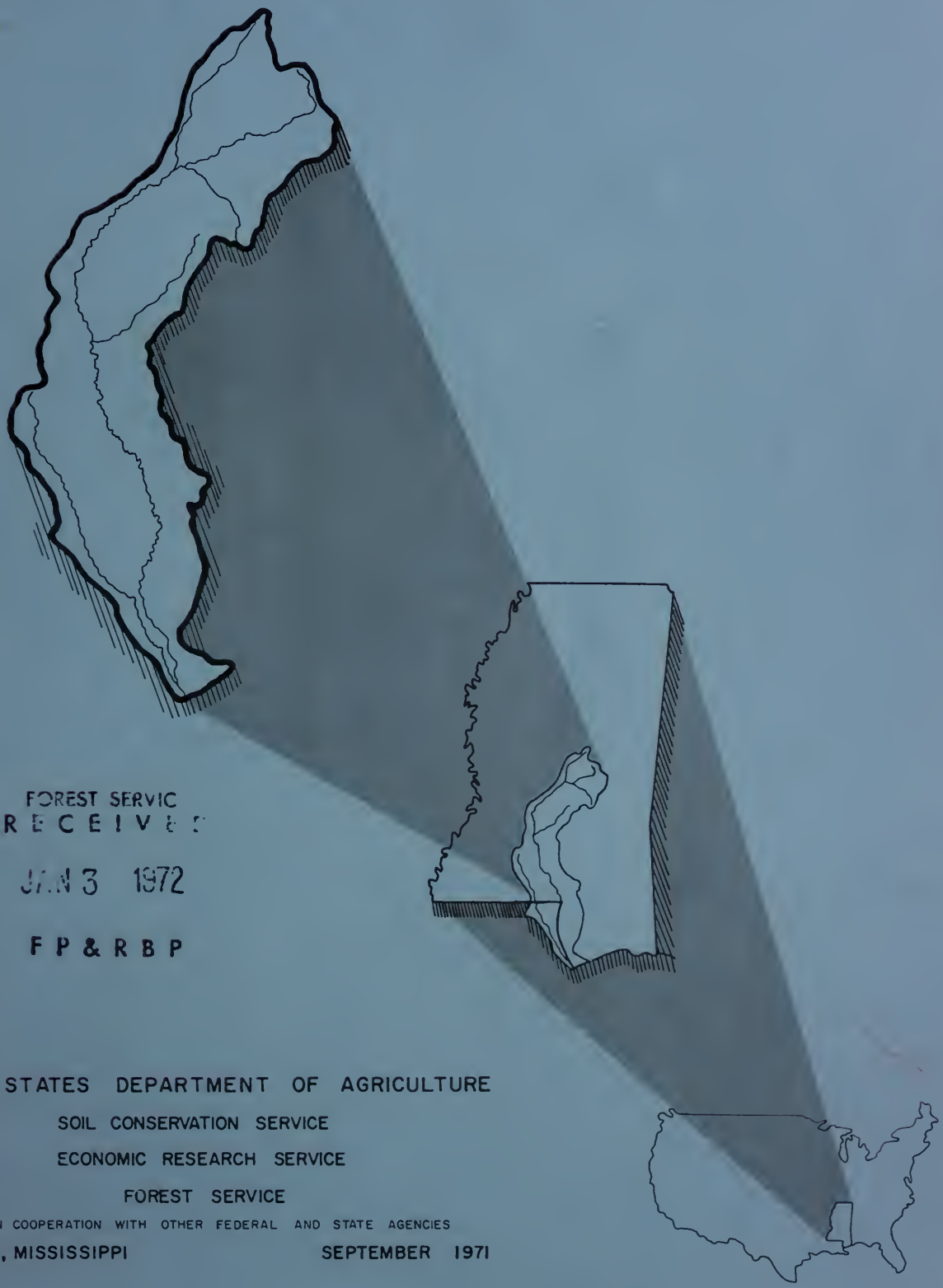
AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT PEARL RIVER BASIN



UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ECONOMIC RESEARCH SERVICE
FOREST SERVICE
IN COOPERATION WITH OTHER FEDERAL AND STATE AGENCIES
JACKSON, MISSISSIPPI SEPTEMBER 1971

AGRICULTURAL REQUIREMENTS AND UPSTREAM WATERSHED DEVELOPMENT

PEARL RIVER BASIN

Mississippi and Louisiana

Prepared by
UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Economic Research Service
Forest Service

Jackson, Mississippi September 1971

FOREWORD

The United States Department of Agriculture summarizes herein the results of studies made in formulating a comprehensive plan of improvement for the conservation, utilization, development, and management of the water and related land resources of the Pearl River Basin.

This report presents the results of investigations made by the Department of Agriculture in connection with the detailed comprehensive study made of the Pearl River Basin. It contains the recommendations for the early action program and identifies potential projects that should be considered in planning to meet needs which develop after 1980. Also, this report is expected to serve as the basis for requesting authorization by Congress of the Department of Agriculture's early action programs as recommended by the Secretary of Agriculture.

The Department of Agriculture's plan for the development of the water and related land resources of the Pearl River Basin is supported by data and information in 15 appendices prepared by all agencies participating in the investigation. Each agency prepared separate reports presenting the results of its studies. The developments recommended in these reports comprise the comprehensive plan of development for the Basin. The comprehensive plan prepared by the Coordinating Committee and the agency reports are identified as follows:

VOLUME I - MAIN REPORT - Prepared by the Coordinating Committee

VOLUME II - CORPS OF ENGINEERS
- Appendix A - Views of Federal and State Agencies on the Comprehensive Plan
- Appendix B - Assurances of Local Cooperation
- Appendix C - Digest of Public Hearings

VOLUME III - CORPS OF ENGINEERS AND U. S. DEPARTMENT OF AGRICULTURE
- Appendix D - Economic Base Study

VOLUME IV - CORPS OF ENGINEERS
- Appendix E - Plan Formulation

VOLUME V - CORPS OF ENGINEERS
- Appendix F - Engineering Studies for Main Stem and Major Tributaries

VOLUME VI - U. S. DEPARTMENT OF AGRICULTURE (SCS, FS, ERS)
- Appendix G - Agricultural Requirements and Upstream Watershed Development

VOLUME VII - DEPARTMENT OF THE INTERIOR

Appendix H - Municipal and Industrial Water Supply and Water Quality Control (FWQA)
Appendix I - Outdoor Recreation (BOR)
Appendix J - Fish and Wildlife Resources of the Pearl River Basin (BSF&WL)
Appendix K - Archeological, Historical and Natural Resources of the Pearl River Basin (NPS)
Appendix L - Geohydrologic Summary of the Pearl River Basin (USGS)
Appendix M - Mineral Resources and Industry of the Pearl River Basin (BOM)

VOLUME VIII - DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Appendix N - Public Health Aspects of the Pearl River Basin (PHS)

VOLUME IX - STATE CONTRIBUTIONS

Appendix O - Role of the States of Mississippi and Louisiana in the Planning and Development of the Water and Related Land Resources in the Pearl River Basin

The study encompasses the entire Pearl River Basin, defines the short- and long-term needs for flood control, flood prevention, water supply, recreation, navigation, pollution abatement, hydroelectric power, irrigation, fish and wildlife enhancement, and environmental quality improvement. The report describes the potential development by which these needs could be met. The Summary Report describes briefly these potential developments, giving emphasis to the early action program.

Appendix G is oriented primarily to upstream watershed development. Other aspects of the agricultural program are fragmented through other appendices.

This report contains three additional chapters not included in Appendix G. Chapter VIII deals with the Pearl River Development District, Chapter IX discusses the early action plan of the Corps of Engineers, and Chapter XII is a statement on environmental quality. The data, plans, and proposals of the two reports are consistent. The purpose of the comprehensive study is to establish the best overall plan of development for water and related land resources, to determine the best means to accomplish this development, and to define the early action plan. It has been determined that the findings and recommendations of all the segments of the study that affect Agriculture's programs are combined into one report.

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CHAPTER I

INTRODUCTION

This report by the U. S. Department of Agriculture is part of a comprehensive plan for the development of the water and related land resources in the Pearl River Basin located in Mississippi and Louisiana. Studies and reports by other Federal and State agencies are also expected to make their contribution to the comprehensive plan. The purpose is to guide the orderly development of all water and related land resources of the Basin to keep abreast or slightly ahead of the needs.

Needs for the development of water and related land resources result from economic and resource losses as well as social losses of an intangible nature. Need arises from such occurrences as water shortages, water surpluses, deficiencies in water quality, land losses due to water action, and inefficiencies in the use of both water and related land. The adverse effects of these water related problems are identified in terms of damages, both direct and indirect, to land, firms, households, communities, and the Basin and regional economy in the absence of correction or development of water and related land resources currently existing or of potential consequence.

The responsibility for determining Basin-wide water development needs for agricultural and non-agricultural uses was borne by several participating agencies and departments. The U. S. Department of Agriculture collaborated with and assisted other agencies as necessary to achieve a complete and consistent assessment of all water problems. This report, however, is concerned primarily with water and related land problems and ways of alleviating them in the headwater areas.

Authority

This study was made under the authority of Section 6 of the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566, as amended) which authorized the Secretary of Agriculture to cooperate with other Federal, State, and local

agencies in their investigations of watersheds, rivers, and of other waterways to develop coordinated programs. This study was carried out in cooperation with other Federal agencies and the States of Mississippi and Louisiana.

Participants

The principal participants within the U. S. Department of Agriculture were the Soil Conservation Service, Forest Service, and Economic Research Service. Agency participation was carried out in accordance with assigned responsibilities and coordinated through a Washington Advisory Committee and a Field Advisory Committee. The functions of these committees are set forth in a Memorandum of Understanding between the Soil Conservation Service, Forest Service, and Economic Research Service.

The personnel assigned to the river basin survey by the three USDA agencies functioned as a planning team under the guidance of the Field Advisory Committee. Each agency had leadership responsibility for designated aspects of the survey as outlined in an adopted plan of work.

Other principal Federal Departments involved in the study were Army, Interior, Health, Education and Welfare, Commerce, Transportation, and the Federal Power Commission. At the Washington level, cooperative relationships among the departments were maintained through the Water Resource Council of Representatives. At the river basin level, cooperative relationships were maintained through a coordinating committee. This committee, made up of representatives of participating Federal and State agencies and chaired by the Corps of Engineers, served as a means of achieving coordination in conducting the studies and formulating the proposed plan.

The planning efforts were coordinated closely with the Pearl River Basin Development District, the Mississippi Board of Water Commissioners, the Louisiana Department of Public Works, and local agencies and organizations concerned with the development, utilization, and management of water and land resources. Full consideration was given to the desires and objectives of the local interests. Viewpoints of project sponsors and other interests directly affected by the agricultural and rural community aspects of the surveys and results were solicited and considered.

Objectives

The primary objective of the U. S. Department of Agriculture study is to facilitate the coordinated and orderly conservation, development, utilization, and management of the water and related land resources. To achieve this aim necessitated a general appraisal of the overall water and related resource problems and development potentials and included:

1. An inventory of resources.

2. Studies and projections of economic development.

3. Translation of such projections into needs for water and related land resource uses.

4. Appraisals of the availability of water supplies both as to quantity and quality.

5. Appraisals of the availability of related land resources.

6. A description of the characteristics of present and future problems and the general approaches that appear appropriate for their solution.

7. Studies and identification of projects which are economically feasible and need to be initiated during the next 10 to 15 years.

8. Studies to determine the extent to which recreational, fish and wildlife habitat improvement, flood control, drainage, irrigation, rural, municipal and industrial water supplies, and water quality control can be provided by water and related land resource development programs in upstream areas to satisfy the demands.

9. An assessment of the development effects of water and related land on other resources.

10. A compilation of economic, engineering, and related data to assist local groups and organizations in planning the development of resources.

Nature, Scope, and Intensity of Investigations

The Pearl River Study is defined as a Type II comprehensive detailed survey. A study of this type includes the major elements of a Type I study (objectives 1 through 6) plus intensive studies of specific projects, the installation of which will need to be initiated within the next 10 to 15 years.

The Department of Agriculture agencies analyzed historical information and developed projections of the following major indicators in addition to minor ones: (1) volume and value of agricultural and timber output; (2) income and employment in basic agricultural and forestry activities; (3) use of rural lands, including the acreage devoted to major crops, forest production, recreation, and fish and wildlife; and (4) employment, income, and other measures of economic activity directly and locationally related to the basic agricultural and forest industries. Analyses and projections of other sectors of the Basin's economy were obtained from results of an economic base study prepared under contract to the Corps of Engineers by Michael Baker, Jr., Inc. 1/

The appraisals of agricultural and rural community water problems and development needs were based on the economic base studies and projections. The determination of resource development needs involved: (1) a physical inventory of the nature, distribution, and extent of agricultural and rural community water problems; (2) appraisals of economic losses sustained by farmers, households, and related trade and service centers which result from these problems under present and projected patterns of land use and development; (3) appraisals of the markets for products and services obtainable from the use of water and related land resources; (4) appraisals of potentials for meeting needs for products or services through alternative means essentially unrelated to water resource development; and (5) estimates of the costs of obtaining the desired products or services from various types of more intensive uses or from development of available supplies of water and related land.

The Soil Conservation Service collaborated with other agencies in hydrologic studies to determine current water supplies and projections of future water availability. The Soil Conservation Service made reconnaissance studies on the amounts of sediment that would enter the stream system at selected points.

1/ Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area, Volume I and Volume II, Michael Baker, Jr., Inc., Jackson, Mississippi, December 1964.

The current and future (1980 and 2015) land requirements for all uses were estimated by the Economic Research Service and Forest Service in collaboration with other agencies. The estimated land needs were compared with the availability of land of various types and capabilities. The cooperation of other agencies with responsibilities for management of public lands was sought so as to include all land in the appraisal.

Potential solutions to water and related land problems in the upstream watersheds include both structural and non-structural measures. Project and non-project type action was considered. Individual watershed projects identified for initiation of installation within the next 10 to 15 years meet the basic requirements for PL-566 projects. Their sizes, purposes, and cost-sharing arrangements are compatible with PL-566.

CHAPTER II

DESCRIPTION OF BASIN

Location and Size

The Pearl River Basin is located in east central and southwest Mississippi and in the southeastern part of Louisiana (Figure 2.1). The principal tributaries are the Yockanookany River and Lobutcha and Tuscolameta Creeks in the Basin above Jackson, Mississippi, and the Strong River and Bogue Chitto in the lower Basin. From its source, the Pearl River flows southwesterly for 146 miles to the vicinity of Jackson and then southerly for 217 miles to its outlet channels, the East and West Pearl Rivers. These channels continue for 48 and 44 miles respectively, to Lake Borgne and the Rigolets, which are arms of the Gulf of Mexico. The Basin drains an area of 8,760 square miles, consisting of all or parts of 23 counties in Mississippi and 3 parishes in Louisiana. A list of counties wholly or partially within the Basin is presented in Table 2.1. Throughout the report, reference to the Pearl Basin refers to these counties and the area within the hydrologic boundary.

An economic study entails an analysis of the economy of smaller parts of the Basin. Counties were used as the units for forming sub-areas and the Study Area. Counties are the smallest political units for which large quantities of statistical information are available on many different subjects; they are recognized as record keeping units; they are sufficiently small to provide a satisfactory reflection of leading local economic variations; and their boundaries are quite stable.

The boundaries of the sub-areas were delimitated by grouping together those counties that possessed some similarities in water needs, geographical characteristics, and economic activities. This homogeneity in socio-physio-economic characteristics permitted a meaningful analysis of the dominant forces influencing future economic changes in both the Study Area and Basin.

The Study Area includes three sub-areas - Upper, Middle, and Lower - to facilitate the development of projections. The counties or parishes in each are as follows: Upper - Hinds, Leake, Neshoba, Rankin, Scott, and Winston; Middle -

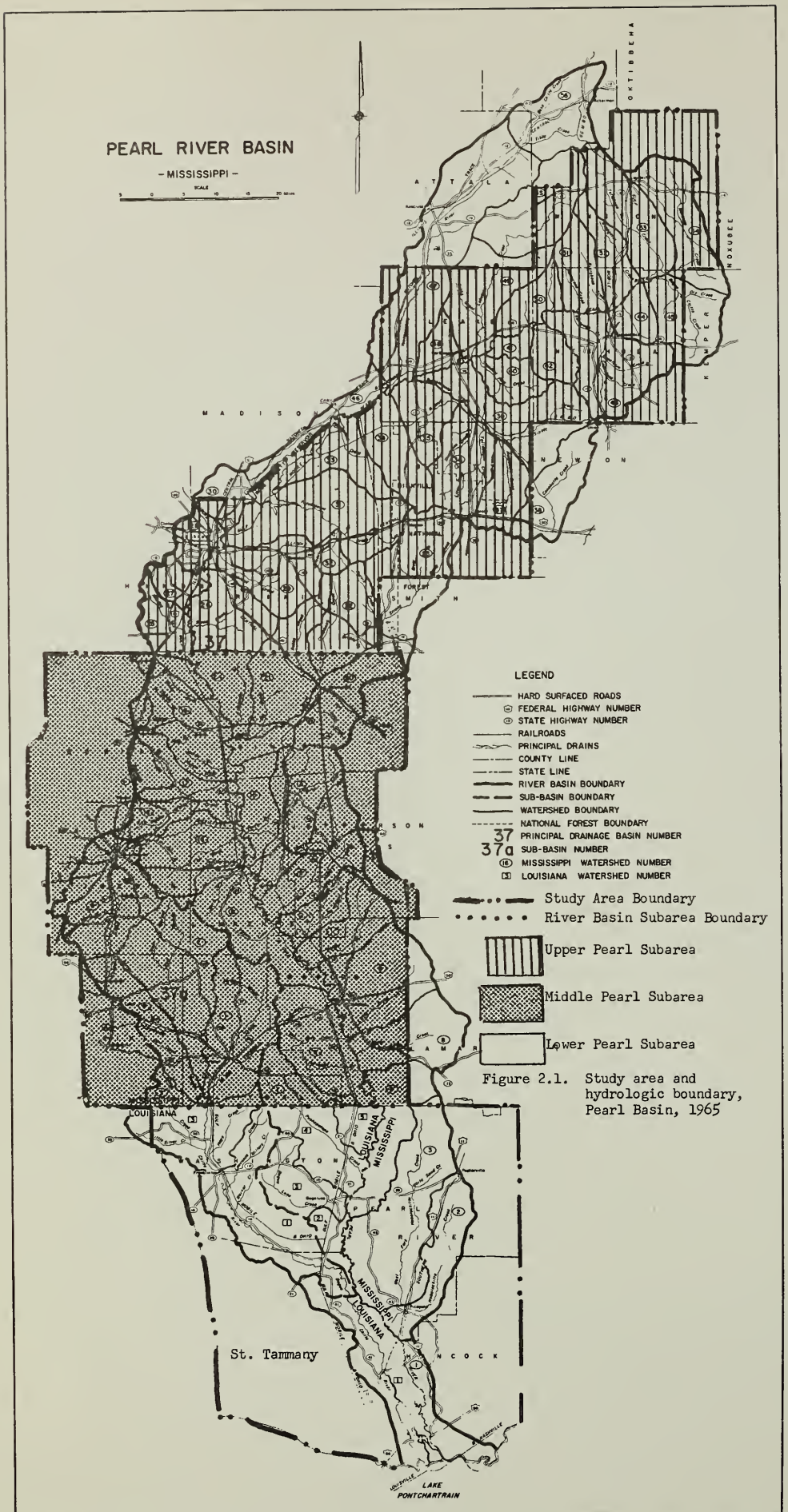


Figure 2.1. Study area and hydrologic boundary, Pearl Basin, 1965

Table 2.1 State and county area in the Pearl Basin, 1958

State and county or parish	County area in Basin	Proportion of total county area
	Acres	Percent
Mississippi:		
Attala	219,747	47
Choctaw	91,770	34
Copiah	189,627	38
Hancock	55,384	18
Hinds	130,856	23
Jefferson Davis	189,034	71
Kemper	60,456	12
Lamar	96,844	30
Lawrence	277,120	100
Leake	364,922	97
Lincoln	256,545	68
Madison	70,470	15
Marion	348,705	99
Noxubee	187	0
Neshoba	325,064	89
Newton	88,798	24
Pearl River	344,974	65
Pike	113,741	43
Rankin	493,676	96
Scott	343,446	87
Simpson	298,231	79
Smith	60,355	15
Walthall	257,920	100
Winston	264,560	68
Louisiana:		
St. Tammany	172,014	30
Tangipahoa	11,581	2
Washington	383,834	90
Basin Total	5,509,861	--

Source: Planimetered by Soil Conservation Service, United States Department of Agriculture, by counties. Consequently, the Basin area given above does not agree exactly with the area as determined by USGS.

Copiah, Jefferson Davis, Lawrence, Lincoln, Marion, Pike, Simpson, and Walthall; and Lower - Hancock, Pearl River, St. Tammany, and Washington. In this report these eighteen counties 1/ are called the Pearl Study Area (Table 2.2).

Geology

Geologically, the Pearl River Basin is part of the Gulf Coastal Plain Province. Within this, several physiographic divisions, crossing the Basin in a northwesterly direction and dipping toward the southwest, are represented. From north to south and from oldest to most recent these are as follows: North Central Hills, Jackson Prairies, Long Leaf Pine Hills, and Coastal Pine Meadows.

The North Central Hills division is a broad sand hill area dissected by numerous streams. Geological material consists of light colored to dark clays, lignitic clays, fine to coarse sands, lignite, marl, and limestone. Formations that crop out are: Wilcox, Tallahatta, Zilpha clay, Winona sand, Neshoba sand, Sparta sand, Cook Mountain, and Cockfield.

The Jackson Prairie presents a rolling landscape with relatively wide stream bottoms. The predominant formation that crops out is the Yazoo clay member of the Jackson Group. This consists of calcareous clays containing some sand and marl. An overburden of more recent deposits covers much of the area.

The Long Leaf Pine Hills division is a rolling upland area dissected by numerous streams. Slopes are gentle to steep with many wide ridgetops that are remnants of an old plateau. Geologic materials consist of light to dark colored clays, sand, gravel, marl, limestone, sandstone, and siltstone. Formations that crop out are: Forest Hill, Vicksburg, Catahoula, Pascagoula, and Hattiesburg clays and Citronelle.

The Coastal Pine Meadows is a narrow level to rolling plain along the Gulf of Mexico and extending some distance inland along the major drainageways. Geologic material consists of loam, sand, gravel, and clay.

1/ St. Tammany and Washington Parishes are in Louisiana. The terms "County" and "Parish" are used interchangeably.

Table 2.2 Area of counties or parishes in the Pearl Study Area, 1964

Sub-area and county or parish	Area in Study Area	Proportion of total county or parish area
	Acres	Percent
Upper	2,159,300	
Hinds	127,400	23
Leake	375,000	100
Neshoba	363,500	100
Rankin	512,000	100
Scott	393,600	100
Winston	387,800	100
Middle	2,665,000	
Copiah	499,900	100
Jefferson Davis	265,000	100
Lawrence	277,100	100
Lincoln	375,000	100
Marion	352,000	100
Pike	262,400	100
Simpson	375,700	100
Walthall	257,900	100
Lower	1,847,300	
Hancock	310,400	100
Pearl River	529,900	100
St. Tammany	581,000	100
Washington	426,000	100
Study Area	6,671,600	

Source: Louisiana and Mississippi Census of Agriculture - 1964, Bureau of the Census, United States Department of Commerce.

Land Resource Areas and Soils

Corresponding roughly in location to the geological physiographic divisions are Land Resource Areas (Figure 2.2). These are physical groupings, based largely on soils and topography, made for purposes of broad agricultural interpretations. There are four land resource areas within the Pearl River Basin. These are as follows: Southern Coastal Plain, Southern Mississippi Valley Silty Uplands, Alabama and Mississippi Blackland Prairies, and Gulf Coastal Flatwoods.

The Southern Coastal Plain Resource Area comprises roughly 75 percent of the Basin. Topography is relatively rugged around the upper perimeter but becomes more gentle in the central portion and rolling toward the Gulf Coast. Most of the land is wooded but where slopes are gentle and soil conditions favorable, a general type farming is practiced. Most of the bottomlands are in woods except for limited areas of pasture and cropland where drainage work has been established.

The principal upland soils are Boswell, Harleston, Myatt, Ora, Pheba, Prentiss, Ruston, Savannah, Shubuta, and Stough. Ruston soils are deep, friable well drained loamy soils. Pheba and Stough are somewhat poorly drained loamy soils with fragipans. Harleston soils found in the southern part of the Basin, are moderately well and somewhat poorly drained loamy soils. Shubuta is well drained clayey and Boswell is moderately well drained clayey soil. Myatt is a poorly drained loamy soil commonly used for pasture when cleared. Yields of locally adapted crops are moderate to high on most of these soils when used within their capabilities.

Principal bottomland soils are Bibb, Iuka, and Mantachie. Iuka and Mantachie are moderately well and somewhat poorly drained friable loamy soils. They respond well to management and yields of locally grown crops are high when drained and protected from overflow. Bibb is a low poorly drained loamy soil best suited to bottomland hardwoods or pasture.

The Mississippi Valley Silty Uplands comprise 15 percent of the Basin. Topography ranges from rolling to steep. Soils are formed from a thin mantle of silty wind blown material underlain by Coastal Plain sands, clays, and gravels. Except for exceptionally steep slopes almost all of the land has at one time been cleared and used for cropland. Erosion has been severe in the past and consequently a considerable acreage has reverted to pine timber and scrub hardwood. A general type agriculture with emphasis on dairying in the lower portion is practiced. Some of the bottomlands are cleared and used for pasture and cropland.

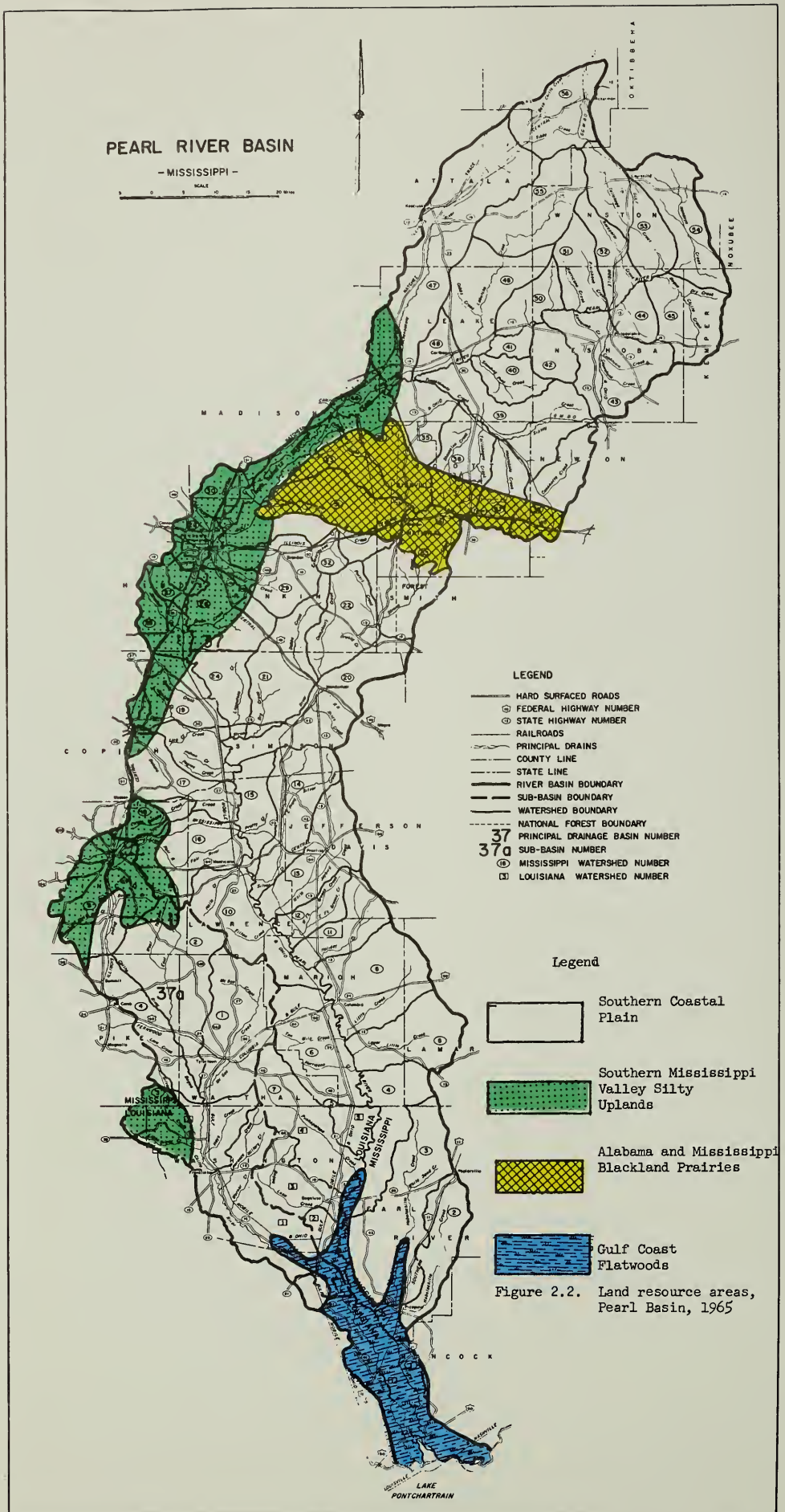


Figure 2.2. Land resource areas, Pearl Basin, 1965

Principal upland soils are Atwood, Brandon, Bude, Falkner, Henry, Lax, Lexington, Providence, and Tippah. Atwood and Lexington are deep well drained silty soils with loamy lower subsoils. Providence and Bude are moderately well and somewhat poorly drained silty soils with fragipans. Henry is a gray poorly drained silty soil with fragipans. Tippah and Falkner are moderately well and somewhat poorly drained silty soils with clayey lower subsoils. Brandon and Lax are well and moderately well drained silty soils over gravelly material. The better drained soils are very productive when managed within their capabilities.

Principal bottomland soils are Collins, Falaya, and Waverly. Collins and Falaya are moderately well and somewhat poorly drained friable silty soils. They respond to management and are very productive when drained and protected from overflow. Waverly is a low poorly drained silty soil best suited to bottomland hardwoods and pasture. Iuka, Mantachie, and Bibb soils, ordinarily found in the Coastal Plain Resource Area, are also common.

The Alabama-Mississippi Blackland Prairies comprise approximately 5 percent of the Basin. This is a narrow belt of soils, formed from calcareous material, extending almost across the upper part of the Basin. Uplands are rolling to steep and the bottoms are flat and relatively wide. The major land uses are forest and pasture. Soils are clayey except for areas that are covered by an overburden of coarser material.

Principal upland soils are Eutaw, Houston, Mayhew, Sumter, and Vaiden. Houston is somewhat poorly to moderately well drained. Vaiden is somewhat poorly drained. Eutaw and Mayhew are poorly drained and Sumter is shallow over calcareous material. All these clayey soils except Sumter have high shrink-swell properties and are difficult to manage. Sumter soils are calcareous. The soils are best suited to grasses, legumes, and trees.

Bottomland soils are Houlka and Una. Houlka is somewhat poorly drained and Una is poorly drained. Both soils are clayey and therefore difficult to manage. They are well suited to grasses, legumes, and bottomland hardwoods.

The Gulf Coastal Flatwoods is a relatively low flat plain paralleling the Gulf of Mexico and extending some distance up the major streams. The native vegetation consists largely of slash pine, water grasses, and galberry bushes. Very little of the land is used for agricultural

purposes but in recent years there has been a great deal of urban and recreational development. The extent of this resource area is limited in the Pearl Basin. It is estimated, however, that with the Coastal marshes and lower Pearl River swamps, they comprise 5 percent of the entire Basin.

Principal soils are Basin, Eustis, Lakeland, Harleston, Leaf, Plummer, and Rains. Eustis and Lakeland are excessively drained sandy soils. Harleston soils are moderately well drained loamy soils. Basin soils are somewhat poorly drained loamy soils with fragipans. Rains and Plummer are poorly drained soils. Leaf soils are clayey. Rains soils are loamy and Plummer soils have thick sandy A horizons over a loamy subsoil. Natural soil fertility is very low. Agriculturally, Harleston is the most desirable; however, Eustis and Lakeland are suited to early truck crops.

River bottoms are swampy and wet in nature. Soils are similar to the poorly drained soils of the Southern Coastal Plain Resource Area.

Land Use and Cover

The Study Area encompasses 6,672,000 acres of land and water. Forest land, including both farm and nonfarm forests, accounts for 4,454,000 acres or 67 percent. Eighty-six percent of the forest land is in the upland and consists of the following major types: oak-pine, oak-hickory, loblolly-shortleaf pine, and longleaf-slash pine. Fourteen percent of the forest land is bottomland forest and consists primarily of oak-gum-cypress type (Figure 2.3).

Cropland (harvested, pastured, and idle) comprises 14 percent of the Study Area. Principal crops harvested include cotton, corn, oats, soybeans, and hay.

Pasture land comprises 12 percent of the Area. This does not include cropland pastured or forestland pastured. Principal grasses found include bermuda, Dallis, and carpet interseeded with clovers.

Seven percent of the Study Area is made up of urban and built-up areas, water, idle, and Federal land (excluding National Forests). Land use presented in subsequent sections will refer more specifically to the agricultural sector, to land in farms, and to nonagricultural land or non-farm land.

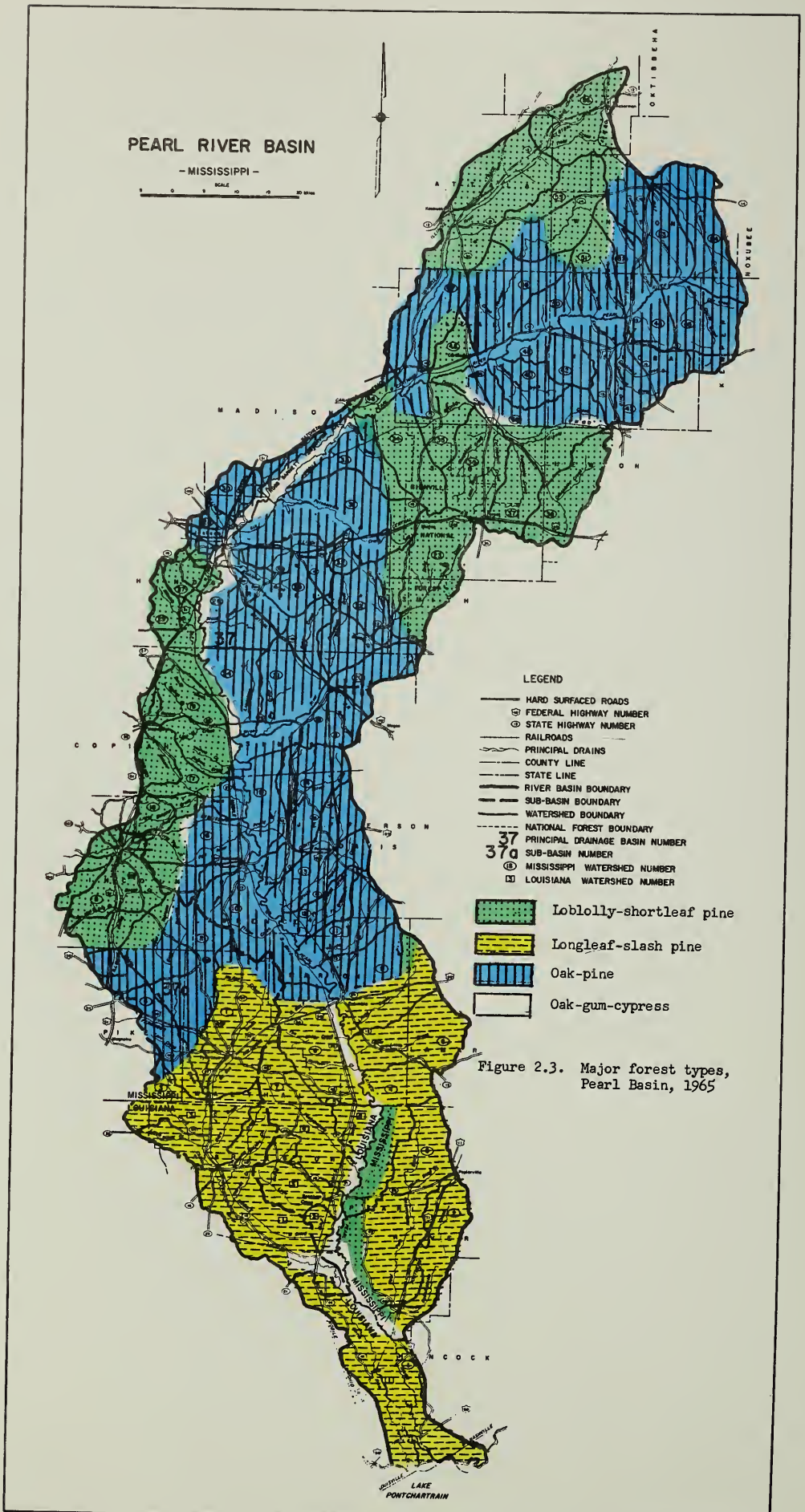


Figure 2.3. Major forest types, Pearl Basin, 1965

Climate

The climate of the Basin is determined primarily by the huge land mass to the north, its subtropical latitude, and the Gulf of Mexico to the south. There are modifications in the climate due to varied topography and the nearness of the Gulf of Mexico. The nearer the Gulf of Mexico the stronger the marine influence. The more distant the Gulf of Mexico the stronger the continental influence. This is of particular significance in the rainfall distribution throughout the year. The area near the Gulf has an average rainfall of about 62 inches with 13 inches occurring in the winter months, 16 inches in spring months, 20 inches in summer months, and 13 inches in fall months. The northern portion of the Basin has an average rainfall of about 52 inches with 16 inches occurring in the winter, 15 inches in the spring, 12 inches in summer, and 9 inches in the fall.

The length of growing season varies from about 225 days from the last killing frost in March to the first killing frost in late October or early November in the northern portion to 260 days or more near the coastline. The mean average annual temperature will vary from 64.0 degrees in the northern portion to 67.0 degrees in the southern portion. This variation is due mainly to the winter month temperatures. Mean average annual January temperatures will vary from 46.0 degrees in the north to 53.0 degrees in the south. The mean average annual July temperature will be 81.0 to 81.5 degrees both north and south. For the entire Basin the percent of possible sunshine will average about 60 percent with an average of about 47 percent in the winter months and about 70 percent in the summer and early fall months.

Hydrology

The hydrology of the Basin is based on the rainfall received, its distribution, the soils of the Basin, the cover or land use and treatment, and the condition of the cover and land treatment. The Basin receives a fairly large amount of rainfall (the mean average annual is about 56 inches), reasonably well distributed, throughout the year. The soils in the sample watersheds studied fall in hydrologic group "A", 5 percent; hydrologic group "B", 34 percent; hydrologic group "C", 50 percent; and hydrologic

group "D", 11 percent. 1/ Present land use in the sample watersheds studied is 63 percent woods, 14 percent pasture, 19 percent crops, 4 percent idle and miscellaneous. The condition of the cover under present conditions is as follows: pasture 35 percent poor, 65 percent fair, and a small percentage good; crops 7 percent straight row, 68 percent contoured, and 25 percent contoured and terraced. The hydrologic condition of the forest land, based on five classes, is 0 percent very good, 1 percent good, 2 percent fair, 41 percent poor, and 56 percent very poor.

The ability of the soil, under its land use, treatment, and cover condition, to accept as infiltration all or a portion of the rainfall and the retention of this water for plant use and/or deep percolation is a prime factor in the hydrologic cycle. This ability along with rainfall amounts and distribution leads to the availability of surface water for damaging floods or for beneficial use under proper management. It also leads to the availability of water in the ground water aquifers that is available for beneficial use and for the re-charge of the aquifers as the water is expended from the aquifers.

Water 2/

The total average annual water supply from rainfall in the Pearl Basin is about 26 million acre feet. Of this, a large percentage is used consumptively by evapo-transpiration, a small part infiltrates to the ground-water reservoirs, and the remainder becomes streamflow. The average annual runoff represents the normal recoverable water supply - it totals about 8 bgd (billion gallons per day), or approximately 9 million acre feet per year. This is equivalent to 19.39 inches of runoff from the entire Basin area.

1/ "A" has lowest runoff potential and includes deep sands with very little silt and clay, also deep, rapidly permeable loess. "B" is mostly sandy soils less deep than "A", and loess less deep or less aggregated than "A", but the group as a whole has above-average infiltration after thorough wetting. "C" comprises shallow soils and soils containing considerable clay and colloid, though less than those of group "D". The group has below-average infiltration after presaturation. "D" has the highest runoff potential and includes mostly clays of high swelling percent, but the group also includes some shallow soils with nearly impermeable subhorizons near the surface.

2/ Geohydrologic Summary of the Pearl River Basin, Appendix L, Geological Survey, United States Department of the Interior.

The Basin cuts across the heart of the central Gulf Coastal Plain which has more potential for ground water development than any other region of comparable size in the nation. The magnitude of the ground water reserve is indicated by the comparatively large dry weather flow of the streams, a high percentage of which is overflow from the various aquifers. Based on available information, the 90 percent duration flow of the Pearl River and West Pearl River at the U. S. Highway 11 crossing between Slidell, Louisiana, and Picayune, Mississippi, is estimated to be about 2,500 cfs. Minimum flow of 1,550 cfs was recorded here in late 1963. Much of the dry weather stream-flow is from the lowland alluvium and the sandy terraced deposits blanketing the upland hills and ridges between Monticello, Mississippi, and the mouth of Bogue Chitto River.

Quality-wise, the water stored in nearly all of the many ground water reservoirs is good to excellent and usually requires little treatment. The chemical quality differs from place to place in individual reservoirs, and from reservoir to reservoir, but at a given site the quality in each reservoir or aquifer is essentially constant.

Development of either water-supply source, ground water or surface water, is feasible in the Pearl River Basin from a hydrologic standpoint. The choice for the developer and manager therefore becomes one of economics.

Tributary Runoff

The major tributaries to the Pearl River are the Bogue Chitto River, Strong River, Yockanookany River, Tuscalameta Creek, Lobutcha Creek, and Hobolochitto Creek. The average annual runoff, as taken from the 1966 "Water Resources Data for Mississippi" and "Water Resources Data for Louisiana," for the Bogue Chitto River is 21.03 inches, Strong River - 17.46 inches, Yockanookany River - 17.41 inches, and Tuscalameta Creek - 15.78 inches. Lobutcha and Hobolochitto Creeks do not have gage records of sufficient detail to give any runoff tabulations.

The minor tributaries to the major tributaries have runoffs in the same general volumes as the major tributary on which they are located but with variations from the mean. In these streams the runoff can be considered the same as stream-flow because of the small amount of artificial storage or diversions in the Basin.

Direct runoff in the minor tributary streams is directly affected by the soils of the Basin and their ability to accept and retain rainfall in the soil profile, by the cover on the soils, and by the hydrologic condition of this cover. In the average watershed and when the soil is at average moisture content before the rain begins, 0.03 inches of direct runoff will occur from a 1.00-inch rainfall, 0.38 inches from a 2.00-inch rain, 0.95 inches from a 3.00-inch rain, 1.67 inches from a 4.00-inch rain, 2.44 inches from a 5.00-inch rain and 3.27 inches from a 6.00-inch rain. When the soil has a high moisture content before the rain begins the runoff will be much higher and if the soil is dry before the rain begins then the runoff will be lower.

Base runoff in most of these minor tributary streams is sufficient to provide some water for beneficial use. The watershed streams in the lower one-third to one-half of the Basin are characterized by large base flows. The dependability of base flow in the minor tributary streams will increase with the size of drainage area and as the stream is located nearer to the southern end of the Basin.

There are no long term stream gaging stations in the minor tributary streams; therefore, the volume and distribution of runoff could not be quantified.

Tributary Streamflow Characteristics

All of the main tributary streams are perennial streams except in extremely dry years and most of them even then. Also, most of the minor tributary streams are perennial except in dry years. The streams that would probably become intermittent or seasonal first are those streams within a 30 to 40 mile radius of Jackson and mainly in the Jackson Prairie physiographic subdivision.

The characteristics of flow after a runoff producing storm in most of the Basin watersheds are: (1) fairly fast and of short duration in the upper reaches of the watershed; (2) slower and of longer duration in the middle reaches; and (3) still slower and even longer duration in the lower reaches. The duration of over-bank flow in even the larger watersheds is seldom more than two or three days because of the relative difference in elevation from top to bottom of the watersheds and relatively short distance the flow has to travel from its source to its outlet. In some of the tributary watersheds where channels have been constructed and are in a good state of maintenance, the flow is fairly fast and of short duration.

Floodplain Delineation

The floodplains of the tributary watersheds vary in the Basin. The floodplains throughout the Basin are fairly wide in comparison to drainage area. They extend from the watershed outlet all the way up into the minor tributary stream bottoms. The length of the floodplains depends almost entirely on the length of the streams as flooding occurs from one end of the stream to the other. The percentage of the total watershed area that floods varies from an average low of 9.1 percent for the watersheds in the Middle Pearl Reach to an average high of 16.8 percent in the Upper Pearl Reach. There are an estimated 270,832 acres of floodplain in the 20 watersheds in the Upper Pearl Reach, 42,974 acres in 4 watersheds in the Reservoir Reach, 62,440 acres in 8 watersheds in the Jackson Reach, 53,714 acres in 4 watersheds in the Strong River Reach, 65,911 acres in 6 watersheds in the Middle Pearl Reach, 93,097 acres in 8 watersheds in the Lower Pearl Reach, and 100,473 acres in 8 watersheds in the Bogue Chitto Reach.

The frequency of damaging flood occurrence varies from an average low of 2.5 times per year in the Standing Pine Creek Watershed to an average high of 6.6 times per year in the Lawrence Creek Watershed. During the crop growing season the average low is 1.8 and the average high is 5.5 times per year in the respective watersheds. The average frequencies of damaging flood occurrence in the watersheds by Basin reaches are: Uper Pearl, 4.4 times per year and 3.4 times during the crop growing season; Reservoir, 5.5 and 4.4; Jackson, 2.9 and 2.0; Strong River, 2.8 and 1.9; Middle Pearl, 4.3 and 3.4; Lower Pearl, 5.2 and 4.2; and Bogue Chitto, 6.2 and 5.1.

The duration of flooding in the tributary floodplains is fairly short in the upper reaches of the watersheds, with maximum durations ranging from 17 to 22 hours. In the middle reaches of the watersheds the duration of flooding is longer with maximum durations ranging from 25 to 47 hours and still longer in the lower reaches with maximums ranging from 28 to 69 hours. Some of the overbank flow velocities become fairly swift particularly in open land areas (for example a maximum floodplain velocity of 4.35 feet per second in the lower reach of the Topisaw Watershed). This means that the depth of water would not be as great as if it were running slower but does mean that there will be more scour damage and more swept-over or knocked-over crops because of the higher velocities.

Flooding occurs more often in the spring and winter months of the year and less often in the summer and fall months. However, there is danger of floods at any time of the year with severe floods having occurred in every month of the year. When floods do occur in the summer and fall months, they do more damage to agricultural crops than if they occur in the spring and winter months.

Fish and Wildlife

To properly document existing fish and wildlife conditions within an area, habitat requirements of each species must be at hand. Too, man's activities have a direct bearing on wildlife habitat and resulting populations. The various practices of agriculture, whether it be dairying, beef cattle, row crops, or a combination of these and other practices, all exert varying influences on wildlife habitat.

Most species of wildlife need some woodland within their range, even those species termed "farm game." Therefore, present day forestry practices, regardless of what they may be, affect wildlife either beneficially or adversely on a short or long termed basis. Generally, bottomland forest types support higher populations as a result of soil fertility producing an abundance of browse plants and wildlife foodstuffs. Forests of this type within the Basin are considered the greatest asset to deer, turkey, squirrel, and furbearers. Among the better areas are Lobutcha and Yockanookany bottoms and Pearl bottoms near the confluence of Tuscalometa Creek. Hardwood areas surrounding the upper part of the 30,000 acre Pearl River Reservoir and within the lower 50 miles of the Basin are important waterfowl wintering areas. Approximately 716,363 acres of bottomland type forest are found within the Basin.

Mixed pine and upland hardwoods type makes up about 71 percent or 3,193,298 acres of the forested area within the Basin. This type is considered the second best forest game habitat and locally may even surpass the bottomland type for some species.

The longleaf-slash type, comprising 608,764 acres, is the least productive of the forest types, but actual carrying capacities depend upon the age of the forest. Near mature pine stands can be effectively managed for deer, turkey, and in most instances quail, by prescribed burning. Conversely, a fifteen year old pine stand offers little in the way of wildlife habitat.

Cooperative efforts between the Mississippi Game and Fish Commission, U. S. Forest Service, and private landowners make possible increased efforts toward management of wildlife resources on more than 140,000 acres within the Basin. Estimated big game harvest within the Basin during the 1966-67 season numbered 868 deer and 335 turkeys.

Farm game, quail, rabbits, and doves are attracted by agricultural operations. Quail and rabbits share much in common in cover requirements. Ditch bank vegetation, fence rows, field borders, hay meadows, and small to medium sized fields of row crops with some wooded areas are needed. Doves prefer larger fields of grains as soybeans and dairy silage crops. Approximately 1.7 million acres of agricultural lands make up farm game habitat.

Natural lakes formed by river changes are found throughout the Basin but become more numerous in the central portion of the Lower Pearl. Strong River and Bogue Chitto River are important fishing streams in areas where other natural waters are low. Better highways and newly constructed waters particularly large reservoirs, have drawn fishermen that formerly used marginal streams. However, the better streams are attracting fishermen from greater distances.

About 68,251 surface acres of water excluding streams are found within the Basin. About half of this acreage comprises the Pearl River Reservoir.

Appendix J, prepared by the Bureau of Sport Fisheries and Wildlife, deals with the supply, demand, and needs of fish and wildlife resources within the Basin.

Mineral Industry and Resources

The Bureau of Mines of the U. S. Department of Interior furnished basic inventory data of the mineral resources and industry.

Mineral substances were produced in all counties in the Pearl River Basin except Choctaw, Leake, Neshoba, and Newton in 1966 and 1967. Produced substances included mineral fuels -- petroleum, natural gas, and natural gas liquids; nonmetallic substances -- clay, sand and gravel, stone, shell, recovered sulfur, regenerated lime, and cement; and iron ore, the only metal ore.

The total annual value of minerals in the Pearl River Basin from 1963 to 1967 is as follows: 1963 - $110.2 million; 1964 - $108.6 million; 1965 - $100.0 million; 1966 - $92.5 million; and 1967 - $83.7 million. The total annual value has declined steadily during this period. Petroleum and natural gas were the dominant products among mineral fuels which accounted for 80 to 88 percent of the total annual value of produced mineral materials. In 1967, sand and gravel yielded the greatest value among nonmetallic minerals. Cement, stone and shell, regenerated lime, and clay were of successively lower value. Output and value of iron ore were very small.

The decline of total annual value of the mineral products in the Pearl River Basin since 1963 was related directly to the decrease in output of mineral fuels. The value of the sand and gravel produced in 1966 was about double that of 1963 and in 1967 declined only a little. Value of output of other minerals remained about equal to that in 1963. Decreasing values of mineral fuels and increasing values of produced sand and gravel are expected to be long term trends within the Basin.

Timber Resources

The timber resource is available from 67 percent of the land in the Study Area. Private ownership accounts for 94 percent of the forest land (38 percent farm, 20 percent forest industry, and 36 percent other private), with the remaining 6 percent in public ownership. The softwood forest type covers 66 percent of the forest land and hardwood types 34 percent.

In 1956 the forest land consisted of 2.2 billion cubic feet of growing stock and 7.7 billion board feet of sawtimber. Softwood species accounted for 52 percent of the growing stock and 62 percent of the sawtimber. The average volume of standing timber per acre is 515 cubic feet for growing stock and 1,800 board feet for sawtimber.

The total net annual growth of growing stock is 170.4 million cubic feet; 72 percent from sawtimber class and 28 percent from pole timber class. The average net annual growth is 40 cubic feet per acre. The net annual growth for sawtimber is 645.8 million board feet, or a yield of 150 board feet per acre.

Ninety-four percent of the forest land, containing 90 percent of the growing stock and sawtimber, is privately owned. The volume of standing timber per acre is 500 cubic feet of growing stock which includes 1,700 board feet for sawtimber.

Publicly owned forest land contains 10 percent of the growing stock and sawtimber. The volume of standing timber per acre is 800 cubic feet of growing stock which includes 2,900 board feet for sawtimber. The larger per acre volume on public land results primarily from better management.

During the calendar year 1967, the Study Area had a reported timber drain of 255.2 million board feet of board measure products. Board measure products include lumber, logs, poles, and cross ties. Other products harvested included 728,341 cords of pulpwood, 5,999 tons of distillate wood, and 380 barrels of turpentine.

CHAPTER III

ECONOMIC DEVELOPMENT - PRESENT AND PROJECTED 1980-2015

General

The principal factors determining the future water needs of the Study Area are its population and production. As these increase, the withdrawal and use of water and needs in fields related to water resources will expand. Thus, one of the basic needs is the extent and character of water resource activity needed for all purposes between the present time, 1980, and 2015 as associated with population growth and production.

Longer-run economic policy and related commitments involve appraisals and assumptions regarding future expansion in the demand for goods and services and in general economic growth. Water and related land resource development often require either systems of river basin or watershed works or large control structures which may endure for a period of 50 years or more and which affect many people, many square miles, and many economic activities. The scale of these developments requires that consideration be given to the impact of these projects on the people and the economy they are intended to serve.

Assumptions

The projections of economic growth were developed under the following major assumptions: (1) Sufficient quantities of water of acceptable quality will be made available by timely development in such a manner as to avoid being a constraint to economic growth; (2) No major depressions and reasonably full employment for the Nation with a stable general price level; and (3) A continued trend toward relative stability of the international situation with no significant worsening of the "cold war" and no widespread outbreak of hostilities.

Limitations

To predict what will happen in the next half century is a feat beyond the power of social science. The projections should not be interpreted as being precise, specific figures

for future years. Rather, they should be utilized as the relative magnitudes, directions, and patterns that may be expected to prevail. For an area as small as the Pearl Basin, analyses and projections were complex because in many instances sharp fluctuations in the direction or rate of historical economic change provided no satisfactory statistical long-run trend. It is expected that such fluctuations will continue to occur among the smaller economic parameters, thus emphasizing the necessity of evaluating such projections as general long-range trends past 1965, rather than specific projections for the specific years of 1980 and 2015.

Population

Population in the Pearl Study Area totaled 558,000 in 1960. Historical growth in the Sub-areas has not been consistent. The agriculturally-dependent Middle Sub-area contained nearly one-half of the Study Area's population in 1870 but only 31 percent in 1960. It reached a peak of 189,977 in 1940 and declined to 169,887 by 1960.

At about the same time the Upper Sub-area began a period of rapid growth. With Jackson's metropolitan area fostering economic growth, population growth averaged about 1.5 percent per year from 1940 to 1960. From 1910 to 1920 the Upper Sub-area's population decreased but rebounded the following decade. The Upper Sub-area comprised 44 percent of the Study Area population in 1870; 36 percent in 1920; and 48 percent in 1960.

The Lower Sub-area, like the Middle Sub-area, experienced great growth in the late 1800's but its rate did not diminish in the 1900's as did the Middle Sub-area's. In the 1870 to 1910 period, population doubled every two decades. Going from 13,200 in 1870 to 119,100 in 1960, the Lower Sub-area increased its relative share of the Study Area's population from 10 to 21 percent.

The Lower Sub-area's population should expand faster than the other two Sub-areas', reaching 425,300 by 2015. Its internal growth coupled with absorption of growth from adjacent areas should assist it to record the highest rate of growth between 1980 and 2015. Its share of the Study Area's population is expected to reach 31 percent in 2015.

The population of the Upper Sub-area stood at 285,000 in 1965 and accounted for 49 percent of total inhabitants. An increase to 383,600 by 1980 will enable it to claim a majority which it is forecast to hold to 2015.

The Study Area's population is projected to increase from 558,000 in 1960 to 745,400 by 1980 and to 1,380,400 by 2015, (Table 3.1). An increased demand for goods and services will accompany this population increase. Balanced water and related land planning is a basic prerequisite to planning for associated needs.

Urban, Rural Nonfarm, and Rural Farm Population

Several characteristics of population other than total size exert influences upon the economy. One is the extent of urbanization. Urbanization has become almost synonymous with economic growth, for as an area becomes more urban its rate of economic growth tends to increase.

The Upper Sub-area, primarily as a result of the Jackson SMSA influence, has been historically the Study Area's most urban Sub-area. Its 166,600 urban inhabitants in 1960 accounted for approximately two-thirds of the Study Area's urban population, compared to slightly over one-half in 1930.

Rural nonfarm population did not exceed rural farm until 1960. As late as 1950, 69 percent of the rural population lived on farms, but during the 1950's, a 38,100 rural farm population loss countered by a 23,800 rural nonfarm population gain effectuated a reversal of this relationship which left only 42 percent of the Sub-area's 1960 rural population on farms.

The Upper Sub-area's rural farm population is expected to decline from 42,900 in 1960 to 19,100 in 2015. Simultaneously, rural nonfarm population is forecast to continue upward from 59,600 to 104,100 during this 55-year period.

Jackson's dynamic growth and the expansion of other municipalities are expected to raise urban population to 291,300 in 1980, and almost double that by 2015.

In 1960, over three-fourths of the people living in the Middle Sub-area were classified rural inhabitants, only slightly below the 88 percent rural majority of 1930. An increase of only 16,700 urban people from 1930 to 1960 was not sufficient to offset the greater decrease in farm population; consequently, total population declined.

Only after 1980 is any sizeable increase in urban population predicted for the Middle Sub-area. Population density will remain predominately rural, terminating at 102,100 urban inhabitants and 136,500 rural nonfarm inhabitants. The Middle Sub-area will have a projected rural nonfarm population exceeding urban population in 2015.

The Middle Sub-area's rural farm population is expected to decline slowly from 45,400 in 1960 to 20,600 in 2015, a loss of 24,800 in contrast to the 56,100 decrease that occurred from 1950 to 1960.

Historical growth in the Lower Sub-area can be attributed to growth in both the rural nonfarm and the urban populations. For example, from 1950 to 1960, rural nonfarm population increased 25,000 while urban population increased 12,900. During the same decade, rural farm population declined 16,700, a loss considerably greater than the gain experienced in urban growth.

Future urban growth in the Lower Sub-area is assumed to begin to accelerate before 1965 as a result of the economic stimuli provided by the NASA facility and the population spillover from adjacent areas. A projected total of 285,200 urban inhabitants in 2015 is five and one-half times the number residing in the Sub-area in 1960.

Rapidly changing land use patterns are predicted to diminish the number of farm inhabitants to a low of 5,500 by 2015 - the result of urban expansion contributing to the existing trend of decreasing rural farm population in the Lower Sub-area. The Study Area's historical and projected population composition by place of residence is presented in Table 3.2.

Table 3.2 Urban, rural nonfarm, and farm population, Pearl Study Area 1930-1960 and projected 1965, 1980, and 2015

Year	Urban	Rural			Total
		Nonfarm	Farm	Total	
	Thousands	Thousands	Thousands	Thousands	Thousands
1930	102.5	75.7	242.0	317.7	420.2
1940	131.1	83.9	262.2	346.1	477.2
1950	182.0	116.7	211.8	328.5	510.5
1960	254.1	202.9	101.0	303.9	558.0
1965	288.8	208.9	81.0	289.9	578.7
1980	440.7	249.6	55.1	304.7	745.4
2015	960.0	375.2	45.2	420.4	1,380.4

Source: Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area, Volume I and Volume II, Michael Baker, Jr., Inc., Jackson, Mississippi, December 1964.

Labor Force

Employment in the Study Area is limited roughly by the size of its labor force derived from its population. In turn, the productivity of the labor force is a major indicator of the income flow that the economy can generate.

The expansion of the labor force in the Study Area from 155,100 in 1930 to 191,100 in 1960 was accomplished despite an 11 percent decline in the Middle Sub-area. With a relatively stable growth pattern by decades, the Upper Sub-area increased its labor force over one-half and accounted for the major share of the expanding labor force of the Study Area in the 1930 to 1960 period.

Between 1940 and 1960 the labor force of the Middle Sub-area declined, and no upswing is in sight before the 1970's. Unable to escape its reliance on agricultural employment, the labor force in the Middle Sub-area declined from 40 percent of the Study Area's total in 1930 to 29 percent in 1960. This declining significance of this Sub-area is evidenced by a projected slide to 18 percent of the Study Area's total labor force in 2015.

The Lower Sub-area experienced a good, but not outstanding, gain of 32 percent in the 1930 to 1960 period. As population "explodes," labor force additions in the Sub-area of 9,400 in the historical period will be multiplied over tenfold in the period 1960 to 2015. Although the Lower Sub-area is not expected to attain the rank of a major labor force center, its anticipated expansion rate of 257 percent should mark the Sub-area as the leading labor force growth area throughout the Study Area.

Total Employment

Study Area employment increased from 140,200 in 1930 to 176,400 in 1960 - a gain of 36,200 workers. This gain was accomplished despite an employment shrinkage in the Middle Sub-area. The Upper Sub-area, with a growth of almost 60 percent, enjoyed particularly good gains in total employment.

The impetus behind employment gains in the Upper Sub-area is found in the development of Jackson as a government-distribution-financial-service center. Jackson and the Upper Sub-area are in the approximate center of a territorial market cluster of dynamic growth and influence, bounded on the east

by Atlanta; on the west by Houston and Dallas; on the north by St. Louis, and on the south by New Orleans. This Sub-area enjoyed an employment expansion of almost 10 percent during the depressed 1930's.

Severe losses in total employment beset the Middle Sub-area in the decade of the 1950's. Total employment dropped from 59,900 in 1950 to 49,800 in 1960 in conjunction with a decline in total population. Little gain is contemplated between 1960 and 2015, as the economy of the Sub-area is concentrated in broiler and lumber production, egg processing, and the manufacture of wood product industries that offer limited promise for generating substantial new payrolls. A compounding influence on future employment in the Middle Sub-area is that a relatively large portion of its labor force will tend to be employed in the Upper Sub-area.

The Lower Sub-area has shown good, consistent growth in total employment since 1940 and has established a firm fundamental base. The close geographical proximity to the fast growing New Orleans and Mississippi Gulf Coast areas is expected to spur future employment gains.

It is anticipated that the Study Area employment will expand from 176,400 in 1960 to 237,800 in 1980, an increase of 35 percent. Between 1980 and 2015, total employment will likely expand an additional 84 percent and approximate 437,000 workers. Historical and projected employment estimates are presented in Table 3.3 for the major employment categories.

Income

Total personal income is that received by residents of an area from all sources, inclusive of transfers from government and business but exclusive of transfers among persons. It is income received before taxes and includes allowances for non-monetary income or income received "in kind" rather than cash. It consists of six major components - wage and salary disbursements, other labor income, proprietors' income, property income, and transfer payments but excluding personal contributions for social insurance.

Study Area personal income was approximately $840 million in 1960. The Upper Sub-area has provided, and is expected to continue to provide, the income leadership for the Study Area. Diversified economic developments and expansion in personal income in Jackson accounted for growth in the Sub-area's personal income from $71.1 million in 1930 to $400 million in 1960. This economic leadership is expected to prevail during the 1960 to 2015 period, with personal income in 2015 almost reaching $2.9 billion - over seven times the 1960 total.

Table 3.3 Employment by major divisions, Pearl Study Area, 1930-1960 and projected 1965, 1980, and 2015

Employment classification	Historical				Projected		
	1930	1940	1950	1960	1965 1/	1980	2015
	Number	Number	Number	Number	Number	Number	Number
Major water-using manufacturing industries	2,026	4,695	6,750	10,072	11,020	14,390	32,320
Food	689	1,632	2,368	5,082	5,220	7,130	17,160
Pulp and paper	729	1,733	2,805	3,824	4,560	5,670	12,070
Chemicals	388	1,240	1,454	769	840	1,100	2,240
Petroleum	2	6	51	81	80	130	390
Primary metals	218	84	72	316	320	360	460
Other manufacturing industries	10,350	12,414	20,879	26,490	28,520	38,370	65,400
Textiles	155	208	120	320	220	220	220
Apparel	324	2,059	3,547	6,796	7,370	10,400	21,060
Lumber, wood and furniture	7,657	8,485	13,025	10,482	10,420	11,220	10,170
Printing and publishing	290	643	1,140	1,472	1,610	2,160	3,740
Stone, clay and glass	0	476	1,199	2,260	2,670	4,140	8,590
Fabricated metals	0	46	338	714	940	1,640	3,580
Machinery	0	154	376	1,013	1,240	1,960	3,980
Electrical machinery	0	---	350	1,675	2,070	3,490	7,070
Transportation equipment	0	241	488	1,333	1,490	2,380	5,390
All other	1,924	102	296	425	490	760	1,600
Nonagricultural-nonmanufacturing	46,533	58,213	88,649	116,920	128,600	174,700	332,100
Mining	330	646	1,381	2,995	3,110	3,310	4,170
Construction	3,023	5,658	10,306	12,712	14,730	20,180	37,300
Transportation & communication	6,475	4,959	7,193	8,748	9,020	9,800	11,700
Wholesale & retail trade	10,194	15,024	25,166	29,487	31,720	45,300	90,850
Finance, insurance and real estate	1,654	4,337	3,024	5,997	7,100	8,550	18,020
Services	17,301	16,066	19,566	27,935	31,220	44,750	89,310
Government	3,524	8,236	17,559	22,538	24,750	35,450	71,750
Utilities	1,824	957	2,047	2,497	2,720	2,940	4,140
Other	2,208	2,330	2,407	4,011	4,230	4,420	4,860
Agriculture	81,308	71,422	56,122	22,914	17,500	10,300	7,200
Total	140,217	146,744	172,400	176,396	185,600	237,800	437,000

Source: Economic Base Study of the Pascagoula, Pearl and Big Black River Basins Study Area, Volume I and Volume II, Michael Baker, Jr., Inc., Jackson, Mississippi, December 1964.

1/ Data for 1965 are projections in the economic base study.

The agriculturally dependent Middle Sub-area has not shown the income expansion exhibited by the Upper Sub-area. This is reflected in the decline in its rate of income growth after 1940. Relatively slow urban growth and lack of diversified economic development in the Middle Sub-area are expected to continue to retard future income growth. Personal income therefore is projected at $635 million in 2015, only about 23 percent above that in 1960.

The Lower Sub-area is in the path of rapidly expanding urban developments along the coast line from Pensacola, Florida, to New Orleans, Louisiana. With the recent establishment of the NASA rocket booster static test facilities in the Lower Sub-area and the almost inevitable spillover of the swift expansion of economic development along the Mississippi Gulf Coast and New Orleans, the future growth in personal income should accelerate at a much higher rate than has occurred in the past. In 1960, personal income of $247 million accounted for about 30 percent of the Study Area's income. By 2015, it is projected to top $2 billion and climb to 37 percent of the Study Area total.

Households

The household is the basic consuming unit of home construction and accessory items in our economy. By definition, the number of households and the number of occupied dwelling units are synonymous. The actual number of households is related to marriage rates in the adult population and to the number of non-family units occupying separate housing units. Further, population age composition and sex distribution have strongly influenced the rate of household formations.

Households in the Study Area increased from 91,100 in 1930 to 147,600 in 1960. Growth was supported by accelerated growth in the Upper and Lower Sub-areas, but restricted by the dormancy of the Middle Sub-area after 1940. If anticipated growth rates materialize between 1960 and 2015, the Study Area will experience sufficient household additions to raise the number of households to 416,000 in 2015.

The Land and Water Resource Base

The economic parameters previously discussed were primarily non-agriculturally oriented and not as directly associated with the land and water base as the agricultural parameters.

Current and future agricultural production is affected by the availability and quality of land and for that reason the base is established to aid in interpreting the changes in individual agricultural parameters.

The total land and water resource base is divided into two broad classes - agricultural land and non-agricultural land and water. Detailed use of land in farms was derived from Censuses of Agriculture and other official data sources. Forestry data for non-farm categories were derived from official U. S. Forest Service sources and appropriate State sources. Non-agricultural land use was adapted from information in the 1958 Conservation Needs Inventory and the unpublished 1966 Inventory.

Major land use data for the Pearl Study Area are presented in Table 3.4. Ninety-four percent of the gross area is considered in the agricultural sector and only six percent in the non-agricultural sector. The agricultural sector includes land in farms and forest acreage held under different types of ownership.

The succeeding discussions deal with agricultural land in farms and agricultural land not in farms, respectively.

Agricultural Economy

The agricultural portion of the total economy of the Pearl Study Area was developed to cover three time periods: (1) historical years (primarily up through 1964), (2) the year 1980, and (3) the year 2015. The present statistical profile of the farm sector is primarily in terms of 1964 data and for non-farm forestry, primarily in terms of 1957 data.

National Production Requirements

The food, feed, and fiber (wood, cotton, and tobacco) requirements were developed to support a national population of 237 million in 1980 and 399 million in 2020. The projected national requirements for 1980 and 2020 represent the expected demand under the specified assumptions presented earlier. The national production requirements were adjusted to account for imports and exports. Consequently, the end result is the amount of agricultural products that will need to be produced to supply domestic requirements in the United States and to allow for projected exports.

Table 3.4 Major land use, Pearl Study Area, 1964 and projected 1980 and 2015

Land use	1964 5/	Projected 1980	Projected 2015
	Acres	Acres	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
Forest ~~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
	Percent	Percent	Percent
Proportion in farms	51	51	48
Agricultural proportion	94	93	88
Non-agricultural proportion	6	7	12

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 for Ross Barnett Reservoir which is included) 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 to be built after 1959 principally by Corps of Engineers and Soil Conservation Service as reflected in tentative plan formulation.

4/ Area converted to new water not deducted from total approximate area in years 1980 and 2015.

5/ 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.

Expanding national requirements for agricultural production results from three major economic forces, i.e., growth of population, rising per capita consumer income and the associated changes in taste which influence trends in per capita use and growth of foreign demand. The product requirements of the United States, in the aggregate, can be expected to increase largely as a function of an assumed population growth. At higher income levels, consumer response to further income gains is reflected mainly in shifts among individual commodities with little increase in total overall consumption of farm products per person. Nutritional and medical findings, food fads, and development of synthetic materials have influenced past trends in consumption, although their influence is difficult to measure quantitatively. These and other intangible factors will continue to affect growth in demand for farm products in the future.

The basis of projecting national product requirements was to project requirements per person for all major crop and livestock products. Estimates of total requirements were derived by multiplying the resulting per capita estimates for each commodity by projected population. Current and projected requirements for major crops, livestock products, and industrial timber products are presented in Table 3.5.

Pearl Study Area Production Requirements

A share of the future national production requirements for agricultural products was assigned to the Pearl Study Area based on the historic relationship of the Area's production to that of the States of Mississippi and Louisiana. 1/ The share assigned to the States was based upon their historic production relationship to that of the Delta Area composed of Mississippi, Louisiana, and Arkansas. The Delta Area's assigned share was based on its historic production relationship to that of the United States.

Information concerning agricultural production in the Pearl Study Area and Sub-areas was obtained from many sources. Previous publications were examined, college and experiment station personnel were contacted, and direct consultation with production specialists was made in some instances. The primary source of data and the main basis of analysis, however, was from the Statistical Reporting Service of the U. S. Department of Agriculture and the Bureau of the Census.

1/ Time series data for the period 1939-1964.

Table 3.5 Production requirements for agricultural commodities, United States, 1959-61, with projections to 1980, 2000, and 2020

Commodity	Unit	1959-61	1980	2000	2020
		Thousands	Thousands	Thousands	Thousands
Feed grains (corn equiv.)	Tons	145,128	197,200	244,100	298,700
Corn	Tons	106,010	141,500	178,400	222,400
Oats	Tons	17,167	17,800	15,800	11,000
Barley	Tons	9,995	12,300	12,200	11,000
Sorghum	Tons	15,445	25,600	37,700	54,300
Food crops					
Wheat	Bu.	1,237,700	1,873,600	2,127,500	2,458,600
Rye	Bu.	27,868	41,400	54,100	71,800
Rice (rough)	Cwt.	54,145	83,300	93,600	107,000
Flaxseed	Bu.	24,605	21,800	27,000	33,500
Soybeans	Bu.	589,257	1,268,900	1,531,900	1,860,900
Peanuts (farm stock)	Lbs.	1,705,500	2,428,000	3,179,000	4,133,000
Sugar	Tons	3,290	7,300	11,400	16,500
Dry beans	Cwt.	19,048	22,900	28,900	36,600
Dry peas	Cwt.	3,927	5,300	6,100	7,200
Potatoes	Cwt.	265,609	319,100	420,600	551,200
Sweet potatoes	Cwt.	16,508	17,500	23,200	30,600
Fruits and vegetables					
Citrus fruits	Tons	8,028	11,000	14,100	17,900
Noncitrus fruits	Tons	9,952	12,600	17,200	22,900
Vegetables	Cwt.	403,902	615,900	801,800	1,034,600
Tree nuts (shelled)	Lbs.	170,000	147,700	275,700	436,000
Fiber crops					
Cotton	Lbs.	7,191,300	8,083,000	9,405,000	11,064,000
Tobacco	Lbs.	1,934,200	2,134,000	2,668,000	3,337,000
Livestock and products					
Beef and veal	Lbs.	28,898,500	45,506,000	60,588,000	79,506,000
Pork	Lbs.	20,220,000	25,947,000	33,990,000	44,056,000
Lamb and mutton	Lbs.	1,683,000	1,630,000	2,164,000	2,831,000
Farm chickens	Lbs.	1,251,700	1,396,000	1,824,000	2,362,000
Turkeys	Lbs.	1,600,900	3,413,000	4,448,000	5,746,000
Eggs	No.	62,302,000	72,613,000	95,251,000	123,886,000
Milk	Lbs.	123,460,700	139,372,000	181,490,000	234,226,000
Broilers	Lbs.	6,207,100	10,263,000	13,293,000	17,094,000

Source: Preliminary Projections of Economic Activity in the Agricultural, Forestry and Related Economic Sectors of the United States and its Water Resource Regions, 1980, 2000, and 2020, Economic Research Service and Forest Service, United States Department of Agriculture, August 1967.

The difference between present output in the Pearl Study Area and projected requirements for agricultural products provides a guide to the needs for development of land and water resources. The agricultural profile of the Study Area may be ascertained from data presented in Table 3.6.

Total agricultural output in the Pearl Study Area is projected to increase in the aggregate but for some individual commodities a decrease in output and resulting resource use will occur. The projected output is the requirement of the Area to meet its share of local and national requirements including exports. Farm operators may find it to their individual advantage to produce more of some commodities and less of some others. However, the resources are such that the requirements could be produced should it be profitable for farmers to do so.

Cotton. Historically, this crop has been a main-stay for the farm operators. Cotton is important in terms of acreage, cash income, use of family labor, and purchased input consumption. However, its importance has declined considerably in recent years. Acreage declined from around 200,000 acres in the 1950's to about 100,000 in the mid-1960's. It is anticipated that acreage will continue to decline through 1980 and level off between 1980 and 2015. Moderate increases in yields are expected to occur. The quality of the land resource and known technology are such that yields could increase considerably more than indicated by the projections. In the future as in the past increased per acre yields will buffer the impact of declining acreage and associated farm marketings and receipts.

Corn. This crop has always been an important crop enterprise in the farm business of the Study Area. Considerable acreage has been used for corn production. The grain itself has traditionally been used for feed for workstock, swine, poultry, and for home consumption. Although inter-farm sales occur, past output was not a major source of cash farm income.

It appears that a decline in corn acreage and production will accompany the decline in farm operators. Unless the structure of agriculture in the Area undergoes a dramatic competitive change, corn production of any consequence will likely cease in the not too distant future.

Table 3.6 Agricultural and forestry resource statistics, Pearl Study Area, 1959 and 1964 and projected 1980 and 2015

Item	1959	1964	Projected 1980	Projected 2015
General				
Number of farms	31,047	26,773	19,000	15,100
Average size of farm (acre)	113	130	180	210
Capital investment (million dollars)	365	492	570	657
Average investment per farm (dollars)	11,765	18,375	30,000	43,500
Agricultural production base				
Land in farms (thou. acres)				
Cropland	1,116	959	953	845
Woodland	1,708	1,563	1,726	1,625
Pasture	622	774	654	622
Other	109	99	96	90
Total	3,555	3,395	3,429	3,182
Use of cropland (thou. acres)				
Cotton	100	100	66	66
Corn	226	139	110	57
Oats	12	4	15	9
Soybeans	1	6	10	15
Hay	113	159	165	150
Miscellaneous and other	104	80	38	33
Total harvested	556	488	404	330
Total pastured	415	347	426	410
Total idle	145	124	123	105
Total cropland	1,116	959	953	845
Pasture for livestock (thou. acres)				
Cropland	415	347	426	410
Woodland	1,054	1,000	949	925
Other - permanent pasture	622	774	654	621
Total pastureland	2,091	2,121	2,029	1,956
Land in forests (thou. acres)				
Farm forests	1,708	1,563	1,726	1,625
Nonfarm forests	2,811	2,891	2,763	2,679
Total forests	4,519	4,454	4,489	4,304
Other land and/or water use (thou. acres)				
Federal	2	16	35	69
Urban	251	287	330	592
Water	53	83	115	150
Total other	306	386	480	811

Continued

Table 3.6 Agricultural and forestry resource statistics, Pearl Study Area, 1959 and 1964 and projected 1980 and 2015 (Continued)

Item	1959	1964	Projected 1980	Projected 2015
Agricultural production requirements				
Crop production				
Cotton (thou. bales)	66	103	79	88
Corn (thou. bushels)	6,761	4,956	5,005	3,640
Oats (thou. bushels)	342	170	777	555
Soybeans (thou. bushels)	20	133	300	510
Hay (thou. tons)	136	219	280	350
Livestock numbers (thousand)				
All cattle and calves	503	612	678	952
Milk cows	111	96	102	143
Sheep and lambs	17	6	9	14
Hogs and pigs	117	63	58	48
Horses and mules	32	22	15	9
Farm chickens	2,270	4,833	4,620	4,924
Broilers	53,000	71,457	123,514	220,000
Turkeys	3	5	18	27
Livestock production				
Beef and veal (thou. lbs.)	125,750	153,000	217,100	328,500
Lamb and mutton (thou. lbs.)	476	168	400	600
Pork (thou. lbs.)	30,420	16,380	15,600	14,300
Broilers and turkeys (thou. lbs.)	164,348	221,598	423,700	770,500
Milk (thou. lbs.)	331,659	268,800	488,200	785,400
Eggs (thousands)	376,820	802,278	1,017,000	1,285,000
Forestry production				
Growing stock (million cu. ft.)				
Inventory	2,217.0 1/	2,548.0 2/	4,376.0	2,959.0
Growth	170.4 1/	190.0 2/	217.0	163.0
Cut	132.4 1/	109.0 2/	128.0	290.0
Sawtimber (million bd.ft.)				
Inventory	7,735.8 1/	8,472.0 2/	14,415.0	10,868.0
Growth	645.8 1/	716.0 2/	789.0	625.0
Cut	450.3 1/	388.0 2/	482.0	985.0

Source: United States Census of Agriculture - Mississippi Counties - 1954 and 1959, United States Department of Commerce and internal data of the U. S. Forest Service.

1/ 1956 estimates.

2/ Derived from projected 1965 estimates.

Oats. The growing of oats for grain is not nearly as widespread in the farm business as cotton and corn. Acreage and production fluctuate within rather wide ranges. Although the trend has not been very uniform, oat production appears to be going out in the Study Area. In the future, limited resource use will be commanded by oats.

Soybeans. Production was practically nonexistent prior to 1960. Currently, about 6,000 acres are being harvested and it is anticipated that acreage will increase to about 10,000 in 1980. Thus far the big increase in acreage has been limited to Rankin and Jefferson Davis Counties. If similar resource adjustments should take place in the other counties of the Study Area, the projected acreage and production will likely be low.

Hay. The total acreage devoted to different hay crops represents a sizeable amount of land. The principal hay crops grown are small grain, lespedeza, clover-timothy, alfalfa, and miscellaneous hay. It is not anticipated that the acreage devoted to this use will change much from 160,000 acres. Better management of the hay land could result in sizeable increases in hay output. Only moderate increases in yields are projected; however, there is ample capacity to increase hay output from a land resource base essentially unchanged from the current base.

Miscellaneous and other crops. The land used, inputs applied, and products derived therefrom are relatively minor when compared to commercial farming. As specialized crop enterprises become more entrenched, only a limited amount of resources will be expended on these crops.

Beef and veal. The shift in emphasis from row crops to livestock and livestock products occurred in the early 1940's. By the early 1950's, farm receipts from all livestock exceeded that derived from crops.

Beef and veal output will increase in the Study Area and will result from increased livestock numbers and from output per head. The number of beef cattle fed will increase moderately. Estimates of cattle on feed have been available from Mississippi for only six to eight years and therefore no meaningful projections could be made.

Milk. The trend in milk cows and other dairy cattle and the associated production of milk and butterfat is definitely downward in the Study Area. It is anticipated that this trend will bottom out between 1964 and 1980 and some increase may be expected by 2015.

Actually, the strength of the dairy industry is concentrated in fewer than half the 17 counties comprising the Study Area. The action of dairy farmers to expand or contract production in these counties will depend largely on several factors - State and Federal regulations, alternative pursuits, and profitability of current operations.

Pork. The trend is definitely downward for swine and associated pork and lard production. Cyclic patterns in swine numbers and production make it difficult to project with any degree of accuracy, however, pork production is expected to continue to decline to relatively insignificant levels.

Lamb and mutton. Sheep production is a minor livestock enterprise with little change anticipated in future years. Production will certainly not be widespread and most likely will be concentrated on a relatively few farms. Future national requirements indicate that Louisiana, Mississippi, and the Study Area will contribute only a meager portion.

Broilers. The Pearl Study Area is an important producer of broilers. The principal producing counties are Scott, Leake, Rankin, and Simpson.

Over 71 million birds were sold in 1964. By 1980, approximately 124 million birds are expected to be marketed and 220 million by 2015. Most of the projected production in the State of Mississippi will be produced in the Pearl Study Area. The Area is currently in a good competitive position and is a surplus supplier of broilers to marketing centers of the United States.

Eggs. Production has been expanding in recent years and this trend is expected to continue. The early development of egg production was as a sideline enterprise on farms. In recent years, a new commercial egg industry has emerged.

Egg producers have adopted new and emerging production and marketing practices. In particular, producers have been receptive to cost-reducing changes and have achieved a high degree of coordination of production, input-supplying, and marketing. The willingness of entrepreneurs to adopt new systems in future years will enhance their competitive position.

Turkeys. This is a relatively minor poultry enterprise. A limited number of turkeys are raised and consequently a limited output. Some increase in numbers and production is anticipated but the change will have little effect on national product requirements.

Horses and mules. These animals are included not because they have just about plowed their last row but because of their emerging use as pleasure animals. The number of horses and mules declined from 50 thousand head in 1954 to 32 thousand head in 1959, the year estimates were discontinued. This trend is expected to continue, however, the rate of decline will likely be curtailed by the retention of horses for recreational pursuits.

Farm Profile - Present and Projected

An inventory of existing resources is fundamental in formulating and proposing plans to aid in water and related land resource development, conservation, and use. Farm profile data are presented to aid in interpreting the meaning and significance of changes in agricultural production and resource use.

Farms. There were 26,773 farms in the Study Area in 1964. The number of farms is declining and this trend is expected to continue. Farmers and farm families have been leaving the farm in large numbers. Consolidation of small farm units into larger operating units has been an important factor contributing to the net decrease in farm numbers.

In the main, farms are relatively small, averaging 130 acres in 1964. Most farms are owner-operated with relatively few tenants. Tenant operations have declined drastically since 1945. White operators outnumber non-white operators approximately two to one.

Land in farms. Land in farms has undergone relatively minor fluctuations since the turn of the century. Under varying types of ownership arrangements, farmers operate a land base of approximately 3.4 million acres. This farm land base will remain essentially unchanged through 1980 but non-farm encroachment will decrease the farm base by the year 2015 (see projection in Table 3.6).

Approximately 28 percent of the land in farms is cropland. The principal crops grown consist of cotton, corn, oats, soybeans, and hay crops.

Forty-seven percent of the land in farms is classified as farm woodland. Pasture land accounted for 22 percent of the base and other land 3 percent in 1964.

Type of farming. Most of the farms are classified as "miscellaneous and unclassified." Value of product sales is less than $2,500 and derived mostly from forest, nursery, and greenhouse products.

Cotton, livestock, and dairy farms are the prevalent commodity type farms. Poultry farms have gained in importance in recent years. Cotton type farms will diminish in importance in future years while livestock and poultry will take on added prominence.

Crop enterprises. The size of individual crop enterprises is dependent upon the cropland base. Most farmers harvest 10 to 49 acres of cropland. A majority of farmers harvest less than 10 acres of cotton, corn, oats, or soybeans.

Livestock enterprises. The most important livestock enterprise (excluding poultry) in 1964 was beef production. Over 80 percent of the farmers reported having cattle and calves.

About 50 percent of the farmers report some milk cows. Commercial milk production is not nearly as widespread as the practice of maintaining a few milk cows to supply farm family needs.

About 50 percent of the farmers report having hogs and pigs. The number of farmers reporting swine is diminishing and the number of swine per farm is relatively small.

Commercial broiler and egg production are important enterprises. The production of both is highly specialized and certainly enhances the economic situation of many farmers.

Forestry enterprises. Farmers derive part of their farm income from the sale of forest products. Pulpwood and sawlogs are the two most important forest products sold. Farmers in addition benefit from the use of forest products in their farm business. Fence posts and fuelwood are typical examples.

Mechanization. Agricultural mechanization is related to the substitution on farms of mechanical sources of power for animal sources with a resulting decrease in man-labor inputs in the production process. The Pearl Study Area, in general, has lagged behind in the mechanization of farms. It is advanced by agricultural specialists familiar with the situation that labor tended to be abundant and inexperienced technically and that expensive mechanical power had difficulty gaining a foothold. The current movement of farm wage hands to high-paying industrial jobs has increased the demand for mechanical power by Study Area farmers. The adoption of labor saving devices will be accelerated in future years.

Farm income. Income estimates are the product of unit prices times the quantity of commodity. Actual prices were used to cover sales reported for historical years. Projected receipts from farm marketings were determined by combining projected production for 1980 and 2015 with anticipated long-run prices of agricultural commodities as presented in the 1951 U. S. Department of Agriculture publication entitled "Agricultural Prices and Cost Projections."

Farm income is that received in cash and non-monetary allowances. It consists of four major components - farm marketings, home consumption of farm produced products, rental value of farm dwellings, and government transfer payments.

Farm income data are presented in Table 3.7. The chief component of gross income is from the marketing of crop, livestock, and forest products. Currently, livestock and livestock products account for 75 percent of marketing receipts and crops 25 percent. Broilers and eggs are the most important source of livestock receipts and cotton is the most important source of crop receipts.

Other income is derived from the consumption of farm produced products, value of the farm dwelling, and government transfer payments. In 1964, approximately 17 percent of gross income was from these sources.

Farm proprietors net income was $57 million in 1964 and averaged $2,136 per farm. Farm per capita income was less than half that of the total population in 1964. It is anticipated that this disparity will not be as great in 1980 and 2015. Projected farm income data are presented in Table 3.7.

Forestry Resources

Forest land accounted for approximately 4.3 million acres in the Pearl Study Area in 1957. Acreage has fluctuated moderately since 1930 and little change is anticipated in the future. Acreage is expected to increase slightly between 1965 and 1980 but a slight reduction is estimated between 1980 and 2015 due to competitive land demands.

In 1957, private ownership accounted for 94 percent of all forest land and public, 6 percent. Forest land privately owned is divided among that in farms, forestry industry, and other private.

Of the total forest land area, 66 percent is covered by softwood forest types. Loblolly-shortleaf pine is the dominant softwood type. Oak-hickory is the dominant hardwood type with oak-gum-cypress almost equally as important. The stand size

Table 3.7 Gross income, production expense, and net income, Pearl Study Area, 1959 and 1964 and projected 1980 and 2015

Item	Unit	1959	1964	Projected 1980	Projected 2015
		Dollars	Dollars	Dollars	Dollars
Receipts					
Farm marketings	Thousands	112,208	119,151	226,064	360,256
Other 1/	Thousands	22,442	23,830	30,827	40,028
Total gross income 2/	Thousands	134,650	142,981	256,891	400,284
Total production expense	Thousands	80,790	85,789	152,435	248,191
Net income 2/	Thousands	53,860	57,192	104,456	152,093
Net income per farm	Dollars	1,735	2,136	5,498	10,072
Per capita farm income	Dollars	533	706	1,896	3,365

Source: Historical data from Louisiana and Mississippi Census of Agriculture - 1964, Bureau of the Census, United States Department of Commerce.

1/ Includes value of home consumption of farm products, value of farm dwellings, and government transfer payments.

2/ Excludes changes in inventories.

mix is as follows: large and small sawtimber, 32 percent; pole timber, 37 percent; seedling and sapling, 28 percent; and non-stocked and other areas, 3 percent.

The volume of growing stock in the Pearl Study Area is 2.2 billion cubic feet - 1.2 billion cubic feet of softwoods and 1.0 billion cubic feet of hardwoods. The forest growing stock is the significant portion of the timber resource. Fifty-eight percent is in sawtimber trees and 42 percent in pole timber trees. The volume of growing stock is estimated at 515 cubic feet per acre.

Total net volume of sawtimber on commercial forest land is 7.7 billion board feet - 62 percent softwood species and 38 percent hardwood species. The inventory volume is estimated at 1,800 board feet per acre.

Growing stock is projected at 4.4 billion cubic feet in 1980 and sawtimber 14.4 billion board feet. This is an increase of 97 percent and 86 percent respectively between 1956 and 1980. The growing stock and sawtimber inventory will decline by year 2015; however, the inventory will be approximately 33 and 40 percent greater than the 1956 inventory.

Softwoods are the major species now and by the years 1980 and 2015, their proportionate share is expected to be larger. The increase is attributed to pine plantings of open areas, interplantings and under plantings, stand conversion, release work, and improved management of the forest land. Hardwood growing stock will register a 16 percent increase by 1980 but by 2015 it is expected to be about the same as in 1956.

The 1956 net annual growth for sawtimber was 470.0 million board feet of softwood and 175.8 million board feet of hardwood. The combined growth per acre was 150 board feet. Net annual growth for growing stock amounted to 109.6 million cubic feet of softwood and 60.8 million cubic feet of hardwood. The growth for all species equals 40 cubic feet or 0.5 cords per acre per year - a growth rate of approximately 8 percent on the 1956 inventory base. Between 1956 and 1980, the net annual growth for growing stock and sawtimber will increase 27 percent and 22 percent, respectively. Most will occur in the softwood species offsetting the decline in hardwood species.

The softwood species, in line with inventory and growth, accounts for the largest volume being cut. By 2015, softwoods will account for about 88 percent of the growing stock and sawtimber cut. The 1956 figures show the annual cut of growing stock to be 78 percent of growth and the cutting of sawtimber amounts to 70 percent of growth.

A comparison of annual timber cut and net annual timber growth of growing stock shows that growth exceeds the cut through the year 1980. Between 1980 and 2015, cut will exceed growth by 127 million cubic feet. This depletion will occur in the softwood species. However, forest landowners may offset this decrease in inventory and growth through intensified timber management - conversion, thinnings, stand improvement, and full stocking.

Good timber management is a must. Currently, only about 27 percent of the upland forest is managed properly. Grazing damage is evident on about one-fourth of the upland forest and varies from light to severe. Timber harvesters themselves are guilty of using poor harvesting practices - improperly located logging road and skid trails, overcutting, etc. This type damage was evident on 13 percent of the upland area. If proper attention is given to these and other management practices it is possible to maintain growth over cut.

On the basis of the stumpage prices, the annual timber harvest represented an annual gross income to the forest landowners of about $3.30 per acre in 1956. By 2015, with a much larger cut, this gross income to the landowners increases to $6.20 per acre. The value of the standing timber was approximately 245 million dollars in 1956, and should increase to 275 million dollars by year 2015.

Employment in timber-based manufacturing industries in the Study Area is presented for three Standard Industrial Classification Groups: Lumber and Wood Products (SIC 24), Furniture and Fixtures (SIC 25), and Paper and Allied Products (SIC 26). Employment in the lumber, wood, and furniture group has increased 37 percent between 1930 and 1960. The present and projected employment figures will remain fairly constant within a range of 10,000 to 11,000 employees. The number of persons employed in the paper and allied products group has steadily increased - 730 in 1930 and 3,800 in 1960. Projected employment is estimated at 5,700 in 1980 and 12,000 in 2015.

A variety of wood industries are located throughout the Study Area. There are approximately 59 large and small sawmills, 11 wood preserving plants, 6 veneer plants, 1 wood pulpmill, and 3 miscellaneous plants (Figure 3.1).

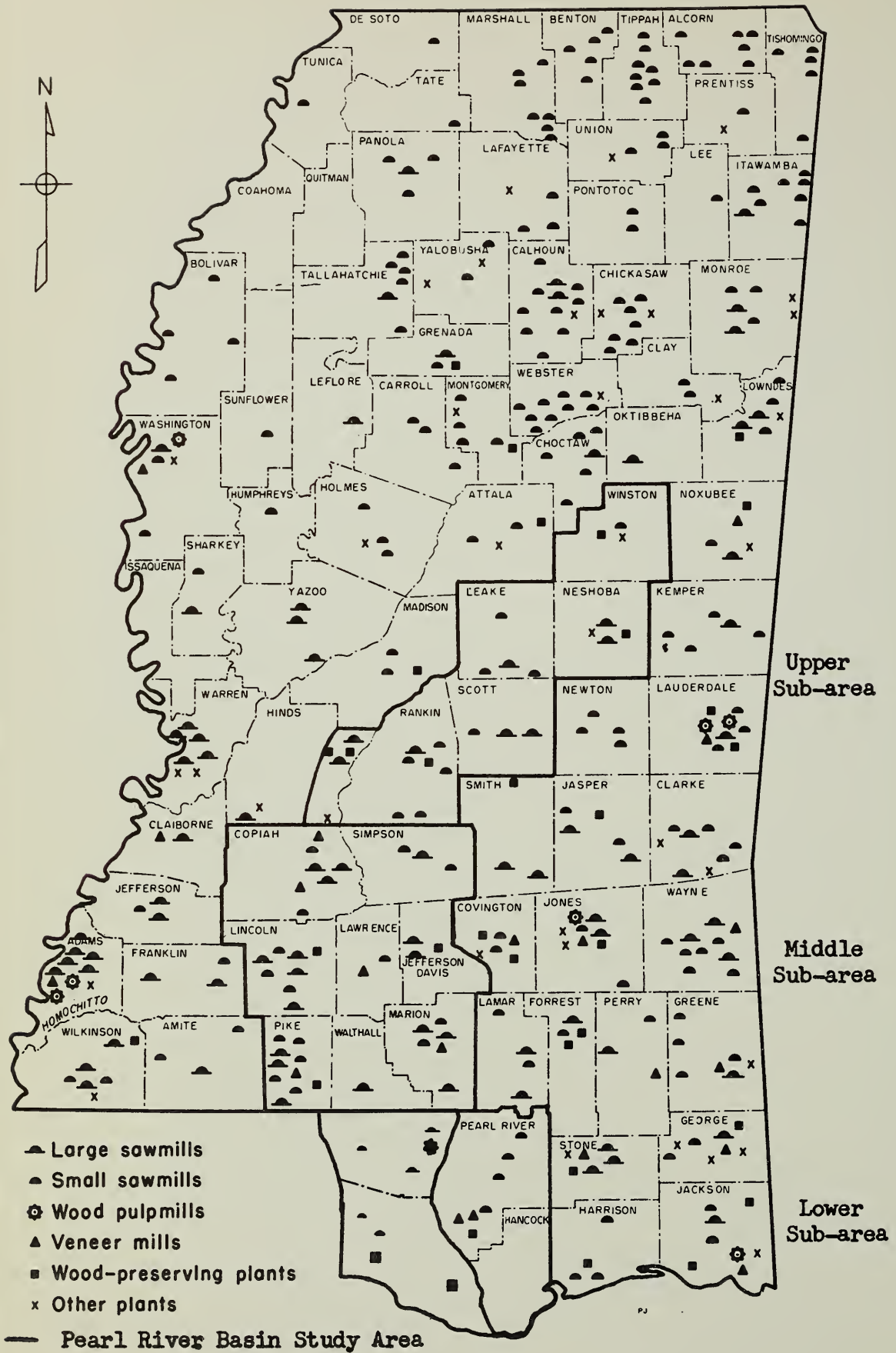


Figure 3.1
Location of primary wood-using plants in
Pearl River Basin Study Area
1962

Commercial Fishing

There are fresh water commercial fisheries operating in the Basin. The latest survey conducted in 1960-61 for the Mississippi portion showed that 6 regular and 69 casual fishermen caught 170,000 pounds of finfish valued at $32,640. Buffalo and blue channel catfish made up approximately 78 percent of the catch by weight and 82 percent of the total value. The 1960 documented catch for the Louisiana portion of the Basin consisted of 1300 pounds of buffalo fish with a repented value of $152. No data was available on the amount and value of catfish sturgeon and GAR caught in Louisiana.

The Marine commercial fisheries of Louisiana and Mississippi are very important to the economy of the two states. In 1964, the Eastern Coastal District of Louisiana and 10 percent of the Mississippi landing provided 271 million pounds of finfish and shellfish worth more than $12,000,000 (ex-vessel) to the fisherman. The Bureau of Commercial Fisheries estimates that this part of the resources is influenced by the Pearl River drainage. The fisheries of menhaden, shrimp, oysters, red snapper, blue crab, king whiting, drum, and mullet represent over 96 percent of the catch in pounds and value. These are by the coastal estuarine environments.

Transportation

The Basin is served by an expanding network of highways and roads. In addition to two interstate highways access is provided the Basin by five U. S. Highways and numerous state and local roads. The Natchez Trace Parkway traverses a part of the Basin. In recent years considerable effort has been made on the part of local interests to improve the quality of farm-to-market type roads. Four interstate railroads serve the Basin with regularly scheduled freight trains to major cities and towns. Some passenger service is available in a north and south direction. Numerous interstate motor freight carriers operating on the highway system provide service throughout the Basin. Jackson is the only city provided with air passenger service. Most of the cities and major towns have airport facilities.

Outdoor Recreation

Outdoor recreation studies and surveys on National, State, and Basin levels strongly suggest the phenomenal future demand to be expected in outdoor recreation activity.

In considering present and future needs, one of the major factors is the population and its expected growth. Other considerations, related to the recreational demand, are the many and varied socio-economic factors as population structure, personal income, trends toward urbanization, and leisure time. A better concept of the intricacies encountered in outdoor recreation planning may evolve when one considers the proximity and accessibility of recreation facilities, two key factors that determine actual use. Growth, nevertheless, in outdoor recreation activity is evident and the various governmental agencies at all levels have become keenly aware of the potential economic impact.

Many agencies concerned with land and resource management have been delegated responsibilities in the field of outdoor recreation. In the Federal Government the Bureau of Outdoor Recreation develops guidelines and criteria for determining supply and demand and is further concerned with actual development of recreational facilities. The Corps of Engineers, National Park Service, Fish and Wildlife Service, Forest Service, and Soil Conservation Service are among the Federal agencies with responsibilities in this area.

The Mississippi State Park System, Mississippi Game and Fish Commission, special districts and local municipalities and, within the Basin, the Pearl River Basin Development District, all have functions in the recreational field. The private sector is becoming increasingly conscious of the opportunities in providing public outdoor recreation as an enterprise. This becomes more evident in the Coastal Area.

Appraisals of outdoor recreation have been primarily to point out recreational needs for present and future. Appendix I, "Outdoor Recreation of the Pearl River Basin - Mississippi and Louisiana," BOR, Department of Interior, is a large part of this effort. Appendix J, "A Report on the Fish and Wildlife Resources of the Pearl River Basin - Mississippi and Louisiana," presents supply and demand for the important outdoor recreation activities within the Study Area.

Relationship of Economic Development and Land and Water Resource Development

In the early part of the nineteenth century, much of the Pearl Study Area was a virgin timber wilderness with sparse settlement. The early settlers cleared the land for agriculture, principally to raise cotton. With the land denuded of its arboreal cover, the heavy annual rainfall rapidly washed away the topsoil and deeply eroded the sub-soil choking streams with sediment.

By 2015, 1.4 million people are projected to live in the Pearl Study Area, supported by $5.8 billion in personal income earned by approximately 437 thousand workers and entrepreneurs. This means that between 1960 and 2015, population will rise 147 percent, employment 147 percent, and personal income 564 percent.

The projections of economic growth were guided by the assumption that sufficient quantities of water of an acceptable quality would be made available by timely development in such a manner as to avoid being a constraint to economic growth. If this is not accomplished, inadequate water resources may inhibit the Area's economic growth and adversely affect projected rates of economic progress.

Failure of growing cities to develop additional sources of clean, fresh drinking water will restrict their ability to serve the growing human and industrial population, thus causing the economic development of such cities to lag behind the projected growth. Failure to correct pollution problems in some sections will deter the location of major water-using industries in these sections, causing employment growth to falter and adversely affecting income that would have been created and population that would have been supported by this additional employment.

Demands in coming decades on the water supplies will arise basically from the increase in population and the expansion of industry. Water requirements, however, will be greater than indicated by projected levels of population and industrial employment because of several trends now evident in the Study Area. Extensive urbanization will raise water demands, as per capita consumption is higher in cities. More leisure time will amplify demands for water related recreational uses. The requirements for clean, fresh water from streams will increase demands to dilute organic wastes as the concentration of people and industry continues.

The Study Area is endowed with abundant supplies of useable industrial water which should sustain growth in industries requiring relatively large quantities of water in manufacturing processes. Unlike many water-short regions in the United States where extensive use of water in industry, together with costly pollution treatment facilities is required, the Area possesses the natural resource assets fundamental to employment gains in all groups of major water-using industries --- food, pulp and paper, chemicals, petroleum, and primary metals.

The Study Area is endowed with large quantities of water, however, in comparison to the remainder of the United States, its water resources are relatively undeveloped. Therefore, municipal water problems are ones of variations in the quantity and quality of water. Because of problems of yearly, seasonal, and irregular variations in rainfall, the quantity of water in a given place and time is never constant. Cities must construct storage facilities to offset such variations as well as plan for increased demands for water in the future. Rising per capita consumption, the trend toward industries favoring municipal water supply, and the expansion of residential areas farther away from the cities' core are examples of the needs for adequate planning. Anticipation of these demands must be made, distribution systems must be expanded and improved, and adequate supplies for projected peak demands provided if the cities and other users are to experience optimum economic growth. What is required is not more water as such but more foresight as to future needs, the willingness to finance preparation of water development plans, and construction of additional water facilities needed.

CHAPTER IV

WATER AND RELATED LAND RESOURCE PROBLEMS AND NEEDS

General

Identifying water and related land resource problems is the first important step in the conservation, utilization, and development of these resources. This step, in conjunction with estimates of what the future portends, is necessary before the people can plan for the satisfaction of human needs associated with land and water resource development. As an aid in identifying land and water resource problems and needs, the Pearl River Basin was delineated into 63 watershed areas. Watersheds as delineated for evaluation are shown in Figure 4.1. Each delineated watershed area comprises either a single hydrologic unit or two or more hydrologic units having similar flood problems and water resource development needs. All watersheds were limited to 250,000 acres or less in size. Flood damage evaluations were made for all tributary floodplain areas studied by the Soil Conservation Service and not subject to flooding from the Pearl River or inundated by existing water impoundments.

Continued population growth generates greater competition for land and water resources. Agricultural production will continue to increase and increased agricultural benefits and efficiencies in farm production will be related to the solutions of land and water problems. The solution to many problems and the satisfying of needs can be achieved through local, State, and Federal cooperation. Local initiative and resources are needed to secure these solutions.

The human needs to be satisfied by land and water resources conservation and development furnish both the reason for planning and the scale of the ultimate plan. Some resource conservation and development have already been accomplished in the Basin. Some unsatisfied needs exist, and some will develop as the population increases. Determination of the magnitude of existing and future problems and needs is essential.

Major Water and Related Land Problems

Erosion

Erosion is still a serious problem but less intense now than in the past. Changes in the agricultural economy in recent years have resulted in shifts of land from crops to

grassland and pasture. There are 3,210,000 acres of inventory land that have an erosion problem or are susceptible to erosion.

Approximately 1,143,400 acres of open land in land capability sub-classes IIe through VIIe 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.

The magnitude of erosion on open and forest land is listed in Table 4.1. 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 that are badly gullied on the open land and another 34,592 acres of logging roads and trails on the forest land that are actively yielding sediment.

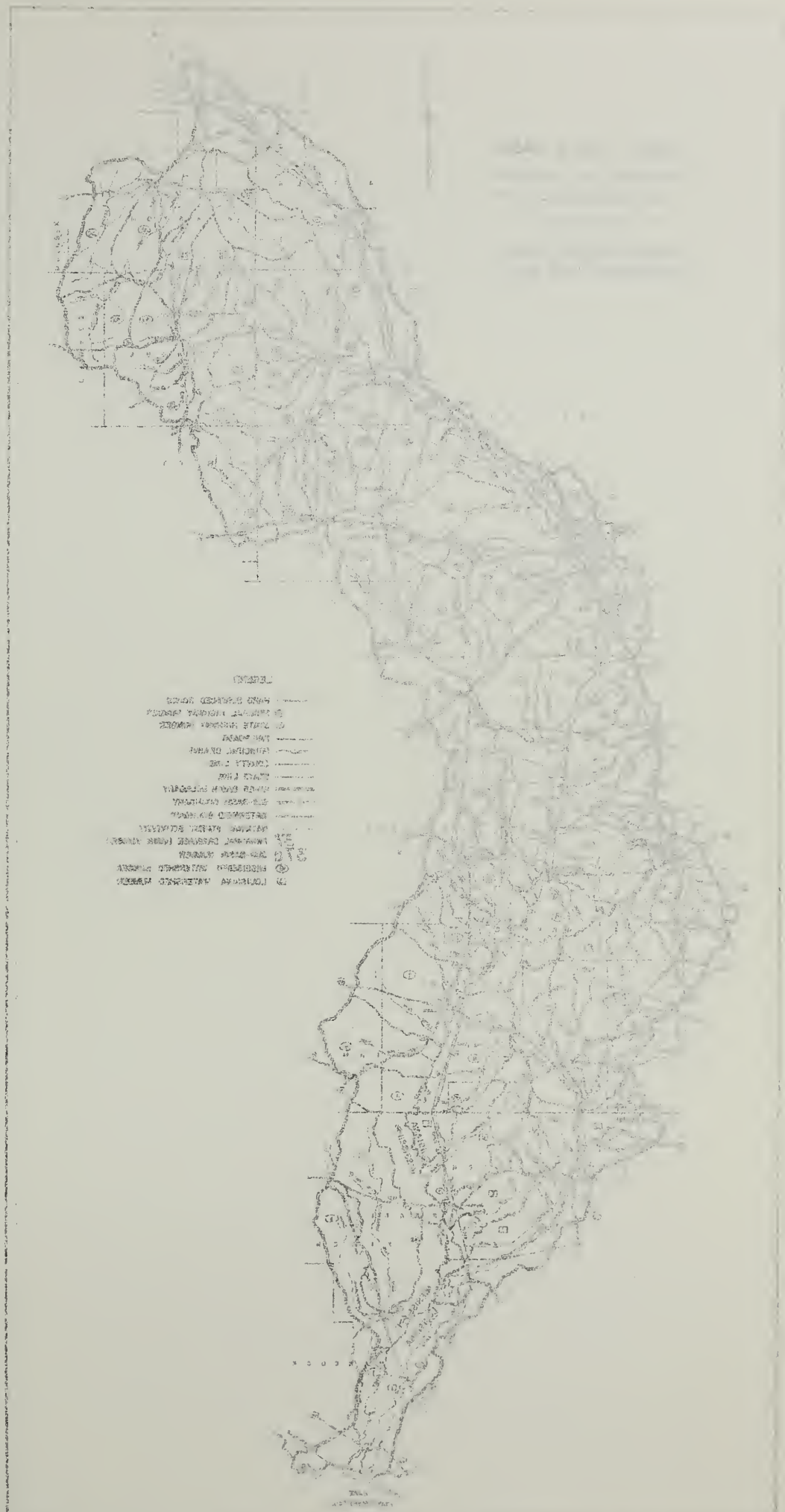
The Basin has an estimated 12,000 miles of farm to market, county, State, and other roads in its highway system. Erosion on 7,690 miles of roadbank has caused moderate to severe deposition in road ditches, culverts, and channels.

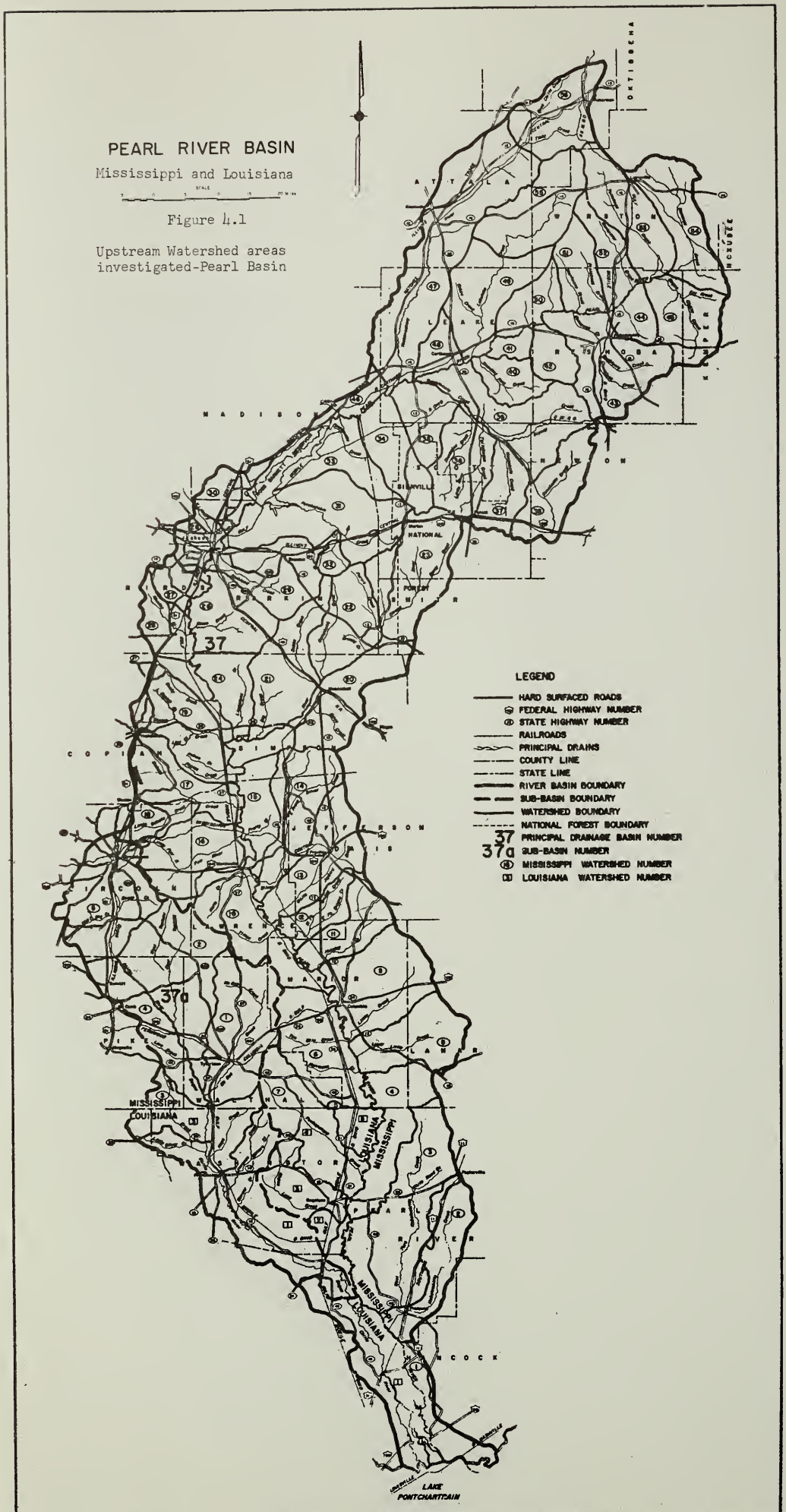
Some scour damage occurs on the floodplain. However, damage is limited in scope and does not seem to appreciably affect the use or productivity of the land.

Table 4.1 The magnitude of erosion problems on open and forest land, by ownership category, Pearl Basin, 1965

Item	Unit	Private	National Forest	Total
Critical areas				
Open	Acres	183,840	---	183,840
Forest	Acres	32,130	80	32,210
Logging roads and trails, gullies and pits				
Open	Acres	8,226	---	8,226
Forest	Acres	34,000	592	34,592
Roadbanks				
Open	Miles	7,622 1/	---	7,622
Forest	Miles	---	68	68

Source: Derived from study data.
1/ Public - county and State.




PEARL RIVER BASIN
Mississippi and Louisiana
Figure 4.1
Upstream Watershed areas
investigated-Pearl Basin
LEGEND
HARD SURFACED ROADS
FEDERAL HIGHWAY NUMBER
STATE HIGHWAY NUMBER
RAILROADS
PRINCIPAL DRAINS
COUNTY LINE
STATE LINE
RIVER BASIN BOUNDARY
SUB-BASIN BOUNDARY
WATERSHED BOUNDARY
NATIONAL FOREST BOUNDARY
37 PRINCIPAL DRAINAGE BASIN NUMBER
37a SUB-BASIN NUMBER
(46) MISSISSIPPI WATERSHED NUMBER
[1] LOUISIANA WATERSHED NUMBER
37
37a
MISSISSIPPI
LOUISIANA
LAKE
PONTCHARTRAIN

Floodwater

There are 689,000 acres of land subject to overflow in upland watersheds. The total direct annual damages from flooding are $3,714,000. Of this amount $2,414,000 are damages to crops and pastures, $248,000 are damages to on-farm minor fixed improvements, $806,000 are damages to roads and bridges, and $246,000 are damages to urban and industrial areas.

The flood of February 1961, with a peak discharge at Jackson of 46,200 cubic feet per second, was the largest storm in 26 years. This storm, which was over an eight-day period, produced total rainfall varying from 9.24 inches in the northern portion of the Basin to 4.69 inches in the central portion to 16.94 inches in the lower part. The total estimated area flooded from this storm was 986,000 acres, 1/ of which two-thirds was forest. Considerable flooding occurred in the cities of Jackson and Columbia, causing damages to houses, business places, and manufacturing plants.

Because of the time of year of this storm, the dominant farm damages were to roads and fences. Estimated monetary damages were as follows:

Damage to crop and pasture land	$ 423,000
Damage to farm roads	455,000
Damage to fences	180,000
Other farm damage	98,000
Total	$1,156,000

The Basin is divided into 63 watersheds. Investigations show that annual flood damages are much more extensive in 42 of the upland watersheds that have been determined to be economically feasible for project action than in the remaining 21. Most of the 42 feasible watersheds are located in the upper portion of the Basin and the present annual direct damages are $3,101,500.

In the remaining 21 watersheds or those not found to be presently feasible for implementation in an early action program, the annual damages are $612,500.

Field investigations were made by the Corps of Engineers to determine the extent of flood damages along the main streams and principal tributaries. Information on losses

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1/ Includes main stem and major tributary streams.

was obtained directly from persons affected. Data on land use, cultural practices, and losses resulting from flooding, sanding, scouring, and delays in planting were obtained from county agents, farmers, and Soil Conservation Service representatives. Responsible officials were interviewed in regard to the effects of floods on business establishments, railroads, streets, roads, highways, and industries. Data were also obtained on losses due to such items as the cost of rerouting traffic, emergency measures, and the removal of debris.

There is a total of 352,745 acres of land subject to flooding along the Pearl River and principal tributaries. Of this total, 2,120 acres are urban and 350,625 acres are rural. The average annual flood damages to these areas is $2,507,800 of which $530,000 or 21 percent is to urban development. These estimates were based on 1966 development, adjusted normalized prices for crops and pastures, and 1968 prices for fixed improvements and urban development.

Sediment

Damages from sediment deposition are relatively minor. Deposition does, however, contribute to flooding problems by filling road ditches, culverts, and stream channels and causing added damage to crops, pasture, fixed improvements, and in some cases fishery resources. Monetary sediment damages were evaluated and combined with flood damages.

Studies of annual gross erosion and sediment yield indicate that the annual sediment yield from the individual subwatersheds of the Basin ranges from 230 to 2,783 tons per square mile drainage area. Highest yields usually come from those watersheds having a high percentage of cropland. Low yields come from those that are largely in forest. The total estimated sediment yield for the Pearl Basin is 5,515,800 tons annually.

Impaired Drainage

Most of the channels in the upland watersheds have sufficient capacity to carry runoff from bottom lands under normal precipitation. However, the channels are usually inadequate when extra runoff from upland areas is considered or when the precipitation is above normal. In many instances complete water disposal systems have not been constructed because of the frequency of flooding on bottom lands.

Some of the land on the main stem of the Pearl is undrained. This, too, is mainly because of inadequate water disposal systems that have not been constructed due to frequent overflows.

The 1958 Conservation Needs Inventory indicates that approximately 943,000 acres of land in the Pearl Basin have a drainage problem. Of this amount, 30 percent is open land.

Major Water and Related Land Development and Management Needs

Flood Control and Prevention

The problems of flooding are more severe in 42 watersheds located mainly in the upper and central parts of the Basin. Studies made in these watersheds indicate an immediate need for flood prevention measures. The first need is for land treatment measures for watershed protection and for critical area treatment. Structural measures needed in addition to land treatment measures to further reduce flood damages include 273 floodwater retarding structures, 35 multiple purpose structures (34 of which would have recreational facilities), and 1,592 miles of stream development.

These measures are needed in an early action program (by 1980). Also there is a need for additional floodwater retarding and multiple purpose structures along with stream development work in all or parts of 16 other watersheds presently not feasible for early action but expected to be feasible for project action by the year 2015.

The Corps of Engineers determined that 352,745 acres of land is subject to flooding along the Pearl River and principal tributaries. The average annual flood damages to these areas amounts to $2,507,800 of which $530,000 or 21 percent is to urban developments. These estimates were based upon 1966 developments, adjusted normalized prices for crops and pastures, and 1968 prices for urban and fixed improvements. The total average annual flood damages in the headwater areas and along the main streams and principal tributaries is $6,221,800. This represents the current measure of the need for flood control in the Basin.

Land Conservation Treatment and Management

Open Land. The problems created by erosion, floodwater, sediment, and drainage were described earlier in this chapter and the causes, extent, and economic losses were given where

determined. The total open land treatment needs, as directly or indirectly associated with either one or more problems or a combination of problems, are presented in Table 4.2. The total land treatment needs are primarily associated with cropland, pasture land, and other farm land in all of the watersheds. Also included is the amount of each land treatment measure that is expected to be accomplished by project action in 42 feasible watersheds and the remaining land treatment needs for the Basin.

Among the major problems for open land are critical area treatment which consists of shaping and planting grasses and legumes on 35,698 acres of badly eroded land and 7,622 miles of caving roadbanks. This will greatly reduce the amount of sediment dropping out in road ditches, culverts, drainageways, and on productive cropland and pasture.

An effective conservation program, based upon the use of each acre of land within its capability and treatment in accordance with its needs, is necessary for a sound flood prevention and water management program. This entails the use of various approved treatment measures, some of which are listed in Table 4.2 and are further explained as follows:

Conservation cropping system and crop residue utilization will increase the protection of cultivated lands by using high residue producing crops and soil conditioning crops periodically. These measures will increase the infiltration rates of the soil, increase available moisture holding capacities, and reduce rainfall runoff and sheet erosion.

Terraces, contour farming, row arrangement, grassed waterways or outlets, and diversions will provide a means for controlled disposal of excess water from the upland areas and will reduce both sheet and gully erosion.

Row arrangement, surface field ditches, and mains and laterals will provide a means of adequate disposal of excess surface water from the floodplain. These are necessary to insure the full realization of benefits made possible by reduction in flooding.

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

Table 4.2 Land treatment needs of open land, Pearl Basin, 1967

Measures	Unit	Total Basin needs 1/	To be installed in 14 PL-566 watersheds	To be installed by special legislation	Remaining needs
Conservation cropping system	Acres	516,900	105,780	237,500	173,620
Pasture planting	Acres	275,900	43,609	135,800	96,491
Pasture renovation	Acres	266,200	60,195	119,600	86,405
Diversion	Miles	1,122	95	671	356
Terracing, gradient	Miles	3,025	976	1,293	756
Grassed waterways	Acres	4,700	1,137	2,100	1,463
Drainage, main and lateral	Miles	878	168	506	204
Drainage, field ditch	Miles	1,834	343	1,030	461
Farm ponds	Number	8,900	1,536	4,400	2,964
Wildlife habitat development	Acres	19,200	2,488	10,000	6,712
Critical area planting 2/					
Grasses and legumes	Acres	35,698	3,959	26,818 3/	4,921
Roadside erosion control	Miles	7,622	610	6,028 3/	984

Source: Internal data, Soil Conservation Service, USDA.

1/ These needs are those remaining after deducting land treatment and structural measures on the land as of June 1967 and identified in Table 6.1.

2/ Tree planting on open land and related practices are presented under Conservation Treatment - Forest Land.

3/ Applies to entire Basin.

Wildlife development consists of removal or control of undesirable vegetation and the encouragement of those plants desirable for food and for natural habitat. These measures will provide food and cover for game, enhance the aesthetic value of the land, and produce additional revenue for the landowners.

Forest land. The magnitude of the erosion problems was identified in the preceding section. Open land that should be planted to trees totals 73,540 acres and 32,130 acres of forest land needs treatment to reduce erosion. Some is gullied land but the majority suffers from sheet erosion.

Hydrologic condition is defined as that condition of a watershed area which reflects its ability to influence the quantity and quality of flow into streams. The hydrologic condition of the forest land in the Basin results from a variety of cover types, soil types, and the use and treatment of the forest. The hydrologic condition in the Basin, based on five classes, is 0 percent very good, 1 percent good, 2 percent fair, 41 percent poor, and 56 percent very poor. Poor and very poor condition is the result of different forest and soil types, and overgrazing, overcutting, and wildfires.

The various uses and treatments that the forest land has been subjected to, either singly or in combination, have been carried on for many years. Under the present forest conditions the annual gross erosion, which is the amount of soil that starts to move, was computed to range from 920 tons to 3,060 tons per square mile drainage area with the weighted average being 1,790 tons. 1/ The sediment delivery rate was calculated and the weighted average annual sediment yield for the Basin is 365 tons per square mile drainage area.

Treatment with trees, grasses, and wildlife food-cover plants is necessary to stop the loss of soil and reduce the flow of damaging sediment by giving protection, through litter, to the bare soil. In time, humus will develop to aid in absorbing storm rainfall and carry it into the soil profile. Pines furnish good protective cover to game birds and animals. Abandoned logging roads and trails need to be stabilized by revegetation of bare soil. Roadbanks need sloping and planting with grass to reduce erosion.

1/ Computed using Musgrave's Soil Loss Prediction Formula.

To establish the needed cover on eroding land - critical areas, logging roads and trails, and roadbanks - approximately 51,242 acres of site preparation work is needed to prepare the land for trees and grasses and about 1,021 miles of fencing to protect these and other areas from grazing. Data pertaining to needs on private forest land and on National Forest land are presented in Table 4.3.

Besides treatment of the critical areas on open land, treatment for watershed protection is needed on many acres of forest land. Forest land measures such as tree planting (conversion, interplanting, and underplanting), releasing and thinning are needed to put desirable tree species into the best productive condition. Treatment will help to develop a protective cover and an absorbent forest floor of spongy humus under a protective layer of litter. Treatment also will aid in retarding runoff and reducing soil losses and sediment to a minimum.

Conversion (planting and releasing) to a more favorable tree species is needed on 82,870 acres of private forest land (Table 4.4). The removal of undesirable species is needed on 751,460 acres. Tree planting - open, inter and under - is needed on 318,290 acres of open and forest land. Approximately 536,860 acres of forest land should have a portion of merchantable timber removed to provide growing room for the remaining timber.

Reforestation and stand improvements have been accomplished on the 86,000 acres in the Bienville National Forest. There still is a need for 850 acres to be reforested by direct seeding or planting. Approximately 1,040 acres of reforested areas need releasing from the over-topping scrub hardwoods (Table 4.5). These phases of forestry will enhance timber production and improve related soil, water, and wildlife resources.

Insects and Diseases. Insects and diseases are prevalent in the forests with resulting losses in timber production through a reduction in growth, lower quality, deformities, and death. Insects that affect the pine reproduction are the tip moth, pine sawflies, the pales weevil, and the pine webworm. Bark beetles such as Ips, southern pine, and black turpentine are a threat to the larger pine trees. Evidence of insects was found on 1 percent of the forest land but insects can infest an area and move on before the damage is discovered. The insect damage was found in the lower part of the Basin. It requires the combined effort of all landowners to locate these problem areas and contain them while they are small.

Table 4.3 Land treatment needs on private forest land and National Forest land, Pearl Basin, 1966

Measures	Unit	Total Basin needs 1/	To be applied - 42 watersheds: 14 under PL-566 authorization	28 under special legislation	Remaining needs
Private forests:					
Critical area stabilization					
Tree planting	Acres:	105,670 2/	5,040	62,540 3/	38,090
Logging roads and trails	Acres:	34,000	0	21,000 3/	13,000
Site preparation	Acres:	16,300	1,300	15,000 3/	0
Fencing	Miles:	966	83	587 3/	296
	Acres:	30,930	1,950	17,810 3/	11,170
Tree planting					
Open	Acres:	183,890	10,950	40,480	132,460
Conversion	Acres:	82,870	3,200	10,010	69,660
Inter and under	Acres:	134,400	6,110	24,340	103,950
Fencing	Miles:	674	10	170	494
	Acres:	37,630	300	8,950	28,380
Hydrologic stand improvement					
Conversion release	Acres:	82,870	3,200	10,010	69,660
Underplanting release	Acres:	95,900	500	7,310	88,090
Pine	Acres:	617,750	35,850	43,410	538,490
Hardwood (upland)	Acres:	37,810	1,530	4,060	32,220
Fencing	Miles:	2,200	13	355	1,832
	Acres:	410,520	1,200	54,700	354,620
Improvement cut	Acres:	536,860	27,130	111,520	398,210
Management plans	Acres:	1,870,570	113,820	466,190	1,290,560
National Forests:					
Critical area stabilization					
Roadbank	Acres:	270	---	154 3/	116
	Miles:	68	---	38 3/	30
Logging roads and trails	Acres:	592	---	190 3/	402
Erosion control - site preparation	Acres:	80	---	50 3/	30
Fencing	Miles:	55	---	27 3/	28
Direct seeding and planting	Acres:	850	---	100	750
Fencing	Miles:	20	---	0	20
Release - stand conversion	Acres:	1,040	---	0	1,040
Fencing - range management	Miles:	10	---	0	10

Source: Derived from study data by U. S. Forest Service.

1/ These needs are those remaining after deducting land treatment and structural measures on the land as of June 1967 and identified in Table 6.1.

2/ Open 72,340 acres and forest 33,330 acres. 3/ Applied to entire Basin.

Table 4.4 Problems and management needs on private forest land, Pearl Basin, 1966

Item	Unit	Amount
Critical area stabilization		
Open	Acres	73,540
Forest	Acres	32,130
Logging roads	Acres	34,000
Site preparation	Acres	16,300
Fencing	Miles	966
Uncontrolled grazing	Acres	683,400
Insects and diseases	Acres	658,100
Management planning	Acres	1,870,570
Tree planting		
Open	Acres	183,890
Conversion	Acres	82,870
Inter and under	Acres	134,400
Releasing		
Conversion	Acres	82,870
Pine	Acres	617,750
Hardwood (Upland)	Acres	37,810
Improvement cut	Acres	536,860

Source: Derived from study data by U. S. Forest Service.

Table 4.5 Total land treatment needs, National Forest land, Pearl Basin, 1966

Land treatment	Unit	Amount
Critical area stabilization		
Roadbank	Acres	270
Logging roads	Acres	592
Erosion control - other 1/	Acres	80
Fencing	Miles	55
Direct seeding and planting	Acres	850
Fencing	Miles	20
Release - stand conversion	Acres	1,040
Fencing - range management	Miles	10

Source: Derived from study data by U. S. Forest Service.

1/ Includes grasses and wildlife food-cover plants.

Fusiform rust, Cronartium fusiforme, was scattered evenly over 25 percent of the Basin. As yet there is no economically feasible method to prevent fusiform rust infection. Some control can be expected through pruning infected branches on young trees and the removal, through thinnings, of larger trees with trunk cankering. Through breeding, progress is being made in developing rust-resistant pine seedlings.

Grazing. Grazing of forest land is a practice that dates back to the coming of the settlers in the early 1800's. Thousands of cattle, sheep, and swine roamed the open and forested areas. As the year passed, the native grasses and other feed gradually disappeared. The cattle trampled and destroyed hardwood and pine seedlings. The soil became compacted and the water absorptive rate declined. This, in turn, increased surface runoff, soil erosion, and sedimentation. Currently, approximately 683,400 acres of private upland forests are in need of protection and treatment. Damages were assessed as severe on 1 percent of the land, moderate on 11 percent, and light on 15 percent. Approximately 2,870 miles of fencing is needed to keep animals out of or to control the number of animals within a forested area. Education of landowners concerning the damage grazing does to forest land is needed. Greater emphasis should be placed on improving permanent pasture land with only carefully managed grazing of forested lands.

A range management plan has been developed which will help reduce grazing on National Forest land. In accordance with better land management, all grazing will be eliminated from the Bienville District of the Bienville National Forest. The Strong River District has seven grazing allotments that have approximately 29,700 acres of National Forest land suitable and available for grazing. Most of the allotments are fenced or agreements of common use have been worked out with the private landowner. It is estimated that 10 miles of fencing is needed to fence National Forest land from private land where agreements of common use could not be worked out.

Besides the fencing and agreements of common use, the range management plan calls for maintaining a working business relationship with all range users to aid in public acceptance of the plan, cooperation between parties to obtain proper use within each allotment, and to eliminate late fall and winter grazing because of nutrient shortages in the native forage.

Forest fires. The control of wildfires on forest land is very important. Fire was an uncontrolled tool used by the farmers to get rid of underbrush and to dispose of crop residue, to "green up" the woods for grazing, and to kill off "varmints." Information from the Mississippi Forestry Commission for the State of Mississippi shows that during Fiscal Year 1927-1928, over 12 percent of the protected forest acres were burned and the average size forest fire was 250 acres. Down through the years the suppression of fires in Mississippi has advanced so that in Fiscal Year 1967-1968 only 0.55 percent of the protected forest acres were burned and the average size fire was 13 acres. All of the State and private forest land in the Pearl Study Area is under fire protection from the Mississippi and the Louisiana Forestry Commissions, cooperating with the U. S. Forest Service.

Since 1960 the annual burn of the protected acres for the Study Area has ranged from 26,900 acres or 0.58 percent to 66,900 acres or 1.45 percent. During this period the average size fire was 13 acres. Damage by fire is great and covers many items. Timber damage includes the loss of timber and growth and the mortality that will occur in later years. Other damages will be to forage, wildlife, recreation, watershed, real property improvements, and personal property. It has been estimated that the average forest fire damage, which includes timber and other damages, is $14.60 per acre. 1/ With this damage figure and using the total forest acres burned since 1960, the monetary loss for the Study Area amounted to almost $5,000,000. The cost of fire protection is about $0.20 per acre. Without this protection the monetary loss from fire would have been much greater.

The present fire suppression equipment of 50 three-men crews and 52 lookout towers can handle all fires under normal conditions in the Study Area. The Mississippi and Louisiana Forestry Commissions are always striving for a low percentage burn of the protected acreage. With a build-up of forest fire fuels, forest values, and to achieve a low percentage burn, additional manpower and suppression equipment is needed. Thirty-one additional units and crews will be needed by 1980. The initial cost for the new suppression units is estimated at $406,000.

Fire protection on the Bienville National Forest is provided by the U. S. Forest Service. This Forest has seven lookout towers and three plow units. The effectiveness of this fire protection is shown in the comparison

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1/ Information from the Mississippi Forestry Commission for 1962, 1963, 1964, and 1965.

between 1936 and the 1967 figures. In 1936, fires numbering 254 consumed 5,728 acres. In 1967, 32 fires burned only 444 acres. This is a big reduction but there is always a job ahead in fire prevention.

Forest industry firms have 29 fire fighting units that are located in the various counties within the Study Area. All units - State, Federal, and industry - combine into an effective fire fighting organization. Cooperation needs to be strengthened between the land protection agencies and private landowners. An effective continuing education program will keep the people informed of losses to resources caused by fires. The problem, wildfires, is the same regardless of forest ownership.

Food and Fiber

The economic status of agriculture and forestry is discussed in detail in Chapter III. Historical and projected agricultural output of specific products, though previously presented in Table 3.6, are reiterated here to stress the importance of food and fiber needs in context with other identified needs. Projected agricultural production is depicted by the data in Table 4.6. The difference between current production in the Study Area and its assigned share of the projected requirements provides a guide to the need for development of land and water resources of the Study Area to meet future requirements.

Total agricultural output in the Pearl Study Area is projected to increase in the aggregate - some individual commodities will decrease. Land is not now nor will it be in the future a limiting factor in the development and growth of the Pearl Study Area. While much of the land is of low natural fertility, it will respond to proper treatment and management.

Feed Crops

The livestock, poultry, and feed grain sectors of the Study Area's economy have experienced rapid changes in recent years. Poultry and beef cattle have been replacing hogs and dairy cattle. Soybean production has steadily increased while production of corn and oats have shown little growth potential.

As a result of these changes, only a small proportion of the feed grain or other feeds fed in the Study Area is produced by the feeder. Thus, the flows of grains and feed ingredients through market channels have shown large increases.

Table 4.6 Current agricultural production and projected production in the Pearl Basin, 1964, 1980, and 2015

Product or commodity group	Unit	1964	Projected 1980	Projected 2015
Cotton	Thou. bales	103	79	88
Corn	Thou. bu.	4,956	5,005	3,640
Soybeans	Thou. bu.	170	777	555
Oats	Thou. bu.	133	300	510
Hay	Thou. tons	219	280	350
Beef and veal	Thou. lbs.	153,000	217,100	328,500
Lamb and mutton	Thou. lbs.	168	400	600
Pork	Thou. lbs.	16,380	15,600	14,300
Broilers and turkeys	Thou. lbs.	221,598	423,700	770,500
Milk	Thou. lbs.	268,800	488,200	785,400
Eggs	Thousand	802,278	1,017,000	1,285,000
Timber growing stock:				
Inventory	Mil. cu. ft.	2,548	4,376	2,959
Growth	Mil. cu. ft.	190	217	163
Cut	Mil. cu. ft.	109	128	290
Sawtimber				
Inventory	Mil. bd. ft.	8,472	14,415	10,868
Growth	Mil. bd. ft.	716	789	625
Cut	Mil. bd. ft.	388	482	985

Source: Agricultural Economic Base Study of the Pearl River Basin Study Area, Economic Research Service and Forest Service; United States Department of Agriculture, January 1966.

The requirements for feed crops is influenced by many factors. Two of the most important are the demand for livestock products and the efficiency of converting feed grains into livestock products. The appraisal here is limited to the requirements of feed crops to meet the projected livestock production in the Study Area by 1980. Data depicting demand, supply, and needs for feeds, equated in terms of feed units, 1/ are presented in Table 4.7.

The demand for livestock feeds is estimated at 4.0 billion feed units in 1980 and supply estimated at 1.2 billion feed units - a deficit of 2.8 billion feed units. In 1980, approximately 24 percent of the feed units produced in the Study Area will come from grain, 13 percent from hay, and 63 percent from grazing.

1/ A feed unit is a pound of corn or its equivalent in other feed.

Table 4.7 Demand, supply, and needs for feeds to sustain projected livestock production, Pearl Study Area, 1980

Feed	1980
	Thou. feed units
Demand (Total)	4,032,500
Beef and veal	1,888,800
Lamb and mutton	5,300
Pork	70,200
Milk	488,200
Poultry 1/	1,168,300
Eggs	411,700
Supply (Total)	1,254,004
Feed grains	302,658
Hay	164,000
Grazing	787,346
Needs	2,778,496

Source: Agricultural Economic Base Study of the Pearl River Basin Study Area, Economic Research Service and Forest Service, United States Department of Agriculture, January 1966.

1/ Broilers and turkeys.

The projected disparity between feed production and utilization is not a new situation. For a number of years utilization of feeds has exceeded production and this situation is expected to prevail in the future with or without resource development.

Irrigation

There is sufficient average annual rainfall (ranging from a low of about 52 inches in the northern portion to a high of 62 inches in the southern portion) to provide moisture for all crops grown in the Basin. This rainfall, however, is not distributed throughout the year in a manner that makes it available for crop use when needed in every case. There are periods of surplus moisture and periods of deficient moisture is almost every year. Since there are periods of deficient moisture in almost every year there is a place for supplemental irrigation in the management of the farm business in order to maintain and increase yields, reduce crop failures, and increase farm income.

The response of crops to supplemental irrigation varies according to the potential of the soil on which the crop is grown. Table 4.8 shows the acreage of dominant floodplain soils that would respond to supplemental irrigation.

Irrigation as a management practice has been slow to grow up to the present time. The present irrigation status is shown on Table 4.9.

The use of irrigation as a management practice in the future should increase at an increasing rate due to such factors as improved methods of irrigation, higher management levels, and other technological advancements.

Livestock Water

A major source of rural demand for water is the livestock industry. Many factors influence the consumption of water by livestock. Water intake by animals generally parallels the dry matter in feeds when animals are on dry feeds. Also, water intake is affected by the water content of the feed itself. The level of production will also affect water consumption. Therefore, there are no clear-cut estimates because of individual variations among animals and the variable effects of rations and level of production. Projected water requirements were based on applicable daily water requirement rates per animal and projected livestock numbers. Annual water requirements for different types of livestock are presented in Table 4.10.

Water for livestock is not a problem insofar as supply is concerned. Adequate ground water is available from wells, springs, and streams in all parts of the Basin. Farm ponds, mainly for livestock, either have been or can be constructed on most of the farms in the Basin.

Rural Domestic Water

Water for domestic use is derived from several sources - streams, reservoirs, lakes, and wells. Rural water comes primarily from private sources. There are no records of the amount of water used by rural residents. The quantity can only be estimated from population figures and average requirements.

A variation exists between the daily water requirements of persons living in households with and without running water. Although there are currently some households in the Basin without running water, it is assumed that all will have running water by 1980. Current and projected annual rural domestic water requirements are presented in Table 4.11.

Table 4.8 Dominant floodplain soils and their potential for irrigation, Pearl Basin, 1964

Irrigation potential	Soil series	Reach: Upper Pearl	Reservoir	Jackson	Strong River	Middle Pearl	Lower Pearl	Bogue Chitto	Total
		Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Group A	Cahaba	0	0	0	0	562	25,529	1,685	27,776
	Collins	0	1,351	445	0	460	0	5,526	7,782
High potential	Falaya	18,890	5,996	2,115	0	1,668	0	20,229	48,898
	Iuka	0	1,528	5,313	2,941	15,711	2,849	11,574	39,916
	Mantachie	35,201	6,972	53,276	51,597	47,390	16,993	42,267	253,696
	Ocholoconee	0	680	1,453	630	2,046	5,046	15,844	26,110
	Prentiss	0	0	4,295	0	7,565	8,705	1,814	22,379
	Tilden	0	0	1,439	0	2,757	49,290	0	53,486
	Vicksburg	0	0	0	0	1,190	0	380	1,570
Group total		54,091	16,527	68,336	55,168	79,760	108,412	99,319	481,613
Group B Medium potential	Houlka	9,652	22,754	2,774	0	0	0	0	35,180
	Stough	5,648	0	6,943	0	7,694	3,195	15,826	39,306
Group total		15,300	22,754	9,717	0	7,694	3,195	15,826	74,486
Group C Low potential	Bibb	155,528	3,966	23,718	22,553	41,641	39,488	34,304	321,198
	Myatt	7,089	0	13,085	0	13,355	3,543	11,643	48,715
	Una	6,434	9,752	1,188	0	0	0	0	17,374
	Waverly	44,075	1,700	752	0	804	0	11,337	58,668
Group total		213,126	15,418	38,743	22,553	55,800	43,031	57,284	445,955
Basin total		282,517	54,699	116,796	77,721	143,254	154,638	172,429	1,002,054

Source: Unpublished manuscript, Water Requirements and Potential for Irrigation in the Pearl, Pascagoula and Big Black River Basins, Soil Conservation Service, United States Department of Agriculture, Jackson, Mississippi, July 1967.

Table 4.9 Status of farm irrigation, Pearl Basin, 1964

County	Type of system			Crops irrigated					Max. cap. of exist. irrigation system	Land leveled
	Sprinkler	Furrow	Flood	Cotton	Corn	Soybeans	Pasture	Truck		
	Number	Number	Number	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Winston	1	-	-	-	50	-	-	-	-	-
Neshoba	2	-	-	-	-	-	-	5	10	-
Leake	-	12	-	125	25	-	40	-	500	-
Scott	-	-	-	-	-	-	-	-	-	-
Rankin	-	1	-	-	-	-	-	-	-	-
Simpson	-	-	-	-	-	-	-	-	-	-
Copiah	50	10	1	100	350	-	175	1,000	2,000	600
Lincoln	1	-	-	-	-	-	-	-	15	-
Lawrence	2	-	-	-	40	-	100	-	250	-
Jefferson Davis	-	-	-	-	-	-	-	-	-	-
Marion	2	1	-	-	-	-	10	4	60	-
Walthall	1	-	-	-	-	-	-	15	-	-
Pike	5	-	-	-	120	-	80	-	200	-
Pearl River	-	-	-	-	-	-	-	-	300	-
Hancock	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-
St. Tammany	12	-	2	-	-	-	50	-	287	-
Total	76	24	3	225	585	-	455	1,024	3,622	600

Source: Unpublished manuscript, Water Requirements and Potential for Irrigation in the Pearl, Pascagoula, and Big Black River Basins, Soil Conservation Service, United States Department of Agriculture, Jackson, Mississippi, July 1967.

Table 4.10 Projected annual water requirements for different types of livestock, Pearl Basin, 1980 and 2015

Type of livestock	1980	2015
	Million gallons	Million gallons
Cattle and calves	2,104.6	2,954.7
Milk cows	742.4	1,042.4
Sheep and lambs	6.6	10.5
Hogs and pigs	63.1	52.2
Turkeys	.4	.6
Farm chickens	67.5	71.9
Broilers	207.5	369.6
Horses and mules	54.8	31.4
Total	3,246.9	4,533.3

Source: Agricultural Economic Base Study of the Pearl River Basin Study Area, Economic Research Service and Forest Service, United States Department of Agriculture, January 1966.

Table 4.11 Annual rural domestic water requirements, Pearl Basin, 1965 and projected 1980 and 2015

Item	Unit	Basin		
		1965	1980	2015
Rural farm population	Number	81,000	55,100	45,200
Water requirement	Mil. gal.	1,774 1/	1,508 2/	1,567 3/
Rural nonfarm population	Number	208,900	249,600	375,200
Water requirement	Mil. gal.	4,575 1/	6,833 2/	13,010 3/
Total rural	Mil. gal.	6,349	8,341	14,577

Source: Agricultural Economic Base Study of the Pearl River Basin Study Area, Economic Research Service and Forest Service, United States Department of Agriculture, January 1966.

1/ 1965 per capita use - 60 gallons.
2/ 1980 per capita use - 75 gallons.
3/ 2015 per capita use - 95 gallons.

Rural domestic water is not a problem insofar as supply is concerned. Adequate ground water is available in all parts of the Basin.

Municipal and Industrial Water

The Federal Water Quality Administration reports that municipalities currently are using in excess of 44 million gallons per day and industries more than 38 million gallons per day. Appendix H indicates that water requirements will increase most in or around Jackson, Monticello, Picayune, and Columbia, Mississippi, and Bogalusa, Louisiana. 1/

The total demand for water in year 2015 is estimated to be 280 mgd. Of this, 128 mgd is domestic and 152 mgd industrial. Surface requirements are estimated at 140 mgd and ground requirements - 140 mgd.

A detailed list of areas where principal water demands are expected to occur may be found in Exhibit III of Appendix H. The list includes only those areas where water needs are projected to be more than one million gallons per day by year 2015.

Water Quality

Information in Appendix H prepared by FWQA reveals that studies conducted by the U. S. Public Health Service in 1961-1964, and the spring and summer of 1965; by the Mississippi Game and Fish Commission in 1965; and by FWQA in the summer of 1966 were used collectively as a basis for determining the water quality in the Pearl Basin. The Pearl River is polluted to the extent that water uses are restricted in four general areas - the Pearl main stem at Jackson, Mississippi; the Pearl main stem in the Bogalusa, Louisiana, area; the East Pearl River below Picayune, Mississippi; and Lake Borgne at the mouth of the Pearl.

The main stem pollution at Jackson extends 40 miles downstream. In addition, there is the potential problem of eutrophication, sedimentation, and iron and manganese buildup in Ross Barnett Reservoir.

1/ Municipal and Industrial Water Supply and Water Quality Control Study - Pearl River Basin, Mississippi and Louisiana, Appendix H, FWQA, United States Department of the Interior.

At Bogalusa, Louisiana, the Pearl is adversely affected by wastes which are first discharged into the Bogue Lusa and Coburn Creeks. Both creeks receive partially treated waste from a large paper mill and Bogue Lusa Creek receives the partially treated waste from the City of Bogalusa. The water quality in each stream is poor.

Below Picayune, Mississippi, the East Pearl was affected in 1966 by waste from the city of Picayune, a large chemical concern, and a dairy discharging into Hobolochitto Creek. Since 1966, both the chemical company and the city reportedly have completed treatment facilities.

The water quality of Lake Borgne during the investigation was reported excellent. However, in the past, during high flows fecal coliform measurements have temporarily closed the area to shellfish harvestings.

The 1966 survey revealed relatively poor water quality in the upper Bogue Chitto River south of Brookhaven, Mississippi. BOD's were high, DO was low, fecal coliform counts were high, and a slight buildup in chlorides was noted. Since the survey, the City of Brookhaven has completed a 40-acre sewage lagoon.

FWQA evaluated economic, sociological, political, and engineering considerations collectively and concluded that the only area in the Pearl Basin with a projected water quality problem in year 2015 is the 40-mile reach of the river below Jackson, Mississippi. The U. S. Corps of Engineers is considering as an early action project an impoundment on the Pearl River at Edinburg, Mississippi. This project could be utilized to store and release dilution water - an alternative among others proposed by FWQA.

Fish and Waterfowl Habitats and Capacities

The Bureau of Sport Fisheries and Wildlife inventoried the freshwater fishery habitat (Table 4.12). The proximity of salt water necessitated the following allocation of demand within each subarea; Upper and Middle Pearl, 5 percent salt water and 95 percent fresh water; Lower Pearl, 60 percent salt water and 40 percent fresh water. Salt water resources are adequate for present and future demands, while fresh water habitat will be in short supply in 2015 without construction of new water (see Table 4.15).

Table 4.12 Fresh water fishery habitat and man-day capacity, Pearl Basin, 1965

Item	Amount	Fishing capacity
	Acres	Man-days
Reservoirs	30,000	600,000
Farm ponds	21,000	420,000
Natural lakes	5,800	174,000
Public lakes	1,600	80,000
Streams		
Main stem	13,500	337,000
Major tributaries	10,200	229,000
Intermediate tributaries	1,200	7,800
Small tributaries	1,300	3,000
Non-main stem	800	8,000
Total	85,400	1,858,800

Source: Fish and Wildlife Resources of the Pearl River Basin-Mississippi and Louisiana, Appendix J, Bureau of Sport Fisheries and Wildlife, United States Department of the Interior.

Total resource planning is a necessary component within watersheds proposed for development. Field investigations within each watershed showed a variety of stream fishery habitat. The significance of the fishery resource has been documented and possible effects of watershed improvements have been studied in those areas where possible conflicts arise. Project proposals in upstream watersheds recommended for early action implementation include stream development on free-flowing streams recommended for preservation and development by other agencies.

USDA has consulted with the Mississippi Board of Water Commissioners and the U. S. Geological Survey on the status of flows on these streams. The Mississippi Game and Fish Commission and other State agencies were consulted for development plans and recommendations.

Streams that have USDA proposals and other agency recommendations are as follows:

Bahala Creek Watershed. Approximately 18 miles of main stem recommended for stream preservation and development. USDA proposal includes no channel work on the lower ten miles and only clearing and snagging on the remaining eight miles. U. S. Geological Survey estimates flows for the seven day Q10 at 12 cfs or 0.08 cfsm at mouth of stream.

Fair River Watershed. Approximately 14 miles of main stem recommended for stream preservation and development. USDA proposal includes no channel improvement on the lower 12 miles of this river and only clearing and snagging on some tributaries. U. S. Geological Survey estimates flows for the seven day Q10 at 20 cfs or 0.20 cfsm.

Lower Little Creek Watershed. About 18 miles of this stream is recommended for stream preservation and development. USDA proposals include clearing and snagging on all of this reach. U. S. Geological Survey low flow seven day Q10 estimate is 20 cfs or 0.40 cfsm.

Upper Little Creek Watershed. Approximately 18 miles of main stem recommended for stream preservation and development. USDA proposal includes "token or random" clearing and snagging on this reach. U. S. Geological Survey low flow seven day Q10 estimate is 10 cfs or 0.08 cfsm.

Topisaw Watershed. Approximately 10 miles of main stem recommended for stream preservation and development. USDA proposal is for clearing and snagging with some shaping of the channel for this reach. U. S. Geological Survey low flow estimate for the seven day Q10 is 26 cfs or 0.40 cfsm.

McGee Creek Watershed. Approximately 25 miles recommended for stream preservation. This watershed was reformulated to reduce stream development from enlargement to clearing and snagging. U. S. Geological Survey records indicate low flow to be 36 cfs for seven day Q10 or 0.26 cfsm.

East Hobolochitto Watershed. Approximately 12 miles of the main stem of this stream is recommended for preservation. The USDA proposal includes clearing and snagging on this reach. Since this stream flows through the City of Picayune some improvement is desirable to reduce flooding in the low lying areas. U. S. Geological Survey has no recorded flow estimates.

The Mississippi Game and Fish Commission recommends in their 1969 Lake and Stream Survey Report that some degree of brushing and snagging be done on McGee, East Hobolochitto, Upper Little, and Little Creeks to improve stream accessibility.

Fish and waterfowl management may conflict when manipulation of water is involved. Good waterfowl feeding areas for puddle ducks in winter are seldom deep enough for good fishing. If managed, these areas are normally drained in summer; therefore, winter rains that flood natural feeding areas are largely responsible for the supply of migratory waterfowl.

The Mississippi Game and Fish Commission maintains a 1,300-acre waterfowl refuge in the Upper Study Area that holds a huntable waterfowl population in the Pearl River Reservoir Area. Yockanookany and Lobutcha bottoms are the better waterfowl areas of the Upper Study Area while the lower portion of the Pearl River bottom with its associated natural sloughs attract wintering waterfowl. The decline in total waterfowl numbers caused largely by destruction of nesting habitat on northern breeding grounds makes uncertain the waterfowl picture from year to year. Future supplies of migratory waterfowl will depend on hatching and rearing success in the north and the condition of wintering grounds in the Study Area. Where such desirable habitat is found, waterfowl supply a portion of the hunting demand.

Wildlife Habitat

Wildlife habitat types and capacities were inventoried by the Bureau of Sports Fisheries and Wildlife (Table 4.13). Supply is adequate within the Basin to satisfy hunting demands to the year 2015 (Table 4.14). Hunting, however, takes on many forms, and supply for some segments of the hunting public may be short locally. Distribution of game populations and populations of people are ever changing and the trend toward less "open to the public" lands places greater hunting pressure on accessible areas.

The Upper and Lower Sub-areas will experience greater pressure over the time periods and much of this should be absorbed by the Middle Sub-area. Too, the planned increase, expansion, and more intensive management of public game management areas by the Mississippi Game and Fish Commission will serve to alleviate hunting pressure problems. A recent appraisal of the recreation potentials within the Basin suggested a keen interest on the part of local landowners to supply hunting opportunity for a fee. 1/ This survey showed a potential of 413 new or improved areas that would provide hunting opportunity. These areas range from small "dove shooting fields" to group cooperation among landowners.

Recreation

The Bureau of Outdoor Recreation determined the unsatisfied demand for outdoor recreation opportunities in the Basin, currently and for each projected time frame, and provided estimates of the present and future resource requirements, or needs, to meet the unsatisfied demand. An in-depth analysis of the many facets or recreation is presented in Appendix I and Appendix J.

1/ An Appraisal of Potentials for Outdoor Recreation Developments in South Central Mississippi, Soil Conservation Service, United States Department of Agriculture, December 1967.

Table 4.13 Wildlife habitat types and capacities, Pearl Basin, 1965

Item	Amount	Hunting capacity
	Acres	Man-days
Cropland	1,116,096	357,200
Forest (farm and nonfarm)		
Type 2 1/	608,764	225,200
Type 8 2/	3,124,521	1,281,000
Type 11 3/	68,777	39,200
Type 13 4/	716,363	537,300
Pasture	622,448	130,700
Federal-Non-Forest 5/	2,270	500
Others 6/	108,691	20,700
Urban	250,960	---
Water 7/	52,710	---
Total	6,671,600	2,591,800

Source: Fish and Wildlife Resources of the Pearl River Basin - Mississippi and Louisiana, Appendix J, Bureau of Sports Fisheries and Wildlife, United States Department of the Interior.

1/ Longleaf-slash.
2/ Shortleaf-loblolly-hardwoods.
3/ Mixed upland hardwoods.
4/ Mixed bottomland hardwoods.
5/ Government land not in National Forest.
6/ House lots, farm lots, lanes, roads, ditches, land area of sands and wastelands.
7/ Water areas less than 40 acres and streams less than one-eighth mile wide.

Existing needs is defined as the demand for outdoor recreation opportunities less the present capacity of existing resources and facilities. Projected needs are based upon projected demand less programmed supply. Data depicting existing and projected demand, supply, and needs for specified recreational activities are presented in Table 4.14. The potential supply derived from the private sector 1/ and the percentage of total Basin needs that these facilities will furnish are presented in Table 4.15.

1/ An Appraisal of Potentials for Outdoor Recreation Developments in South Central Mississippi, Soil Conservation Service, United States Department of Agriculture, December 1967.

Table 4.14 Existing and projected demand, supply, and needs for specified recreational activities, Pearl Basin, 1965, 1980, and 2015

Item	Boating	Swimming	Camping	Picnicking	Hunting	Fishing: Fresh water
	1,000 activity occasions	1,000 activity occasions	1,000 activity occasions	1,000 activity occasions	1,000 man days	1,000 man days
1965 total annual						
Demand	3,269.5	2,618.1	855.8	3,983.0	953.3	1,396.1
Supply 1/	1,577.9	1,576.1	94.6	491.0	2,591.7	1,858.8
Needs	1,691.6	1,042.0	761.2	3,492.0	0	0
1980 total annual						
Demand	5,557.5	4,459.8	1,462.4	6,762.9	1,106.6	1,646.3
Supply 2/	1,647.2	1,846.9	265.2	815.3	2,537.9	1,858.8
Needs	3,910.3	2,612.9	1,197.2	5,947.6	0	0
2015 total annual						
Demand	18,037.5	14,435.7	4,730.4	21,906.7	1,857.4	2,715.3
Supply 2/	1,647.2	1,846.9	265.2	815.3	2,417.7	1,858.8
Needs	16,390.3	12,588.8	4,465.2	21,091.4	0	856.5

Source: Outdoor Recreation - Pearl River Basin - Mississippi and Louisiana, Appendix I, BOR, United States Department of the Interior, and Fish and Wildlife Resources of the Pearl River Basin - Mississippi and Louisiana, Appendix J, BSF&W, United States Department of the Interior.

1/ Annual use that can be expected from supply.

2/ Annual use generated by five year programmed additions to 1965 supply. Not applicable to hunting and fishing.

Table 4.15 Projected recreation activity occasions satisfied within the private sector, 1980, compared to total needs, Pearl Basin

Recreation enterprises	Estimate of facilities	Activity occasions	Basin needs 1/	Percent provided Basin need
	Number	1,000	1,000	
Vacation cabins	327	679.1	-	-
Camping grounds	154	183.9	1,197.2	15.4
Picnic and field sports	316	370.3	5,947.6	6.2
Fishing waters	1,112	213.0	-	-
Golf courses	54	556.0	-	-
Natural, scenic & historic	49	2.9	-	-
Riding stables	104	212.0	-	-
Shooting preserves	29	114.5	-	-
Vacation farms	13	3.3	-	-
Water sports areas	190			
Water acres	10,661			
Swimming	25	375.0	2,612.9	14.4
Boating	10,661	150.0	3,910.3	3.8
Total activity occasions		2,800.0		
Total recreation days		1,866.6		
Water based activity occ.		1,019.2		
Recreation days		679.4		

1/ Water based activities as computed by BOR.

The greatest amount of public outdoor recreation land and water is in the Upper Pearl Sub-area. The smallest amount of public outdoor recreation land and water is in the Lower Pearl. As far as water acres are concerned, however, this situation is somewhat misleading as it does not take into account all of the surface acres in the Pearl River itself or out of the Basin, effects of Lake Pontchartrain, or the vast recreational resources of the Mississippi Sound. The outdoor recreational opportunities offered by these resources are obviously enormous.

Navigation 1/

The only active projects for navigation consists of a 58-mile channel and canal from Bogalusa, Louisiana, to the mouth of the West Pearl River constructed by the Corps of Engineers,

1/ Engineering Studies for Main Stem and Major Tributaries, Appendix F, Corps of Engineers, Mobile District.

and a 20-mile long channel in the East Pearl River from Gainsville, Mississippi, to the Gulf Intracoastal Canal constructed by the National Aeronautics and Space Administration. Navigation projects have been authorized as far north as Edinburg, Mississippi, on the Pearl River and up to near Summit, Mississippi, on the Bogue Chitto by various Rivers and Harbors Acts of Congress but have not been constructed.

During the course of this study, investigations were made to determine the feasibility of providing a suitable channel for modern barge transportation on the Pearl River up to Jackson, Mississippi. These studies included a review of previous navigation reports, canvass of shippers and receivers of freight to determine the present traffic flow pattern, a freight rate analysis to develop information on commerce that could reasonably be expected to move on the waterway, estimates of probably savings in transportation charges, and cost estimates of improvements for barge navigation.

It was concluded that improvement of the Pearl River for barge navigation or further investigations thereof is unwarranted at this time.

Hydroelectric Power [1/]

The need exists for the continued development of power in the Pearl Basin area. There are no hydroelectric plants in the Basin. The possibilities of providing hydroelectric power capacity at prospective dam sites were investigated by the Corps of Engineers. At all of the sites, the head and runoff were sufficient only for the installation of small capacity plants. The wide valleys and poor foundation conditions resulted in high costs for the dams and power plant structures. The investigation confirms previous conclusions that development of hydroelectric power projects in the Basin is not economically feasible.

1/ Engineering Studies for Main Stem and Major Tributaries, Appendix F, Corps of Engineers, Mobile District.

CHAPTER V

WATER AND LAND RESOURCE DEVELOPMENT POTENTIAL

Availability of Land for Development

The Pearl Study Area comprises 6,671,600 acres of land with a water surface area of 83,000 acres. The area devoted to Federal uses, urban uses, and water comprises 386,000 acres. The remaining 6,286,000 acres are in farms and non-farm forests. Current data indicates that there is a plentiful supply of land for a diversity of development purposes.

The 6.3 million acres in farms and in non-farm forests (excluding Federal) are referred to as inventory acres. In 1958, 73 percent was classified as suitable for cropland. The actual recorded use was: 20 percent cropland, 11 percent pasture land, 65 percent woodland, and 4 percent in other inventory uses. 1/

Potentially there are 4.5 million acres in the Study Area suitable for cultivation. Presently only 1.2 million acres are being cultivated. If an increased need for cropland became evident, the shift would probably come from land presently in forest and pasture. Additional cropland requirements, however, are not indicated. Land use shifts in terms of physical potential for development are assessed below.

Cropland Suitable for Regular Cultivation

The acreage devoted to each major land use by land capability classes is shown in Table 5.1. Conservation needs estimates indicate that 1,140,021 acres are in Classes I through IV which are the lands deemed suitable for row crops when managed within their capabilities. Of this amount 32,457 acres are in Class I, or land which is suitable for continuous cultivation requiring only good cultural practices; 520,420 acres are in Class II, or land having certain limitations such as soil slope or erosion that restrict the choice of crops or require moderate conservation treatment; 411,292 acres are in Class III, or land having severe limitations that restrict the choice of crops or require special conservation practices; 175,852 acres are in Class IV, or land having very severe limitations that restrict the choice of plants or require very special conservation treatment.

1/ Land use distribution presented under Land Use and Cover included both inventory and non-inventory acreage.

Table 5.1 Use of inventory acreage by capability class, Pearl Study Area, 1964

Capability class	Cropland	Pastureland	Forest	Other	Total	Distribution
	Acres	Acres	Acres	Acres	Acres	Percent
I	32,457	6,355	50,149	5,635	94,596	1.5
II	520,420	194,073	603,303	50,712	1,368,508	21.8
III	411,292	247,332	1,189,387	64,899	1,912,910	30.4
IV	175,852	171,680	807,828	35,820	1,191,180	19.0
V	4,321	17,249	323,051	9,056	353,677	5.6
VI	75,365	36,515	359,404	11,470	482,754	7.7
VII	24,720	18,056	633,614	39,342	715,732	11.4
VIII	---	---	---	21,734	21,734	0.3
Unclassified	201	200	144,308	200	144,909	2.3
Total 1/	1,244,628	691,460	4,111,044	238,868	6,286,000	xxx
Percent	19.8	11.0	65.4	3.8	xxx	100.0

Source: Mississippi and Louisiana Soil and Water Conservation Needs Inventories, 1958-1975 Mississippi and Louisiana Conservation Needs Committees, Jackson, Mississippi, and Alexandria, Louisiana.

1/ Excludes land classified as non-inventory acreage.

In addition, 104,406 acres in Classes V through VII, or 8 percent of the presently cultivated land, are not suitable for use as cropland due largely to slope conditions or unfavorable soils. Thus of the 1,244,628 acres of presently cultivated cropland, 1/ 3 percent is adapted to very intensive cultivation, 42 percent to intensive, 33 percent to moderate, 14 percent to limited, and 8 percent is not recommended for cultivation at all.

Potential Shift From Grassland to Cropland

Additional areas shown by land capability estimates as being susceptible and feasible for development as cropland consist of 447,762 acres of grassland pasture. Much of this acreage could be put into cultivation by simply turning under the sod. The balance would require the application of drainage or erosion control practices and in some instances clearing of scrub timber and brush. Of the 447,762 acres suitable for cultivation, 6,355 acres are Class I; 194,075 acres are Class II, and 247,332 acres are Class III land.

Development of suitable grassland into cropland and its incorporation into the cropping system might take several years. Time would be needed for the demand for additional products to materialize. The conversion of pasture to crops would reduce the acreage available to pasture unless additional land was diverted to pasture from some other use. It would substitute one kind of production for another and changes in the farming system would be required. Such a massive shift does not in the foreseeable future seem necessary or desirable. Limited shifts of pasture land to cropland for the production of soybeans is currently taking place.

Potential Shift of Woodland to Cropland

There are 1,842,839 acres of woodland suitable for cropland. Of this amount 50,149 acres are Class I, 603,303 acres are Class II, and 1,189,387 acres are Class III. Approximately 2 percent needs no additional treatment other than clearing, 36 percent would require drainage, and 51 percent would require some level of erosion control, 11 percent has a soil limitation and in addition might require either drainage or erosion control.

1/ The 1958 Conservation Needs data are not comparable with 1959 Census of Agriculture data.

The Pearl Basin with its large acreage of suitable land is well adapted for production of additional food and feed crops. However, before large scale clearing is undertaken, alternative costs of conversion over returns from forest products should be studied. Desirable commercial timber species already on the land may in the long run give better returns than would clearing and converting to some other use.

Recommended Shift of Cropland to Grassland and Woodland

Partially offsetting the potential shift of grassland and woodland to cropland are 104,406 acres of Class V through VII cropland that has been classified as unsuitable for crops. This is mainly land with so much slope that it should be kept in continuous sod or tree cover. Assuming that this land was taken from crop production, the remaining Class I, II, III, and IV land presently in crops would more than meet the anticipated need of the Basin in both 1980 and 2015.

Surface Water Availability and Development Potential

Runoff

Surface water runoff is that part of the precipitation that appears in surface streams. The total runoff may come from one or more of the following sources - surface runoff, storm seepage, or groundwater runoff. There are, or have been, 10 stream gaging stations with satisfactory stream-flow records in the Basin that could be used in the runoff analysis.

Surface runoff analysis in this report is based on the period from the beginning of water year 1938, 1939, or 1940 through water year 1966 with the exception of the Bogue Chitto near Tylertown, which begins with water year 1945, and Yockanookany River near Ofahoma, which begins with water year 1944. The average runoff during this 29-year period appears to be typical of the average runoff that could be expected over a long period of years. The average annual runoff rate (in watershed inches and in acre-feet per square mile), the maximum runoff rate, and the minimum run-off rate at each gaging station are shown in Table 5.2.

Table 5.2 Maximum, minimum, and average runoff rates at selected gaging stations, Pearl Basin, 1966

Gaging Station	Drainage area	Watershed runoff			Volume per square mile		
		Average	Maximum	Minimum	Average	Maximum	Minimum
	Sq.mi.	Inches	Inches	Inches	Ac.ft.	Ac.ft.	Ac.ft.
Pearl							
Edinburg	898	15.86	32.94	3.58	846	1,757	191
Jackson	3,100	16.58	34.97	4.13	884	1,865	220
Monticello	5,040	16.53	32.77	5.40	882	1,748	288
Bogalusa	6,630	18.19	36.71	6.99	970	1,958	373
Tuscolameta							
Walnut Grove	411	15.84	29.11	4.77	845	1,552	254
Yockanookany							
Kosciusko	314	16.65	33.60	3.91	888	1,792	209
Ofahoma	484	17.50	31.81	3.66	933	1,696	195
Strong							
D'Lo	429	17.45	34.50	6.27	931	1,840	334
Bogue Chitto							
Tylertown	502	21.88	34.61	10.65	1,167	1,846	568
Bush	1,210	21.05	37.64	10.33	1,123	2,007	551

Source: Soil Conservation Service, United States Department of Agriculture.

The average annual runoff varies from a low of 15.84 inches or 845 acre-feet per square mile above the Walnut Grove gage on Tuscolameta Creek to a high of 21.88 inches or 1,167 acre-feet per squire mile above the Tylertown gage on Bogue Chitto River. The summary of annual runoff for each of the gaging stations for the water years 1938 through 1966 is shown in Table 5.3. The annual runoff can be expected to equal or exceed 9.85 watershed inches, 525 acre-feet, or 171.0 million gallons per square mile in eight out of ten years from the drainage area above the Walnut Grove gage on Tuscolameta Creek, which has the smallest average annual runoff. At the Tylertown gage on Bogue Chitto River, which has the highest average annual runoff, the annual runoff can be expected to equal or exceed 15.70 watershed inches, 837 acre-feet, or 272.7 million gallons per square mile in eight out of ten years.

A portion of the annual runoff is allocated for beneficial use by the Mississippi Board of Water Commissioners. The amount allocated, as of July 1966, is shown in Table 5.4. The portion of the annual runoff allocated is only a small percentage of the total annual runoff that could be allocated for beneficial uses.

Impoundments

The topography is such that there are suitable physical sites in all portions of the Basin that could be utilized to impound sufficient storage so that the entire average annual runoff, minus water losses, could be made available for beneficial uses. Man-made improvements such as highways, pipe lines, houses, etc., are beginning to limit the usefulness of the sites for water storage in some locations or at least making the easement and rights-of-way cost more. These man-made improvements are expected to continue and possibly increase in the future. If possible, sites for water storage should be selected in the near future and dedicated for that use to the exclusion of other type developments in the area affected.

In the Upper Pearl reach the average physical storage capacity is about a 46.14 inch equivalent. 1/ The average sediment storage requirements are 0.89 inch equivalent and the average detention capacity requirement is 5.90 inch equivalent, leaving about 39.35 inch equivalent available for beneficial water storage. The data as shown above for the Upper Pearl reach along with similar data for the other reaches is shown in Table 5.5.

1/ A watershed capacity measurement for a specific drainage area.

Table 5.3 Annual runoff rates, ten gaging stations, Pearl Basin, 1938-1966

Water Year	Gaging station and volume									
	Pearl at Edinburg	Tuscolameta at Walnut Grove	Yockanookany near Kosciusko	Yockanookany near Ofahoma	Pearl at Jackson	Strong at D'Lo	Pearl at Monticello	Pearl at Bogalusa	Bogue Chitto near Tylertown	Bogue Chitto near Bush
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
1938	16.96	---	---	---	17.06	21.51	---	---	---	16.21
1939	16.80	---	13.29	---	15.10	14.32	15.46	16.65	---	17.10
1940	15.99	14.45	16.23	---	15.73	21.50	17.03	17.82	---	17.51
1941	11.02	10.15	11.67	---	12.28	15.26	12.88	13.96	---	15.73
1942	7.54	8.58	10.29	---	8.24	10.03	9.59	11.27	---	16.87
1943	6.98	9.05	5.35	---	8.27	13.03	10.52	14.01	---	28.94
1944	18.58	18.77	19.04	20.87	19.57	21.36	19.20	20.29	---	21.77
1945	16.56	18.67	17.76	17.67	18.02	21.61	18.74	19.84	20.08	21.76
1946	23.23	23.51	22.65	24.77	23.94	18.86	22.67	24.13	26.59	28.64
1947	17.72	21.56	19.14	18.99	19.60	21.81	21.34	24.03	31.72	31.36
1948	14.84	15.68	17.76	17.54	15.33	14.44	14.76	18.94	25.63	26.49
1949	32.94	29.11	33.60	31.81	34.97	34.50	32.77	36.71	34.61	37.64
1950	22.29	23.14	23.78	20.92	23.32	25.58	24.20	23.67	30.57	25.71
1951	19.06	15.73	31.72	28.50	21.43	16.27	18.14	18.32	20.42	19.75
1952	7.07	4.77	10.00	8.37	6.63	6.27	6.84	8.26	12.02	11.20
1953	14.97	15.71	17.37	17.36	18.43	22.91	19.11	20.08	29.03	23.34
1954	6.74	7.13	10.40	8.98	7.52	8.25	7.49	9.75	10.65	13.83
1955	11.65	11.04	12.23	11.88	12.31	14.29	12.92	14.14	19.12	16.47
1956	15.25	17.31	13.62	16.02	16.04	14.14	14.45	15.89	15.79	15.56
1957	10.46	9.27	14.75	13.98	11.33	10.60	11.10	11.61	16.08	13.13
1958	21.19	23.53	23.13	23.24	24.99	25.83	24.28	25.26	26.06	23.43
1959	13.87	12.11	13.90	13.47	13.53	14.13	13.52	14.73	16.04	18.68
1960	17.42	13.53	17.95	17.51	16.60	15.15	15.38	17.33	17.26	18.31
1961	18.31	23.67	14.41	15.06	18.89	22.22	19.73	23.11	30.95	30.26
1962	30.82	25.79	27.27	28.69	29.50	25.58	27.78	29.67	28.05	31.15
1963	3.58	5.32	3.91	3.66	4.13	6.49	5.40	6.99	10.69	10.33
1964	18.11	15.90	17.74	16.67	17.77	15.28	16.32	17.36	17.61	17.21
1965	14.23	17.71	15.02	13.07	14.45	18.71	15.47	16.97	19.56	18.21
1966	15.71	16.40	12.33	13.45	15.72	16.23	15.62	18.55	22.82	23.73
Total	459.89	427.59	466.31	402.48	480.70	506.16	462.71	509.34	481.35	610.32
Average	15.86	15.84	16.65	17.50	16.58	17.45	16.53	18.19	21.88	21.05
Maximum	32.94	29.11	33.60	31.81	34.97	34.50	32.77	36.71	34.61	37.64
Minimum	3.58	4.77	3.91	3.66	4.13	6.27	5.40	6.99	10.65	10.33

Source: Surface Water Supply of the United States, annual volumes 1938-1966, Geological Survey, United States Department of the Interior.

Table 5.4 Water use allocation by Mississippi Board of Water Commissioners through July 1966, Pearl Basin

Area of use	Purpose for which water was allocated					
	Domestic	Indus-trial	Irri-gation	Municipal	Recreation	Fish culture
	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.
Basin	15	37,847	2,646	101,827	401,050	1,694

Source: Data supplied by the Mississippi Board of Water Commissioners, Jackson, Mississippi

Table 5.5 Physically available storage capacity, by reach, Pearl Basin, 1965

Reach	Equivalent storage			
	Total	Average sediment required	Detention required	Availability for water storage
	Inches	Inches	Inches	Inches
Upper Pearl	46.14	0.89	5.90	39.35
Reservoir	48.55	0.78	6.17	41.60
Jackson	48.61	1.04	5.91	41.66
Strong River	46.01	0.87	6.01	39.13
Middle Pearl	50.40	1.07	5.58	43.75
Lower Pearl	45.82	0.80	6.45	38.57
Bogue Chitto	49.35	0.91	6.07	42.37

Source: Soil Conservation Service, United States Department of Agriculture.

The average available storage for beneficial uses ranges from a low of about 1.7 times the average annual runoff in Lower Pearl reach up to a high of about 2.2 times the average annual runoff in the Middle Pearl reach. Water budget analyses for the storage of irrigation water indicate that storage of one and one-half times the average annual runoff is about the maximum feasible storage that should be considered for irrigation water storage. If these findings hold true for storage of water for other beneficial uses then there is plenty of storage available anywhere in the Pearl Basin for maximum feasible storage of water for beneficial uses.

Ground Water Developments

Wells [1]

Practically all wells more than 100 feet deep are rotary drilled and are artesian - that is, the water is under pressure and rises above the top of the aquifer when the aquifer is penetrated by a well. Depths of water wells in the Basin range from very shallow to more than 2,500 feet deep.

The ground water in the Basin is still a generally undeveloped resource. Many of the deeper aquifers have never been tapped. Total withdrawals now average about 50 to 60 mgd (million gallons a day) for all uses with another estimated 20 mgd being lost from uncontrolled flowing wells.

Fresh ground water occurs from the surface to depths ranging from about sea level in the extreme upper end of the Basin to more than 3,000 feet below sea level in the lower part. In the upper half of the Basin the surface is underlain by three aquifer systems (Meridian - Upper Wilcox, Sparta Sand, and Cockfield). The middle portion of the Basin is also underlain by three aquifer systems (Sparta Sand, Cockfield Formation, and Catahoula Sandstone). The lower portion of the Basin is underlain by several aquifers and has the most potential for ground water development of all the areas within the Basin.

A summary of ground water conditions and geohydrologic relationships for the entire Basin is adequately described in Appendix L. [1] In addition to briefly describing the geology, character of the deposits and their water-bearing properties, the report reveals the availability, quality, present, and potential use of ground water, ground water-surface water relations, and presents an annotated bibliography of selected works.

Stream Development and Levees

The potential for use of channel developments and levees as structural measures for flood prevention in upstream watersheds and flood control in the main stem is directly associated with the natural characteristics of the landscape and cultural features imposed by society. There are few limitations imposed on channel developments by the landscape. However, there is one exception - in certain locations the design features might have to be modified in order to achieve channel stability. In addition,

1/ Geohydrologic Summary of the Pearl River Basin, Appendix L, Geological Survey, United States Department of the Interior.

some limitations are imposed by highway, railroad, and road locations, oil and gas transmission lines, and a few urban-type developments. Under present conditions these developments do not impose too great a restriction on stream development; however, they could in the future if sufficient consideration is not given to location or design features that might affect present or potential channels.

The use of levees in the upstream watersheds is limited due to the narrow floodplains and the absence of extensive urban-type developments in the floodplain areas. Levees in specific locations for a special or local type problem could evolve in the future.

The use of levees or a combination of channels and levees on the main stem will depend almost entirely on future development (agricultural and other) in the floodplain area. There are a few locations for large flood control reservoirs available in the Basin. Therefore, to achieve maximum floodplain protection on the main stem, a combination of floodwater retarding structures, reservoirs, channels, and levees is needed.

The potential for use of stream development, levees, or a combination of channels and levees for flood prevention and flood control will depend almost entirely on future developments and future needs in the floodplain areas of the Basin.

Irrigation

Irrigation in the future depends almost entirely on future needs, economic determinations, and farm management practices. From a physical standpoint, there are about one million acres of floodplain land that would respond to supplemental irrigation water. About one-half of this one million acres is made up of soils that have a high response to supplemental irrigation water (see Table 4.9).

There are adequate opportunities for the development of surface sources of water in sufficient volume to irrigate any or all of the bottom land soils of the Basin. In addition there are undeveloped or under-developed underground aquifers from which water could be pumped for supplemental irrigation water.

Recreation Developments and Fish and Wildlife

Potentials for outdoor recreation developments within the Study Area were appraised through group meetings. [1/] Local members of various governmental agencies and interested individuals comprised the appraising team in each county. Eleven different activities were considered, including fishing waters and hunting area development. The appraising group discussed the important elements that affect recreation developments and assigned values to each. Total scores for each activity resulted and were rated as high, medium, or low potential. [2/] The potential numbers of private sector recreational facilities by 1980 are presented in Table 5.6.

User-oriented activities received the best ratings near the larger cities and towns as proximity directly affects these activities. Resources of existing water and potential impoundment sites exhibited influence on water oriented activities, area-wide. Since the completion of the 30,000-acre Pearl River Reservoir in 1964 in the Upper Study Area, the impact of growing demands for outdoor recreation has been demonstrated through its use. A recreational boatway for the entire Pearl River has been proposed and work begun on the lower reach from Columbia, Mississippi, southward.

Vacation cabins, cottages, and homesites have a medium to high potential throughout the Study Area. Elements most influencing these ratings were potential impoundment sites in the Upper Sub-area, potential and existing water in the Middle Pearl, and accessibility and population of people in the Lower Sub-area. Camping grounds of three categories, vacation sites, float trips, and transient, rated good potentials where adequate tourist routes and floatable streams are present.

1/ The appraisal of potentials, under the sponsorship of the National Association of Soil Conservation District Commissioners, is a group judgment of opportunities in recreational development.

2/ The methodology and scoring system is outlined in the Guide to Making Appraisals of Potentials for Outdoor Recreation Developments, Soil Conservation Service, United States Department of Agriculture, Washington, D. C., July 1966.

Table 5.6 Potential development of private recreational facilities by Sub-area, Pearl Study Area, 1980

Item	Upper	Middle	Lower	Basin
	Number	Number	Number	Number
Vacation cabins	71	106	150	327
Camping grounds	51	79	24	154
Picnic and field sports area	108	118	90	316
Fishing water areas	415	485	212	1,112
Golf courses	12	12	8	32
Hunting areas	167	209	85	461
Natural, scenic, and historic areas	16	24	9	49
Riding stables	18	60	26	104
Shooting preserves	7	17	5	29
Vacation farms	3	5	5	13
Water sport areas	40	97	53	190
New water areas (recreation acres)	2,270	6,995	1,396	10,661

Source: An Appraisal of Potentials for Outdoor Recreation Developments in South Central Mississippi, Soil Conservation Service, United States Department of Agriculture, December 1967.

The potential development of fishing waters is one of the best recreational opportunities within the Study Area. The private sector estimated 1,112 new areas to be established by 1980. Such areas would include any improvements in existing facilities or addition of new ones. The Mississippi Game and Fish Commission has plans to establish access areas on 14 of the better fishing streams and has proposed the creation of an 85,000-acre Pearl River Wildlife Management Area to be located in Leake, Madison, Scott, and Rankin Counties. These measures over the next two years will provide for more efficient use of fishery resource and broader recreational opportunities. The Louisiana Wildlife and Fisheries Commission has under consideration a stream preservation program. In addition, the Commission has constructed concrete boat ramps at Franklinton, Angie, and Bogalusa to provide access.

The people expected to inhabit the Basin by 1980 are the most significant factor influencing the medium potential rating for golf courses. Hunting is popular over the entire region and the potential for establishment of hunting areas and shooting preserves rated well.

Numerous riding clubs are presently active within the Study Area and many are adding other facilities as swimming pools and picnic areas where space permits. Limited development of vacation farms may be expected; however, rural ownership and land use patterns contribute little in favor of this activity.

Natural, scenic, and historic areas have good potentials locally. Customs and culture of the Choctaw Indians in the Upper Study Area offer potentials for historic attractions. Water sports areas possess good potentials area-wide with an estimated 190 new areas to be established by 1980. Larger bodies of water will be built on suitable sites in the Lower Study Area where the greatest influence of population pressure from urban areas is now concentrated.

The U. S. Forest Service provides outdoor recreational facilities in the Bienville National Forest. The facilities are designed to meet probable increased needs of a growing local population and heavier demands on forest facilities by transient recreationists. A horse trail is planned which will include about six loops. All together these loops will total 92 miles. In the near future one loop, about 21 miles, will be ready and opened for public use. The development is in cooperation with the Pearl River Basin Development District. A list of planned and potential recreational facilities within the National Forest lands is presented in Table 5.7. Accomplishment of planned development is contingent upon the availability of regular Forest Service funds for this purpose.

Forest industry owns about 20 percent of the forest in the Basin. Generally these areas are open to hunters and fishermen. There are times due to severe forest fire hazards or logging operations that the areas will be closed. Campgrounds or picnic areas have not been developed nor have the facilities desired by most campers and picnickers. The potential for development on these lands is high and this is recognized by the managers of these lands.

The identification of water and land resource development potential expressed in this report evolved out of a Department of Agriculture study. For complete assessment of recreation potential refer to Appendix I. 1/

1/ Outdoor Recreation - Pearl River Basin, Mississippi and Louisiana, Appendix I, BOR, United States Department of the Interior.

Table 5.7 Inventory of planned and potential recreation developments in the Bienville National Forest, Pearl Basin, 1980 and 2015

Activity	Planned facilities 1/		Potential 2/
	1980	2015	
Water impoundments	660 acres	895 acres	0 acres
Camping 3/	15 acres 45 F. U.	26 acres 78 F. U.	18 acres 54 F. U.
Picnicking 4/	10 acres 30 F. U.	25 acres 75 F. U.	5 acres 15 F. U.
Swimming	2 acres	3 acres	5 acres
Boating	5 acres launch 65 acres water	3 acres launch 200 acres water	6 acres launch __ acres water
Fishing	660 acres	895 acres	__ acres
Hunting	85,000 acres	---	---

Source: Internal data, U. S. Forest Service, United States Department of Agriculture.

1/ Estimates are not cumulative.

2/ Potential - area is suitable and available as defined by existing plans of U. S. Forest Service.

3/ F. U. - Family unit is a table, fireplace, garbage can, parking spur, and tent space.

4/ F. U. - Family unit is a table, fireplace, and garbage can.

CHAPTER VI

EXISTING PROGRAMS, PROJECTS, AND OPPORTUNITIES FOR MEETING SOME OF THE BASIN NEEDS

PL-46, PL-566, Corps of Engineers, Pearl River Basin Development District and Others

The first Soil Conservation District in the Pearl River Basin was organized in October 1938 in Kemper County. Since that time, Districts have been organized in all of the other counties or parishes that are wholly or partially within the Basin. All of the Districts are actively engaged in carrying out soil and water conservation programs with individual farmers.

To date, detail 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 include conservation cropping systems, contour farming, critical area land treatment, tree planting, woodland management practices, etc. The land treatment measures applied on the land as of June 30, 1968, are shown in Table 6.1.

The first local water management district organized in the Basin under Public Law 566 was Pleasant Valley Creek Watershed located in Washington Parish, Louisiana. A work plan was prepared for this watershed and it was approved for operation in December 1958. Since that time, thirteen other watersheds have been organized. Watershed work plans have been prepared for eleven of these, which are: Tallahaga, Beasha, Standing Pine, Eutacutaches, Richland, Copiah, Silver, Whitesand, Holiday, Bogue Lusa, and Little Bahala. All of these are presently approved for operations. To date most of the land treatment and structural measures have been installed in Pleasant Valley Watershed. Some land treatment measures have been installed in Standing Pine. Measures installed to date include five floodwater retarding structures and 1.08 miles of stream development. Two watersheds - Carthage (Five Creeks) and Hanging Moss - are presently in the planning stage and have not been approved for operations. These two watersheds are included in the early action plan in Chapter X. (Table 6.2 and Figure 6.1)

Table 6.1 Land treatment and structural measures now on land, Pearl Basin, as of June 1967

Practice	Unit	Going programs PL-46, PL-566 ACP
Brush control	Acres	256,100
Conservation cropping system	Acres	329,000
Contour farming	Acres	310,600
Controlled burning	Acres	21,600
Cover and green manure crop	Acres	242,500
Critical area planting	Acres	49,200
Crop residue use	Acres	282,900
Diversion	Feet	433,100
Farm ponds	Number	29,200
Firebreaks	Feet	26,070,000
Fishpond management	Number	8,000
Grassed waterway or outlet	Acres	8,300
Irrigation system sprinkler	Number	17
Land smoothing	Acres	3,000
Drainage main or lateral	Feet	1,096,000
Drainage field ditch	Feet	1,625,000
Pasture and hayland management	Acres	499,800
Pasture renovation	Acres	396,700
Pasture planting	Acres	328,700
Row arrangement	Acres	53,700
Terrace, gradient	Feet	74,851,000
Terrace, parallel	Feet	226,200
Tree planting	Acres	122,400
Wildlife habitat development	Acres	47,900
Woodland harvest cutting	Acres	282,600
Woodland intermediate cutting	Acres	332,100
Woodland interplanting	Acres	31,900
Woodland weeding	Acres	421,400
Debris basins	Number	23
Floodwater retarding structures	Number	5
Grade stabilization structures	Number	58
Stream development	Feet	235,000

Source: Compiled from internal data of the Soil Conservation Service, United States Department of Agriculture.

Table 6.2 Status of PL-566 watersheds, Pearl Basin, July 1968

Watershed	Planned	In the planning stage	Approved for operation
Tallahaga	X		X
Beasha	X		X
Standing Pine	X		X
Eutacutaches	X		X
Richland	X		X
Copiah	X		X
Little Bahala	X		X
Silver	X		X
Whitesand	X		X
Holiday	X		X
Pleasant Valley	X		X
Bogue Lusa	X		X
*Carthage (Five Creeks)		X	
*Hanging Moss		X	

Source: Soil Conservation Service, United States Department of Agriculture.

* Included in early action plan in Chapter X.

Measures to be installed in the twelve PL-566 watersheds that are approved for operations include land treatment for watershed protection, critical area stabilization, and structural measures. Structural measures to be installed include 94 floodwater retarding structures, 6 multiple purpose structures, 5 recreational facilities, and 390 miles of stream development. Two of the multiple purpose structures contain storage for municipal water supply and 5 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 roadbanks. Physical and structural data along with location, costs, and benefits by watersheds are shown in Table 6.3 and Figure 6.2.

The total annual benefits for structural measures are $1,899,710. Of this amount, $1,194,700 is damage reduction benefits, $155,600 is from changed and more intensive land use, $307,700 is from planned recreation, $23,800 is incidental recreation in the floodwater retarding structures, $28,000 for municipal water supply, and $189,910 is secondary benefits. Incidental recreation was based upon 25 annual visitor days per surface acre of water in the sediment pool

Table 6.3 Physical data, costs, and benefits, by PL-566 watersheds, Pearl Basin

Watershed	Total area	Floodwater retarding and multi-purpose structures: Drainage area controlled	Floodwater retarding and multi-purpose structures: To be installed	Stream development: Installed	Stream development: To be installed	Total cost of land treatment measures yet to be installed	Total installation cost of structural measures yet to be built	Annual cost of structural measures	Annual benefits to structural measures 1/	Benefit cost ratio
	Acres	Acres	Number	Miles	Miles	Thou. dollars	Thou. dollars	Dollars	Dollars	
Tallahaga	79,320	28,006	-	-	51.45	804	2,392	92,300	124,800	1.4:1
Beasha	35,603	15,898	-	-	18.10	320	732	31,700	80,700	2.5:1
Standing Pine	36,648	12,422	-	-	20.82	552	1,031	39,100	79,100	2.0:1
Eutacutaches	18,128	4,557	-	-	14.67	206	603	22,800	35,900	1.6:1
Richland	93,000	31,462	-	-	38.37	807	2,838	102,100	196,100	1.9:1
Copiah	126,358	39,718	-	-	67.33	1,542	4,171	185,000	368,500	2.0:1
Little Bahala	32,340	12,442	-	-	16.80	263	1,153	74,300	141,000	1.9:1
Silver	113,259	38,157	-	-	55.65	1,839	3,143	127,300	196,600	1.5:1
Whitesand	131,260	40,762	-	-	70.22	2,030	4,468	185,300	287,500	1.6:1
Holiday	63,760	27,955	-	-	36.35	918	1,447	56,600	95,400	1.7:1
Pleasant Valley	11,800	2,496	5	1.08	-	122	-	-	-	-
Bogue Lusa	62,000	41,632	-	-	-	290	4,146	151,700	254,100	1.7:1
Total	803,476	295,507	5	1.08	389.76	9,693	26,124	1,068,200	1,859,700	1.7:1

Source: Soil Conservation Service and Forest Service, United States Department of Agriculture.

1/ Includes downstream benefits.

2/ Includes 2 multi-purpose structures, 1 with recreational facilities.

3/ Includes 1 multi-purpose structure with recreational facilities.

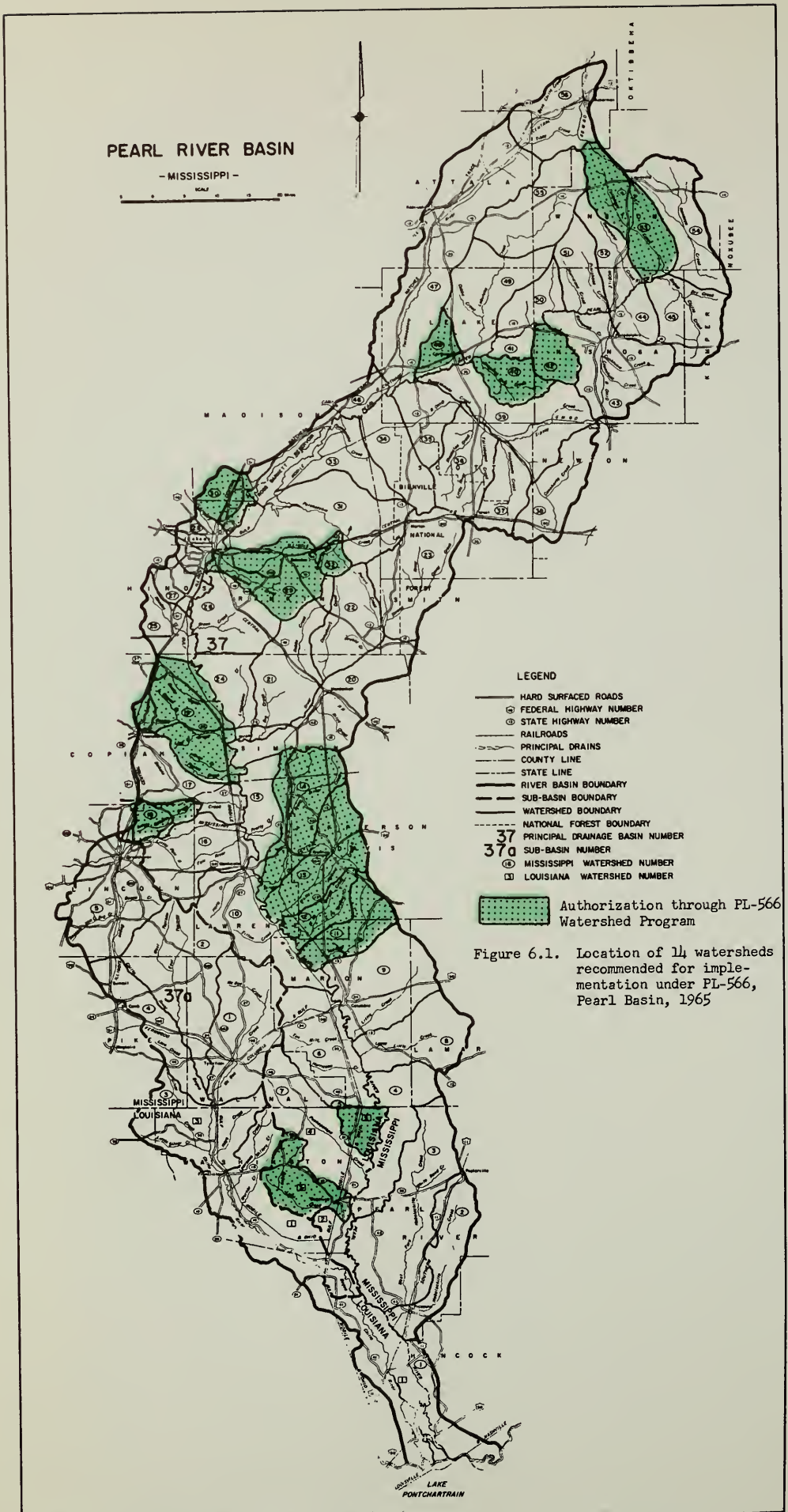

Figure 6.1. Location of 14 watersheds recommended for implementation under PL-566, Pearl Basin, 1965

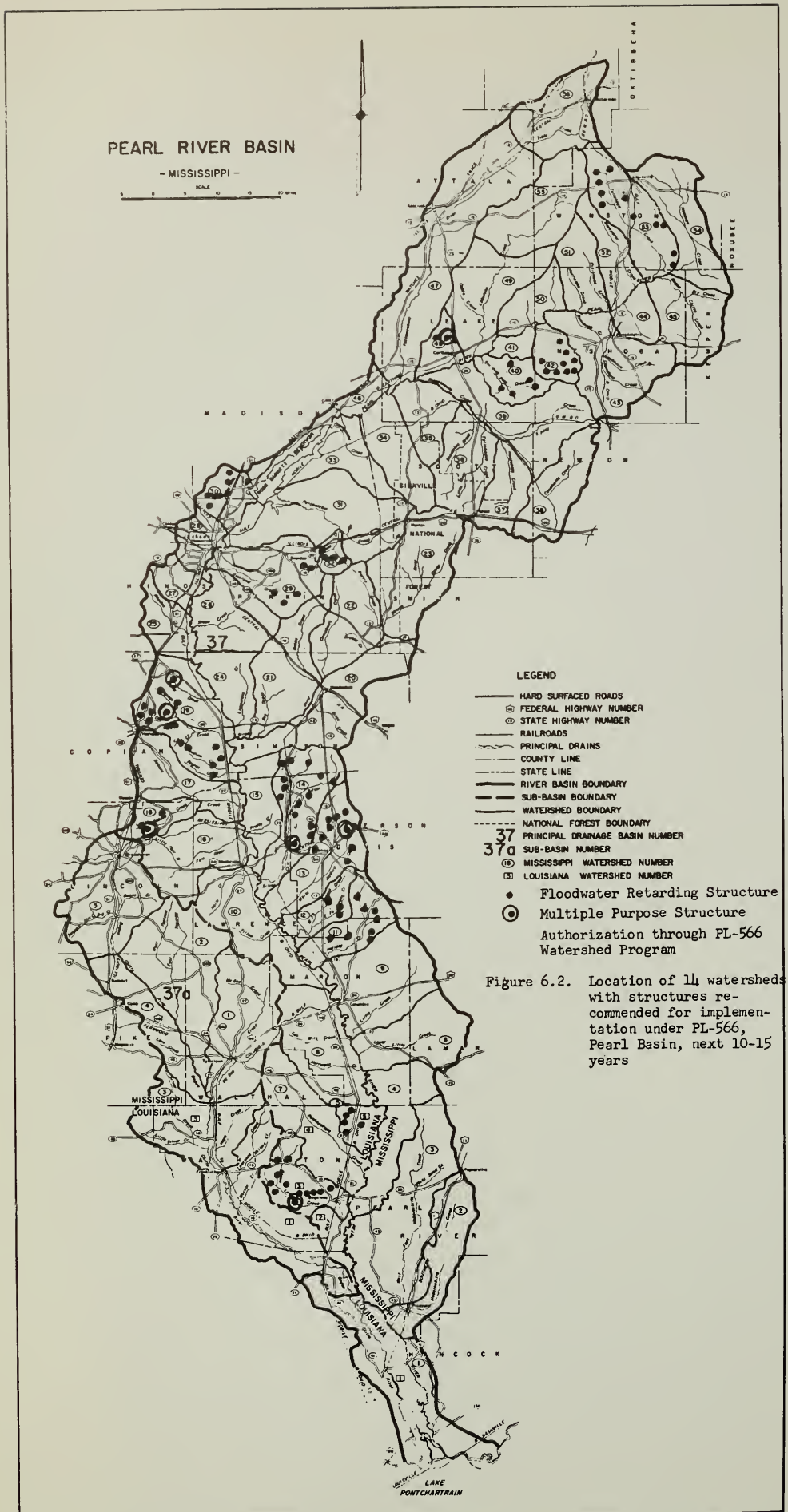

Figure 6.2. Location of 14 watersheds with structures recommended for implementation under PL-566, Pearl Basin, next 10-15 years

of the floodwater retarding structures. The benefits were discounted for decreasing water area because of sediment filling. Summary data for the 12 PL-566 watersheds approved for operation are shown in Tables 6.4 through 6.11.

A part of the remaining land treatment needs for water resources development as shown in Tables 4.3 and 4.4 will be met in the future by the regular going PL-46, ACP, and other programs.

Existing or authorized projects of the Corps of Engineers include navigation facilities in the lower portion of a flood control project along Pearl River at Jackson, Mississippi. The existing navigation project provides a 58-mile long channel 7-feet deep at mean low water from the mouth of West Pearl River to Richardson's Landing at Bogalusa, Louisiana. This canal includes three locks that have a total lift of 54.5 feet. Other existing navigation projects include a 9-foot deep channel from the intercoastal waterway to the mouth of East Pearl River.

The flood control project, which is now complete, consists of levees and stream development to provide protection for about 6,290 acres of land on the east and west side of the river at Jackson, Mississippi. This project includes 13 miles of levees, 13.4 miles of drainage canals with 5 gated outlets through the levees and one pumping station and 2.3 miles of channel cut-offs on the river.

The Mississippi Test Facility is located in Hancock County, Mississippi. The National Aeronautics and Space Administration has constructed a 20-mile long navigation channel in East Pearl River from Gulf Intracoastal Canal to an excavated harbor near Gainesville, Mississippi.

The Natchez Trace Parkway has about 83 miles of roadway that traverse the Basin in a southwesterly direction. It is a scenic highway with many historic sites and recreational facilities located on it.

A Choctaw Indian reservation is located in the Basin that includes approximately 17,000 acres of land. Also a part of the Noxubee Wildlife Refuge is located near Louisville, Mississippi.

There are two State Parks in the Study Area. These are Roosevelt State Park with 147 acres of water area near Morton, Mississippi, and Percy Quin State Park near McComb, Mississippi, with 540 acres of water area. These State Parks have facilities for picnicking, camping, boating, and cabins.

Table 6.4 Estimated installation costs of land treatment and structural measures for 12 PL-566 watersheds, authorized for operation, Pearl Basin

Item	Unit	Amount	Estimated cost		
			Federal	Other 1/	Total
			Thou. dollars	Thou. dollars	Thou. dollars
LAND TREATMENT MEASURES					
Cropland and pastures					
Cropland	Acres	55,400	---	1,219	1,219
Grassland	Acres	105,500	---	4,712	4,712
Wildlife land	Acres	29,800	---	140	140
Critical area planting					
Grasses and legumes	Acres	3,959	208	112	320
Roadside erosion cont.	Miles	550	135	73	208
Technical assistance	---	---	1,506	431	1,937
Total - Cropland and pasture	---	---	1,849	6,687	8,536
Forest land					
Private forest land	Acres	81,910	---	689	689
Critical area planting					
Tree planting	Acres	4,280	169	42	211
Technical assistance	---	---	199	59	258
Total - Forest land	---	---	368	790	1,158
Total - Land treatment measures	---	---	2,217	7,477	9,694
STRUCTURAL MEASURES					
Floodwater retarding structures	Number	94	8,690	0	8,690
Multiple purpose structures	Number	6	1,371	373	1,744
Minimum basic facilities	Number	5	456	455	911
Stream development	Miles	390	5,105	0	5,105
Sub-total - Construction	---	---	15,622	828	16,450
Installation services	---	---	5,106	188	5,294
Land easements and R.O.W.	---	---	392	3,785	4,177
Adm. of contracts & other	---	---	0	203	203
Total - Structural measures	---	---	21,120	5,004	26,124
TOTAL PROJECT	---	---	23,337	12,481	35,818

Source: Derived from study data and compiled by the Forest Service and Soil Conservation Service, United States Department of Agriculture.

1/ Includes private and public program funds.

Table 6.5 Estimated structural cost distribution, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Construction & installation services: Construction	Construction & installation services: Installation	Land easements and R.O.W.	Administration of contracts and other	Total installation
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	8,690	2,854	2,273	103	13,920
Multiple purpose structures	1,744	551	906	16	3,217
Minimum basic facilities	911	283	89	10	1,293
Stream development	5,105	1,606	909	74	7,694
Total	16,450	5,294	4,177	203	26,124

Source: Soil Conservation Service, United States Department of Agriculture.

Table 6.6 Cost allocation and cost sharing summary, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Purpose: Flood prevention	Purpose: Recreation	Purpose: Municipal	Total
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
	COST ALLOCATION			
Floodwater retarding structures	13,920	0	0	13,920
Multiple purpose structures	1,643	1,288	286	3,217
Basic recreational facilities	0	1,293	0	1,293
Stream development	7,694	0	0	7,694
Total	23,257	2,581	286	26,124
	COST SHARING			
	Federal funds Thou. dollars	Other Thou. dollars		
Floodwater retarding structures	11,544	2,376		13,920
Multiple purpose structures	2,224	993		3,217
Basic recreational facilities	641	652		1,293
Stream development	6,711	983		7,694
Total	21,120	5,004		26,124

Source: Soil Conservation Service, United States Department of Agriculture.

Table 6.7 Structure data, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Unit	Total
Drainage area controlled	Sq. Mi.	461.73
Storage capacity		
Sediment	Ac. Ft.	39,225
Floodwater	Ac. Ft.	147,301
Recreation	Ac. Ft.	9,576
Municipal	Ac. Ft.	5,500
Potential water storage	Ac. Ft.	993,918
Total	Ac. Ft.	1,195,520
Surface area		
Sediment	Acre	5,502
Floodwater	Acre	20,167
Recreation	Acre	1,352
Municipal	Acre	965
Potential water storage pool	Acre	64,974

Source: Soil Conservation Service, United States Department of Agriculture.

Table 6.8 Annual costs, 12 PL-566 watersheds authorized for operation, Pearl Basin

Measures	Amortization of installation cost	Operation, maintenance, and replacement cost	Total
	Dollars	Dollars	Dollars
Floodwater retarding structures	605,400	60,700	666,100
Multiple purpose structures	54,800	1,400	56,200
Minimum basic facilities	22,900	41,700	64,600
Stream development	181,800	99,600	281,400
Total	864,900	203,400	1,068,300

Source: Soil Conservation Service, United States Department of Agriculture.

Table 6.9 Estimated average annual flood damage reduction benefits, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Estimated average annual damage		Damage reduction benefits
	Without project	With project	
	Dollars 1/	Dollars 1/	Dollars 1/
Floodwater			
Crop and pasture	828,200	191,100	637,100
Other agricultural	7,400	1,500	5,900
Nonagricultural			
Urban and industrial	120,600	12,600	108,000
Road and bridge	306,500	84,400	222,100
Sub-total	1,262,700	289,600	973,100
Erosion, reduced road maintenance	2,200	500	1,700
Sediment and scour	107,900	26,500	81,400
Indirect	133,200	31,800	101,400
Total	1,506,000	348,400	1,157,600

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Price base - long term projected.

Table 6.10 Comparison of benefits and costs for structural measures, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Average annual benefits 1/									Benefit-cost ratio primary benefits	Benefit-cost ratio total benefits
	Flood prevention										
	Damage reduction	Changed and more intensive land use	Incidental recreation	Municipal	Planned recreation	Total primary benefits	Secondary benefits	Total benefits	Average annual cost		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Benefits upland watersheds 2/	1,112,800	55,300	23,800	28,000	307,700	1,527,600	171,700	1,699,300	1,068,300	1.4:1	1.6:1
Benefits downstream	81,900	100,300	-	-	-	182,200	18,210	200,410	-		
Total	1,194,700	155,600	23,800	28,000	307,700	1,709,800	189,910	1,899,710	1,068,300	1.6:1	1.8:1

Source: Soil Conservation Service, United States Department of Agriculture and Corps of Engineers, United States Army.

1/ Price base long term projected.

2/ In addition, land treatment measures will provide damage reduction benefits of $44,800 annually.

Table 6.11 Summary of physical and plan data, 12 PL-566 watersheds authorized for operation, Pearl Basin

Item	Unit	Quantity without project	Quantity with project
Watershed area	Sq.mi.	1,256	1,256
	Acres	803,400	803,400
Area of cropland	Acres	117,900	128,700
Area of grassland	Acres	162,100	161,500
Area of woodland	Acres	473,300	463,300
Miscellaneous area	Acres	50,000	49,900
Floodplain area subject to inundation by maximum storm in evaluation series	Acres	137,000	---
Area of floodplain benefited by proposed structural measures	Acres	---	105,300
Watershed area controlled by floodwater retarding structures	Acres	---	295,500
	Percent	---	37

Source: Soil Conservation Service, United States Department of Agriculture.

The Mississippi Game and Fish Commission manages six lakes in the Basin that are used primarily for fishing and picnicking. These are: Simpson Legion Lake near Mendenhall, Mississippi, with 75 acres of surface area; Lake Mary Crawford near Monticello, Mississippi, with 140 acres; Lake Jeff Davis near Prentiss, Mississippi, with 164 acres; Lake Walthall near Tylertown, Mississippi, with 62 acres; Lake Columbia near Columbia, Mississippi, with 90 acres; and Lake Tom Watts near Columbia, Mississippi, with 15 acres.

The Ross Barnett Reservoir is located just northeast of Jackson, Mississippi. It has a surface area of approximately 30,000 acres of water. It is presently used for recreational purposes and for municipal and industrial water for the City of Jackson.

The existing supply of outdoor recreation areas for the Pearl River Basin is shown in Table 6.12. This table shows the location, total area, and the administrative agency.

Sixteen drainage districts were organized between 1912 and 1927 in the Basin covering 76,400 acres of land. As of June 1939 these districts had constructed 168 miles of channels. These districts were on seven tributary streams of the Pearl River. These were: Yockanookany, Tuscolameta, Standing Pine, Beasha, Kentawah, Tallahaga, and Town Creek. Most of these districts are dormant and there has been little or no maintenance on channels.

The Pearl River Basin Development District was created by an act of the Mississippi Legislature in 1964. This is a Basin-wide organization with legal authority to work with local, State, and Federal agencies in the planning and construction of water and related land projects within its jurisdiction. In the future they plan to construct water and related works of improvement for recreation, flood control, etc.

The Department of Public Works, an agency of the Louisiana State Government, has the legal authority to work with local, State, and Federal agencies in the planning and construction of water and related land resource development within Louisiana. They are the responsible State agency for most of the channel development work that is done in Louisiana. Approximately 10 miles of stream development work was done in St. Tammany Parish in the Pearl Basin east of Slidell from 8 to 10 years ago. Also a small amount has been done in Washington Parish, mostly around Bogalusa.

Table 6.12 Existing supply of outdoor recreation areas, Pearl Basin

Facility Name 1/	Administrative Agency 2/	County or Parish	Land Acres	Water Acres	Marsh Acres	Total
Upper Pearl Subarea						
Tombigbee Nat'l Forest	USFS	Winston	16,918	---	---	16,918
Mitchell Pond Rec. Area	USFS	Winston	35	2	---	37
Webster Lake Rec. Area	USFS	Winston	240	---	---	240
Noxubee Lake Rec. Area	USFS	Winston	840	90	---	930
Choctaw W'life Mgt.Area	MGFC	Winston	14,640	90	---	14,730
Nanih Waiya Hist. Site	MPS	Winston	68	---	---	68
Noxubee Nat'l Wildlife Refuge	BSF&W	Winston	18,749	512	---	19,261
Dancing Rabbit Wildlife: Management Area	MGFC	Winston	44,000	---	---	44,000
Bienville Nat'l Forest	USFS	Scott	100,000	---	---	100,000
Raworth Rec. Area	USFS	Scott	22	5	---	27
Tallabogue Rec. Area	USFS	Scott	40	3	---	43
Bienville Pines Scenic Area	USFS	Scott	189	---	---	189
Homewood Rec. Area	USFS	Scott	96	---	---	96
Bienville Wildlife Management Area	MGFC	Scott	14,180	---	25	14,205
Tallahala Wildlife Management Area	MGFC	Scott	12,800	---	---	12,800
Roosevelt State Park	MPS	Scott	560	120	---	680
Golden Mem. State Park	MPS	Leake	136	---	---	136
Robinson Road, etc.	NPS	Leake	2	---	---	2
Yockanookany Picnic Area	NPS	Leake	2	---	---	2
Choctaw Indian Agency	BIA	Leake	1,809	---	---	1,809
Lake Dockery	MGFC	Hinds	26	55	---	81
Rankin County Lake Park	CO	Rankin	200	600	---	800
Ross Barnett Reservoir	CO	Multiple	12,000	30,000	6,000	48,000
Choctaw Indian Agency	BIA	Neshoba	10,703	---	---	10,703
Subtotal			248,255	31,477	6,025	285,757
Middle Pearl Subarea						
Copiah Game Area	MGFC	Copiah	6,500	---	---	6,500
Homochitto Nat'l Forest	USFS	Copiah	7,108	---	---	7,108
Homochitto Nat'l Forest	USFS	Lincoln	7,834	---	---	7,834
Lake Walthall	MGFC	Walthall	90	62	---	152
Simpson-Legion Lake	MGFC	Simpson	26	75	---	101
Dixie Springs Lake	MGFC	Pike	10	100	---	110
Percy Quin State Park	MPS	Pike	1,620	650	---	2,270
Jefferson Davis Lake	MGFC	Jefferson	51	164	---	215
Mary Crawford Lake	MGFC	Lawrence	51	134	---	185
Marion Co. Game-Fish A.	MGFC	Marion	7,200	100	---	7,300
Wolf River W. M. Area	MGFC	Marion	27,000	---	---	27,000
Subtotal			57,490	1,285	---	58,775

- Continued

Table 6.12 Existing supply of outdoor recreation areas, Pearl Basin (continued)

Facility Name [1]	Administrative Agency [2]	County or Parish	Land Acres	Water Acres	Marsh Acres	Total
Lower Pearl Subarea						
DeSoto Nat'l Forest	USFS	Pearl River	4,046	---	---	4,046
Wolf River Wildlife Management Area	MGFC	Pearl River	134,000	---	---	134,000
Pearl River, Lock No. 1	USCE	St.Tammany	130	290	10	430
Pools Bluff	USCE	St.Tammany	44	---	---	44
Pearl River, Lock No. 2	USCE	St.Tammany	30	90	---	120
Pearl River, Lock No. 3	USCE	St.Tammany	90	440	10	540
Bogue Falaya St. Wayside Park	LSPRC	St.Tammany	13	---	---	13
Fontainbleau St. Park	LSPRC	St.Tammany	2,610	---	---	2,610
St. Tammany Game Refuge	LSPRC	St.Tammany	1,750	---	---	1,750
Fairview Riverside State Park	LSPRC	St.Tammany	85	1	14	100
Angie City Area	LSPRC	Washington	5	---	---	5
Bogalusa City Area	LSPRC	Washington	5	---	---	5
Subtotal			142,808	821	34	143,663
Total			448,553	33,583	6,059	488,195

1/ Source: BOR Form 8-73 (updated to 1966) and BSF&W report on streams in the Pearl River Basin.

2/ USFS - Forest Service; USCE - Corps of Engineers; BSF&W - Bureau of Sport Fisheries and Wildlife; BIA - Bureau of Indian Affairs; LSPRC - Louisiana State Parks and Recreation Commission; MGFC - Mississippi Game and Fish Commission; MPS - Mississippi State Park System; NPS - National Park Service; CO - County.

Cooperative State-Federal Forestry and Related Programs

There is a vital interest in the Basin for the development of the forest resources. A part of this development can be carried out under the different forestry programs that are available between the Forest Service, State, and private landowners and other Federal agencies. Some of these programs and their principal features are discussed briefly.

The Weeks Law of 1911 authorized and directed the Secretary of Agriculture to examine, locate, and recommend for purchase such forested, cut-over, or denuded lands within the watersheds of navigable streams as in his judgment may be necessary to the regulation of the flow of navigable streams or for the production of timber.

The Clarke-McNary Act was passed June 7, 1924. This Act provides for protection of forest resources from fire (CM-2), produce, purchase, and distribute planting stock or seed for forest, windbarrier, or watershed plantings (CM-4), and for farm forestry extension work. The assistance to private forest owners is handled through appropriate State agencies.

The McSweeny McNary Act, passed in 1928, provides a broad charter for forest research programs in the United States. Under its provisions the U. S. Forest Service operates regional forest and range experiment stations to serve the principal forest regions of the Nation. The Basin is located within the territory of the Southern Forest Experiment Station headquartered in New Orleans, Louisiana. Surrounding the Basin are various centers doing research on the silviculture of southern hardwoods and pines, insects and diseases, range and wildlife habitat, forest fire prevention, watershed management, forest genetics, timber management, forest products utilization, and engineering.

The Soil Conservation Act, passed in 1935, authorized the Secretary of Agriculture through the Soil Conservation Service to furnish technical assistance (woodland planning) to farmers in soil conservation districts.

The Bankhead-Jones Farm Tenant Act of July 22, 1937, provided for a program of land conservation and land utilization to correct maladjustments in land use. The purpose of the Act was to assist in controlling soil erosion, reforestation, preserving natural resources, protecting fish and wildlife, and protecting the watersheds in navigable streams.

The Forest Past Control Act of June 25, 1947, provides for Federal cooperation to protect and preserve forest resources from destructive forest insect pests and diseases. It empowered the Secretary of Agriculture to act on Federal lands, or through cooperative agreement with the State forester, or appropriate State officials on non-Federal lands.

The Granger-Thye Act of April 24, 1950, provided that funds could be expended for the erection of buildings, lookout towers, and other structures on land owned by States, counties, municipalities, and other political subdivisions, corporations, or individuals.

The Cooperative Forest Management Act of August 25, 1950, authorized cooperation with State foresters or equivalent officials and provides funds, on a 50-50 basis for technical services to private forest landowners and operators, and processors of primary forest products with respect to the management of forest lands and the harvesting, marketing, and processing of forest products.

The Watershed Protection and Flood Prevention Act (PL-566) provides authority to assist local watershed groups in solving water management and flood prevention problems. The Soil Conservation Service is the agency within the U. S. Department of Agriculture responsible for the administration of the Act. The U. S. Forest Service is responsible for making and carrying out the forestry plan for the forest lands. The Forest Service, in cooperation with State foresters, has responsibility for furnishing technical on-the-ground forest land management assistance including supervision of installation of the forestry measures recommended for the forest lands.

The Agricultural Conservation Program provides for assistance to the individual landowners for land treatment measures on forest land for the following practices: (1) establishment of a stand of trees on farm land for purposes other than the prevention of wind or water erosion; (2) establishment of a stand of trees on farm land to prevent wind or water erosion; (3) improvement of a stand of forest trees on farm land; (4) construction of firebreaks for forest land protection; and (5) the Naval Stores Conservation Program.

The Agriculture Act of 1956 authorized assistance to the States in undertaking needed programs of tree planting and other forestation work to help assure an adequate future supply of industrial wood. This assistance is available for all classes of forest land suitable for industrial wood production, regardless of ownership.

The Food and Agricultural Act of 1962 authorized a program to assist farmers in shifting their land to nonagricultural uses. The purpose is to promote the development of soil, water, forest, wildlife, and recreational resources and to establish and protect open spaces and natural beauty.

The McIntire-Stennis Act of October 10, 1962, recognized that research in forestry is the driving force behind progress in developing and utilizing the resources of the Nation's forest and related rangelands. It authorized the Secretary of Agriculture to cooperate with the several states for the purpose of encouraging and assisting them in carrying out programs of forestry research.

The Land and Water Conservation Fund Act (P.L. 88-578) became effective on January 1, 1965. The purpose of this Act is to preserve, develop, and assure accessibility to all citizens the quality and quantity of outdoor recreation resources as may be available and are necessary and desirable for individual active participation in such recreation. This will be done by: (1) providing funds for and authorizing Federal assistance to the States in planning, acquisition, and development of needed land and water areas and facilities; and (2) providing funds for the Federal acquisition and development of certain lands and other areas.

The Mississippi Forestry Commission has programs that provide various services to the forest landowner. Some of these services are as follows: (1) utilization and marketing of timber products; (2) prevention and suppression of all wild forest fires; (3) forest land examination and advice to owners as to practices which should be applied if maximum timber production is desired. Assistance is given to Boards of Supervisors in managing and marketing timber on 16th Section school lands and to State and other public owned forest land; (4) timber marking up to 40 acres to each landowner; (5) tree seedlings are available for reforestation purposes; and (6) tree planting, control of undesirable trees, and fire land construction is available on a fee basis.

National Forest Development and Multiple-Use Programs

Since the Forest Service's beginning in 1905, the broad goal has been "the greatest good for the greatest number of people in the long run." The specific objective is multiple use. Multiple use is briefly defined as "the use of all the various resources of the forest - outdoor recreation, range, timber, watershed, and wildlife and fish - in combination that best fits the needs of the American people."

The U. S. Forest Service manages the Bienville, Tombigbee, and DeSoto National Forests in the Pearl River Basin. Most of this publicly owned forest land, about 85,800 acres, comprises portions of two ranger districts, Bienville and Strong River, Figure 6.3. There are 100 acres in the Tombigbee National Forest and 1,200 acres in the DeSoto National Forest. The lands were purchased under the authority of the Weeks Law of 1911 and an Enabling Act by the Mississippi Legislature of 1926. The Federal Government was invited to purchase these cut-over lands and to manage them in the interest of conservation.

These Forests provide developed sites for camping and picnicking. "Green tree" reservoirs are planned which will provide feeding areas for waterfowl. One of the newly developed areas in the Bienville National Forest is the Bienville Pines Scenic Area. This is a 189-acre tract with virgin loblolly pine. A walking tour has been laid out which has a number of points of interest such as the nesting place for the red cockaded woodpecker, a rare species. A walk through this area gives an idea of how some of the Coastal Plain forests looked when the early settlers arrived.

Grazing on National Forest lands is important to the economy of the rural communities. The objective is to manage livestock grazing consistent with good management of forage, water, timber, recreation, and wildlife resources. Efforts are underway now to regulate grazing through a program of education, distribution of range use, stocking rates, and fencing. In the Bienville Forest, only the Strong River District is compatible to grazing.

Timber management is making progress through even-age silviculture in achieving a better yield from the forest land. Each year areas are planted and seeded for full stocking and stands are improved through removal of undesirable trees, pruning, pre-commercial thinnings, and prescribed burning. This will mean more wood products, sawtimber, pulpwood, veneer logs, post pilings, poles, firewood, handle bolts, shuttle blocks, distillate wood, and naval stores.

Watershed management consists of two principal parts: (1) protection of the watershed by stabilizing the soil and thereby preserving and improving water quality, and (2) management of the area to improve water yields. In this Basin the primary objective is protection of the watershed to improve the water quality and to give a better time control of water yields. Progress is being made in the rehabilitation of eroding and sediment-producing areas. Galled and sheet eroded areas, abandoned forest roads and trails, and severely eroded roadbanks are being stabilized by revegetation.

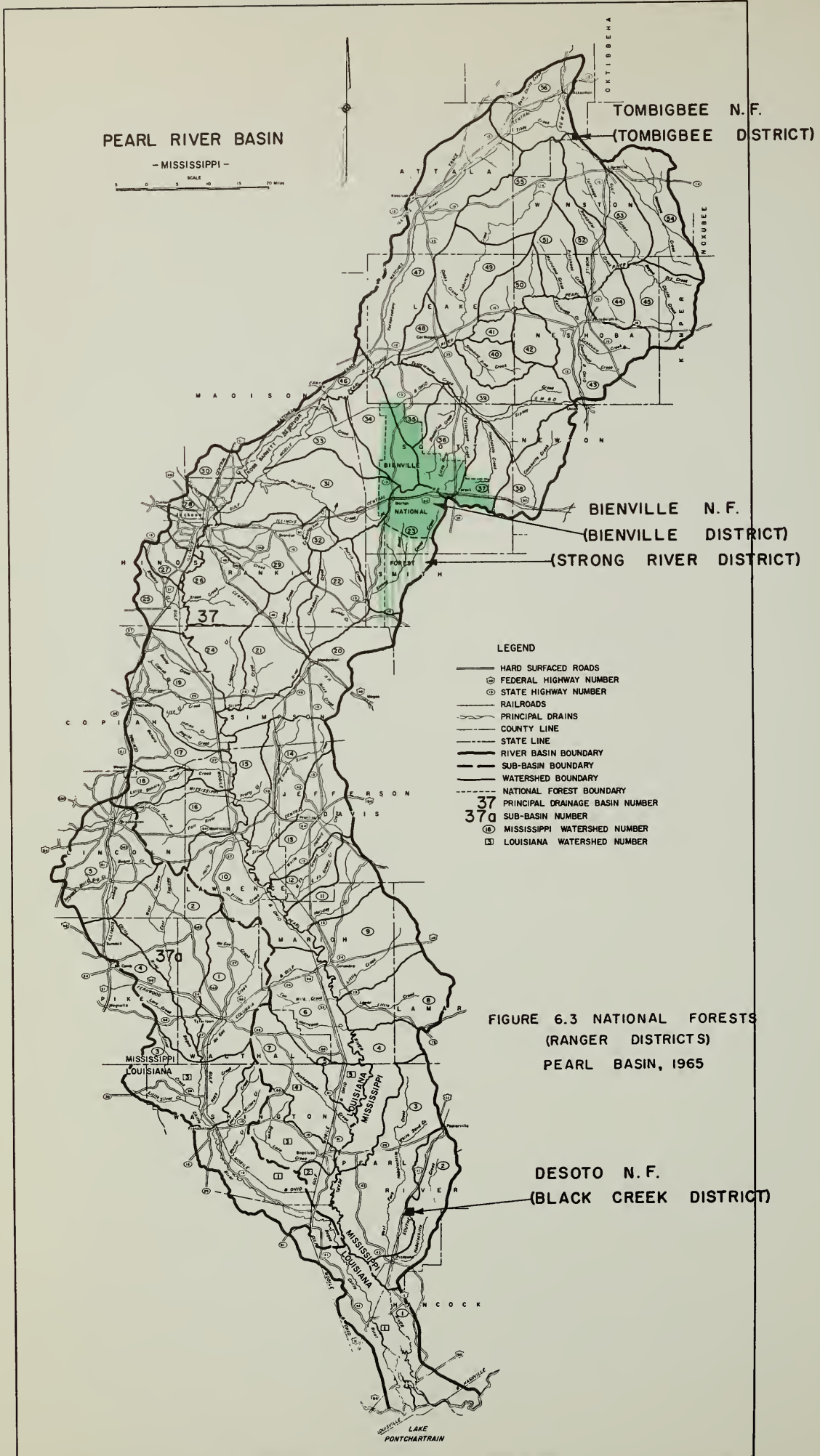

FIGURE 6.3 NATIONAL FORESTS (RANGER DISTRICTS) PEARL BASIN, 1965

Wildlife is becoming more abundant on National Forest lands through the cooperative efforts of the Forest Service and the Mississippi Game and Fish Commission. Wildlife habitat is given special consideration in all phases of forest management. The Forest Service's ultimate goal is to produce the optimum annual crop of game consistent with other land use and development activities. Waterfowl feeding areas are being planned in conjunction with some of the water development.

These programs on National Forest land bring the multiple-use principle into reality. It will take time, funds, manpower, and public support. The job requires many professions and managers with diversified experience and training to practice multiple management.

CHAPTER VII

PLANNING CONCEPTS AND CONSIDERATIONS

General

The most important and complex problem encountered in comprehensive plan evolution is the problem of weaving together into one balanced plan the means of satisfying the water and related land needs that were identified. 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. This is necessary because the ultimate aim of resource projects and programs, in common with all other productive activity, is to help satisfy human needs and desires.

Because of the widespread effects of land and water resource development, a responsibility falls on all levels of government and on the private sector to participate in resource planning and in the execution of resource programs. The Mississippi Legislature created the Pearl River Basin Development District in 1964 to provide the means of coordinating and participating in river basin planning and implementing recommendations. The Legislature declared as a matter of legislative determination that the waterways and surface waters of the State are among its basic resources; that such waters have not been conserved to realize their full beneficial use; that the utilization, development, conservation, and regulation of such waters are necessary to insure adequate flood control, sanitary water supply at all times, balanced economic development of State forests, irrigation of lands, and pollution abatement; and that the waters within the Pearl River are for the beneficial use and general welfare of the entire people of the State. The Pearl River Basin Development District was created as necessary to comply with this "determination" ... and to work with all State, local, and Federal agencies in planning and implementing such plans for the beneficial use of waters in the Basin. Its creation provided a necessary and opportune means of coordinating and formulating water resource development projects in upstream watersheds and along the main streams and principal tributaries in the Pearl Basin.

Coordination with Public and Private 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 the Federal Power Commission. This committee serves as a means of achieving coordination in conducting the study and formulating the proposed plan. The District Engineer of the Mobile District, U. S. Army Corps of Engineers, serves as chairman. The State Conservationist of the Soil Conservation Service in Mississippi represents the USDA.

A general plan of investigation was prepared by the Corps of Engineers and reviewed by the participating agencies to provide an orderly program for the comprehensive Basin study. The USDA prepared a detailed plan of work and work outline which governed the conduct of USDA activities. These documents provided for special investigations needed by participants for use in their studies.

The Basin Coordinating Committee established Ad Hoc Working Committees on flood prevention, recreation, pollution, fish and wildlife development, and others as needed to facilitate investigations or studies in these fields. The state representative was a member of each and participated in called meetings.

Federal and State agencies made investigations to determine the needs or problems related to pollution, water supply other than rural, domestic, ground water availability, recreation, fish and wildlife, minerals, navigation, and power. Preliminary study results were used as a basis for determining needs and how the programs of the Corps of Engineers and USDA could best help in planning projects to share in the satisfaction of these needs.

Considerable local interest was manifested in the USDA PL-566 watershed program during the course of these investigations. The Pearl River Basin Development District was largely responsible for this interest to the extent that four watersheds were authorized for planning under the PL-566 Act. Information and need for water resource projects were incorporated in these plans as developed in the comprehensive Basin study. Structures were provided for flood prevention and recreation and fish and wildlife development. No provisions were made for additional storage for water supply or water quality control because no needs were evident in the four watersheds. Viewpoints and needs were ascertained in other feasible watersheds while the study was in progress.

Conflicts of interest in overlapping projects proposed for early action by the Corps of Engineers and USDA were resolved through consultations with local watershed groups and the Pearl River Basin Development District. Modifications in plans were made to the satisfaction of the Corps of Engineers, USDA, and local interest groups involved without compromising basin objectives.

The U. S. Forest Service is interested in the opportunities provided by all resource development projects of other agencies and cooperating from the initial time that a project may be considered. Forest Service engineering design criteria is used for floodwater retarding and multiple-purpose dam structures if they are to be built on or partly on National Forest land. If conflicts between proposed projects and National Forest interests should occur, they will be resolved in the process of project development. Installation of planned land treatment measures on National Forest lands will be carried out by the Forest Service and are contingent on the availability of Forest Service funds for this purpose.

The preceding discussion emphasizes the importance of a number of general water and land resource guides and planning aids necessary in weighing and selecting those alternatives which produce an effective plan. The effective use of guides and planning techniques required adherence to assumptions and criteria, adopted and in effect, by the participating agencies.

The comparison of benefits and costs was one of the principal guides used in plan formulation. The measurement of benefits and costs is an essential part of the process of formulating and selecting projects that will be economically feasible and give the best possible combination of results in meeting the various objectives for development of the water resources of the Pearl Basin.

Details on benefits, costs, and cost allocations for major reservoir projects proposed by the Corps are set forth in Appendix F.

The remainder of this chapter is concerned primarily with plan formulation related to the upstream projects proposed by the Department of Agriculture. As previously indicated, the Corps of Engineers and USDA worked cooperatively and adequately resolved conflicts of interest in overlapping projects.

USDA Policy and Local Interest Considerations

Project appraisals were made for each potential watershed project identified for initiation of installation within the next 10 to 15 years. Project formulation, evaluation, and cost-sharing criteria were developed in conformity to PL-566 Watershed Protection and Flood Prevention Act, as amended. The policies of the Secretary of Agriculture in carrying out the provisions of the Act served as additional guides in formulating projects and plans in upstream watersheds.

Adherence to provisions in the Act and policies of the Secretary of Agriculture imposed limitations in planning for full resource development. The guides are as follows: (1) Plans were confined to watershed areas of less than 250,000 acres; (2) No structure providing more than 12,500 acre feet of floodwater detention capacity or more than 25,000 acre feet of total capacity was included in a plan; (3) No part of the installation costs was considered for cost allocation or cost sharing in any structure for purposes other than flood prevention, agriculture water management, recreation, and fish and wildlife development; (4) The bringing of new land into production through irrigation and drainage measures and limited enhancement benefits from flood prevention measures limited full resource development. These limitations also tend to reduce the most efficient use and management of lands in the watersheds; (5) Increase in use of surplus crops was not considered in watershed project formulation; (6) No provisions were made to include single purpose reservoirs for recreation or fish and wildlife development nor was consideration given to recommending watershed projects for just the accelerating of land treatment measures; and (7) The use of PL-566 funds for land acquisition as related to flood prevention measures and critical area measures was not considered in project formulation.

Watershed project formulation was designed to carry out the primary objectives of the Act and began with the formulation of plan objectives of the local people. Local objectives were not limited to flood prevention where recognizable needs for water storage for other purposes were obvious.

In carrying out the objectives of the local people for flood prevention, land treatment measures were considered the basic element for each watershed project and the initial increment for project justification. Floodwater detention structures were considered as the first choice in retarding the flow of floodwaters and in reducing damages to agricultural and urban areas. The second choice, in combination with detention reservoirs, was stream development.

The extent of structural measures for flood prevention is a combination of detention reservoirs and channel improvement needed to meet the overall objectives of the local people. Where recreation and fish and wildlife were project purposes, costs of constructing single-purpose flood prevention and single-purpose recreation reservoirs were compared with a multiple-purpose reservoir providing the same benefits. The combined costs of a multiple-purpose reservoir were less than two single-purpose structures.

The size of the recreation pool in multiple-purpose structures and the extent of basic facilities to satisfy the demand for recreation activities was based largely on the needs of and desires of the local people and their ability to share in the costs of facilities. 1/

The Pearl River Basin Development District has the legal authorities and financial capabilities to sponsor recommended projects of the Corps of Engineers or USDA and to assume the responsibilities of local cooperation, including the share of local costs allocated to the projects. They may also plan for and construct water resource projects that do not meet the statutory requirements of the Corps of Engineers and USDA.

Investigations and Analysis - Upstream Feasible Watersheds

Full use was made of existing information including studies made by other agencies. On-site field surveys and schedules were made so that tentative agreement could be reached on the nature and scope of the project and on levels of flood protection or project development and estimates of project costs and feasibility. Engineering field surveys included alternative sites so that the best possible combination of structural measures could be considered for potential development within the watershed.

Estimates of the present and projected land use of uplands and floodplain lands were made for each watershed in the Basin. Land capability data and soil association surveys were used to determine the need for land treatment measures for watershed protection, adjustments in land use between uplands and floodplain lands, and the potential for agricultural production in floodplain lands if protected from flooding. On-site investigations, land capability data, and detail soil survey information

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1/ The needs and desires of the local people were determined through the Pearl River Basin Development District.

were used to determine the scope, extent, and need for critical area treatment on open lands and woodlands. This information also provided a base for estimating annual gross erosion and sediment yields for impoundments proposed by the USDA and Corps of Engineers.

On-site field investigations were made to determine the frequency, amount, and extent of floodwater damages to agricultural lands and fixed improvements in the rural and urban areas. Benefits from land enhancement were limited to the degree of protection expected and the dominant type of agriculture projected in the floodplains in specified future years. The value of enhancement benefits were not to exceed those benefits from flood damage reduction. In most instances, the enhancement benefits were derived from clearing not over 20 percent of the woods in the benefited floodplain.

The extent of enhancement benefits was also guided by the effects on existing fish, wildlife, and other recreation resources. Soil Conservation Service biologists made on-site investigations in each feasible watershed to determine the damages, if any, to habitats from proposed project structural measures. Where damages to wildlife habitat would occur, provisions were made to mitigate damages.

Early-action authorization for planning of upstream watershed projects will follow reexamination of each project and will be an integral step in implementation of recommendations contained in the USDA plan. The recommendations specify that the early-action program be carried out with such modifications as the Secretary deems necessary and appropriate to the public interest. Each watershed included will be replanned and projects reformulated with local sponsoring organizations to meet local, regional, and national objectives. Alternative measures deserving further study may afford a reasonable solution to local flood control and drainage problems that will be more compatible with environmental quality preservation than the program of stream channel development proposed in the Basin plan. In the process of reassessing the projects and alternatives, full use shall be made of the expertise available in the various State and Federal agencies charged with responsibility for fish, wildlife, outdoor recreation, pollution control, and related environmental matters.

In watershed project formulation for flood prevention purposes consideration will be given to the conservation of environmental values including fish, wildlife, and recreation resources as well as to attaining a reasonable degree of flood protection. Consideration will be given to both structural and nonstructural measures in attaining this goal. Among the

structural measures, first consideration will be given to floodwater retarding structures. Second consideration would be given to stream development which may include, where necessary, selective snagging, snagging and clearing, or enlargement. Among nonstructural measures, consideration will continue to be given to such conservation practices as land treatment and critical area stabilization. The Service recognizes that fish, wildlife, and recreation resources including the scientific and aesthetic qualities of the environment have tangible and intangible value. These values will be taken into consideration in project evaluation. The Service will consider these values in determining the degree of flood protection to be attained and in the design and operation of flood protection measures. The Service will limit channel development to a minimum. Every reasonable precaution will be taken to avoid excessive velocities and to take appropriate action to protect side slopes, berm, spoil, and channels against erosion.

Some adverse effects to existing resources may occur as a result of stream development. However, substantial changes have been and are being made in procedures relative to design of channels in the upstream watershed program. Where there are no alternatives to stream channel development, design may include features to simulate natural stream characteristics; i.e., meandering alignment, streambank cover, pools and riffles, variable cross sections, braided channels in places, floodways and diversions of flat relief to handle high flow only, preservation of natural flood storage areas (swamps, oxbow lakes, swales, and distributaries), and other considerations.

Mitigating measures will be proposed for inclusion in watershed projects where losses occur to fish, wildlife, and other natural resources. The Service, in cooperation with other concerned agencies, will determine and recommend to local organizations measures for mitigation of damages.

Current procedures, with respect to fish, wildlife, and other natural resources affected by proposed stream development, include serious consideration of affected areas so as to disturb as little of the natural environment as possible in keeping with watershed objectives. For example, stream development will be stopped or reduced in the interest of fish, wildlife, and natural area preservation when channel outlets reach such unusual areas as wooded bottomlands or swamps. Channels will be treated and designed through a transition zone to avoid sediment deposition within these wooded areas. The Service will not participate in projects

in which the purpose is to drain wetlands of types 3, 4, 5, and 7 as defined in Fish and Wildlife Circular 39. Also, channel development will stop where steep valley slopes would cause excessive channel velocities.

After projects are authorized for implementation, each watershed will be replanned in detail. This will provide an opportunity to reassess resource values, including the need for stream preservation, scale of channel development, degree of protection to floodplain reaches, and overall objectives of the local sponsoring organizations. This also will provide opportunity to weigh the beneficial and adverse impacts of the programs as required by Section 102 of the National Environmental Policy Act of 1969 (Public Law 91-190). Recreation resource specialists, biologists, and other staff technicians with Federal and State agencies will work with USDA and the local sponsors before plan reformulation in examining structural and nonstructural alternatives in the preparation of a plan for total resource development.

Physically and economically feasible watersheds were identified as those where benefits were at least equal to costs. Primary flood prevention benefits include flood damage reduction, restoration, and enhancement; additional benefits are secondary and redevelopment. The sum of these constitute the total benefits from flood prevention measures (on-site and off-site).

The benefits also were determined from planned recreation facilities. The appraisal of benefits is outlined in a succeeding section. The sum of the benefits from flood prevention and planned recreation provide the total benefits for all project purposes.

When in the evaluation of individual watersheds it was concluded that the total benefits from flood prevention were less than the cost of flood prevention measures, these watersheds were classified as not being economically feasible for the 1980 period.

All or parts of 42 watersheds were determined as being economically feasible watershed projects (Figure 7.1). All or parts of 16 watersheds are potentially feasible watershed projects and 5 watersheds are not considered as feasible because of the character of the soils in the floodplain or other undesirable features of the floodplain. The location of the watersheds in relation to major reservoir projects was a factor in this determination.

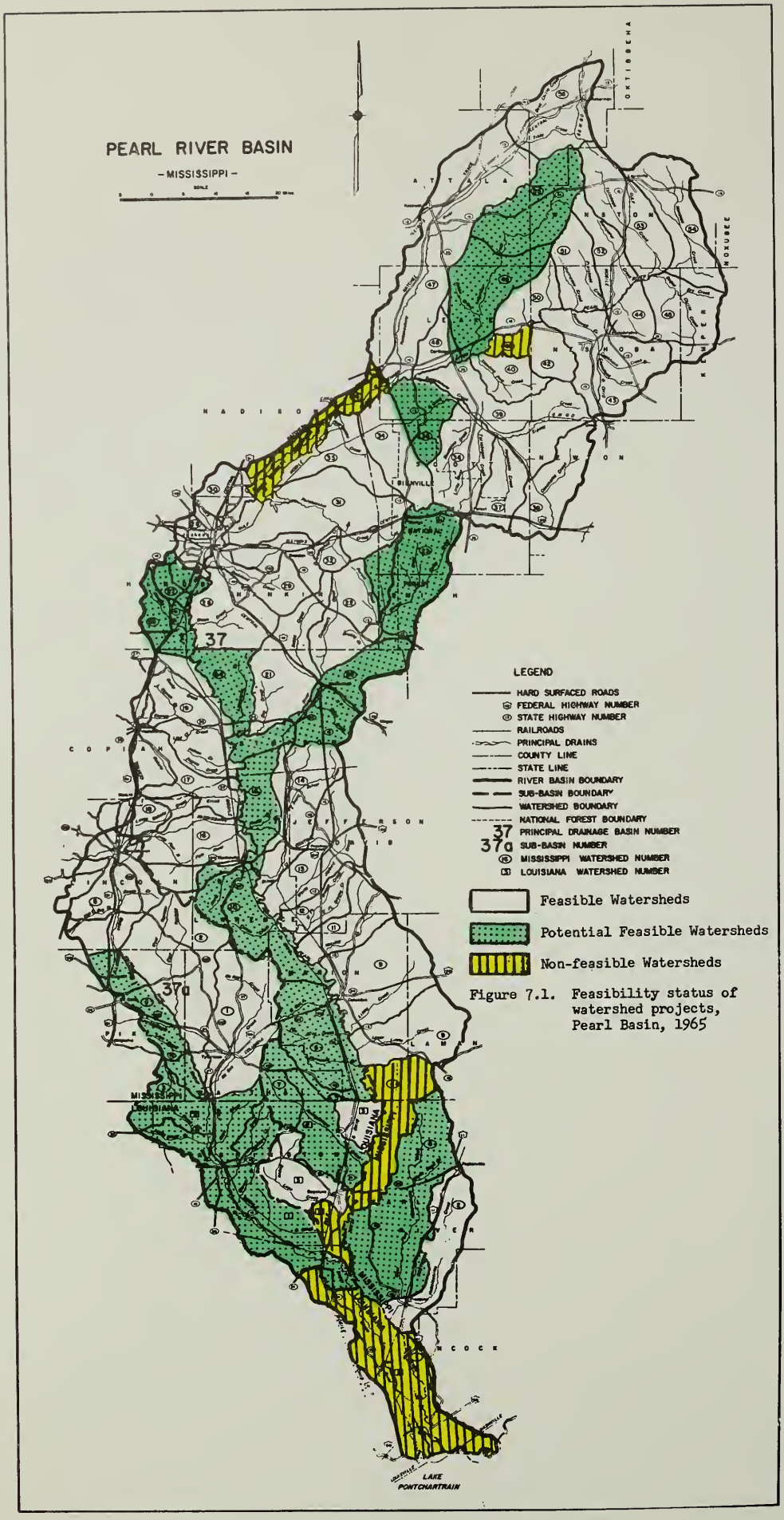

Figure 7.1. Feasibility status of watershed projects, Pearl Basin, 1965

Upstream Watersheds for Flood Prevention

A primary objective was to make physical appraisals of agricultural and rural water problems, determine the development potential in upstream areas, and evaluate the physical and economic effects of upstream projects and coordinate them with proposals of other agencies. Secondary sources of information, reconnaissance investigations, and knowledge of the agricultural and rural water problems within the Basin provided a basis for determining the scope and intensity of investigations in fulfilling the objective. It was determined that most of the physically and economically feasible watersheds are located in the upper stream reaches of the Basin.

Evaluation of Land Treatment Measures as Related to Erosion and Sediment

Basin-wide accelerated land treatment is needed to reduce the total sediment load entering the streams in the Basin. Rectification of the critical sediment problems cannot be achieved through action of the 42 feasible watersheds. Reducing the sediment pollution problem can only be achieved in the immediate action period with an accelerated program throughout the Basin.

One of the primary purposes of the USDA investigation was to determine the extent, need, and cost of land treatment and land stabilization measures for watershed protection and flood prevention. The extent and costs of these measures were made for the entire Basin and were not limited to those feasible watershed projects within the next 10 to 15 years. The benefits that would accrue from land treatment and land stabilization measures have proven in the past to be equal to or greater than the costs, consequently no benefit-cost ratio was established for these measures for the feasible watersheds or for the Basin as a whole.

In developing basic sedimentation data, criteria and procedures are in keeping with those used by the Department of Agriculture in the Small Watershed Program. A detailed field study was made on land above 42 proposed floodwater retarding structures located in sample watersheds throughout the Basin. Land use, cover, and slope conditions were recorded. Gullies, pits, and caved roadbanks contributing sediments were delineated. Existing soil surveys were used where available.

Annual sheet erosion in tons per acre was determined for each land use, under present and projected future conditions, using the Musgrave Soil Decline equation. The delivery ratio of sheet erosion was from the curve, "Sediment Delivery Rates vs. Size of Drainage Area."

Gullies, caved roadbanks, and pits were assigned an annual soil loss of 300 tons per acre under present conditions and 150 tons per acre under future conditions. A delivery ratio of 60 percent was used in both instances.

Sediment storage requirements were calculated using Technical Release 12, "Procedures for Computing Sediment Requirements for Retarding Reservoirs." A volume weight of 1,300 tons per acre-foot was used for submerged sediments and 1,800 tons per acre for those aerated.

Floodplain scour and detrimental deposits on cropland and pasture were mapped where found. These seem to be of a minor nature.

Recreation in Upstream Watersheds

Multiple-purpose structures for recreation and fish and wildlife were considered for each of the economically feasible watersheds. The number and location of multiple-purpose structures in each watershed was not finalized until purpose needs were coordinated with studies of the Bureau of Outdoor Recreation, U. S. Fish and Wildlife Service, and known projects of the Corps of Engineers. An analysis was made of the demand, supply, and need for outdoor recreation in the Basin by the Bureau of Outdoor Recreation (Appendix I). The preliminary report of the BOR, which contains the methodology and planning criteria for determining the demand, supply, and needs, was agreed to by all participating agencies before any allocation of demand was made to any recreation project in the Basin.

The preliminary location and size of all multiple-purpose projects (reservoirs) proposed by USDA, Corps of Engineers, and the State were studied to see if too many reservoirs were being considered in any given area of the Basin to satisfy recreation needs. When it was determined that an imbalance would not be created, individual site studies were made for each proposed multiple-purpose reservoir. An allocation of demand for water-dependent activities (boating, fishing, and swimming) and water-enhanced activities (picnicking and camping) were made for each site. The annual activity occasions

were calculated and divided by 1.5 to arrive at a recreation user day. 1/ The value of a recreation user day was used to determine the annual benefits for each site.

Costs for providing the recreation facilities, including the estimated added cost for the multiple-purpose dam, and the land necessary to achieve full recreation benefits were made and allocated to each purpose. Costs were amortized to an annual equivalent and benefits from recreation compared to the costs.

The number of multiple-purpose sites proposed in each feasible watershed did not exceed the criteria established by the Soil Conservation Service in planning PL-566 watersheds. The governing factors were the desires of the local people in the watershed and the Pearl River Basin Development District, their financial capability to share the local costs, and the physical characteristics of the sites. Organic and inorganic pollutants were not used in site selection criteria. In all instances the topography, cover, soils, and land use were conducive to good outdoor recreation features. The relationship of the drainage area to the recreation pool was adequate to maintain a satisfactory "permanent pool level" during the summer months or period of maximum use.

An appraisal of private outdoor recreation potential was made in the Pearl River Basin. One of the objectives of the appraisal was to determine the extent of water-based recreation development that would be provided by 1980. It was determined that the water resource recreation projects proposed for development by the public (Federal and State) and private sectors will not satisfy the estimated demand in 1980.

Bacterial standards for swimming and other body contact sports are being proposed by State and Federal agencies. Water quality criteria for interstate streams for the State of Mississippi are being promulgated by the State Air and Water Pollution Control Commission.

The USDA will work with local sponsoring organizations in the preparation of detailed watershed work plans in which multiple purpose reservoirs will be included for recreation. If basic facilities are proposed to satisfy the needs for swimming, boating, camping, picnicking, and water-oriented activities, assurances from the appropriate State and/or Federal agencies will be obtained to satisfy the requirements of meeting all health standards before inclusion in the plan.

1/ The annual activity occasions for the major multiple purpose reservoirs were calculated and divided by 2.3 to arrive at a recreation user day.

Irrigation

The use of supplemental water for increasing the production of cotton, corn, soybeans, or pasture to satisfy national or regional requirements is not needed in the Basin. No detail studies were made to determine specific benefits from increased production of row crops or pastures from irrigation. Consequently, no provisions were made to provide irrigation water storage in any proposed reservoirs as a project purpose.

Irrigation as a cultural practice can be of importance in specialized areas or to individual farmers who grow high value crops. Studies were made on the physical need for water for optimum production of truck crops, cotton, corn, and pasture or hay crops. In most years, eight out of ten, the use of supplemental water is required for optimum plant growth.

Except in the Coastal Flatwood Resource Area the physical characteristics of the landscape are satisfactory for storing water for irrigation. The average annual runoff ranges from 18 to 30 inches. The storage-runoff relationship creates a favorable condition for using surface water for irrigation.

The initial construction cost of impounding an acre-foot of water varies with the amount of storage and the storage characteristics of the valley above the dam. On an average, the cost range varies from $300 per acre-foot for storing 25 acre-feet, to $25 per acre-foot for storing 10,000 acre-feet. The number of acres irrigated from an impoundment will vary because of difference in the gross irrigation water needs of crops, the water losses at the impoundment site (seepage, evaporation, etc.), the recovery rate for the impoundment (inflow), and with the transportation losses from the impoundment to the farm. The cost of storing water per irrigated acre usually decreases as the size of impoundment is increased provided the inflow, water use, and water loss relationship remains constant.

The initial construction cost of wells will vary with the well capacity and with aquifer depths. For example, on an average the initial construction cost for a 500 gallon per minute well will range from a low of $20,000 to a high of $35,000 and for a 1,000 gallon per minute well will range from $25,000 to $37,500. The number of acres that can be irrigated from a well will depend on the well capacity, the peak daily irrigation water need of the crop, the daily hours of pumpage, and any water losses from the well to the farm.

The comparison of costs in providing water for irrigation from surface impoundments and from wells will need to be made for each individual case. Generally, surface impoundments will provide the cheaper source of water for group-type irrigation enterprises for most crops. However, wells could provide the cheaper source of water for small acreages.

The feasibility of on-farm irrigation is dependent upon several criteria other than the availability and costs of water. The method of irrigation - furrow, flooding, or sprinkler - affects unit costs, but the most important is the nature and topography of the soil. Most of the flood-plain soils in the feasible watersheds are suitable for irrigation and land leveling.

The alternatives in recommending the use of supplemental water for on-farm irrigation, all other factors being equal, is where sufficient quality water is available from: (a) large streams or lakes, (b) impoundments, or (c) wells.

Drainage

At this time no plan to drain the wet pine forest land has been formulated. Some industrial forest owners may remove surface water through small ditches put in with fire plows in specific locations. Further studies are needed to determine the actual acres of forest land with a water problem and to what extent timber growth increases could be expected from drainage to wet pinelands.

The need for group drainage to increase the production of row crops, grasses, and legumes to satisfy regional or local requirements is not warranted. On the basis of field examinations and preliminary investigations in the Coastal Flatwood Resource Area no provisions were made to include multiple-purpose channels as a project purpose in the USDA plan. Improvements in farm efficiencies could be realized on individual farms with drainage systems designed for the specific crops involved. Generally, outlets are adequate for farm drainage systems.

Studies were made to locate and inventory acreages by land use and to determine the drainage problems of the agricultural land in the resource area. Included were determinations of acreages that are adequately drained, acres still needing drainage, the adequacy of outlets, and an estimate of works of improvement to provide adequate drainage where feasible.

The special drainage study area ranges inland 5 to 25 miles from the Mississippi Gulf Coast. The topography generally ranges from nearly level to gently sloping ridges. There are, however, some moderately sloping ridges and a few short steep escarpments in the area. Elevations range from sea level to about 50 feet with most of the area being below an elevation of 25 feet.

The average annual rainfall based on the 1965 annual summary of the study area ranges from 58.58 inches to 64.39 inches. The wettest month of the year is July for which the average monthly rainfall ranges from 7.05 inches to 8.64 inches. The driest month of the year is October for which the average monthly rainfall ranges from 2.49 inches to 2.69 inches.

Information on soils is necessary in order that the extent and severity of the drainage problem can be determined in any drainage survey. The study area was grouped into 13 soil associations to accomplish this. The following criteria were used to set one group apart from the other:

1. Patterns and percent soil composition.
2. Similarity in topography.
3. Similarity in drainage problems.
4. Use potential.
5. Associations of soils developed from one kind of parent material.

Each soil association is named for the three or four dominant soils that compose it and is described by stating the topographic and soil features. All but two, Coastal Beach and Made Land, have a definite drainage problem. Two others, Tidal Marsh and Swamp-Alluvial Land, were determined as not being feasible for drainage. The remaining nine soil associations contained poorly drained soils that ranged from 24 percent to 87 percent of the total area in the association. If somewhat poorly drained soils are included along with the poorly drained soils these same percentages are 42 to 100. Where the drainage problem is the greatest the drainage pattern is not well defined.

A soil association map was prepared. The groups were delineated on photo mosaics at contact print scale. These groupings were also delineated on county highway maps. U. S. Geological Survey topographic maps cover the entire area and were used in studying the area.

Watershed boundaries were delineated on quadrangle sheets. These were studied and needed major ditches were determined. A field study confirmed or changed the location of the needed ditches. After the field study the final determination of the needed ditches was made. During the field study dimensions of major ditches, bridges, and culverts at the key locations were obtained. Drainage areas at key points for the major ditches were determined. The entire area was not investigated.

A sample in each of the nine soil associations was selected and engineering surveys were made to help determine the topography of these areas and the need for drainage. These areas were of small drainage areas, less than two square miles in size.

Profiles of the major ditches were obtained from the quadrangle maps of the area. The required capacities of the ditches were determined using the Cypress Creek Formula. The formula is $Q = CM^{5/6}$ and for forest drainage the coefficient "c" is 10. The yardage of excavation and other items of work were determined for the major ditches sampled. Cost estimates were prepared.

Typical layouts for the minor ditches were established based on the field surveys for the various soil associations. Yardage of excavation and other items of work were determined and cost estimates were prepared. Capacities of the minor ditches were such that one-half inch runoff will be removed in 24 hours.

CHAPTER VIII

PEARL RIVER BASIN DEVELOPMENT DISTRICT PLAN

Enabling Legislation

Chapter 249, Laws of Mississippi 1964, approved June 1, 1964, is the basic statute authorizing the creation of Pearl River Basin Development District and defining its powers. This act, and amendment thereto, appear as Sections 5956-251, Mississippi Code of 1942, Recompiled. Fifteen (15) Mississippi counties have by appropriate proceedings of the respective Board of Supervisors become members of the District as of January 1, 1969:

Attala	Copiah	Hancock
Hinds	Lawrence	Leake
Lincoln	Marion	Neshoba
Pearl River	Pike	Rankin
Scott	Simpson	Walthall

Every eligible county having frontage on the Pearl River is a member of the District.

General Purposes

The statutory purpose for creation of the District is 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, for irrigation projects, for navigation projects, and for pollution abatement. The District is empowered to develop plans for public works of improvement for these purposes and to cooperate with other Federal, State, and local agencies in the construction, operation, and maintenance of such public works and improvements.

The District is an agency of the State of Mississippi and a body politic and corporate. It may sue and be sued in its corporate name; adopt, use, and alter a corporate seal; make bylaws for the management and regulation of its affairs; employ engineers and attorneys; and make contracts and execute instruments needed for the exercise of its powers, rights, and privileges. The District may buy or lease real or personal property necessary for the purpose of the District and maintain use and operate such property.

Organization

The District is governed by a Board of Directors. The Board of Supervisors of each member county designates two directors to represent that county. Four additional directors are appointed by the Governor of the State of Mississippi. Also, one director is appointed from each of the following State agencies: The Board of Water Commissioners, the State Game and Fish Commission, the Mississippi Forestry Commission, and the Mississippi State Board of Health. Terms are staggered to assure continuity. The direct representation of other State agencies concerned with water resources is of value to the District.

The Board chooses from its own membership a president, a vice president, a secretary, and a treasurer. The Directors employ an executive vice president who acts as general manager of the District.

Finances

The District is funded by a tax levy equal to one-half mill on all taxable property within each county which is a member of the District. This tax, or a sum equivalent thereto, is paid to the District by the Board of Supervisors of each member county. In addition, commencing with the calendar year 1969 and for so long thereafter as there remains unpaid and outstanding any bonded indebtedness or other obligation of the District, the District will receive the amount of two mills of all ad valorem taxes due by each member county to the State of Mississippi, provided that the county is not presently retaining two mills of State ad valorem tax for some other authorized purpose. At present, a number of counties are retaining all or a portion of this two mills for some other purpose. To provide additional funds for a particular project of special benefit to and situated wholly or partially within a member county, the Board of Supervisors can cause an additional tax not to exceed two mills to be levied upon all taxable property within that county, after submitting the levy to a referendum.

To finance its projects, the District may apply for and accept grants from the United States or from any corporation or agency of the United States. The District also has broad authority to act jointly with political subdivisions and agencies and commissions and instrumentalities of the State of Mississippi or any other state, and with the Federal Government and the agencies thereof, and the performance of any service or the execution of any project.

The Board of Directors of the District is authorized to borrow money and issue bonds of the District to pay the cost of acquiring, owning, constructing, operating, repairing, and maintaining the projects and works and related facilities authorized by the statute. Bonds so issued are secured by pledge of the net revenues of the District, but such bonds do not constitute general obligations of the State of Mississippi or the counties comprising the District and are not secured by a pledge of the full faith and credit of the state or of the individual counties. Bonds may be issued over a period not to exceed forty (40) years, in an aggregate principal amount not to exceed twenty-five million dollars.

Project Powers of the District

With respect to any particular project, the District has broad authority to impound and appropriate for beneficial use the overflow waters and surface waters of streams within the District. The District may store water for irrigation and for prevention of water pollution, as well as for purposes of navigation and flood control. The District has broad power to construct, maintain, and operate water supply and distribution facilities for municipalities and private corporations and to charge and collect fees and payment with respect thereto. The District may acquire by condemnation any and all property or interest in property strictly and presently necessary for the projects of the District and the exercise of the powers, rights, and privileges and functions conferred upon the District by law, except that the District cannot thus acquire mineral rights or royalty interest. Where necessary for a particular project, the District can require the relocation of roads and highways and utility structures. The District may either operate and maintain facilities or may permit other agencies to operate and maintain its facilities with the District retaining sufficient control to assure that its standards are maintained.

Program of Action

The Board of Directors of the Pearl River Basin Development District has listed the following as its major interests:

1. Flood control to reclaim wasted flood areas for the future use of agriculture, industry, and recreation in this area.

2. Navigation to Central Mississippi which would offer rapid and substantial economic benefits for an economically depressed area through increased industrial complexes locating here and utilizing the waterway. We believe that the seemingly insoluble crisis for our nation's cities related to poverty and slums can be met by industry expanding into rural areas revitalized by water resource development.

3. The abatement of pollution to provide the region with fresh, clean water for the enhancement of public health, recreation, and fish and wildlife. Much progress has been, and is being made in eliminating pollution of rivers, lakes, and streams in our Basin.

4. Provision of an abundant water supply for future industrial, municipal, and agricultural needs.

5. Development and improvement of recreation facilities in the Basin to provide for boating, water skiing, swimming, picnicking, camping, hiking, bicycle, and bridle paths, and recreation facilities for our handicapped and aged. We feel that this development will increase the ability of the people in our Basin to live a more enjoyable and complete life and thus become better workers and citizens. We also feel that the recreation development will be a further enhancement to industry to locate in our Basin and will thus provide more and better jobs for those living in our Basin.

The Pearl River Basin Development District also seeks to coordinate activities between Federal agencies engaged in water resource development and the State and local government. In this capacity, the District seeks to define the major needs of the Basin and interpret these needs to the Federal, State, and local governments and the public.

The District expects to provide the United States Army Corps of Engineers with the local financial support required in the building of the three Corps reservoirs to be located on the Yockanookany River, Lobutcha Creek, and the Pearl main stem at Edinburg. The direct benefits of these reservoirs through flood control, water quality storage, and recreational facilities will help greatly in meeting the above mentioned objectives of the Basin related to flood control, pollution abatement, and recreation.

The Pearl River Basin Development District will also aid local Soil Conservation Districts in funding multiple purpose structures for recreation. The District also contemplates operating many of these multiple purpose structures.

The Basin District has worked closely with the Soil Conservation Service in recent years and supplied them with financial aid to allow them to keep one extra planning party in the state for planning PL-566 programs in the Basin.

In addition to working closely with the Corps of Engineers and the Soil Conservation Service, the District is working closely and will continue to work closely with other Federal and State agencies in developing the entire Pearl Basin.

The District will work closely with involved Federal agencies in the pursuit of restoring the former water level to the East Pearl River.

It will also seek to implement the development of a Spur Canal to Picayune from the lower Pearl Canal.

The District expects to work closely with the Forest Service in developing recreation areas on National Forest lands in the Pearl Basin.

The Mississippi Game and Fish Commission and the District plan to work jointly in developing boat launching areas on the smaller tributaries and the main stem of the Pearl.

The Pearl River Basin Development District has long noted the lack of recreation facilities in the Basin. Even with the implementation of the Corps reservoirs in the Upper Basin and the Soil Conservation Service's early action projects throughout the Basin, there still remains a critical need for water oriented recreation in the Basin. Understanding the demand industries and workers are making for more and more recreation, the District has committed itself to a bold plan to develop a pleasure boatway the entire length of the Pearl. The early action plan calls for the desnagging of 302 miles from the end of the NASA Canal on the East Pearl to the proposed Edinburg Dam.

Three types of parks will be built along the desnagged, tree shrouded, winding, sand-barred Pearl to provide recreational opportunities for the people of the Basin and visitors from over the state and nation. The three types are also scheduled to be built on main tributaries of the Pearl.

Type one will consist of one or two acres of land with a boat launching ramp, picnic tables, primitive camping area, and small natural area. Twenty-eight of this type will be built.

Type two will consist of 10 to 40 acres of land with boat launching ramps, picnicking tables, camping areas, comfort stations, running water, horseback riding, hiking, and bicycle trails. Forty-three of this type will be built.

Type three will consist of approximately 100 acres of land with a greater number of the facilities provided for the type two and other types of recreational facilities as needed in each particular area. Eleven of type three will be built.

Enhancement and preservation of the scenic qualities of the river will be carefully pursued.

Historical and archeological sites along the River will be preserved and developed as attractions for tourists and as vivid reminders of the historical heritage of the people of Mississippi.

The Basin District in joint cooperation with the Mississippi Game and Fish Commission will also make a study of public hunting areas in the Basin and publish a map and directory listing these areas.

It is believed by the District that the boatway will not only satisfy much of the local recreation demand, but will also be a tourist attraction that will add much to the economic growth of the Basin.

Financial and technical assistance for the development of the pleasure boatway is expected to come from Federal agencies such as the United States Army Corps of Engineers, Economic Development Administration, Bureau of Outdoor Recreation, Housing and Urban Development, Soil Conservation Service, Office of Economic Opportunity, and Farmers Home Administration. Local support will be required from local counties and municipal governments to see the implementation of this bold and vital project for the Pearl River Basin and the entire State of Mississippi.

The estimated first costs, annual charges and benefits for the Pearl River Boatway are given in Table 8.1.

The Basin District also expects to work closely with the State Park System in developing water resources in future State Parks to be located in the Basin.

Table 8.1 Costs and benefits, Pearl River Boatway early action development program

	Unit	Unit cost	Quantity	Total Investment
Facilities:				
Desnagging Pearl River	Miles	$ 4,000	302	$1,208,000
Recreational Unit Development				
Type I	Each	15,000	32	480,000
Type II	Each	65,000	38	2,470,000
Type III	Each	200,000	11	2,200,000
Clearing Bogue Chitto	Miles	2,000	25	50,000
Total Investment for Recreation Lands and Facilities				$6,408,000
Annual Charges: Lands and Facilities				
Interest and Amortization on Investment				$ 315,000
Operation and Maintenance				500,000
Total Annual Charges				$ 815,000
Benefits:				
General Recreation				$2,005,000
Area Redevelopment				69,000
Total				$2,074,000
Benefit-to-Cost Ratio:				2.5

Source: Pearl River Basin Development District.

CHAPTER IX

CORPS OF ENGINEERS PLAN 1/

The early action plan selected for flood control, water quality control, recreation, and fish and wildlife includes three large multiple purpose reservoirs to be built by the Corps of Engineers. These are Ofahoma, Carthage, and Edinburg. The locations of these projects are shown on Figure 9.1. A brief description of each reservoir is given in the following paragraphs.

Ofahoma Dam and Reservoir

The Ofahoma dam site 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.

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 186,000 acre feet 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.

Carthage Dam and Reservoir

The Carthage dam site 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.

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.

1/ The information in this chapter is from Appendix F, Engineering Studies for Main Stem and Major Tributaries, Corps of Engineers, Mobile District.

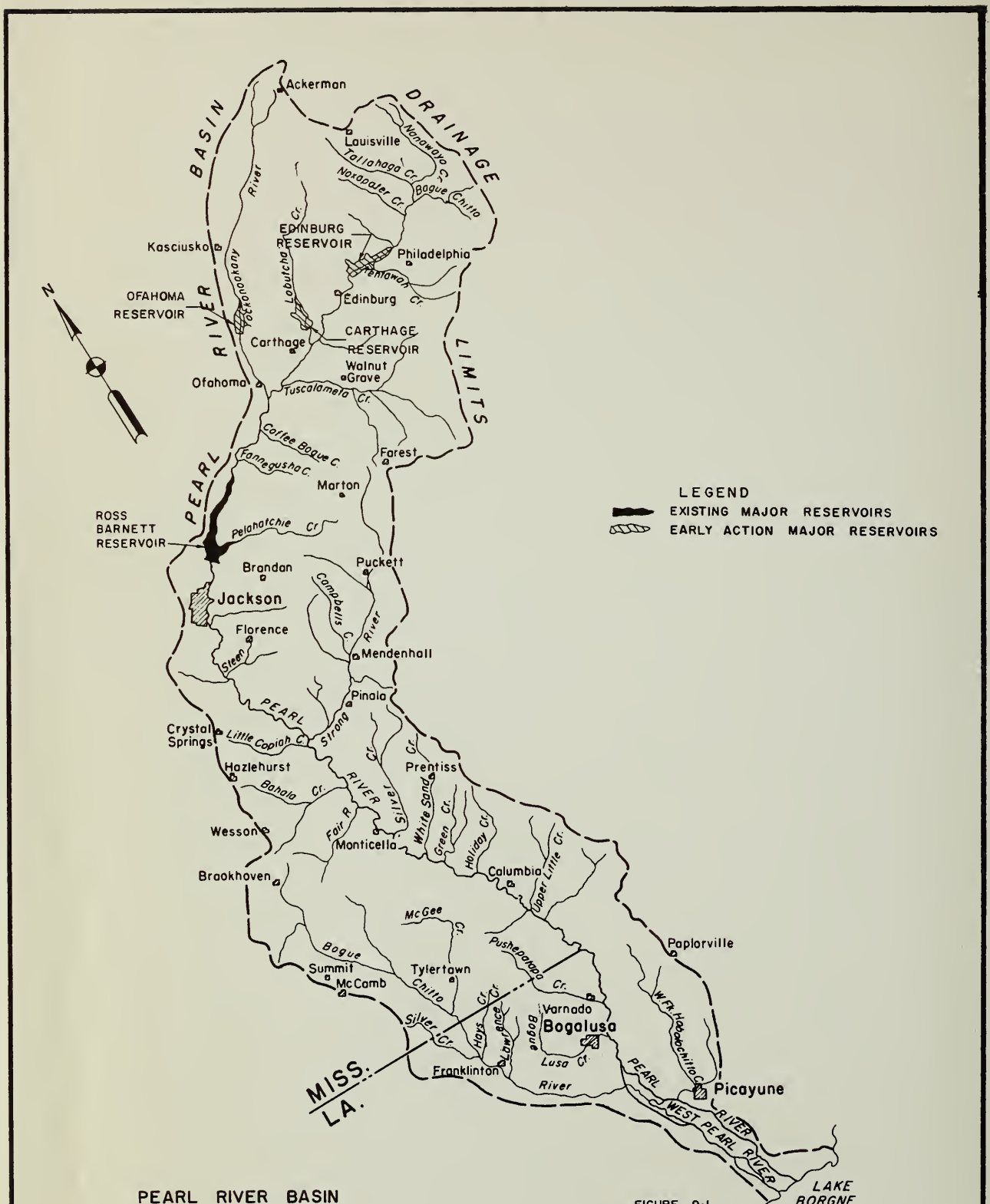

FIGURE 9-1
MAJOR RESERVOIRS INCLUDED IN THE EARLY ACTION PLAN
BY THE CORPS OF ENGINEERS

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 msl. Additional storage of 112,500 acre feet would be provided for controlling the 100-year flood. Facilities would be provided for water-dependent and water-enhanced recreation activities.

Edinburg Dam and Reservoir

The Edinburg dam site is located in the western part of Neshoba County at mile 391 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 plan for the Edinburg project includes compacted earthfill and concrete non-overflow dam sections, a 292-foot gated spillway containing 6 tainter gates, and two 3x5-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 would be provided for controlling the 100-year flood. Facilities would be provided for water-dependent and water-enhanced recreation activities.

Costs and Benefits

These three reservoirs would have a combined area of 19,300 acres at conservation pool elevation. A total of 712,500 acre feet of water could be stored in the 100-year pool for flood control. The total installation costs of the projects including delayed costs for recreation facilities to be installed at a later date are $101,500,000.

The total annual charges which includes operations and maintenance costs are $5,539,000 for the entire project. Pertinent data on each of these projects are shown in Table 9.1.

The annual benefits for the total projects are $11,840,000. Of this amount $4,517,000 are benefits to flood control, $1,146,000 are water quality control, and $6,177,000 are recreation benefits which includes fish and wildlife. Benefits, when compared to annual costs, gives a benefit-cost ratio of 2.1:1 for the total project. Economic data for each of the major reservoirs is shown in Table 9.2.

Table 9.1 Summary of pertinent data for major reservoirs in early action plan, Pearl Basin

Item	Ofahoma	Carthage	Edinburg
Site Number:	12	13	14
Stream	Yockanockany R.	Lobutcha Cr.	Pearl R.
Stream mile	8.7	13.2	391.0
Drainage area, sq. miles	469	266	827
Dam location, county	Leake	Leake	Neshoba
Purpose	FC,R,FW	FC,R,FW	FC,WQC,R,FW
Pool elevations, msl			
Sedimentation	339.0	379.2	368.0
Conservation (normal)	348.5	384.2	377.0
Average summer	348.5	384.2	376.0
50-year flood	370.2	401.2	395.6
100-year flood	371.3	402.3	396.9
Standard project flood	379.0	408.5	403.3
Spillway design flood	393.3	418.7	408.3
Storage volumes, acre feet			
Sedimentation	7,000	12,000	40,600
Conservation	23,000	8,000	89,400
Water quality	---	---	(89,400)
Recreation	(23,000)	(8,000)	---
Flood control (100-yr.pool)	210,000	112,500	390,000
Total to spillway crest	620,000	310,000	113,000
Dam dimensions and data			
Type	Earthfill	Earthfill	Earthfill & Concrete
Length, feet	8,240	6,000	7,154*
Top width, feet	32	32	32-22.5
Top elevation, msl	398.5	424	413.5
Maximum height, feet	64.0	55.0	54.0
Spillway type	fixed-crest	fixed-crest	gated
Spillway gates, no.& sizes			6 x 42'x28.5'
Spillway length, feet	650	400	292
Spillway crest elev., msl	388.0	413.5	375.0
Spillway design flood outflow, cfs	22,200	13,200	186,100
Conduit U/S invert elevation, msl	330.0	365.0	355.0
Conduit D/S invert elevation, msl	322.0	358.5	354.0
Conduit discharge, cfs	900	700	594
Conduit diameter, feet	7.5	6.5	2 - 3x5
Areas, acres			
Sedimentation pool	1,300	1,600	6,900
Conservation pool	3,700	3,000	12,600
Flood control storage pool	16,200	9,200	29,000
Spillway crest	31,200	16,500	11,400
Total to be acquired	36,800	19,600	54,500

Source: U. S. Army, Corps of Engineers.
FC - Flood control. R - General recreation.
FW - Fish and wildlife. WQC - Water quality control.
*Includes spillway section and retaining walls.

Table 9.2 Summary of economic data for major reservoirs in early action plan, Pearl Basin (Values in $1,000)

Item	Ofahoma	Carthage	Edinburg	Total
FIRST COST AND INVESTMENT				
Lands and damages	$ 7,420	$ 3,871	$ 8,227	$ 19,518
Relocations	11,773	2,736	1,655	16,164
Reservoir & pool preparation	983	719	2,823	4,525
Dams	7,645	5,008	10,817	23,470
Access roads	17	17	38	72
Public use and access	1,077	930	3,256	5,263
Bldgs., grounds & utilities	160	160	184	504
Permanent operating equip.	75	75	138	288
Engineering and design	2,210	1,126	2,035	5,371
Supervision & administration	1,740	858	1,527	4,125
Initial project first cost	33,100	15,500	30,700	79,300
Interest during construction	3,227	1,511	3,742	8,480
Init.proj.gross & net invest.	36,327	17,011	34,442	87,780
Delayed investment	2,680	2,340	8,700	13,720
Delayed invest.(present worth)	(1,274)	(1,112)	(4,135)	(6,521)
Total project first cost	35,780	17,840	39,400	93,020
Total proj.gross & net invest.	39,007	19,351	43,142	101,500
ANNUAL CHARGES				
Initial project:				
Interest	1,771	829	1,679	4,279
Amortization	15	7	15	37
Operation and maintenance				
(with major replacements)	142	137	211	490
Total initial project	1,928	973	1,905	4,806
Delayed project:				
Interest	62	54	202	318
Amortization	1	1	2	4
Operation and maintenance	80	65	266	411
Total delayed project	143	120	470	733
Total project:				
Interest	1,833	883	1,881	4,597
Amortization	16	8	17	41
Operation and maintenance				
(with major replacements)	222	202	477	901
Total proj. annual charges	2,071	1,093	2,375	5,539
ANNUAL BENEFITS				
Initial project:				
Flood control	1,697	858	1,962	4,517
Water quality control	---	---	1,146	1,146
Recreation	438	356	1,279	2,073
(General recreation)	(400)	(325)	(1,150)	(1,875)
(Fish and wildlife)	(38)	(31)	(129)	(198)
Total initial project	2,135	1,214	4,387	7,736
Delayed project:				
Recreation	798	646	2,660	4,104
Total delayed project	798	646	2,660	4,104
Total project annual benefits	2,933	1,860	7,047	11,840
BENEFIT-TO-COST RATIO				
Initial project	1.1	1.2	2.3	1.6
Total project	1.4	1.7	3.0	2.1

Source: U. S. Army, Corps of Engineers

CHAPTER X

USDA WATER AND RELATED LAND RESOURCE PROJECTS AND MEASURES RECOMMENDED FOR EARLY ACTION

Plan Elements

The plan elements proposed by the Department of Agriculture include projects and measures by both the U. S. Forest Service and the Soil Conservation Service. The elements formulated in this Appendix are in harmony with total Basin plan formulation and the recommended plan presented in the Main Report. The United States Department of Agriculture's contribution is the culmination of studies and contributing studies by other Federal, State, and local entities.

The plan elements are stratified by agencies within the Department of Agriculture - U. S. Forest Service and Soil Conservation Service. The plan elements of the Soil Conservation Service are further stratified by proposed method of authorization.

U. S. Forest Service

The U. S. Forest Service elements quantified in this summary are specifically oriented to recreation. Land treatment measures and costs proposed by the Forest Service are included as a part of the Soil Conservation Service projects and measures, and are identified in subsequent sections of this Chapter.

The U. S. Forest Service has planned for additional water impoundments and facilities. These elements include 660 acres of new water, camping, picnicking, swimming, and boating facilities (see Table 5.7). Some of the facilities will be located near the new water areas and others will be added to existing recreation sites. All water and recreation facilities proposed, whether new or an expansion of existing developments, will be on National Forest lands.

A benefit-cost ratio was not determined for the water areas and the facilities. There is a need for these developments and they are in agreement with the multiple use of National Forest lands.

The total installation costs of water impoundments and facilities are estimated to be $872,000. Operation and maintenance costs are incorporated in cost data presented in Appendix I, Outdoor Recreation.

Soil Conservation Service

Proposed plan elements by the Soil Conservation Service [1/] include two watershed projects that are presently being implemented through the PL-566 program and twenty-eight projects for concurrent authorization along with critical area land treatment measures in the remainder of the Basin. Summary data for PL-566 projects and concurrent projects are presented in Table 10.1. Detailed data for project elements and measures under both methods of authorization are presented in subsequent chapter sections.

Table 10.1 Plan data for 30 watersheds included in the early action plan, Pearl Basin

Item	Unit	Two PL-566 watersheds in planning stage	28 watersheds for concurrent authorization	Total
Total drainage area	Acres	78,300	2,628,800	2,707,100
Drainage area controlled	Acres	15,600	788,500	804,100
Floodwater retarding structures	Number	10	169	179
	Thou.dollars	1,235	22,786	24,021
Multiple purpose structures	Number	1	28	29
	Thou.dollars	182	10,352	10,534
	Surface acres	150	12,220	12,370
Basic recreational facilities	Number	1	28	29
	Thou.dollars	160	8,528	8,688
Stream development measures	Miles	46	1,156	1,202
	Thou.dollars	292	11,214	11,506
Land treatment measures	Thou.dollars	590	30,027	30,617
Cropland & pasture	Thou.dollars	466	21,025	21,491
Forest land	Thou.dollars	124	9,002	9,126
Total project cost	Thou.dollars	2,459	84,800	87,259
Federal	Thou.dollars	1,333	53,981	55,314
Other	Thou.dollars	1,126	30,819	31,945
Annual cost	Dollars	91,300	3,727,100	3,818,400
Annual benefits	Dollars	150,500	5,320,100	5,470,600
Benefit-cost ratio	---	1.6:1	1.4:1	1.4:1

Source: Compiled from internal data of the Soil Conservation Service, United States Department of Agriculture.

1/ Measures pertaining to the forest land were developed by the U. S. Forest Service.

PL-566 Watershed Projects

Two watershed projects that have not been authorized for operation through existing programs (Public Law 566) are included in the early action plan. Twelve other watershed projects (PL-566) are authorized for operation and are included in Chapter VI. These two watersheds, which are Carthage and Hanging Moss, have a combined total area of 78,266 acres. Measures to be installed in the two PL-566 watersheds include land treatment for watershed protection, critical area stabilization, and structural measures. Structural measures to be installed include 10 floodwater retarding structures, 1 multiple purpose structure with basic recreational facilities, and 46 miles of stream development. Also 760 acres of critical area land are to be planted to trees. Erosion control measures are expected to be applied on 60 miles of roadbanks. The total installation cost of land treatment measures is $590,000 and the installation cost of the structural measures is $1,869,000. The retarding structures will control runoff from 15,609 acres or 20 percent of the two watersheds. The multiple purpose structure will provide 150 surface acres of water for recreation purposes. Approximately 5,800 acres of land will be benefited from a reduction in flooding. Flood damages to crops, pastures, and fixed improvements will be reduced by 72 percent.

The total annual benefits for structural measures are $150,500. Of this amount, $80,000 are damage reduction benefits, $15,000 is from changed land use, $36,000 is from planned recreation, $3,200 is incidental recreation in the floodwater retarding structures, and $16,300 is secondary benefits. The total annual costs of structural measures including operation and maintenance are $91,300. The benefit-cost ratio is 1.6:1.

Data on these two watersheds are shown in Table 10.2. Summary data are shown in Tables 10.3 to 10.10. The location of the watersheds and the structures are shown on Figures 6.1 and 6.2.

Projects for Concurrent Authorization

Projects in 28 watersheds are proposed under concurrent authorization. This method of authorization is the most expedient means of accelerating the solution of problems and the satisfaction of upstream resource development needs in the remaining feasible upstream watersheds. In addition to satisfaction of upstream resource development needs, the projects in the upper sub-basins are interdependently related to projects of the Corps of Engineers. Also, a combination of all feasible upstream projects and those of the Corps of Engineers is needed to serve downstream needs.

Table 10.2 Plan data for two watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Unit	Amount		
		Carthage	Hanging Moss	Total
Total drainage area	Acre	34,600	43,700	78,300
Drainage area controlled by structures	Acre	4,600	11,000	15,600
Floodwater retarding structures	Number	2	8	10
	Thou.dollars	148	1,087	1,235
Multi-purpose structures	Number	1	-	1
	Thou.dollars	182	-	182
Basic recreational facilities	Number	1	-	1
	Thou.dollars	160	-	160
Stream development	Mile	15.6	30.5	46.1
	Thou.dollars	129	163	292
Cost of land treatment measures - Total	Thou.dollars	305	285	590
Cropland and pasture	Thou.dollars	227	239	466
Forest land	Thou.dollars	924	1,535	2,459
Federal	Thou.dollars	557	776	1,333
Other	Thou.dollars	367	759	1,126
Annual cost	Dollars	40,100	51,200	91,300
Annual benefits	Dollars	63,700	86,800	150,500
Benefit-cost ratio	-	1.6:1	1.7:1	1.6:1

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.3 Estimated installation costs of land treatment and structural measures for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Unit	Amount	Estimated cost		
			Federal	Other 1/	Total
			Thou. dollars	Thou. dollars	Thou. dollars
LAND TREATMENT MEASURES					
Cropland and pastures					
Cropland	Acres	7,700	---	46	46
Grassland	Acres	8,800	---	251	251
Wildlife land	Acres	300	---	9	9
Critical area planting					
Grasses and legumes	Acres	---	---	---	---
Roadside erosion control	Miles	60	19	10	29
Technical assistance	---		106	25	131
Total - cropland and pasture	---		125	341	466
Forest land					
Private forest land	Acres	6,560	---	45	45
Critical area planting					
Tree planting	Acres	760	38	10	48
Technical assistance	---	---	27	4	31
Total - Forest land	---	---	65	59	124
Total - Land treatment measures	---	---	190	400	590
STRUCTURAL MEASURES					
Floodwater retarding structures	Number	10	510	---	510
Multiple purpose structures	Number	1	82	27	109
Minimum basic facilities	Number	1	58	59	117
Stream development	Miles	46	192	---	192
Sub-total - Construction	---	---	842	86	928
Installation services	---	---	277	18	295
Land easements and R.O.W.	---	---	24	607	631
Adm. of contracts and other	---	---	---	15	15
Total - Structural measures	---	---	1,143	726	1,869
TOTAL PROJECT	---	---	1,333	1,126	2,459

Source: Derived from study data and compiled by the Forest Service and Soil Conservation Service, United States Department of Agriculture.

1/ Includes private and public program funds.

Table 10.4 Estimated structural cost distribution for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Construction and installation services		Land easements and R.O.W.	Administration of contracts and other	Total installation
	Construction	Installation services			
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	510	166	553	6	1,235
Multiple purpose structures	109	32	40	1	182
Minimum basic facilities	117	35	6	2	160
Stream development	192	62	32	6	292
Total	928	295	631	15	1,869

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.5 Cost allocation and cost sharing summary for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Purpose			
	Flood prevention	Recreation	Municipal	Total
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
	COST ALLOCATION			
Floodwater retarding structures	1,235	---	---	1,235
Multiple purpose structures	72	110	---	182
Basic recreational facilities	---	160	---	160
Stream development	292	---	---	292
Total	1,599	270	---	1,869
	COST SHARING			
	Federal funds Thou. dollars		Other Thou. dollars	
Floodwater retarding structures	676		559	1,235
Multiple purpose structures	134		48	182
Basic recreational facilities	79		81	160
Stream development	254		38	292
Total	1,143		726	1,869

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.6 Structure data for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Unit	Total
Drainage area controlled	Sq. mi.	24.39
Storage capacity		
Sediment	Ac. ft.	1,169
Floodwater	Ac. ft.	9,151
Recreation	Ac. ft.	1,399
Municipal	Ac. ft.	0
Potential water storage	Ac. ft.	58,681
Total	Ac. ft.	70,400
Surface area		
Sediment	Acre	362
Floodwater	Acre	1,397
Recreation	Acre	150
Municipal	Acre	0
Potential water storage pool	Acre	4,697

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.7 Annual costs for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Measures	Amortization of installation cost	Operation, maintenance and replacement cost	Total
	Dollars	Dollars	Dollars
Floodwater retarding structures	39,400	3,100	42,500
Multiple purpose structures	6,200	500	6,700
Minimum basic facilities	5,400	14,400	19,800
Stream development	9,500	12,800	22,300
Total	60,500	30,800	91,300

Source: Soil Conservation Service, United States Department of Agriculture.

Item	Estimated average annual damage		Damage reduction benefits 1/
	Without project	With project	
Floodwater			
Crop and pasture	42,900	15,100	27,800
Other agricultural	5,700	2,200	3,500
Nonagricultural			
Urban and industrial	35,800	5,500	30,300
Road and bridge	6,100	1,900	4,200
Sub-total	89,500	24,700	64,800
Erosion, reduced road maintenance	1,700	600	1,100
Indirect	9,100	2,500	6,600
Total	100,300	27,800	72,500

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Price base - long term projected.

Table 10.6 Structure data for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Unit	Total
Drainage area controlled	Sq. mi.	24.39
Storage capacity		
Sediment	Ac. ft.	1,169
Floodwater	Ac. ft.	9,151
Recreation	Ac. ft.	1,399
Municipal	Ac. ft.	0
Potential water storage	Ac. ft.	58,681
Total	Ac. ft.	70,400
Surface area		
Sediment	Acre	362
Floodwater	Acre	1,397
Recreation	Acre	150
Municipal	Acre	0
Potential water storage pool	Acre	4,697

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.7 Annual costs for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Measures	Amortization of installation cost	Operation, maintenance and replacement cost	Total
	Dollars	Dollars	Dollars
Floodwater retarding structures	39,400	3,100	42,500
Multiple purpose structures	6,200	500	6,700
Minimum basic facilities	5,400	14,400	19,800
Stream development	9,500	12,800	22,300
Total	60,500	30,800	91,300

Source: Soil Conservation Service, United States Department of Agriculture.

Floodwater			
Crop and pasture	41,900	15,100	26,800
Other agricultural	5,700	2,200	3,500
Nonagricultural			
Urban and industrial	35,800	5,500	30,300
Road and bridge	6,100	1,900	4,200
Sub-total	89,500	24,700	64,800
Erosion, reduced road maintenance	1,700	600	1,100
Indirect	9,100	2,500	6,600
Total	100,300	27,800	72,500

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Price base - long term projected.

Table 10.9 Comparison of benefits and costs for structural measures for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Average annual benefits 1/										
	Flood prevention									Benefit-cost ratio primary benefits	Benefit-cost ratio total benefits
	Damage reduction	Changed and more intensive land use	Incidental recreation	Municipal	Planned recreation	Total primary benefits	Secondary benefits	Total benefits	Average annual cost		
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Benefits upland watersheds 2/	70,300	5,800	3,200	-	36,000	115,300	14,400	129,700	91,300	1.3:1	1.4:1
Benefits downstream	9,700	9,200	-	-	-	18,900	1,900	20,800	-	-	-
Total	80,000	15,000	3,200	-	36,000	134,200	16,300	150,500	91,300	1.5:1	1.6:1

Source: Soil Conservation Service, United States Department of Agriculture and Corps of Engineers, United States Army.

1/ Price base long term projected.

2/ In addition, land treatment measures will provide damage reduction benefits of $2,200 annually.

Table 10.10 Summary of physical and plan data for 2 PL-566 watersheds included in the early action plan that are being implemented under PL-566, Pearl Basin

Item	Unit	Quantity without project	Quantity with project
Watershed area	Sq.mi.	122	122
	Acres	78,300	78,300
Area of cropland	Acres	14,300	12,600
Area of grassland	Acres	11,500	15,200
Area of woodland	Acres	39,100	37,400
Miscellaneous area	Acres	13,400	13,100
Floodplain area subject to inundation by maximum storm in evaluation series	Acres	7,800	---
Area of floodplain benefited by proposed structural measures	Acres	---	5,800
Watershed area controlled by floodwater retarding structures	Acres	---	15,600
	Percent	---	20

Source: Soil Conservation Service, United States Department of Agriculture.

Twenty-eight upstream watersheds were identified and determined to be physically and economically feasible and are recommended for early action implementation under special concurrent authorization (Table 10.11 and Figure 10.1).

Land Treatment Measures

Watershed Protection. [1] Land treatment measures for watershed protection were considered as a basic element in formulating projects within the 28 watersheds recommended for concurrent authorization. They are essential if planned structural measures are to function properly. These measures are to be planned and applied on farm land by individual landowners in cooperation with the respective Soil Conservation Districts in which the individual watershed is located. Measures to be applied include: conservation cropping systems, pasture planting and renovation, diversion and terrace construction, drainage, farm ponds, wildlife habitat development, tree planting, and hydrologic stand improvement of forest lands. [2] The cost of applying these measures will be financed by local funds but will include some Federal funds from the Agricultural Conservation Program. There will be cost sharing on technical assistance between Federal, State, and local.

Private forest land measures will be applied under the supervision of the Mississippi Forestry Commission in cooperation with the U. S. Forest Service. Cooperation is in accordance with such programs as the Clarke-McNary Act, Forest Pest Control Act, Cooperative Forest Management Act, Watershed Protection and Flood Prevention Act, and the Agricultural Conservation Program as presented in Chapter VI.

Treatment on National Forest land and the estimated costs are included in the overall totals. The U. S. Forest Service will install the land treatment measures planned on National Forest land.

1/ Includes just the 28 watersheds recommended for concurrent authorization. Measures for the 12 PL-566 watersheds authorized for operation are identified in Chapter VI and the remaining Basin in Chapter IV. Measures for 2 PL-566 watersheds not authorized for operation are included at the beginning of this chapter.

2/ The improvement of hydrologic conditions through the release of desirable soil building species, release of under planted trees from undesirable overstory, and improvement cuts to improve stand quality.

Table 10.11 Twenty-eight watersheds recommended for concurrent authorization through special legislation, Pearl Basin, next 10 to 15 years

Name	Water-shed number	Acres	Counties
Nanawaya	54	89,680	Winston, Neshoba, Kemper
Noxapater	52	51,280	Winston, Neshoba
Hurricane	51	51,560	Winston, Neshoba
Bogue Chitto	45	88,600	Kemper, Neshoba, Winston
Sandtown	44	34,300	Neshoba
Kentawah	43	118,830	Neshoba
Edinburg	50	48,360	Leake, Winston, Neshoba
Sipsey	39	126,360	Neshoba, Leake, Scott, Newton
Shockaloo	36	94,960	Scott, Leake
Hontokalo	37	45,520	Scott
Tibby	56	99,640	Choctaw, Attala
Yockanookany	47	225,860	Attala, Leake
Coffee Bogue	34	61,160	Scott, Leake
Fannegusha	33	70,680	Rankin, Scott
Pelahatchie	31	153,702	Rankin, Scott
Jackson	28	39,200	Hinds
Steen	26	73,710	Rankin
Campbell	22	90,900	Rankin, Simpson, Smith
Dobbs	21	99,240	Rankin, Simpson
Bahala	17	74,403	Copiah, Lincoln, Lawrence
Fair River	16	98,952	Lincoln, Lawrence
Lower Little	8	87,756	Marion, Lamar
Little	9	100,544	Marion, Lamar, Jefferson Davis
Boone	37a5	132,072	Lincoln, Pike
Topisaw	37a2	167,448	Lincoln, Lawrence, Pike, Walthall
McGee	37a1	146,260	Walthall, Lawrence, Marion
Hobolochitto	2	77,800	Pearl, Hancock
Conehatta	38	80,000	Newton, Scott
Total	XX	2,628,777	XX

Source: Soil Conservation Service, United States Department of Agriculture.

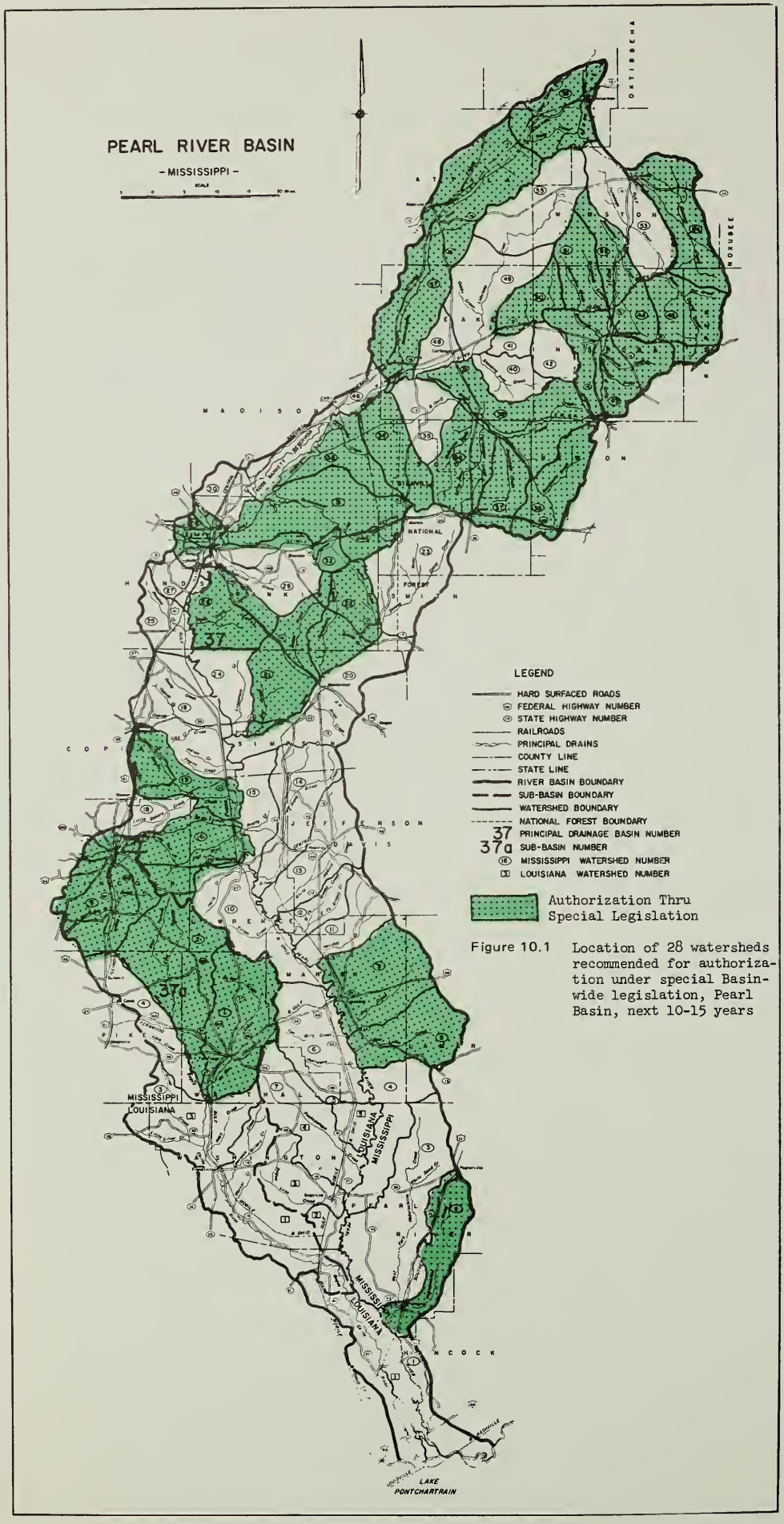

Figure 10.1 Location of 28 watersheds recommended for authorization under special Basin-wide legislation, Pearl Basin, next 10-15 years

The land to be treated for watershed protection includes 217,913 acres of cropland, 214,368 acres of grassland, 182,238 acres of wildlife habitat, and 251,280 acres of forest land, Table 10.12. The total estimated installation cost of these measures is $18,090,000. Of this amount, $3,583,000 is to be financed by Federal funds and $14,507,000 by other funds. The Federal funds are for technical assistance.

Critical Area Treatment. 1/ Land treatment measures for land stabilization are important features of the concurrent authorization program. They consist mainly of establishing a cover on badly eroded land. Critical area treatment will consist of establishing grasses and legumes, tree planting, site preparation, sloping and revegetating roadbanks, fencing to control grazing, etc. These measures will provide protective cover for the critical areas and reduce the rate of erosion, the production of sediment, and the amount of runoff. The future annual sediment yield from forest land was 231 tons. This is a reduction of annual sediment yield of 134 tons per square mile drainage area.

Critical area treatment measures on non-Federal land will be installed by local water management districts or Soil Conservation Districts on a contract basis. The Mississippi Forestry Commission in cooperation with the U. S. Forest Service will supervise the installation of forestry measures on private forest land. On National Forest land the U. S. Forest Service will install the needed critical area treatment.

The total installation cost of critical area treatment measures needed in the next 10-15 years is $11,937,000. (Table 10.13 and Table 10.18). Included in this amount is the $129,000 cost of installing needed measures on National Forest lands. The Forest Service anticipates receiving $74,000 of this through its regular funding.

Cost sharing of installation costs include $8,854,000 to be financed by Federal funds and $3,083,000 by other funds. Federal funds are for the additional technical assistance to accelerate the land treatment for watershed protection programs, for financing of the installation of critical area plantings, and roadside erosion control. Other funds are for installing the land treatment measures for watershed protection and come from local, State, and going Federal programs.

1/ Includes the entire Basin with the exception of the 14 PL-566 watersheds.

Table 10.12 Estimated land to be treated in 28 concurrent authorization watersheds and for the remaining areas, Pearl Basin, next 10-15 years

Watershed	Land treatment							
	Watershed protection				Critical area			
	Cropland	Grassland	Wildlife	Forest	Grasses & legumes	Roadside erosion	Trees	Logging roads & trails
	Acres	Acres	Acres	Acres	Acres	Miles	Acres	Acres
Nanawaya	7,706	5,915	8,908	7,450	522	83	2,060	300
Noxapater	5,093	3,532	4,752	4,260	314	47	1,720	200
Hurricane	5,389	3,730	4,286	4,140	318	48	2,010	200
Bogue Chitto	7,286	7,180	4,766	10,500	454	82	2,750	390
Sandtown	3,972	2,739	2,140	3,230	214	32	1,830	140
Kentawah	13,761	9,489	7,414	11,560	741	108	5,800	390
Edinburg	4,197	3,391	3,152	4,200	254	44	1,590	200
Sipsey	12,452	10,949	8,942	9,590	765	170	3,180	430
Shockaloo	5,466	5,211	13,555	6,470	537	134	560	480
Hontokalo	3,189	5,338	1,378	5,530	231	67	500	220
Tibby	5,644	4,888	7,233	8,230	408	83	890	430
Yockanookany	12,996	18,849	14,094	16,835	1,051	187	4,020	850
Coffee Bogue	3,799	4,276	18,493	1,480	569	48	340	332
Fannegusha	3,589	6,923	3,249	3,010	314	48	640	300
Pelahatchie	10,211	10,826	6,210	23,180	645	108	2,040	684
Jackson	313	784	18,873	2,770	403	34	220	60
Steen	3,041	7,867	2,466	13,440	302	56	340	300
Campbell	6,574	13,390	4,244	13,535	555	69	900	300
Dobbs	7,020	9,542	2,890	16,710	459	86	1,120	390
Bahala	4,344	9,205	4,626	15,780	411	69	1,010	250
Fair River	8,432	6,538	5,821	6,180	494	79	90	390
Lower Little	6,574	4,284	4,330	10,230	364	70	2,340	390
Little	10,422	3,172	2,457	15,760	412	80	2,020	430
Boone	9,922	13,225	8,498	5,230	732	161	---	500
Topisaw	23,989	14,356	3,797	10,800	1,062	205	2,120	550
McGee	16,642	17,878	5,772	8,520	968	178	360	500
Hobolochitto	8,572	4,015	2,228	5,750	373	62	400	300
Conehatta	7,318	6,876	7,664	6,910	507	107	2,820	250
Subtotal-28 concurrent authorization	217,913	214,368	182,238 1/	251,280	14,379	2,545	43,670	10,156
Other 2/	---	---	---	---	12,519	3,551	18,870	11,436
Total	217,913	214,368	182,238 1/	251,280	26,898	6,096	62,540	21,592

Source: Soil Conservation Service and Forest Service, United States Department of Agriculture.

1/ Includes idle and miscellaneous.

2/ Includes all other critical areas in the Basin except the 14 PL-566 watersheds.

Table 10.13 Estimated costs of land treatment measures for 28 watersheds proposed for concurrent authorization, Pearl Basin, next 10 to 15 years 1/

Watershed	Water-shed number	Land treatment for watershed protection	Critical area treatment	Technical assistance SCS & FS	Total
		Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
Nanawaya	54	498	245	199	942
Noxapater	52	289	178	118	585
Hurricane	51	296	197	119	612
Bogue Chitto	45	455	288	204	947
Sandtown	44	212	164	80	456
Kentawah	43	659	526	282	1,467
Edinburg	50	299	162	109	570
Sipsey	39	679	393	282	1,354
Shockaloo	36	416	194	200	810
Hontokalo	37	295	109	100	504
Tibby	56	435	167	214	816
Yockanookany	47	957	512	495	1,964
Coffee Bogue	34	198	127	124	449
Fannegusha	33	222	113	146	481
Pelahatchie	31	641	289	343	1,273
Jackson	28	48	73	46	167
Steen	26	287	96	168	551
Campbell	22	526	164	206	896
Dobbs	21	586	182	231	999
Bahala	17	602	165	188	955
Fair River	16	620	121	192	933
Lower Little	8	469	208	194	871
Little	9	365	206	228	799
Boone	37a5	668	186	264	1,118
Topisaw	37a2	894	351	355	1,600
McGee	37a1	695	236	299	1,230
Hobolochitto	2	311	107	161	579
Conehatta	38	319	302	183	804
Sub-total		12,941	6,061	5,730	24,732
Other areas 1/			4,820	475	5,295
Total		12,941	10,881	6,205	30,027

Source: Soil Conservation Service and Forest Service, United States Department of Agriculture.

1/ Includes critical area treatment in all other areas of the Basin except in the 14 PL-566 watersheds.

Structural Measures

Floodwater Retarding Structures. This type of structure was considered as the first choice of structural measures in formulating a plan to reduce flooding in upstream watersheds. The structures are compacted homogeneous earth fill dams having a fixed drawdown tube and an emergency spillway.

There are 169 floodwater retarding structures planned for the 28 watersheds (Table 10.14). The approximate location of each structure in each watershed is shown in Figure 10.2. The estimated installation costs are $22,786,000, of which $18,225,000 would be financed by Federal funds and the remaining $4,462,000 financed by other funds. Federal costs include construction, engineering services, and general administrative costs. Local costs include easements and rights-of-way, administration of contracts, and general miscellaneous costs.

Flood Prevention Channels. Development of streams was the second combination of structural measures planned for further reduction in floods and damages to floodplain land in upstream watersheds. Stream development may include selective snagging and clearing, cutoffs, and clearing and enlargement. Of the estimated 1,156 miles of stream development, approximately 400 miles will include channel enlargement, 440 miles of selected clearing and snagging, and the remaining 316 miles in between these two categories.

Approximately 1,156 miles of stream development are planned for the 28 watersheds (Table 10.14). The total installation cost is $11,214,000. Of this amount $9,727,000 is to be financed by Federal funds and $1,487,000 by local interests. Federal funds include cost of construction, engineering services, and general administrative costs. Local costs are for easements and rights-of-way, administration of contracts, and administrative costs.

Multiple Purpose Structures for Flood Prevention and Recreation. A total of 28 multiple purpose structures for flood prevention and recreation are planned in 23 watersheds (Table 10.15 and Figure 10.2). These structures are the same as floodwater retarding structures, however, additional storage of water for recreation is included in the permanent pool area. Recreational activities will consist mainly of fishing, boating, swimming, picnicking, and camping. The costs were allocated between flood prevention and recreation by the "Use of Facilities" method.

The total installation costs of multiple purpose structures are $10,352,000 (Table 10.20). The Federal cost is $7,470,000 and the local cost is $2,882,000.

Table 10.14 Number of floodwater retarding structures, miles of stream development, and estimated cost, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Watershed	Floodwater Retarding structures		Stream development		Total structural cost
	Number	Cost	Channels	Cost	
		Thou. dollars	Miles	Thou. dollars	Thou. dollars
Nanawaya	4	692	54	1,135	1,827
Noxapater	4	596	26	354	950
Hurricane	2	401	24	296	697
Bogue Chitto	4	835	42	413	1,248
Sandtown	1	102	13	93	195
Kentawah	5	918	35	254	1,172
Edinburg	4	406	26	179	585
Sipsey	10	1,007	66	491	1,498
Shockaloo	4	690	36	279	969
Hontokalo	4	491	37	442	933
Tibby	5	624	31	358	982
Yockanookany	12	1,149	79	612	1,761
Coffee Bogue	-	---	26	509	509
Fannegusha	6	782	20	218	1,000
Pelahatchie	15	1,946	56	1,119	3,065
Jackson	1	61	44	338	399
Steen	6	634	35	146	780
Campbell	6	861	31	90	951
Dobbs	8	914	49	209	1,123
Bahala	8	871	38	349	1,220
Fair River	5	650	40	264	914
Lower Little	4	904	27	246	1,150
Little	10	1,181	60	254	1,435
Boone	7	1,129	49	480	1,609
Topisaw	8	1,561	45	312	1,873
McGee	18	2,174	84	947	3,121
Hobolochitto	1	462	26	208	670
Conehatta	7	745	57	619	1,364
Total	169	22,786	1,156	11,214	34,000

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.15 Costs of multiple purpose structures and basic recreational facilities, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Watershed	Multiple purpose structures: Recreation: Number	Surface pool: Recreation: Acres	Cost of structures: Recreation: Thou. dollars	Basic facilities: Thou. dollars	Total cost: Thou. dollars
Nanawaya	1	1,500	991	678	1,669
Hurricane	1	300	288	252	540
Bogue Chitto	1	200	196	178	374
Sandtown	1	400	341	323	664
Kentawah	1	400	331	322	653
Edinburg	1	160	162	160	322
Sipsey	2	550	511	483	994
Shockaloo	2	770	663	546	1,209
Hontokalo	1	500	474	352	826
Tibby	1	250	246	191	437
Yockanookany	1	250	243	191	434
Steen	1	500	406	352	758
Campbell	1	300	256	252	508
Dobbs	1	750	588	456	1,044
Bahala	1	600	490	387	877
Fair River	1	750	613	457	1,070
Lower Little	1	600	470	387	857
Little	2	750	677	589	1,266
Boone	1	250	252	191	443
Topisaw	1	600	481	387	868
McGee	1	400	384	322	706
Hobolochitto	2	750	679	545	1,224
Conehatta	2	690	610	527	1,137
Total	28	12,220	10,352	8,528	18,880

Source: Soil Conservation Service, United States Department of Agriculture.

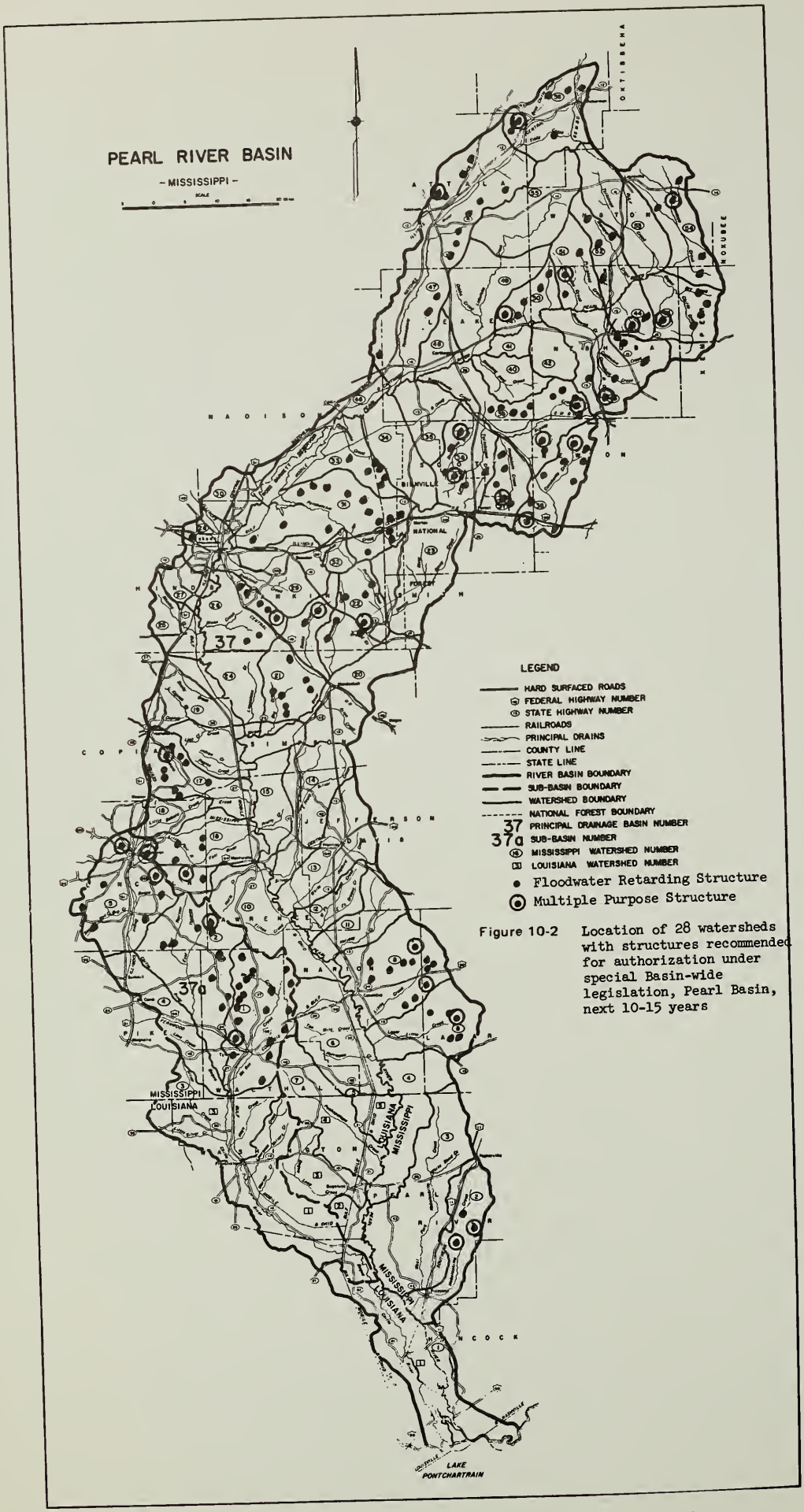

Figure 10-2 Location of 28 watersheds with structures recommended for authorization under special Basin-wide legislation, Pearl Basin, next 10-15 years

Basic Facilities for Recreation. Planned recreational facilities on which there is to be Federal cost sharing are to be constructed on 28 of the multiple purpose structures in 23 of the watersheds (Table 10.15 and Figure 10.2). Basic facilities include, but are not necessarily limited to, access roads, electric power, domestic water, boat ramps, swimming beaches, camping and picnic grounds, land, and the necessary associated features to provide a well developed highly attractive outdoor recreation facility. The estimated installation costs of these facilities are $8,528,000 (Table 10.20). Of this amount, $4,229,000 will be financed by Federal funds and $4,299,000 by local funds. Financing is divided on a 50-50 basis for construction, engineering services, and land easements and rights-of-way between Federal and local funds. Administration of contracts and other local costs are to be financed with local funds.

The total cost of all structural measures is $52,880,000. Of this amount $39,651,000 is to be financed with Federal funds and $13,229,000 with local funds.

Work Plan Preparation. The cost of preparing individual work plans for the 28 watersheds recommended for concurrent authorization is $1,893,000. These plans will contain about the same information as those presently prepared for PL-566 watersheds. This cost will be financed with Federal funds.

The total estimated costs of installing the recommended projects in the 28 watersheds are $84,800,000. This includes land treatment measures for both watershed protection and critical area treatment, structural measures, and cost of work plan preparation. The projects are to be financed with $53,981,000 Federal funds and $30,819,000 with other funds, which include private and public funds.

Comparison of Monetary Benefits and Costs

Flood Prevention. Flood prevention benefits from a reduction in damages to crops, pastures, and fixed improvements within upland watersheds are estimated to be $1,200,100 annually because of structural measures. Approximately 33,700 acres of land now in poor grade woodland would be cleared and used for crops and pastures if flooding was reduced. The annual changed land use benefits would be $439,600. In addition, the surface water area in the permanent pools of the floodwater retarding structures would provide $101,800 in annual incidental recreation benefits. The total flood prevention primary benefits are $1,741,500. Secondary benefits from increased trade activity that can be expected to accrue locally due to flood prevention are $332,000. Economic redevelopment benefits that will accrue

in the watersheds are estimated to be $169,000 annually. The total benefits expected to accrue within the upland watersheds are $2,242,500. Also downstream benefits in the amount of $483,000 are expected to accrue from works of improvement in upland watersheds. The total benefits from flood prevention measures in the 28 watersheds are $2,725,500.

The total cost of structural measures for flood prevention is $37,842,000. This includes $22,786,000 for 169 floodwater retarding structures, $11,214,000 for 1,156 miles of stream development, and $3,842,000 for that portion of the 28 multiple purpose structures allocated to flood prevention. The annual cost of flood prevention structural measures is $3,727,100. This includes annual operation and maintenance costs.

A comparison of total annual benefits to total annual costs for all structural measures for flood prevention in the 28 watersheds gives a benefit-cost ratio of 1.2:1.

Planned Recreation. The annual benefits from planned recreation in 23 upland watersheds are $2,220,800. An additional $222,100 of secondary benefits will increase the total to $2,442,900.

The total installation costs of structural measures for recreation are $15,038,000. Of this amount $6,510,000 is the portion of the multiple purpose structures allocated to recreation and $8,528,000 is planned basic recreation facilities. The annual cost of recreation including operations and maintenance is $1,518,700.

A comparison of total annual benefits to annual costs for structural measures for recreation gives a benefit-cost ratio of 1.7:1.

Summary. The total annual benefits for flood control and planned recreation are $5,320,100. The total annual cost of all structural measures including operation and maintenance is $3,727,100. Total annual benefits when compared to total annual costs give a benefit-cost ratio of 1.4:1. Specific summary data not previously referred to are presented in Tables 10.16 through 10.25. A demand-supply relationship of several recreation activities relative to the USDA projects may be determined from data in Table 10.17.

Table 10.16 Comparison of total annual benefits to total annual costs, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Watershed	Total annual benefits 1/	Total annual costs	Benefit to cost ratio
	Dollars	Dollars	
Nanawaya	385,300	257,700	1.4:1
Noxapater	56,800	53,800	1.1:1
Hurricane	133,700	91,200	1.5:1
Bogue Chitto	172,500	137,300	1.3:1
Sandtown	115,700	75,200	1.5:1
Kentawah	194,400	128,000	1.5:1
Edinburg	82,000	66,300	1.2:1
Sipsey	249,000	185,600	1.3:1
Shockaloo	245,100	168,200	1.5:1
Hontokalo	166,800	127,700	1.3:1
Tibby	163,600	97,300	1.7:1
Yockanookany	249,100	142,000	1.8:1
Coffee Bogue	38,200	33,400	1.1:1
Fannegusha	67,600	54,900	1.2:1
Pelahatchie	202,800	170,800	1.2:1
Jackson	82,400	31,800	2.6:1
Steen	162,500	116,900	1.4:1
Campbell	170,300	100,100	1.7:1
Dobbs	267,100	158,300	1.7:1
Bahala	257,100	150,800	1.7:1
Fair River	230,400	147,400	1.6:1
Lower Little	210,300	141,400	1.5:1
Little	268,200	197,200	1.4:1
Boone	199,000	135,700	1.5:1
Topisaw	218,000	182,600	1.2:1
McGee	290,400	245,200	1.2:1
Hobolochitto	186,100	148,400	1.3:1
Conehatta	255,700	181,900	1.4:1
Total	5,320,100	3,727,100	1.4:1

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Includes downstream annual benefits.

Table 10.17 Existing and projected annual demand, supply, and needs for specified recreational activities, 30 watersheds proposed for early action, Pearl Basin, 1965 and 1980

Activity	Unit	1965			1980			
		Demand 1/	Supply 1/	Demand-supply relationship	Demand	Supply 2/	USDA projects 3/	Demand-supply relationship
		1000	1000	1000	1000	1000	1000	1000
Swimming	Act. occ.	2618.1	1576.1	- 1042.0	4459.8	1846.9	1583.0	- 1029.9
Boating	Act. occ.	3269.5	1577.9	- 1691.6	5557.5	1647.2	451.0	- 3459.3
Fishing	Man-days	1396.1	1858.8	+ 462.7	1646.3	1858.8	277.0	+ 489.5
Camping	Act. occ.	855.8	94.6	- 761.2	1462.4	265.2	155.0	- 1042.2
Picnicking	Act. occ.	3983.0	491.0	- 3492.0	6762.9	815.3	609.0	- 5338.6
Hunting	Man-days	953.3	2591.7	+ 1638.4	1106.6	2537.9	- USFS	+ 1431.3
(All activities)	Rec. days						145.0	

1/ Demand and supply estimates translated from average summer Sunday demand data by BOR, and Fish and Wildlife Resources of the Pearl River Basin, Mississippi and Louisiana, Appendix J, BSF&W, United States Department of the Interior.

2/ Includes expansions of 1965 facilities.

3/ Includes recreation facilities in concurrent watersheds and those programmed by the U. S. Forest Service.

Table 10.18 Estimated installation cost of land treatment and structural measures, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Unit	Amount	Estimated Cost		
			Federal	Other	Total
			Thou. dollars	Thou. dollars	Thou. dollars
LAND TREATMENT MEASURES					
Watershed protection 1/					
Cropland and pasture					
Cropland	Acres	217,913		1,638	1,638
Grassland	Acres	214,368		8,326	8,326
Wildlife land	Acres	182,238		301	301
Technical assistance	---	---	2,976	1,370	4,346
Total cropland & pasture	---	---	2,976	11,635	14,611
Forest land					
Private Forest land	Acres	251,140		2,673	2,673
Technical assistance	---	---	606	197	803
National Forest land	Acres	140	1	2	3
Total Forest land	---	---	607	2,872	3,479
Total watershed protection	---	---	3,583	14,507	18,090
Critical area treatment within the 28 concurrent authorization watersheds					
Cropland and pasture					
Grasses and legumes	Acres	14,379	935	503	1,438
Roadside erosion control	Miles	2,525	829	446	1,275
Technical assistance	---	---	331		331
Total cropland & pasture	---	---	2,095	949	3,044
Forest land					
Private Forest land	Acres	53,670	2,646	662	3,308
Technical assistance	---	---	250		250
National Forest land	Acres	234	14	26	40
Total Forest land	---	---	2,910	688	3,598
Total - 28 watersheds	---	---	5,005	1,637	6,642
Critical area treatment Remaining area 2/					
Cropland & pasture					
Grasses and legumes	Acres	12,439	809	435	1,244
Roadside erosion control	Miles	3,503	1,149	619	1,768
Technical assistance	---	---	358		358
Total cropland & pasture	---	---	2,316	1,054	3,370

Continued

Table 10.18 Estimated installation cost of land treatment and structural measures, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years (Continued)

Item	Unit	Amount	Estimated Cost		
			Federal	Other	Total
			Thou. dollars	Thou. dollars	Thou. dollars
Forest land					
Private forest	Acres	29,870	1,375	344	1,719
Technical assistance	---	---	117		117
National Forest	Acres	708	41	48	89
Total Forest land	---	---	1,533	392	1,925
Total remaining area	---	---	3,849	1,446	5,295
Total critical area treatment	---	---	8,854	3,083	11,937
TOTAL - Land Treatment	---	---	12,437	17,590	30,027
STRUCTURAL MEASURES					
Floodwater retarding structures	Number	169	13,810		13,810
Multiple purpose structures	Number	28	4,364	1,426	5,790
Minimum basic facilities	Number	28	3,115	3,115	6,230
Stream development	Miles	1,156	7,186		7,186
Sub-total- Construction			28,475	4,541	33,016
Installation services			9,595	924	10,519
Land easements and rights-of-way			1,581	7,259	8,840
Administration of contracts and other				505	505
TOTAL - Structural Measures			39,651	13,229	52,880
Work plan preparation			1,893		1,893
TOTAL PROJECT			53,981	30,819	84,800

Source: Soil Conservation Service and Forest Service, United States Department of Agriculture.

1/ Includes 28 watersheds recommended for concurrent authorization only.

2/ Includes remaining areas needing critical area treatment outside of the 28 watersheds recommended for concurrent authorization and the 14 PL-566 watersheds.

Table 10.19 Estimated structural cost distribution, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Construction and installation services		Other		Total installation cost
	Construction	Installation services	Land easement and rights-of-way	Administration of contract and other	
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	13,810	4,415	4,344	217	22,786
Multiple purpose structures	5,790	1,716	2,780	66	10,352
Minimum basic facilities	6,230	1,847	381	70	8,528
Stream development	7,186	2,541	1,335	152	11,214
Total	33,016	10,519	8,840	505	52,880

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.20 Cost allocation summary, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Purpose		
	Flood prevention	Recreation	Total
	Thou. dollars	Thou. dollars	Thou. dollars
	Cost allocation		
Floodwater retarding structures	22,786	0	22,786
Multiple purpose structures	3,842	6,510	10,352
Basic facilities	0	8,528	8,528
Stream development	11,214	0	11,214
Total	37,842	15,038	52,880
	Cost sharing		
	Federal funds	Other	Total
	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	18,225	4,561	22,786
Multiple purpose structures	7,470	2,882	10,352
Basic facilities	4,229	4,299	8,528
Stream development	9,727	1,487	11,214
Total	39,651	13,229	52,880

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.21 Structure data, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Unit	Total
Drainage area	Sq. mi.	1,232.03
Storage capacity		
Sediment	Ac. ft.	58,863
Floodwater	Ac. ft.	409,286
Recreation	Ac. ft.	112,837
Potential water storage	Ac. ft.	2,534,884
Total	Ac. ft.	3,115,870
Surface area		
Sediment pool	Acre	14,874
Floodwater pool	Acre	60,796
Recreation	Acre	12,220
Potential water storage pool	Acre	166,467

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.22 Annual costs, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Amortization of installation cost	Operation and maintenance costs	Other economic cost	Total
	Dollars	Dollars	Dollars	Dollars
Floodwater retarding structures	1,120,400	62,900	---	1,183,300
Multiple purpose structures	509,000	23,800	---	532,800
Minimum basic facilities	419,300	767,600	---	1,186,900
Stream development	572,000	252,100	---	824,100
Total	2,620,700	1,106,400	---	3,727,100

Source: Soil Conservation Service, United States Department of Agriculture.

Table 10.23 Estimated average annual flood damage reduction benefits, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Estimated average annual damages: Without project: Dollars 1/	With project: Dollars 1/	Damage reduction benefits: Dollars 1/
Floodwater			
Crop and pasture	1,175,500	406,300	769,200
Other agricultural	149,900	62,800	87,100
Non-agricultural			
Urban and industrial	89,200	11,700	77,500
Road and bridge	334,700	127,100	207,600
Sub-total	1,749,300	607,900	1,141,400
Erosion			
Reduced road maintenance	56,000	20,100	35,900
Indirect	163,800	62,800	101,000
Total	1,969,100	690,800	1,278,300

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Price Base - Long term projected.

Table 10.24 Comparison of benefits and costs for structure measures, 28 concurrent authorization watersheds, Pearl Basin, next 10-15 years

Evaluation unit	Average annual benefits 1/								Average annual cost	Benefit-cost ratio, primary benefits	Benefit-cost ratio, total benefits
	Flood prevention										
	Damage reduction	Changed and more intensive land use	Planned recreation	Incidental recreation	Total primary benefits	Secondary benefits	Economic redevelopment	Total benefits			
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Flood prevention											
Upland watersheds	1,200,100	439,600	-	101,800	1,741,500	332,000	169,000	2,242,500			
Downstream watersheds	245,900	193,200	-	-	439,100	43,900	0	483,000			
Total - Flood prevention	1,446,000	632,800	-	101,800	2,180,600	375,900	169,000	2,725,500	2,208,400	1.0:1	1.2:1
Recreation	-	-	2,220,800	-	2,220,800	222,100	151,700	2,594,600	1,518,700	1.5:1	1.7:1
Total 2/	1,446,000	632,800	2,220,800	101,800	4,401,400	598,000	320,700	5,320,100	3,727,100	1.2:1	1.4:1

Source: Soil Conservation Service, United States Department of Agriculture.

1/ Price base long term projected.

2/ In addition it is estimated that land treatment measures will provide flood damage reduction benefits of $35,100, erosion (reduced road maintenance) benefits, $35,900, and indirect benefits, $7,200. Total benefits of $78,200 annually.

Table 10.25 Summary of physical and plan data, 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Unit	Quantity without project	Quantity with project
Watershed area	Sq. mi.	4,107	4,107
	Acres	2,628,800	2,628,800
Area of cropland	Acres	447,800	338,200
Area of grassland	Acres	329,300	470,100
Area of woodland	Acres	1,587,900	1,563,500
Miscellaneous area	Acres	263,800	257,000
Floodplain area subject to inundation by maximum storm in evaluation series	Acres	371,000	---
Area of floodplain benefited by proposed structural measures			
Directly	Acres	---	216,700
Indirectly	Acres	---	55,400
Total	Acres	---	272,100
Woodland conversions	Acres	---	33,700
Watershed area controlled by floodwater retarding and multiple purpose structures	Acres	---	776,953
	Percent	---	30

Source: Soil Conservation Service, United States Department of Agriculture.

Installation Costs

Installation costs of land treatment measures to be installed in the Basin are $30,037,000. Approximately $12,437,000 will be financed by accelerated Federal funds and $17,590,000 will be financed from other funds.

Federal funds are for additional technical assistance to accelerate the land treatment for watershed protection programs, for financing of the installation of critical area plantings, and roadside erosion control. Local or other costs are for installing land treatment measures for watershed protection and technical assistance from State agencies.

Installation costs for the 169 floodwater retarding structures are $22,786,000, of which $18,225,000 will be financed by Federal funds and the remaining $4,561,000 by local funds. Federal funds include construction, engineering services, and general administrative costs. Local cost includes easements and rights-of-way, administration of contracts, and general miscellaneous costs. The estimated structural cost distribution table identified these costs for all structural measures in the 28 watersheds.

The 1,156 miles of flood prevention channels will be installed at an estimated total cost of $11,214,000. Of this amount, $9,727,000 is to be financed by Federal funds and $1,487,000 by local interest. Federal funds include costs for construction, engineering services, and general administrative costs. Local interest costs include easements and rights-of-way, administration of contracts, and administrative costs.

Installation cost of the multiple purpose structures is $10,352,000. Of this amount, $7,470,000 will be financed by Federal funds and $2,882,000 will be financed by other funds. The specific costs of the multiple purpose structures were allocated directly to the purpose they serve. The joint costs of these structures were allocated between flood prevention and recreation by the "Use of Facilities" method.

Specific costs for flood prevention include costs for flowage, easements, and relocation. Primary joint costs are associated with the construction of the structure.

The cost of basic facilities for planned recreation sites for 28 of the multiple purpose structures is $8,528,000. Of this amount, $4,229,000 will be financed from Federal funds and $4,299,000 by local funds.

The estimated cost of preparing a work plan on each of the 28 watersheds recommended for concurrent authorization is $1,893,000. These watersheds will contain about the same information as those prepared for PL-566 watersheds. This cost will be financed with Federal funds.

The total estimated cost of installing the recommended project is $84,800,000. This includes land treatment and structural measures along with the cost of preparing the individual watershed work plans. Of this amount, $53,981,000 is to be financed by Federal accelerated funds and $30,819,000 with other funds (Table 10.18).

Financing Project Installation

Special legislation is needed for implementing works of improvement in 28 watersheds in the Pearl Basin. The Field Advisory Committee feels that simultaneous authorization of watershed projects is the best means of solving local watershed problems and at the same time serve downstream needs. The 28 watersheds that are proposed for special authorization are those shown in Table 10.12 and Figure 10.1.

Adequate sponsorship either exists or can be organized to satisfy the requirements of local interest to participate in carrying out, operating, and maintaining works of improvement in the watersheds. Federal assistance for carrying out the works of improvement as described in this plan would be provided under special legislative authority to be sought from the Congress of these United States. The requirements of local water management districts and other sponsoring organizations and agencies in the construction, operation, and maintenance of installed flood prevention and multiple purpose works of improvement will be the same as those required under existing PL-566 authorization at the time of project implementation.

The total estimated cost of establishing land treatment measures is $30,027,000. The cost of establishing land treatment measures for watershed protection on non-critical land is $18,090,000, of which $3,583,000 is to be financed with Federal funds and $14,507,000 is to be from other funds. Federal funds are to be used to defray part of the cost of technical assistance only. The estimated costs of critical area treatment are $11,937,000. Of this amount, $8,854,000 is to be financed with Federal accelerated funds and $3,083,000 is to be from other funds.

Structural measures are to be installed at a cost of $52,880,000. Of this amount, $39,651,000 is to be financed from Federal funds and $13,229,000 will be financed from other funds (local water management districts).

Provisions for Operation and Maintenance

Provisions for operation and maintenance will apply to watersheds under which structural works of improvement for all purposes will be implemented. The provisions for operation and maintenance of critical area land treatment measures installed in all parts of the Basin are also applicable.

Each of the legal water management districts will assume the responsibility to operate and maintain the floodwater retarding structures, flood prevention channels, multiple purpose structures, and recreational facilities. The recreational facilities may be operated through a lease arrangement with other legally responsible groups such as municipalities, county boards of supervisors, or others. Critical area land treatment measures are to be maintained by local landowners or through local Soil Conservation Districts.

The estimated annual cost for operating and maintaining floodwater retarding structures, stream development, multiple purpose structures, and basic facilities for recreation are shown in Tables 10.22 and 10.26.

Table 10.26 Estimated annual operation and maintenance costs of structural measures and basic facilities in 28 concurrent authorization watersheds, Pearl Basin, next 10 to 15 years

Item	Cost
	Dollars
Floodwater retarding structures	62,900
Stream development	252,100
Multiple purpose structures	23,800
Basic recreation facilities	767,600
Total	1,106,400

Source: Soil Conservation Service, United States Department of Agriculture.

Institutional Arrangements for Carrying Out
the Upstream Plan Contribution

Legislative History

The first drainage law was enacted in Mississippi in 1886. Since that time numerous drainage laws and amendatory acts have been passed by the State Legislature.

In a 20-year period, 1886-1906, 48 Swamp Land Districts were organized; from 1906-1930, 256 Drainage Districts were organized, most of which were in the Mississippi Delta and the Blackland Resource Area in northeast Mississippi. The peak period of organization was in the early 1920's.

The powers and authorities of drainage districts during the period 1886-1930 remained fairly constant. Amendments to these laws were usually confined to the manner governing procedures of administration or how benefited lands would be assessed by the District.

An Act known as the Soil Conservation District law was passed by the Legislature in 1938. This act defines a District as being a governmental sub-division of the State, a public body corporate and political. Soil Conservation Districts have the power to conduct surveys and investigations relating to the character of soil erosion and the preventive measures needed - to carry out preventive and control measures - to cooperate and enter into agreements with any agency, owner, or operator of lands within the District in carrying out erosion control measures --. They do not have the power to assess or levy taxes in carrying out the functions of the District.

The Watershed Protection and Flood Prevention Act of 1954, as amended, established a new national policy for Federal assistance to State and local agencies in projects for flood prevention and the conservation, development, utilization, and disposal of water.

Chapter 92, Laws of Mississippi, Extraordinary Session, 1955, (Senate No. 1220), as amended, confers on existing drainage districts the additional authority to cooperate with the United States under the provisions of PL-566 in constructing, operating, and maintaining works of improvement -- and provides the procedure which must be followed before such additional authorities may be exercised.

House Bill 670, Mississippi Legislature, 1960, provides for the creation of master water management districts, and the inclusion of existing drainage districts, -- and provides that this authority be limited to projects developed and carried out under PL-566 or other laws of the United States.

Chapter 255, General Laws of Mississippi, 1964 (House Bill 507) as amended by subsequent legislation in 1966 and 1968, created the Pearl River Basin Development District. The District comprises nineteen counties in central and southern Mississippi, all or parts of which drain into the Pearl River.

Chapter 186, Laws of Mississippi, 1956 (House Bill 429) authorized the Boards of Supervisors in each county to make contributions to any Soil Conservation District. As such, each Soil Conservation District will encourage financial or other assistance from the respective boards of supervisors to implement and accelerate erosion control measures on roadbanks needing such treatment in each Soil Conservation District.

Sponsoring Organizations

Drainage districts, water management districts, and river basin districts have the power to: develop with agencies of the U. S. Government, State and local, plans for works of improvement, enter into agreements with these agencies, and to meet the local requirements of cost sharing; acquire by condemnation lands or other property for rights-of-way; construct, operate, and maintain any kind of facility in the Basin necessary to the project. In addition to the above, the river basin districts have power to: acquire lands for recreation facilities and issue rules and regulations for use of these facilities; issue bonds, fix, and collect charges for services, lease, sell, and dispose of property.

Local. Owners and operators of land within each watershed (less than 250,000 acres) will be the primary motivating force in requesting technical and financial assistance in the planning, construction, operation, and maintaining of works of improvement in each of the 28 watersheds recommended for concurrent authorization. Each will petition and organize under appropriate laws of the State which provides for the participation of the Federal government in planning and construction of works of improvement within organized drainage or water management districts.

Each local sponsoring organization will be responsible for working with appropriate Federal agencies in the development of the watershed work plan, which will not only identify the problem and needs in the watershed but reflect the decisions and agreements reached in work plan development. The work plan will identify those measures required to solve these problems or provide the needs in the watershed, make estimates of the costs and benefits from proposed works of improvement, allocate costs to purposes, determine cost sharing between the Federal government and local people, and provide for the operation and maintenance of works of improvement or facilities identified in the watershed work plan.

Soil Conservation Districts. Soil Conservation Districts will act as a co-sponsor for each watershed project and will be responsible for carrying out all the accelerated land treatment measures as identified in the work plan.

In addition, Soil Conservation Districts will be the primary sponsoring organization in planning for and in carrying out accelerated land treatment measures on critical areas in the Basin not otherwise identified with a watershed project.

Pearl River Basin Development District. The Pearl River Basin Development District will act as co-sponsor to the local sponsoring organization in each watershed project. They will share with each local sponsoring organization in the development of the watershed work plan and to encourage the maximum development and use of multiple purpose structures commensurate with the needs of the people in each watershed.

To encourage maximum development and use of the water resource in each watershed, the Pearl River Basin Development District will agree to support the local sponsoring organizations by assuming all or part of the costs for legal services, rights-of-way, and easements for floodwater retarding structures and multiple purpose structures, and basic facilities for recreation, provided they have the funds.

In addition, they will work with Soil Conservation Districts in the planning and carrying out of land treatment measures on critical areas not identified with a watershed project.

Conclusions

The Plan is considered the most practical and economically feasible to meet the present and future needs in upstream watersheds for flood prevention and planned outdoor recreation. Watershed projects were coordinated with other agencies and no conflict of interest in projects exists. Works of improvement proposed are needed and constitute harmonious elements in the comprehensive development of the Basin. Local interests will provide the necessary cooperation in implementing and constructing the works of improvement.

Implementation of watershed projects will be carried out following procedures normally used in the Watershed Protection and Flood Prevention Act. Plans will be developed by the local sponsoring organizations, Soil Conservation Districts, water management districts, and the Pearl River Basin Development District with the technical assistance being provided by the United States Department of Agriculture.

Watershed projects will be planned and works of improvement installed in a progressive manner. Critical area treatment measures that are outside of watershed projects will be planned and applied as rapidly as time will permit. Watershed projects will be planned two or three per year to satisfy the needs and requirements of the Basin in the next 10-15 years. Local sponsoring organizations will assure the Secretary of Agriculture that they can make arrangements for local participation.

Other purposes for water resource development may be included in the next 10 to 15 years. Where such amendments may prove beneficial to proposed watershed projects or potentially feasible watershed projects as identified in the USDA plan, the twenty-eight watershed projects may be re-evaluated to include these in the next 10 to 15 year period for authorization if proved to be economically feasible and supported by local interests.

Recommendations

"The Secretary of Agriculture recommends that the early action program be carried out in the Basin, with the installation of all elements of the program being initiated prior to 1980;

That in carrying out such a program, the Secretary of Agriculture be authorized to assist local organizations, upon their request, to prepare and carry out sub-watershed work plans for the sub-watersheds designated in the early action program;

That in carrying out such a program, the Secretary of Agriculture be authorized to provide financial and other assistance in the installation of structural works of improvement for furthering the conservation, development, utilization, and disposal of water and that such assistance should be provided on a basis comparable to that authorized for similar purposes under other Federal programs, with such modifications as the Secretary deems necessary and appropriate in the public interest.

That the Secretary of Agriculture be authorized to provide financial and other assistance in the stabilization of critical sediment source areas including roadsides, surface-mined areas, and streambanks which lie above and would adversely affect any structural works of improvement existing or included in the total early action program, and that such assistance should be provided on a basis comparable to that authorized for similar purposes under other Federal programs, with such modifications as the Secretary deems necessary and appropriate in the public interest.

That prior to participation in the installation of the upstream structural works of improvement and the measures for sediment and erosion control described herein on non-Federal lands, cooperating non-Federal interests shall furnish assurances satisfactory to the Secretary of Agriculture that an adequate land treatment program is being installed to provide necessary protection to the watershed lands and planned structural measures; they will acquire, with such Federal financial assistance as is provided for herein, all land rights needed in connection with the installation of such works of improvement; and they will maintain and operate all upstream structural works of improvement and measures for sediment and erosion control on non-Federal participation described herein or as may be available for such purposes under other Federal programs;

That the installation of the planned works of improvement may be carried out under Federal construction contracts when requested by the local organization;

That the first estimate of costs for the installation of the upstream structural works of improvement, which includes land treatment measures for watershed protection and work plan preparation costs, is $72,863,000, of which $45,127,000 will be assumed by the Federal government and $27,736,000 will be assumed by other interests;

That the first estimate of costs for installation of the critical area stabilization measures is $11,937,000, of which $8,854,000 will be assumed by the Federal government and $3,083,000 will be assumed by non-Federal interest."

CHAPTER XI

EARLY ACTION PLAN AND FRAMEWORK FOR FUTURE PLANNING

General

The early action plan for the Pearl River Basin as presented in Chapters VIII, IX, and X is considered the best complimentary and economically feasible combination of projects and measures to provide for the foreseeable water and related land needs in the Pearl Basin within the next 10-15 years. The single and multiple purpose projects by the Department of Agriculture, the Corps of Engineers, and the Pearl River Basin Development District would provide flood control, water-based recreation, fish and wildlife improvements, and erosion and sediment control.

The early action plan includes three multiple purpose reservoirs (Ofahoma, Carthage, and Edinburg) to be installed by the Corps of Engineers, 30 upland watershed projects which include 179 floodwater retarding structures, 29 multiple purpose structures, 1,202 miles of stream development measures, and land and critical area treatment measures for erosion and sediment control to be installed by the Department of Agriculture. Also included in this early action plan to be installed by the Pearl River Basin Development District is the development of a pleasure boatway along the Pearl River by snagging 302 miles of the channel from the NASA 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. Summary data for the early action projects are shown in Table 11.1.

The total installation costs, including initial and delayed, amounts to $187,559,000 for the total early action plan. The total annual costs or charges are $10,172,000 and the total benefits are $20,427,000 with a benefit-cost ratio of 2.0:1.

The Early Action Plan as It Relates to Major Identified Needs

Included in the following paragraphs are quantitative evaluations of the influence which would be exerted by the early action plan.

Table 11.1 Summary of installation and annual costs, benefits, and benefit to costs for the total early action plan, Pearl Basin, 1980

Item	Corps of Engineers	USDA				Pearl River Basin Development Dist.	Total Early Action Plan
		PL-566	Con-Current Authorization	National Forest	Total USDA		
First Costs ($1000)							
Initial	79,300	2,459	84,800	1/ 872	2/ 88,131	6,408	173,839
Delayed	13,720	-	-	-	-	-	13,720
Total	93,020	2,459	84,800	872	88,131	6,408	187,559
Annual Costs ($1000)							
Initial	4,806	91	3,727	-	3/ 3,818	815	9,439
Delayed	733	-	-	-	-	-	733
Total	5,539	91	3,727	-	3,818	815	10,172
Annual Benefits ($1000)							
Initial							
Flood Control	4,517	95	2,079	-	2,174		6,691
Water Quality Control	1,146	-	-				1,146
4/ Recreation	2,073	39	2,323	-	2,362	2,005	6,440
Subtotal	7,736	134	4,402	-	4,536	2,005	14,277
Delayed							
Recreation	4,104	-	-		-	-	4,104
Total Primary Benefits	11,840	134	4,402	-	4,536	2,005	18,381
Other Benefits	1,042	16	919	-	6/ 935	5/ 69	2,046
Total Benefits	12,882	150	5,321	-	5,471	2,074	20,427
Benefits to Costs Ratio							
Primary Benefits	2.1	1.5	1.2	-	1.2	2.5	1.8
Including Other Benefits	2.3	1.6	1.4	-	1.4	2.5	2.0

Source: Derived from Study Data.

1/ Annual Cost and Benefit Data presented in Appendix I, Outdoor Recreation.
2/ Includes land treatment, critical area stabilization, and structural measures.
3/ Structural measures only.
4/ Includes fish and wildlife enhancement.
5/ Area redevelopment.
6/ Includes $614,000 secondary and $321,000 area redevelopment.

Flooding

Projects in 30 upland watersheds to be installed by the U. S. Department of Agriculture and three major reservoirs by the Corps of Engineers would provide flood control for rural and urban areas of the Basin. Overall, the structural measures of the early action plan would reduce danger in the Basin by about 49 percent (Table 11.2).

Practically all of the flooding in the Basin is the result of direct storm runoff. The degree of severity of flooding is dependent on the volume and management of the direct storm runoff. The volume of direct storm runoff is affected by the hydrologic soil-cover complex of the watershed under consideration. The hydrologic curve number for a watershed represents a calculation of the various hydrologic elements of the soils and cover conditions that determine the portion of the storm that will be retained and the portion that will become direct storm runoff.

Hydrologic curve numbers were calculated under present and projected soil-cover complex conditions for sample watersheds. For present conditions the watershed curve number ranged from a low of 75 to a high of 82 with an average of 78. With the projected changes in land use and treatment the watershed curve number ranged from a low of 72 to a high of 79 with an average of 75. For an analysis of runoff (present and future) for different size storms, see Table 11.3. The reduction of future direct runoffs as related to the present is the result of improved land treatment measures and/or changed land use. This table is not intended to show that there will be a reduction in the total runoff from the watershed but just in the direct storm runoff. The total runoff in most cases will be affected very little because of increased base flow.

The structural measures included in the watersheds proposed for early action will manage the direct storm runoff by retaining that portion of the excess water in floodwater retarding structures and in improved channels to control the stage of direct storm runoff not controlled by floodwater retarding structures. These structural measures, aided by the runoff reduction caused by land treatment, will reduce the number of floods per year, the number of floods during the crop months, and will reduce the stage of the remaining floods. The result will be a reduction in the average annual cumulative acres flooded. Table 11.4 shows an analysis of the number of floods per year, during the crop months, average annual cumulative acres flooded for directly benefited areas, average annual cumulative acres flooded for the entire watershed, and percent reductions in the cumulative acres flooded. The average annual cumulative acres flooded are shown only for those watersheds which served as samples.

Table 11.2 Damage reduction - early action program, Pearl Basin

Program	Average annual damage: Without program	Average annual damage: With program	Percent reduction
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

Source: Derived from study data.

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.

Table 11.3 Direct storm runoff from sample watersheds having the lowest, average, and highest runoffs under present and future hydrologic soil-cover complex conditions, Pearl Basin

Storm rainfall in inches	Lowest CN 75[1/]	Average CN 78[1/]	Highest CN 82[1/]	Lowest CN 72[1/]	Average CN 75[1/]	Highest CN 79[1/]
	Inches	Inches	Inches	Inches	Inches	Inches
1.0	0.03	0.06	0.11	0.01	0.03	0.07
2.0	0.38	0.48	0.65	0.29	0.38	0.52
3.0	0.95	1.13	1.38	0.81	0.95	1.19
4.0	1.67	1.89	2.20	1.46	1.67	1.96
5.0	2.44	2.72	3.08	2.19	2.44	2.80
6.0	3.27	3.59	3.98	2.99	3.27	3.68
7.0	4.15	4.48	4.91	3.83	4.15	4.58
8.0	5.04	5.40	5.86	4.69	5.04	5.51
9.0	5.94	6.33	6.81	5.58	5.94	6.45
10.0	6.87	7.27	7.77	6.49	6.87	7.39

Source: Soil Conservation Service, United States Department of Agriculture.

1/ CN denotes watershed curve number.

Table 11.4 Effect of projects on 30 watersheds proposed for early action, Pearl Basin, 1980

Watershed	Average floods				Average annual cumulative acres flooded				Reduction in average annual cumulative acres	
	Present		Future		Present		Future			
	Year	Crop mo.	Year	Crop mo.	Direct benefit	Total W/S	Direct benefit	Total W/S	Direct benefit	Total W/S
	Number	Number	Number	Number	Acres	Acres	Acres	Acres	Percent	Percent
Nanawaya	3.7	2.7	1.2	0.6	-	-	-	-	75.0	47.0
Noxapater	3.7	2.7	1.2	0.6	-	-	-	-	80.0	43.0
Hurricane	3.7	2.7	1.2	0.6	-	-	-	-	75.0	62.2
Bogue Chitto	3.7	2.7	1.2	0.6	-	-	-	-	75.0	62.2
Sandtown	3.7	2.7	1.2	0.6	-	-	-	-	75.0	35.0
Kentawah	5.6	4.5	1.7	1.0	-	-	-	-	68.0	40.3
Edinburg	3.7	2.7	1.2	0.6	-	-	-	-	75.0	35.0
Sipsey	5.0	3.9	1.8	1.1	-	-	-	-	75.0	35.0
Shockaloo	5.0	3.9	1.8	1.1	-	-	-	-	75.0	35.0
Hontokalo	5.0	3.9	1.8	1.1	22,274	27,811	3,951	8,875	82.0	68.0
Tibby	4.8	3.8	2.8	1.9	-	-	-	-	75.0	52.6
Yockanookany	4.8	3.8	2.8	1.9	-	-	-	-	75.0	62.2
Coffee Bogue	5.5	4.4	1.7	1.0	-	-	-	-	57.0	37.5
Fannegusha	5.5	4.4	1.7	1.0	-	-	-	-	65.0	38.0
Pelahatchie	5.5	4.4	1.7	1.0	53,881	79,200	10,903	33,832	80.0	58.0
Jackson	-	-	-	-	-	-	-	-	-	-
Steen	2.6	1.7	1.3	0.7	-	-	-	-	67.6	39.5
Campbell	2.6	1.7	1.3	0.7	8,787	16,766	2,846	10,148	67.6	39.5
Dobbs	3.0	2.1	1.5	0.8	13,534	19,089	3,417	8,258	74.8	56.7
Bahala	3.0	2.2	2.2	1.5	-	-	-	-	71.1	62.2
Fair River	3.0	2.1	1.5	0.8	-	-	-	-	74.8	39.8
Lower Little	3.8	2.9	1.2	0.6	-	-	-	-	74.4	37.2
Little	3.8	2.9	1.2	0.6	-	-	-	-	74.4	46.4
Boone	5.9	4.8	2.6	1.9	-	-	-	-	86.5	36.7
Topisaw	5.9	4.8	2.6	1.9	26,063	70,320	3,519	44,486	86.5	36.7
McGee	5.9	4.8	2.6	1.9	-	-	-	-	86.5	36.7
Hobolochitto	6.0	5.0	3.2	2.4	-	-	-	-	67.7	41.8
Conehatta	5.0	3.9	1.8	1.1	-	-	-	-	75.0	62.2
Carthage	4.8	3.8	2.8	1.9	-	-	-	-	75.0	62.2
Hanging Moss	-	-	-	-	-	-	-	-	-	-

Source: Soil Conservation Service, United States Department of Agriculture.

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 damage 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

Critical area protection measures will be accomplished on open and forested land in the 30 early action watersheds and 21 non-feasible watersheds. Approximately 26,818 acres of badly eroded open land and 6,156 miles of eroding roadbanks will be planted to grasses and legumes. An additional 63,300 acres of open and forested land will be planted to trees and 10,000 acres seeded to wildlife habitat development. These measures are necessary to stop the loss of soil and reduce the flow of damaging sediment.

Watershed protection measures will be applied to the 30 upstream watersheds. These measures will help to control water runoff by increasing the infiltration and percolation rates of the soil and control the surface water by mechanical means such as terracing and waterways (see Tables 4.2, 4.3, 10.3, and 10.18).

Sediment

Studies of annual gross erosion and sediment yields for present conditions in sample watersheds studied by the U. S. Department of Agriculture indicates an annual sediment yield ranging from 0.2612 to 1.2895 acre feet per square mile of drainage area. Future land use conditions without any project action would reduce the total Basin yield by approximately 48 percent and with the early action projects in place by approximately 55 percent.

An analysis and evaluation of sediment reduction into the Pearl River Reservoir as a result of the USDA portion of the early action program reveals that the annual sediment load would be reduced 56 percent.

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 income 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. Basin-wide, 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 basin-wide is presently adequate to satisfy the demand for hunting for all periods of the study. However, the Upper Pearl sub-area, 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 sub-area, especially after 1980, it will be necessary and possible to shift part of this pressure to the other sub-areas. This shift of hunter demand is possible due to Jackson, the major population center, being located near the southern boundary of the Upper Sub-area and the easy access afforded the hunters of this area to the Middle and Lower Sub-areas via Interstate Highway 55. Increased demand in the Middle and Lower Sub-areas can be satisfied in the respective sub-areas.

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 under-utilized.

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

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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 floodplains, 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 revegetation 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.

An important environmental conflict surfaced during the study is the proposed channel development included in the upstream watersheds and the Pearl River Boatway. Special consideration will be given in detail planning of such projects to preserve and incorporate natural stream characteristics; i.e., meandering alignment, streambank cover, pools and riffles, variable cross-sections, braided channels, floodways and diversions of flat relief to handle high flows only, and preservation of natural flood storage areas (swamps, oxbow lakes, swales, and distributaries).

During detailed planning, the implementing Federal and/or State agencies will re-examine each water resource development project and make appropriate modifications with special attention being given to viable alternatives as means of minimizing or mitigating adverse impacts on the environment. This will include consideration of all resource values necessary for the orderly development of water and related land resources.

Framework for Future Planning

Projects and programs beyond the year 1980 were studied in sufficient detail to determine only their general applicability in meeting foreseeable needs and their compatibility with other projects and programs in the Basin. The measures included in the framework study by the USDA and the Corps of Engineers for future planning include 16 upstream watershed projects, additional multiple purpose structures in 10 authorized PL-566 or early action watersheds, 9 reservoirs, and improvements for barge transportation. Although these 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 interest. The measures for each agency are discussed in the following paragraphs.

U. S. Department of Agriculture. Sixteen upstream watersheds were determined to be potentially feasible projects and required to help satisfy future needs in the Basin. These watersheds would have land treatment measures, single purpose floodwater retarding structures, multiple purpose structures for flood control and recreation, and stream development. Data for these 16 watersheds are presented in Table 11.5.

The only other elements of the long range plan in the upstream area pertain to recreation. Twelve of the aforementioned long range watersheds provide for recreational facilities and water. Thirteen recreational developments are proposed and programmed to supply 7,550 acres of water.

Of the 30 watersheds proposed for early action by 1980 -- seven additional recreational projects are programmed with a water surface of 2,800 acres. Therefore by the year 2015, if implementation occurs, the 30 watersheds will contain 36 recreational sites located in 25 watersheds and containing 15,020 acres of recreational water.

Of the 12 PL-566 watersheds now in operation -- three additional recreational projects are programmed with a water surface of 950 acres. Therefore by the year 2015, if implementation occurs, the 12 PL-566 watersheds will contain eight recreational sites in nine watersheds which contain 2,300 acres of water. Data for recreation projects in the framework watersheds and modification to others are depicted in Table 11.6.

For framework planning (2015), the U. S. Forest Service has planned recreational sites and facilities on National Forest land. These planned recreation developments are listed in Table 5.7 and are estimated to include 895 acres of water area.

Corps of Engineers. There are nine 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 nine reservoirs included in this category are given in Table 11.7.

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.

Table 11.5 Data on 16 upstream watersheds included in the framework for future planning, Pearl Basin, 2015

Watershed name	Watershed Number	Watershed area	Area controlled by structural measures	Multiple purpose structures	Potential storage 1/
		Acres	Percent	Number	Acre-feet
West Hobolochitto	3 M	175,000	34.7	1	267,000
Ten Mile	6	108,000	38.8	1	176,000
Tilton	10	117,000	27.0	1	141,000
Pretty	15	54,400	13.7	0	28,000
Riles	20	129,000	16.9	1	91,300
Caney	23	125,000	26.7	2	123,000
Limestone	24	59,200	26.1	1	59,500
Rhodes	25	52,600	22.0	0	53,000
Big Creek	27	23,000	30.7	0	37,100
Balucta	35	38,800	29.7	1	44,100
Lower Lobutcha	49	98,800	34.5	0	116,000
Upper Lobutcha	55	105,000	36.9	1	150,000
Clabber	37a4	92,500	21.7	1	91,500
Lawrence	1 L	172,000	21.0	1	176,000
Mt. Herman, Clifton	3 L	110,000	42.3	1	169,000
Pushepatapa	4 L	137,000	35.6	1	211,000
Total	XXX	1,597,300	XXX	13	1,933,500

Source: Soil Conservation Service, United States Department of Agriculture.
1/ Estimated physical storage limits.

Table 11.6 Recreation projects in framework watersheds and modification of recreation in early action projects to help satisfy needs, Pearl Basin, 2015

Watersheds	1980 1/			Additions in year 2015		
	Watersheds with multiple purpose projects	Recreation sites	Recreation water	Watersheds with multiple purpose projects	Recreation sites	Recreation water
	Number	Number	Acres	Number	Number	Acres
30 Early Action	24	29	12,370	1	7	2,800
12 PL-566 in operation	6	5	1,350	3	3	950
21 Non-feasible	0	0	0	12	13	7,550
63 Total	30	34	13,720	16	23	11,300

Source: Formulated by Soil Conservation Service and Bureau of Outdoor Recreation.

1/ The situation in 1980 is shown to enable a fuller understanding of changes recommended and included in the framework plan.

Table 11.7 Large reservoirs included by the Corps of Engineers in the framework for future planning, Pearl Basin

Name	Location			Drainage area (Sq.mi.)	Purpose 1/	Total Storage Capacity (Ac.ft.)	Area at Normal Pool (Acres)
	Stream	Mile	County				
Varnado	Pushepatapa Ca.	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 Ca.	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

Source: U. S. Army, Corps of Engineers.

1/ FC = Flood Control; R = General Recreation; FW = Fish and Wildlife Enhancement; P = Hydroelectric Power; WS = Water Supply.