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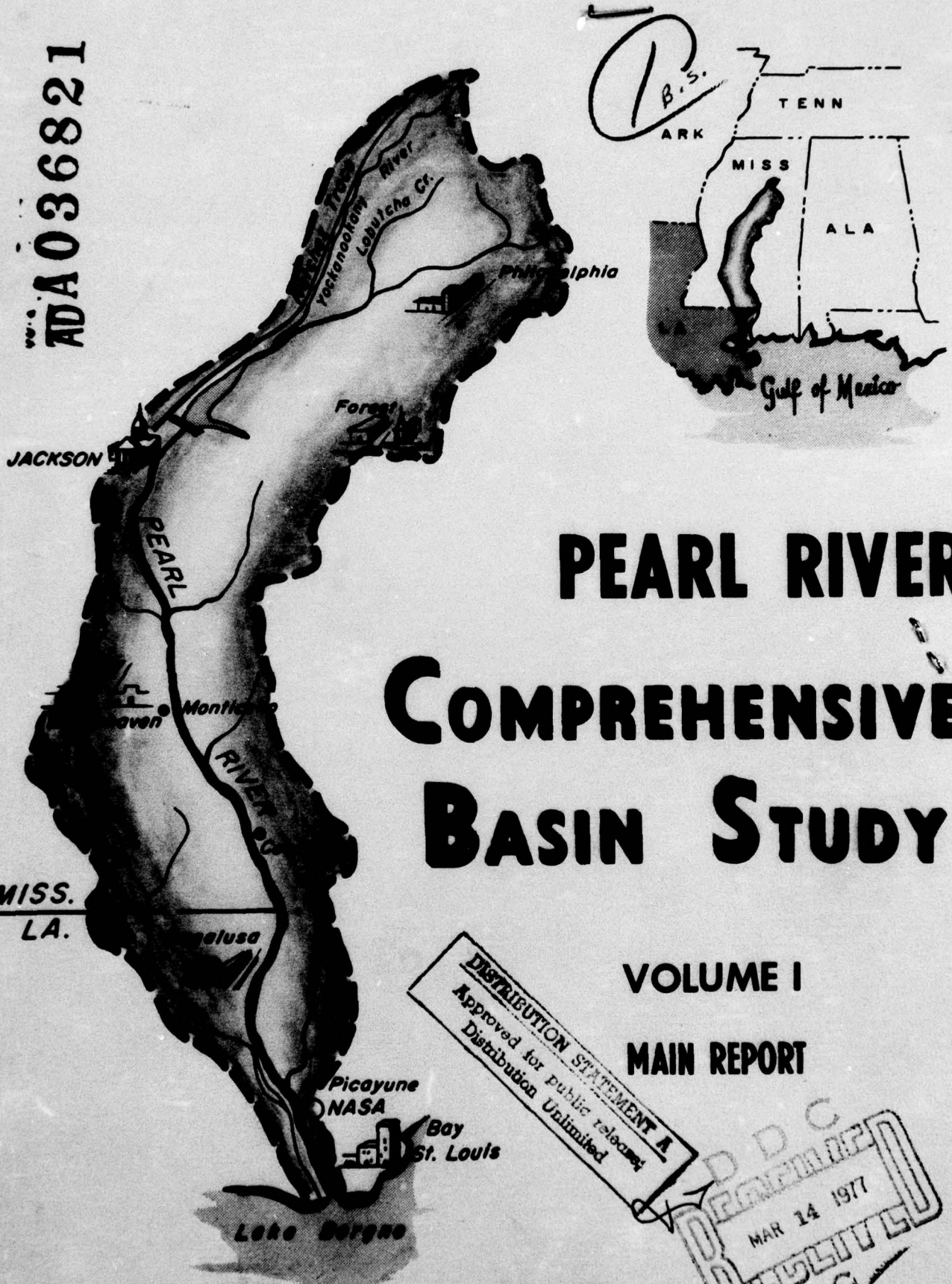

PEARL RIVER COMPREHENSIVE BASIN STUDY

VOLUME I

MAIN REPORT

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DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2288
MOBILE, ALABAMA 36601

IN REPLY REFER TO

SAMEN-EB

6 November 1970

SUBJECT: Pearl River Comprehensive Basin Study Report

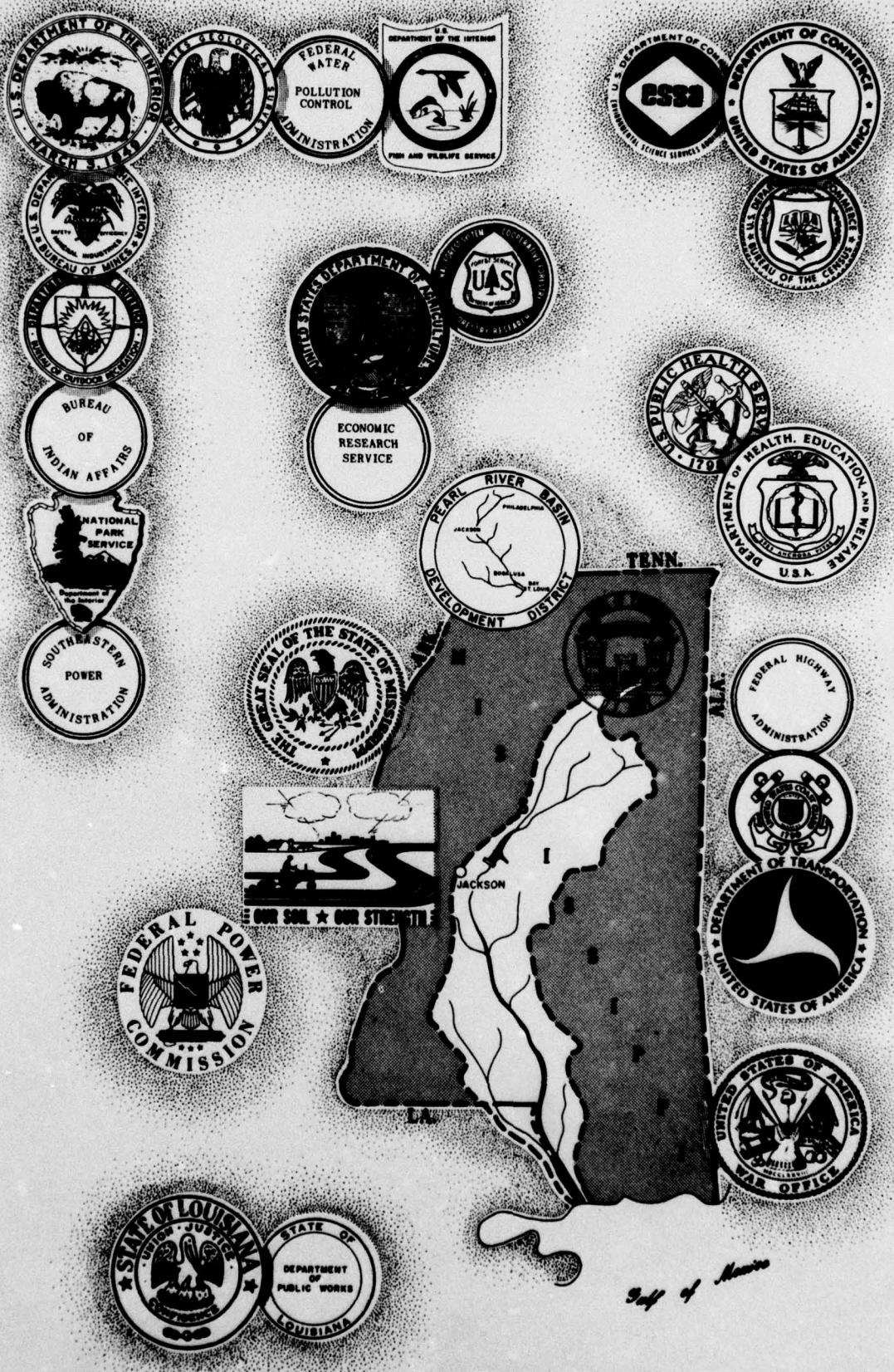
Division Engineer
U. S. Army Engineer Div., North Central
536 South Clark Street
Chicago, Illinois 60605

In accordance with instructions contained in EC 1120-2-52, dated 3 April 1970, there are inclosed for your information one copy each of the Main Report and Plan Formulation Appendix of the Pearl River Comprehensive Basin Study Report.

FOR THE DISTRICT ENGINEER:

J. J. DANAHER
Chief, Engineering Division

Incls
Main Report
Plan Formulation App.


U.S. DEPARTMENT OF THE INTERIOR
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U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ESSA
DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA
BUREAU OF MINES
BUREAU OF THE CENSUS
BUREAU OF OUTDOOR RECREATION
BUREAU OF INDIAN AFFAIRS
UNITED STATES DEPARTMENT OF AGRICULTURE
ECONOMIC RESEARCH SERVICE
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DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
U.S.A.
NATIONAL PARK SERVICE
SOUTHEASTERN POWER ADMINISTRATION
PEARL RIVER BASIN DEVELOPMENT DISTRICT
PHILADELPHIA
JACKSON
ST. LOUIS
TENN.
ALA.
THE GREAT SEAL OF THE STATE OF MISSISSIPPI
FEDERAL HIGHWAY ADMINISTRATION
OUR SOIL ★ OUR STRENGTH
JACKSON
DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA
FEDERAL POWER COMMISSION
LA.
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WAR OFFICE
STATE OF LOUISIANA
UNION · JUSTICE
CONFIDENCE
STATE OF
DEPARTMENT OF PUBLIC WORKS
LOUISIANA
Gulf of Mexico

PEARL RIVER COMPREHENSIVE BASIN STUDY

VOLUME INDEX

(6)

PEARL RIVER
COMPREHENSIVE BASIN STUDY.
Volume I.

MAIN REPORT.

Prepared for the Coordinating Committee by
the Mobile District, Corps of Engineers,
Department of the Army

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F O R E W O R D

This report of the Coordinating Committee for the Pearl River Comprehensive Basin Study presents a proposed plan for the development and management of the water and related land resources of the Pearl River Basin and is subject to review by the interested Federal agencies, by the Governors of the affected States, and by the Water Resources Council prior to its transmittal to the Congress for its consideration in implementing Federal participation.

S Y L L A B U S

This report presents the consolidated results of the comprehensive study of the water and related land resources of the Pearl River Basin. The basic objective was the formulation of a plan of development to provide the best use, or combination of uses, of these resources to meet the foreseeable short- and long-term needs. Requirements are based on a projection of the basin economy to the years 1980 and 2015.

The principal needs are for flood protection, water quality control, recreation, fish and wildlife enhancement and agricultural land and water management. The most practical means to provide for these and other needs of the basin is through a coordinated comprehensive plan of structural and nonstructural measures.

Structural measures are divided into two categories:

- The early-action program, consisting of those projects found necessary to meet immediate and near future needs of the basin and found to be economically feasible for construction within the next 10 to 15 years.

- The framework for future planning, consisting of those projects that are not economically feasible for construction in the next 10 to 15 years but which could help meet future needs of the basin and are potentially feasible for development or are strongly supported by local interests.

Nonstructural measures for early and continuing action include:

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 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 habitat 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) Lobutcha 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.

The early-action structural program includes 3 multiple-purpose reservoirs, 30 upstream watershed projects, stabilization of critical land areas throughout the basin, and development of the Pearl River as a recreational boatway. Within the 30 upstream watershed projects there are 179 floodwater retarding structures, 29 multiple-purpose structures, 1,202 miles of channel development, and land treatment measures for watershed protection. The total cost of the program is estimated at $186,687,000, including $30,617,000 for land treatment and stabilization of critical land areas. It is estimated that the non-Federal portion of the construction cost (excluding land treatment and stabilization of critical land areas) would be $33,073,000. Excluding land treatment and stabilization of critical land areas, annual charges are $10,172,000 and annual primary benefits are $18,381,000, giving a benefit-to-cost ratio of 1.8.

The framework for future planning includes 9 multiple-purpose reservoirs, 16 upstream watershed projects, including 13 multiple-purpose structures, one additional multiple-purpose structure in each of 10 approved or early-action watersheds and a barge navigation project.

The Coordinating Committee recommends:

I. That the comprehensive plan of structural and nonstructural measures presented in this report be adopted as the basic plan for the coordinated development, conservation, and beneficial use of the water and related land resources of the Pearl River Basin.

II. That the early-action structural program be implemented as follows:

1. That the Corps of Engineers submit a separate report recommending authorization of the Ofahoma, Carthage and Edinburg Dams and Reservoirs by the Congress. Estimated total cost for construction is $93,020,000; annual charges, $5,539,000; and annual benefits, $11,840,000. The benefit-to-cost ratio is 2.1.

2. That the Department of Agriculture submit a separate report or reports recommending authorization by the Congress of land treatment measures, 179 floodwater retarding structures, 29 multiple-purpose structures and 1,202 miles of channel development in 30 upstream watershed areas and critical land area stabilization for the remainder of the basin. The estimated total cost for these measures is $87,259,000, of which $30,617,000 is for land treatment and critical land area stabilization. Average annual costs of the structural measures (excluding land treatment and critical land area stabilization) are $3,818,000 and annual primary benefits are $4,536,000, giving an overall benefit-to-cost ratio of 1.2.

3. That the 302-mile Pearl River Boatway and 82 associated recreational areas be implemented by the Pearl River Basin Development District as State of Mississippi projects with Federal aid through existing authorities. Estimated total costs for construction are $6,408,000; annual charges $815,000; and annual benefits $2,005,000. The

benefit-to-cost ratio is 2.5.

III. That the States adopt such legislation as may be required and take appropriate action, utilizing available Federal assistance and programs, to permit implementation of the various nonstructural measures of the plan.

IV. That the comprehensive plan be reviewed and updated periodically.

MAIN REPORT

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CHAPTER 1

AUTHORITY AND BACKGROUND

INTRODUCTION

The Pearl River Comprehensive Basin Study is part of the national comprehensive river basin planning program that has developed from recommendations in the 1961 report of the Senate Select Committee on National Water Resources and subsequent actions of the Executive Branch and the Congress. The basic objective of this program is to plan for the best use, or combination of uses, of water and related land resources to meet all foreseeable short- and long-term needs.

The study has been directed towards developing an understanding of the existing and future needs of the Pearl River Basin; providing a sound basis for, and recommendation of, an early-action program of measures that should be undertaken within the next 10 to 15 years; and establishing a framework for future planning for the basin. It has been conducted as a coordinated State-Federal interagency investigation and the findings have been incorporated in this main report and supporting appendixes, in accordance with guidelines for comprehensive river basin studies (Type 2) issued by the Water Resources Council.

AUTHORITY

The comprehensive study for the Pearl River Basin, Mississippi and Louisiana, is one of the original 16, later reduced to 15, Type 2 studies for the United States which were selected by the Interdepartmental Staff Committee of the Ad Hoc Water Resources Council for completion by 1970. Subsequently, the Water Resources Council was made a permanent body by the Water Resources Planning Act, Public Law 89-80, approved July 22, 1965. Members of the Council are: the Secretary of the Interior, Chairman; the Secretary of Agriculture; the Secretary of the Army; the Secretary of Health, Education, and Welfare; the Secretary of Transportation; and the Chairman of the Federal Power Commission. Associate Members are the Secretary of Commerce and the Secretary of Housing and Urban Development. Observers are the Director, Bureau of the Budget, and the Attorney General, Department of Justice.

Since all water and related land resource needs were to be considered, the direct participation and contributions of a number of Federal agencies and the concerned States were required. Therefore, concerned agencies of the Department of Agriculture, Department of the Army, Department of Commerce, Department of Health, Education, and Welfare, Department of the Interior, Department of Transportation and Federal Power Commission joined together with the States of Mississippi and Louisiana in the study. The Corps of Engineers, Department of the Army, was designated as study leader; a coordinating committee was formed; a plan of investigation was developed, outlining scope, agency responsibilities and schedules; and coordinated budget estimates were submitted

through the Water Resources Council.

Federal agencies participated in accordance with their pertinent statutory responsibilities. Authorities are cited in the individual agency appendixes to this report. All agencies worked closely with their State counterparts in conducting their studies.

OBJECTIVES AND SCOPE OF INVESTIGATION

This report presents the results of the comprehensive study of the water and related land resources of the Pearl River Basin. The purpose, as previously indicated, was to determine the best use, or combination of uses, of the water and related land resources to meet all foreseeable short- and long-term needs in the basin. Specific objectives, contained in general guidelines and criteria for comprehensive studies, were to provide:

- A sound basis for necessary current and near-future action programs, including construction, and

- An appraisal of longer-range water and related land resource development needs and alternative solutions and a framework for future planning and action programs, including construction.

To accomplish these objectives in an orderly and efficient manner, guidelines were established as follows:

- Identify the general nature and scope of existing and future water and related land resource development needs.

- Identify the resources and alternative means for dealing with those needs.

- Define and evaluate the projects which are to be recommended for initiation of construction in the next 10 to 15 years, in sufficient detail to comprise a basis for the recommendation.

- Identify the general nature and scope of the measures which should be undertaken under non-Federal or other Federal programs to supplement or utilize the projects for which authorization is sought.

The investigations for this report were carried only to the point where reasonable conclusions could be reached in satisfying the outlined objectives.

Comprehensive planning to achieve the above objectives for the Pearl River Basin was guided by Senate Document No. 97, 87th Congress, 2nd Session, "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources." In accordance with Senate Document No. 97 planning for use and development of the water and related land resources

of the Pearl River Basin was on a fully comprehensive basis so as to consider the needs and possibilities for all significant resource uses and purposes. To the extent practical, planning considered all viewpoints at all levels, including consideration and evaluation of regional, state, and local objectives 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, appropriate consideration was given to each of the following objectives and reasoned choices made between them when they conflict: development, preservation, and well-being of people. Well-being of all of the people was the overriding determinant in considering the best use, with care being taken to avoid development for the benefit of a few or the disadvantage of many. Planning was based on the expectation of a full and expanding national economy in which timely development of water and related land resources will occur in such a manner as to avoid being a constraint to economic growth.

Thus, comprehensive water and related land resource planning involves appropriate consideration of the broad alternative social and economic objectives and the technical and administrative means which may be employed to achieve the objectives.

The broad objective alternatives may be categorized as (a) national 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 due to increased economic activity within the region caused by resource development; 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.

An economic base study of the Pearl River Basin was made, as described in Appendix D. This study projected the economy of the basin to the year 2015, within the framework of a full and expanding national economy as depicted in "National Economic Growth Projections 1980, 2000, 2020," a preliminary report of the Economic Task Group of the Ad Hoc Water Resources Council Staff, July 1963. The projected growth rates of population, labor force, total personal income, and per capita income for the basin as a whole are greater than the national rates but the per capita income in 2015 would remain below the national average at about 62 percent.

Planning for the development of the water and related land resources of the Pearl River Basin was based on identified needs, related to the economy as projected in the economic base study. Careful consideration was given to balancing the broad objectives of economic efficiency and environmental quality, taking into account the desire of the people for maximum physical development of the water resources in support of their growing economy and for their enjoyment. As a

powerful means to further that end, the State of Mississippi in 1964 created the Pearl River Basin Development District, a legal entity with broad powers to promote the objectives of "the preservation, conservation, storage and regulation of the waters of the Pearl River and its tributaries and their overflow waters for domestic, commercial, municipal, industrial, agricultural and manufacturing purposes, for recreational uses, for flood control, timber development, irrigation, navigation and pollution abatement, and for the preservation, conservation and development of the soil of the Pearl River Basin."

Full consideration could not be given to the broad objective of regional development since this requires the evaluation of types of benefits which is beyond the scope of this report. Procedures for such evaluation are presently being considered by the Water Resources Council. They should be applied, as appropriate, in future planning for the Pearl River Basin.

Planning for the development of the water and related land resources of the Pearl River Basin also took account of alternative means of achieving objectives. For example, flood control may be dealt with by structural measures - reservoirs, diversion, local protection works - or by nonstructural measures - land treatment, flood plain management, evacuation.

ORGANIZATION FOR CONDUCTING THE STUDY

Studies, investigations, and preparation of the Pearl River Basin Comprehensive Report were performed through joint efforts of participating agencies. A Basin Coordinating Committee was formed with representatives from the States of Mississippi and Louisiana, Department of the Army, Department of Agriculture, Department of the Interior, Department of Health, Education, and Welfare, Department of Commerce, Department of Transportation, and Federal Power Commission. The members of this Committee are listed on the following page.

PEARL RIVER BASIN COORDINATING COMMITTEE

STATE OF MISSISSIPPI	Mr. Swep T. Davis Executive Director-Secretary Pat Harrison Waterway District Hattiesburg, Mississippi
STATE OF LOUISIANA	Mr Daniel V. Cresap[1/] Chief Engineer Louisiana Department of Public Works Baton Rouge, Louisiana
DEPARTMENT OF THE ARMY **(Chair Agency)**	Colonel Harry A. Griffith[2/] District Engineer Corps of Engineers Mobile, Alabama
DEPARTMENT OF AGRICULTURE	Mr. W. L. Heard State Conservationist Soil Conservation Service Jackson, Mississippi
DEPARTMENT OF THE INTERIOR	Mr. D. P. Shoup[3/] Regional Coordinator, Southwest Region Albuquerque, New Mexico
DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE	Mr. Howard W. Chapman[4/] Regional Assistant Administrator Environmental Health Service - PHS Atlanta, Georgia
DEPARTMENT OF COMMERCE and DEPARTMENT OF TRANSPORTATION	Mr. Douglas E. Schneible Hydraulic Engineer Public Highway Administration, Region 3 Atlanta, Georgia
FEDERAL POWER COMMISSION	Mr. Robert C. Price Regional Engineer Federal Power Commission Atlanta, Georgia

1/ Relieved Mr. Calvin T. Watts, January 1970.
2/ Relieved Colonel Robert E. Snetzer, June 1970, who in turn relieved Colonel Robert C. Marshall, June 1967.
3/ Relieved Mr. Kenneth D. McCall, November 1969.
4/ Relieved Mr. Herbert H. Rogers, May 1966.

Under the chairmanship of the District Engineer, Mobile District, Corps of Engineers, this Committee, collectively and individually, has served as a means of achieving coordination in conducting the specific studies applicable to each agency, in exploring and formulating plans of development, and in reviewing drafts of the report.

All studies were coordinated with the appropriate State agencies concerned with water resources development through the State member of the Basin Coordinating Committee. In addition, county and municipal agencies, private firms, and industrial concerns were consulted and gave freely of their time, experience and data. The Basin Coordinating Committee met at intervals throughout the course of the study to discuss developments and resolve any problems encountered. In addition, about 70 work-level conferences were held between cooperating agencies to insure effective conduct of the study.

All of the Federal agencies have been equal partners in the study and have participated and contributed to the planning in the area of water resources in which they have the best knowledge and bear the primary responsibility. The principal Federal agencies worked closely with their State counterparts.

Participation by agencies has been generally as follows:

Three agencies of the DEPARTMENT OF AGRICULTURE participated actively in the study: the Soil Conservation Service, the Forest Service, and the Economic Research Service.

The Soil Conservation Service made physical appraisals of agricultural problems, determined the physical and economic feasibility of upstream watershed projects and determined land treatment needs for non-Federal open lands in the basin.

The Forest Service determined present and future cover condition and land treatment needs of forest lands, made an analysis of the forest resource section of the economy and determined use, treatment, development and management needs of National Forest lands.

The Economic Research Service in cooperation with the Forest Service made an agricultural economic base study of the basin, made studies of problems and needs of agriculture and rural water as they relate to economic activity and needs for water and related land resource development, and assisted in formulating the early action plan.

THE CORPS OF ENGINEERS had the principal responsibility of conducting and coordinating the study and the plan formulation, consolidating information from studies and other agencies and processing the Committee report. The Corps investigated potential reservoir sites and determined the magnitude of present and future requirements for and the value of flood control measures and navigation facilities along the main streams and principal tributaries. Hydroelectric power studies were also

made at potential sites. Plans were formulated for major multiple-purpose projects to help satisfy the needs of the basin.

THE DEPARTMENT OF COMMERCE, through the Environmental Science Services Administration, Weather Bureau, furnished hydrologic and climatic data for use in the comprehensive study. The Bureau of the Census furnished statistical data.

THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, through the Public Health Service, conducted a study on the public health aspects of water and related land resource development in the basin. The study covered water supply, solid waste disposal, radiological health, vector control, recreation and shellfishery.

Eight agencies of the DEPARTMENT OF THE INTERIOR participated in the study: The Federal Water Quality Administration, the Bureau of Outdoor Recreation, the Bureau of Sport Fisheries and Wildlife, the National Park Service, the U. S. Geological Survey, the Bureau of Mines, the Southeastern Power Administration, and the Bureau of Indian Affairs.

The Federal Water Quality Administration made studies of the municipal and industrial water supply needs and flow requirements for water quality control to meet proposed water uses in the basin. The monetary benefits were calculated for these two services, both present and projected.

The Bureau of Outdoor Recreation made studies of the recreation aspects of existing and potential water resource development within the basin. The studies included an inventory of existing and potential recreation developments, present and projected recreational needs and facilities to meet those needs, estimates of recreational use to be assigned to the studied reservoirs and multiple-purpose upstream watershed structures, and estimates of benefits that could be expected to result from utilization. A plan to help meet the recreation needs of the basin was also proposed.

The Bureau of Sport Fisheries and Wildlife made an inventory of existing and potential fish and wildlife resources in the basin. Studies were also made of the expected loss of wildlife habitat at reservoirs and upstream watershed structures and of measures for mitigating these losses. Measures were recommended to gain maximum fish and wildlife benefits at the studied reservoir sites and upstream watershed structures, and the monetary value of these benefits was estimated. An early-action plan to satisfy the diversified fishing and hunting needs was also proposed.

The National Park Service investigated the historical, archeological and natural science aspects which would be affected by potential and proposed developments in the basin and presented information on pertinent programs of the National Park Service that could be used by the States in establishing historical sites.

The U. S. Geological Survey provided a general description of the geology of the basin, and the location, extent and hydrological characteristics of the main groundwater sources.

The Bureau of Mines made an inventory of the nature and extent of mineral industry in the basin, both current and projected, and an estimate of the amount of mineral products, present and future, that could be moved over a considered inland waterway system. The Bureau also reviewed the existing and potential development of mineral resources in areas of proposed major reservoir project sites.

The Southeastern Power Administration served as a review agency for hydroelectric power studies made by the Corps of Engineers.

The Bureau of Indian Affairs served as a review agency for proposed projects and programs affecting Choctaw Tribal Land located in the upper portion of the Pearl River Basin.

THE DEPARTMENT OF TRANSPORTATION, through the Federal Highway Administration, cooperated with the State Highway Departments to assure that proper road relocation or reconstruction costs were included for Federal-aid roads affected by proposed major reservoirs. The U. S. Coast Guard did not participate actively in the study but reviewed the report as an interested agency concerned with boating and navigation.

THE FEDERAL POWER COMMISSION furnished power values and load projections for potential hydroelectric projects in the basin and reviewed the hydroelectric power possibilities of projects selected for the early-action program.

Various agencies of the States also participated in the study. Most of this was done through the State members of the Coordinating Committee.

FORMAT OF THE REPORT

In the interest of clarity of presentation and reference, the report has been arranged into a Main Report and 15 appendixes.

This Main Report presents the consolidated results of the comprehensive study of the Pearl River Basin. Included are a physical description of the basin and the present state of water and related land resource development; its past, present, and projected future economy; its present and future needs for water and related land resource development; alternatives for meeting those needs; a comprehensive plan including an early-action program of structural and nonstructural measures and a framework for long-range planning; and recommendations for implementing the comprehensive plan.

The 15 appencixes to this Main Report present details covering specific disciplines and features of the Pearl River Basin study. They have been given a letter designation and are outlined in the following paragraphs.

APPENDIX A contains the field-level views of the various Federal and State agencies on the comprehensive plan for the Pearl River Basin.

APPENDIX B contains assurances that the required local participation will be provided if the proposed early-action program is undertaken.

APPENDIX C contains a resume of public hearings held in the Pearl River Basin.

APPENDIX D, prepared by the MOBILE DISTRICT CORPS OF ENGINEERS, is an economic base study of the Pearl River Basin Study Area. Data for this appendix were taken from (a) "Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area," prepared under private contract to the Corps of Engineers, and (b) "Agricultural Economic Base Study of the Pearl River Basin Study Area," prepared by the ECONOMIC RESEARCH SERVICE and the FOREST SERVICE of the U. S. DEPARTMENT OF AGRICULTURE. This appendix shows past trends and future projections of population and economic growth indicators such as employment, personal income, and value added by manufacturing. It also compares the economic projections of the Pearl River Basin and its subareas with those for the Nation as a whole.

APPENDIX E contains plan formulation data on the proposed comprehensive plan for the basin. Preparation of this appendix was the primary responsibility of the MOBILE DISTRICT CORPS OF ENGINEERS and the DEPARTMENT OF AGRICULTURE. However, all agencies were responsible for furnishing input for their various programs.

APPENDIX F contains engineering studies performed primarily by the MOBILE DISTRICT CORPS OF ENGINEERS. These studies include hydrology studies concerning water availability, storm types, previous storms and floods, low flow and flood flow frequencies; flood damage studies; general design criteria; project formulation studies and descriptions of proposed early-action major reservoir projects; studies of navigation possibilities; and studies of hydroelectric power possibilities. This appendix also includes estimates of annual gross erosion and sediment yields determined by the Soil Conservation Service for 26 potential reservoir sites selected by the Corps of Engineers.

APPENDIX G, prepared under the joint leadership of the Soil Conservation Service, Economic Research Service, and the Forest Service, includes projections and needs for agricultural output, timber production, land use, land treatment and management, as well as employment on farms and in wood-using industries. A comprehensive program for land treatment and upstream watershed development was formulated to help meet the needs for floodwater and sediment damage reduction, water quality control, municipal and industrial water, fish and wildlife, and water-based recreation.

APPENDIX H, prepared by the FEDERAL WATER QUALITY ADMINISTRATION, presents studies of the water supply (municipal and industrial) and water quality control needs of the basin, flow requiremnts at all major centers of need to meet water quality requirements for all present and projected uses, and the monetary benefits for these services.

APPENDIX I, prepared by the BUREAU OF OUTDOOR RECREATION, contains studies of the recreation aspects of existing and potential water resource development within the Pearl River Basin. These studies include an inventory of existing and potential recreation developments, present and projected recreational needs and facilities required to meet those needs, estimates of use to be assigned to major reservoirs and multiple-purpose upstream watershed structures in the comprehensive plan, and estimates of benefits that could be expected to accrue to the early-action portion of the plan.

APPENDIX J, prepared by the BUREAU OF SPORT FISHERIES AND WILDLIFE in cooperation with the BUREAU OF COMMERCIAL FISHERIES and state fish and game agencies, contains an inventory of existing and potential fish and wildlife resources in the basin, expected losses of wildlife habitat at the studied reservoirs and upstream watershed structures, measures for mitigating these losses, recommended measures to gain maximum fish and wildlife benefits at proposed developments, and estimates of the monetary value of these benefits. An early-action plan proposed to satisfy the diversified fishing and hunting needs in the Pearl River Basin is also presented.

APPENDIX K is a report from the NATIONAL PARK SERVICE containing comments on the historical, archeological and natural science aspects which would be affected by potential and proposed developments in the basin.

APPENDIX L, prepared by the U. S. GEOLOGICAL SURVEY, contains a report on geology and groundwater resources of the Pearl River Basin.

APPENDIX M is a report from the BUREAU OF MINES which contains an inventory of the nature and extent of mineral resources and industry in the basin, both current and projected; an estimate of the amount of mineral products present and future, that could be moved over a considered inland waterway system; and the relationship of the existing and potential development of mineral resources to proposed major reservoir projects.

APPENDIX N, prepared by the PUBLIC HEALTH SERVICE of the DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, contains a report on the public health aspects of water and related land resource development in the basin. Health evaluation aspects included in the report are water supply, solid waste disposal, radiological health, vector control, recreation and shellfishery.

APPENDIX O contains information on the laws and programs of the STATES of MISSISSIPPI and LOUISIANA pertaining to the development of

water and related land resources in the Pearl River Basin and shows the role of each State in the comprehensive study. The STATE of MISSISSIPPI portion of the appendix was prepared by the PEARL RIVER BASIN DEVELOPMENT DISTRICT and the LOUISIANA portion by the LOUISIANA DEPARTMENT OF PUBLIC WORKS.

PUBLIC HEARINGS

To insure that full consideration was given to all views and area requirements, two public hearings were held early in the study to obtain an expression of the desires of local interests. The hearings were held in Jackson, Mississippi, on March 23, 1965, and Picayune, Mississippi, on March 24, 1965.

At the conclusion of the study, a public hearing was held to explain the proposed early action plan for the development of the basin and to determine the attitude of local interests toward this plan. This hearing was held in Jackson, Mississippi, on September 9, 1970.

Resumés of all public hearings are contained in APPENDIX C. The transcript of all official hearings, including written statements submitted for inclusion in the hearing records, are available for inspection at the office of the Mobile District, Corps of Engineers, Mobile, Alabama.

CHAPTER 2

DESCRIPTION OF BASIN

GENERAL

The Pearl River Basin, as shown on Plate No. 1 in the back of this volume, comprises most of the south-central portion of Mississippi and a small part of southeastern Louisiana. The river drains an area of 8,760 square miles consisting of all or parts of 23 counties in Mississippi and parts of 3 Louisiana parishes. The basin has a maximum length of 240 miles and a maximum width of 50 miles. It is bounded on the north by the Tombigbee River Basin, on the east by the Pascagoula River Basin, on the south by Lake Borgne and the Mississippi Sound, and on the west by the Mississippi River Basin and several coastal streams in the lower portion of Louisiana. There are numerous lakes within the basin but only a few of significant size. The largest of these is the Ross Barnett Reservoir which is located on the Pearl River about 6 miles northeast of Jackson. This lake, with a normal surface area of some 30,000 acres and a length of about 43 miles, has a gross storage volume of 310,000 acre-feet. Its primary purposes are water supply for the Jackson area and recreation. Other impoundments in the basin range in size from 2 to 675 acres.

TOPOGRAPHY AND PHYSIOGRAPHY

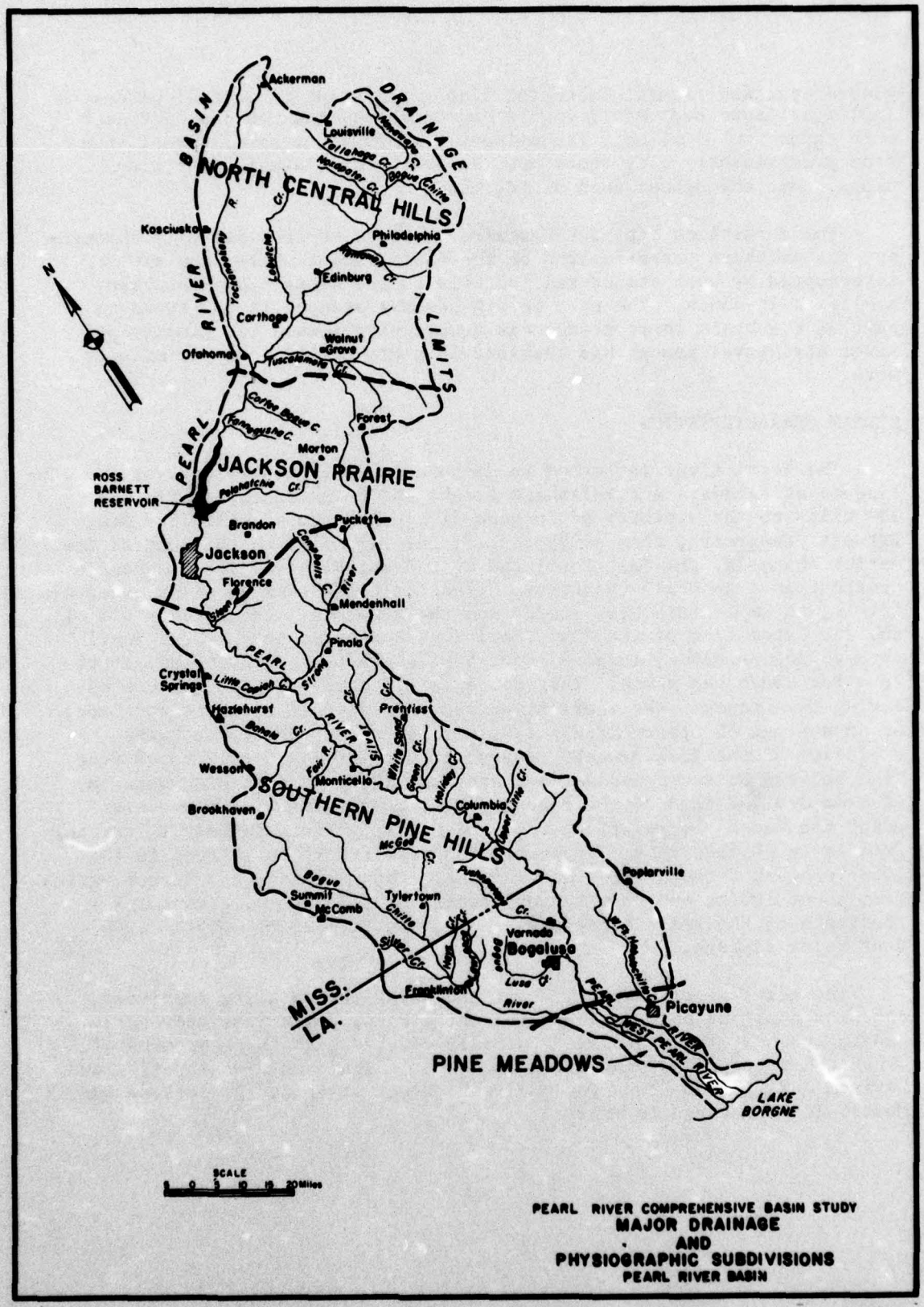
The Pearl River Basin lies within the East Gulf Coastal Plain which is physiographically subdivided into the North Central Hills (or Plateau), Jackson Prairie, Southern Pine Hills and Coastal Pine Meadows districts. These districts, shown on Figure 1, cross the basin generally in a northwesterly direction. Elevations in the basin range from sea level in the Coastal Pine Meadows subdivision to approximately 650 feet in the North Central Hills. The topography and physiography of the basin are discussed in detail in Appendix L.

Drainage patterns for the basin are shown in Figure 1. Major tributaries to the Pearl River are, from the upper part of the basin southward, Lobutcha and Tuscalometa Creeks, Yockanookany and Strong Rivers, and Bogue Chitto. Smaller streams characterized by large base flows include the following creeks: Whitesand, Silver, Holiday, Upper and Lower Little, Pushepatapa, Hobolochitto, and West Hobolochitto.

GEOLOGY AND SOILS

Geologically, the Pearl River watershed is not a contained unit because the formations extend beyond the topographic divides into adjoining stream basins. The formations at the surface are sedimentary in origin and range in age from early Eocene to Recent.

Sand and clay in various proportions constitute nearly all of the immense prism of sedimentary deposits extending from the northern part of the basin to the coast; a few thin units of marl, limestone, and



PEARL RIVER COMPREHENSIVE BASIN STUDY
MAJOR DRAINAGE
AND
PHYSIOGRAPHIC SUBDIVISIONS
PEARL RIVER BASIN

FIGURE 1

glauconitic and lignitic material also are present in several places. Individual sand beds are irregular in thickness and few can be traced more than about 5 miles. Predominantly sandy zones as differentiated from predominantly clay zones are, however, correlatable over wide areas, some throughout much of the basin.

The formations dip southwestward at 20 to 80 feet per mile throughout the northern three-fourths of the basin except where they are interrupted by such structural features as the Jackson Dome and many smaller salt domes. The rate of dip becomes steeper in the southern part of the basin where pronounced downwarping toward the Mississippi River structural trough has resulted in a dip of 100 feet per mile or more.

STREAM CHARACTERISTICS

The Pearl River is formed in Neshoba County, Mississippi, by the confluence of Nanawaya and Tallahaga Creeks and flows southwesterly for 130 miles to the vicinity of Jackson (including the 43-mile-long Ross Barnett Reservoir), then southeasterly for 233 miles to the head of its outlet channels, the East Pearl and West Pearl Rivers. These channels continue in a generally southerly direction for 48 and 44 miles, respectively, to empty into Lake Borgne and the Rigolets. Practically all of the low-water flow of the East Pearl is transferred to the West Pearl through Holmes Bayou, located about 5 miles west of Picayune and about 29 miles above the mouth. This reach is affected by tidal influences during low stages. The Pearl River has a total fall of about 407 feet, or an average of approximately 1.0 foot per mile. The river banks, exclusive of the Ross Barnett reservoir, vary from about 12 to 40 feet high between Edinburg and Jackson and from 20 to 90 feet high between Jackson and the head of the East and West Pearl Rivers. Below this point the banks are relatively low and fairly uniform in height, varying from 18 to 20 feet in the upper sections and from 5 to 10 feet in the lower reaches through the tidal marshes. The width of the channel varies from about 100 to 400 feet between Jackson and Edinburg, except for the reach of the Ross Barnett Reservoir, and from about 400 to 1,000 feet below Jackson.

The Pearl River channel, above and below the existing reservoir, contains numerous obstructions, including bars, drift jams and overhanging trees. The banks are generally covered with thick growths of brush and trees of varying sizes and types. The bankful capacities and maximum and minimum flows for the Pearl River at Edinburg, Jackson and Monticello are given in Table 1.

Table 1

Pearl River discharges and bankful capacities
(Cubic feet per second)

Gage location	Discharge		
	Maximum	Minimum	Bankful
Edinburg	31,400 [1]	1.7	4,400
Jackson	85,000 [2]	78	9,800
Monticello	100,000 [3]	269	5,200

[1] Recorded March 8, 1935
[2] Computed by extending rating curve, March-April 1902 flood.
[3] Estimated, from reports by USWB for March-April 1902 flood.

The five principal tributaries of Pearl River are Lobutcha and Tuscolameta Creeks, Yockanookany and Strong Rivers and Bogue Chitto. These are described in the following paragraphs.

Lobutcha Creek, 55 miles long, rises in Atalla and Winston Counties and drains an area of 328 square miles. It flows generally in a southwesterly direction to enter the Pearl River at mile 370.5. The drainage basin is about 36 miles long and averages about 9 miles in width. The channel varies from 50 to 150 feet in width and has banks 7 to 12 feet in height. The bankful channel capacity near Carthage, about 4 miles above the mouth, is approximately 700 c.f.s. The lower 32 miles of the creek has an average fall of about 2 feet per mile. The lower 20 miles of the creek are subject to backwater influence during extreme high stages on Pearl River.

Tuscolameta Creek from its source in the western part of Newton County flows northwesterly about 38 miles to join the Pearl River about 15 miles below the mouth of Lobutcha Creek. The 35-mile-long basin has an average width of about 16 miles and an area of 573 square miles. In 1924, 24-mile-long dual canals extending upstream from mile 6.9 were completed by local interests on this stream to provide drainage for the upper area. Although the channel below mile 6.9 is tortuous and contains numerous obstructions, it provides an outlet sufficient to minimize sanding and shoaling in the lower ends of the canals. The 24-mile-long canals have an average fall of about 2.8 feet per mile. Below the canals to the mouth of the stream, the channel has an average fall of 3.8 feet per mile. At Walnut Grove, 14 miles above the mouth, the combined channel capacity of the 2 canals at bankful stage is 2,300 c.f.s.

The Yockanookany River rises in the southern part of Choctaw County and flows southwesterly 71 miles to enter the Pearl River at mile 350.9.

The basin has an area of 495 square miles and is 55 miles long with an average width of 9 miles. The stream was canalized from mile 70.4 to mile 50.9 in 1914 and from mile 50.9 to mile 34.1 in 1928. The canal in several places is clogged with debris and/or silt and needs major rehabilitation and regular maintenance. The lower 34.1 miles of the stream has an average fall of 2.3 feet per mile. The canalized reach has an average fall of 2.9 feet per mile. The lower 18 miles of the stream are affected by high stages on the Pearl River. The channel capacity at Ofahoma, about 4 miles above the mouth, is 1,900 c.f.s.

The Strong River rises in Scott County and flows southwesterly 65 miles to join the Pearl River at mile 226, about 60 miles south of Jackson. The 688-square-mile drainage basin is about 50 miles long, with a maximum width of 23 miles. From D'Lo to a point 22 miles downstream, the channel has a fall of 55 feet, or about 2.5 feet per mile. Below that point to the mouth, the average slope is about 4.3 feet per mile. The channel in the lower reaches is generally free from bars, drift jams and other obstructions. At D'Lo, the channel averages about 80 feet in width and has banks 12 to 18 feet high. The channel capacity at this point is 1,404 c.f.s.

Bogue Chitto rises in Lincoln County and drains an area of 1,244 square miles. It flows generally southeasterly for about 100 miles to join the West Pearl River about 48 miles above its mouth. The banks of Bogue Chitto are low and the channel wide and shallow, with numerous sand and gravel bars. The average low water slope is about 1.7 feet per mile. The channel capacity near Tylertown, at which point the drainage area is 502 square miles, is about 1,600 c.f.s.

Drainage characteristics of the Pearl River tributaries are representative of streams indigenous to the southern region. The smaller tributaries vary in character from those with relatively steep gradients and narrow valleys in the North Central Hills and Jackson Prairie to the more moderate streams of the Southern Pine Hills and Coastal Pine Meadows.

Flow characteristics of the basin streams are related to sub-basin location and topography and to previous channel and drainage improvements. The flow in the small upstream tributaries ranges from very low to large flood flows of short duration. Rapid runoffs from isolated storms over the smaller streams cause out-of-bank flows along these tributaries but seldom affect the stages along the main stem to any appreciable degree. The sustained high flows along the lower reaches of the principal tributaries and the main stem of the Pearl River usually result from rainfall over larger areas and the timing of the tributary peak flows.

The amount of sediment entering the stream system varies widely, depending chiefly upon land use and soil type. Under present conditions, the estimated average annual sediment discharge of the Pearl River at the Edinburg gage with a drainage area of 898 square miles is about 888,000 tons (equivalent to 683 acre-feet or 0.76 acre-feet per square mile). The sediment concentration in the river is related more to the

manner in which the river stage is changing than to the volume of water being discharged. Rising stages are accompanied by a larger sediment concentration than are the falling stages. The average annual sediment discharge of the Pearl River Basin streams studied by the U. S. Department of Agriculture ranges from 34 to 167 tons (or 0.2612 to 1.2895 acre-feet) per square mile of drainage area. Probable annual sedimentation rates under present conditions for the major reservoir projects investigated range from 0.2800 to 1.1190 acre-feet per square mile of drainage area. The sedimentation report prepared by the Soil Conservation Service of the Department of Agriculture is contained in Appendix F.

Surface water in the Pearl River Basin is generally of suitable chemical quality for use as public water supply, for irrigation, and for most industrial applications. Under natural conditions, surface waters in the area above the zones of saltwater intrusion are low in dissolved solids, and the chemical constituents remain fairly constant at all rates of streamflow. As a result of drainage from swampy areas, waters in most of the extreme southerly tributary streams have high color and, in some instances, a low pH-value. In order for most of these waters to meet the general requirements for industrial-process water, treatment would be necessary to remove color and suspended materials and to adjust the pH-values. Seepage from the abundant groundwater resources underlying the basin sustains the base flow of the Pearl River and its tributaries. A report on the groundwater resources of the Pearl River Basin by the U. S. Geological Survey is presented in Appendix L.

NATURAL RESOURCES

In addition to water and soils, the natural resources of the basin include forests, which cover more than one-half of its entire area, wildlife for recreational hunting and enjoyment, commercial and sport fisheries, and mineral resources. Minerals found in the area include petroleum and oil, salt, sandstone and limestone, sulfur, shale, iron, sand and gravel, and clays.

TEMPERATURE

The Pearl River Basin has a temperate, humid climate with short, usually mild winters and long, warm summers typical of the Gulf Coast region. The normal annual temperature for the basin is about 66 degrees Farenheit, varying from 64 degrees in the upper portions to 67 degrees near the coast. The normal temperature for the basin during January, the coldest month, is 50 degrees and during July, the warmest month, 82 degrees. The average frost-free season ranges from 210 days in the northern portion of the basin to 270 days in the coastal section. Severe cold spells are infrequent and freezing temperatures, although they occur often, are of short duration. Extreme temperatures recorded in the basin are a high of 109 degrees and a low of -14 degrees.

PRECIPITATION

Rainfall in the Pearl River Basin in general is abundant and well distributed throughout the year. There is some seasonal variation, with the heaviest rains usually occurring in the winter and spring and the lightest during the fall. The average annual precipitation over the basin is about 57 inches, of which 28 percent occurs in the winter, 28 percent in the spring, 26 percent in the summer and 18 percent in the fall. Normally, the period of greatest monthly precipitation occurs in March or July and the least in October.

Light snowfall in the basin is not unusual. However, it forms only a small part of the annual precipitation.

Prolonged droughts seldom occur in the basin. The year 1924, with an average basin-wide rainfall of 38.02 inches, was the most extreme of record in terms of basin-wide rainfall deficiency. The outstanding wet year was 1961 when the basin rainfall averaged 81.90 inches.

The daily amounts of precipitation observed at climatic stations are published monthly in the Climatological Bulletins of the United States Weather Bureau. As of December 31, 1966, 52 of the stations in or immediately adjacent to the basin were equipped to record precipitation amounts continuously. Records from these and 23 discontinued stations are available for periods of 1 to 85 years. Data on these stations are given in Appendix F.

STORM CHARACTERISTICS

Storms which occur in the Pearl River Basin include local thunderstorms, or cloudbursts, and general disturbances of the hurricane and frontal types. Summer storms are generally of the thunderstorm type with high intensities over small areas. Flood-producing storms in the winter and spring are usually of the frontal type, covering large areas and lasting from two to four days. Past records indicate that winter storms are likely to be more intense in the northern part of the basin and the summer storms more intense in the southern portion. In addition, the southern portion of the basin usually bears the brunt of the occasional tropical and equinoctial storms which sweep in from the Gulf of Mexico; for example, the major hurricanes of July 1916 and August 1969.

An important characteristic of the extreme flood-producing storms is that each culminated in a period of very intense rainfall extending over an interval of 24 hours or less. This high-intensity rainfall was usually preceded by a period of less intense precipitation which saturated the ground. Due to the rapid rate of runoff in the basin, the severity of a flood is frequently determined by the high-intensity rainfall in the 24-hour period. Maximum 24-hour rainfalls recorded at various stations in the basin, based on published records of the United States Weather Bureau, range from 4.5 to 9 inches.

Thunderstorms and cloudbursts usually occur in the summer months as a consequence of the rapid rise of warm, moist air. Most of the water is precipitated in a period of five or six hours over a small area. The precipitation intensity can be high, however, and these storms are critical for small watersheds in the basin.

RUNOFF AND STREAMFLOW

The average annual runoff in the basin varies from 15.87 inches at Edinburg in the upper portion of the basin to 16.58 inches at Jackson near the middle of the basin, and 18.13 inches at Bogalusa in the lower portion of the basin. Records from the gage at Jackson show that the average annual runoff in that portion of the basin is about 29 percent of the average annual precipitation.

The runoff varies greatly during the year, being high during winter and early spring and low in late summer and early fall. About 63 percent of the annual runoff of the basin occurs during the four-month period from January through April. Minimum runoff occurs during the three-month period from August through October and averages only about 8 percent of the annual runoff.

Average rates of streamflow range from about 0.9 to 1.7 cubic feet per second per square mile, with the maximum values occurring on the tributary streams near the coast. The average rate of flow in the Pearl River at Bogalusa is about 1.34 cubic feet per second per square mile, and for the main tributary streams, the Yockanookany and Strong Rivers, 1.2 cubic feet per second per square mile.

Runoff data for this report were obtained primarily from records of gage height and discharge collected by the U. S. Geological Survey and supplemented with those obtained by the U. S. Weather Bureau and the Corps of Engineers. There are presently 101 stream gaging stations in service throughout the Pearl River Basin. In addition to data from these stations, data from staff gages and discontinued gages were used where pertinent. The gages and their locations are discussed in Appendix F.

FLOOD CHARACTERISTICS

Flood-producing storms may occur in the basin at any season but are more prevalent in the winter and spring when runoff conditions are more favorable. Storms at that time are usually of the frontal-type which last from two to four days and produce general flooding, often aggravated by favorable antecedent conditions. Local flooding occurs in the summer due to storms of the thunderstorm variety, with high intensities over small areas. However, general floods in the summer and early fall may occur as a result of severe hurricane-type storms. Under normal runoff conditions, an intense and general rainfall of 5 to 6 inches over the basin will result in widespread flooding while 3 to 4 inches are sufficient to produce local flooding on most of the small tributaries.

The flood of March 1902, with a peak discharge at Jackson of 85,000 c.f.s., was the greatest of record along the Pearl River. However, it is estimated that the pre-record flood of April 1874 had a discharge of 100,000 c.f.s. at the same location. Other major floods on various streams in the basin occurred in 1935, 1951 and two in 1961. The maximum floods at various locations in the basin are listed in Table 6 of Appendix F.

The peak rates of flow during the maximum floods of record on the Pearl River and the principal tributary streams vary from about 12.6 c.f.s. per square mile along the Pearl River at Monticello in the lower part of the basin to 35.0 c.f.s. per square mile along the Pearl River at Edinburg, and 84.2 c.f.s. per square mile along Tuscalometa Creek at Walnut Grove. Peak recorded rates of flow on smaller drainage areas vary from about 170 to over 1,500 c.f.s. per square mile.

DEPENDABLE FLOW

The dependable flow is that amount of streamflow which can reasonably be counted on to be available in drought periods. The flows during the droughts of 1954 and 1963 were the lowest of record at most of the stations in the basin. Other significant periods of widespread low flow conditions occurred in 1943, 1955 and 1966. The minimum recorded unregulated rate of flow since 1901 at the Jackson gage on Pearl River was 78 c.f.s., or 0.0252 c.f.s. per square mile, and occurred on October 11, 1954. A low flow of 1.7 c.f.s., or 0.0019 c.f.s. per square mile, was recorded at the Edinburg gage in the Pearl River in October 1954. These flows are approximately 1.2 and 0.16 percent, respectively, of the average discharges of the Pearl River system at these points. Minimum flow data for active gaging stations in the basin are shown in Table 6 of Appendix F.

LOW FLOW FREQUENCY

Low flow volume data are essential for many water utilization design problems because they determine the dependable flow available without stream regulation. In order to apply these data to practical problems of design at specific locations, further information is required concerning the frequency of various low flow volumes. This was developed in the form of frequency-flow curves for the various durations applicable to the problem.

Low flow volume-duration-frequency estimates were made for selected stream gaging stations in the Pearl Basin based on data from the Water Supply Papers of the U. S. Geological Survey. Base curves prepared by the U. S. Geological Survey were used to correlate short-record values and provide the means for estimating low flow frequencies for locations where data were not available.

The low flow-frequency analysis is based on the minimum flows of a stream for periods of various durations. A tabulation of low flow

frequency data for periods of 7, 15, 30, 60, 120, and 183 days and recurrence intervals of 1.03, 1.2, 2, 5, 10, 20, and 50 years is given in Table 10 of Appendix F.

FLOOD FREQUENCY

The analysis of flood problem areas depends heavily upon the frequency at which floods of various magnitudes may be expected to occur. Stream gaging records form the basis for flood frequency analyses. Since these records are relatively short, general accumulated knowledge as well as statistical procedures must be employed in frequency studies. Therefore, historical flood data were used to adjust statistics at the longest-term gaging stations at Jackson and Edinburg. Frequency statistics of other stations were then adjusted to these stations. Also, a regional flood frequency analysis was made to provide a means for estimating frequencies for locations where data were not available. Table 2 gives the estimated frequency of occurrence of various peak flows at selected stations in the basin. Details of the analysis are discussed in Appendix F.

Table 2

Frequency of peak discharge for selected stations in Pearl River Basin
(Discharge in c.f.s.)

Station	Drainage area (sq.mi.)	Peak Discharge in c.f.s. for indicated frequency of occurrence in years						
		1	2	5	10	25	50	100
Pearl River at Edinburg	898	8,600	13,400	21,100	28,200	39,000	48,500	60,000
Pearl River at Jackson	3,100	22,600	32,100	46,200	58,500	76,000	91,500	108,000
Tuscolameta Creek at Walnut Grove	411	7,600	12,400	20,900	28,600	40,900	51,500	66,000
Yockanookany River near Ofahoma	484	5,450	8,900	15,000	20,800	30,000	38,000	47,000
Strong River at D'lo	429	6,500	10,500	17,200	24,600	35,600	45,500	56,500

GROUNDWATER

Practically all of the groundwater is derived from precipitation and reaches the water table through infiltration and percolation. In general, groundwater is relatively free from pollution and nearly constant in quality and temperature. The abundant groundwater resources which underlie the Pearl River Basin are generally of good to excellent

quality. Most of the groundwater contains sodium bicarbonate, is usually soft, and has a low to moderate dissolved-solids content. Excessive iron is a problem in places, particularly where water supplies are obtained from shallow aquifers. Salt-water encroachment is a potential problem in the coastal area, but little increase in saltiness has been observed in monitor wells in the period 1960-65. The U. S. Geological Survey report on groundwater resources is presented as Appendix L. The following paragraphs summarize the groundwater conditions.

Aquifers in the Claiborne Group furnish practically all existing groundwater supplies in the northern third of the basin. Although the underlying Wilcox Group occupies about 1,000 feet of the freshwater section in that area, it is virtually untapped for water supplies due to its greater depth and the availability of adequate water at shallow depths. However, a large part of any substantial increase in groundwater withdrawals will probably come from wells deeper than now commonly drilled in the area.

Beds of Miocene age constitute sources of groundwater supplies throughout the southern two-thirds of the basin and are the only significant sources in about half of the basin. Pliocene aquifers furnish most supplies in the basin's southern extremity.

Total groundwater pumpage for municipal, industrial, rural domestic and farm supplies in the Pearl River Basin was estimated to be 50-60 million gallons per day in 1965, distributed widely throughout the basin. Practically all domestic and municipal water supplies, except for Jackson, and most industrial supplies, except for withdrawals from the Pearl River and Bogue Lusa Creek in the southern portion of the basin by two large paper industries, are obtained from the groundwater reservoir.

CHAPTER 3

ECONOMIC DEVELOPMENT

GENERAL

The need for water and related land resource development, for the most part, is dependent upon the size and characteristics of the basin population and the level and mix of the economic activities. The indicators of economic activity for the basin are based on data developed in (a) the "Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area", December 1964, prepared under private contract to the Corps of Engineers for use in the three Type 2 comprehensive studies of the Pascagoula, Pearl and Big Black River Basins, and (b) "Agricultural Economic Base Study of the Pearl River Basin Study Area," January 1966, prepared by the Economic Research Service and the Forest Service of the U. S. Department of Agriculture.

The purpose of the economic base study was to project the economic growth of the basin to 1980 and 2015 for guidance in the preparation of an adequate plan of development for the water and related land resources of the basin and for use in the evaluation of benefits that would accrue from such development. Major parameters of the general economic activity included in this study are population, households, labor force, employment, personal income, and value added by manufacturing. A detailed presentation of the data cited in this chapter is given in Appendix D.

DESCRIPTION OF THE STUDY AREA

The area treated in the "Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area" will be referred to as the "base study area." It lies in the southeastern part of the United States and includes all of the State of Mississippi, 19 counties in central and western Alabama and 12 parishes in southeastern Louisiana. The base study was divided into seven components approximating drainage areas. One of these principal components applies to the Pearl River Basin and will be referred to as the "basin study area" or simply the "basin."

The basin study area boundary follows the county lines nearest the basin's physical boundary and includes 15 complete counties and the eastern portion of Hinds County in Mississippi and 2 parishes in Louisiana. Division of the basin into subareas (Upper Pearl, Middle Pearl, and Lower Pearl) was accomplished by grouping together those counties that are strongly related by watershed factors, water needs, and economic activity. These subareas are shown in Figure 2.

CURRENT ECONOMIC DEVELOPMENT

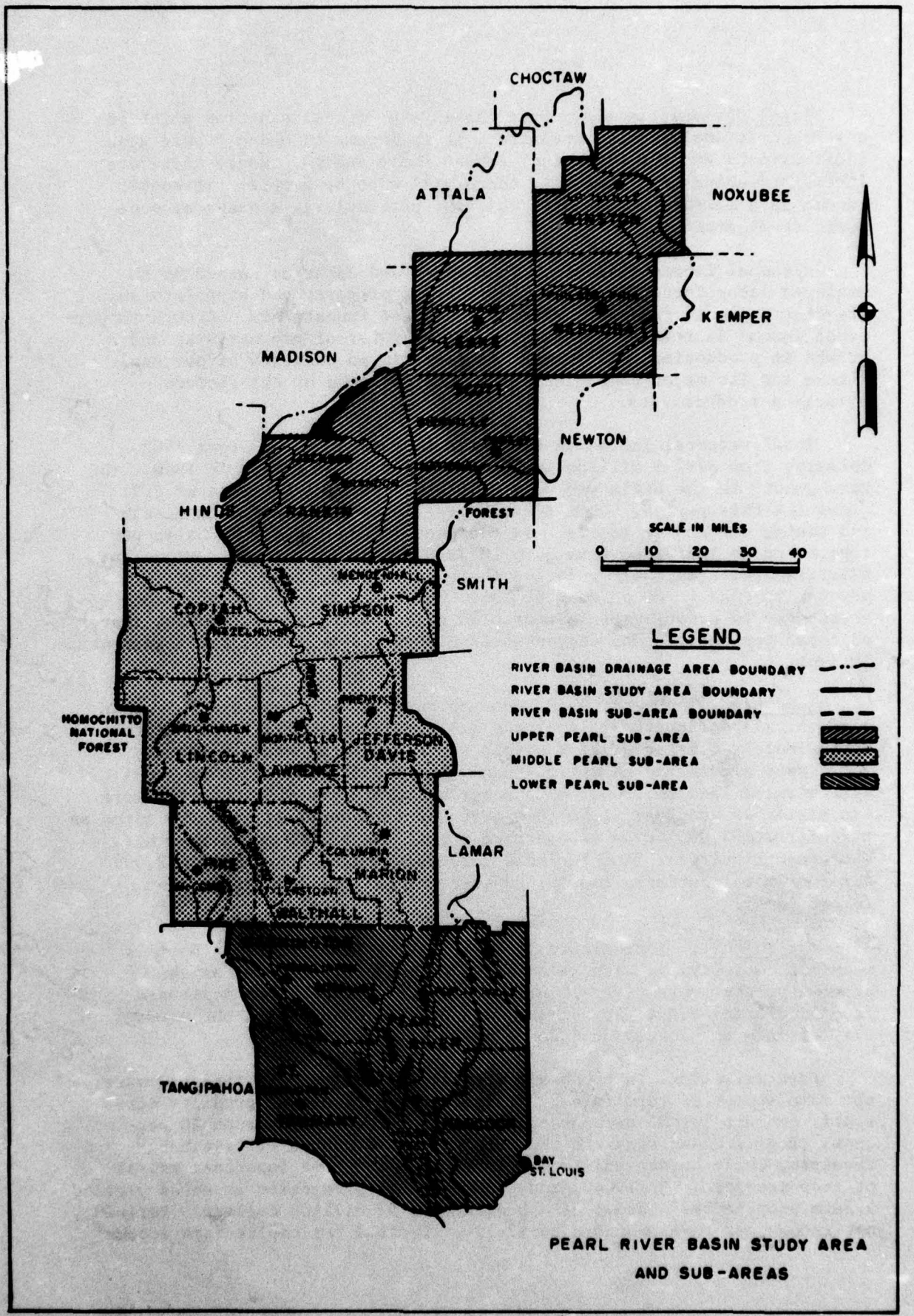
Population. One of the primary measures of an area's economy is the number of persons living therein. People reflect the opportunities and problems of the area in which they live and constitute the market for consumer goods and services. They provide the labor force that responds to industrial, commercial and agricultural employment demand, and represent social requirements such as schools, hospitals, transportation facilities, recreational facilities and other social services. They constitute one of the principal factors that determine the needs for water resource development. Effective river basin planning is based upon a full understanding of these needs and is dedicated to satisfying them through the implementation of timely water resource development.

The population of the Pearl River Basin study area increased from 127,200 in 1870 to 558,000 in 1960. Historically, growth in the Basin's subareas has been erratic. The agriculturally-dependent Middle Pearl subarea increased in population to 190,000 in 1940, then decreased to 169,900 in 1960. The Upper Pearl subarea lost population from 1910 to 1920 then started increasing and in about 1940 began a period of accelerated growth of 1.5 percent a year from then until 1960. The Lower Pearl subarea experienced a sustained growth from 13,200 in 1870 to 119,100 in 1960.

The urban population of the basin more than doubled between 1930 and 1960, increasing from 102,500 to 254,100. The rural non-farm population showed a greater rate of growth than did the urban population, increasing from 75,700 in 1930 to 202,900 in 1960; however, rural farm population decreased from 242,000 to 101,000, resulting in a net decrease of 13,800 in total rural population between 1930 and 1960.

Total employment. The number of potential employees of the basin at a particular time is limited roughly by the size of the labor force derived from the population. In turn, the productivity of labor through employment is an indication of the income flow that the basin's economy can generate. In interpreting the economic growth of the basin, consideration was given to the up-grading of the productive capacities of the labor force through the development of skills and the transfer into higher value-added industries of large segments of the labor force freed by declining agricultural employment. The expansion of employment opportunities in urban areas has tended to offset employment losses in agriculture and agriculturally related industries. This trend has caused considerable loss of population in counties dependent on an agricultural employment base.

Total employment in the basin rose nearly 26 percent from 1930 to 1960, increasing from 140,217 to 176,396. This is about one-half the rate of increase achieved by the Nation but exceeds the base study area rate of less than 10 percent for the 30-year period.



PEARL RIVER BASIN STUDY AREA AND SUB-AREAS

FIGURE 2

Total personal income. Even though the logical starting point of any economic analysis is population, it is income to which people gear their efforts and for which they expend their energy. Where there are income-producing opportunities, there will also be people. Personal income is a measure of economic welfare, particularly a guage of economic development.

Personal income is derived from wages and salaries earned by the employed labor force, from income-producing property and proprietorships, transfer payments and other personal business investments. Growth in personal income is related directly to rising rates of productivity and growth in production. Therefore, inherent in an analysis of personal income and its major components is a consideration of the factors affecting productivity.

Total personal income in the basin increased, in constant 1962 dollars, from $197.5 million in 1930 to about $840 million in 1960. The rate growth in the basin was well above the national increase of 2.9 times for this period. This increase reflects both population growth and rising per capita income. In constant 1962 dollars, the basin per capita income increased from $470 in 1930 to $1,505 in 1960. Wages and salaries increased their relative share of total personal income from 50 percent in 1930 to 60 percent by 1960. Although the amount of income attributed to proprietors increased in this period, their relative share of total personal income decreased from 22 percent in 1930 to 15 percent in 1960.

Land use. The total land resource base was divided into two broad classes: (1) agricultural land, and (2) non-agricultural land. Of the approximately 6,672,000 acres within the basin study area, 6,286,000 acres were classified as agricultural land and 386,000 acres as non-agricultural land in 1964. Of the agricultural land 959,000 acres were classified as cropland, 1,563,000 acres as farm woodland, 774,000 acres as pasture, 2,891,000 acres as non-farm forest and 99,000 acres as other. The non-agricultural land included 287,000 acres of urban land, 83,000 acres of water surface, and 16,000 acres of Federal land other than forest land.

Agriculture. Agriculture is an important segment of the basin's economic activity, but its relative importance is declining as the economy becomes more diversified. The number of farms has decreased from 51,871 in 1939 to 26,773 in 1964. During this period the average size of farm has increased from 73 acres to 130 acres.

Farm marketings in the basin totaled $119,151,000 in 1964 and were the main source of farm income. Livestock and livestock products currently account for 80 percent of marketing receipts and crops 20 percent. Broilers and eggs are the most important source of livestock receipts, while cotton and farm forestry are the most important source of crop receipts. In 1964, gross income minus production expenses yielded a farm proprietors' income of approximately 57 million dollars. Derived net income per farm amounted to $2,136. Derived per capita farm income

in 1964 was $706, less than half that for all segments of the population.

Forestry. The area occupied by forests in the basin is considerably larger than the acreage devoted to all other land uses. Forest acreage in 1957 accounted for 4.3 million acres out of a total of 6.7 million acres in the study area. Thirty-eight percent of the forest area is in the farmland sector with 62 percent in other types of ownership. Softwood forest types, which include longleaf-slash pine, loblolly-shortleaf pine and oak-pine, cover 66 percent of the commercial forest land. In 1956 these trees contained 2.2 billion cubic feet of wood classified as forest growing stock. The total net volume of sawtimber on commercial forest lands was 7.7 billion board feet.

Employment in the basin as a result of timber resources is classified into two broad categories: (1) those employed in timber based manufacturing industries and (2) those employed in timber management and harvesting. The first category is made up of employment in the following SIC (Standard Industrial Classification) major groups:

24 - Lumber and Wood Products
25 - Furniture and Fixtures
26 - Paper and Allied Products

Employment in SIC major groups 24 and 25 increased from 7,657 in 1930 to 10,482 in 1960. The SIC major group 26 has shown a steady growth from 729 in 1930 to 3,824 in 1960. Employment in the second category, timber management and harvesting, decreased from 6,020 in 1954 to 3,790 in 1958.

Commercial fishing. There are freshwater commercial fisheries operating in the basin. The latest survey, conducted in the Mississippi portion of the basin showed that from July 1, 1960, through June 30,1961, 6 regular and 69 casual fishermen caught 170,000 pounds of finfish valued at $32,640 (ex-vessel). Buffalo fish and catfish (blue and channel) constituted approximately 78 percent of the catch by weight and 82 percent of the total value. The 1960 Louisiana catch, represented by the St. Tammany Parish landings within freshwater, consisted of 1,300 pounds of buffalo fish, with a reported (ex-vessel) value of $152.

Marine commercial fisheries of Mississippi and Louisiana are important to these States' economies and are supported by the coastal estuarine environments. In 1964 the landings from areas influenced by the Pearl River approximated 271 million pounds of finfish and shellfish, with an ex-vessel value of slightly more than $12 million. The fisheries of menhaden, unclassified industrial fish, shrimp, oysters, red snapper, blue crab, king whiting, grouper, and mullet represented over 99 percent of the catch in pounds and value.

Mineral resources. In 1967 mineral products, with a total value of $83.7 million, were produced in the study area (Table 3). Petroleum and related fuels accounted for 82 percent of the total value. The combined values of hydrocarbons, cement, sand and gravel, clay, stone, recovered

sulfur, and oystershell produced in the Pearl River Basin accounted for approximately 40 percent of the total value of Mississippi's mineral output in 1967.

Table 3

Mineral production in the Pearl River Basin Study Area in 1967

Commodity	Unit	Quantity (1,000)	Value ($1,000)
Clay	Short tons	751	1,479
Natural gas	1,000 cubic ft	103,742	17,964
Natural gas liquids	Gallons	23,516	1,482
Petroleum (crude)	Barrels	18,032	49,157
Sand and gravel	Short tons	5 593	5,663
Total value of items whose individual values cannot be disclosed:			
Certain nonmetals and metal ore	Short tons	2,304	7, 19
TOTAL			83,664

Transportation of produced petroleum from the major oilfields and most minor oilfields is accomplished through pipelines. In 1963 trucks transported 871,000 tons of the 1.3 million tons of sand and gravel produced in the Jackson area, indicating that most of the materials were used by the local market.

Construction. Employment in construction rose from 3,023 in 1930 to 12,712 in 1960. The expansion of population, the development of nonmanufacturing facilities and improvements of public facilities influenced this growth. Construction employment generated $30.2 million in wage and salary income in 1960, up from $3.9 million in 1930.

Manufacturing. Consistent decade-to-decade growth in manufacturing industries was achieved from 1930 to 1960. Manufacturing employment increased from 12,376 in 1930 to 36,562 in 1960. The major water-using industries experienced an 8,046 increase in employment during this period, rising from 16 percent of total manufacturing employment in 1930 to 28 percent in 1960. Employment in the food and pulp and paper industries accounted for 7,488 of this increase.

Employment in other manufacturing industries rose from 10,350 in 1930 to 26,490 in 1960. The apparel, lumber, wood and furniture industries combined accounted for more than one-half of this increase.

Value added by manufacturing, generally, is the best measure available for comparing the relative economic importance of manufacturing among industries and geographic areas. Total value added by manufacturing for the basin has increased at a steady rate from $88 million in 1947 to $207 million in 1963.

Wholesale and retail trade. As indicated by employment trends, wholesale and retail trade is in a strong growth phase and is one of the most significant sectors of nonagricultural-nonmanufacturing employment. With the growth in employment there is a corresponding growth in wage and salary income. In 1960, this sector provided $84.9 million in wage and salary income, or 16.8 percent of the total wage and salary income.

Transportation facilities. The basin is served by an expanding network of highways and roads. Access is provided by 7 highways on the U. S. numbered system and numerous State numbered hishways and local roads. In addition, 4 interstate highways are under construction on the national system of interstate highways. Considerable effort has been made by local interests in recent years to improve the quality of their farm-to-market roads. Five interstate railroads serve the basin with regularly scheduled freight trains to all major cities and towns. Numerous interstate motor freight carriers operating on the well-developed highway system provide service throughout the basin. Air passenger and freight service are provided from the major cities to all parts of the country. The West Pearl River has a 7-foot-deep navigation channel from the mouth for 58 miles to Bogalusa, Louisiana.

PROJECTED ECONOMY

General. Historical economic growth can be attributed to increased efficiency in production due to technological progress, a high rate of capital input, development of natural resources, advances in education and skills, increasing mobility of the work force, and the economic advantages of large-scale production. Population growth and increasing female participation in the labor force have contributed to the increase in annual man-hours worked. However, these influences have been partly offset by a desire of people for a shorter work week. As a result, there has been an increase in leisure time that has been and will continue to be used for increasing participation in recreational activities. All of these factors were considered in projecting the study area's future economic parameters. Projections of economic activity provide a guide in determining the needs for future development of water and related land resources in the Pearl River Basin.

Population. Total population in the study area has grown every decade since 1870 and is projected to reach 1,380,400 by 2015. This growth is illustrated in Figure 3. Urban population is projected to increase from 254,100 in 1960 to 960,000 by 2015. The rural nonfarm population is projected to grow from 202,900 to 375,200 during this period. Rural farm population has declined since the 1940's and is projected to decrease from 101,000 in 1960 to 45,200 by 2015.

Total employment. The study area total employment is projected to increase from 185,600 in 1965 to 437,000 in 2015. This employment growth, as compared to population and personal income, is shown in Figure 4. Agricultural employment is projected to decline significantly while manufacturing and other employment (including trade and service employment) are projected to increase. These employment trends toward increasing numbers of higher paying jobs are expected to provide a higher living standard for the basin residents.

Personal income. Total personal income, a measure of the basin's economic activity, is projected to grow at a slower rate than national personal income. The expected disparity in income growth between the basin and the United States likely will exist because the United States contains the dynamic geographical growth areas, while the basin has a less aggressive income growth due to its relatively rural character. Per capita personal income in constant 1962 dollars, shown in Figure 5, is projected to grow from $1,713 in 1965 to $4,041 by 2015. In 1965 basin per capita income was 69 percent of the national; by 2015 this is projected to decrease to 62 percent. Wages and salaries accounted for a majority of the total personal income in the past and are expected to comprise a larger share in the future. By 2015, they are projected to account for nearly 66 percent of personal income of the area. Proprietors' income share of the total personal income is projected to decrease 1.4 percent between 1960 and 2015.

PEARL RIVER BASIN STUDY AREA

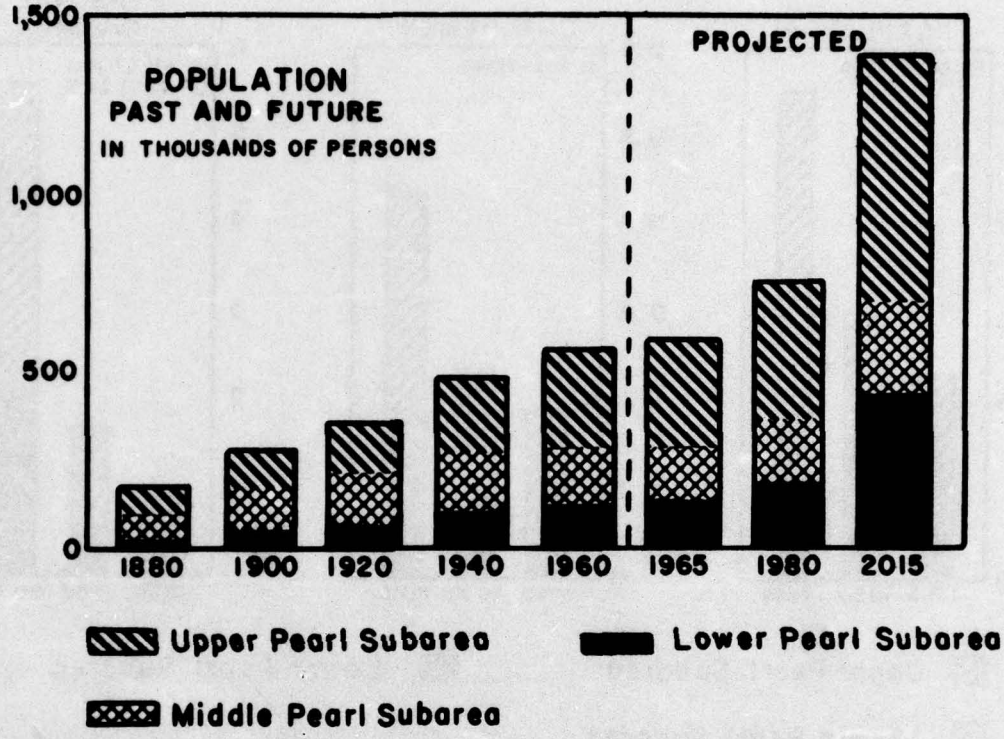


FIGURE 3

PEARL RIVER BASIN STUDY AREA

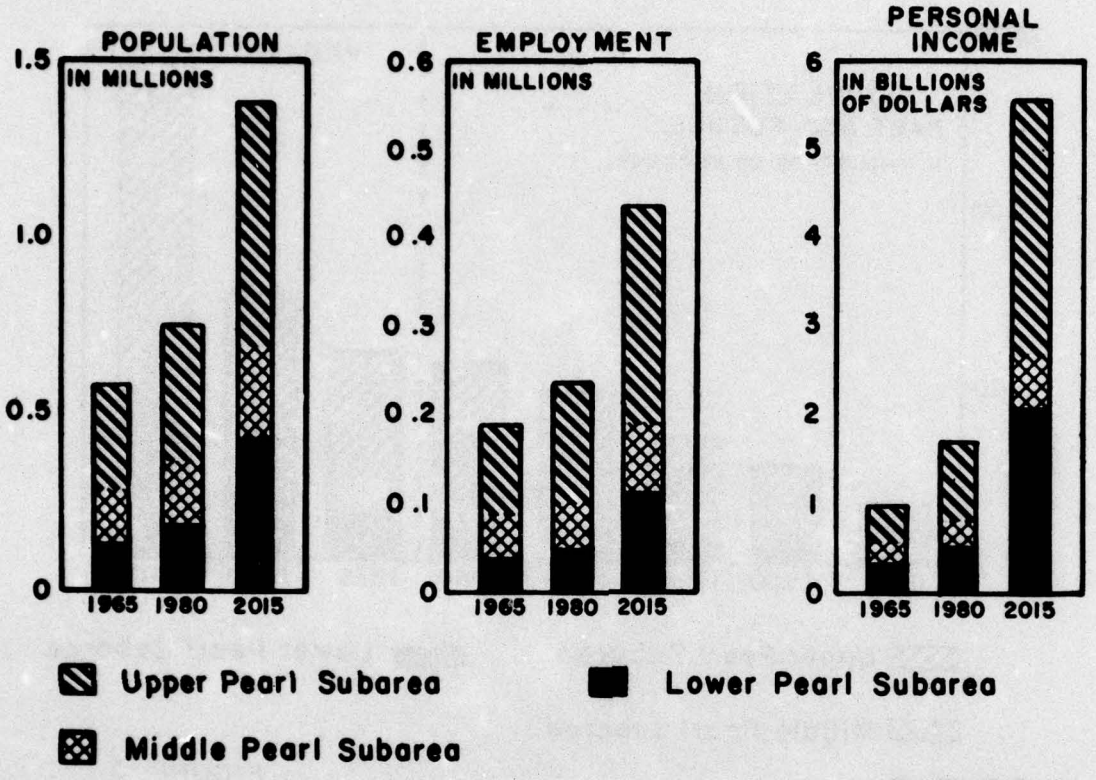


FIGURE 4

PEARL RIVER BASIN STUDY AREA

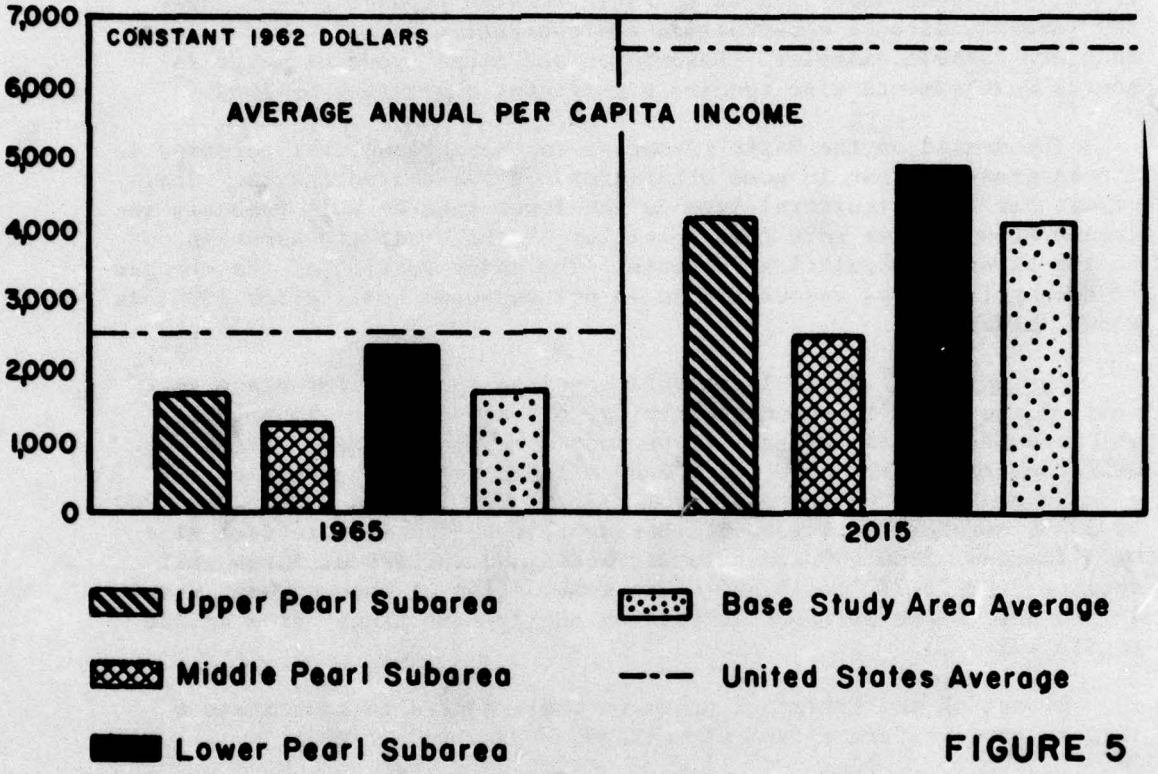


FIGURE 5

Land use. The primary factors that will affect future agricultural production other than demand are the availability and quality of land. Land is being withdrawn from agricultural use for urban, industrial, and other uses related to an increasing population. Highway development, airport construction and recreation demands on the land base are notable examples. Reservoirs and other types of water resource developments also require significant quantities of land.

The demand on the basin resources for nonagricultural purposes is not as great as that in some other areas of the United States. The demand for nonagricultural land in the lower subarea will probably increase at a greater rate than in either of the other two subareas due to the expected population increase. The major portion of the changes in the agricultural resource base is not expected until after 1980, as shown in Table 4.

Agriculture. Agriculture will continue to be an important segment of the basin's economic activity, but its relative importance will become less as the economy becomes more diversified. Farm marketing is projected to reach $360 million by 2015. Net farm income is projected to increase from $57,192,000 in 1964 to $152,093,000 by 2015, as shown in Figure 6. During this period average farm size will increase from 130 acres to 210 acres and numbers of farms will decline from 26,772 to 15,100. The combination of changes will result in the net income per farm increasing nearly five times, from $2,136 to $10,072.

Livestock and livestock products are expected to constitute a larger share of future farm marketings.

Forestry. The trend toward conversion of farmlands to forests has tended to offset the effects of land clearing. Basin-wide, the net result of shifting land use is that the 1980 projected forest acreage will be 3 percent more than the present acreage; however, by 2015, it will be about one percent less.

The growing stock is projected at 4.4 billion cubic feet and sawtimber at 14.4 billion board feet in 1980. The growing stock and sawtimber inventory will decline by 2015 but will still be 33 and 40 percent greater, respectively, than the 1956 inventory. Softwoods are the major species now and by 2015 their proportionate share will be larger. The increase is expected from pine plantings of open areas, inter and underplantings, stand conversion, release work and better management of the forest land. Hardwood growing stock will register a 16 percent increase by 1980 but by 2015 it is expected to be only about 2 percent more than in 1956.

Employment in SIC major groups 24 and 25 is projected to decrease by 312 employees between 1960 and 2015. The SIC major group 26 is expected to continue the past trend, increasing to 12,070 employees by 2015.

Table 4

Major land use, Pearl River Basin
1964 and projected 1980 and 2015

Land use	1964 (acres)	Projected 1980 (acres)	Projected 2015 (acres)
Agricultural			
In farms	3,395,000	3,429,500	3,181,800
Cropland total	959,000	953,400	845,300
Harvested	488,000	404,200	329,700
Pastured	347,000	425,900	409,900
Idle	124,000	123,300	105,700
Woodland total	1,563,000	1,725,500	1,625,300
Pasture	774,000	654,300	621,500
Other land	99,000	96,300	89,700
Non-farm forest[1]	2,891,000	2,762,800	2,678,600
Total agricultural	6,286,000	6,192,300	5,860,400
Non-agricultural			
Federal[2]	16,000	34,700	69,200
Urban	287,000	329,600	592,000
Water[3]	83,000	115,000	150,000
Total non-agricultural	386,000	479,300	811,200
Total approximate area[4]	6,672,000	6,671,600	6,671,600

Source: Cooperative efforts between the Economic Research Service, U. S. Forest Service and Soil Conservation Service, March 1968.

[1] Includes National Forest.
[2] Does not include National Forest.
[3] 1964 --- Includes only water impoundments of less than 40 acres (except Ross Barnett Reservoir) and streams less than 1/8 mile in width (CNI data 1966). 1980 and 2015 -- Includes water impoundments of less than 40 acres and streams less than 1/8 mile in width plus expected impoundments of 40 acres or more built after 1959 or expected to be built as reflected in tentative plan formulation.
[4] Data for 1964 were rounded to nearest thousand acres when data were updated from 1959. The projections were rounded to nearest hundred acres therefore accounting for the difference in approximate area for 1964 and that for 1980 and 2015.

PEARL RIVER BASIN STUDY AREA

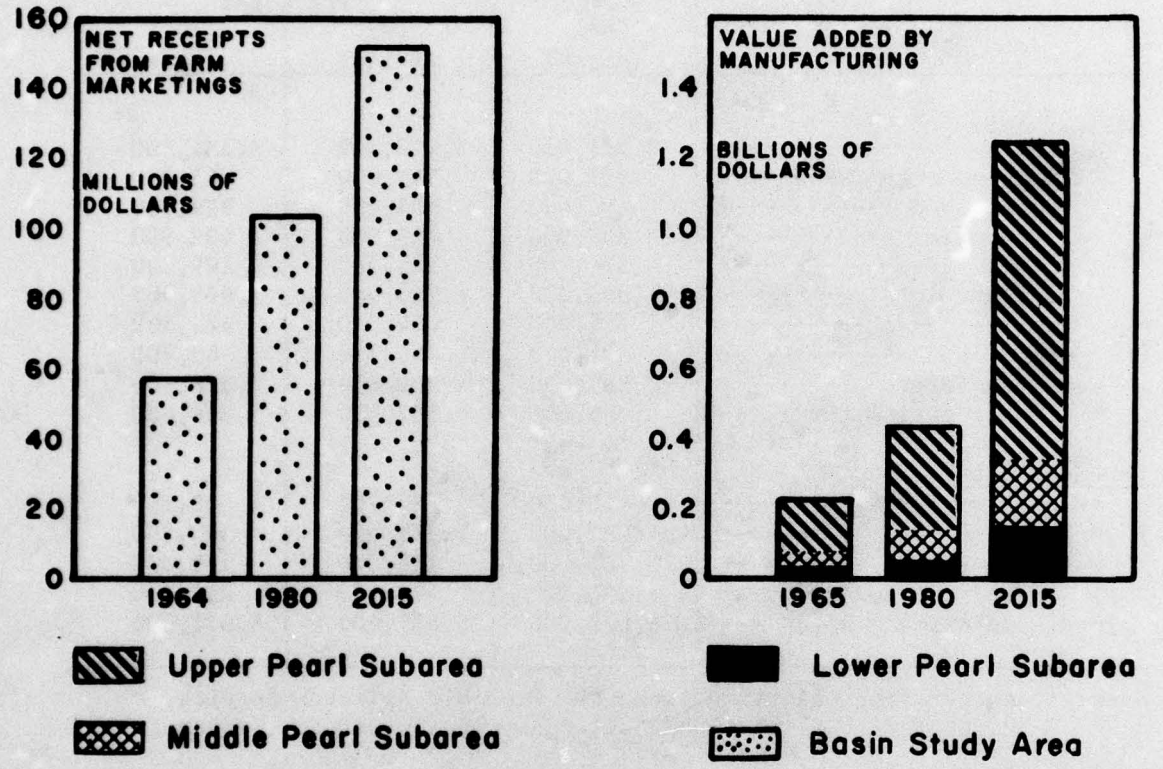


FIGURE 6

Mineral resources. Reserves of petroleum in the basin as of December 31, 1966, estimated from Mississippi and Louisiana reserves determined by the American Petroleum Institute and the American Gas Association, were 561.6 million barrels. Natural gas reserves amounted to 1.2 trillion cubic feet and natural gas liquids reserves were 381.6 million gallons.

No adequate estimate of the amount of available sand and gravel, the foremost solid mineral products in 1965, has been published. The sand and gravel deposits are abundant and widespread in the basin from southern Hinds and Rankin Counties, Mississippi, to Washington Parish and northern parts of Tangipahoa and St. Tammany Parishes, Louisiana.

Construction. The future population growth, the development of manufacturing facilities, and the need for vast public improvements are expected to give considerable thrust to construction employment. Construction employment is projected to increase to 37,300 by 2015, with a wage and salary income of $247.4 million, indicating a large expansion in capital formation.

Manufacturing. Manufacturing employment in the basin is projected to reach 52,800 in 1980 and 97,700 by 2015. Employment in major water-using manufacturing industries is projected to increase from 10,072 in 1960 to 32,320 by 2015. The food and paper groups are expected to make the most significant gains in future employment in the water-using industries. Other manufacturing is forecast to increase from 26,490 in 1960 to 65,400 by 2015.

With the abundance of water and other natural resources available water-using industries have experienced a substantial growth in the past. Future employment in these industries is projected to increase at a slower rate, rising from 28 percent of total manufacturing employment in 1960 to 33 percent by 2015.

Other manufacturing employment mix is expected to change in the future. A decline of employment in lumber, wood and furniture is projected for future years to 2015. The apparel, stone and glass, and electrical machinery industries are projected to expand over the same period.

The proportion of wage and salary income from manufacturing has increased in the past. This trend is expected to continue until 2015, when manufacturing wage and salary income will constitute about 28 percent of total wage and salary income.

Total value added by manufacturing increased at a steady rate during the period investigated. This trend is expected to continue throughout the projection period, reaching approximately 1.3 billion by 2015. This growth is shown in Figure 6.

Wholesale and retail trade. The strong growth phase indicated by the wholesale and retail trade employment trend is expected to continue throughout the forecast period with employment reaching about 90,850 by 2015. With the growth in employment there will be a corresponding growth in wage and salary income. By 2015, this sector will account for $775.5 million or about 22 percent of total wage and salary income.

CHAPTER 4

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 resources developments, either constructed or under construction, include one large reservoir for water supply and recreation, channel development for navigation and flood control, a flood protection project for the Jackson area consisting of levees, pumping stations and appurtenant interior drainage facilities and several Public Law 566 watershed projects. Other Federal and non-Federal developments include several small channel projects for flood control, and several lakes, parks and related recreational areas. At the present time, municipal and industrial use of water in the basin is approximately 82 million gallons per day. Of this total, groundwater supplies an estimated 32 million gallons per day.

EXISTING AND AUTHORIZED WATER RESOURCE DEVELOPMENTS

Corps of Engineers. Existing or authorized projects of the Corps of Engineers in the basin include several navigation projects and a flood control project.

The only active project for navigation, authorized by the River and Harbor Act of 1935, provides a 58-mile-long channel 7 feet deep at mean low water from the mouth of the West Pearl River to Richardson's Landing on the Pearl River at Bogalusa, Louisiana. It consists of a 100-foot-wide channel in the lower 28.5 miles of West Pearl River; an 80-foot-wide and 20.3-mile-long lateral canal with 3 locks having a total lift of 54.5 feet; and a 100-foot-wide channel in a 9.2-mile-long reach of the Pearl River from the head of the canal to Bogalusa. Construction of the project was initiated in October 1938 and it was opened to navigation in November 1953.

The River and Harbor Act of 1966 authorized a plan of improvement for the lower 26 miles of the existing navigation project, consisting of cutoffs and easement of bends, with no increase in project depth. Construction on this project has not been initiated. 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 the Pearl River from Jackson to Edinburg, Mississippi.

The Flood Control Act of 1960 authorized a plan of improvement for flood control measures along the Pearl River at Jackson consisting of: a levee about 1.5 miles long on the west bank with appurtenant interior drainage facilities, including a pumping plant; a levee about 10.3 miles long on the east bank opposite the City of Jackson with appurtenant drainage facilities, including two pumping plants; and development of about 5 miles of the river channel, including a cutoff 2.3

miles long. The improvements were completed and turned over to local interests for operation and maintenance in 1968.

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 Clarke-McNary and Cooperative Forest Management Acts, the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566) and other programs include conservation cropping systems, pasture planting and improvements, farm ponds, drainage, terracing, contour farming, critical area land treatments, tree planting, and woodland management practices.

The first local water management district organized in the basin under Public Law 566 was the Pleasant Valley Creek Watershed, located in Washington Parish, Louisiana. The work plan for this watershed was approved 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 operation (Tallahaga, Beasha, Standing Pine, Pleasant Valley, Richland, Copiah, Silver, Whitesand, Holiday, Eutacutaches, Bogue Lusa, and Bahala). The remaining 2 (Carthage and Hangine Moss) are presently being planned. Most of the land treatment and structural measures (5 floodwater retarding structures and 1.08 miles of channel development) have been installed in the Pleasant Valley Creek Watershed. Some land treatment measures have been installed in the Standing Pine Watershed.

Measures to be installed in the 12 approved watersheds include land treatment for watershed protection, critical land area stabilization and structural measures. Structural measures include 94 floodwater retarding structures, 6 multiple-purpose structures, 5 recreational facilities and 390 miles of channel development. Two of the multiple-purpose structures will contain storage for municipal water supply and 5 will have storage for recreation. Also, 3,959 acres of critical area land 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 pine forest looked when the early settlers arrived.

Department of the Interior. The National Park Service is responsible for the development, maintenance, and operation 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 1830, a post road and highway between Natchez, Mississippi, and Nashville, Tennessee. It is now a scenic motor road with many historic sites, natural areas, and recreational facilities located on it. The Parkway is a major traffic artery for interregional travelers, carrying over 10 million visitors in 1969.

The Bureau of Sports Fisheries and Wildlife is responsible for the Noxubee National Wildlife Refuge. This refuge, which is located just outside the northern end of the basin, supports waterfowl and forest-dwelling wildlife in a flat woods 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. This land was reserved for the Choctaw Indians who refused settlement to permanent reservations in Oklahoma provided by treaty.

Other Federal developments. 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, providing a maximum lift of 18 feet, extends eastward from the harbor into the work area of the Mississippi Test Facility.

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 reservoir, with storage of about 310,000 acre-feet provides about 150 mgd for water supply and a 30,000-acre lake for recreation.

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 and conservation 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.

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 construction of water and related land resource development within its jurisdiction. Developments by the Department in the basin include channel works, drainage projects, and stream access. Approximately 10 miles of channel development work was completed in St. Tammany Parish from 8 to 10 years ago and a small amount has been done in Washington Parish. Seven drainage projects involving approximately 26 miles of channels have been completed. Three boat launching ramps have been constructed for public use.

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

Local interests also constructed levees to protect about 770 acres of land in the Pearl River flood plain in Rankin County, Mississippi. 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. The Mississippi Game and Fish Commission operates the Bienville, Hugh L. White, Wolf River and Choctaw Wildlife Management Areas; the Copiah Game Area; the Marion County Game-fish Area; and six lakes. Four parks in or immediately adjacent to the basin are operated by the Mississippi Park Service and two parks and four other areas are administered by the Louisiana State Park and Recreation Commission. There are also several county operated lakes and parks in the basin.

CHAPTER 5

WATER AND RELATED LAND RESOURCES DEVELOPMENT PROBLEMS AND NEEDS

INTRODUCTION

The need for water and related land resources development in the Pearl River Basin continues to increase as the population increases. Many areas need protection from repeated floods. New and added demands are being made by the developing industrial complexes which are essential to balanced economic growth. Day by day, water-oriented recreation plays a more important part in the leisure time activities of the growing population of the area. These demands require water of sufficient quality as well as quantity. The increasing water and related land resource development needs in the basin are discussed in this chapter.

FLOOD CONTROL

The control of high flows is vital to the security of the people residing in those areas of the basin which are threatened by floods. Tremendous amounts of property damage and business losses have resulted from past floods. Potential damage from floods which could occur is even greater. Careful estimates of the potential damages from floods of several different magnitudes were used as a measure of the severity and extent of the flood problem. However, the anguish and suffering of those affected cannot be measured. For the purpose of this study, evaluation of flood damages was divided geographically between upstream watershed areas and the Pearl River and its principal tributaries. Investigations showed that there are approximately 1,041,750 acres of land subject to flooding in the Pearl River Basin, of which 352,750 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.

Flood control needs have been estimated in terms of average annual flood damages using adjusted normalized prices for crops, average 1968 prices for other damage components, and a 100-year evaluation period beginning in 1980. 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. Of this amount $2,414,000 are damages to crops and pasture, $248,000 are damages to minor farm improvements, $806,000 are damages to roads and bridges, and $246,000 are damages to urban and industrial areas. 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 measures and flood plain regulation programs 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 are not economical units because of the nature of farm enterprises, output and management know-how. Therefore, in many instances, the owner must seek part-time off-farm employment to supplement his farm earnings. Due to the low farm income the owner, even if he desired to place all needed conservation and management practices into use on his farm, cannot 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 resources 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 72 percent of the forest land that is being mistreated or ignored completely will need to be put under good forestry practices. For the future, more scientific management must be applied to all 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 projected production without development and the projected regional share of national production provides a guide to resource development needs. 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 foreseeable future a limiting factor in the development and growth of the agricultural sector of the basin's economy. While much of the land is of low natural fertility, it responds well to proper treatment and management. Idle and partially used land is found throughout the study area. Resource conservation and development are needed to upgrade the area by increasing the present low per acre yield and by putting to use idle land and under-developed resources associated with the land.

Only a small portion of the livestock feed grain or other feed used in the study area is locally grown. Most is acquired from out-of-state sources. Past and future utilization has and will continue to exceed basin production. A continuation of basin imports is expected to prevail.

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/or increase yields, reduce crop failures in dry years and thereby 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

Although changes in the agricultural economy in recent years have resulted in shifts of land from crops to grassland and pasture, erosion remains 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 another 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 of sediment.

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 conditions of the land, does occur from some of the upland areas of the basin.

WATER SUPPLY

The expanding number of persons expected to reside within the area served by resources from the Pearl River Basin, the growing economic activity, the rising standard of living and many new and improved water-using appliances and devices are increasing the requirements for water.

Municipal and industrial water supplies in the basin are obtained from springs, wells and streams. The 1965 municipal and industrial water supply requirements totaled about 82 million gallons per day. These requirements are expected to increase to 280 million gallons per day by the year 2015. The estimates of future municipal and industrial water supply requirements were made by the Federal Water Quality Administration (Appendix H). The Administration estimated that, as a result of additional population and greater per capita water use, the municipal demand will increase from the 1965 level of 44 million gallons per day to 128 million gallons per day in 2015. Industrial water demand will increase in proportion to increased production and employment. The estimated future municipal and industrial water requirements for selected locations in the basin are shown as Exhibit III, Appendix H.

Rural and agricultural water requirements were investigated by the U. S. Department of Agriculture (Appendix G). It was determined that 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. 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.

WATER QUALITY CONTROL

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.

National water quality criteria are expressed in the Federal Water Pollution Control Act of 1961, as amended. The Act established maximum attainable degrees of waste treatment as a prerequisite for any development plan for water quality control. It expressly states that storage

for regulation of streamflow for the purpose of water quality control shall not be provided as a substitute for adequate treatment or other methods of controlling wastes at their source. The recently established Mississippi State Air and Water Pollution Control Commission has been designated as the control agency for Mississippi for all purposes of the Federal Water Pollution Control Act, as amended. For Louisiana, the Stream Control Commission has been designated as the control agency.

Pollution of streams in the Pearl River Basin is not extensive or widespread at the present time. Some pollution problems do exist, however, in several locations. The most severe cases caused by discharge of untreated or inadequately treated waste into the streams are the Pearl River below Jackson and Bogalusa, the East Pearl below Picayune, and the Bogue Chitto below Brookhaven. The interstate aspects of pollution in the vicinity of Bogalusa and Picayune have been the subject matter of two sessions of a Conference on Interstate Pollution of the Pearl River called in accordance with the terms of section 10 of the Federal Water Pollution Control Act as amended. Problems of less severity exist throughout the basin where treated or partially treated wastes are discharged into streams having extremely small or intermittent flow during dry periods. However, the only major problem area expected to remain after installation of adequate treatment facilities is the Pearl River below Jackson where the stream would still be unable to assimilate the waste load. Therefore, something more than conventional treatment will be required to maintain adequate water quality in this area.

OUTDOOR RECREATION

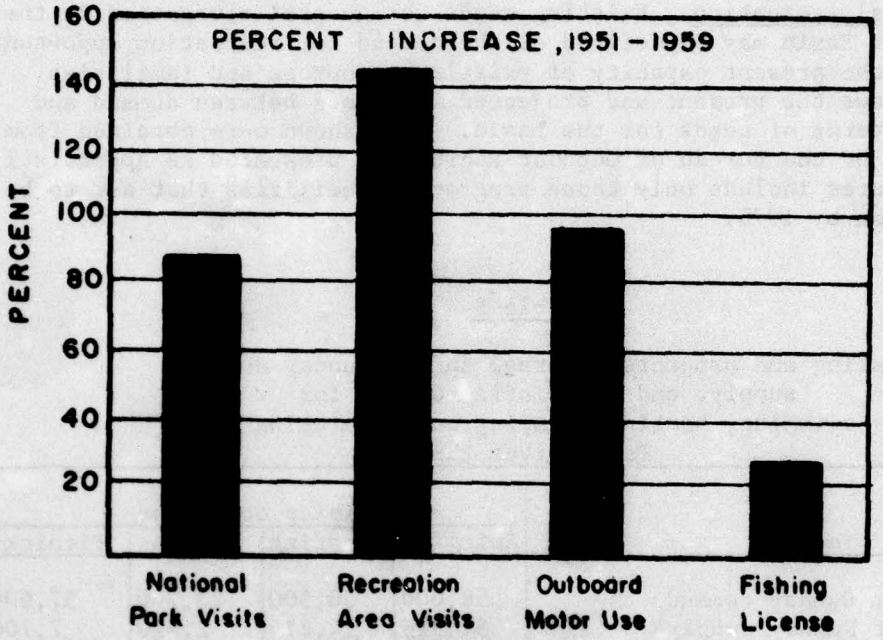
The outdoor recreation needs of the Pearl River Basin were divided into the two categories of general recreation and fish and wildlife enhancement. General recreation includes such water-dependent and water-enhanced activities as swimming, boating, water skiing, sailing, camping, picnicking, sightseeing, hiking, nature study, and incidental fishing in combination with other activities. Fish and wildlife enhancement includes hunting and sport fishing.

The majority of people seeking outdoor recreation wish to be near water areas and to engage in water-associated activities such as swimming, boating, camping, picnicking and fishing. Our expanding population, with more leisure time, more purchasing power, and more mobility, continues to seek more opportunities to enjoy the outdoors. The demand for outdoor recreation, consequently, has been increasing steadily, as illustrated by Figure 7.

The growing demand for outdoor recreation in the Nation is detailed in "Outdoor Recreation for America," a report to the President and to the Congress by the Outdoor Recreation Resources Review Commission (ORRRC). This report, which was submitted in January 1962, shows that the number of occasions of outdoor activities in which persons over 12 years of age will participate is expected to increase 184 percent between 1960 and the year 2000, assuming that the quality and quantity of facilities per capita remain constant. With a greater opportunity factor

Figure 7

Increase in selected outdoor recreation pursuits in the United States[1]



[1] Data obtained from "Outdoor Recreation for America", Jan. 1962.

provided by additional per capita facilities, the number of occasions of participation is expected to increase 228 percent by the year 2000. Outdoor activities, concerned directly with water -- swimming, boating, and water skiing -- should increase 251 percent by the year 2000, while additional per capita facilities should result in a participation increase of 311 percent. The ORRRC report states that proximity to water tends to enhance the pleasure associated with many other recreational activities.

Participation in activities at public recreation areas in the United States represented almost 10 percent of the national market in 1960. The size of the public recreation portion of the market is influenced by the quantity, quality and distribution of public recreation facilities.

In the Pearl River Basin, there are approximately 235,500 acres of land under Federal administration including three national forests, and a portion of a national parkway. There are six State parks having a total area of about 5,260 acres and many local parks. The total amount of Federal and State land in the basin developed for recreation is only 826 acres. In 1963, the reported day visits to the public recreation areas within the basin totaled 634,135. Natchez Trace Parkway visitation in 1968 for the portion in the basin amounted to about 3,142,000

visitors. Water-associated activities in the basin are limited due to the absence of large fresh-water surface areas other than the Ross Barnett Reservoir, completed in 1964, and the shortage of stream access areas and related facilities.

General recreation. Existing needs for general recreation in the Pearl River Basin may be defined as the demand for recreation opportunities less the present capacity of existing resources and facilities. Table 5 shows the present and projected imbalance between demand and supply in terms of needs for the basin. Data shown were obtained from the report of the Bureau of Outdoor Recreation presented as Appendix I. Supply figures include only those programmed facilities that are to be in operation by 1970.

Table 5

Existing and projected average summer Sunday demand, supply, and unsatisfied demand for swimming, boating, camping and picnicking in Pearl River Basin

Year	Activity occasions			
	Swimming	Boating	Camping	Picnicking
1965 Summer Sunday demand	58,000	50,300	23,700	57,600
1965 Summer Sunday supply*	34,916	24,275	2,620	7,100
1965 Summer Sunday unsatisfied demand	23,084	26,025	21,080	50,500
1980 Summer Sunday demand	98,800	85,500	40,500	97,800
1970 Summer Sunday supply*	40,916	25,342	7,345	11,790
1980 Summer Sunday unsatisfied demand	57,884	60,158	33,155	86,010
2015 Summer Sunday demand	319,800	277,500	131,000	316,800
1970 Summer Sunday supply*	40,916	25,342	7,345	11,790
2015 Summer Sunday unsatisfied demand	278,884	252,158	123,655	305,000

*Use that can be expected from supply.

As shown in the above table, there is a critical shortage of facilities in every class of water-dependent and water-enhanced outdoor recreation activities in the Pearl River Basin. Existing swimming areas, picnicking and camping facilities, and water for boating do not satisfy the present demand, nor will the programmed facilities that are to be completed by 1970. The preference of the public to recreate on or near water, coupled with the expected large increases in the total market, indicates that any public water areas developed in the basin would be utilized.

Fish and wildlife enhancement. The fish and wildlife resources of the Pearl River Basin constitute a major recreation potential for residents of the area. Many of the streams in the basin provide excellent opportunity for sport fishing. It is estimated that the approximately 85,000 acres of existing water surface in the basin suitable for fishing have a capacity of approximately 1,859,000 man-days annually. This would provide for all of the estimated 1980 demand and for about 68 percent of the demand expected in 2015.

The hunting capacity of the wildlife resource of the basin is adequate to satisfy the demand for hunting for all periods of the study. Areas in the basin open to public hunting include about 427,250 acres under public ownership or under lease to the Mississippi State Game and Fish Commission and the Louisiana State Park and Recreation Commission. These lands supply hunter opportunity for about 22 percent of the existing demand at the 1965 level, and with intensive management can supply about the same 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 and fish will not automatically remain. Therefore, fish and wildlife resources must be considered in the comprehensive plan of improvement for the Pearl River Basin. The need for providing additional fish and wildlife opportunities for the basin was measured by the Bureau of Sport Fisheries and Wildlife in terms of man-days of hunting and fishing. The present and projected levels of man-days for sport fishing and hunting in the basin, developed by the Bureau of Sport Fisheries and Wildlife (Appendix J), are given in Table 6.

Table 6

Existing and projected annual demand,
supply and unsatisfied demand for hunting and fresh-water fishing
Pearl River Basin

Year	1,000 man-days	
	Hunting	Fishing
1965 Demand	953.3	1,396.1
1965 Supply	2,591.7	1,858.8
1965 Unsatisfied demand	0	0
1980 Demand	1,106.6	1,646.3
1980 Supply	2,537.9	1,858.8
1980 Unsatisfied demand	0	0
2015 Demand	1,857.4	2,715.3
2015 Supply	2,417.7	1,858.8
2015 Unsatisfied demand	0	856.5

NAVIGATION

During the course of this study, investigations were made to determine the justification of providing additional navigation projects within the basin. The detail studies, which are given in Appendix F, revealed that navigation projects at the present time or in the near future are not warranted.

Navigation studies made for the Big Black River Comprehensive Basin Study, submitted to the Water Resources Council on 30 June 1969, considered providing a navigation channel from the Mississippi River to Jackson by way of the Big Black River. These investigations revealed that a navigation project on the Big Black River to Jackson at the present time or in the near future is not warranted.

HYDROELECTRIC POWER

The needs for power in the area are such that hydroelectric developments in the Pearl River Basin could be readily utilized. 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 1929, 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. These studies are given in Appendix F. Comments by the Federal Power Commission and the Southeastern Power Administration on the hydroelectric power potential of the basin are contained in Appendix A.

ENVIRONMENTAL PRESERVATION AND ENHANCEMENT

The Nation's economic development has been accompanied by rapid increases in population, industrialization and urban sprawl. These factors have generated increased pressures upon existing land and water resources as people strive to satisfy their intellectual, emotional and aesthetic aspirations. An increasing public awareness of the need to preserve natural beauty and maintain a high quality environment has resulted in laws which set aside wilderness areas, establish more parks and govern pollution of water and air.

Past indifference to natural beauty, aesthetic values and quality of the environment becomes evident in the problems we now face in trying to improve our surroundings. Such problems are not limited to specific areas as urban or rural, rather, each locale discovers the uniqueness of its environmental fitness problems when corrective measures are undertaken.

Three broad influences from which environmental quality problems arise may be categorized as industrial, urban or rural. Intricate socio-economic problems affect each sphere of influence. Within the industrial and urban realm the greatest hazards exist in maintaining water and air quality. A problem of water quality exists within the Pearl River below Jackson for approximately 40 miles, caused largely by industrial and municipal waste and urban construction. Urban and industrial developers within the basin need to take advantage of the technical assistance available to them in planning land treatment measures where construction takes place. Planning of industrial and urban areas in the future should include preservation of high quality scenic views, preservation of open areas for parks and playgrounds, and establishment of green belts to shield natural beauty detractors.

Corrective measures are now being taken by municipalities and private industry within the basin to improve water quality. Proper development and use of the basin's streams will require high quality water.

Maintaining a quality rural environment will involve continued efforts to obtain proper land use, soil stabilization measures to reduce erosion and stream turbidity, vegetative rehabilitation of areas needing treatment, and an end to indiscriminate waste disposal in rural areas. Cleaning up trash dumps along otherwise scenic rural drives should receive priority by local or multi-county planning boards. Innovations for waste disposals associated with feed lots, dairying and poultry farming are needed. This may include new lagoons and waste treatment methods or commercial use development of by-products.

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 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 lakes of

significant size. Beautification has become an important facet in the design of reservoir projects. 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 "wild" river areas or as free-flowing streams.

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 on Hurricane Survey of Mississippi Coast" was issued in January 1965. Protection by structural means was not found to be economically justified. It was recommended, however, that local authorities give consideration to:

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

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

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

CHAPTER 6

PLAN FORMULATION

GENERAL CONSIDERATIONS

The basic objective in the formulation of a comprehensive plan of development for the water and related land resources of the Pearl River Basin is to provide for the best use, or combination of uses to meet the foreseeable short- and long-term needs within the study area. Plan formulation studies must consider all water and related land problems and the inter-relation of projects and project purposes 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. The plan formulation concepts and procedures are discussed briefly in this chapter and are given in greater detail in Appendix E.

Comprehensive planning for the Pearl River Basin to achieve the above objective was guided by Senate Document No. 97, 87th Congress, 2nd Session, "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources", and by general guidelines and criteria for comprehensive studies.

An analysis and comparison of the solutions available to meet the basin's needs indicated in general terms the elements required in any comprehensive water resource development plan for the Pearl River Basin. The choice of flood control solutions was made on the basis of economics and the type of protection most suitable for each area. Local protection projects would not be economically feasible at the urban damage centers nor would levees be feasible in the rural areas. It would be economical, however, to protect many of the areas with single-purpose flood control storage in reservoirs and in flood-water retarding structures in upstream watersheds. Provision of flood control storage in reservoirs and upstream watershed structures needed for other purposes would be ever more economical due to the sharing of costs between purposes. Land treatment measures and channel development in upstream watersheds would also alleviate flooding in the basin. In presently developed areas where protection is not feasible or where protection would not be complete, a flood plain management program by State and local governments would limit the growth of uneconomic development in areas subject to flooding.

Much 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, supplied from the Ross Barnett Reservoir, and withdrawals from the Pearl River and Bogue Lusa Creek in the southern portion of the basin by two large paper industries. In the future, the majority of the domestic demands will continue to be met from groundwater sources; the large concentrated

demands of heavy water-using industries will probably be met from surface supplies. No major problems of water supply deficiencies are envisioned as long as the existing resources are managed properly.

The water quality problems in the basin, with the exception of the Pearl River below Jackson, would be alleviated by adequate secondary treatment of the wastes discharged to the streams. For the Jackson area, lowflow augmentation from reservoir storage is the most practical and economical method presently available to maintain water quality after adequate secondary treatment of wastes.

Outdoor recreation is not primarily dependent on major water resource developments since parks, natural areas, land, streams and shores provide much opportunity for general recreation and fishing and hunting. However, water is an important focal point for outdoor recreation and is in great demand. Therefore, recreation and fish and wildlife enhancement were considered equal to other purposes during formulation of the comprehensive plan. In addition, any water-resource outdoor recreation developments proposed for the basin must be compatible with the outdoor recreation plan for the States.

Barge navigation on the Pearl River to Jackson, strongly desired by local interests, is not economically feasible at this time. However, it should be included in the framework portion of the comprehensive plan as a potential for future development. The regulated flows from reservoirs provided for other purposes would aid navigation should it be found feasible at some later date.

The development of hydroelectric power is uneconomical at this time. Preliminary studies showed that the low head and small stream flows would produce a benefit-to-cost ratio for the specific power facilities alone of less than unity. However, hydroelectric power should still be considered in the framework for future planning as a long-range potential.

Land management, conservation measures, vector control, maintenance of an adequate water hygiene program and other nonstructural measures are vital parts of any water and related land resource development plan.

The quality of the environment of the basin could be enhanced by measures to satisfy other needs. Scenic and other aesthetic values would accrue to the area from the creation of lakes and the restoration of polluted and eroded areas. However, care must be exercised in the selection, planning and design of channel development projects so that the impact on the environment would be minimized. In addition some streams should remain as free-flowing streams in their natural state.

PROJECT SELECTION

It is essential in developing the 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 of 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.

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 both the national and regional interest. As previously stated, the case for regional development has been left to future investigations since the benefit evaluation required is beyond the scope of this study.

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 most economical 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.

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. Following selection of the basic flood control plan, other purposes were added as appropriate and needed.

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, 16 upstream watershed projects and one additional multiple-purpose structure in each of 7 early-action and 3 authorized upstream watersheds for the framework for future planning. In addition, works of improvement in 12 upstream watersheds will be accomplished under existing Public Law 566 authority.

Development of part of the Pearl River Boatway was included in the early-action program to meet some of the recreational needs of the area. Included were 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. 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.

Certain nonstructural measures in the areas of flood plain management, agricultural land and forest management, health, water quality, recreation, preservation, fish and wildlife enhancement and data collection also were developed by the study participants to enhance the conditions of health and welfare of the people and the quality of their environment. These measures would operate alone and in conjunction with the structural measures and are an integral part of the early-action plan.

CHAPTER 7

THE COMPREHENSIVE PLAN

GENERAL FEATURES OF THE PLAN

The comprehensive plan developed for the Pearl River Basin includes the existing and under-construction water 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. The "Early-Action Program," includes projects found necessary to meet immediate needs and to be economically feasible for construction within the next 10 to 15 years.

2. The "Framework for Future Planning," includes projects which could help meet future needs of the basin and are potentially feasible for development or are strongly supported by local interests.

Data on the projects that constitute the comprehensive plan are given in Table 7 and their locations are shown on Plate 1.

In addition to the structural measures listed in Table 7, nonstructural measures in the following areas are also vital parts of the Plan and should be implemented as soon as practicable: flood plain management, agricultural land and forest management, health, water quality, recreation, fish and wildlife enhancement, preservation of natural areas, data collection and review of water resource programs and policies.

The projects and programs of the early-action portion of the proposed plan of improvement would satisfy 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 could supplement the early-action plan of 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 consist of:

- 3 multiple-purpose reservoirs;

- Land treatment measures, 179 floodwater retarding structures, 29 multiple-purpose structures, and 1,202 miles of channel development in 30 upstream watersheds, and critical land area stabilization for the remainder of the basin; and

Table 7

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

RESERVOIRS[1]

Name	Location: Stream	Location: Mile	Location: County[2]	Drainage area (sq.mi.)	Purpose[3]	Total storage capacity (acre-feet)	Area at normal pool (acres)
			EXISTING Non-Federal				
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
			RECOMMENDED FOR INCLUSION IN EARLY-ACTION PROGRAM Federal				
Ofahoma	Yockanookany R.	8.7	Leake	469	FC,R,FW	620,000	3,700
Carthage	Lobutcha 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
			RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING				
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
	EXISTING Federal projects	
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
	RECOMMENDED FOR INCLUSION IN EARLY-ACTION PROGRAM Non-Federal	
Recreation navigation-Pearl R.Boatway	Pearl R. (to Edinburg)	Clearing and snagging
	RECOMMENDED FOR INCLUSION IN FRAMEWORK FOR FUTURE PLANNING	
Commercial navigation	Pearl River (to Jackson)	Canalization
Recreation navigation	Pearl River (above Edinburg) Strong R., Yockanookany R., Lobutcha Creek Bogue Chitto	Clearing and snagging

Table 7 (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
Fannegusha	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
Nanawaya	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[6]	-
Topisaw	2A-M	---	--	1[6]	-
West Fork Hobolochitto	3 -M	175,000	34.7	1	9
Mt. Herman (Little Silver)	3A-ML	110,000	42.3	1	1
Clebber	4A-M	92,500	21.7	1	8
Boone	5A-M	---	--	1[6]	-
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[6]	-
Caney Creek	23	125,000	26.7	2	6
Limestone Creek	24	59,200	26.1	1	6

Table 7 (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 ([8])
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	---	--	1[7]	-
Pelahatchie	31	---	--	1[6]	-
Balucta	35	38,700	29.7	1	2
Standing Pine	40	---	--	1[7]	-
Lower Lobutcha	49	98,800	34.5	-	9
Tallahaga	53	---	--	1[7]	-
Upper Lobutcha	55	105,000	36.9	1	15
Tibby Creek	56	---	--	1[6]	-
Louisiana					
Lawrence	1L	172,000	21.0	1	9
Pushepatapa	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.

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

These measures are discussed in the following paragraphs.

Reservoirs. The 3 reservoir projects, Ofahoma, Carthage and Edinburg, would variously serve the purposes of flood control, water quality control, general recreation and fish and wildlife enhancement. The locations of the projects are shown on Plate 1 and a brief description of each is given in the following paragraphs. A detailed description is given in Appendix F.

Ofahoma Dam and Reservoir. The Ofahoma damsite is located at mile 8.7 on the Yockanookany River in northwestern Leake County. A dam at this location would control the runoff from 469 square miles, or about 95 percent of the entire Yockanookany River Basin. This project would be constructed for the purposes of flood control, recreation and fish and wildlife enhancement.

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 a maximum height of about 64 feet. The reservoir would cover about 3,700 acres and contain 30,000 acre-feet of water at normal pool elevation 348.5. Additional storage of 210,000 acre-feet (8.4 inches of runoff) for containing the 100-year flood volume would be provided. A total of 36,800 acres of land would be required for the project. Recreation facilities would be provided for fishing, boating, swimming, camping, picnicking, hiking and other water-related or water-enhanced activities. This project would necessitate relocation of approximately 14 miles of the Natchez Trace Parkway.

Carthage Dam and Reservoir. The Carthage damsite is located in the central part of Leake County at mile 13.2 on Lobutcha Creek. A dam at this location would control the runoff from a 266-square-mile drainage area, or about 81 percent of the entire Lobutcha Creek Basin. This project would be operated for the purposes of flood control, recreation and fish and wildlife enhancement.

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 dam would be approximately 6,000 feet long with a maximum height of 55.0 feet. The reservoir would cover about 3,000 acres and contain 20,000 acre-feet of storage at normal pool elevation 384.2 m.s.l. Additional storage of 112,500 acre-feet (7.9 inches of runoff) would be provided for containing the 100-year flood volume. Facilities would be provided for water-dependent and water-enhanced recreation activities.

Edinburg Dam and Reservoir. The Edinburg damsite is located at mile 390.4 on the Pearl River. A dam at this location would control the runoff from 827 square miles, or about 9.5 percent of the entire Pearl River Basin. The purposes included in this proposed project include flood control, water quality improvement, recreation, and fish and wildlife enhancement.

The plan for the Edinburg project includes compacted earthfill and concrete non-overflow sections, a 292-foot gated spillway containing 6 tainter gates, and two 3 x 5-foot sluices in the right abutment of the spillway. The dam, including the spillway section, would be 7,154 feet long and would have a maximum height of 54 feet. The reservoir at normal pool elevation 377.0 would cover approximately 12,600 acres. The average summer pool would cover 12,000 acres. Storage of 130,000 acre-feet would be available below elevation 377.0, of which 89,400 would be storage for water quality control and recreation and 40,600 for sedimentation storage. Additional storage of 390,000 acre-feet (8.8 inches of runoff) would be provided for controlling the 100-year flood. Facilities would be provided for water-dependent and water-enhanced recreation activities.

Upstream watersheds. There are 30 watersheds, all in Mississippi, in which land treatment and structural measures were determined to be needed and to be economically feasible for initiation of construction within the next 10 to 15 years. In addition, critical land area stabilization measures are needed for the remainder of the basin.

Land treatment and critical land area stabilization measures would be required on approximately 1,001,000 acres of land and 6,100 miles of road banks. Of this total, 958,000 acres of land and 2,600 miles of roadbank are in the 30 early-action watersheds. There are 179 floodwater retarding structures, 29 multiple-purpose structures for flood control and recreation, and 1,202 miles of channel development planned for the 30 watersheds. The floodwater retarding and multiple-purpose structures, which would consist of a compacted earthfill dam having a fixed drawdown tube and an emergency spillway, would control the runoff from approximately 1,256 square miles. Flood control storage of 412,200 acre-feet (equivalent to 5.1 inches of runoff from the area controlled) would be provided. Channel development would consist of snagging and shaping, clearing and snagging, and channel enlargement or excavation. Recreation facilities would be provided for water-dependent and water-enhanced activities of fishing, boating, swimming, picnicking and camping. Pertinent data on the structural development within the 30 watersheds are given in Table 8, and their locations are shown on Plate 1.

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 and building of 82 recreation areas with boat-launching ramps along the Pearl River and its principal tributaries. The recreational boatway route is shown on Plate 1.

Table 8

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

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 pleasure 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 and other recreation facilities. The general locations of these projects are shown on Plate 1. 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 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 certain nonstructural 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. These nonstructural measures are summarized as follows:

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 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) Lobutcha 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 which would decrease the basin's supply of free-flowing streams should be very carefully evaluated when the basin needs so indicate. The nonstructural measures previously described are of a continuing nature and are equally as pertinent to the framework for future planning as to the early-action program.

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 economically 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, and their locations are shown on Plate 1.

Reservoirs. There are 9 reservoirs included in the framework for future planning. These reservoirs have potential storage for flood control, water quality control, water supply, 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 economic justification, resolve any conflict with the stream preservation program in the early-action program, and to evaluate possible alternative solutions.

Pertinent data for the 9 reservoirs included in this category are given in Table 7.

Upstream watersheds. Sixteen upstream watersheds were determined to be potentially feasible projects and required to help satisfy future needs in the basin. These future projects would include the following measures: land treatment; single-purpose flood-water retarding structures; multiple-purpose structures incorporating storage for flood control and sedimentation, water supply, lowflow augmentation, recreation and fish and wildlife enhancement; and channel development. In addition, it is anticipated that at least 10 additional multiple-purpose structures including recreation will be needed in watersheds already approved for operation or in the early-action program.

Pertinent data for the 16 framework watersheds and on the additional structures in the early-action watersheds are given in Tables 7 and 9, respectively. The location of each watershed is shown on Plate 1.

Navigation improvements. The navigation improvements considered in this report would provide barge transportation from the mouth of the Pearl River to Jackson. The project would consist of 11 low-head dams with locks having lifts varying from 11 to 27 feet. 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, 16 upstream watershed projects, additional multiple-purpose structures in 10 authorized or early-action watersheds, and improvements for barge navigation. The locations of

the reservoirs, upstream watersheds and navigation improvements are shown on Plate 1.

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 desirable means of satisfying the basin needs. Such study should be undertaken when periodic review of the comprehensive plan indicates the need.

Table 9

Data on additional projects in approved and early-action watersheds 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	29	1	400
Pelahatchie	31	1	400
Standing Pine	40	1	250
Tallahaga	53	1	300
Tibby Creek	56	1	400

CHAPTER 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 Chapter 7 contains an early-action program 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 planning future development.

FLOOD CONTROL

Development of the multiple-purpose reservoirs with flood control storage and upstream watershed projects contained in the early-action program would provide varying degrees of 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 10. The urban area of Jackson outside the existing levee project would be provided an even higher degree of flood protection.

Table 10

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	3,688,400	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 & 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 required. 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 would 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 operations.

LAND TREATMENT AND WATERSHED PROTECTION

The primary effects of watershed protection measures 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 productiveness of soils. 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.

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 interstate aspects of pollution in the vicinity of Bogalusa and Picayune have been the subject matter of two sessions of a Conference on Interstate Pollution of the Pearl River in accordance with the terms of section 10 of the Federal Water Pollution Control Act as amended.

The study showed that adequate treatment, secondary or equivalent, and control of wastes discharged into the stream would eliminate the problem in every area except the Pearl River below Jackson. Storage in the proposed Edinburg project to augment low flows in the Pearl River at and below Jackson would assure proper assimilation of adequately treated waste discharges from the city and surrounding industrial and urban areas. Higher dissolved oxygen levels would be maintained which are essential for the propagation of fish. By providing reservoir releases during summer months when water quality needs are most severe, flow of an acceptable quality would be maintained in the stream to permit recovering the 40 miles of the river that is severely degraded. Assured water quality would provide favorable conditions for fish and wildlife enhancement and for general recreation use of the streams. The riparian property owners and all other users of the stream would enjoy improved aesthetics, clean surface waters, and an improved public health environment.

GENERAL RECREATION

Studies revealed a need for privately and publicly developed facilities to provide additional opportunity in the water-dependent or water-enhanced recreation activities 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 needs satisfied by expansion of existing areas, establishment of free-flowing streams, scenic drives, scenic areas, hiking and saddle trails, and from recreational development by the private sector, are not included in the above estimates.

The need for recreation facilities in the years after 1980 is expected to increase as the population and per capita incomes increase. A portion of this increasing need 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 need 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.

FISH AND WILDLIFE

Studies show that there are now, and will be through the year 2015, 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 would provide additional fishery habitat in excess of the anticipated demand.

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. This shift of hunter demand is possible due to Jackson, the major population center, being located near the southern boundary of the Upper Subarea and the easy access afforded the hunters of this area to the Middle and Lower Subareas via Interstate Highway Number 55. 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, the stream development program for the upstream watersheds, and Pearl River Boatway. Utilization of available 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. The effects of the Pearl River Boatway and associated parks on the fish and wildlife resources of the basin would be insignificant.

Protection and preservation of unique and scenic environmental areas associated with the basin streams, National Forest lands, State wildlife management areas, and developments included in the early-action program, would provide additional opportunities for birdwatching and wildlife photography and other varied recreational experiences. 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 low flow augmentation for water quality improvement should materially increase the freshwater commercial fishery resources of the basin. However, to fully satisfy the projected needs, significant growth in fish-farming operations will be required to supplement production from natural waters. Although the estuary habitat would be improved by the improvement in water quality including decreased sediment load, and by the increased low flows to some extent, the major expansion of the marine fishery resources must come from improved fishing techniques and increased markets for species presently underutilized.

HEALTH ASPECTS

The impact of the early-action program insofar as health aspects are concerned would be favorable since appropriate attention is to 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 judicious 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, general 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 birdwatching, nature study, and associated activities. Enhancement and preservation of the scenic qualities of the streams and historical and archeological sites will be carefully pursued.

There is a possibility of some aquifers in the groundwater system becoming locally water-logged as a result of the proposed reservoirs and upstream watershed structures. However, the overall effect of the structures will probably be beneficial to the groundwater resource. Increased storage in the aquifers will result from raising the water table. The quality of the water making up the increased storage will be different from the existing groundwater; hence, dependent upon the quality of the blended water, a further benefit may be realized.

The preservation measures for all or portions of 14 free-flowing streams, totaling about 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 populations in these areas will be reduced.

Other adverse effects include the loss of free-flowing streams at impoundment sites, the loss of high value wildlife habitat in hardwood bottomlands, and the loss of 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.

Construction of the proposed Ofahoma Reservoir would require relocation of approximately 14 miles of the Natchez Trace Parkway. The abandoned portions of the Natchez Trace would be utilized in planning recreation facilities for the project.

CHAPTER 9

ECONOMIC EVALUATION OF THE EARLY-ACTION PROGRAM

GENERAL

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 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, including benefits foregone. 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. 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.

Cost estimates for upstream watershed projects were based on detailed studies of sample watersheds and the data expanded to similar watersheds on which no detailed studies were made. 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 as a group as part of the plan.

The cost estimate for the pleasure boatway along the Pearl River was developed 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 for all projects include interest and amortization on the 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.

BENEFITS

General. An economic evaluation of benefits was made for each reservoir project and upstream watershed considered and the pleasure boatway. 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 (1980) and distributed in an equivalent annual series using an interest rate of 4.875 percent over a 100-year period of economic analysis. In addition to the above direct benefits, estimates of area redevelopment benefits for all projects and a partial evaluation of secondary benefits for the upstream watershed projects were made. However, these benefits were not used in project justification. Execpt for these relatively minor benefits, no attempt was made to evaluate secondary benefits that would result from the early-action projects since development of the necessary procedures was beyond the scope of this study.

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 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 additional 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 damage. 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 this method of computing water quality control benefits is presently being studied by all concerned Federal agencies under the Water Resources Council. However, since the problem has not been resolved, it was agreed at the field level that the benefits would continue to be determined by the least-costly-alternative method.

General recreation. 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 and waterfowl hunting benefits were based on estimates of days of 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. 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 employed 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 $18,381,000, giving an overall benefit-to-cost ratio of 1.8. A summary of the first costs, annual charges, benefits and benefit-to-cost ratios of the various elements of the structural portion of the early-action program is given in Table 11. Secondary benefits of $614,000 for the upstream watershed projects and area redevelopment benefits of $1,363,000 are not included in the above figures. These benefits would increase the overall benefit-to-cost ratio to 2.0.

Table 11

Summary of first costs, annual charges, benefits, and benefit-to-cost ratios for portions of the early-action program for the Pearl River Basin (100-year project life [1980-2080], 4.875 percent discount rate)

Item	Reservoirs			Upstream watershed projects	Pearl River boatway	Total
	Ofahoma	Carthage	Edinburg			
PROJECT FIRST COSTS ($1,000)						
Initial	$ 33,100	$ 15,500	$ 30,700	$ 87,259[1]	$ 6,408	$ 172,967
Delayed	2,680	2,340	8,700	---	---	13,720
Total	35,780	17,840	39,400	87,259	6,408	186,687
PROJECT ANNUAL CHARGES ($1,000)						
Initial	1,928	973	1,905	3,818[2]	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
Subtotal	2,135	1,214	4,387	4,536	2,005	14,277
Delayed:						
Recreation	798	646	2,660	---	---	4,104
Total primary benefits	2,933	1,860	7,047	4,536	2,005	18,381
Other benefits	440[3]	202[3]	400[3]	935[4]	69[3]	2,046
Total benefits	3,373	2,062	7,447	5,471	2,074	20,427
BENEFIT-TO-COST RATIO (primary benefits)	1.4	1.7	3.0	1.2	2.5	1.8
BENEFIT-TO-COST RATIO (including other benefits)	1.6	1.9	3.1	1.4	2.5	2.0

[1] Includes land treatment, basinwide critical land area stabilization and structural measures.

[2] Structural measures only.

[3] Area redevelopment.

[4] Includes $614,000 secondary and $321,000 area redevelopment.

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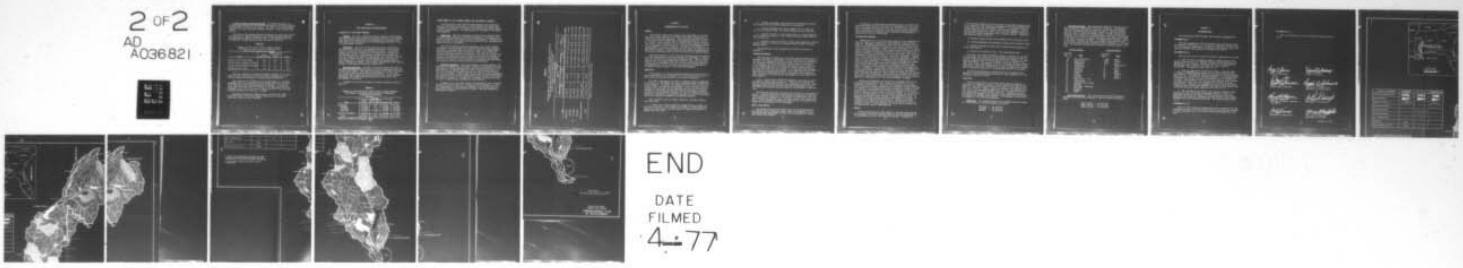

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Costs of other programs and studies. As stated previously, the primary responsibility for the nonstructural measures is with the States, municipalities, and the private sector. The costs of the nonstructural measures for which costs were estimated 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 12.

Table 12

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.

CHAPTER 10

COST ALLOCATION AND APPORTIONMENT

ALLOCATION OF COST AMONG PURPOSES

General. The costs of multiple-purpose reservoirs and upstream watershed projects were allocated to project purposes in such a manner that each project purpose would share equitably in the saving that would result from construction of a multiple-purpose project in lieu of single-purpose projects.

Reservoirs. The costs of the reservoirs in the early-action plan have been allocated to the purposes applicable to each project using the "separable cost-remaining benefit" method. This method assures that the cost allocated to any purpose does not exceed the corresponding benefits; each purpose is assigned as a minimum the cost of including that purpose in the project; and separable costs are less than alternative costs. The $93,020,000 first costs for the three reservoirs in the early-action program has been allocated to project purposes as follows: flood control, $44,260,000; water quality control, $7,948,000; and recreation, $40,812,000.

Upstream watersheds. The cost of multiple-purpose structures in upstream watersheds has been allocated to project purposes by the "use of facilities" method. This method distributes joint costs in proportion to the storage capacity used for each purpose. Of the total $54,749,000 first cost of the structural measures in the 30 upstream watersheds, $39,441,000 has been allocated to flood control and $15,308,000 to recreation.

A summary of the costs allocated to project purposes is given in Table 13.

Table 13

Summary of allocated project first costs to project purposes for Ofahoma, Carthage and Edinburg Dams and Reservoirs and upstream watersheds
($1,000)

Item	Purpose			Total
	Flood control	Water quality control	Recreation	
Reservoirs	$ 44,260	$ 7,948	$ 40,812	$ 93,020
Ofahoma	(23,091)	(---)	(12,689)	(35,780)
Carthage	(8,950)	(---)	(8,890)	(17,840)
Edinburg	(12,219)	(7,948)	(19,233)	(39,400)
Upstream watersheds	39,441	---	15,308	54,749[1]
Total	$ 83,701	$ 7,948	$ 56,120	$147,769

[1] Does not include land treatment costs.

APPORTIONMENT OF COST BETWEEN FEDERAL AND NON-FEDERAL INTERESTS

The construction costs and the annual operation and maintenance costs of the projects allocated to project purposes were apportioned to Federal and non-Federal interests in accordance with existing laws, policies and procedures. The apportionment is discussed in the following paragraphs.

Reservoirs. The costs allocated to flood control and water quality control were assigned to the Federal Government in accordance with Federal legislation for reservoirs of the type proposed. The apportionments were made to the Federal Government because of the widespread and general nature of the benefits.

The costs allocated to general recreation and fish and wildlife enhancement would be shared by the Federal Government and non-Federal interests in accordance with the policy outlined in the Federal Water Project Recreation Act (Public Law 89-72). Under this act Federal interests would pay one-half the separable first cost and all the joint costs of the project allocated to recreation and fish and wildlife enhancement and non-Federal interests would pay one-half the separable first cost and bear all costs of operation, maintenance and replacement of recreation and fish and wildlife areas and facilities.

Upstream watersheds. The costs allocated to project purposes were apportioned to Federal and non-Federal interests in accordance with the provisions of the Watershed Protection and Flood Prevention Act of the 83rd Congress, as amended (Public Law 566). Under the provisions of this act, non-Federal interests must pay that portion of the construction costs allocated to flood control due to costs of obtaining easements and rights-of-way and contract administration and one-half of the costs allocated to recreation. In addition, non-Federal interests must bear all cost of operation and maintenance of the projects.

A summary of the cost apportionment between Federal and non-Federal interests is given in Table 14. Of the total $147,769,000 first cost for construction for the structural measures in the early-action program, $26,665,000, or approximately 18 percent, has been assigned to non-Federal interests.

Table 14

Apportionment of first costs of Ofahoma, Carthage and Edinburg Dams and Reservoirs and upstream watershed projects between Federal and non-Federal interests
(First costs in $1,000)

Item	Purpose								
	Flood control		Water quality control		Recreation		Total		
	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Total
Reservoirs	44,260	---	7,948	---	28,102	12,710	80,310	12,710	93,020
Ofahoma	(23,091)	(---)	(---)	(---)	(8,749)	(3,940)	(31,840)	(3,940)	(35,780)
Carthage	(8,950)	(---)	(---)	(---)	(6,570)	(2,320)	(15,520)	(2,320)	(17,840)
Edinburg	(12,219)	(---)	(7,948)	(---)	(12,783)	(6,450)	(32,950)	(6,450)	(39,400)
Upstream watersheds	32,796	6,645	---	---	7,998	7,310	40,794	13,955	54,749[1]
Total	77,056	6,645	7,948	---	36,100	20,020	121,104	26,665	147,769

[1] Does not include land treatment costs.

CHAPTER 11

IMPLEMENTATION OF THE PLAN

GENERAL

The proposed comprehensive plan for the development of the water and related land resources of the Pearl River Basin includes structural and nonstructural measures. Those structural measures included in the early-action program should be implemented within the next 10 to 15 years. Future studies will be required before proper consideration can be given to employing any of the structural measures included in the framework portion of the plan. Therefore, the discussion of implementation of structural measures in this report is limited to the early-action program. Nonstructural measures should be implemented at the earliest practicable date in order to obtain their maximum benefit.

Structural measures in the early-action program would be constructed under authorities of the Corps of Engineers, Department of Agriculture, and the Pearl River Basin Development District. Each of these agencies and the Louisiana Department of Public Works would also play a major role in implementation of the various nonstructural measures. The implementation of the structural and nonstructural measures is discussed by major features in the following paragraphs.

RESERVOIRS

In accordance with existing Federal statutes and policies the primary responsibility for development of the reservoir portion of the early-action program was assigned to the Corps of Engineers.

The Corps of Engineers will submit a separate report recommending authorization of the Ofahoma, Carthage and Edinburg Dams and Reservoirs by the Congress. The report will contain details on the projects and required local cost sharing and assurances. Local interests would be required to pay one-half of the separable costs of all three projects allocated to recreation and fish and wildlife enhancement, presently estimated to be $12,710,000, and bear all costs of operation and maintenance and replacement of recreation and fish and wildlife enhancement facilities, presently estimated to be $270,000 annually.

Local interests would be further required to furnish assurance that they would:

a. Obtain water rights needed for storage and use of water, resolve any conflicts in water rights as necessary to assure effective operation of the projects, and use water in a manner consistent with Federal and State laws;

b. Prevent encroachment and obstruction of downstream channels which would adversely affect operation of the projects;

c. Provide assurances that water flowing into all reservoirs will be of a quality needed for project purposes in each reservoir;

d. Control pollution in the streams subject to lowflow augmentation by adequate treatment or other methods of controlling wastes at their source; and

e. Exercise to the full extent of their legal capability, control against removal or detention of streamflow made available for water quality control.

The assurances of local cooperation are discussed further in Appendix B.

UPSTREAM WATERSHEDS

The Department of Agriculture would have primary responsibility to implement the works of improvement in the 30 early-action watersheds. In view of the immediate needs for services which could be provided by the remaining 28 potential watershed projects listed in the early-action program, and since the current and expected level of activity of the PL-566 program would not permit all these needed projects to be installed within the next 15 years, it is expected that the Department may ask concurrent authorization of at least those project elements which are interdependent and are interrelated with existing or other proposed early-action project developments of other Federal and State agencies.

Local interests would provide the necessary cooperation in implementing and constructing the projects. Plans would be developed by the local sponsoring organizations, soil conservation districts, water management districts and the Pearl River Basin Development District, with technical assistance being provided by the Department of Agriculture.

Watershed projects would be planned and installed in a progressive manner. A legally constituted local sponsoring organization would provide assurances satisfactory to the Secretary of Agriculture that they would provide the necessary local interests' share of the installation costs, obtain necessary easements and rights-of-way, and guarantee the operation and maintenance of the development.

PEARL RIVER BOATWAY

The boatway and associated parks, which would provide primarily for selected local recreational needs, would be implemented by the Pearl River Basin Development District with the assistance of applicable Federal-aid programs.

In addition to constructing the boatway project, the Pearl River Basin Development District will assist in implementation of the total plan by coordinating all facets with other State and local agencies, and by furnishing or assisting in securing the necessary assurances of local cooperation for proposed Corps of Engineers and Department of Agriculture projects in Mississippi.

NONSTRUCTURAL MEASURES

Implementation of the nonstructural measures of the comprehensive plan will require the cooperation of many Federal, State and local agencies. Management programs for controlling and regulating the economic use and development of flood plain areas and for reducing flood losses should be undertaken by State and local governments in conjunction with Federal interests. While Federal agencies can prevent unwise Federal and Federally-assisted construction in the flood plains and provide information and guidance on flood hazard areas, State and local leadership is essential for effective flood plain management. Regulation of flood plain usage by zoning, subdivision regulations, building codes, and other police-power measures can be accomplished only by State or local governments. The States should encourage local communities with existing or potential flood problems to establish flood plain control and request a flood plain information study be undertaken to delineate flood problems in these communities throughout the State. In addition, consideration should be given to the preservation of fish and wildlife habitat, public recreation sites, open space, greenbelts and other uses that would enhance the quality of the environment. The Corps of Engineers, under provisions of Section 206, Public Law 86-645, will assist State and local governments and their planning agencies in implementation of flood plain management programs.

Current land management and conservation programs should be continued and accelerated by local interests in cooperation with the Department of Agriculture. State and local agencies, in cooperation with the Bureau of Outdoor Recreation and the Bureau of Sport Fisheries and Wildlife, should undertake programs to complete an adequate recreation plan and a diversified fish and wildlife program for the basin. Special attention should be given, during development of the recreation plan, to the preservation of the free-flowing streams and studies of potential recreational areas included in the comprehensive plan. An adequate water hygiene program should be maintained by the States in cooperation with the Public Health Service. Maximum practicable treatment of all wastes entering the basin's streams will require a cooperative effort of State agencies, the Public Health Service, and the Federal Water Quality Administration.

SUMMARY

A plan including such a large number of structures and affecting so many people in so many different areas can only be implemented by the cooperative effort of all interests concerned. Although most

of the structural measures of the plan would be provided by Federal agencies, a portion of the construction program would be the responsibility of the Pearl River Basin Development District. In addition to having primary responsibility for a part of the structural measures, local interests would be required to pay a portion of the separable recreation and fish and wildlife enhancement cost in Federal projects. Therefore, they should at least be able to:

- Collect revenue and pay the non-Federal share of project costs,
- Provide management and maintenance services for recreation areas,
- Provide coordination among other interested State agencies and local organizations,
- Preserve the reservoir sites in the comprehensive plan.

The Pearl River Basin Development District, an agency of the State of Mississippi, was created by the Mississippi Legislature in 1964 to provide a means of coordinating and participating in planning and implementing recommendations for the beneficial use of the waters in the Pearl River Basin. This agency is capable of meeting the above requirements and has furnished assurances that it will meet the items of local cooperation required for construction of Corps of Engineers and Department of Agriculture projects in the Mississippi portion of the basin.

The Louisiana Department of Public Works has the authority and capability to provide required assurances of local cooperation for the Louisiana portion of the plan.

PRIORITIES

The structural portion of the early-action plan as presented in this report is composed of projects that are economically feasible and should be constructed within the next 10-15 years if the needs of the basin are to be met. However, experience indicates that implementation of a plan of this magnitude probably would not be accomplished within this time because of other National priorities. Therefore, relative priorities were assigned to the reservoirs, upstream watershed projects, and segments of the Pearl River Boatway. The assignment of priorities is discussed in the following paragraphs.

Reservoirs. The reservoir projects were assigned priorities based on initial project net primary benefits as follows:

Edinburg	--	1st priority
Carthage	--	2nd priority
Ofahoma	--	3rd priority

Upstream watershed. The upstream watersheds were divided into two priority groups in consultation with local interests. The watershed above the existing Ross Barnett Reservoir and the proposed Edinburg, Carthage, and Ofahoma Reservoirs were assigned to the first priority group in order to reduce the sediment loads. The East Hobolochitto watershed, which would have 2 multiple-purpose structures, was assigned a high priority in order to provide for some of the recreational needs of the lower portion of the basin. The Hanging Moss watershed, located in the Jackson metropolitan area, was assigned a high priority due to the need for protection from flooding of urban development in the watershed. The upstream watersheds were assigned to priority groups as follows:

Priority Group 1		Priority Group 2	
Watershed No.	Name	Watershed No.	Name
2M	East Hobolochitto	1A-M	McGee
30	Hanging Moss	2A-M	Topisaw
31	Pelahatchie	5A-M	Boone
33	Fannegusha	8	Lower Little
34	Coffee Bogue	9	Little
36	Shockaloo	16	Fair
37	Hontokalo	17	Bahala
38	Conehatta	21	Dobbs
39	Sipsey	22	Campbell
43	Kentawah	26	Steen
44	Sandtown	28	Jackson
45	Bogue Chitto - Dry		
47	Yockanookany		
48	Carthage (five creeks)		
49	Edinburg		
51	Hurricane - Pinishook		
52	Noxapater		
54	Nanawaya		
56	Tibby		

Pearl River Boatway. The following priorities were assigned to segments of the Pearl River Boatway to meet anticipated recreation needs.

Lower subarea -- 1st priority
Upper subarea -- 2nd priority
Middle subarea -- 3rd priority

CHAPTER 12

RECOMMENDATIONS

The Coordinating Committee makes the following recommendations:

RECOMMENDATION I

That the comprehensive plan of structural and nonstructural measures presented in Chapter 7 of this report be adopted as the basic plan for the coordinated development, conservation and beneficial use of the water and related land resources of the Pearl River Basin.

RECOMMENDATION II

That the early-action structural program be implemented as follows:

1. That the Corps of Engineers submit a separate report recommending authorization of the Ofahoma, Carthage and Edinburg Dams and Reservoirs by the Congress. Estimated total cost for construction is $93,020,000; annual charges, $5,539,000; and annual benefits, $11,840,000. The benefit-to-cost ratio is 2.1.

2. That the Department of Agriculture submit a separate report or reports recommending authorization by the Congress of land treatment measures, 179 floodwater retarding structures, 29 multiple-purpose structures and 1,202 miles of channel development in 30 upstream watershed areas and critical land area stabilization for the remainder of the basin. The estimated total cost for these measures is $87,259,000, of which $30,617,000 is for land treatment and critical land area stabilization. Excluding land treatment and critical land area stabilization, annual charges are $3,818,000 and annual primary benefits are $4,536,000, giving an overall benefit-to-cost ratio of 1.2.

3. That the Pearl River Boatway with associated parks be implemented by the Pearl River Basin Development District as State of Mississippi projects with Federal aid through existing authorities. Estimated total costs for construction are $6,408,000; annual charges $815,000; and annual benefits $2,005,000. The benefit-to-cost ratio is 2.5.

RECOMMENDATION III

That the States adopt such legislation as may be required and take appropriate action, utilizing available Federal assistance and programs, to permit implementation of the various nonstructural measures of the plan.

RECOMMENDATION IV

That the comprehensive plan be reviewed and updated periodically.

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State of Mississippi

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State of Louisiana

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Federal Power Commission

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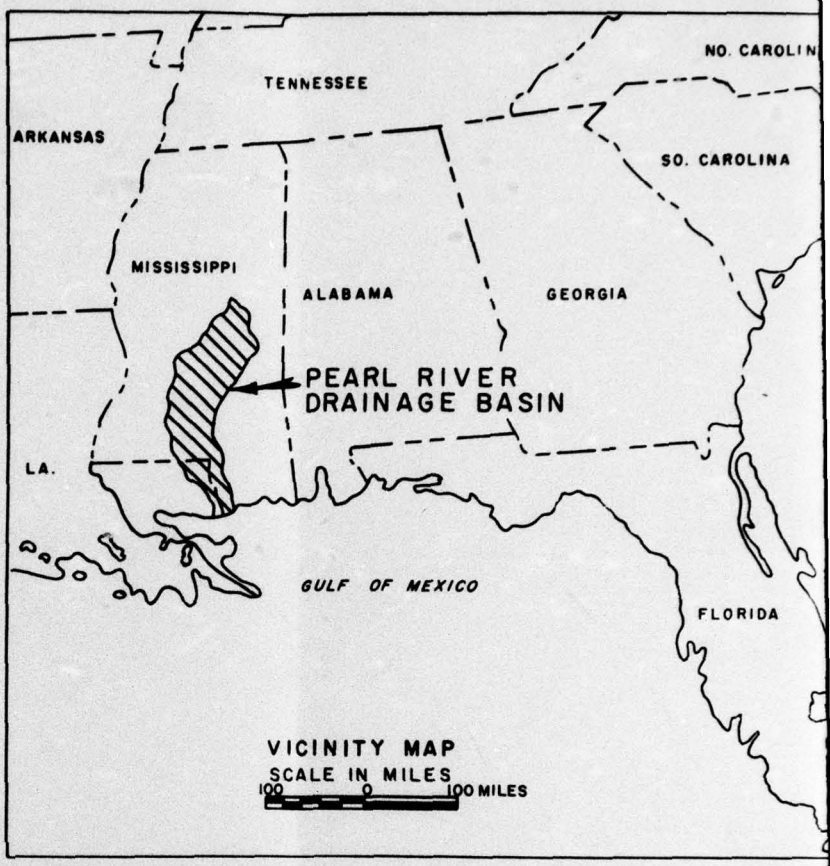
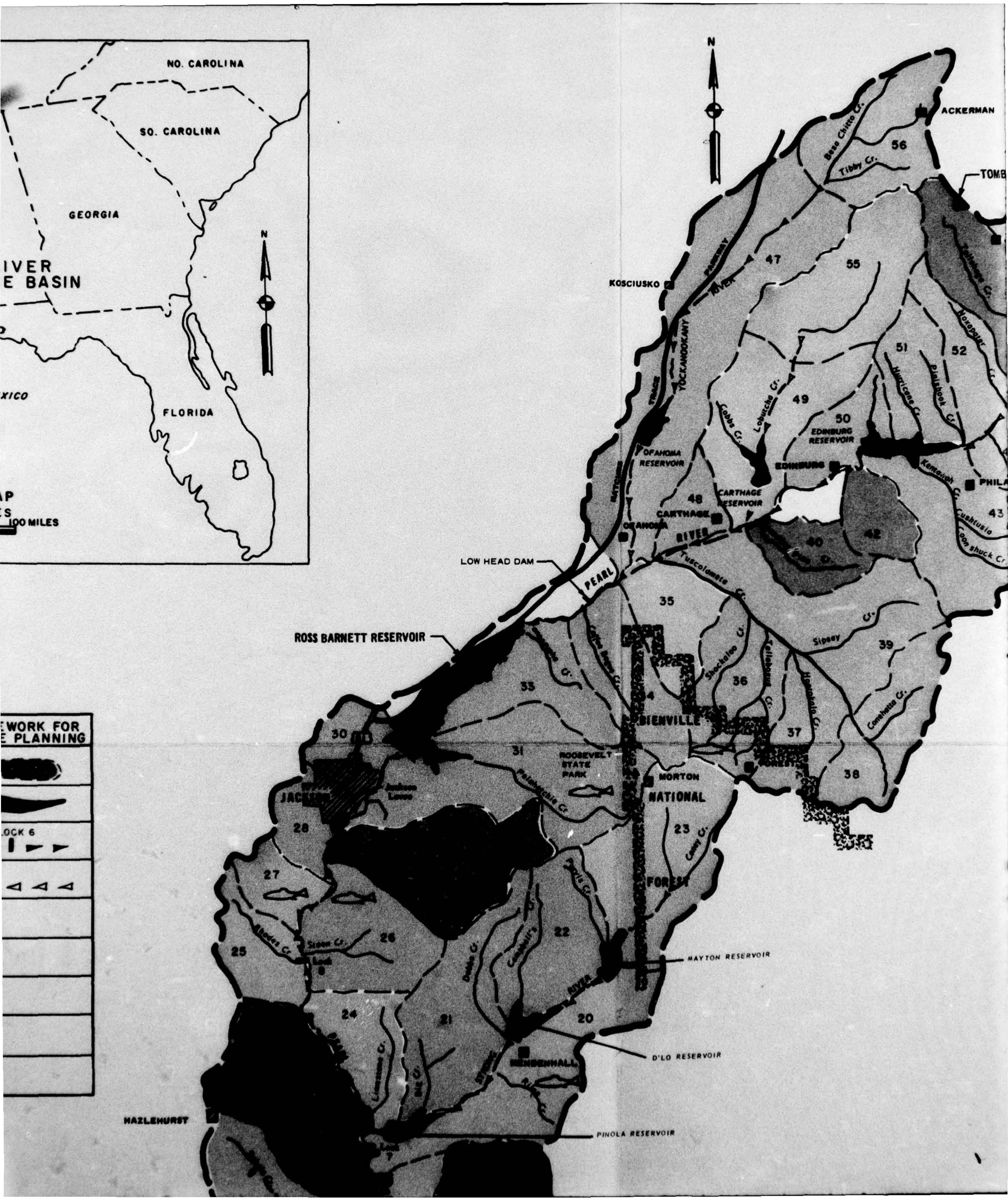
October 15, 1970



PROJECT OR PROGRAM	EXISTING OR AUTHORIZED	EARLY-ACTION	FRAMEWORK FOR FUTURE PLANNING
UPSTREAM WATERSHED PROGRAM			
MAJOR RESERVOIRS			
COMMERCIAL NAVIGATION	LOCK 2		LOCK 6
RECREATION NAVIGATION			
PEARL RIVER BOATWAY			
STREAM PRESERVATION			
BOAT LAUNCHING AREA		(1)	
STATE PARK			
STATE OR COUNTY LAKE (2)			

HAZLEHURST

(1) THERE WILL BE APPROXIMATELY 82 AREAS WITH BOAT LAUNCHING RAMPS AND OTHER RECREATIONAL FACILITIES


NO. CAROLINA
SO. CAROLINA
GEORGIA
IVER
E BASIN
XICO
FLORIDA
AP
ES
100 MILES
EWORK FOR
E PLANNING
LOCK 6
N
ACKERMAN
TOMB
56
KOSCIUSKO
47
55
51
52
49
50
EDINBURG RESERVOIR
OFAHOMA RESERVOIR
48
CARTHAGE RESERVOIR
CARTHAGE
RIVER
PEARL
LOW HEAD DAM
40
42
43
35
39
ROSS BARNETT RESERVOIR
33
36
37
38
30
31
BIENVILLE
ROOSEVELT STATE PARK
MORTON
NATIONAL
FOREST
JACKSON
28
23
27
26
25
22
MAYTON RESERVOIR
24
21
20
D'LO RESERVOIR
HAZLEHURST
PINOLA RESERVOIR

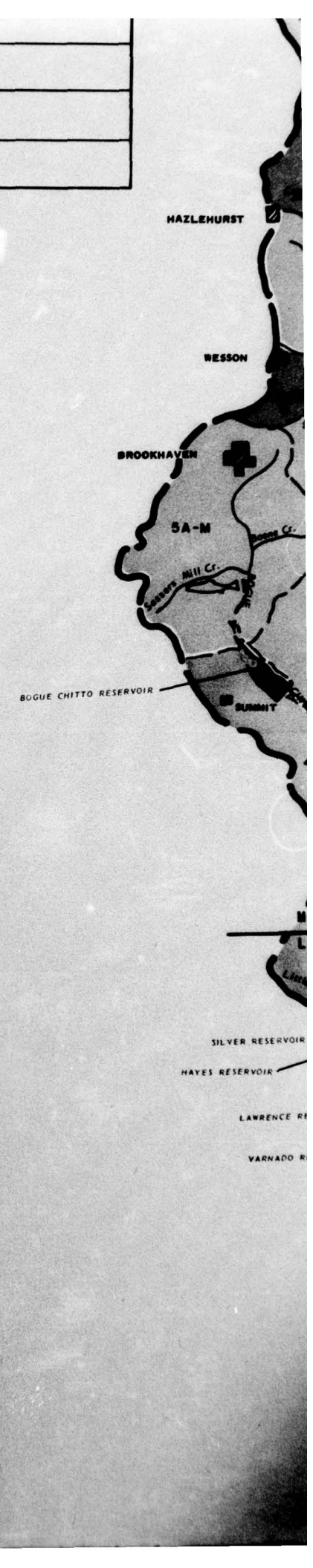

ACKERMAN
TOMBIGBEE NATIONAL FOREST
LOUISVILLE
PHILADELPHIA
56
55
54
51
52
49
50
45
44
43
39
38

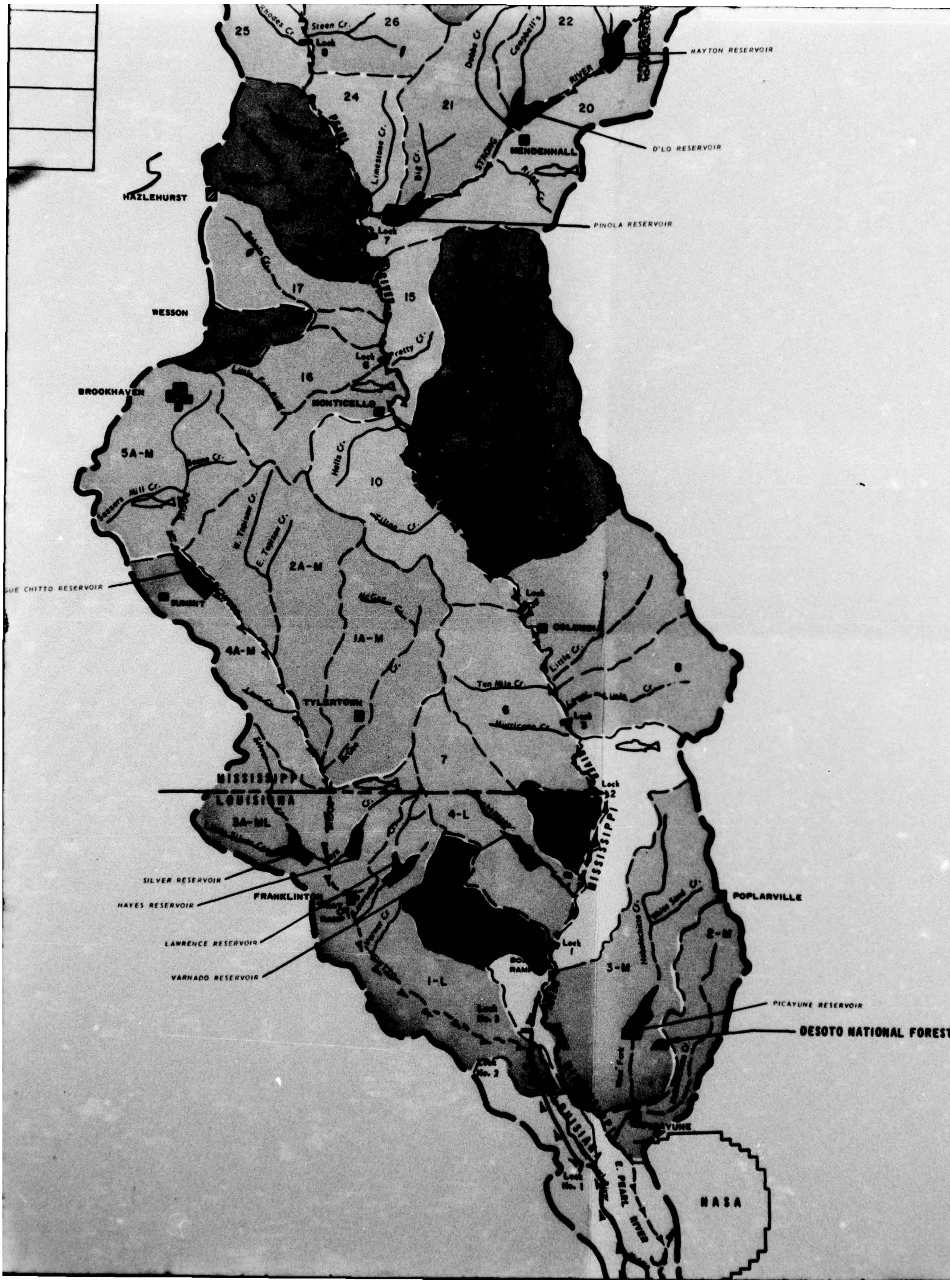
STREAM PRESERVATION			
BOAT LAUNCHING AREA	○	(1)	
STATE PARK			
STATE OR COUNTY LAKE (2)			

4

(1) THERE WILL BE APPROXIMATELY 82 AREAS WITH BOAT LAUNCHING RAMPS AND OTHER RECREATIONAL FACILITIES STRATEGICALLY PLACED ALONG THE PEARL RIVER BOATWAY.

(2) INCLUDES ONLY THOSE WITH 50 ACRES OR MORE OF SURFACE AREA.





25
26
22
Rhodes Cr.
Steen Cr.
Dabbs Cr.
Campbell's
MAYTON RESERVOIR
RIVER
24
21
20
PEARL
Limestone Cr.
Big Cr.
STRONG
MENDENHALL
D'LO RESERVOIR
HAZLEHURST
PINOLA RESERVOIR
Lock 7
17
15
WESSON
Pretty Cr.
Lock 6
16
BROOKHAVEN
MONTICELLO
5A-M
Hells Cr.
10
Mill Cr.
W. Topisaw Cr.
E. Topisaw Cr.
2A-M
GUE CHITTO RESERVOIR
SUMMIT
9
1A-M
4A-M
Little Cr.
8
Ten Mile Cr.
TYLERTOWN
6
Hurricane Cr.
Lock 3
7
MISSISSIPPI
LOUISIANA
Lock 2
4-L
3A-ML
MISSISSIPPI
SILVER RESERVOIR
HAYES RESERVOIR
FRANKLINTON
POPLARVILLE
LAWRENCE RESERVOIR
Lock 1
VARNADO RESERVOIR
3-M
2-M
1-L
Lock No. 3
PICAYUNE RESERVOIR
DESOTO NATIONAL FOREST
Lock No. 2
LOUISIANA
Lock No. 1
E. PEARL
RIVER
NASA

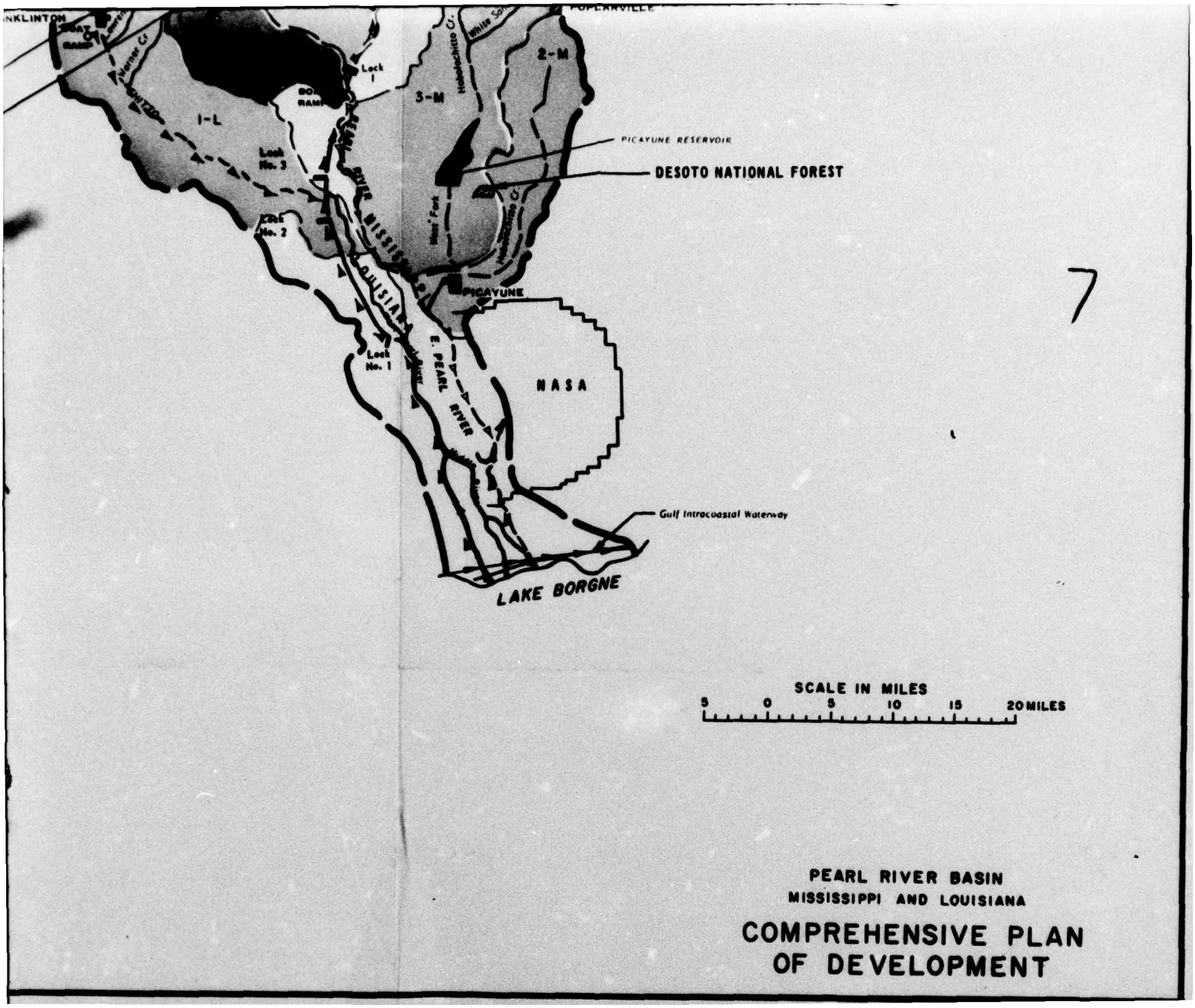
6

POPLARVILLE

PICAYUNE RESERVOIR

DESOTO NATIONAL FOREST

SA



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PEARL RIVER BASIN
MISSISSIPPI AND LOUISIANA

COMPREHENSIVE PLAN OF DEVELOPMENT