in the basin, it was determined, after screening 26 potential reservoir sites, that flood control storage of 712,500 acre-feet in 3 reservoirs above Jackson could reduce downstream damages to 1966 development by about \$1,191,000 annually. As single-purpose flood control projects, 2 of the reservoirs would provide benefits in excess of costs. When considered as a part of a flood control system above Jackson the third reservoir also would provide benefits in excess of costs.

Flood damages in the basin could not be relieved through the diversion of water from one stream to another within the basin. Diversion of a portion of the flood waters to the Big Black River Basin immediately west of the Pearl River Basin would be physically possible. However, the flood season for the Big Black River coincides with that for the Pearl River and, therefore, this would not be a practical or economical solution.

Because of the relatively small amount of average annual urban flood damages in the basin, consideration was given to such nonstructural measures as flood proofing, raising structures above flood level, relocating structures out of the flood zones, and complete flood plain evacuation. If evacuation were practicable and economically feasible for some of the urban areas, residents of the areas would prefer remaining with existing adverse conditions rather than evacuating. The other nonstructural measures would not provide flood relief to the rural areas which suffer about 87 percent of the flood damages. Due to the degree of development of the basin for agricultural use and the high productivity potential of the floodplain soils, abandonment of the rural flood plains was not given serious consideration. To abandon these areas would mean the loss of some of the most productive agricultural lands in the basin. Such a plan would be totally unacceptable to local interests.

Wise utilization of the flood plains is an economic need and is being strongly encouraged through a broad program initiated late in 1966 by the President and Congress. Objectives of the program are outlined in "A Unified National Program for Managing Flood Losses," House Document No. 465, 89th Congress, 2nd Session. Improved technical services to managers of flood plain property are carried out by the Corps of Engineers in close cooperation with the Department of Housing and Urban Development and the Department of Agriculture. Under the provision of Section 206, Public Law 86-645, State and local governments and their planning agencies may request flood plain information and certain technical services from the Corps of Engineers to assist them in meeting the objectives of the program and in planning for the use and regulation of flood plain areas. In addition, the Department of Agriculture assists local entities, landowners and operators in land use planning under the authority of the Soil Conservation Act of 1935 (Public Law 46).

Flood plain regulation has the broad purposes of preventing public or private investment in areas where unusual hazards and potential flood losses exist, and protecting existing public and private investment in the flood plains by precluding activities that would adversely alter flow conditions and thereby increase the existing flood hazard. Specific regulations such as zoning, building codes, subdivision regulations and city ordinances can be used to regulate the use of the flood plains, adapt structures in the flood plain to be resistant to flood hazards, develop emergency evacuation plans, and make the public aware of the flood hazard in these areas. However, the execution of any effective flood plain management program is encumbered by individual property rights, economic pressures, enforcement problems, and lack of public awareness.

Nonstructural measures were considered as a means for flood damage reduction in the urban areas in the basin. However, for the areas where appreciable flood damage occurs other economically feasible methods of damage reduction were determined to be better solutions

because these methods would prevent agricultural as well as urban losses and would provide a more satisfactory degree of protection. A flood plain information study has been completed for Purple Creek in the vicinity of Jackson, Mississippi, and several other studies along streams in this urban area are underway. Studies will probably be made at other locations in the basin which will have flood problems even with the comprehensive plan functioning. These studies will aid local interests in planning and managing flood plains to reduce residual flood damages where other measures are only partially effective or are ineffective in preventing such damages. Due to its potential, much more consideration should be given flood plain management by State and local interests.

The Weather Bureau provides a specific flood forecast service for Edinburg, Jackson, Monticello, Columbia, Bogalusa and Pearl River on the Pearl River, and for Franklinton on Bogue Chitto. This service reduces the threat to human life and economic losses by providing sufficient time for removal of the people and non-fixed property from low areas.

In addition, the effectiveness of both structural and nonstructural measures for reducing flood damages will, in many cases, depend upon a timely notification of oncoming floods. While the Weather Bureau maintains an effective flood forecast service in the basin, it should be expanded and strengthened by expanded use of electronic gear. Further, the application of automatic data processing techniques and procedures is required to accelerate formulation and dissemination of flood forecasts.

AGRICULTURAL LAND AND WATER MANAGEMENT

The most practical solution to the agricultural land and water management problems of the basin was determined to be acceleration of current land management and conservation programs. An effective conservation program, based upon needed treatment and the use of each acre of land within its capability, is necessary for a sound agricultural land and water management program. A detailed discussion of such a program is presented in Appendix G.

Conservation cropping systems and crop residue utilization would increase the protection of cultivated lands. These measures would increase the infiltration rates of the soil, increase available moisture holding capacities and reduce rainfall runoff and sheet erosion. Terraces, contour farming, row arrangement, grassed waterways or outlets and diversions would provide a means for controlled disposal of excess water from the upland area and would reduce both sheet and gully erosion. Row arrangement, surface field ditches and mains and laterals would provide a means of adequate disposal of excess surface water from the flood plain. These measures are necessary to insure the full realization of benefits made possible by reduction in flooding. Pasture

planting, pasture renovation, brush control and pasture management should be followed, where appropriate, on idle acres and on established pasture and other land needing a perennial cover for sustained agricultural production. Farm ponds should be located to facilitate a more uniform distribution of grazing. This management consideration would provide the most effective grass cover for runoff and erosion control.

About one-half million acres of floodplain lands have soils that would have a high response to supplemental irrigation. Adequate water supplies are generally available from large streams or lakes, surface impoundments, or wells. However, major irrigation development measures were not planned as increased production of the principal crops are not needed to satisfy national or regional requirements.

LAND TREATMENT AND WATERSHED PROTECTION

Basinwide accelerated land treatment is needed to reduce erosion and the resulting sediment load in the basin's streams. Rectification of the critical sediment pollution problems cannot be achieved through treatment of the 42 feasible watersheds only. It requires the implementation of accelerated land treatment and critical land area stabilization programs throughout the basin. Details of these measures are given in Appendix G.

WATER SUPPLY

Water supply requirements for the basin are presented in Section 3 of this appendix and in Appendix H. These requirements were developed and projected on the basis of population and industrial growth and the estimated increases in per capita usage of water. An inventory of existing supplies was made and deducted from the requirements to obtain net needs. From an overall basinwide viewpoint, existing supplies are in excess of those needed to meet requirements for some time in the future. No major problems of water supply deficiencies are envisioned so long as the existing resources are managed properly.

WATER QUALITY CONTROL

Studies contained in Appendix H show that one of the four areas in the basin with existing water quality problems will continue to have them even after secondary treatment of wastes. This area is the Pearl River below Jackson.

The water quality standards adopted by the States provide for a minimum treatment level of "secondary" for municipal wastes and its equivalent for industrial wastes. The full practicable and economical development of secondary treatment facilities, therefore, is considered a basic step in solving the water quality problems. However, since this treatment would satisfy only a part of the needs, other types of solutions must be considered. The possible alternatives considered for the Pearl River Basin include additional treatment at the source,

dilution in the stream by flow regulation, physical stream aeration, and ground injection. Only additional treatment and dilution by flow regulation were found to be practical.

GENERAL RECREATION

As discussed in Appendix I, the Pearl River Basin offers a variety of opportunities for developing a basin water-related recreation plan. Those available range from the development of large reservoirs to the preservation of free-flowing streams, and from the development of large amounts of forest land for recreation to the preservation of unique areas of natural beauty.

General recreation activities, although not dependent on water resource development alone, are enhanced by the availability of large water areas. A major consideration in development of a recreation plan, therefore, is water, either in the form of lakes or free-flowing streams.

Reservoirs, both large and small, will be required in future years if the growing demand for water-dependent and water-enhanced outdoor recreation opportunities is to be met. A number of reservoir sites have been investigated and considered. As a result, recreation was included as a project purpose in three reservoir projects and in 29 structures in 24 upstream watersheds for early-action development.

The increasing demand for water-enhanced recreation activities — primarily camping and picnicking — can be met in part by development of sites surrounding the future water impoundments in the basin and by expanding the facilities of the U. S. Forest Service, Mississippi Game and Fish Commission, Mississippi Park System, Mississippi Forestry Commission, Louisiana State Parks and Recreation Commission, and local county and city parks. In addition, part of the demand could be met by improving access to the Pearl River and its tributaries and providing camping and picnicking facilities. Boat-trip camping could be provided at such sites as well as at additional sites kept in a more primitive condition along the river as scenic or wild areas. Much of the needs for water-dependent recreation — swimming, boating, and related water sports — could be met by water impoundments at potential reservoir sites on the main streams and tributaries and in upstream watersheds and National Forests. However, the projected demand for boating could not be satisfied even with full development of these resources by the year 2015.

The following list suggests those projects and programs which could best provide for the outdoor recreation needs in the Pearl River Basin:

1. Enlargement of existing recreation areas and acquisition of land and installation of facilities at areas having recreation potential.

2. Preservation of streams or locally unique sections of streams as free-flowing.

3. Improvement of the Pearl River as a boatway and installation of recreation facilities adjacent thereto.

4. Installation of measures to abate stream pollution.

5. Installation of recreation developments at multiple-purpose reservoirs and in upstream watershed projects.

6. Special studies to determine acquisition of portions of High Bluff, Honey Island, Red Bluff and the river's delta, and designation of a scenic route paralleling the Pearl River for pleasure driving.

7. Preservation of areas of unique natural beauty, and/or historical, archeological, scientific, and ecological importance.

8. Programs for tourist information, service industries and highway development.

FISH AND WILDLIFE ENHANCEMENT

Provisions for hunting and sport fishing also are not dependent on water resource development alone. As described in Appendix J, the Pearl River Basin presently contains excellent upland game and sport fisheries habitat and populations. Basin inhabitants have unusual opportunities for resource utilization on private and public lands and in fresh and salt water. Included in the diversified fishery habitat are several excellent float-fishing streams only partially developed for access and boat launching. The basin contains many nature areas associated with coastal marshes, upland pine forests, and mixed bottomland hardwoods.

Solutions to the fish and wildlife needs of the basin were developed in cooperation with other Federal and State agencies. Certain planning items were developed for incorporation into water development project plans, while other items were designed to be accomplished independently. Measures considered as part of the plan to satisfy the fishing needs include stream preservation, low flow augmentation, development of public lakes for fishing, and water management structures for lakes and reservoirs. Measures considered in the plan to satisfy hunting needs included land acquisition, land development and management for wildlife, and provision of public access to these areas over all-weather roads. These plans, based on historical and present use of fish and wildlife resources, were developed to meet both short- and long-range public needs. They are given in detail in Appendix J.

COMMERCIAL FISHING

Future needs for commercial fishery products were determined for both fresh and salt water. For fresh water, the 1965 supply of such products was considered to be 170,000 pounds. Projection of future needs indicate the demand will increase 43.4 percent by 1980, and another 41 percent by 2015. To satisfy these needs, significant growth in fish-farming operations will be required to supplement production from natural waters.

The national demand for marine fishery products, especially shrimp and oysters, has greatly exceeded the supply. Demand for these products will continue to grow based on expanding populations in the basin and the Nation. Marine fisheries are capable of supporting increased production if estuarine habitats are protected against damage from pollution, construction projects, or major changes in seasonal river flows. The offshore marine catch may be expanded by improved fishing techniques and the expected increased market for species presently underutilized.

NAVIGATION

A channel, with a minimum depth of 9 feet and sufficient width to permit two-way navigation would be required in the Pearl River system to attract modern barge service and effect a reduction in transportation charges sufficient to divert traffic from other methods or routes. Studies of streamflow records and other characteristics of the river indicated that it would be physically impracticable to provide a dependable 9-foot channel by open river methods. Therefore, canalization was determined to be the most practicable means to provide a dependable navigation channel.

In consideration of other connecting waterway dimensions, modern barge sizes, and the volume and type of traffic which could move on the waterway, a minimum channel size of 9 by 100 feet and lock dimensions of 84 by 600 feet were selected for the considered Pearl River improvement. The upstream limits of the improvement would be at Jackson. Known and anticipated foundation conditions, plus the desirability of keeping land acquisition at a minimum, led to the selection of a plan of improvement comprising 11 low dams with locks. The locks would have lifts varying from 11 to 27 feet, with an average lift of 21.5 feet. Dams would be rolled earth-fill structures with riprapped faces and gated concrete gravity spillways. Dredging in portions of the existing river bed and shallow pool areas would complete the waterway and assure continuous navigable depth. However, the cost of the waterway would exceed the benefits which would accrue to it.

Details of the navigation study, including the first cost, annual charges, benefits and benefit-to-cost ratio for the considered plan are described in Appendix F.

HYDROELECTRIC POWER

The possibility of providing single-purpose reservoirs for hydroelectric power was investigated at six prospective damsites in the basin. At all of these sites, the head and runoff were sufficient only for the installation of small capacity plants. In addition, the wide valleys and poor foundation conditions resulted in high costs for the dams and powerplant structures. Therefore, as single-purpose projects, none of the six reservoirs or combinations thereof has benefits in excess of costs. The benefit-to-cost ratio of specific power facilities alone would be less than unity precluding the inclusion of power in multiple-purpose developments. Details on the projects considered, including the first costs, annual charges, benefits, and benefit-to-cost ratios are given in Appendix F.

HEALTH ASPECTS

One of the more important needs to be met before proper development of the basin can be realized is the establishment of an effective water-hygiene program by the State health agencies. Determination of raw water quality in light of all chemical characteristics included in the Public Health Service in 1962 Drinking Water Standards was beyond the scope of this report. Health significance of high total and fecal coliform densities has not been determined on streams where proposed reservoirs include recreation as a purpose. Continual surveillance of finished drinking water supplies, as well as waters used for contact recreation, will be necessary for proper planning, development and safe utilization of the projects.

Important considerations involved in health aspects studies of reservoirs include preimpoundment clearing, providing adequate depths in reservoirs to discourage aquatic growth, water level management in the interest of vegetative and mosquito control, control of marshy and seep areas downstream from dams, proper location of recreational facilities with respect to the mosquito potential, provisions for proper disposal of waste and debris, and provisions for vector surveys at project sites. All of these factors have been considered in a general way; however, specific consideration must, in most cases, be deferred until detailed planning is undertaken.

ENVIRONMENTAL PRESERVATION AND ENHANCEMENT

The further development of land and water resources in the Pearl River Basin and in this Nation is essential to our expanding economy. However, material wealth alone does not provide a satisfactory and complete life for most people. The quality of our existence includes the diversity and preservation of beauty as well as the use of our resources to produce material wealth. Preserving unspoiled nature is part of the satisfaction of our spiritual and social needs.

For this comprehensive study, natural areas of value were inventoried, identified and evaluated, and consideration given to various means through which their preservation could be effected. These include stream preservation, acquisition of lands for environmental enhancement, and consideration of the impact of structural measures on the environment in the formulation of plans for such measures with concomitant effort to minimize unfavorable impacts.

MULTIPLE-PURPOSE PROJECT OPPORTUNITIES

Reservoirs are capable of satisfying different requirements at the same time, either by multiple use of the same storage or by inclusion of storage increments to serve additional purposes. Storage reservoirs used for water supply and water quality control not only serve these purposes but also create a recreational resource by providing bodies of water. These, just by their existence, would satisfy some of the water-related recreation demand. The addition of recreation facilities and developed recreation areas around these reservoirs would meet an even greater portion of the recreation demand. The joint-use of the reservoirs for flood control, water quality control, water supply, and outdoor recreation, including fishing and hunting, results in a substantial reduction in the costs for each purpose when compared to single-purpose use of storage to provide identical amounts of goods and services.

Studies revealed that multiple-purpose projects could be economically developed at three sites considered previously for single-purpose flood control reservoirs. In addition, nine other sites were determined to be potentially feasible for development at some future date.

Investigation of the possibility of developing multiple-purpose projects at those sites considered previously for single-purpose power projects revealed that the specific cost to power alone at each site exceeded the power benefits and, therefore, power could not be considered as a purpose. The investigations also revealed that multiple-purpose projects, excluding power, could be economically developed at three of these locations which also were flood control reservoir sites.

The possibility of developing multiple-purpose structures in upstream watersheds was also investigated. The investigations determined that the inclusion of additional storage purposes was economically justified and needed in the next 10 to 15 years in some 29 flood water retarding structures, in 24 separate upstream watersheds. In addition, some 23 other sites were found to be potentially feasible for future modification or inclusion of other storage purposes. Some of the other purposes which could be included in these sites are municipal and industrial water supply, low-flow augmentation, irrigation, recreation, and fish and wildlife.

SECTION 5 - DEVELOPMENT OF THE PLAN

PLANNING CONCEPTS AND CONSIDERATIONS

The basic objective of this study was to produce a water and related land resource development plan which would serve as a guide for meeting the foreseeable short- and long-range needs of the Pearl River Basin. The plan must provide for the development of specific projects and programs to meet current and early prospective needs, and in addition, serve as a guide for the future orderly development of the basin's water and related land resources to meet needs over the next 50 years.

The basic guide used to formulate the plan for the Pearl River Basin was Senate Document 97, 87th Congress, 2nd Session, "Policies, Standards and Procedures in Formulation, Evaluation and Review of Plans for Use and Development of Water and Related Land Resources." This document states that planning for use and development of water and related land resources shall be on a fully comprehensive basis so as to consider the needs and possibilities of all resource uses and purposes. It stresses that planning must consider viewpoints at all levels, but that regional, state and local objectives shall be considered and evaluated within a framework of national public objectives and available projections of future national conditions and needs. In pursuit of the basic conservation objective to provide the best use, or combination of uses, of water and related land resources to meet all foreseeable short- and long-term needs, full consideration should be given to each of the following objectives and reasoned choices made between them when they conflict: development, preservation, and well-being of people. The well-being of all the people is to be the overriding determinant.

The broad alternative objectives in Senate Document 97 may be categorized as (a) economic efficiency; i.e., satisfying identifiable needs to the extent that each is justified by national benefits; (b) regional development; i.e., satisfying identifiable needs to the extent that each is economically justified by inclusion of benefits derived from increased economic activity due to water resource developments; and (c) environmental quality; i.e., satisfying identifiable needs to the extent that each can be met by projects and measures that enhance, preserve, or do not adversely affect the general quality of the environment.

Using the general guidelines and criteria for comprehensive studies developed by the Water Resources Council and Senate Document 97 as guides, recognizing that adequate consideration of the regional development objective requires the evaluation of secondary benefits, which is beyond the scope of this report, the following planning concepts were adopted:

1. A coordinated comprehensive plan for the development of the water and related land resources of the Pearl River Basin through the year 2015 would be formulated and presented in the report, with special emphasis on an early-action program.

2. Elements of the comprehensive plan should be compatible with each other and should provide an arrangement of projects and programs flexible enough to meet the changing pattern of needs that would undoubtedly result from unforeseen demands placed on the environment of the basin.

3. Full and equal consideration would be given to all purposes which could be served by water and related land resource development.

4. Each separable component of the plan would be considered on the basis of the contribution it would make in net benefits to the Pearl River Basin, the States of Louisiana and Mississippi, and the entire Nation.

5. The plan would be formulated with due regard to all pertinent benefits and cost, both tangible and intangible. Benefits and costs would be expressed in comparable economic terms to the fullest extent possible.

6. The expressed desires of local people and their rights and interests, as well as those of the states and Nation would be considered in determining the development of water and related land resources and the preservation and protection of established uses in the basin.

7. Existing and authorized projects and programs of Federal and non-Federal agencies which are compatible with the balanced comprehensive development and use of the water and related land resources of the Pearl River Basin would be included in the plan.

8. Additional studies might be required for some projects and programs to support specific recommendations for State or Federal authorization or development by private interests.

9. Provisions should be made for a periodic review of the comprehensive plan to keep it current and for subsequent action.

An analysis and comparison of the solutions available to meet the needs, as discussed in the previous section, indicated in general terms the measures required in any comprehensive plan for the Pearl River Basin. These measures fall into the following categories:

- Major control impoundments to regulate streamflow along the principal watercourses;

- Flood control, flood prevention, and watershed protection projects in upstream reaches of tributary areas;

- Management programs for controlling and regulating the economic use and development of flood plains and for reducing flood losses to existing developments in areas where flood control is not economically feasible;

- Measures and programs for conservation or enhancement of fish and wildlife, enhancement of recreation, and preservation of archaeological, historic, and natural science values.

These measures are not entirely independent of each other. In many cases, they act together to contribute to the overall effectiveness of the plan and in others they may be in conflict and detract from the plan. Selection of the appropriate project or program involved consideration of economic factors and other elements such as desires of local interests, position of the States, and pending Federal legislation relating to the basin.

In addition to regulation of flood flows, all impoundments were investigated for other purposes such as water quality control, recreation, and fish and wildlife enhancement.

PROJECT SELECTION

General. It is essential in developing a comprehensive plan that all available and applicable alternatives be afforded adequate consideration, to the end that optimum solutions to the water and related land resource problems of the basin may be developed. In this connection, it is important to recognize that not all problems respond to structural measures, and that, in many cases, nonstructural measures alone, or in combination with structural measures, may be required to effect optimum solutions.

General considerations applied in the formulation of individual projects were:

- That tangible benefits exceed project costs.
- That each separable segment or purpose provides benefits at least equal to its cost.
- That the scale of development is such as to provide the maximum excess benefits over costs insofar as practicable.
- That no more economical means, evaluated on a comparable basis, for accomplishing the same purpose or purposes, is available.
- That the scope and timing of selected projects and programs be responsive to the nature and urgency of the need.

The projects included in the comprehensive plan developed for the basin were separated into the following two categories:

1. The "Early-Action Plan", which includes projects and programs found necessary to meet immediate and near-future needs and to be economically feasible for construction within the next 10 to 15 years, and

2. The "Framework for Future Planning," which includes those measures that are not needed or are not economically feasible for construction in the next 10 to 15 years or for some other reason were omitted from the early-action plan but which could help meet future needs of the basin and are potentially feasible for development or are strongly supported by local interests.

As stated previously, it was determined during the evaluation of possible solutions to the basin problems that the majority of the basin needs could be met more economically through the provision of multiple-purpose reservoirs and upstream watershed projects than by any other method. These projects are discussed in the following paragraphs.

Reservoirs. A preliminary selection of potential reservoir project sites was made from map studies. This selection of sites having an apparent storage potential and an acceptable damsite was based primarily on topography and included all sites studied in previous reports. Subsequently, reconnaissance-type field investigations were made of each site to obtain information on possible engineering and geological problems, economic development in reservoir areas, and general attributes of the damsites. Storage capabilities were developed in engineering studies, along with the relationships between storage capacity and preliminary cost information. Those sites having obvious defects, such as unsuitable geologic conditions and extremely poor storage-cost relationships were eliminated from further consideration in developing the comprehensive plan. In this manner, 28 sites were analyzed and compared, of which 10 were eliminated from further consideration. Data on the 18 sites remaining were then developed in greater detail. The sites considered are listed in Table 10 and their locations within the basin are shown on Figure 2.

Upstream watersheds. The Pearl River Basin was divided into 63 upstream watersheds. Evaluation procedures consisted of detailed studies in sample watersheds and expansion of these data to other similar watersheds for which reconnaissance studies had been made. Also, data obtained from watersheds for which Public Law 566 work plans had been prepared or preliminary evaluations made were used to evaluate similar watersheds not studied in detail. Using this procedure, 5 watersheds were eliminated from further consideration in the comprehensive plan, due to the character of the soils in the flood plain or other undesirable features, and 58 were retained for further consideration. The watersheds are listed in Table 11 and shown on Figure 3.

Table 10

Summary of preliminary analysis of reservoirs

Location		Drainage area (sq. mi.)	Disposition
Stream	Site number		
Bogue Lusa Creek	1	49	Eliminated
Pushepatapa Creek	2	115	Retained
Holiday Creek	3	65	Retained
Green's Creek	4	42	Eliminated
White Sand Creek	5	108	Eliminated
Strong River	6	360	Retained
Strong River	7	630	Retained
Strong River	8	248	Retained
Steen Creek	9	84	Retained
Fannegusha Creek	10	54	Eliminated
Coffee Bogue Creek	11	70	Eliminated
Yockanookany River	12	468	Retained
Lobutch Creek	13	266	Retained
Pearl River	14	827	Retained
Hayes Creek	15	41	Retained
McGee Creek	16A	127	Eliminated
McGee Creek	16B	76	Eliminated
Bogue Chitto	17A	261	Eliminated
Bogue Chitto	17B	312	Retained
Bahala Creek	18	147	Retained
West Hobolochitto Creek	19	175	Retained
Upper Little Creek	20	125	Retained
East Bogue Chitto	21	19	Eliminated
Hontokalo Creek	22	57	Eliminated
Fair River	23	101	Retained
Copiah Creek	24	46	Retained
Lawrence Creek	25	44	Retained
Silver Creek	26	93	Retained

Navigation improvements. Investigations were made to determine justification of providing a suitable channel for modern barge transportation from the Gulf Intracoastal Waterway to Jackson on the Pearl River. Preliminary traffic and cost studies showed that such navigation could not be economically justified at this time. However, such a project has the strong support of local interests and may warrant development in the future. The considered waterway system is shown on Figure 4.

Other projects. The Pearl River Basin Development District has committed itself to develop a pleasure boatway the entire length of the Pearl River. This boatway would include various types of

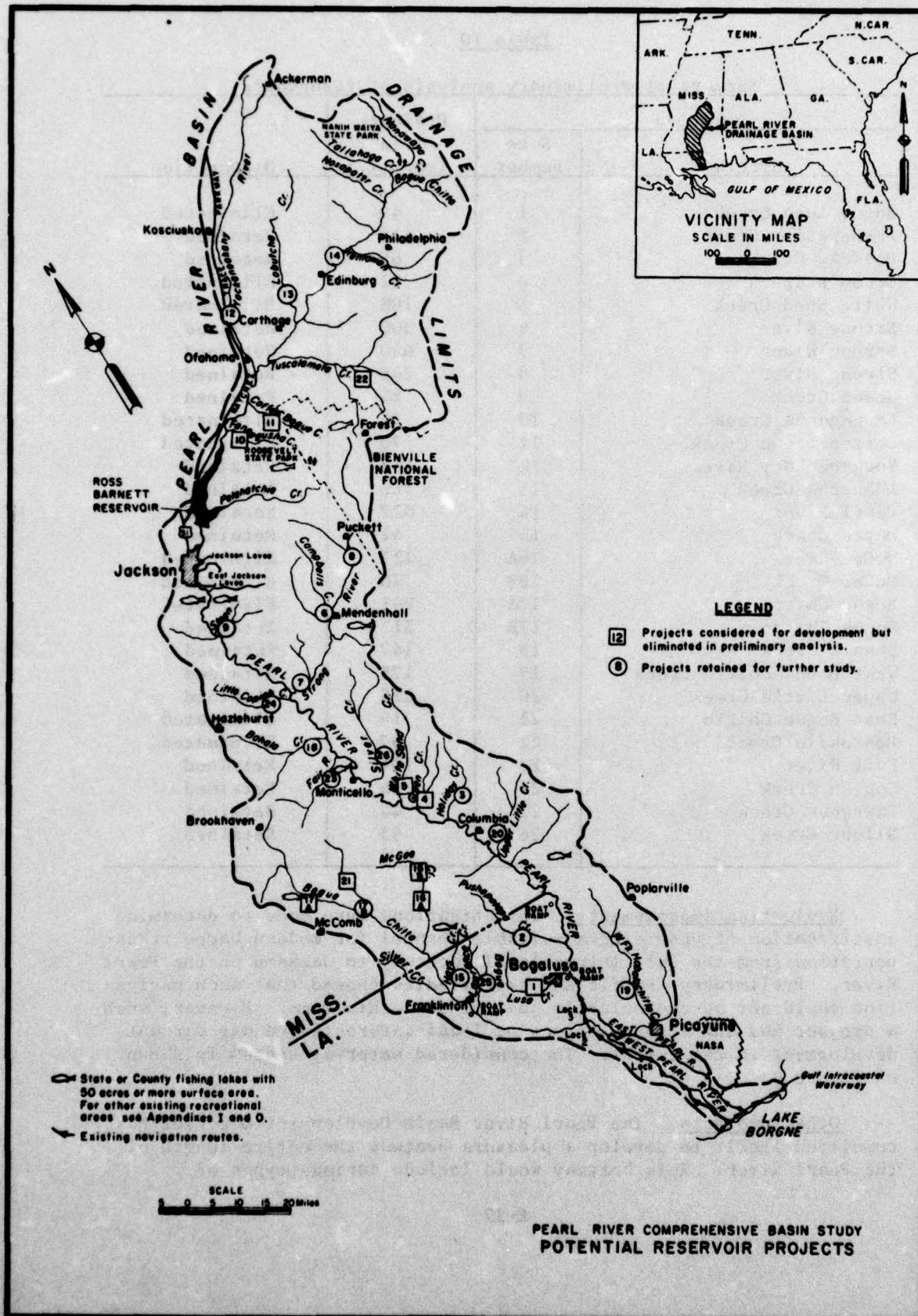


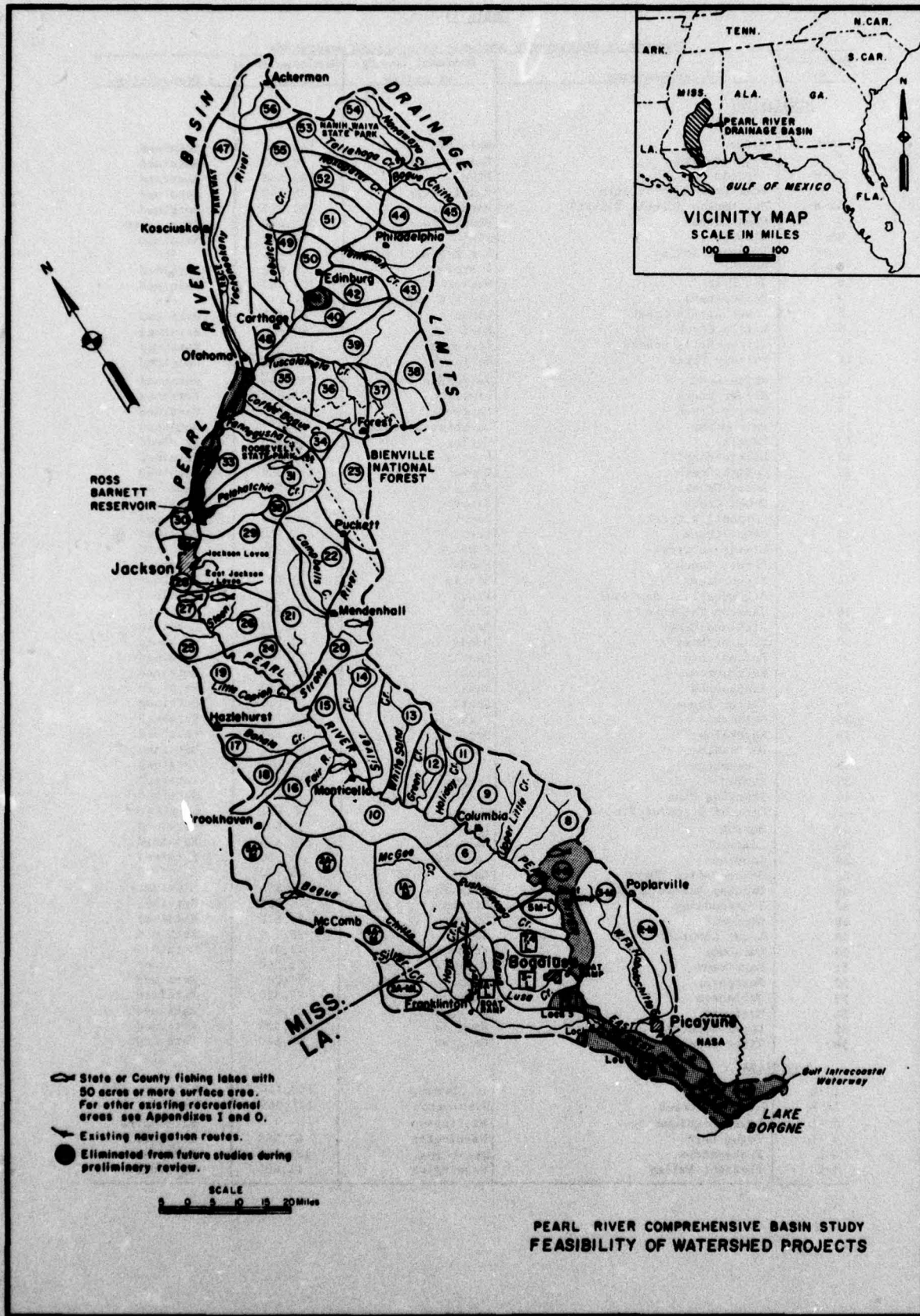
Table 11

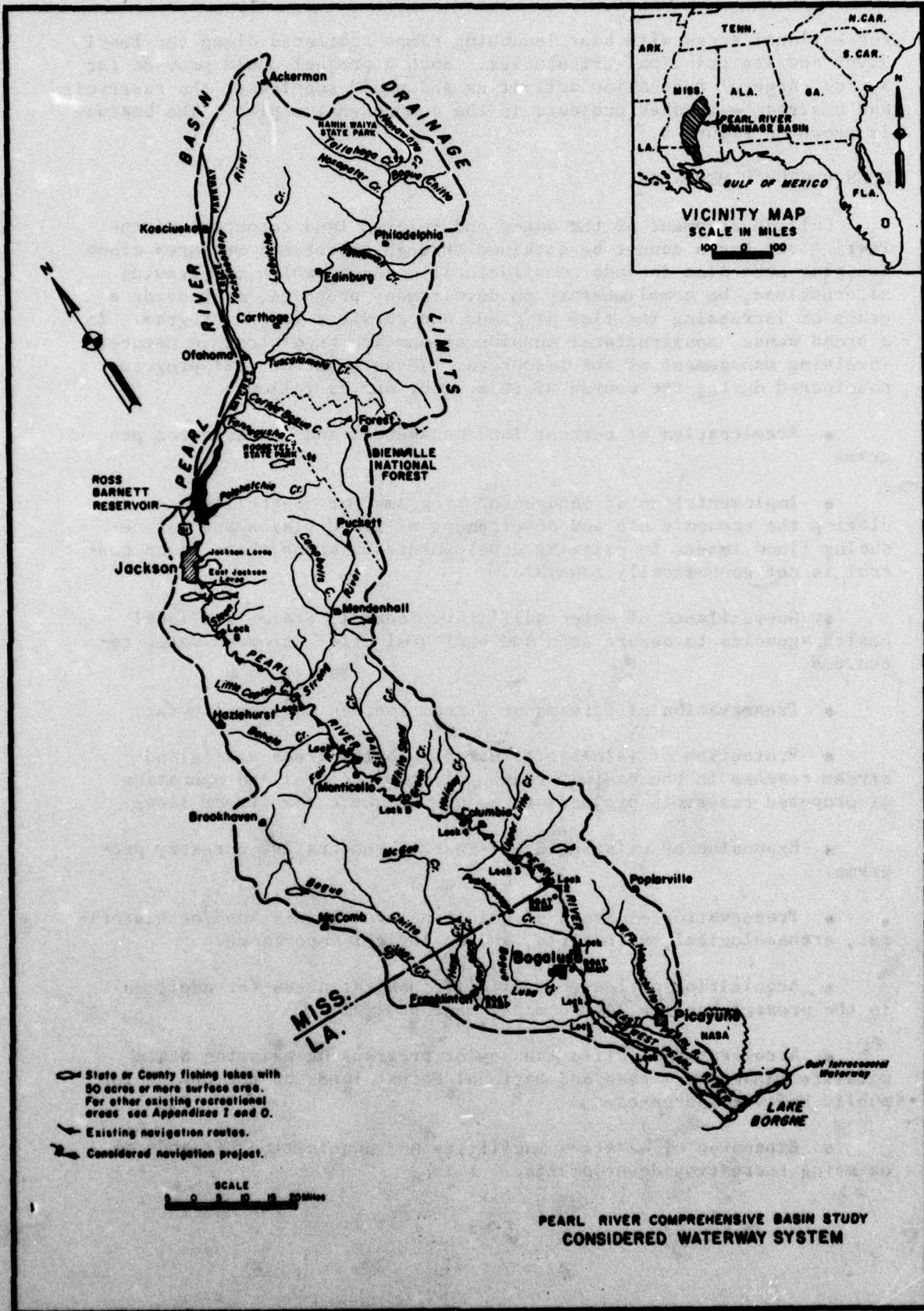
Summary of preliminary analysis of upstream watersheds				
Watershed No.	Watershed name	Dominant county or parish	Drainage area (acres)	Disposition
MISSISSIPPI				
1A-M	McGee	Walthall	146,260	Retained
2 -M	Hobolochitto	Pearl River	77,800	Retained
2A-M	Topisaw	Pike	167,448	Retained
3 -M	West Fork Hobolochitto	Pearl River	175,000	Retained
3A-M-L	Mt. Herman (Little Silver)	Washington	66,211	Retained
4	Clear Creek	Pearl River	133,440	Eliminated
4A-M	Clabber	Pike	92,521	Retained
5 -M	Pleasant Valley	See W/S No.5 in La.	---	---
5A-M	Boone	Lincoln	132,072	Retained
6	Ten Mile	Marion	107,760	Retained
7	Pushpatapa	See W/S No.4 in La	---	---
8	Lower Little Creek	Lamar	87,756	Retained
9	Little Creek	Marion	100,544	Retained
10	Tilton-Halls Creeks	Lawrence	116,944	Retained
11	Holiday Creek	Marion	63,760	Retained
12 & 13	White-sand	Jefferson Davis	204,100	Retained
14	Silver Creek	Lawrence	113,259	Retained
15	Pretty Creek	Lawrence	63,525	Retained
16	Fair River	Lawrence-Lincoln	98,952	Retained
17	Bahala	Copiah	74,403	Retained
18	Little Bahala	Lincoln	32,340	Retained
19	Copiah Creek	Copiah	126,358	Retained
20	Riles Creek	Simpson	128,781	Retained
21	Dobbs Creek	Simpson	99,240	Retained
22	Campbell's Creek	Rankin	90,900	Retained
23	Caney Creek	Scott	125,360	Retained
24	Limestone Creek	Simpson	59,200	Retained
25	Rhodes Creek	Hinds	52,624	Retained
26	Steen Creek	Rankin	73,710	Retained
27	Big Creek (S. Jackson)	Hinds	22,952	Retained
28	Jackson Watershed	Hinds	39,200	Retained
29	Richland Creek	Rankin	93,000	Retained
30	Hanging Moss	Hinds	43,706	Retained
31	Pelahatchie	Rankin	153,702	Retained
32	Eutacutaches	Rankin	18,128	Retained
33	Fannegusha	Rankin	70,680	Retained
34	Coffee Bogue	Scott	61,160	Retained
35	Balucta	Leske-Scott	38,760	Retained
36	Shockaloo	Scott	94,960	Retained
37	Nontokalo	Scott	45,520	Retained
38	Conehatta	Newton	80,000	Retained
39	Sipsey	Leske	126,360	Retained
40	Standing Pine	Leske	36,648	Retained
41	Part of Standing Pine	Leske	12,174	Eliminated
42	Beasha	Leske	35,603	Retained
43	Kentawah	Neshoba	118,830	Retained
44	Sandtown	Neshoba	34,300	Retained
45	Bogue Chitto (Dry)	Kemper	88,600	Retained
46	Dancing Rabbit Creek	Madison	54,954	Eliminated
47	Yockanookany	Attala	225,860	Retained
48	Carthage	Leske	58,820	Retained
49	Lower Lobutcha	Leske	98,820	Retained
50	Edinburg	Neshoba	48,360	Retained
51	Hurricane	Neshoba	51,560	Retained
52	Noxapater	Winston	51,280	Retained
53	Tallahaga	Winston	79,320	Retained
54	Nanewaya	Winston	89,680	Retained
55	Upper Lobutcha	Winston	104,720	Retained
56	Tibby Creek	Choctaw	99,640	Retained
LOUISIANA				
1 -L	Lower Pearl	St. Tammany	188,144	Eliminated
1A-L	Lawrence Creek	Washington	171,769	Retained
2 -L	Lower Bogalusa	Washington	---	Eliminated
3 -L	Bogue Lusa	Washington	62,000	Retained
4-L	Pushpatapa	Washington	197,802	Retained
5-L	Pleasant Valley	Washington	21,800	Retained

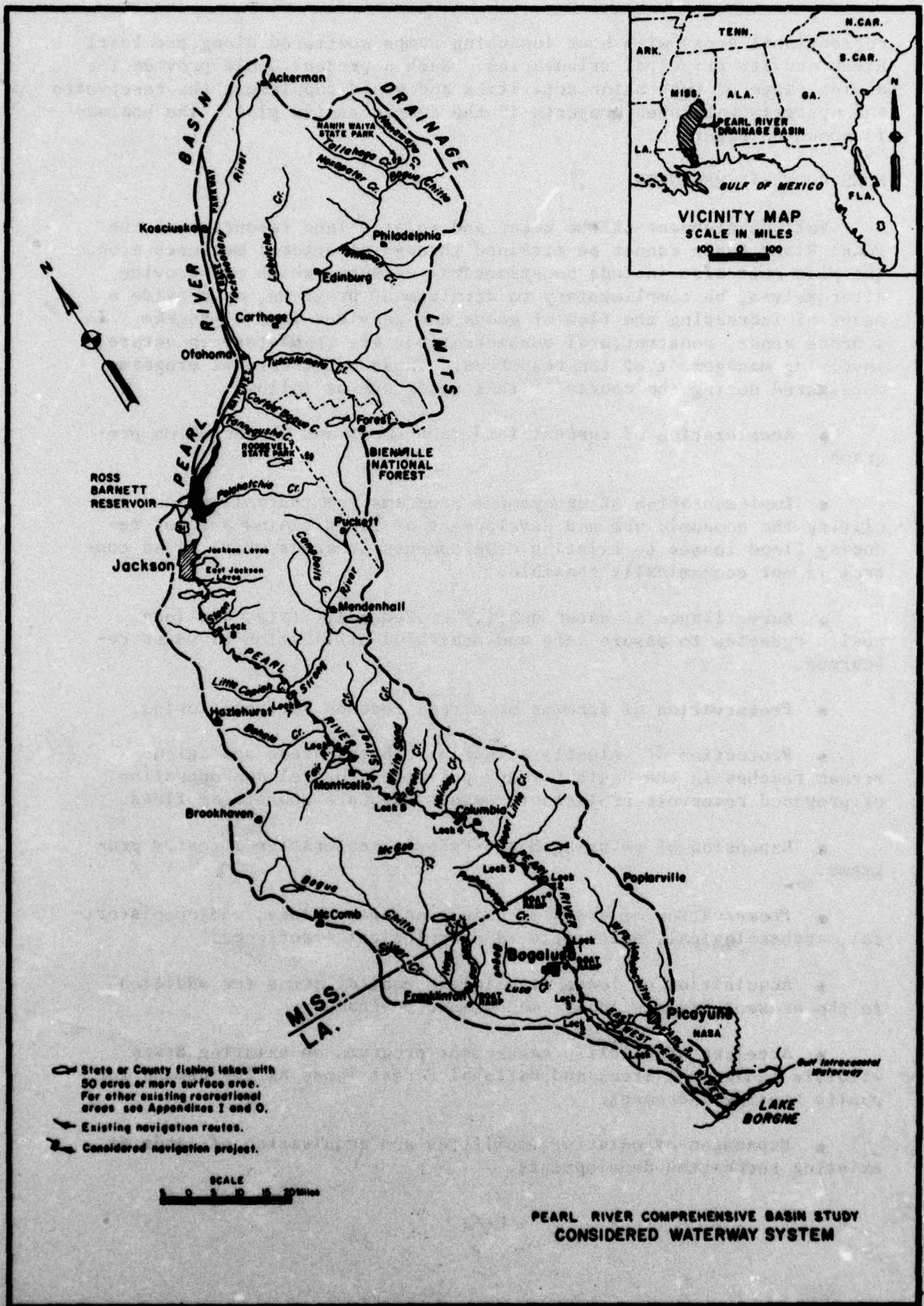
Table 11

Summary of preliminary analysis of upstream watersheds

Watershed No.	Watershed name	Dominant county or parish	Drainage area (acres)	Disposition
MISSISSIPPI				
1A-M	McGee	Walthall	146,260	Retained
2 -M	Hobolochitto	Pearl River	77,800	Retained
2A-M	Topisaw	Pike	167,448	Retained
3 -M	West Fork Hobolochitto	Pearl River	175,000	Retained
3A-M-L	Mt. Herman (Little Silver)	Washington	66,211	Retained
4	Clear Creek	Pearl River	133,440	Eliminated
4A-M	Clabber	Pike	92,521	Retained
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12 & 13	White-sand	Jefferson Davis	204,100	Retained
14	Silver Creek	Lawrence	113,259	Retained
15	Pretty Creek	Lawrence	63,525	Retained
16	Fair River	Lawrence-Lincoln	98,952	Retained
17	Bahala	Copiah	74,403	Retained
18	Little Bahala	Lincoln	32,340	Retained
19	Copiah Creek	Copiah	126,358	Retained
20	Riles Creek	Simpson	128,781	Retained
21	Dobbs Creek	Simpson	99,240	Retained
22	Campbell's Creek	Rankin	90,900	Retained
23	Caney Creek	Scott	125,360	Retained
24	Limestone Creek	Simpson	59,200	Retained
25	Rhodes Creek	Hinds	52,624	Retained
26	Steen Creek	Rankin	73,710	Retained
27	Big Creek (S. Jackson)	Hinds	22,952	Retained
28	Jackson Watershed	Hinds	39,200	Retained
29	Richland Creek	Rankin	93,000	Retained
30	Hanging Moss	Hinds	43,706	Retained
31	Pelahatchie	Rankin	153,702	Retained
32	Eutacutaches	Rankin	18,128	Retained
33	Fannegusha	Rankin	70,680	Retained
34	Coffee Bogue	Scott	61,160	Retained
35	Balucta	Leake-Scott	38,760	Retained
36	Shoakaloo	Scott	94,960	Retained
37	Hontokalo	Scott	45,520	Retained
38	Conehatta	Newton	80,000	Retained
39	Sipsey	Leake	126,360	Retained
40	Standing Pine	Leake	36,648	Retained
41	Part of Standing Pine	Leake	12,174	Eliminated
42	Beasha	Leake	35,603	Retained
43	Kentawah	Neshoba	118,830	Retained
44	Sandtown	Neshoba	34,300	Retained
45	Bogue Chitto (Dry)	Kemper	88,600	Retained
46	Dancing Rabbit Creek	Madison	54,954	Eliminated
47	Yockanookany	Attala	225,860	Retained
48	Carthage	Leake	58,820	Retained
49	Lower Lobutchu	Leake	98,820	Retained
50	Edinburg	Neshoba	48,360	Retained
51	Hurricane	Neshoba	51,560	Retained
52	Noxapater	Winston	51,280	Retained
53	Tallahaga	Winston	79,320	Retained
54	Nansaya	Winston	89,680	Retained
55	Upper Lobutchu	Winston	104,720	Retained
56	Tibby Creek	Choctaw	99,640	Retained
LOUISIANA				
1 -L	Lower Pearl	St. Tammany	188,144	Eliminated
1A-L	Lawrence Creek	Washington	171,769	Retained
2 -L	Lower Bogalusa	Washington	---	Eliminated
3 -L	Bogue Lusa	Washington	62,000	Retained
4-L	Pushepatapa	Washington	197,802	Retained
5-L	Pleasant Valley	Washington	11,800	Retained





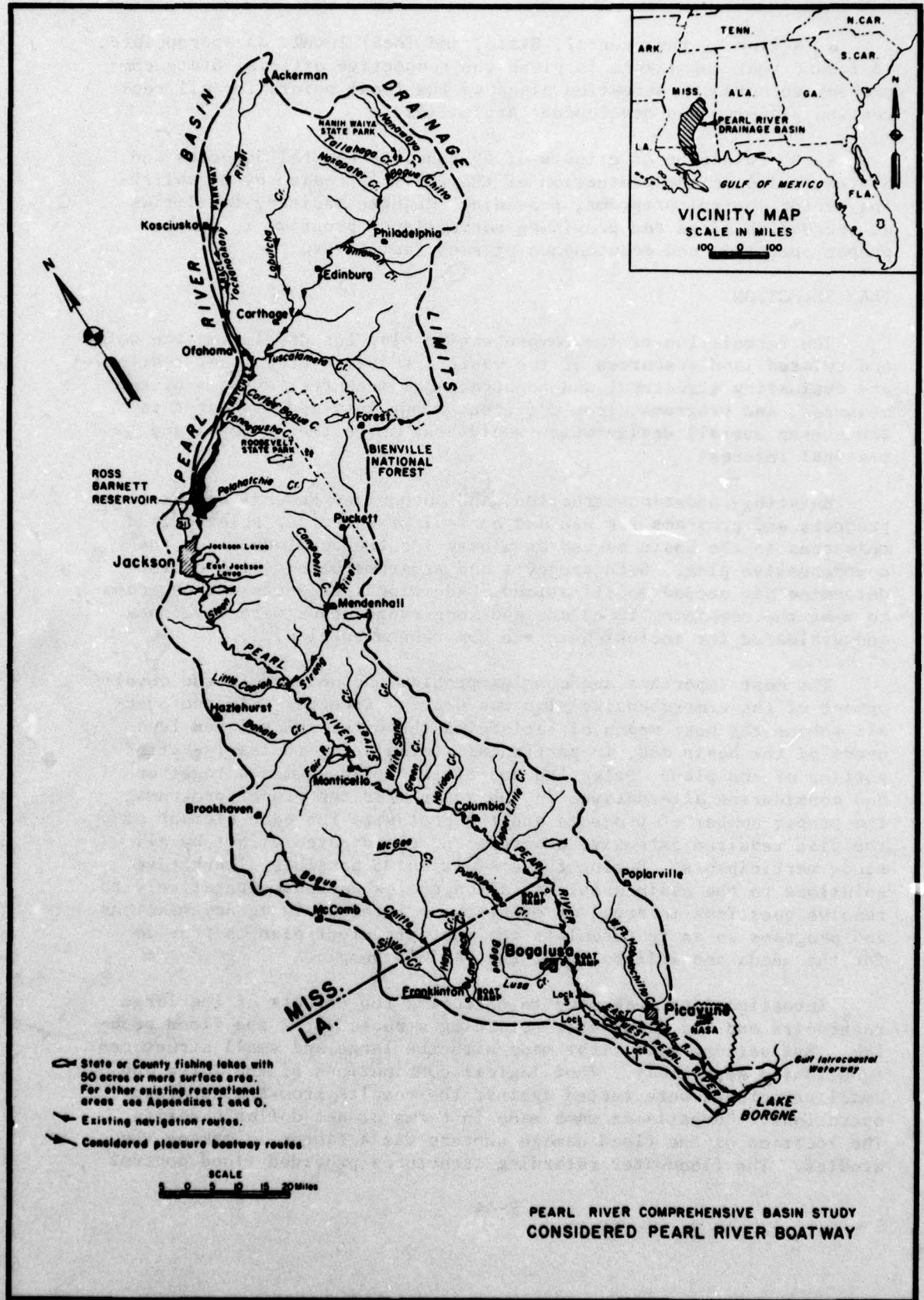


recreational areas with boat launching ramps scattered along the Pearl River and its principal tributaries. Such a project would provide for a wide range of recreation activities and would supplement the reservoirs and upstream watershed projects in the comprehensive plan. The boatway is shown on Figure 5.

NONSTRUCTURAL MEASURES

Full development of the water and related land resources of the Pearl River Basin cannot be attained through structural measures alone. The plan must also include nonstructural measures which may provide alternatives, be complimentary to development programs, or provide a means of increasing the flow of goods and services from a program. In a broad sense, nonstructural considerations are regulatory in nature, involving management of the resources. Those nonstructural programs considered during the course of this study are as follows:

- Acceleration of current land management and conservation programs.
- Implementation of management programs for controlling and regulating the economic use and development of flood plains and for reducing flood losses to existing developments in areas where flood control is not economically feasible.
- Surveillance of water quality by Federal, State, and local health agencies to assure safe and healthful utilization of water resources.
- Preservation of streams or stream reaches as free-flowing.
- Protection of valuable estuarine habitat areas and inland stream reaches in the basin through pollution control and operation of proposed reservoir projects to assure adequate downstream flows.
- Expansion of existing State-Federal cooperative forestry programs.
- Preservation of areas of unique natural beauty, and/or historical, archaeological, scientific, and ecological importance.
- Acquisition or lease of wildlife habitat acres for addition to the present basin wildlife management program.
- Accelerated wildlife management programs on existing State wildlife management areas and National Forest lands as the demand for public hunting increases.
- Expansion of existing facilities and acquisition of lands at existing recreation developments.



- Action at the Federal, State, and local level, as appropriate, to insure that cognizance is given the respective official State comprehensive outdoor recreation plans as the focal points for all recreation planning and development activities.

- Coordination of efforts of appropriate Federal agencies and States to insure the protection of the public's health by establishing vector control programs, providing adequate sanitary facilities at recreation sites and providing surveillance programs to insure proper operation and maintenance of such facilities.

PLAN SELECTION

The formulation of the comprehensive plan for developing the water and related land resources of the basin involved a process of testing and evaluating structural and nonstructural measures, systems of such measures, and programs, from different viewpoints and standards to achieve an overall design which would best serve the national and regional interest.

Existing, under-construction, and authorized Federal and State projects and programs for use and control of water and related land resources in the basin served as a base for the development of the comprehensive plan. Such projects and programs were evaluated to determine any needed modifications. Additional projects and programs to meet the remaining immediate and long-range needs were developed and evaluated for inclusion in the comprehensive plan.

The most important and complex problem encountered in the development of the comprehensive plan was weaving together into one overall scheme the best means of satisfying the water and related land needs of the basin and, in particular, formulating the early-action portion of the plan. Selecting and fitting plan segments together and considering alternatives in the search for the proper programs, the proper number of projects and the best size for each element of the plan required extensive analysis and coordinated effort by all study participants. During the evaluation of possible alternative solutions to the basin problems, all agencies worked cooperatively to resolve questions in areas of overlapping interest in agency missions and programs so as to formulate the most efficient plan to provide for the needs and well-being of the basin's people.

Investigations were made to determine the effects of the large reservoirs and the floodwater retarding structures on the flood problem. Evaluations were first made with the large and small structures functioning separately. Then logical combinations of the large and small structures were tested against the results from the separate operations. Comparisons were made in terms of net dollar benefits. The location of the flood damage centers was a factor in making the studies. The floodwater retarding structures provided flood control

and prevention at locations farther upstream than provided by the large reservoirs because of their locations. The larger reservoirs provided flood control farther downstream than the retarding structures, mainly because of location and holding ability.

These evaluations resulted in the selection of 3 multiple-purpose reservoirs and 30 upstream watershed projects for the early-action program and 9 multiple-purpose reservoirs and 16 upstream watershed projects for the framework for future planning. In addition, works of improvement in 12 upstream watersheds will be accomplished under existing Public Law 566 authority. The results of the evaluations are given in Tables 12 and 13.

Development of part of the Pearl River Boatway was included in the early-action program. Included was 302 miles from the N.A.S.A. canal on the East Pearl River to the vicinity of Edinburg and 82 recreational areas with boat-launching ramps along the Pearl River and principal tributaries. The remaining portion of the Boatway and barge navigation on the Pearl River from the Gulf Intracoastal Waterway to Jackson has been included in the framework for future planning. Such a project has the strong support of local interests.

As previously indicated nonstructural measures also were developed by the study participants. These measures would operate alone and in conjunction with structural measures. Coordination of all projects and programs was maintained throughout the study.

When a tentative overall plan had been developed, it was presented at a public hearing in Jackson, Mississippi, on 9 September 1970. The hearing provided a final opportunity to elicit local views on the plan on a broad scale. Prior to the public hearing, the proposed plan was submitted along with the supporting data to the participating States and agencies for formal field review and comment. These comments are contained in Appendix A.

Table 12

Summary of final analysis of reservoirs

Location		Drainage area (sq.mi.)	Disposition
Stream	Site No.		
Pushepatapa Creek	2	115	Framework. Possible preservation as free-flowing stream.
Holiday Creek	3	65	Eliminated. Better adapted to upstream watershed development.
Strong River	6	360	Framework. Possible preservation as free-flowing stream.
Strong River	7	630	Framework. Possible preservation as free-flowing stream.
Strong River	8	248	Framework. Possible preservation as free-flowing stream.
Steen Creek	9	84	Eliminated. Better adapted to upstream watershed development.
Yockanookany River	12	469	Early-action. Ofahoma Dam and Reservoir.
Lobutchka Creek	13	266	Early-action. Carthage Dam and Reservoir.
Pearl River	14	827	Early-action. Edinburg Dam and Reservoir.
Hayes Creek	15	41	Framework.
Bogue Chitto	17B	312	Framework. Possible preservation as free-flowing stream.
Bahala Creek	18	147	Eliminated. Better adapted to upstream watershed development.
West Hobolochitto Creek	19	175	Framework. Possible preservation as free-flowing stream.
Upper Little Creek	20	125	Eliminated. Better adapted to upstream watershed development
Fair River	23	101	Eliminated. Better adapted to upstream watershed development
Copiah Creek	24	46	Eliminated. Better adapted to upstream watershed development.
Lawrence Creek	25	44	Framework.
Silver Creek	26	93	Framework.

Table 13

Summary of final analysis of upstream watersheds

Watershed No.	Watershed name	Dominant county	Drainage area (acres)	Disposition
MISSISSIPPI				
1A-M	McGee	Walshall	146,260	Early-action
2 -M	Hobolochitto	Pearl River	77,800	Early-action
2A-M	Topisaw	Pike	167,448	Early-action
3 -M	West Fork Hobolochitto	Pearl River	175,000	Framework
3A-M-L	Mt. Herman (Little Silver)	Washington	66,211	Framework
4A-M	Clabber	Pike	92,521	Framework
5 -M	Pleasant Valley	Washington	---	(See watershed #5 under La.)
5A-M	Boone	Lincoln	132,072	Early-action
6	Ten Mile	Marion	107,600	Framework
7	Pushpatapa	Walshall	197,802	(See watershed #4 under La.)
8	Lower Little Creek	Lamar	87,756	Early-action
9	Little Creek	Marion	100,544	Early-action
10	Tilton-Halls Creeks	Lawrence	116,944	Framework
11	Holiday Creek	Marion	63,760	PL-566 (App. for operation)
12 & 13	Whitesand	Jefferson Davis	204,100	PL-566 (App. for operation)
14	Silver Creek	Lawrence	113,259	PL-566 (App. for operation)
15	Pretty Creek	Lawrence	63,525	Framework
16	Fair River	Lawrence-Lincoln	98,952	Early-action
17	Bahala	Copiah	74,403	Early-action
18	Little Bahala	Lincoln	32,340	PL-566 (App. for operation)
19	Copiah Creek	Copiah	126,358	PL-566 (App. for operation)
20	Riles Creek	Simpson	128,781	Framework
21	Dobbs Creek	Simpson	99,240	Early-action
22	Campbell's Creek	Rankin	90,900	Early-action
23	Caney Creek	Scott	125,360	Framework
24	Limestone Creek	Simpson	59,200	Framework
25	Rhodes Creek	Hinds	52,624	Framework
26	Steen Creek	Rankin	73,710	Early-action
27	Big Creek (S. Jackson)	Hinds	22,952	Framework
28	Jackson	Hinds	39,200	Early-action
29	Richland Creek	Rankin	93,000	PL-566 (App. for operation)
30	Hanging Moss	Hinds	43,706	Early-action
31	Pelahatchie	Rankin	153,702	Early-action
32	Eutacutaches	Rankin	18,128	PL-566 (App. for operation)
33	Fannegusha	Rankin	70,680	Early-action
34	Coffee Bogue	Scott	61,160	Early-action
35	Balucta	Leake-Scott	38,760	Framework
36	Shockaloo	Scott	94,960	Early-action
37	Hontokalo	Scott	45,520	Early-action
38	Conshatta	Newton	80,000	Early-action
39	Sipsy	Leake	126,360	Early-action
40	Standing Pine	Leake	36,648	PL-566 (App. for operation)
42	Beasha	Leake	35,603	PL-566 (App. for operation)
43	Kentawah	Neshoba	118,830	Early-action
44	Sandtown	Neshoba	34,300	Early-action
45	Bogue Chitto (Dry)	Kemper	88,600	Early-action
47	Yockanookany	Attala	225,860	Early-action
48	Carthage	Leake	34,560	Early-action
49	Lower Lobutchas	Leake	98,820	Framework. Better adapted for early-action reser. development
50	Edinburg	Neshoba	48,360	Early-action
51	Hurricane	Neshoba	51,560	Early-action
52	Noxapater	Winston	51,280	Early-action
53	Tallahaga	Winston	79,320	PL-566 (App. for operation)
54	Nanawaya	Winston	89,680	Early-action
55	Upper Lobutchas	Winston	104,720	Framework
56	Tibby Creek	Choctaw	99,640	Early-action
LOUISIANA				
1-L	Lawrence Creek	Washington	171,769	Framework
3-L	Bogue Lusa	Washington	62,800	PL-566 (App. for operation)
4-L	Pushpatapa	Walshall	197,802	Framework
5-L	Pleasant Valley	Washington	11,800	PL-566 (App. for operation)

SECTION 6 - THE COMPREHENSIVE PLAN

GENERAL FEATURES OF THE PLAN

The comprehensive plan developed for the Pearl River Basin includes the existing and under-construction water resource and related land improvement facilities in the basin, and additional improvements required to meet present and long-range water and related land resource needs to the maximum practicable extent. The additional improvements are separated into the categories of:

1. Those recommended for inclusion in an early-action program of construction; and
2. Those recommended for inclusion in a framework for future planning.

Data on projects that constitute the comprehensive plan are given in Table 14. The locations of the structural measures are shown on Figure 6.

In addition to the structural measures listed in Table 14, land treatment, critical land area stabilization and other nonstructural measures are also vital parts of the plan. Nonstructural measures include flood plain management, preservation of streams or reaches of streams as free-flowing programs for expansion of existing recreation facilities and areas, preservation of natural areas, acquisition or lease of acres of wildlife habitat for addition to the present basin wildlife management program, programs for protecting the water quality of the basin streams, and programs to insure the protection of the public's health.

The projects and programs of the early-action portion of the proposed plan of improvement would satisfy the urgent needs for additional flood protection, water quality control, recreation, and fish and wildlife enhancement in the Pearl River Basin; stimulate the economic growth in the region; and provide for the preservation of valuable environmental features. The projects and programs in the framework for future planning would permit the full development of the basin's water and related land resources as the need arises. A resumé of the projects and programs included in the comprehensive plan is presented in the following paragraphs.

EARLY-ACTION PROGRAM - STRUCTURAL MEASURES

Structural measures included in the early-action portion of the comprehensive plan consists of:

- 3 multiple-purpose reservoirs;

Table 14

Structural portion of the comprehensive plan of development for the Pearl River Basin

RESERVOIRS ¹							
Name	Location			Drainage area (sq.mi.)	Purpose ³	Total storage capacity (acre-feet)	Area at normal pool (acres)
	Stream	Mile	County ²				
<u>EXISTING</u> <u>Non-Federal</u>							
Ross Barnett	Pearl River		Hinds-Rankin		WS, R, FW		30,000
Lake Dockery			Hinds		R, FW		55
Roosevelt			Scott		R, FW		320
Rankin Co. Lake			Rankin		R, FW		600
Lake Walthal			Walthal		R, FW		62
Simpson-Legion			Simpson		FW		75
Dixie Spring			Pike		R, FW		100
Mary Crawford			Lawrence		R, FW		134
Marion Co. Game-Fish			Marion		R, FW		103
<u>RECOMMENDED FOR INCLUSION IN EARLY-ACTION PROGRAM</u>							
<u>Federal</u>							
Ofahoma	Yockanookany R.	8.7	Leake	469	FC, R, FW	620,000	3,700
Carthage	Lobutchs Cr.	13.2	Leake	266	FC, R, FW	310,000	3,000
Edinburg	Pearl River	390.4	Neshoba	827	FC, WQC, R, FW	1,100,000	12,600
<u>RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING</u>							
Varnado	Pushepatapa Cr.	15.2	Washington, La.	115	FC, R, FW	105,000	1,200
D'Lo	Strong River	33.6	Simpson	360	FC, P, R, FW	313,000	2,500
Pinolo	Strong River	10.7	Simpson	630	FC, P, R, FW	220,000	5,300
Mayton	Strong River	49.2	Rankin-Smith	248	FC, P, R, FW	288,000	2,700
Hayes	Hayes Creek	5.3	Washington, La.	41	FC, R, FW	37,000	380
Bogue Chitto	Bogue Chitto	95.8	Pike	312	FC, R, FW	280,000	1,700
Picayune	W.Hobolochitto Cr.	20.9	Pearl River	175	FC, WS, R, FW	150,000	2,700
Lawrence	Lawrence Cr.	4.0	Washington, La.	44	FC, R, FW	61,000	650
Silver	Silver Creek	6.0	Washington, La.	93	FC, R, FW	48,000	935

NAVIGATION AND FLOOD CONTROL IMPROVEMENTS		
Project	Stream	Type of improvement
<u>EXISTING</u> <u>Federal projects</u>		
Commercial navigation-Pearl R. Waterway	West Pearl River	Open river and canalization
Commercial navigation-East Pearl River	East Pearl River	Open river
Commercial navigation-East Pearl River	East Pearl River	Open river and canalization
Flood control - Jackson-East Jackson	Pearl River	Levee
<u>RECOMMENDED FOR INCLUSION IN EARLY-ACTION PROGRAM</u>		
<u>Non-Federal</u>		
Recreation navigation-Pearl R. Boatway	Pearl R. (to Edinburg)	Clearing and snagging
<u>RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING</u>		
Commercial navigation	Pearl River (to Jackson)	Canalization
Recreation navigation	Pearl River (above Edinburg) Strong R., Yockanookany R., Lobutchs Creek, Bogue Chitto	Clearing and snagging

Table 14 (Cont'd)

Structural portion of the comprehensive plan
of development for the Pearl River Basin

UPSTREAM WATERSHED PROJECTS ⁴					
Watershed name ⁵	Watershed number	Watershed area (acres)	Percent watershed area controlled by structural measures	Number of multiple-purpose structures	Number of floodwater retarding structures (e)
EXISTING, UNDER CONSTRUCTION OR AUTHORIZED					
Mississippi					
Holiday Creek	11	63,760	43.8	-	8
Whitesand	12, 13	131,260	31.1	1	12
Silver Creek	14	113,259	33.7	1	13
Little Bahala	18	32,340	38.5	1	2
Copiah Creek	19	126,358	31.4	2	14
Richland Creek	29	93,000	33.8	-	5
Eutacutachee	32	18,128	25.1	-	4
Standing Pine	40	36,648	33.9	-	5
Beasha	42	35,603	44.7	-	9
Tallahaga	53	79,320	35.3	-	11
Louisiana					
Bogue Lusa	3L	62,000	67.1	1	11
Pleasant Valley	5ML	11,800	21.2	-	5
RECOMMENDED FOR INCLUSION IN EARLY-ACTION PROGRAM					
McGee Creek	1A-M	146,260	36.8	1	18
Hobolochitto	2 -M	77,800	44.4	2	1
Topisaw	2A-M	167,448	36.9	1	8
Boone	5A-M	132,072	26.4	1	7
Lower Little Creek	8	87,756	45.3	1	4
Little Creek	9	100,544	40.9	2	10
Fair River	16	98,952	25.1	1	5
Bahala	17	74,403	42.0	1	8
Dobbs Creek	21	99,240	35.4	1	8
Campbell's Creek	22	90,900	30.2	1	6
Steen Creek	26	73,710	23.9	1	6
Jackson	28	39,200	1.1	-	1
Hanging Moss	30	43,700	25.0	-	8
Pelahatchie	31	153,702	32.8	-	15
Fannagusha	33	70,680	24.4	-	6
Coffee Bogue	34	61,160	0	-	-
Shockaloo	36	94,960	35.5	2	4
Hontokalo	37	45,520	43.0	1	4
Conehatta	38	80,000	27.3	2	7
Sipsey	39	126,360	18.2	2	10
Kentawah	43	118,830	29.3	1	5
Sandtown	44	34,300	17.4	1	1
Bogue Chitto (Dry)	45	88,600	39.0	1	4
Yockanookany	47	225,860	13.0	1	12
Carthage	48	34,600	13.4	1	2
Edinburg	50	48,360	17.6	1	4
Hurricane	51	51,560	36.1	1	2
Noxapater	52	51,280	26.7	-	4
Manawaya	54	89,680	43.5	1	4
Tibby Creek	56	99,640	24.1	1	5
RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING					
Mississippi					
McGee Creek	1A-M	---	--	1 ^a	-
Topisaw	2A-M	---	--	1 ^a	-
West Fork Hobolochitto	3 -M	175,000	34.7	1	9
Mt. Herman (Little Silver)	3A-ML	110,000	42.3	1	1
Clabber	4A-M	92,500	21.7	1	8
Boone	5A-M	---	--	1 ^a	-
Ten Mile	6	108,000	38.8	1	6
Tilton-Halls Crs.	10	117,000	27.0	1	6
Pretty Creek	15	54,400	13.7	-	-
Riles Creek	20	129,000	16.9	1	7
Dobbs Creek	21	---	--	1 ^a	-
Caney Creek	23	125,000	26.7	2	6
Limestone Creek	24	59,200	26.1	1	6

Table 14 (Cont'd)

Structural portion of the comprehensive plan
of development for the Pearl River Basin

UPSTREAM WATERSHED PROJECTS ⁴ (Cont'd)					
Watershed name ⁵	Watershed number	Watershed area (acres)	Percent watershed area controlled by structural measures	Number of multiple-purpose structures	Number of floodwater retarding structures ⁶
RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING (Cont'd)					
Mississippi (cont'd)					
Rhodes Creek	25	52,600	22.0	-	7
Steen Creek	26	---	--	1 ⁶	-
Big Creek (S. Jackson)	27	23,000	30.7	-	9
Richland Creek	29	---	--	17	-
Pelahatchie	31	---	--	1 ⁶	-
Balucta	35	38,700	29.7	1	2
Standing Pine	40	---	--	17	-
Lower Lobutchka	49	98,800	34.5	-	9
Tallahaga	53	---	--	17	-
Upper Lobutchka	55	105,000	36.9	1	15
Tibby Creek	56	---	--	1 ⁶	-
Louisiana					
Lawrence	1L	172,000	21.0	1	9
Fushepatapa	4L	137,000	35.6	1	8

¹ Reservoirs having a normal pool of 50 acres or more.

² Counties are in Mississippi unless otherwise noted.

³ FC = Flood control; WQC = Water quality control; WS = Water supply; R = General recreation; FW = Fish and wildlife enhancement; P = Hydroelectric power.

⁴ Accelerated land treatment for the early-action projects and critical land area stabilization for the entire basin are also included in the comprehensive plan.

⁵ See Plate 1 for location.

⁶ Additional multiple-purpose structure in early-action watershed.

⁷ Additional multiple-purpose structure in PL-566 watershed.

⁸ Does not include multiple-purpose structures.

- 179 floodwater retarding structures, 29 multiple-purpose structures, and 1,202 miles of channel development in 30 upstream watersheds; and

- Development of a pleasure boatway along the Pearl River by snagging 302 miles of the channel from the N.A.S.A. canal on the East Pearl River to the vicinity of Edinburg and building 82 recreational areas with boat-launching ramps along the Pearl River and principal tributaries.

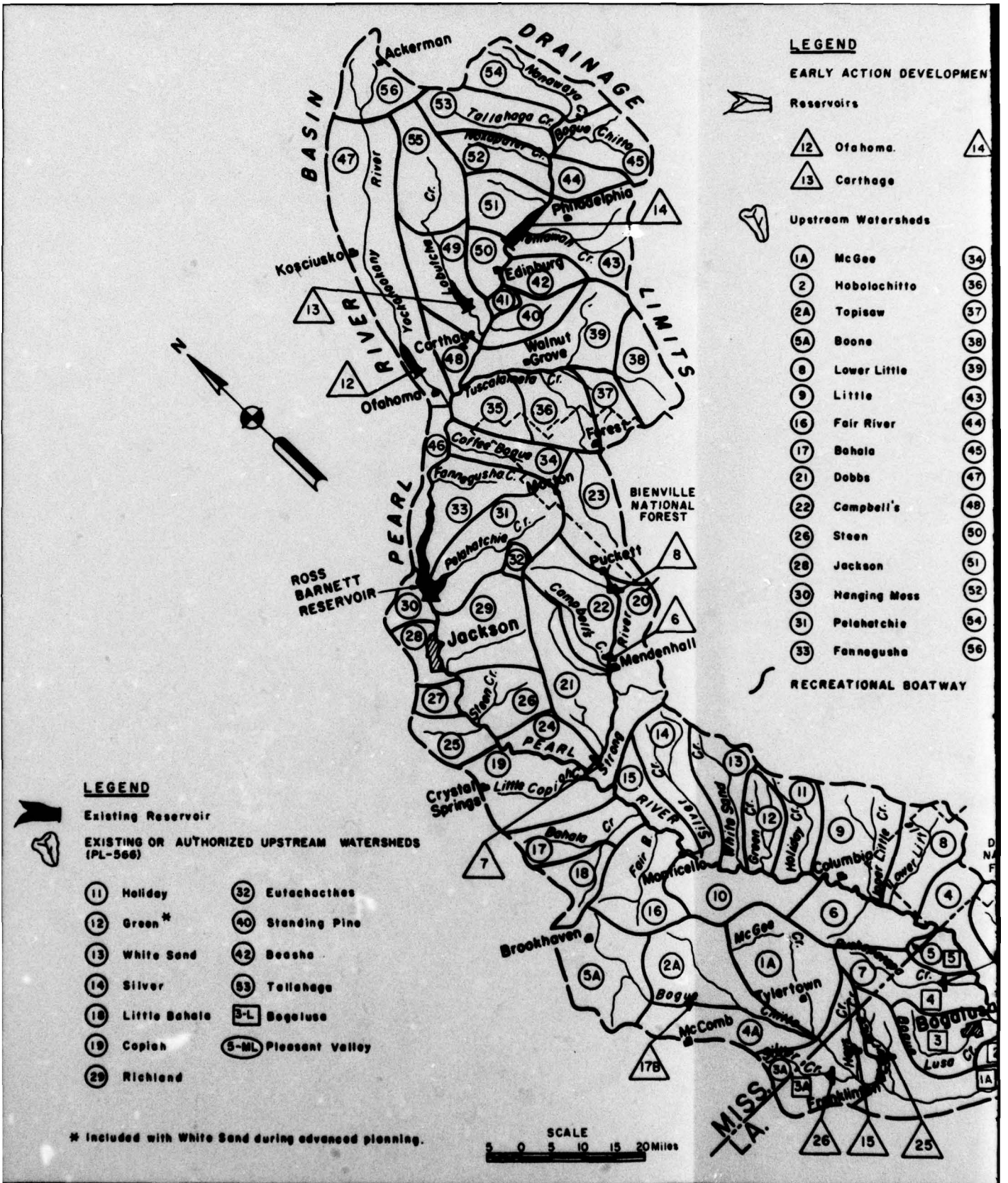
These measures are discussed in the following paragraphs.

Reservoirs. The three multiple-purpose reservoirs, Ofahoma, Carthage and Edinburg, would operate as a flood control system, controlling approximately 50 percent of the drainage area above Jackson. The system would provide a high degree of protection for the downstream urban and rural areas, particularly at Jackson and vicinity. In addition, conservation storage would be provided in the Ofahoma and Carthage Reservoirs to help meet the recreation and fish and wildlife needs of the area. Additional storage would be provided in Edinburg Reservoir to improve the quality of the water in the Pearl River below the Jackson metropolitan area and to help meet the recreation and fish and wildlife needs of the area. Pertinent data on the projects are given in Appendix F. Locations of the projects are shown on Figure 7. A brief description of each project is given in the following paragraphs.

Ofahoma Dam and Reservoir. The Ofahoma damsite is located at mile 8.7 on the Yockanookany River in northwestern Leake County. This project would control the runoff from 469 square miles, or about 95 percent of the Yockanookany River Basin.

The plan for the Ofahoma project includes an earth dam, a high-level, fixed-crest emergency spillway, an intake structure, and an outlet conduit with a stilling basin. The dam would be approximately 8,240 feet long, with the top at elevation 398.5. It would have a maximum height of about 64 feet and a top width of 32 feet to accommodate a 20-foot access road for two-way traffic. The 650-foot-long fixed-crest emergency spillway would be located in a ridge about 2,600 feet north-east of the left abutment and would have a crest elevation of 388.0. The outlet works would be located near the existing river channel.

The reservoir would be operated primarily for flood control. However, conservation storage would be provided for recreation and fish and wildlife uses and future water use needs should they arise. It would have an area of 3,700 acres at conservation pool elevation 348.5. Flood control storage of 210,000 acre-feet (8.4 inches of runoff) would be allocated between elevations 348.5 and 371.3 to store floods up to and including the 100-year flood. Conservation storage of 30,000 acre-feet below elevation 348.5 includes 7,000 acre-feet for sediment accumulation and 23,000 acre-feet for recreation and fish



LEGEND

EARLY ACTION DEVELOPMENT

Reservoirs

- △ 12 Ofahoma
- △ 13 Carthage
- △ 14

Upstream Watersheds

- ① McGee
- ② Hobolochitto
- ②A Topisaw
- ⑤A Boone
- ⑧ Lower Little
- ⑨ Little
- ⑩ Fair River
- ⑩A Behala
- ⑩B Dobbs
- ⑩C Campbell's
- ⑩D Steen
- ⑩E Jackson
- ⑩F Hanging Mess
- ⑩G Pelahatchie
- ⑩H Fannegusha
- ⑩I
- ⑩J
- ⑩K
- ⑩L
- ⑩M
- ⑩N
- ⑩O
- ⑩P
- ⑩Q
- ⑩R
- ⑩S
- ⑩T
- ⑩U
- ⑩V
- ⑩W
- ⑩X
- ⑩Y
- ⑩Z

RECREATIONAL BOATWAY

LEGEND

Existing Reservoir

EXISTING OR AUTHORIZED UPSTREAM WATERSHEDS (PL-566)

- ① Holiday
- ② Green*
- ③ White Sand
- ④ Silver
- ⑤ Little Behala
- ⑥ Copiah
- ⑦ Richland
- ⑧ Eutawchokes
- ⑨ Standing Pine
- ⑩ Beasha
- ⑪ Tallahoga
- ⑫ Bogue
- ⑬ Pleasant Valley

* Included with White Sand during advanced planning.

SCALE

0 5 10 15 20 Miles

LEGEND

EARLY ACTION DEVELOPMENTS



Reservoirs



Ofohome.



Edinburg



Carthage



Upstream Watersheds



McGee



Coffee Bogus



Hoblochitto



Shockaloo



Topisaw



Hontokalo



Boone



Conehatta



Lower Little



Sipsy



Little



Kentawah



Fair River



Sandtown



Bahole



Bogue Chitto



Debbs



Yeckenookany



Campbell's



Carthage



Steen



Edinburg



Jackson



Herricone



Hanging Moss



Noxapater



Pelohatchie



Naneweys

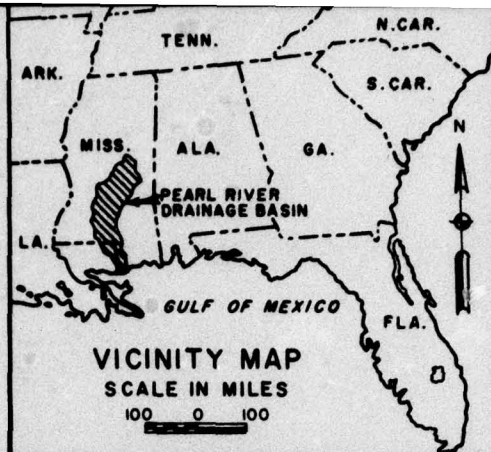


Fannegusha



Tibby

RECREATIONAL BOATWAY



LEGEND

FRAMEWORK FOR FUTURE PLANNING



Reservoirs



Pushapatapa Creek



Bogue Chitto



Strong River



West Hoblochitto Creek



Strong River



Lawrence Creek



Strong River



Silver Creek



Hayes Creek



Upstream Watersheds



West Fork Hoblochitto



Rhodes



Clear



Big Creek (South Jackson)



Love



Calucta



Ten Mile



Lower Lubutcha



Pushapatapa-Bogue Lusa



Upper Lubutcha



Tilton



Lawrence



Pretty



Lower Bogalusa



Riles



Mt. Herman (Little Silver)

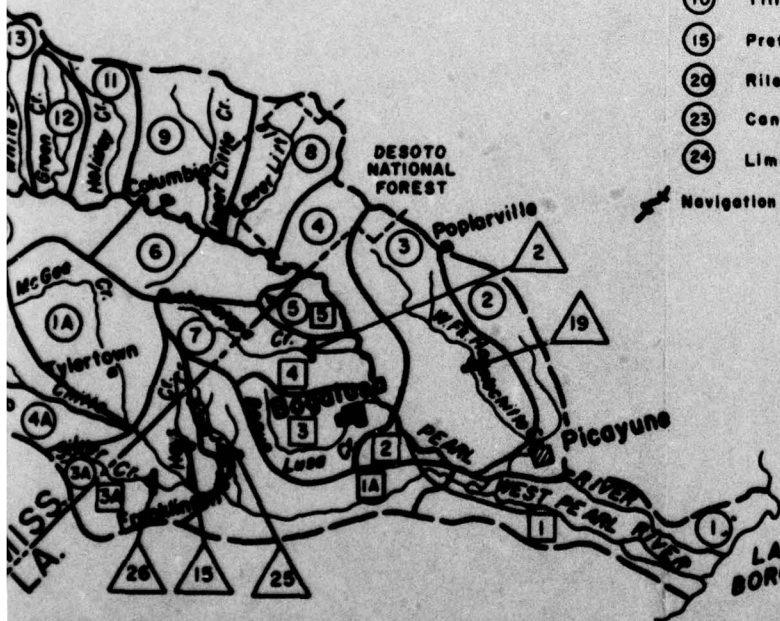


Coney



Pushapatapa

Navigation Developments



**PEARL RIVER BASIN
STRUCTURAL PORTION OF
COMPREHENSIVE PLAN
OF DEVELOPMENT**

and wildlife. A total of 36,800 acres of land would be acquired for the project.

The initial general recreation facilities for the Ofahoma project, planned to help meet the expected needs of the Upper Subarea in 1980, include: 2 overlooks, 2 boat launching areas, 5 camping areas, 11 picnicking areas, 6 acres of swimming beaches, and 10 miles of hiking trails. The delayed facilities, estimated to be constructed over a 35-year period (1980-2014), are those necessary to help keep pace with the projected demand. These include one boat launching area, 20 camping areas, 17 picnicking areas, and 54 acres of swimming beaches.

Planned fish and wildlife facilities include 2 reservoir access areas and 2 tailrace access areas.

The locations of the general recreation and fish and wildlife facilities were not set for this report and would be determined during the advanced planning stage following authorization of the project by the Congress. Construction of the Ofahoma Dam would require relocation of a portion of the Natchez Trace Parkway. Prior to construction or flooding of existing Parkway lands, the relocation of the Parkway would be completed and opened to traffic. Plans for use of the Parkway as an access to recreational facilities located on the reservoir would be developed cooperatively and in keeping with the National Park Service policies and standards.

Carthage Dam and Reservoir. This project would be operated primarily for flood control, with provisions for recreation and fish and wildlife enhancement. The dam would be located in the central part of Léake County at mile 13.2 on Lobutchka Creek. Runoff from 266 square miles, or about 81 percent of the Lobutchka Creek Basin, would be controlled by the project.

The plan for the Carthage project includes an earth dam, a high-level, fixed-crest emergency spillway, an intake structure, and an outlet conduit with a stilling basin. The 6,000-foot-long dam, with the top at elevation 424.0, would have a maximum height of 55.0 feet and a top width of 32 feet to accommodate a 20-foot access road for two-way traffic. The 400-foot-long, fixed-crest emergency spillway, with the crest at elevation 413.5, would be located in a ridge about 1,300 feet east of the left abutment. The outlet works would be located near the center of the dam.

The reservoir would provide 112,500 acre-feet of allocated flood control storage (7.9 inches of runoff) between elevations 384.2 and 402.3. This would contain floods up to and including the 100-year flood. Total storage to elevation 384.2 would be 20,000 acre-feet, of which 12,000 acre-feet would be for sediment accumulation below elevation 379.2 and 8,000 acre-feet between elevations 379.2 and 384.2 would be for recreation and fish and wildlife enhancement. The reservoir would

have an area of 3,000 acres at conservation pool elevation 384.2. Total acreage to be acquired would be 19,600 acres.

The initial general recreation facilities for the Carthage project, planned to help meet the expected needs of the Upper Subarea in 1980, include: 2 overlooks, 2 boat launching areas, 4 camping areas, 9 picnicking areas, 5 acres of swimming beaches, and 10 miles of hiking trails. The delayed facilities, estimated to be constructed over a 35-year period (1980-2014), are those necessary to help keep pace with the projected demand. These include one boat launching area, 17 camping areas, 14 picnicking areas, and 38 acres of swimming beaches.

Planned fish and wildlife facilities include 2 reservoir access areas and 2 tailrace access areas.

The locations of the general recreation and fish and wildlife facilities were not set for this report and would be determined during the advanced planning stage following authorization of the project by Congress.

Edinburg Dam and Reservoir. This proposed project would provide storage for flood control, water quality control, recreation and fish and wildlife enhancement. The dam would be located just east of the Neshoba-Leake County line at mile 390.4 on the Pearl River. This project would control the runoff from 827 square miles or 27 percent of the Pearl River Basin above Jackson.

The dam would consist of compacted earthfill, concrete nonoverflow sections and a gated concrete spillway. The earthfill portion of the dam would consist of two sections, one 6,000 feet long and the other 600 feet long, connecting the concrete non-overflow sections to high ground. They would have a maximum height of 54 feet and a top width of 32 feet at elevation 413.5. The concrete nonoverflow sections would extend from each end of the gated spillway for a distance of 102 feet. These structures would have a maximum height of 98.5 feet and a top width of 23.5 feet, sufficient width for a 20-foot-wide roadway. The 292-foot-long gated spillway would have a crest at elevation 375.0. Flow over the crest would be regulated by 6 tainter gates, 42 feet long and 28.5 feet high. Two 3-foot-wide by 5-foot-high sluices would be provided in the right abutment of the spillway.

The reservoir would provide 89,400 acre-feet of storage between elevations 368.0 and 377.0 for water quality control. The volume reserved for storage of flood waters from the top of the conservation pool, elevation 377.0, to elevation 396.9 would be 390,000 acre-feet (8.8 inches of runoff). The volume of sedimentation storage below elevation 368.0 would be 40,600 acre-feet. The reservoir would have an area of 12,000 acres at the average summer pool, elevation 376.0, and an area of 12,600 acres at the full conservation pool. A total of 54,500 acres of land would be acquired for the project.

The initial general recreation facilities for the Edinburg project, planned to help meet the expected needs of the Upper Subarea in 1980, include 3 overlooks, 5 boat launching areas, 17 camping areas, 36 picnicking areas, 8 acres of swimming beaches, and 33 miles of hiking trails. The delayed facilities estimated to be constructed over a 35-year period (1980-2014), are those necessary to help keep pace with the projected demand. These include 5 boat launching areas, 67 camping areas, 56 picnicking areas, and 185 acres of swimming beaches.

Planned fish and wildlife facilities include 2 reservoir access areas and 2 tailrace access areas.

The locations of the general recreation and fish and wildlife facilities were not set for this report and would be determined during the advanced planning stage following authorization of the project by the Congress.

Upstream watersheds. The 30 watersheds in which land treatment and structural measures were determined to be economically feasible for initiation of construction within the next 10 to 15 years are shown on Figure 7.

Land treatment measures were considered the basic element for each watershed project and the initial increment for project justification. Floodwater retarding structures were considered as the first choice of structural measures in retarding the flow of floodwaters and in reducing damages to agricultural and urban areas. The second choice, in combination with retarding structures, was channel development. The retarding structures would be compacted earth-fill dams having a fixed drawdown tube and an emergency spillway. Channel development consists of snagging and shaping, clearing and snagging, and channel enlargement or excavation.

The channel development program will be evaluated in greater depth and detail when preparing the authorizing document and, after authorization, during advanced planning. Special attention will be given to viable alternatives and to minimizing or mitigating the impact of this program on the basin's recreation and fish and wildlife resources.

Land treatment and critical land area stabilization measures would be required on approximately 1,001,000 acres and 6,100 miles of roadbank. There are 179 floodwater retarding structures and 1,202 miles of channel development planned for the 30 watersheds. In addition, 29 multiple-purpose structures for flood prevention and recreation are planned in 24 of the watersheds. These structures are the same as floodwater retarding structures; however, additional storage of water for recreation would be included in the permanent pool area. Recreation activities would consist mainly of fishing, boating, swimming, picnicking and camping. Pertinent data on structural development within the 30 watersheds are given in Table 15.

Table 15

Pertinent data on 30 upstream watersheds in the early-action program for the Pearl River Basin

Name	Watershed Number	Area (acres)	Floodwater retarding structures		Channel development (miles)	Multiple-purpose	
			Number	Normal pool (acres)		Number	Normal pool (acres)
McGee	1A-M	146,260	18	555	84	1	400
Topisaw	2A-M	167,448	8	535	45	1	600
Hobolochitto	2M	77,800	1	205	26	2	750
Boone	5A-M	132,072	7	429	49	1	250
Lower Little	8	87,756	4	334	27	1	600
Little	9	100,544	10	325	60	2	750
Fair River	16	98,952	5	267	40	1	750
Bahala	17	74,403	8	396	38	1	600
Dobbs	21	99,240	8	404	49	1	750
Campbell	22	90,900	6	469	31	1	300
Steen	26	73,710	6	292	35	1	500
Jackson	28	39,200	1	15	44	-	---
Hanging Moss	30	43,700	8	305	30	-	---
Pelahatchie	31	153,702	15	1,225	56	-	---
Fannegusha	33	70,680	6	395	20	-	---
Coffee Bogue	34	61,160	-	---	26	-	---
Shockaloo	36	94,960	4	586	36	2	770
Hontokalo	37	45,520	4	293	37	1	500
Conehatta	38	80,000	7	384	57	2	690
Sipsey	39	126,360	10	509	66	2	550
Kentawah	43	118,830	5	837	35	1	400
Sandtown	44	34,300	1	51	13	1	400
Bogue Chitto	45	88,600	4	847	42	1	200
Yockanookany	47	225,860	12	506	79	1	250
Carthage	48	34,600	2	57	16	1	150
Edinburg	50	48,360	4	214	26	1	160
Hurricane	51	51,560	2	391	24	1	300
Noxapater	52	51,280	4	435	26	-	---
Nanawaya	54	89,680	4	572	54	1	1,500
Tibby	56	99,640	5	331	31	1	250
Totals		2,707,077	179	12,164	1,202	29	12,370

Pearl River Boatway. The early-action program includes the snagging of 302 miles of the Pearl River from the end of the N.A.S.A. canal on the East Pearl River to the vicinity of Edinburg to provide a recreational boatway. The boatway would also include the development of 82 recreation areas with boat launching ramps along the Pearl River and principal tributaries. The recreational boatway route is shown on Figure 7.

Summary. Structural measures in the early-action program for the basin consist of: 3 multiple-purpose reservoirs; 179 floodwater retarding structures, 29 multiple-purpose structures, and 1,202 miles of channel development in 30 upstream watersheds; and a recreational boatway along the Pearl River from the N.A.S.A. canal on East Pearl River to the vicinity of Edinburg, including 82 recreation areas with boat launching ramps along the Pearl River and principal tributaries. The locations of the measures are shown on Figure 7. Accelerated land treatment measures in the 30 watersheds and stabilization of critical land areas for the entire basin are also a part of the early-action structural program.

EARLY ACTION PROGRAM — NONSTRUCTURAL MEASURES

Full development of the water and related land resources cannot be attained through structural measures alone. The plan accordingly contains recommendations relative to implementation of the following non-structural measures. Implementation of these measures will require the cooperation of Federal, State, and local interests and should begin at the earliest practicable date. Their application should be of a continuing nature.

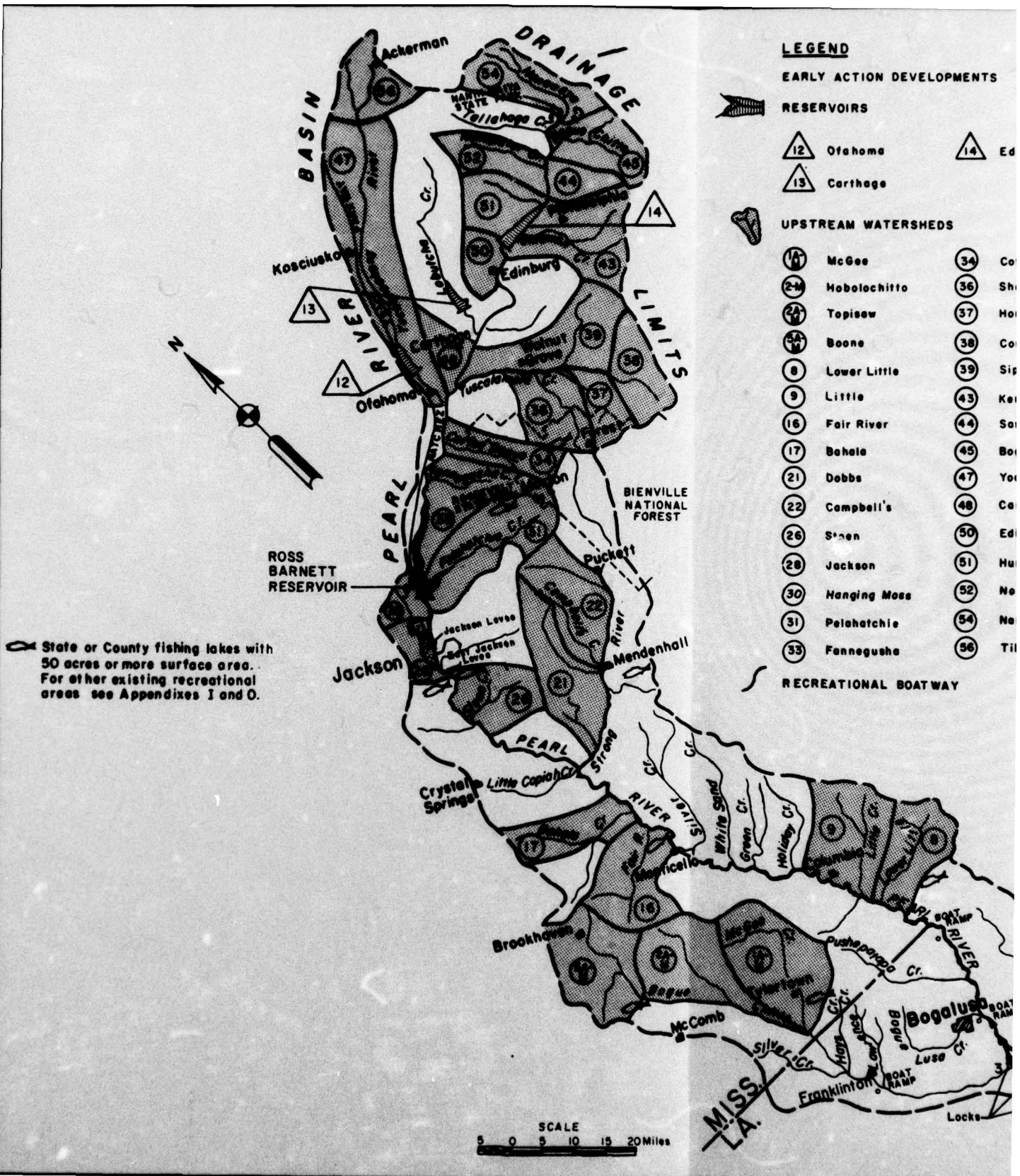
1. Flood plain management.

a. Development of more precise data relating to the flood hazard to the end that management programs for controlling and regulating the economic use of the flood plains may be more effectively developed and implemented.

b. Action at the State and local level, to fully utilize information relative to flood plain management in the development of plans to guide the utilization of flood plains to reduce flood losses and to preserve fish and wildlife habitat and public recreation sites. Such plans should be developed not only for areas in which flood damages cannot be eliminated or reduced economically by structural measures, but also for areas where structural measures for control of flood damage already exist or are proposed as features of the comprehensive plan.

c. Improvement of the flood forecast system by use of digital recording and other equipment to expand and accelerate the flood forecasting capabilities.

2. Agricultural land and forest management.
 - a. Expansion of current land management and conservation programs.
 - b. Expansion of State-Federal cooperative forestry programs.
3. Health programs.
 - a. Surveillance of water quality by Federal, State, and local agencies to assure safe and healthful utilization of water resources and expansion of the data collection network to support such surveillance.
 - b. Coordination of efforts of appropriate Federal agencies and States to insure the protection of the public's health by establishing basin-wide vector control programs, providing adequate sanitary facilities at recreation sites, and providing surveillance and enforcement programs to insure proper operation and maintenance of such facilities.
4. Water quality control.
 - a. Enforcement of State Water Quality Standards and of requirements set by the sessions of the Conference on Interstate Pollution of the Pearl River.
5. Outdoor recreation.
 - a. Action at the Federal, State and local level to insure that cognizance is given to the respective official State comprehensive outdoor recreation plan as the focal point for all recreation planning and development activities.
 - b. Expansion of existing recreation areas and facilities.
 - c. Special studies to determine acquisition of portions of High Bluff, Honey Island, Red Bluff, Pearl River Delta, and Jackson waterfront areas and designation of a scenic route paralleling the Pearl River for pleasure driving.
6. Fish and wildlife enhancement.
 - a. Protection of valuable stream and estuarine fish and wildlife habitat areas through pollution control and the operation of proposed reservoir projects to prevent adverse changes in stream discharges.
 - b. Acquisition or lease of 307,000 acres of wildlife habitat for addition to the present wildlife management program as contemplated



LEGEND

EARLY ACTION DEVELOPMENTS

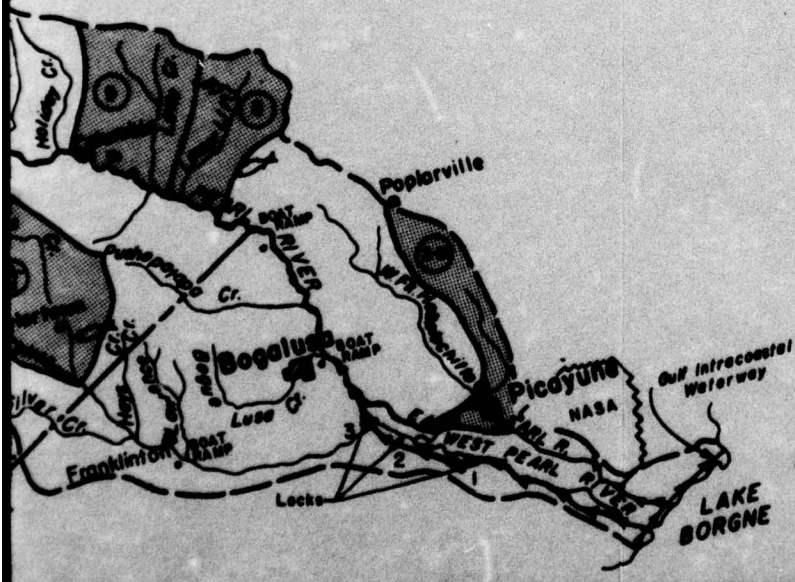
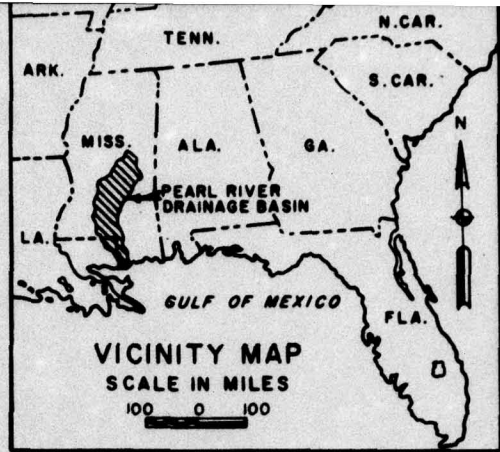
RESERVOIRS

- | | |
|---|---|
|  12 Ofahoma |  14 Edinburg |
|  13 Carthage | |

UPSTREAM WATERSHEDS

- | | |
|---|---|
|  1 McGee |  34 Coffee Bogue |
|  2 Hobeochitto |  36 Shekaloo |
|  3 Topisaw |  37 Montokelo |
|  4 Boone |  38 Conchotta |
|  5 Lower Little |  39 Sipsy |
|  6 Little |  43 Kentawah |
|  7 Fair River |  44 Sandtown |
|  8 Bahala |  45 Bogue Chitto |
|  9 Dobbs |  47 Yeckenookany |
|  10 Campbell's |  48 Carthage |
|  11 Steen |  50 Edinburg |
|  12 Jackson |  51 Hurricane |
|  13 Hanging Moss |  52 Nexopeter |
|  14 Patkatchie |  54 Nonaways |
|  15 Fanneguaha |  56 Tibby |

RECREATIONAL BOATWAY



**PEARL RIVER BASIN
EARLY-ACTION
STRUCTURAL PROGRAM**

by the Mississippi Game and Fish Commission, and acquisition of 18,000 acres of wildlife habitat for establishment of a wildlife management area as contemplated by the Louisiana Wild Life and Fisheries Commission, to provide additional public hunting opportunity.

c. Acceleration of wildlife management programs on existing State wildlife management areas and National forest lands as the need for public hunting increases and encouragement of a basinwide wildlife habitat improvement program by the public agencies and the private sector.

d. Compensation for project-induced wildlife losses by making available to the State game and fish agencies for wildlife management purposes as mitigation all suitable water development project lands not needed for primary project purposes.

e. Coordination of detailed project proposals with the Mississippi Game and Fish Commission, the Louisiana Wild Life and Fisheries Commission, and other involved agencies.

7. Preservation.

a. Preservation of areas of unique natural beauty, and/or historical, archeological, scientific, and ecological importance.

b. Preservation of segments, totaling about 200 miles, of the following streams as free-flowing:

- (1) East Hobolochitto Creek
- (2) West Hobolochitto Creek
- (3) Strong River
- (4) Bogue Chitto
- (5) McGee Creek
- (6) Lobutchka Creek
- (7) Yockanookany River
- (8) Lower Little Creek
- (9) Little Creek
- (10) Bahala Creek
- (11) Fair River

(12) Topisaw Creek

(13) Pushepatapa Creek

(14) Pearl River

8. Data collection.

a. Establishment of a systematic data collection program to provide a base for proper development of the groundwater resource.

b. Consideration in the detailed design of construction projects to the need for providing facilities for collecting hydrologic data.

9. Review of water resource programs and policies.

a. Action at the Federal, State and local level, as appropriate, to insure continuing review of water resource development laws, policies, and programs and their effect on the Pearl River Basin.

FRAMEWORK FOR FUTURE PLANNING

Projects and programs in the framework for future planning were studied in sufficient detail to determine only their general applicability in meeting foreseeable needs. Some of the framework projects present an alternative use of the free-flowing streams proposed in the early-action plan. These alternatives would have to be evaluated when the basin needs so indicate. This section presents the structural features of the framework plan. Nonstructural measures previously described are of a continuing nature and are equally pertinent to the early-action program and the framework for future planning.

Structural measures included in the framework for future planning consist of reservoirs, upstream watershed projects and improvements for barge navigation. Although these measures are not justified for inclusion in the early-action program, they are needed to help satisfy the remaining projected needs of the basin or are strongly supported by local interests. The measures are discussed in the following paragraphs.

Reservoirs. There are 9 reservoirs included in the framework for future planning. These reservoirs have potential storage for flood control, power, recreation, and fish and wildlife enhancement. In addition to being able to help satisfy the projected needs of the basin not being met by the early-action projects, these reservoirs have the capability of meeting potential needs beyond 2015, the limits of the study. As these needs occur, each potential project will have to be studied in more detail to determine its justification and to evaluate possible alternative solutions.

Pertinent data for the 9 reservoirs included in this category are given in Table 14. The location of each is shown on Figure 8.

Upstream watersheds. Sixteen upstream watersheds were determined to be potentially feasible projects and required to help satisfy future needs in the basin. These watersheds would have land treatment measures, single-purpose floodwater retarding structures, multiple-purpose structures, including floodwater detention, water supply and recreation, and channel developments. In addition, modification and the inclusion of recreation would be needed in 7 early-action watersheds and 3 watersheds now in operation. These watersheds are in the middle and upper portions of the basin where near future recreation needs are being adequately provided for by the early-action portion of the plan.

Pertinent data for the 16 watersheds included in this category are given in Table 14 and the location of each is shown on Figure 8. Data on the additions to the 7 watersheds in the early-action program and 3 watersheds now in operation are given in Table 16.

Table 16

Data on modification of early-action and PL-566 watershed projects proposed for recreation in framework for future planning
Pearl River Basin

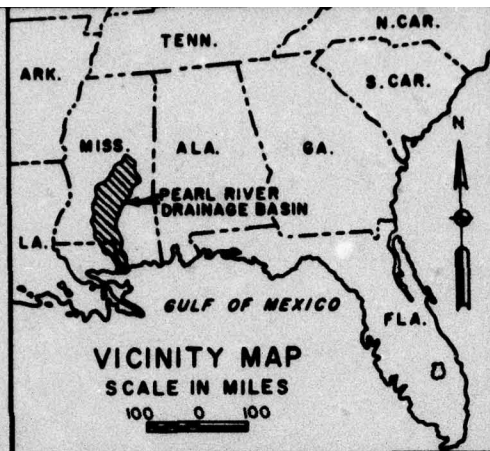
Watershed name	Watershed No.	No. additional multiple-purpose structures	Surface area (acres)
McGee Creek	1A-M	1	400
Topisaw	2A-M	1	600
Boone	5A-M	1	250
Dobbs Creek	21	1	400
Steen Creek	26	1	350
Richland Creek	29	1	400
Pelahatchie	31	1	400
Standing Pine	40	1	250
Tallahaga	53	1	300
Tibby Creek	56	1	400

Navigation improvements. The navigation improvements considered in this report would provide barge transportation from the mouth of the Pearl River to the City of Jackson, Mississippi. The project would consist of 11 low-head dams with locks. The locks would have lifts varying from 11 to 27 feet, with an average lift of 21.5 feet. The dams would be rolled earth-fill structures with riprapped faces and concrete-gated spillways. Dredging in portions of the existing river bed and shallow pool areas would complete the waterway and assure continuous navigable depths. This project was determined to be uneconomical for

inclusion in the early-action program. However, it has been included in the framework for future planning and has the strong support of local interests.

Summary. Structural measures included in the framework for future planning include 9 reservoirs, works of improvement in 16 upstream watersheds, additional works in 10 watersheds now in operation or in the early-action program, and improvements for barge navigation. The locations of the reservoirs, upstream watersheds and navigation improvements are shown on Figure 8.

As stated previously, these measures would help meet projected needs in the basin. However, further detailed study is needed to adequately define those projects that should be undertaken, evaluate possible alternatives, and determine the most economical means of satisfying the basin needs. Such study should be undertaken when periodic review of the comprehensive plan indicates the need.



LEGEND

FRAMEWORK FOR FUTURE PLANNING

RESERVOIRS

- | | | | | | |
|---|----|-------------------|---|-----|------------------------|
| ▲ | 2 | Pushepatopa Creek | ▲ | 17B | Bogue Chitto |
| | 6 | Strong River | ▲ | 19 | West Hobeochitto Creek |
| | 7 | Strong River | ▲ | 25 | Lawrence Creek |
| | 8 | Strong River | ▲ | 26 | Silver Creek |
| | 15 | Hayes Creek | | | |

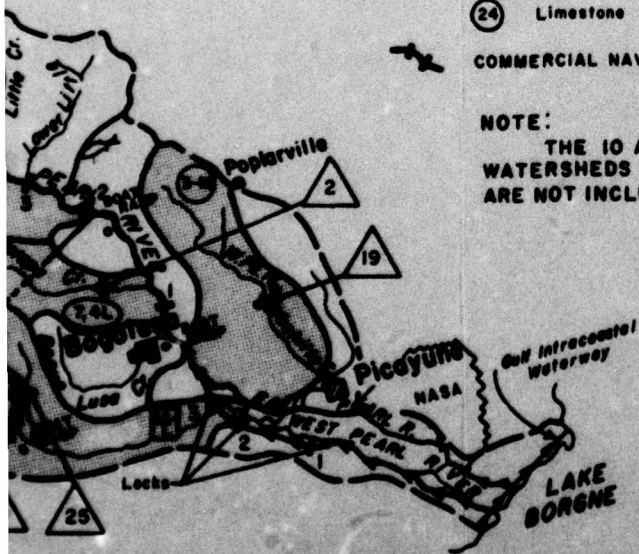
UPSTREAM WATERSHEDS (ADDITIONAL)

- | | | | | | |
|---|----|-----------------------|---|-------|----------------------------|
| ● | 54 | West Fork Hobeochitto | ● | 25 | Rhodes |
| ● | 14 | Clobber | ● | 27 | Big Creek (South Jackson) |
| ● | 6 | Ten Mile | ● | 38 | Calucta |
| ● | 10 | Tilton-Halls | ● | 49 | Lower Lubutcha |
| ● | 15 | Pretty | ● | 58 | Upper Lubutcha |
| ● | 20 | Riles | ■ | 1A | Lawrence |
| ● | 23 | Caney | ● | 5A-ML | Mt. Herman (Little Silver) |
| ● | 24 | Limestone | ● | 7,4L | Pushepatopa |

COMMERCIAL NAVIGATION

NOTE:

THE 10 APPROVED OR EARLY-ACTION WATERSHEDS TO BE MODIFIED FOR RECREATION ARE NOT INCLUDED ON THIS FIGURE.



**PEARL RIVER BASIN
STRUCTURAL PORTION OF
FRAMEWORK FOR
FUTURE PLANNING**

SECTION 7 - ECONOMIC EVALUATION OF THE EARLY-ACTION PROGRAM

GENERAL

The evaluation and justification of projects and programs included in the early-action program have been in accordance with authority, policy, and procedures of the agency that would be responsible for implementing the applicable features of the plan. Monetary evaluations of tangible costs and benefits have been made for main stem and major tributary reservoirs, upstream watershed projects, the pleasure boatway, stream preservation, and the expansion of existing recreation areas. However, intangibles were given full consideration in formulating these projects. The nonstructural measures, such as preservation of areas of unique natural beauty, and/or historical, archeological, scientific, and ecological importance and other specific recreation and fish and wildlife proposals, were assumed to have benefits at least equal to their costs. The primary responsibility for development of these measures, except for the Fish and Wildlife Service and the United States Forest Service, is with the States, municipalities, and private sector. They are responsible for the final decisions concerning economic justification. Economic evaluation of the land treatment program is not required by existing legislation.

COSTS

Project costs are the value of labor, goods, and services that would be required to implement, operate, and maintain a project. Market prices are assumed to be an adequate measure of the value of the labor, goods, and services.

Cost estimates for reservoirs on the main stem and major tributaries were developed by separating each major item involved in the construction of the dam and its appurtenances, computing the quantities for each item, and estimating the unit cost of items applicable for each project. Contingency factors were used to reflect the degree of difficulty to be encountered in construction and the possibility of unexpected costs due to foundation, excavation, or material deficiencies not revealed by the survey scope investigations. All costs were based on the 1968 price level. Real estate costs were estimated in accordance with criteria in "Joint Policies of the Department of the Interior and of the Army Relative to Reservoir Project Lands" dated 22 February 1962. Recreation costs were based on Corps of Engineers practice and experience in the Southeastern States. Allowances were made for engineering and design, and supervision and administration. In addition, the costs include allowances for beautification of project land and facilities, for adequate control of vector problems, and for surveillance of water quality. Annual costs include amortization of investment costs, annual operation and maintenance costs, and the annual equivalent cost of major replacements. Interest and amortization were computed using an interest rate of 4.875 percent over a useful economic life of 100 years.

Cost estimates for upstream watershed projects were developed by the Soil Conservation Service of the Department of Agriculture in accordance with their Departmental procedures for initial planning of watershed developments. Detailed studies were made of sample watersheds and the data expanded to similar watersheds on which no detailed studies were made. For selected representative structures actually designed, cost estimates were based upon bid item prices furnished by the Mississippi State Conservation Engineer. The cost estimates for the non-designed structures were based upon data from developed cost curves of various resources areas, using the cost estimates of the selected representative structures as guides to proper curve selection. Amortization of investment cost was computed using an interest rate of 4.875 percent over a useful economic life of 100 years. While more detailed studies will be needed to accurately estimate the cost of the individual headwater reservoirs, their aggregate costs are sufficiently firm to include them in groups as part of any plan, and to base the design and costs of major structures generally on the assumption of the completion of the upstream watershed projects in their scheduled time.

The cost estimate for the pleasure boatway along the Pearl River was developed by the Pearl River Basin Development District by separating each major item involved in the construction of the boatway, computing the quantities for each item, and estimating the unit cost of each item. Unit costs were based upon similar work recently completed in the basin. Annual costs include amortization of the investment cost, annual operation and maintenance costs, and the annual equivalent cost of major replacements. Interest and amortization were computed using an interest rate of 4.875 percent over a useful economic life of 100 years.

BENEFITS

General. An economic evaluation of benefits was made during project formulation for each reservoir project and upstream watershed considered. Tangible project benefits were evaluated, where appropriate, for storage of water for flood control, water quality control, recreation, and fish and wildlife. All benefits were determined in accordance with their expected rate of accrual. These benefits were discounted to present worth at the assumed time of project completion and distributed in an equivalent annual series using a 4.875 percent interest rate over a 100-year period of economic analysis. In addition to the above benefits, sediment reduction and area redevelopment benefits would accrue to the proposed reservoirs in the plan. However, these benefits were not used in project justification.

An economic evaluation also was made of the considered pleasure boatway. Benefits were evaluated for recreation, fish and wildlife, and area redevelopment. All benefits were determined in accordance with their expected rate of accrual and discounted to present worth at the assumed time of project completion. They were then distributed

in an equivalent annual series using a 4.875 percent interest rate over a 100-year period of economic analysis.

Flood control. Flood control benefits would result from reduction in losses and from change in land use. Reduction benefits which accrue to both urban and rural areas, consist of the amount by which damages under natural conditions would be reduced by installation of the proposed flood control measures. Change-in-land-use benefits would accrue as the result of more intensive use of the cropland presently in cultivation and from more intensive land-use conversion. These changes would occur in the present economy as a consequence of the flood plain lands being wholly or partially protected from flooding. Flood control benefits also would accrue to future flood plain development in an expanding economy. These benefits would result from protection of increased agricultural production in the rural flood plain and from protection of prudent future growth and development in the urban flood plain. No benefits were attributed to enhancement of the urban flood plain lands.

Flood control benefits were assigned to the reservoirs and upstream watershed projects on an incremental basis; i.e., the flood control benefits produced by adding a project to the plan were assigned to that project.

Adjusted normalized prices were used in estimating the flood control benefits due to reduced crop damages. All other benefit categories were evaluated using average 1968 prices.

Water quality control. Water quality control benefits for Edinburg Dam and Reservoir were determined by the Federal Water Quality Administration in close cooperation with the Corps of Engineers. These benefits were computed on the basis of the cost of obtaining the desired water quality by the least costly alternative that could be developed in the absence of the project for which benefits were being evaluated. Revision of policy procedures for evaluation of water quality control benefits is presently being considered by all concerned Federal agencies under the Water Resources Council. Since the problem has not been resolved and since the benefits would be widespread and extremely difficult to assign to the end user, it was agreed at the field level that the benefits would continue to be determined by the least-costly alternative method.

General recreation. General recreation benefits were based on the estimated annual use in recreation days expected at each project and an estimated value per recreation day. This value was determined on the basis of the project location with respect to population centers, location of alternative recreation areas, the quality of facilities to be provided at each project, and other factors.

Fish and wildlife. Fishing benefits were based on estimates of fisherman-day utilization under "with" and "without" project conditions.

An estimated value per man-day was assigned each area to determine the monetary value of the benefit. Incidental waterfowl benefits will accrue to the projects from increased waterfowl use and associated hunting opportunities. Benefits for this purpose were determined by assigning a monetary unit value of \$3.00 per man-day. Mitigation of the wildlife losses expected to occur as a result of loss of wildlife habitat was based on replacement of the hunter utilization of these resources by the use of lands not needed for primary project purposes as wildlife management areas.

SUMMARY OF ECONOMIC DATA

Costs, benefits and benefit-to-cost ratios for structural measures. The total first cost of the structural measures in the early-action program would be \$186,687,000, of which \$93,020,000 would be for multiple-purpose reservoirs; \$87,259,000 for upstream watersheds, including \$30,617,000 for land treatment and critical land area stabilization; and \$6,408,000 for the pleasure boatway. Excluding land treatment and critical land area stabilization, the estimated total average annual charges are \$10,172,000 and the total average annual benefits \$18,995,000, giving an overall benefit-to-cost ratio of 1.9. A summary of the first costs, annual charges, benefits and benefit-to-cost ratios of the various elements of the early-action program, excluding land treatment and critical land area stabilization, is given in Table 17. Area redevelopment benefits of \$1,363,000 are not included in the above figures or in the table. These benefits would increase the overall benefit-to-cost ratio to 2.0.

Table 17

Summary of first costs, annual charges, benefits, and benefit-to-cost ratios for structural portion of the early-action program for the Pearl River Basin

Item	Reservoirs			Upstream watershed projects ¹	Pearl River boatway	Total
	Ofahoma	Carthage	Edinburg			
PROJECT FIRST COSTS (\$1,000)						
Initial	33,100	15,500	30,700	56,642	6,408	142,350
Delayed	2,680	2,340	8,700	---	---	13,720
Total	35,780	17,840	39,400	56,642	6,408	156,070
PROJECT ANNUAL CHARGES (\$1,000)						
Initial	1,928	973	1,905	3,818	815	9,439
Delayed	143	120	470	---	---	733
Total	2,071	1,093	2,375	3,818	815	10,172
PROJECT ANNUAL BENEFITS (\$1,000)						
Initial:						
Flood control	1,697	858	1,962	2,174	---	6,691
Water quality control	---	---	1,146	---	---	1,146
Recreation (including fish & wildlife enhancement)	438	356	1,279	2,362	2,005	6,440
Other (secondary)	---	---	---	614	---	614
Subtotal	2,135	1,214	4,387	5,150	2,005	14,891
Delayed:						
Recreation	798	646	2,660	---	---	4,104
Total	2,933	1,860	7,047	5,150	2,005	18,995
BENEFIT-TO-COST RATIO (Total)	1.4	1.7	3.0	1.3	2.5	1.9

¹ Land treatment costs and benefits are not included.

Costs of other programs and studies. As stated previously, the primary responsibility for the nonstructural measures is with the States, municipalities, and the private sector. The costs of the nonstructural measures for which costs were estimated are given in the following paragraphs.

The costs of the stream preservation program with associated access and facilities to provide opportunity for 875,000 recreation days and the expansion of existing recreation areas to provide opportunity for an additional 145,000 recreation days are given in Table 18.

Table 18

Summary of first costs, annual charges, benefits and benefit-to-cost ratios for portions of the early-action nonstructural program

Item	Stream preservation	Expansion of existing areas	Total
Project first cost (\$1,000)	853	580	1,433
Project annual charges (\$1,000)	149	58	207
Project annual benefits (\$1,000)	576	145	721
Benefit-to-cost ratio	3.9	2.5	3.5

The total first cost to provide secondary treatment or its equivalent for the municipal and industrial wastes discharged into the basin's streams is estimated to be approximately \$21,000,000.

The acquisition of 18,000 acres for establishment of a wildlife management area as contemplated by the Louisiana Wild Life and Fisheries Commission will cost approximately \$3,500,000. It is anticipated that the 307,000 acres to be added to the Mississippi wildlife management areas will be acquired by lease which has in the past been obtained from the land owners for no charge.

The special recreation resource studies of High Bluff, Honey Island, Red Bluff, Delta Area, Jackson waterfront, and the Pearl River Road would cost about \$185,000.

SECTION 8 - EFFECTS OF THE EARLY-ACTION PROGRAM

GENERAL

The plan for the development of the water and related land resources in the Pearl River Basin presented in Section 6 contains an early-action program of structural and nonstructural measures to meet immediate and near future needs of the basin and a long-range program to serve as a guide for future development. The following paragraphs present quantitative evaluations of the influence which would be exerted by the early-action program. A similar detailed appraisal of the effects of the long-range program is not presented since it is essentially a flexible framework for future study.

FLOOD CONTROL

Development of the multiple-purpose reservoirs and upstream watershed projects contained in the early-action program would provide varying degrees of flood protection to urban and rural areas in the basin. Overall, the structural measures of the early-action program would reduce damages in the basin by about 49 percent as shown in Table 19. The urban area of Jackson outside the existing levee project would be provided an even higher degree of flood protection, with flood stages being reduced as much as six feet.

Table 19

Damage reduction - Early-action program
Pearl River Basin

Program	Average annual damage		Percent reduction
	Without program	With program	
PEARL RIVER AND MAJOR TRIBUTARIES			
Basinwide	\$4,790,000	\$2,273,000	52.5
Downstream of proposed reservoir projects	3,668,400	1,151,600	68.6
UPSTREAM WATERSHEDS			
Basinwide	2,740,900 ¹	1,535,200 ²	44.0
30 early-action watersheds	1,838,800	632,600	65.6
TOTAL			
Basinwide	7,530,900 ¹	3,808,200 ²	49.4
Downstream of proposed reservoirs and in 30 early-action watersheds	5,507,200	1,784,200	67.6

¹ Does not include damage reduction of \$973,100 to be obtained from 12 PL-566 watershed projects approved for operation.

² Includes damage remaining of \$289,600 in 12 PL-566 watersheds approved for operation.

It should be recognized that not all flood damages are preventable by structural measures. All too frequently, construction of flood control works has served to spur unwise use of flood plains and thus contributed to a growing toll. More consideration of the contribution which can be made by nonstructural measures such as proper regulation of developments in flood-prone areas, and floodproofing, is essential. This is not to say that there is an "either/or" relationship between structural and nonstructural measures in the reduction of flood damages. In fact, the contributions of both will be maximized by intelligently combining the two.

AGRICULTURAL LAND AND WATER MANAGEMENT

The implementation of structural and land treatment measures as proposed in the early-action program would include using the land within its capabilities and treating it according to its needs for protection and improvement. This would (1) reduce floodwater and sediment damages in the basin, (2) reduce soil erosion, (3) improve soil fertility and increase the productivity of crop and pasture lands, woodland, and wildlife habitat, (4) increase agricultural income through more efficient land use and management, and (5) permit the multiple use of waters. The stability of family farms and the economic conditions of low income farm families would be improved by more efficient operators.

LAND TREATMENT AND WATERSHED PROTECTION

Approximately 1,143,400 acres of open land are slightly to very severely eroded. Of this amount sheet erosion is moderately to severely active on 595,300 acres of cropland and slightly to moderately active on 548,100 acres of pasture and idle land. There are about 32,200 acres of forest land and 183,800 acres of open land on which erosion is considered critical.

The primary effects of watershed protection measures to the above land would be to reduce erosion, retard surface runoff and reduce peak flows from small areas, and improve the soil profile. Reducing erosion keeps the soil on site, thus maintaining depth and more productiveness of soil profiles. This prevents sediment from entering waterways and improves drainage conditions. It also helps keep streams clear which makes them better habitat for fish and more attractive for recreation. Deep soils contain more humus and are easier tilled than shallow soils. They also retard surface runoff and thus reduce peak flows from small areas, especially for small storms occurring when the soil is unsaturated.

Watershed protection measures on forest lands also benefit recreation by providing improved ground cover and forests for more aesthetically desirable sites and terrain. These measures improve wildlife habitat by providing increases in both food and cover.

WATER SUPPLY

With proper utilization of groundwater, return flows, and pollution control measures, sufficient water resources will be available to meet all foreseeable municipal and industrial water supply needs of the Pearl River Basin to the year 2015.

Water for agricultural and rural domestic needs is not a problem insofar as supply is concerned since adequate water is available from wells, springs and streams in all parts of the basin.

WATER QUALITY CONTROL

Generally, the present quality of water in the streams in the basin is satisfactory for most purposes with the exception of the Pearl River main stem below Jackson, Mississippi, and Bogalusa, Louisiana; the East Pearl River below Picayune, Mississippi; and the Bogue Chitto below Brookhaven, Mississippi. The study showed that adequate treatment and control of wastes discharged into the streams would eliminate the problem in every area except the Pearl River below Jackson. Even with secondary treatment of wastes discharged into the stream in this area, augmentation of low flow would be required to maintain the desired water quality.

Storage would be provided in the proposed Edinburg project in the early-action program to provide stream flow regulation for water quality control in the Pearl River at Jackson. The project would assure adequate flows in the Pearl River to properly assimilate treated waste discharges from the city and surrounding industrial areas. Higher dissolved oxygen levels would be maintained which are essential for the propagation of fish and wildlife. By providing reservoir releases during summer months when water quality needs are most severe, sufficient flow of acceptable quality would be maintained in the stream to permit higher species of game fish to live in the area and to protect and enhance use of the stream for sport fishing. Assured water quality would provide favorable conditions for general recreation use of the streams, particularly by those living in or near Jackson. The riparian property owners and all other users of the stream would enjoy improved aesthetics, clean surface waters, and a satisfactory public health water environment.

GENERAL RECREATION

The varied topography, the existing impoundments and many miles of free-flowing streams in the basin are favorable for nearly all types of recreational activities. However, only a relatively small part of the full recreational potential of the basin has been developed and a critical shortage of facilities exists in every class of water-dependent and water-enhanced outdoor recreation activity.

Studies revealed a need for privately and publicly developed facilities to provide additional opportunity in the water-dependent

or water-enhanced activities - boating, camping, picnicking and swimming - for about 9.1 million recreation days in 1980 and about 37.1 million recreation days in 2015. This need should be satisfied within the overall framework and schedules shown in the respective comprehensive statewide outdoor recreation plans of Mississippi and Louisiana. It is not practicable to meet the entire need through development of water and related land resources alone. However, as part of the total recreational effort, development of the water and related land resources of the basin should satisfy as much of the need as appropriate and practicable.

Development of the early-action program would provide an additional water-surface area of approximately 31,000 acres to meet some of the present and future recreational needs of the basin. Initial development of the early-action projects would support an annual visitation of approximately 5.7 million. Ultimate development of the early-action projects would support an annual visitation of about 26.7 million. The early-action program would meet about 63 percent of the unsatisfied demand for the four major water-dependent or water-enhanced recreation activities of boating, camping, picnicking and swimming estimated in the basin for the year 1980.

The need for recreation facilities in the years after 1980 is expected to increase as the population and per capita income increases. A portion of this increasing demand may be satisfied by the expansion of existing facilities and the facilities in the early-action program, and by development of projects in the framework for future planning. The increasing demand for camping and picnicking can be met in part by providing camping and picnicking sites in areas where access to streams is afforded, and through expanded facilities of the Louisiana and Mississippi State Park Systems, and local county and city parks. In addition the private sector is expected to increase its share of the recreational demand.

FISH AND WILDLIFE

Studies show that there are now, and will be in the target years, sufficient quantities of salt-water fish available to satisfy the demand for sport salt-water fishing. Basinwide, this is essentially the same for fresh-water fishing to 1980. With the exception of the Middle Pearl subarea, capacity levels are in excess of the anticipated demand for 1980. However, by 2015, the anticipated deficit in the basin is expected to be 856,500 man-days per year. Approximately 735,600 man-days, or 86 percent, of this demand would be satisfied by projects in the early-action program. Resources included in the framework for future planning could provide additional fishery habitat in excess of the anticipated demand. However, single-purpose projects, such as State owned and managed fishing lakes and access to streams should be considered either as alternative solutions, or possibly in combination with several of the multiple-purpose reservoirs, to provide diversified sport fishing opportunities.

Studies of wildlife resources show that capacity basinwide is presently adequate to satisfy the demand for hunting for all periods of the study. However, the Upper Pearl subarea, because of a heavy increase in human population and associated hunter demand, will bring about a pronounced uneven distribution of basin demand to capacity. To satisfy hunter demand in this subarea, especially after 1980, it will be necessary and possible to shift part of this pressure to the other subareas. Increased demand in the Middle and Lower subareas can be satisfied in the respective subareas.

There would be a loss of high-value upland game habitat and associated hunting opportunity with construction of reservoirs and stream development. Utilization of reservoir project lands for wildlife management purposes by appropriate State game and fish agencies would compensate for project induced losses and would provide diversified public hunting. Provisions for mitigating wildlife habitat losses in upstream watershed structures and channel development features would also be important in reducing such losses.

Protection and preservation of unique and scenic environmental areas associated with the basin streams, National Forest land, State wildlife management areas, and developments included in the early-action program, would provide additional opportunities for bird-watching and wildlife photography and other varied recreational experiences throughout the basin. Conditions for protecting rare species and other unusual forms of wildlife would be greatly enhanced, and the continued importance of the intangible values would be safeguarded in future years.

COMMERCIAL FISHING

The 1965 demand for freshwater commercial fishery products is projected to increase 43.4 percent by 1980 and another 41 percent by 2015. The low flow augmentation for water quality improvement would materially increase the freshwater commercial fishery resources of the basin. However, to fully satisfy the projected needs significant growth in fish-farming operations would be required to supplement production from natural waters. Although the estuary habitat would be enhanced by the improvement in water quality, the effect of the plan on marine fisheries would be minimal. The major expansion of the marine fishery resources must come from improved fishing techniques and increased markets for species presently under-utilized.

NAVIGATION

During the course of this study, investigations were made to determine the justification of providing a suitable channel for modern barge traffic from the Gulf Intracoastal Waterway to Jackson on the Pearl River. It was determined that navigation at the present time or in the near future is not warranted. However, the navigation project

has been included in the framework for future planning and has the strong support of local interests.

HYDROELECTRIC POWER

Since it would not be economically feasible, there is no provision for hydroelectric power in the early-action program. However, the development of hydroelectric power should be considered in any reservoir projects in future planning.

HEALTH ASPECTS

The impact of the early-action program insofar as health aspects are concerned would be favorable since appropriate attention would be given to the development of features required to safeguard health and well-being when detailed planning of these projects is undertaken. Important factors which must be considered include the provision of adequate sanitary facilities and provision of vector control measures both in the construction and operation of the projects. Specific measures responsive to the above include the provision of potable water supplies; means for disposal of wastes; preimpoundment clearing in reservoirs; water-level variations in reservoirs to provide vegetation and mosquito control; borrow pit drainage; drainage of seep areas; rodent-proofed buildings; removal of brush and weeds along paths, trails, and roadways; and supplemental use of insecticides and rodenticides where adequate vector control is not obtained through source reductions.

ENVIRONMENTAL PRESERVATION AND ENHANCEMENT

The measures in the early-action program would provide varying degrees of flood protection to urban and rural areas in the basin so as to reduce the threat to life and property, thereby providing a greater economic efficiency in land use and increasing the disposable income of the landowners. This increase in disposable income will result in a higher standard of living and should improve social, cultural and aesthetic values. In addition, the reduction of flooding would ameliorate the associated vector, sanitation, and other health problems.

The land treatment measures proposed for approximately one million acres of land and accompanying land use changes would result in decreased erosion of and runoff from upland areas, reduced stream and reservoir pollution from sediment, improved upland wildlife habitat, improved scenic attractiveness, and increased income of low-income landowners allowing them to participate more fully in improvement of rural aesthetic values.

The augmentation of stream flows from storage in the proposed Edinburg Reservoir would increase the assimilative capacity of the Pearl River below the project and thereby improve the water quality of approximately 80 miles of the Pearl main stream from about 10 miles above Carthage to 40 miles below Jackson. In addition, the

proposed projects would reduce downstream sediments and act as sediment traps for the basin's streams and for the Ross Barnett Reservoir. Improved water quality would provide more favorable conditions for fish and wildlife enhancement, recreational use, and would result in improved aesthetics, cleaner waters, and improved public health conditions. The early-action program would provide an additional 43,000 acres of water surface, of which approximately 31,000 acres would be developed for recreational purposes. The remaining approximately 12,000 acres would be in permanent sediment storage pools in upstream floodwater retarding structures. Project-acquired lands at reservoir sites, not needed for primary project purposes, would provide upland game and waterfowl management areas for lease to State game and fish agencies and use by the general public. These same waters and lands would provide the setting for bird watching, nature study, and associated activities. Enhancement and preservation of the scenic qualities of the streams and historical and archeological sites will be carefully pursued.

The preservation measures for all or portions of 14 free-flowing streams, totaling 200 miles throughout the basin, would protect areas for the enjoyment of nature by both the present and future inhabitants of the basin. Protection and preservation of unique and scenic environmental areas associated with the basin streams, National Forest lands, and State wildlife management areas along with other nonstructural measures included in the early-action program would perpetuate opportunities for nature study throughout the basin. Such measures would also enhance conditions for protecting endangered species and unusual habitats, thereby safeguarding these intangible values for the enjoyment of future generations.

Areas of natural environment will be adversely affected in clearing, drainage, and other conversion operations of land for agricultural, commercial, and other uses, including installation of structural measures. Reduction in flooding will result in clearing of bottomland forest, reduced hardwood timber production, and the loss of associated wildlife. Stream fishing will also be reduced since the species are dependent to some extent on seasonal overflow. It is also expected that with more intensive use of the flood plains, wildlife and fishery population in these areas will be reduced.

Other adverse effects include the loss of free-flowing streams, high-value wildlife habitat in hardwood bottomlands, and productive forest, crop, and pasture lands at impoundment sites. Channel development to increase the level of flood protection and clearing, snagging, and other channel works to accommodate shallow-draft recreational craft may also result in adverse environmental effects. Those effects could, however, be minimized by selecting a method of construction which would be most conducive to the maintenance of varied natural characteristics of specific reaches and by supplementary measures such as re-vegetation of streambanks and appropriate landscape plantings.