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BIG BLACK RIVER, MISSISSIPPI

COMPREHENSIVE BASIN STUDY

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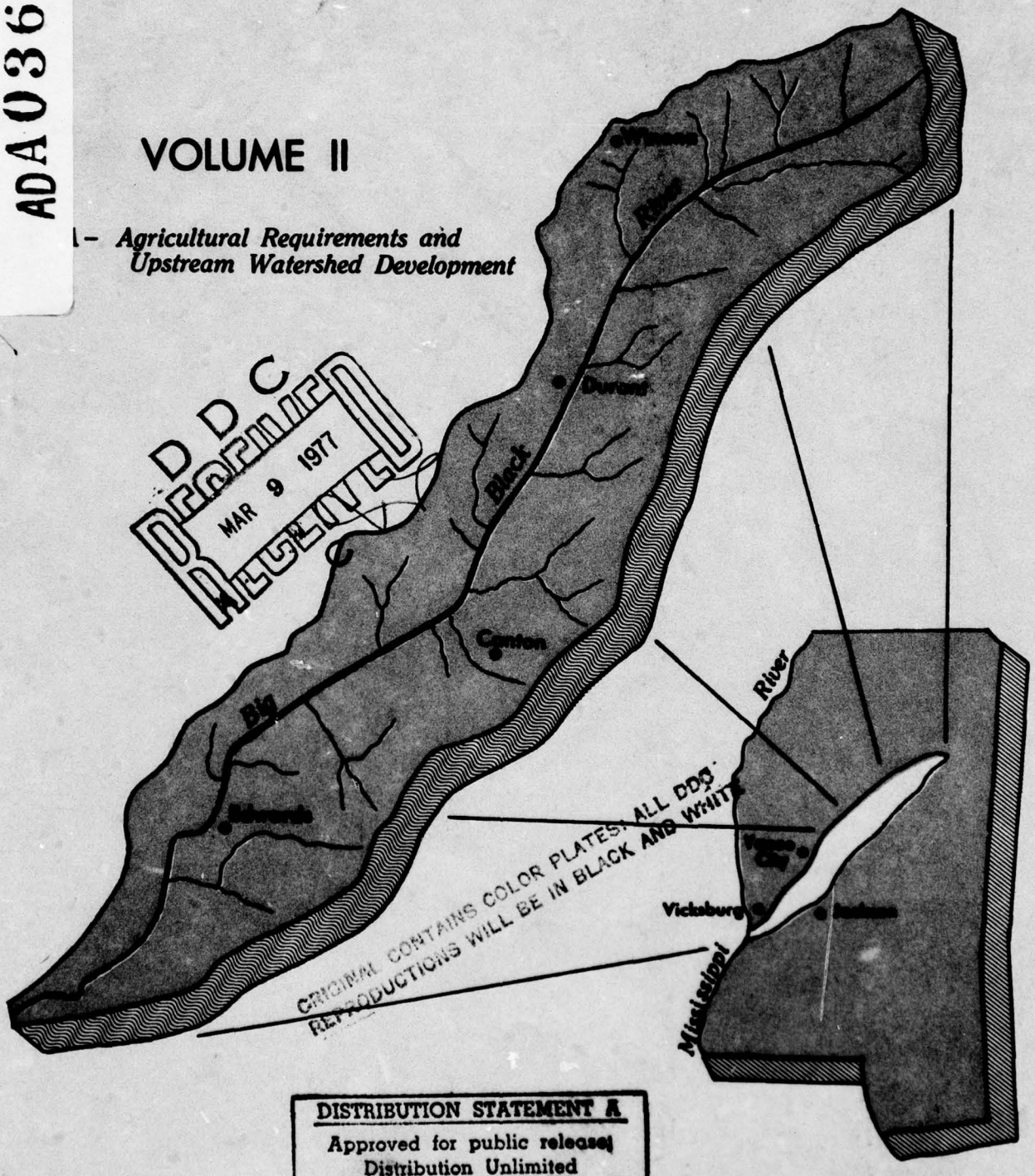
VOLUME II

I – Agricultural Requirements and Upstream Watershed Development



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BIG BLACK RIVER BASIN COORDINATING COMMITTEE

APRIL 1968

BIG BLACK RIVER COMPREHENSIVE BASIN STUDY

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(6) Mississippi

BIG BLACK RIVER COMPREHENSIVE BASIN STUDY
Volume II.
ANNEX A.

AGRICULTURAL REQUIREMENTS AND
UPSTREAM WATERSHED DEVELOPMENT
BIG BLACK RIVER

(11) Jun 68

(12) 167p.

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

JACKSON, MISSISSIPPI JUNE 1968

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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 Big Black 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 Big Black River Basin. It contains the recommendations for the early action program of the Department of Agriculture 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 Big Black River Basin is supported by data in 10 annexes 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 - Interagency Summary Report

VOLUME II - DEPARTMENT OF AGRICULTURE (SCS, FS, ERS)
Annex A - Agricultural Requirements and Upstream Watershed Development - Big Black River

VOLUME III - CORPS OF ENGINEERS
Annex B - Engineering Studies of Water Resource Development Projects, Big Black River

VOLUME IV - DEPARTMENT OF THE INTERIOR
Annex C - A Report on the Recreation Aspects of the Big Black River Basin, Mississippi
Annex D - A Report on the Fish and Wildlife Resources of the Big Black River Basin, Mississippi
Annex E - Municipal and Industrial Water Supply and Water Quality Control Study
Annex F - Geology and Water Resources of the Big Black River Basin, Mississippi
Annex G - Archeological, Historic and Natural Resources of the Big Black River Basin, Mississippi

VOLUME V - OTHER REPORTS
Annex H - Hydroelectric Power
Annex I - Role of the State of Mississippi in the Planning and Development of the Water and Related Land Resources in the Big Black River Basin
Annex J - Transcripts of the Public Hearings

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

Annex A is oriented primarily to upstream watershed development. Other aspects of the agricultural program are fragmented through other annexes.

AGRICULTURAL REQUIREMENTS AND
UPSTREAM WATERSHED DEVELOPMENT
BIG BLACK BASIN

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AGRICULTURAL REQUIREMENTS AND UPSTREAM
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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 Big Black Basin located in west-central Mississippi. Studies and reports by other Federal and State agencies made a contribution to the comprehensive study and the proposed development plan. The purpose is to guide the orderly development of 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 direct and indirect damages to land, firms, households, communities, and the Basin and regional economy in the absence of correction or development of water and land related 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

The Department of Agriculture's participation 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 other waterways to develop coordinated programs. This study was carried out in cooperation with other

Federal agencies and the State of Mississippi. Authority for agency participation, other than USDA, is set forth in their formal reports enumerated in the Foreword.

Participants

The principal participants within the U. S. Department of Agriculture were the Soil Conservation Service, the Forest Service, and the Economic Research Service. Participation of the USDA agencies 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, the Forest Service, and the Economic Research Service which states in part:

> "The field committee members will maintain appropriate liaison with the administratively responsible officers of their respective Services and facilitate the coordination of activities by their respective Services in carrying out the investigations and surveys. The field committee will meet from time to time on the call of the chairman and shall meet often enough to accomplish effective coordination of the work and to keep a constant check on progress. The Committee will maintain sufficient liaison with field officers of other Department agencies and other Departments to provide assurance that the field work of the Department of Agriculture is adequately coordinated with that being done by other Departments."

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, and Federal Power Commission. At the Washington level, cooperative relationships among the departments were maintained through the Water Resources 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 Mississippi Board of Water Commissioners, other State 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 study is to facilitate the coordinated and orderly conservation, development, utilization and management of water and related land resources of the Basin. To achieve this aim necessitated a general appraisal of the overall water and related land resource problems and development potentials of the Basin and included:

(1) An inventory of resources.

(2) Studies and projections of economic development.

(3) Translations 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 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 and programs in upstream areas to satisfy the demands.

(9) 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 Big Black 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 output, including timber production; (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., of Jackson, Mississippi.

The appraisal 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 potential 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 in the Basin.

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 areas of land of various types and capabilities available in the Basin. 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 land related problems 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.

The plan for the development of water and related land resources in the headwater areas of the Basin is proposed according to the method of authorization, PL-566 and Basin-wide authorization. The projects recommended for implementation through the going PL-566 program are presented in Chapter VI. The projects proposed for Basin-wide authorization are presented in Chapter VIII.

The basic reason that projects are proposed under different methods of authorization is that the interests of local organizations demanded action in satisfactorily solving the water and land related problems. Thus, ten watersheds demanding immediate attention were identified and authorization proposed under PL-566. Twenty-two watersheds determined as needing action in the next 10 to 15 years are proposed in Chapter VIII for Basin-wide authorization.

The economic criteria used to formulate the plan of development for the Basin are in accordance with Senate Document No. 97, 87th Congress, "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources".

CHAPTER II

PHYSICAL AND ENVIRONMENTAL DESCRIPTION OF BASIN

Location and Size

The Big Black Basin is located in the western and central portion of Mississippi. The Big Black River rises in the eastern portion of Webster County and flows about 270 miles in a southwestern direction. It enters the Mississippi River approximately 25 miles below Vicksburg near Grand Gulf in Claiborne County. The Basin is long and narrow and has no major tributary streams. It is approximately 155 miles in length, 22 miles in width and encompasses an area of 2,264,600 acres. The valleys vary in width from one-half mile in the upper portion to three and one-half miles in places with an average width of two miles. Land subject to overflow comprises about 21 percent of the area, including land in the upland watersheds and on the main stem.

A list of counties wholly or partially within the Basin is presented in Table 2.1. Throughout the report, reference to the Big Black River Basin refers to the area of the part of these counties that are within the hydrologic boundary. Reference to the Big Black Study Area refers to the entire area of the counties in the Basin (Figure 2.1).

Geology

Geologically, the Big Black Basin lies in the Coastal Plain Province. Four physiographic divisions, crossing the Basin in a northwesterly direction as old shore lines, are represented. From oldest to most recent and in a downstream direction they are - North Central Hills, Jackson Prairies, Long Leaf Pine Hills, and Loess or Bluff Hills. These physiographic divisions are reflected in topography, kind and composition of underlying material and, to a degree, on soils and type of vegetation present.

The North Central Hills physiographic division is a broad sand hill upland dissected by numerous streams. Formations that crop out are Wilcox and various members of the Claiborne group of formations. All are of Eocene age. These consist principally of irregularly bedded sand and clays, some of which are glauconitic or lignitic. A mantel of windblown silt thinning in an easterly direction covers much of the western area.

The Jackson Prairie is a rolling landscape with relatively wide stream bottoms. Formations that crop out are members of the

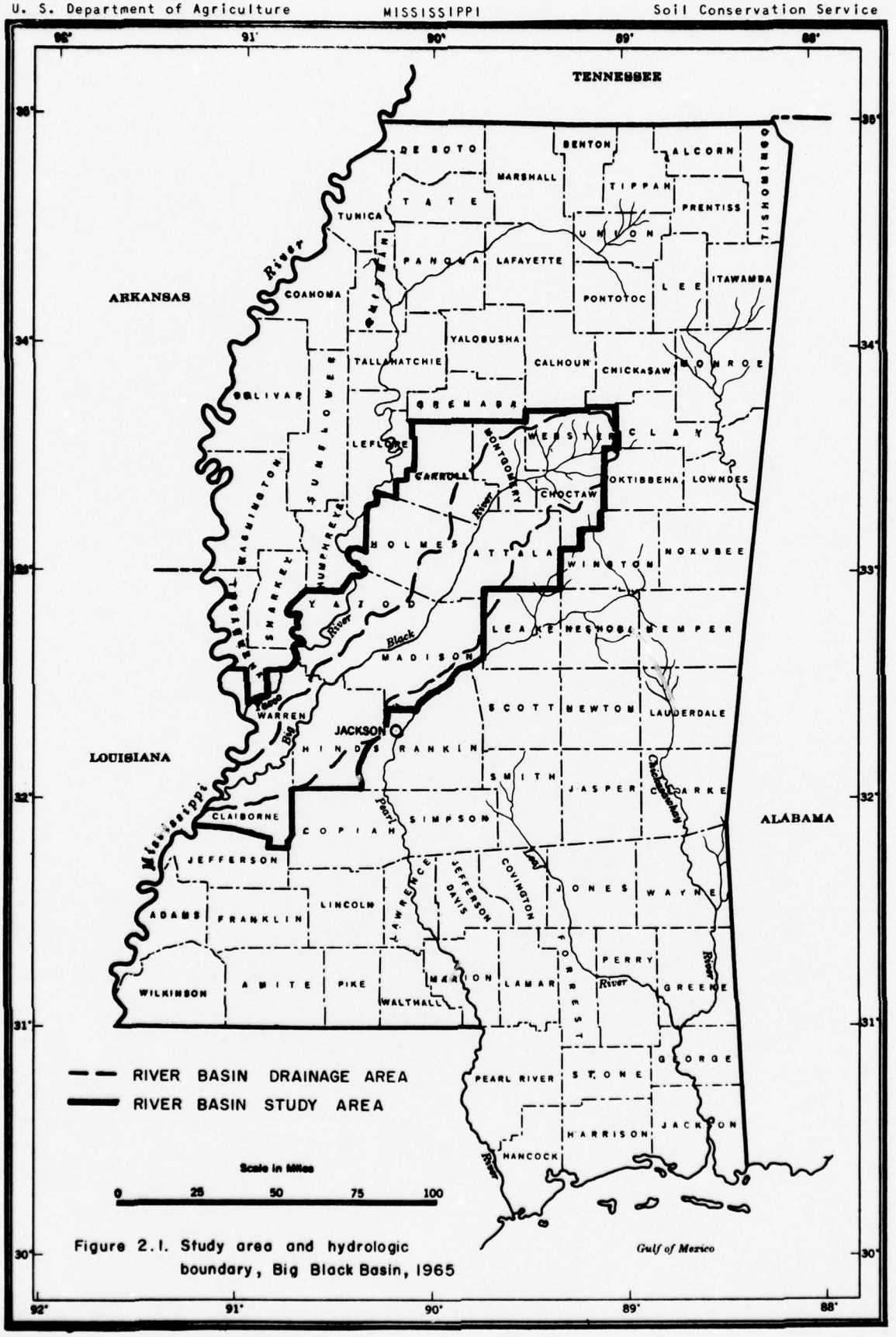

Figure 2.1. Study area and hydrologic boundary, Big Black Basin, 1965

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Table 2.1. County area in the Big Black Basin or Study Area, 1958

County	Total area of county	County area of River Basin	County area in Study Area	Proportion of total county area in River Basin	Proportion of total county area in Study Area
	Acres	Acres	Acres	Percent	Percent
Attala	463,400	237,600	463,400	51	100
Carroll	408,300	98,300	408,300	24	100
Choctaw	266,900	143,800	266,900	54	100
Claiborne	311,000	72,000	311,000	23	100
Hinds	561,300	356,200	1/433,900	63	77
Holmes	489,000	132,900	489,000	27	100
Leake	375,000	15,700	0	4	0
Madison	480,600	401,700	480,600	84	100
Montgomery	257,900	167,200	257,900	65	100
Oktibbeha	290,600	5,800	0	2	0
Warren	362,200	235,600	362,200	65	100
Webster	266,200	153,400	266,200	58	100
Yazoo	600,300	244,400	600,300	41	100
Total	5,132,700	2/2,264,600	4,339,700		

Source: Mississippi Soil and Water Conservation Needs Inventory, 1958-1975, Mississippi Conservation Needs Committee, Jackson, Mississippi.

1/ Hinds County was divided into Hinds West - that part to be included in the Big Black Study Area, and Hinds East - that part to be included in the Pearl River Study Area.

2/ River Basin area quantified by Corps of Engineers was based on stream gaging stations. USDA based their estimate on CNI data.

Jackson Group of formations of Eocene age. These consist of calcareous clays containing some sand and marl. A thin mantel of windblown silt thinning out in an easterly direction covers most of the area.

The Long Leaf Pine Hills is a broad upland area well dissected by numerous streams. Topography is gently sloping to steep with many wide ridgetops that are remnants of an old plateau. It is limited in extent and occurs in the extreme southeast portion of the Basin. Formations that crop out are Forest Hill sand and Vicksburg limestone, clays and marls of Oligocene age, and Catahoula sandstone of Miocene age. Thin windblown silt deposits cover much of the area.

The Loess or Bluff Hills lying in the southwest portion of the Basin is a steep upland area dissected by relatively deep gorges. Geologic material consists of windblown silt deposits of Recent age fifty feet or more thick near the bluffs along the Mississippi Delta and decreasing in thickness in an easterly direction. Underlying formations that crop out are Cockfield, various members of the Jackson group, Forest sand and Catahoula.

Soils

Corresponding roughly in location to the geologic physiographic areas are Land Resource Areas. These are physical groupings, based on soil and topography, made for purpose of agricultural interpretations. The Big Black Basin falls into four Land Resource Areas - Southern Coastal Plain, Thin Loess, Brown Loam or Thick Loess and Southern Mississippi Valley Alluvium (Figure 2.2).

The Southern Coastal Plain comprises the upper reaches of the Basin. Topography ranges from almost flat in the bottomlands to very steep in the uplands. The majority of the land is wooded but where slopes are gentle and soil conditions favorable, a general type farming prevails.

Principal upland soils are Ruston, Ora, Savannah, Prentiss, Stough, Shubuta, Boswell and Myatt. Ruston is a deep, friable, well drained soil. Ora, Savannah, and Prentiss are friable, moderately well drained soils with fragipans. Stough is a somewhat poorly drained soil with a fragipan. Shubuta is well drained and Boswell is moderately well drained over clayey subsoils. Myatt is poorly drained and not generally recommended for row crops. Yields of commonly grown crops are moderate to high when the soils are used within their capabilities.

Principal bottomland soils are Mantachie, Bibb and Iuka. Iuka is well drained and Mantachie is somewhat poorly drained. They are suited to most locally grown crops and are very productive when drained and protected from overflow. Bibb is a poorly drained soil generally used for forest or pasture.

The Thin Loess Resource Area is adjacent to the Southern Coastal Plains. Topography is rolling to steep with certain sections around the perimeter being rugged. Soils consist of thin loessal silts over Coastal Plain sands, clays and gravels. Bottoms are relatively wide and are used extensively for row crops. Uplands are used largely for pasture and forest.

Principal upland soils are Lexington, Providence, Grenada, Bude, Tippah, and others. Lexington is a deep well drained soil. Providence and Grenada are moderately well drained with fragipans. Grenada occurs in areas where the loessal layer is thicker. Bude is somewhat poorly drained with a fragipan and Tippah is somewhat poorly drained over clay. The soils are adapted to commonly grown crops, grasses and legumes and when managed within their capabilities, moderate to high yields may be expected.

Bottomland soils are similar to those of the Southern Coastal Plain and Brown Loam Resource areas. Internally the soils are dominantly well to somewhat poorly drained. They are very productive when provided with surface drainage and protected from overflow.

The Brown Loam or Thick Loess Resource Area is a rugged upland area of narrow ridge tops and steep side slopes. A mantel of windblown silts fifty feet or more thick near the Mississippi River Bluffs and thinning out toward the east covers the area. The more rugged parts are densely covered with hardwood trees but, where slope conditions are favorable, general farming is done. Bottoms are relatively wide and are extensively used for crop production. Principal upland soils are Memphis, Natchez, Lintonia, Loring, Grenada, Richland, Calloway and Olivier. Memphis and Natchez are deep, well drained soils. Loring, Grenada and Richland are moderately well drained with fragipans. Calloway and Olivier are somewhat poorly drained with fragipans. Yields of commonly grown crops are moderate to high when the soils are used within their capabilities.

Principal bottomland soils are Vicksburg, Collins, Falaya and Waverly. Vicksburg is well drained, Collins moderately well, and Falaya somewhat poorly. The soils are highly productive when drained and protected from overflow. Waverly is poorly drained and is best suited to grasses and trees.

The Southern Mississippi Valley Alluvium Resource Area comprises part of the Mississippi River floodplain. This is a nearly level plain interspersed with depressional areas that are remnants of old stream runs.

Dominant soils are Commerce, Tunica, Bowdre, Sharkey and Dowling. Commerce is a moderately well drained, loamy soil. Tunica and Bowdre are somewhat poorly drained clayey soils. Sharkey is a poorly drained, clayey soil and Dowling is a poorly drained, depressional soil. Yields are high when these soils are given surface drainage and protected from backwater.

Climate

The climate of the Study Area, in its broad aspects, is determined by the huge land mass to the north, its subtropical latitude, and the Gulf of Mexico to the south. In the spring and summer months the prevailing southerly winds provide a moist, semitropical climate favorable to afternoon thundershowers. In some periods of the summer and in the fall, the pressure distribution is altered so as to bring westerly or northerly winds with corresponding hotter and drier weather. In the colder season the Study Area is alternately subjected to warm tropical air from the Gulf of Mexico and cold continental air from the north. The cold spells seldom last more than 3 or 4 days at the time.

The average annual rainfall is about 52 inches with a high of about 54 inches at the extreme lower end of the Basin and a low of about 50 inches just northeast of Vicksburg. The length of the growing season will average about 225 days from the last killing frost in March to the first killing frost in late October or early November.

The mean average annual temperature varies from 64.0 degrees in the north end to 66.0 degrees in the south end. The average January temperature will vary from a low of 46.0 degrees in the north end to 49.0 degrees in the south end. The average July temperature will be 81.0 degrees at both the north and south ends but will reach a high of 82.0 degrees just east of Vicksburg.

The climate might briefly be described as having little severe cold in winter, little extreme heat in summer, short duration cold spells, long growing season, plenty of rainfall, plenty of sunshine and with dry spells coming most frequently at harvest time. Outdoor activities are generally favored year-round.

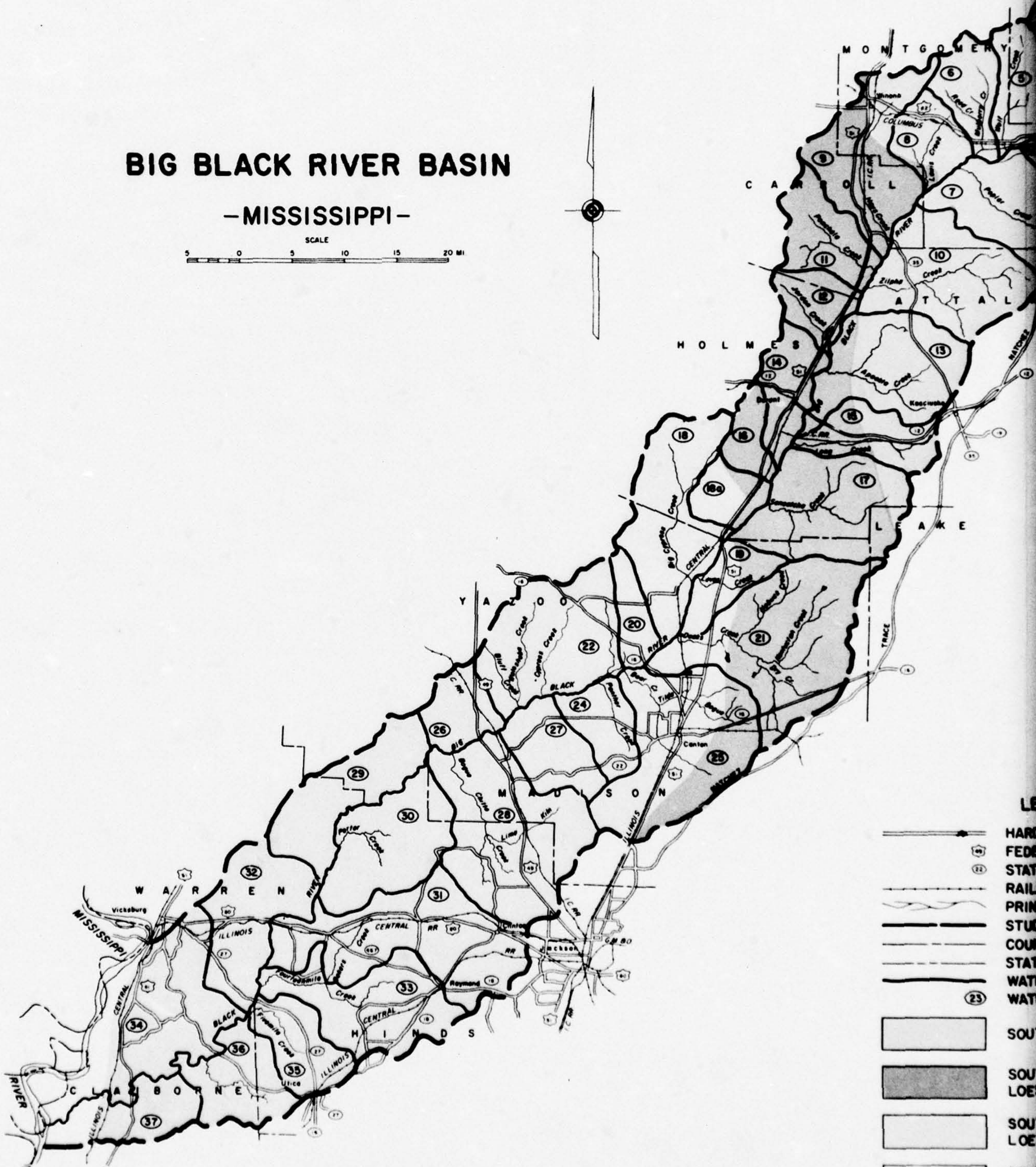


Figure 2.2. Land resource areas, Big Black Basin, 1965

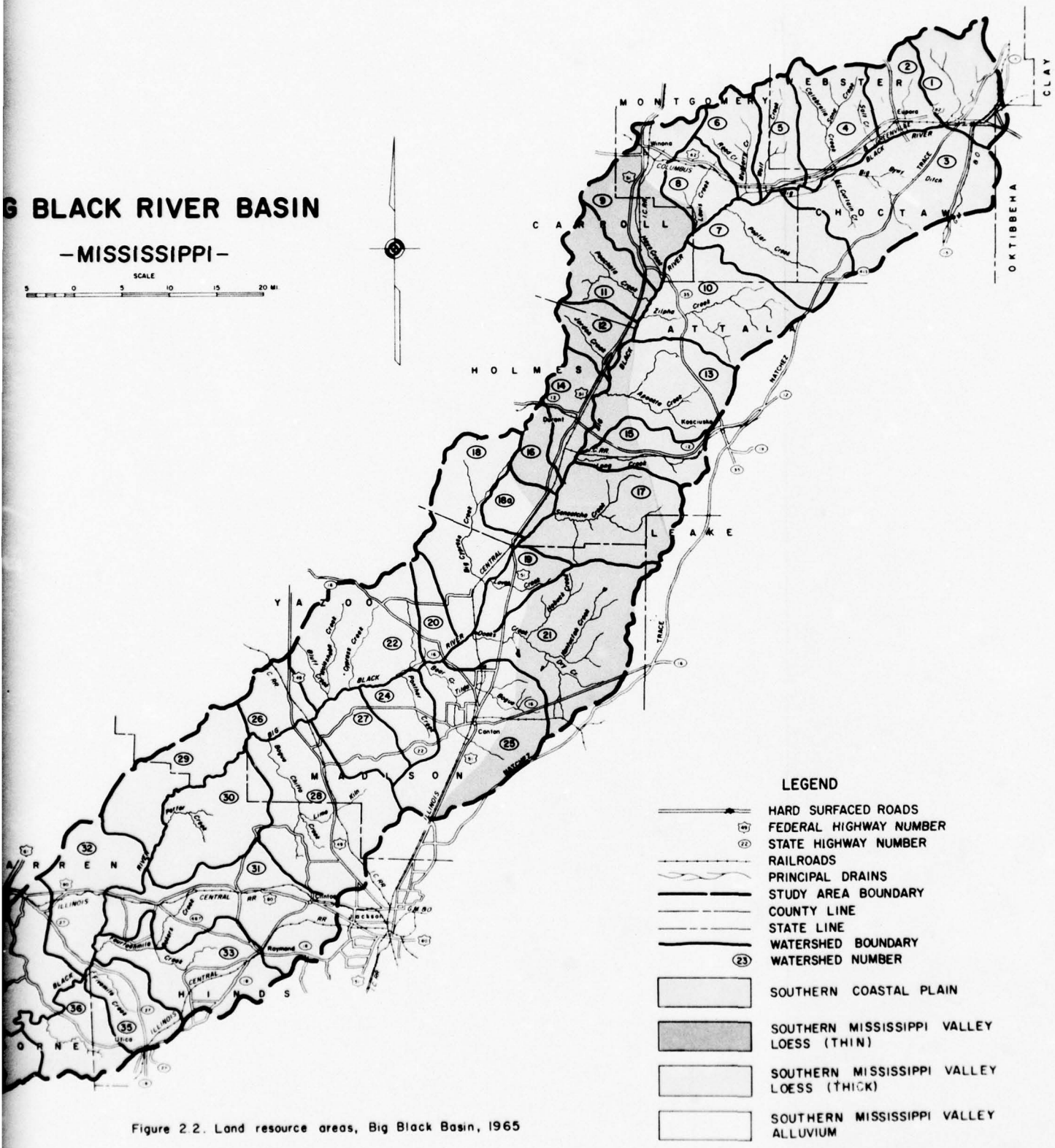


Figure 2.2. Land resource areas, Big Black Basin, 1965

Land Use and Cover

Total area of the 11 counties that comprise the Big Black Study Area is 4,339,700 acres. 1/ The major land use distribution is as follows; forest land - 57 percent, cropland - 23 percent, pastureland - 13 percent, and other uses - 7 percent. 2/

There are four major forest types in the Basin; loblolly-shortleaf pine, oak-pine, oak-hickory, and oak-gum-cypress. The types vary from loblolly-shortleaf in the northern part to the oak-pine and oak-hickory in the southern part. The oak-gum-cypress type is found mostly on land adjacent to the Big Black (Figure 2.3). About 20 percent of the total forest acreage is on bottom land.

Loblolly and shortleaf pines are the major pine species in the Basin. Principal hardwoods species are sweet gum, hickory, willow, and red and white oaks. Several other species such as black and tupelo gum, elm, yellow poplar, ash,beech, hackberry and sycamore are present in lesser quantities.

Cropland comprises about one-fifth of the total land area with over 80 percent in the upland. The principal crops are corn, cotton, soybeans, oats, and hay and account for over 85 percent of the crops harvested. Other minor crops found in the Basin include, but are not limited to, sorghums, potatoes, sugarcane, vegetables and fruits.

Pastureland refers to that land other than forest and cropland that is used for pasture or grazing. Approximately 78 percent of the acreage is located in the uplands. Principal grasses include Bermuda, Dallis, and Carpet.

Other uses occupy the remaining land area. A relatively small amount of land is currently devoted to this land use category.

1/ Excludes 127,400 acres in Hinds County which is included in the Pearl River Basin Study Area.

2/ Other uses include certain unclassified farm land, urban areas, water areas and Federal land excluding National Forests.

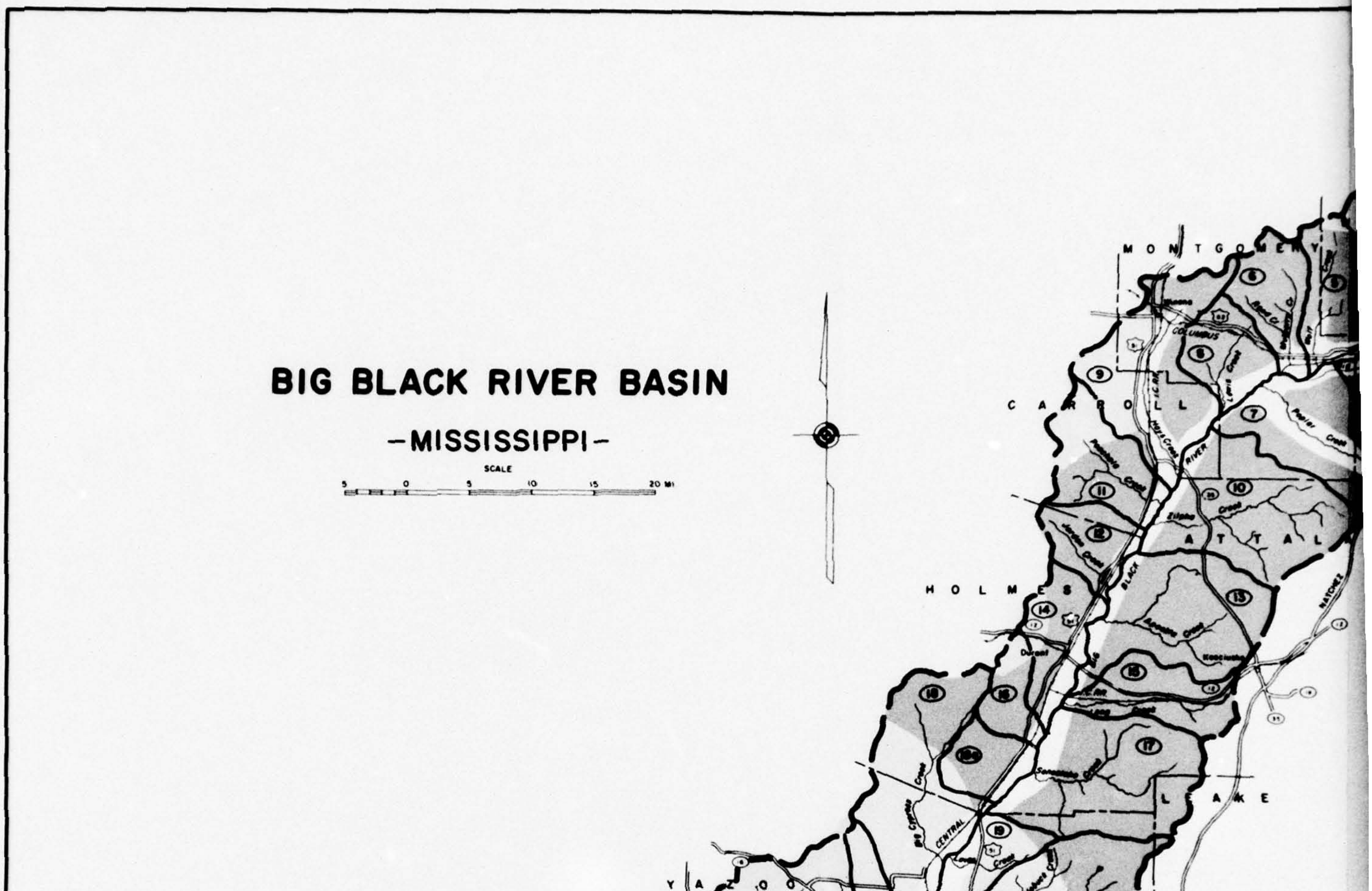


Figure 2.3. Major forest types, Big Black Basin, 1965

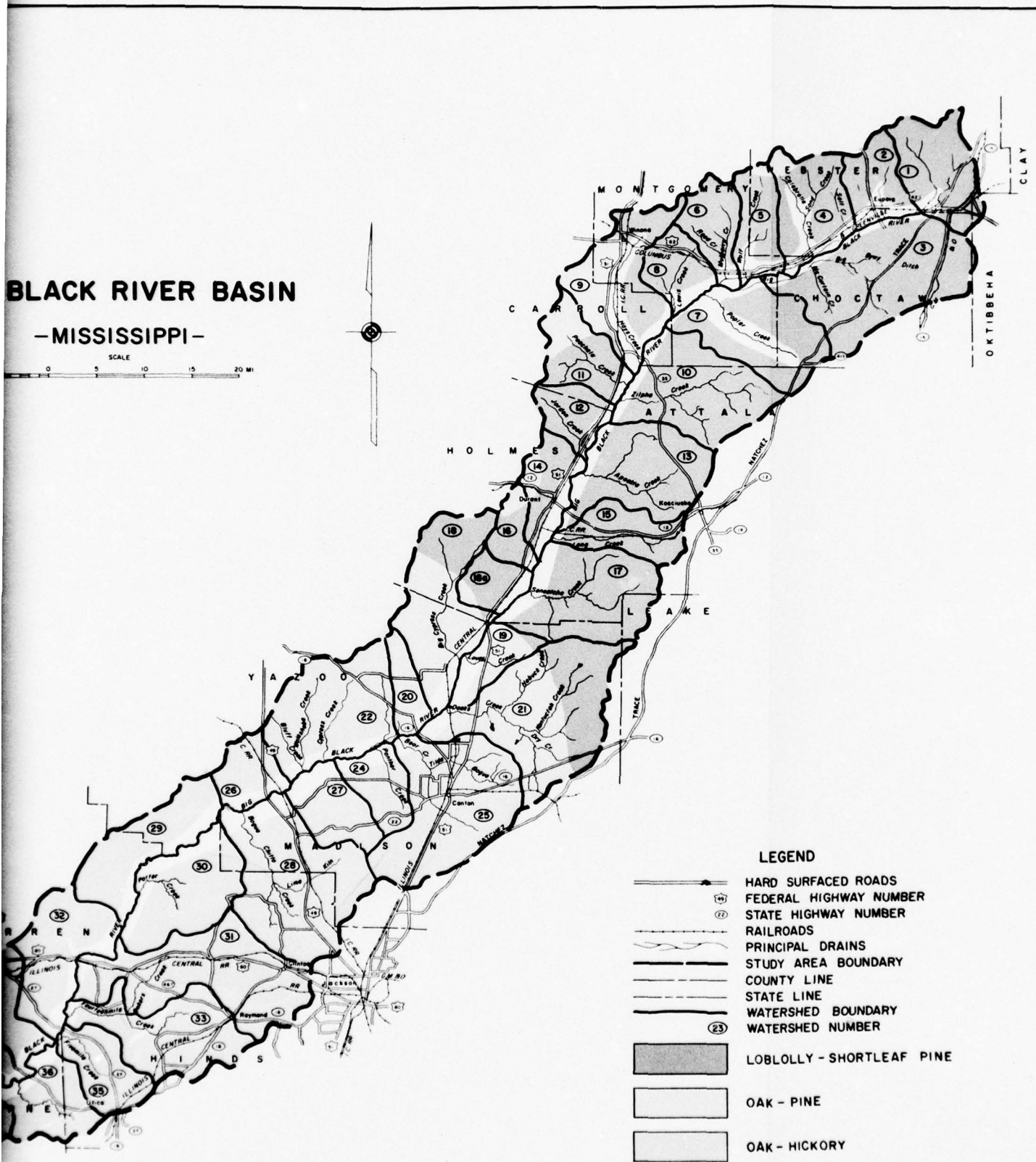


Figure 2.3. Major forest types, Big Black Basin, 1965

Hydrology

Water 1/

Abundant supplies of water of good quality are available in the Big Black Basin from either ground water or surface water sources. Flow in the lower half of the Big Black River is seldom less than 100 cfs (cubic feet per second) and low flows of more than 5 cfs are available in several of the eastern tributary streams in the upper half of the Basin. Chemical quality of water in the streams is excellent, except for impairment caused by pollution at several places.

The Big Black Basin is underlain by several thousand feet of clay, silt, sand, gravel, and limestone. This sedimentary material is mostly loose to semi-consolidated and is stratified. The beds dip to the southwest at the rate of 20 to 50 feet per mile. The Big Black flows southwestward but at a lower gradient; therefore, any specific formation is at a greater depth below the river the farther one goes down the river. The formations crop out in northwest-southeast trending belts.

Most of the available ground water is contained in six of the more permeable zones of the stratigraphic section underlying the Basin. These water bearing zones range in thickness from about 100 feet to about 1,000 feet. The aquifers overlap to the extent that a well drilled to the base of fresh water will in most places penetrate two or more aquifers.

Quality of the water is variable, but generally water suitable for most needs can be obtained. At most localities two or more aquifers, each containing water of different quality, are available. Dissolved-solids content of water within an aquifer increases down the dip. Also, generally the deeper a well is the higher will be the dissolved-solids content of the water. Shallow ground water (less than 200 feet deep) in the Basin usually contains about 100 ppm (parts per million) of dissolved solids. Most water in the Basin from more than 2,500 feet below land surface contains more than 1,000 ppm of dissolved solids. Several areas have deeper fresh water, but near the mouth of the Big Black River brackish water is found much shallower than 2,500 feet. There the base of the fresh water is only about 300 feet below land surface.

1/ Geology and Water Resources of the Big Black River Basin, Annex F, Geological Survey, United States Department of the Interior, 1966.

Practically all of the water used in the Basin is ground water--a limited amount of surface water is used for supplemental irrigation of row crops. Well depths range from less than 20 to 2,400 feet.

Wells producing 500 to 1,000 gallons per minute are common in the Basin. Most of the area is underlain by one or more aquifers from which a properly constructed well could produce as much as 2,000 gallons per minute. All towns in the area should have sufficient ground water available to at least double or triple their ground water pumpage.

Tributary Runoff

In the hydrologic cycle runoff is that part of the precipitation that appears in surface streams. Runoff for the tributary streams as a whole can be considered the same as stream-flow because of the small amount of artificial storage or diversions in the Basin.

Direct runoff (the runoff entering stream channels promptly after rainfall or snowmelt) in the 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 soil 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, 0.25 inches of direct runoff will occur from a 1.00 inch rain, 0.96 inches from a 2.00 inch rain, 1.82 inches from a 3.00 inch rain, 2.72 inches from a 4.00 inch rain, 3.66 inches from a 5.00 inch rain and 4.62 inches from a 6.00 inch rain.

Base runoff in the tributary streams of the Basin is not large but in most of the watersheds (in the larger streams of the watershed, at least) is large enough to provide some water for beneficial use. The watersheds on the east side of Big Black River and flowing west generally have more base flow than those watersheds on the west side of the river flowing east. There are smaller streams in every watershed that have little or no flow for varying periods of time during every year. There are indications that each square mile in a watershed does not contribute the same amount of base flow to total base flow at the foot of the watershed as does every other square mile. This indicates that as the drainage area of the streams become smaller the less dependable will be its base flow. The base flow dependability of any stream, from which beneficial water is expected to be taken, should be thoroughly checked before such use is undertaken.

In the tributary streams there are no long term stream gaging stations so that the volume of runoff could not be quantified. However, the stream gaging stations on the Big Black River proper indicate that there is an average annual runoff of between 16 and 17 inches from the Basin watershed area. There will be some variation in average annual runoff from one tributary watershed to another tributary watershed, but the variation probably will not be over one or two inches from the Basin average.

Tributary Streamflow Characteristics

All or almost all of the main tributary streams are perennial streams except in extremely dry years. Some of the smaller tributary streams are perennial (about 43 percent), some are intermittent or seasonal (about 45 percent), and some are ephemeral (about 12 percent).

The characteristics of flow after a runoff producing storm in most of the watersheds in the upper two thirds of the Basin are; (1) fairly fast and of short duration in the upper reaches, (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 overbank flow in even the larger watershed 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.

In the lower one-third of the Basin flows both stream and overbank are fast and of short duration. This is due to relative steepness of the terrain and of the valley slopes as well as to the relative large size of the channels as compared to the drainage area above the channel.

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 percent for the watersheds in the lower reach of the Basin to an average high of 14 percent for the middle two reaches. The upper reach has an average 13 percent of the watershed areas as floodplains. There is an estimated 81,500 acres of floodplain land in the 11 watersheds in the Kilmichael Reach,

37,500 acres in the 7 watersheds in the West Reach, 103,400 acres in 10 watersheds in the Bentonia Reach and 54,400 acres in 9 watersheds in the Bovina Reach. There are 276,800 acres of floodplain lands in the tributary watersheds of the Big Black Basin.

The frequency of damaging flood occurrence varies from an average low of 1.7 times per year in the Clear Creek Watershed to an average high of 5.0 times per year in Bear Creek Watershed. During the crop growing season the average low is 1.1 and the average high is 4.0 times per year in the respective watersheds. The average frequency of damaging flood occurrence in the watersheds by Basin reaches are: Kilmichael, 3.8 times per year and 2.5 during the crop growing season; West, 3.4 and 2.6; Bentonia, 4.1 and 3.1; and Bovina, 2.2 and 1.4.

The duration of flooding in the tributary floodplains are from 6 to 17 hours in the upper reaches of the watersheds, from 11 to 26 hours in the middle reaches, and from 12 to 46 hours in the lower reaches. The variation in duration of flooding is due to the size and the hydraulic characteristics of the watershed. Some of the overbank flow velocities become fairly swift, particularly in the open land areas. The maximum velocities reach the 2.5 to 3.5 feet per second range. 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 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 the 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

Wildlife habitat within the Study Area consists largely of two major forest types; the oak-gum-cypress type on the flood plain and the oak-pine type on the uplands. Agricultural developments are more extensive in the headwater areas; however, there is encroachment completely to river banks at points along the Basin. Steep topography within the lower one-fourth of the Basin, suited mostly for woodland, results in this section supporting high wildlife populations, particularly deer and turkey.

All game species common to the State are found throughout the Study Area. Quail, squirrels and rabbits are taken in large numbers. Past efforts of big game stocking by the Mississippi Game and Fish

Commission have taken place at strategic points. Records show at least eleven turkey releases within the Study Area over the past ten years. High deer and turkey populations are present within the Choctaw Game Management Area - 7,000 acres of which are within the Study Area. West of Highway 61, either sex deer harvests have been necessary to keep deer numbers within range capacity.

Although turkey populations are present through the middle and upper sector, the element of human disturbance has prevented the establishment of huntable populations in many localities. Only 13 turkeys were reported harvested during the 1966 spring season. Deer harvest was estimated to be 2,749 animals.

Waterfowl habitat is found largely where the major tributaries overflow into hardwood bottoms during the winter months and in the areas where the Big Black confluences with the Mississippi River. A number of oxbow lakes add diversity to waterfowl habitat.

The Basin is comparatively narrow, averaging 15 to 20 miles in width. For the most part hunter accessibility is not a problem. Established hunting and fishing camps are numerous only west of Highway 61 where accessibility becomes difficult during the winter months.

Fur resources have gone virtually untapped by local trappers over the past ten years. Low fur market prices correspond with high beaver, mink, and racoon populations. Beavers are present on most of the small streams and have created fish and waterfowl habitat along with drainage problems.

Fishery resources consist mainly of catfish, mostly flatheads, taken from the Big Black and game fish, principally crappie, bluegill, and bass, from natural lakes. There has been a slow decline in catfish production over the past several years. Whether it is sedimentation, loss of spawners through illegal harvest, a general lowering of fish populations in the Mississippi River that would offer restocking, or a combination of these and other factors, it is not clear. There is still, however, considerable fishing pressure applied along the Big Black by the overnight camper using trotlines.

An estimated 168 lakes over 20 acres in size are found within the Study Area. These lakes comprise 21,136 acres with most of this water being in large lakes within the Delta portion of the Study Area.

Timber Resource

The Study Area timber resource consists of 897.3 million cubic feet of growing stock. Eighty-one percent of this volume is hardwood species. Sawtimber volumes are estimated at 2.9 billion board feet. Hardwood species account for 79 percent of the total sawtimber volume and softwood species 21 percent. The average volume of standing timber per acre for growing stock is 380 cubic feet and 1,230 board feet for sawtimber.

The total net annual growth of growing stock is 64.7 million cubic feet - 79 percent from sawtimber class and 21 percent from pole timber class. Current sawtimber net annual growth is 53.4 million board feet of softwood and 143.3 million board feet of hardwood. The average net annual growth of growing stock is 27 cubic feet per acre. The growth for sawtimber is 83 board feet per acre which is about 20 percent of the average potential.

Ownership of the forest land is 97 percent private (57 percent farm, 7 percent forest industry, and 33 percent other private) and 3 percent public. Over 80 percent of the public ownership is Mississippi Sixteenth Section school lands.

Ninety-six percent of the growing stock and sawtimber inventory volume is on private land. The volume of standing timber per acre is 370 cubic feet for growing stock and 1,210 board feet for sawtimber. The public ownership volume of standing timber per acre for growing stock is 510 cubic feet and 1,770 board feet for sawtimber.

Since 1947, forest land has increased twelve percent. This is partially due to the accelerated tree planting brought about by the Soil Bank Conservation Reserve Program and the shifting of marginal cropland to forests.

During the calendar year 1965 the Study Area had a reported timber drain of 125.6 million board feet of board measure products and 200,176 cords of pulpwood. Board measure products include lumber, logs, poles, and cross ties.

CHAPTER III

ECONOMIC DEVELOPMENT-PRESENT AND PROJECTED 1980-2015

General

The principal factors determining the future water needs of the Basin are its population and production. As these increase, the withdrawal and use of water and needs in fields related to water resources will increase. Thus, one of the basic needs is the extent and character of water resource activities that will be needed for all purposes between the present time and 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 requires 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 impacts of these projects on the people and the economy they are intended to serve.

Assumptions

The projections of economic growth in the Study Area 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 in hostilities.

Limitations

To predict what will happen in the Study Area over 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 small Basins such as the Big Black, analysis 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 in these areas among the smaller economic components, 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

The effect of national wartime mobilization upon an agricultural economy is exemplified in the Big Black Study Area. Prior to World War I the Study Area's population was increasing. However, by 1920, it showed a decline. By the time the Study Area had almost recovered this loss, World War II occurred, and its population tumbled back to less than its pre-World War I level. Obsolescence of small-scale farming during the 1950's continued the downward trend, leaving 241,900 people in the Area in 1960, slightly less than the number 70 years earlier.

Population in the Study Area is forecast to continue downward to 235,400 in the middle 1960's and slowly rise to 248,500 by 1980. Increased growth in the Vicksburg and Jackson areas is expected to halt the short-range population decline. From 1980 to 2015, the Study Area population should expand to 379,000 (Table 3.1).

In 1930, rural residents comprised 85 percent of the total population. Despite a severe decline in rural population from 232,300 in 1930 to 168,900 in 1960, 70 percent of the Study Area population remained in the rural category in 1960.

It was not until 1960 that the number of rural non-farm inhabitants exceeded rural farm. Previously about three-fourths of the rural population resided on farms. However, between 1950 and 1960 a 51 percent decline in rural farm population and a 63 percent increase in rural nonfarm population resulted in non-farm residents comprising the greater percentage of total rural population. Despite the decline, the number of rural farm residents still accounted for 42 percent of the rural population.

The decade of greatest relative urban advance occurred from 1930 to 1940 when urban population rose 26 percent. The expected growth in urban population in the period 1960 - 2015 will be tantamount to the increase in urban population in the Vicksburg urbanized area and that portion of the Jackson urbanized area lying within the Study Area boundary. From 1960 to 1980, population in the urban areas is projected to grow at a modest rate. Unlike the slow transition period of 1960-1980, the Study Area is forecast to experience a marked breakthrough in urbanization from 1980 to 2015, based on the full impact of Jackson's urban expansion and a rising nonagricultural employment status.

Table 3.1. Summary of projections of major economic indicators for the Big Black Study Area, 1930-60 and projected 1965, 1980 and 2015

Item	Historical				Projections		
	1930	1940	1950	1960	1965	1980	2015
Population (Thousands)	274.0	298.9	266.4	241.9	235.4	248.5	379.0
Number of households (Thousands)	67.1	75.3	69.4	63.7	62.6	68.6	111.5
Labor force (Thousands)	119.2	114.0	94.4	80.3	77.3	81.9	124.9
Employment (Thousands)	114.9	100.0	89.7	74.2	70.2	72.1	109.2
Personal income (Millions of 1962 dollars)	96.6	136.5	223.9	275.5	311.8	430.1	1,088.7
Per capita income (1962 dollars)	353	457	840	1,139	1,325	1,731	2,873

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.

A continuing decline is anticipated in the rural population through the late 1960's. However, some stabilization is expected to occur before 1980, resulting in a 1980 farm population of 30,700. As rural farm population declines to approximately 23,000 in 2015, the rural nonfarm population is forecast to climb simultaneously to 136,600.

Labor Force

The employment potentials of the Study Area are 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 labor force includes all persons 14 years and over classified as employed or unemployed, as well as members of the Armed Forces. Employed persons are all civilians 14 years and over who were either at work (those who did any work for pay or profit or worked without pay for 15 hours or more on a family farm or in a family business), or with a job but not at work, such as those who had a job or business from which they were temporarily absent because of bad weather, industrial disputes, vacations, illness or other personal reasons.

A declining labor force has withered the short-run development potential of the Study Area. Large out-migrations of unemployed workers caused a 33 percent loss in total labor force from 1930 to 1960. The remainder of this century will be required to regain the 1930 level, and by 2015, the total labor force is projected at only 124,900. No reversal of the current labor force down-turn is expected before 1980, when as previously referred to, Jackson's population expansion should become a major source of labor force growth. Vicksburg should also contribute to the growth after 1980.

Employment

The Study Area suffered declining employment in each decade between 1930 and 1960. With the downswing in demand for agricultural labor, total employment declined from 114,900 in 1930 to 74,200 in 1960. No reversal of this employment downtrend is anticipated in the near future.

The slow pace of industrial development and the necessity for further downward adjustments to stabilize the level of agricultural employment will cause total employment to shrink to about 70,200 in the middle and late 1960's. In the 1965-2015 period, employment is expected to turn upward slightly and reach 72,100 in 1980; then expand to 109,200 in 2015. An important portion of the

labor force in the Big Black in proximity to Jackson should derive its personal income from employment in Jackson and the upper Pearl River Basin.

Employment in Nonagricultural - Nonmanufacturing Industries

Nonagricultural-nonmanufacturing employment, one of the three major divisions of total employment, consists of employment in nine industrial divisions. They are - mining, contract construction, transportation and communications, utilities, wholesale and retail trade, finance-insurance and real estate, services, government and other industries.

Between 1930 and 1960, nonagricultural-nonmanufacturing employment in the Study Area rose only 57 percent. During the forecast period, the employment level is projected to rise about two-thirds to 71,800 in 2015. The economy of the Study Area offers little expansion stimuli.

Employment in Major Water-Using Manufacturing Industries

This Study Area contains few workers in major water-using industries. The Area could claim but 400 such workers in 1930 and 1,800 in 1960 and projections indicate only 7,000 workers in all major water-using industries by 2015.

In coming periods, only employment in the food, chemical and paper industries can be construed as displaying growth quantities among major water-using industries. Employment of 800 in the chemical industry in 1960 is forecast to expand to 3,500 by 2015. Employment in the food industry is expected to increase from 900 to 2,700. Some expansion in employment in petroleum refining and a major development of the paper industry round out all employment of consequence in the major water-using industries anticipated in the Study Area.

Employment in Other Manufacturing Industries

The manufacturing sector of the economies of both the United States and the Study Area is now undergoing changes that profoundly affect the techniques of production and in turn, the demand for human skills. Most lines of manufacturing are directly substituting capital and machine-time for manpower. Routine clerical and bookkeeping jobs are being displaced by computers in practically all industries. In companies that produce or distribute goods in large quantities, the extensive use of conveyors and other devices for handling materials is rapidly replacing manpower. Manufacturing concerns are replacing labor by electronic devices in both production and quality-control operations.

All manufacturing industries not classified as major water-users compose the other manufacturing industries. Hence, employment in other manufacturing industries includes employment in the following specific industries; textiles, apparel, lumber-wood and furniture, printing and publishing, stone-clay and glass, fabricated metal products, machinery - except electrical, electrical machinery, transportation and other manufacturing with relatively small employment.

The Study Area must be judged insignificant as an employment center for other manufacturing industries. In 1960, about one-half of other manufacturing employment was concentrated in the lumber, wood and furniture groups. Over the forecast period, major employment gains are projected in apparel, nonelectrical machinery and electrical machinery. A substantial share of these employment gains will be attributable to the growth of manufacturing activity in the Vicksburg area.

Employment in Agriculture

Agricultural employment includes employment in agricultural, forestry and fishing operations. Employment shifts in the economy of both the Study Area and the United States have tended to be influenced historically by decreasing demands for labor in agriculture. Massive adjustments in the agricultural sector have been precipitated by an expansion in the size of farms, mechanization of agricultural jobs, and dramatic gains in agricultural productivity. These adjustments, occasioned by the substitution of capital for human labor, have freed a large portion of the agricultural labor force for employment in other occupations.

Over the past three decades the national growth in output per man hour in agriculture has been very rapid - at a rate approaching 1.5 percent per year. This growth has been achieved with approximately the same crop acreage but with a large increase in the amount of farm machinery and equipment per man. Further, declining labor requirements have been accompanied by higher expenditures for variable capital inputs, viz., fertilizer, seed, insect and disease control and weed eradication.

Agricultural employment in the Study Area stood at 83,014 in 1930 and represented 72 percent of total employment. Since then, agricultural employment has declined significantly each decade and represented only 21 percent of total employment in 1965. This trend is expected to continue, however, the rate of decline beyond 1980 should be less drastic than the decline prior to then (Table 3.2).

Table 3.2. Employment by major categories, Big Black Study Area, 1930-60, projected 1965, 1980 and 2015

Year	Agriculture	Manufacturing	Nonagricultural-nonmanufacturing	Total
	Number	Number	Number	Number
1930	83,014	4,303	27,610	114,927
1940	63,193	5,836	30,990	100,019
1950	41,806	7,596	40,350	89,752
1960	20,146	10,714	43,304	74,164
1965	14,600	11,700	43,900	70,200
1980	8,500	15,000	48,600	72,100
2015	6,000	31,400	71,800	109,200

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.

Personal 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 - wages and salary disbursements, other labor income, proprietors' income, property income, and transfer payments, less personal contributions for social insurance.

Personal income in the Study Area rose 185 percent from 1930 to 1960. The growth rate was short of that achieved by most areas in proximity to the Study Area. Personal income is expected to rise almost 300 percent from 1960 to 2015 but the increase in areas surrounding the Study Area should be greater.

The rate of growth in personal income is expected to accelerate to a steeper slope from 1980 to 2015, due to the expected faster growth in that portion of the Study Area included in the Jackson Standard Metropolitan Statistical Area. It is assumed that major expansion in industrial payrolls and other diversified economic development near Jackson, as well as throughout the Study Area, will occur to correct the current economic deficiencies.

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 the marriage rates in the adult population and, especially since 1950, 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.

The number of households peaked at 75,300 in 1940 and since then there has been a constant decline. Continued out-migration of family farming age groups during the 1940 to 1960 period caused an absolute decline in the number of households by almost 12,000. In fact, the Study Area contained more households in 1930 than in 1960; 67,100 in contrast to 63,700.

Household declines are expected to continue until after 1965. It should be 1980 when households are projected at 68,800 - before the number of households again approaches the 1950 level of 69,400. The overflow of Jackson's residential areas into the Study Area should then become a large factor in the rise in number of households.

The Land and Water Resource Base

The total land resource base is divided into two broad classes - land in farms and land not in farms. Detailed use of land in farms was derived from Censuses of Agriculture. Land use of the area not in farms was derived from information presented in the 1958 Conservation Needs Inventory. 1/ Major land use data for the Study Area are presented in Table 3.3.

A primary factor affecting future agricultural production is the availability and quality of land. A number of forces are working to reduce the land resource base available for agricultural use. Land is currently being withdrawn from agricultural use for urban and industrial uses and for related developments required to support the expanding economy and the related increase in population. Highway development, airport construction and recreational demand on the land base are notable examples. Reservoirs and other types of water and related land resource developments also require additional land. Urban use of land will increase from 131,640 acres in 1959 to approximately 293,000 acres in 2015.

1/ Reference here and elsewhere in report refers specifically to 1958 Conservation Needs Inventory.

Table 3.3. Major land use, Big Black Study Area, 1959 and projected 1980 and 2015

Land	1959	Projected 1980	Projected 2015
	Acres	Acres	Acres
In farms	2,985,579	3,110,700	2,888,100
Cropland	983,220	951,800	827,900
Harvested	527,938	490,800	411,300
Used for pasture	336,347	363,300	317,100
Idle	118,935	97,700	99,500
Woodland	1,301,308	1,434,500	1,330,700
Pasture	588,802	622,700	641,200
Other farm land	112,249	101,700	88,300
Other than in farms	1,354,121	1,229,000	1,451,600
Forest 1/	1,174,461	1,034,100	1,100,700
Federal 2/	13,130	13,600	14,600
Urban	131,640	140,000	293,000
Water 3/	34,890	41,300	43,300
Total approximate area	4,339,700	4,339,700	4,339,700

Source: Mississippi Soil and Water Conservation Needs Inventory, 1958-1975 and United States Census of Agriculture - Mississippi Counties - 1959, United States Department of Commerce.

1/ Includes National Forest land of 11,213 acres.

2/ Does not include National Forest land.

3/ Area converted to new water not deducted from total approximate area.

The demand for nonagricultural land is not as great in the Study Area as the demand that exists in other areas of the United States, however, this demand will exert increasing influence beyond those projected years used in this study. The farm agricultural base is expected to increase slightly between 1959 and 1980, although only a negligible amount. This is presumed to result from farm operators purchasing fringe land adjacent to present operations basically for two uses - improved and expanded farm forestry enterprises and development of additional areas for the production of soybeans. The agricultural resource base is expected to decrease slightly between 1980 and 2015. The decline is not significant since within the farm land base there exists room for flexibility in uses.

Agricultural Economy

The agricultural portion of the total economy of the Study Area was developed to cover three time periods: (1) historical years (primarily up through 1959); (2) the year 1980; and (3) the year 2015. The present status for farm characteristics is indicated primarily in terms of 1959 data and for forestry, primarily in terms of 1957 data.

National Production Requirements

The food, feed and fiber (wood and cotton) requirements were developed to support a national population of 254 million in 1980 and 461 million in 2015. The projected national requirements for 1980 and 2015 represent a need of 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.

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 products 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. The historical and projected per capita utilization rates of major farm products in the United States are shown in Table 3.4. Current and projected requirements for major crops, livestock products and industrial timber products are presented in Table 3.5.

Table 3.4. Per capita utilization of major farm products, United States, 1959-1961 and projected 1980 and 2015

Item	1959-1961	1980	2015
	Number	Number	Number
Eggs	359.5	308.7	307.8
	Pounds	Pounds	Pounds
Cotton	-----	41.0	41.0
Wheat	393.4	366.0	300.0
Rye	8.7	7.7	7.2
Rice	29.3	33.1	22.4
Flax	8.8	5.1	4.7
Soybeans	198.3	333.0	302.4
Peanuts	9.7	9.9	9.8
Sugar cane	85.3	146.0	190.0
Sugar beets	188.6	278.0	362.0
Dry beans	10.3	7.7	7.7
Dry peas	2.2	1.2	1.2
Potatoes	142.8	158.1	157.6
Sweet potatoes	9.3	6.8	6.8
Vegetables	230.4	236.6	236.0
Citrus fruit	85.4	96.0	92.0
Noncitrus fruit	89.6	96.0	106.0
Tree nuts	1.7	1.6	1.6
Beef and veal	156.0	193.1	197.4
Lamb and mutton	9.2	6.9	7.0
Pork	113.7	97.8	97.7
Chicken	41.9	46.4	50.0
Turkey	8.5	13.9	13.8
Milk	670.2	583.5	578.1

Source: Internal data, Economic Research Service, United States Department of Agriculture (subsequent statistical releases reflect slightly different disappearance rates).

Table 3.5. Current and projected requirements for major crops, livestock products, and industrial timber products, United States, 1959-61, 1980 and 2015 1/

Commodity	Unit	1959-1961	1980	2015
		Thousands	Thousands	Thousands
Crops				
Cotton	Bales	---	20,582	37,802
Feed grains	Thou.F.U.	287,432,000	344,196,000	465,213,000
Wheat	Bushels	1,185,533	1,660,071	2,469,643
Rye	Bushels	28,143	34,925	59,271
Rice	Cwt.	52,960	84,070	1,032,640
Flax	Bushels	28,411	23,132	38,691
Soybeans	Bushels	597,600	1,409,700	2,324,400
Peanuts	Pounds	1,760,000	2,515,000	4,517,800
Sugar crops:				
Sugar cane	Tons	7,712	18,542	43,795
Sugar beets	Tons	17,047	35,306	83,441
Dry beans	Cwt.	18,710	19,558	35,497
Dry peas	Cwt.	4,010	3,048	5,532
Potatoes	Cwt.	258,230	401,320	728,380
Sweet potatoes	Cwt.	16,840	17,272	31,348
Vegatables	Cwt.	416,640	600,964	1,087,960
Fruits, citrus	Tons	7,723	12,192	21,206
Fruits, noncitrus	Tons	8,098	12,192	24,433
Tree nuts	Pounds	307,000	406,400	737,600
Livestock				
		Millions	Millions	Millions
Beef and veal 2/	Pounds	28,206	49,047	91,001
Lamb and mutton 2/	Pounds	1,658	1,752	3,227
Pork 2/	Pounds	20,564	24,841	45,040
Chicken 2/ (Ready to cook)	Pounds	7,571	11,786	23,050
Turkey 2/ (Ready to cook)	Pounds	1,540	3,531	6,362
Milk	Pounds	121,164	148,209	266,504
		Millions	Millions	Millions
Eggs	Number	64,993	78,410	141,896

Continued

Table 3.5. Current and projected requirements for major crops, livestock products, and industrial timber products, United States, 1959-1961, 1980 and 2015 1/ (Continued)

Commodity	Unit	1959-1961	1980	2015
		Thousands	Thousands	Thousands
Industrial timber products 3/				
Saw logs (lumber)	Cu.ft.	4/5,191,000	6,050,000	8,340,000
Veneer logs (veneer and plywood)	Cu.ft.	4/ 856,000	1,540,000	2,400,000
Other miscellaneous industrial timber products	Cu.ft.	4/ 464,000	460,000	460,000
Total	Cu.ft.	4/6,511,000	8,050,000	11,200,000
Pulpwood	Cords	4/ 41,700	77,000	138,500

Source: Internal data, Economic Research Service and Forest Service, United States Department of Agriculture.

1/ These data were adopted by the USDA Field Advisory Committee for planning purposes. Subsequent data releases reflect some minor adjustments.

2/ Liveweight.

3/ All round timber products harvested from the forests except fuelwood. Estimates exclude Hawaii, Alaska, and the Tennessee Valley.

4/ Timber products data are for 1962.

Big Black Study Area Production Requirements

A share of the future national production requirements for agricultural products was assigned to the Big Black Study Area based upon the past relationship of the Area's production to that of the State of Mississippi. The share assigned to Mississippi was based upon the past relationship of its production to that of the Delta Area composed of Mississippi, Arkansas and Louisiana. The Delta Area's assigned share was based on its past production relationship to that of the United States. The Study Area production requirements, therefore, were stepped down from the national level, to a regional level, to a state level, thence to those counties that compose the universe under investigation.

Information concerning agricultural production in the Study Area 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 the analysis, however, was from USDA Crop Reporting Board information

and United States Agricultural Censuses. The difference between present output in the Study Area and its assigned share of the projected requirements provides a guide to the needs for development of land and water resources of the Study Area to meet future needs for agricultural products. Selected current and projected agricultural and forestry statistics are presented in Table 3.6.

Table 3.6. Agricultural and forestry resource statistics, Big Black Study Area, 1954 and 1959 and projected 1980 and 2015 1/

Item	1954	1959	Projected 1980	Projected 2015
General				
Number of farms	29,325	18,911	8,800	7,700
Average size of farm (acre)	129	176	360	380
Capital investment (million dollars)	176	236	264	362
Average investment per farm (dollars)	6,000	12,500	30,000	47,000
Agricultural production base				
Land in farms (thousand acres)				
Cropland	1,143	1,014	974	844
Woodland	1,555	1,322	1,450	1,342
Pasture	660	612	640	654
Other	120	116	104	90
Total	3,478	3,064	3,168	2,930
Use of cropland (thousand acres)				
Cotton	247	172	169	183
Corn	225	174	80	43
Soybeans	55	60	101	76
Oats	42	27	31	20
Hay	79	68	79	63
Miscellaneous	63	39	40	33
Total harvested	711	540	500	418
Total pasture	298	351	374	325
Total idle	134	123	100	101
Total cropland	1,143	1,014	974	844

Continued

Table 3.6. Agricultural and forestry resource statistics, Big Black Study Area, 1954 and 1959 and projected 1980 and 2015 1/ (Continued)

Item	1954	1959	Projected 1980	Projected 2015
Pasture for livestock (thousand acres)				
Cropland	298	351	374	325
Woodland	982	796	725	671
Other - permanent pasture	660	612	640	654
Total pastureland	1,940	1,759	1,739	1,650
Land in forests (thousand acres)				
Farm forests	1,555	1,322	1,450	1,342
Nonfarm forests	789	1,186	1,043	1,107
Total forests	2,344	2,508	2,493	2,449
Other land and/or water use (thousand acres)				
Federal	---	13	14	15
Urban	---	169	200	370
Water	---	35	42	45
Total other	---	217	256	430
Agricultural production requirements				
Crop production				
Cotton (thou.bales)	174	176	220	340
Corn (thou. bu.)	3,106	5,411	3,600	2,795
Soybeans (thou. bu.)	588	1,234	2,717	2,806
Oats (thou. bu.)	1,447	1,026	1,575	1,200
Hay (thou. tons)	82	91	158	189
Livestock number (thou.)				
All cattle and calves	404	375	550	798
(milk cows)	57	32	13	9
Sheep and lambs	11	10	5	7
Hogs and pigs	123	146	73	60
Horses and mules	44	25	12	9
Farm chickens	681	855	1,375	1,238
Broilers	812	1,585	2,246	3,995
Turkeys	16	22	30	31

Continued

Table 3.6. Agricultural and forestry resource statistics, Big Black Study Area, 1954 and 1959 and projected 1980 and 2015 1/ (Continued)

Item	1954	1959	Projected 1980	Projected 2015
Livestock production				
Beef and veal (thou.lb.)	---	93,750	175,705	276,279
Lamb and mutton (thou.lb.)	---	286	214	289
Pork (thou.lb.)	---	37,814	19,669	18,077
Broilers (thou.lb.)	---	4,914	7,862	13,982
Turkeys (thou.lb.)	---	374	600	624
Milk (thou.lb.)	69,628	68,916	61,339	83,340
Eggs (thou.)	16,102	52,507	250,000	338,000
Forest production 2/				
Growing stock (million)				
Inventory Cu. ft.	---	897.3	1,468	1,187
Growth Cu. ft.	---	64.7	60	52
Cut Cu. ft.	---	65.8	35	57
Sawtimber (million)				
Inventory Bd. ft.	---	2,922.0	2,605	1,961
Growth Bd. ft.	---	196.7	116	102
Cut Bd. ft.	---	248.9	123	143

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/ Agricultural estimates include all of Hinds County. To factor each item would not have resulted in more reliable estimates either for present or future time frames.

2/ Historical forestry production data for 1956.

Farm Production

The increase in population expected in the United States for 1980 and 2015 will place some demands on the Study Area for an expanded agricultural production of certain products. Studies indicate that there will be an increased demand for agricultural products such as cotton, soybeans, feed crops and livestock and poultry products that are produced in the Study Area. In order to meet national needs for food and fiber products, it is projected that the Study Area would need to produce 164 thousand more bales of cotton in 2015 than were

produced in 1959. In addition, the Study Area would need to produce 2,218,000 more bushels of soybeans in 2015 than were produced in 1959.

Due to expanded national demand for livestock and poultry products, production of some products will increase in the Study Area and some will decline because of production efficiencies. Study Area production of beef and veal will need to expand by 183 million pounds in 2015 as compared to 1959. Likewise, the Study Area would need to produce about 9 million more pounds of broilers and turkeys, 14 million more pounds of milk and 24 million more dozens of eggs than were produced in 1959. Studies indicate that pork production in the Study Area will decline approximately 52 percent by 2015 when compared with 1959 production. An expanded output of agricultural products must be met with fewer farms and farm people on essentially the same land base as existed in 1959.

Farm marketings of agricultural products are projected to reach $123,000,000 in the year 2015 in the Study Area as compared to $73,000,000 in 1959. Cotton, cattle and calves, eggs and soybeans currently, and will in the future, account for most marketing receipts. Farm size will be more than twice as large in 2015 as in 1959 and the total capital investment will increase by more than 50 percent. Average investment per farm will increase from $12,500 in 1959 to $47,000 in 2015, an increase of 276 percent.

Commodity Requirements

Total agricultural output in the Study Area is projected to increase in the aggregate but for some individual commodities a decrease is projected. The projected amount is the requirements of the area to meet its share of local and national requirements including exports. Farm operators may find it to their advantage to produce more of some commodities and less of some others. However, the resources of the area are such that the requirements could be produced should it be profitable for farmers to do so. Increased production will occur from shifts in acreages of crops and in the number and types of livestock, and from increased yields per acre of crops and per head of livestock. Crop yield estimates are presented in Table 3.7.

Cotton - Cotton is the number one money enterprise in the Study Area and is projected to be number one in 1980 and 2015. Acreage is currently declining with a bottoming out expected in the 1980's and a gradual increase from then to 2015. Production is anticipated to actually increase due to the achieved and obtainable yields per acre.

The Study Area lies adjacent to the renowned Delta cotton country and profits by the adoption of proven production techniques.

Table 3.7. Yield per acre of selected crops, Big Black Study Area, 1954 and 1959 and projected 1980 and 2015

Crop	Unit	1954	1959	Projected 1980	Projected 2015
Cotton	Bales	0.7	1.0	1.3	1.9
Corn	Bu.	14	31	45	65
Soybeans	Bu.	11	21	27	37
Oats	Bu.	34	38	51	60
Hay	Tons	1.0	1.3	2.0	3.0

Source: Derived study data.

Certainly, the immense interest in soybean production makes it difficult to assess what the future holds in store for these companion enterprises. It is anticipated that cotton will still reign supreme because of its proven income potential and also due to the nature of farm resources controlled by the farm operators.

Corn - Corn has always been important in the farm business. This crop currently is the number one user of harvested cropland. In the main, corn has never been used as a major cash money generating source.

It is anticipated that corn acreage will decline through the projected target years. Yields per acre have been traditionally low. Corn, in many instances, is used to round out the farm business and absorb left-over resource inputs from other major money crops. While some corn enters the marketing channel as grain, most is used on farms where produced - basically for livestock feeding and human consumption.

Oats - Oats are the most important small grain produced in the Study Area. Acreage and production both appear to change in an erratic manner. No real definitive direction in acreage or production is identified. It is reasonable to assume that oats will continue as a crop enterprise.

Empirical evidence indicates that yields are improving and high yields are obtainable on the soils of the Area. This enterprise, like other minor ones, appears destined to remain of a second rate nature until such time as the competitive situation changes - no significant change anticipated in near future.

Soybeans - Soybeans are being heralded as the miracle crop of the century. The evolving factors certainly warrant prudent observation. Will it replace cotton in an Area such as the Big Black? Evidence certainly indicates that soybean acreage is increasing and probably will continue to rise through the 1980's. Beyond that time, a decline is anticipated.

It is reasonable to expect many farmers to "cash in" on this crop, but some skepticism is anticipated until such time as production, orderly marketing, product utilization, etc., are supported by proven methods. Soybeans will not overcome the supremacy of cotton in the near future.

Hay - The principal hay crops grown are small grain, lespedeza, clover-timothy, alfalfa and miscellaneous hay. There will be an increased hay requirement needed for the projected increase in livestock output. Acreage devoted to the production of hay crops is not expected to change much from the current acreage. Increased output will be realized from increased yields and shifts to those hays better adapted to the land and climatic conditions.

Miscellaneous and Other Crops - Most of the acreage of miscellaneous and other crops is used for products for home consumption, livestock feed, and product sales for pocket money. A decline in acreage will occur as the number of farms decline and particularly sub-marginal units.

Beef and Veal - Sale of cattle and calves and associated products is the most important source of livestock receipts and ranks second to receipts from cotton and cottonseed - currently and for each projected year. Receipts from sale of mature cattle now exceed that from calf sales but the situation is anticipated to reverse by 1980 and gradually increase the gap by 2015.

Beef and veal production is projected to increase from 94 million pounds in 1959 to 176 million pounds in 1980 and to 276 million pounds in 2015. Beef and veal production, currently and in the future, exceeds the demand of Study Area inhabitants. The Study Area is in a relatively good competitive position in the production of grass-fed cattle. Some limited grain feeding operations now prevail and this practice is anticipated to grow in importance. Grain storage facilities appear adequate presently.

It is anticipated that livestock leaders will insure adequate storage facilities and develop them in conjunction with the evolving needs. An increasing demand for soybean storage facilities will be a factor in the use of facilities - existing or to be constructed.

Pork - The number of hogs and pigs on farms declined from 176 thousand head in 1950 to 140 thousand head in 1960. Since 1960 the decline has been more rapid and is expected to continue through 1980 and 2015. Production, likewise, will decline.

It is not anticipated that the decline in pork production will be offset by a decline in per capita consumption. An objective measuring of the consumption pattern of the inhabitants would probably reveal consumption rates in excess of the national averages. The pork demands of the inhabitants will be logically met from pork producing areas with a comparative production advantage.

Workstock and swime traditionally have been the prime consumers of corn in the Study Area. The decline in corn production and swine numbers appear closely related.

Lamb and Mutton - Sheep production is a minor enterprise with little or no change anticipated in future years. National future requirements indicate that the State of Mississippi and the Study Area will contribute only a meager portion. With other changes and adjustments being made in the Study Area's agriculture, it is likely that sheep and lamb production will do no more than hold its own in the future and continue to be a deficit producing area.

Broilers - The production of broilers is a relatively minor farm enterprise. Production is concentrated on less than one percent of total farms.

Production is projected to increase from 5 million pounds in 1959 to 8 million pounds in 1980 and 14 million pounds in 2015. The Study Area is deficit in broiler production in relation to inhabitant needs but a plentiful supply is available from other areas within the State of Mississippi.

Eggs - The production of eggs is an important and profitable poultry enterprise. Approximately 2,000 farm operators are engaged in egg production and cash receipts rank second to those of cattle and calves in the livestock and poultry category.

The headquarters of one of the largest commercial egg operations in the United States is located in the Study Area. The dynamic approach of this firm in production, processing and distribution indicates tremendous growth potential in the Study Area and adjacent areas.

Milk - The Study Area is deficit in the production of milk and manufactured dairy products. The number of milk cows on farms is declining and is projected to continue this trend through the projected years. Total milk production is declining and is expected to bottom out in the 1980's and gradually swing upward to the year 2015. Production per cow will greatly improve during the 1980-2015 period and partially reduce the impact of declining milk cows. The Study Area currently must rely partially on milk supplies originating outside of the area and this will also hold true in the future.

Production Versus Food Requirements of Local Population

A comparison of the projected production of major nonfeed crops and livestock products with the utilization requirements for the projected population is presented in Table 3.8. The data reveal the magnitude of the deficit and surplus situations for the years 1980 and 2015. The Study Area in the future will be deficit in the production of lamb and mutton, pork, milk and poultry. The Study Area will produce a surplus of beef and veal, eggs, soybeans and cotton.

Production of Feeds Versus Livestock Requirements

The main requirements for feed crops is livestock production; however, industrial uses, human consumption and net exports are realized to be a part of the total requirement. The requirement 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.

Based on the projected acreage and production of the crops - corn, oats and hay - as well as the level of livestock output anticipated in 1980 and 2015, the feed units necessary to sustain the projected level of livestock output will be short of needs. By 1980, it will require 1.5 billion feed units to sustain the projected level of livestock output and 2.2 billion feed units in 2015 (Table 3.8).

The principal source of feed in the Study Area in 1980 will be from corn (18 percent), oats (4 percent), hay (12 percent), and grazing (66 percent). The combined feed units supplied from these sources will satisfy 72 percent of the Study Area needs. By 2015, the production of feed units will satisfy only approximately 52 percent of the needs. The balance will have to be imported if production adjustments are not adequately planned for.

Table 3.8. A comparison of the projected production of major livestock products, nonfeed crops, and feed units with projected utilization, Big Black Study Area, 1980 and 2015

Item	Unit	Study area	
		1980	2015
Livestock products			
Beef and veal 1/			
Indicated production 2/	Pounds	175,705	276,279
Projected utilization 3/	Pounds	47,985	74,815
Lamb and mutton 1/			
Indicated production 2/	Pounds	214	289
Projected utilization 3/	Pounds	1,715	2,653
Pork 1/			
Indicated production 2/	Pounds	19,669	18,077
Projected utilization 3/	Pounds	24,303	37,028
Milk 1/			
Indicated production 2/	Pounds	61,339	83,340
Projected utilization 3/	Pounds	145,000	219,100
Poultry 1/ 4/			
Indicated production 2/	Pounds	8,462	14,606
Projected utilization 3/	Pounds	14,985	24,180
Eggs			
Indicated production 2/	Pounds	32,500	39,000
Projected utilization 3/	Pounds	9,973	15,165
Nonfeed crops			
Soybeans			
Indicated production 2/	Bushels	2,717	2,806
Projected utilization 3/	Bushels	1,379	1,910
Cotton			
Indicated production 2/	Bales	220	340
Projected utilization 3/	Bales	20	31
Feed units			
Indicated production 5/	Feed units	1,105,196	1,129,263
Projected utilization 6/	Feed units	1,528,634	2,182,604

Source: Derived study data.

1/ Liveweight.

2/ Indicated production based on an analysis of historical data and projected to 1980 through the use of least squares regression techniques-to 2015, the 1980 Nation-Study Area relationship assumed to exist in 2015.

3/ Projected requirements calculated on the basis of projected population and per capita utilization rates.

4/ Broiler and turkey production.

5/ Feed units from corn, oats, hay and from grazing of pastured cropland, woodland, permanent pasture, and crop residues.

6/ Based on livestock and poultry production and feed conversion rates.

Farm Income

Income estimates presented in this report 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 1957 U. S. Department of Agriculture publication entitled "Agricultural Prices and Cost Projections." 1/

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

The 1959 farm marketings totaled $72.8 million and are the principal component of farm income. Income from marketings is comprised of the quantity of production marketed times the price per unit received. Currently, crops account for 57 percent of marketing receipts and livestock and livestock products 43 percent. Cotton accounts for 81 percent of total crop receipts. Cattle and calves account for 67 percent of livestock receipts.

Income from sources other than product marketings contribute about 12 percent toward total gross income. Projected farm income data are presented in Table 3.9. Most of the increased income in the future is due to the projected increase in production with only a small part due to price changes.

Farmland

Land in farms fluctuated between 3.2 million acres and 3.5 million during the period 1934-1954. Between 1954 and 1959, total land in farms declined almost one-half million acres to 3.1 million acres. It is anticipated that the farm land base in 1980 will be approximately the same as existed in 1959. By 2015, it is anticipated that the farm land base will range between 2.5 and 3.0 million acres.

1/ Interim price standards were issued by the Interdepartmental Staff Committee of the Water Resource Council dated April 1966. The Soil Conservation Service transmitted copies of these interim price standards on May 11, 1966. Instructions for using this document are, in part: "These price standards should be used for all river basin studies started in fiscal year 1966. Their use is optional for studies started prior to 1966."

Table 3.9. Gross income, production expense and net income, Big Black Study Area, 1959 and projected 1980 and 2015

Item	Unit	1959	Projected 1980	Projected 2015
		Dollars	Dollars	Dollars
Receipts				
Farm marketings	Thousands	72,796	83,250	123,038
Other 1/	Thousands	13,251	11,353	13,671
Total gross income 2/	Thousands	86,047	94,603	136,709
Total production expense	Thousands	49,907	52,031	75,190
Net income 2/	Thousands	36,140	42,572	61,519
Net income per farm 2/	Dollars	1,911	4,838	7,990
Per capita farm income	Dollars	506	1,387	2,675

Source: United States Census of Agriculture - Mississippi Counties - 1959, United States Department of Commerce. Projections are derived study data.

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

2/ Excludes changes in inventories.

Land in farms is classified according to the way in which it is used. The four major categories of use are - cropland, woodland, pasture and other land.

Total cropland (harvested, pastured and idle) has undergone little change since 1934. The uses made of the cropland is where the basic change has occurred. Harvested cropland has declined and cropland pastured has increased with little change in idle cropland.

Farm woodland acreage has undergone relatively minor change. Total farm woodland acreage will show only a small net change by 1980 and 2015. Clearing of bottomland is anticipated and is occurring; however, steep land and eroded land is being planted to trees helping to offset the loss of timber production in the bottom land.

Permanent pasture land has fluctuated only moderately. It is anticipated that a small increase in acreage will occur during

the projected target years. Better management of the existing acreage will increase the livestock carrying capacity and minimize the necessity of additional pasture land to sustain the projected livestock numbers.

Forestry Resources 1/

Forest acreage accounts for 2.5 million acres out of a total of 4.3 million acres in the Study Area. Historically, forest land has ranged from 49 percent to 56 percent of the total land area. Past, present, and projected forest acreage by the two broad classes, farm and non-farm, are presented in Table 3.10. During the period 1947-57, there was an increase of 12 percent in forest acreage. The increase was partially due to the accelerated tree planting brought about by the Soil Bank Conservation Reserve Program, plus other marginal cropland reverting to forest. Between 1959 and 1980 and from 1980 to 2015, the forest acreage is expected to decrease about 0.3 percent and 1.5 percent, respectively. An increasing demand for urban and built-up areas will account for part of the decrease in total forest land.

Table 3.10. Past, present and future commercial forest land by class, Big Black Study Area, 1935-59 and projected 1980 and 2015

Year	Forest land		
	Farm	Non-farm	Total
	Thou. acres	Thou. acres	Thou. acres
1935	---	---	2,090.6
1947	---	---	2,111.1
1957	1,348.2	1,025.9	2,374.1
1959	1,301.3	1,174.5	2,475.8
1980	1,434.5	1,034.1	2,468.6
2015	1,330.7	1,100.7	2,431.4

Source: Forest Survey Release No. 54, Southern Forest Experiment Station, February 1946; Forest Resource Report No. 4, Southern Forest Experiment Station, 1951; Forest Survey Release No. 81, Southern Forest Experiment Station, 1958; and United States Census of Agriculture - Mississippi Counties - 1959, United States Department of Commerce.

1/ Forest statistics were compiled from Forest Survey releases. The definition of commercial forest land used for this section includes: (a) land which is at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) land from which the trees have been removed to less than 10 percent stocking and which has not been developed for other use; (c) afforested areas.

Private ownership - farm, forest industry, and other - accounts for 97 percent of the total forest land. (Table 3.11). Fifty-seven percent of the total forest land is in the farmland sector. By 2015 the farm forest acreage is expected to be approximately the same as the 1957 acreage. Public ownership includes a portion of the Tombigbee National Forest and Mississippi's Sixteenth Section school lands.

Table 3.11. Commercial forest land by ownership class, Big Black Study Area, 1957

Ownership class	Area	Distribution
	Thou. acres	Percent
Private		
Farm	1,348.2	56.8
Forest industry	176.5	7.4
Other	775.7	32.7
Total	2,300.4	96.9
Public		
National Forest	10.8	0.5
Other Federal	2.9	0.1
State and County	60.0	2.5
Total	73.7	3.1
All classes	2,374.1	100.0

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958.

The softwood forest types, which include loblolly-shortleaf and oak-pine, cover 37 percent of the commercial forest land. Sixty-three percent of the forest area is stocked with hardwood types. They are oak-hickory, elm-ash-cottonwood, and oak-gum-cypress. The stand size for both softwood and hardwood is 74 percent pole timber, seedlings and saplings, Table 3.12.

Table 3.12. Commercial forest land by stand size and forest type, Big Black Study Area, 1957

Forest type	All stand sizes	Large saw-timber	Small saw-timber	Pole timber	Seedlings and saplings	Non-stocked and other areas
	Thou. acres	Thou. acres	Thou. acres	Thou. acres	Thou. acres	Thou. acres
Softwood						
Loblolly-shortleaf pine	512.3	40.8	95.5	173.2	196.8	6.0
Oak-pine	363.8	23.6	29.8	160.8	143.1	6.5
Total	876.1	64.4	125.3	334.0	339.9	12.5
Hardwood						
Oak-hickory	811.3	103.4	75.1	361.3	259.2	12.3
Elm-ash-cottonwood	78.9	22.9	7.7	32.8	12.5	3.0
Oak-gum-cypress	607.8	115.1	62.2	259.0	160.0	11.5
Total	1,498.0	241.4	145.0	653.1	431.7	26.8
All types	2,374.1	305.8	270.3	987.1	771.6	39.3

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958.

Grazing damage ranges from light to severe on 44 percent of upland forest. Damage to the upland hydrologic condition by logging was evident on 18 percent of the area and is considered light. The damage was caused partially by over-cutting and exposing the humus and litter to the weather. The remaining damage is from unhealed logging roads and skid trails. There is a lack of good timber management in the forest area. Only 6 percent was classed as receiving proper forest management practices. Eighteen percent of the present forest was formerly cultivated and reverted to trees through natural regeneration.

All of the counties in the Study Area are participating in the intensive fire control program provided by the Mississippi Forestry Commission. The area burned by wildfires in Fiscal Year 1966 was three-tenths of one percent of the total commercial forest area. Thirty-five crews (truck-tractor units) from the State are efficiently performing a high level of suppression.

The wood supply is derived from trees that are now standing on commercial forest land. In 1956, these trees contained 897.3 million cubic feet of wood classified as forest growing stock. 1/ The volume does not include that of cull trees, salvable dead trees, and hardwood limbs.

The forest growing stock is the significant portion of the timber resource. Fifty-four percent of it is in sawtimber trees; 2/ the other 46 percent is in pole timber trees and smaller trees that may become sawtimber trees in the future. The estimated volume for growing stock is 380 cubic feet per acre.

The total net volume of sawtimber on commercial forest lands is 2.9 billion board feet, measure by the International one-fourth inch log rule. Hardwood species account for 79 percent of the total sawtimber volume and softwood species 21 percent. The inventory volume is estimated at 1,230 board feet per acre.

Ninety-six percent of the growing stock and sawtimber volume is in private ownership (Table 3.13). The volume per acre in public ownership is almost 1.5 times as great as that in private ownership. Considering only National Forest land, the volume per acre is three times as great (Table 3.14). The difference is due to proper and meaningful forest management.

1/ Growing stock - Net volume in cubic feet of live sawtimber and live poletimber trees (5.0" DBH) from stump to a minimum 4.0 inch top diameter (of central stem) inside bark.

2/ Sawtimber - Net volume in board feet, International one-fourth inch rule, of live sawtimber trees to a specified merchantable top.

Table 3.13. Volume of growing stock and sawtimber on commercial forest land by ownership classes, Big Black Study Area, 1956

Ownership class	Growing stock			Sawtimber		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
Public:						
National Forest	9.2	7.7	1.5	40.4	38.6	1.8
Other Federal	1.2	0.3	0.9	4.5	1.4	3.1
State	---	---	---	0.1	---	0.1
County and municipal	27.4	9.3	18.1	85.7	33.5	52.2
Total	37.8	17.3	20.5	130.7	73.5	57.2
Private:						
Farm	469.8	85.9	383.9	1,519.2	293.1	1,226.1
Forest industry	88.2	20.2	68.0	308.9	75.7	233.2
Other	301.5	47.0	254.5	963.2	163.7	799.5
Total	859.5	153.1	706.4	2,791.3	532.5	2,258.8
Grand total	897.3	170.4	726.9	2,922.0	606.0	2,316.0

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958.

Table 3.14. Per acre volume of growing stock and sawtimber on commercial forest land by ownership classes, Big Black Study Area, 1956

Ownership class	Growing stock	Sawtimber
	Cubic feet	Board feet
Public:		
National Forest	850	3,740
Other Federal	410	1,550
State, county and municipal	460	1,430
Total	510	1,770
Private:		
Farm	350	1,130
Forest industry	500	1,750
Other	390	1,240
Total	370	1,210
Basin Study Area	380	1,230

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958.

Growing stock is projected at 1.5 billion cubic feet in 1980 and sawtimber 2.6 billion board feet. Between 1956 and 1980, the growing stock inventory is expected to increase over 60 percent. Both species groups, softwoods (114 percent) and hardwoods (52 percent), are included in this greater volume. The growing stock inventory will decline by 2015 but will be 32 percent greater than the 1956 inventory. The 1956 sawtimber inventory will decline 11 percent in 1980 and 33 percent in 2015. Hardwood will still be the major species in 2015 but will be down to 66 percent of the total inventory volume.

The net annual growth for sawtimber in 1956 amounted to 53.4 million board feet of softwood and 143.3 million board feet of hardwood. The combined growth per acre was 83 board feet. Net annual growth for growing stock is listed below by class of timber and species groups.

Class of timber	All species	Softwood	Hardwood
	Million cubic feet		
Sawtimber	51.0	13.4	37.6
Poletimber	13.7	4.4	9.3
Total	64.7	17.8	46.9

The growth for all species equals 27 cubic feet or 0.4 cords per acre per year. This is a growth rate of seven percent on the 1956 inventory base. Annual growth of growing stock and sawtimber will decrease 20 and 48 percent respectively by 2015.

The 1956 figures show the annual cut of growing stock and sawtimber to be greater than the growth. The hardwood species, growing stock and sawtimber, accounts for about 76 percent of the volume cut. By 2015 this figure will have dropped to 55 percent. Timber inventory, annual growth and annual cut of growing stock and sawtimber for current and projected years are presented in Table 3.15.

A comparison of annual timber cut and annual timber growth of growing stock and sawtimber is in Table 3.16. This table shows the growing stock growth exceeds the cut in 1980 and that by 2015 the cut will be 5 million cubic feet greater than growth. Overcut is more drastic in sawtimber and occurs in each period. Only the growth of the softwood species in 1980 will be greater than cut. By 2015 the cut in sawtimber will be 41 million board feet greater than growth.

The estimated value of timber cut of growing stock and sawtimber is presented in Table 3.17. On the basis of the stumpage prices, the value of the standing timber for 1956 was approximately 72 million dollars and the annual timber harvest represented an annual gross income to the forest landowners of about $2.50 per acre.

Employment in timber-based manufacturing industries in the Study Area is presented for two classifications. These groups are based on classifications contained in the Standard Industrial Classification Manual. The groups are Lumber and Wood Products and Furniture and Fixtures SIC 24 and 25, and Paper and Allied Products SIC 26.

Employment in the lumber, wood, and furniture groups (SIC 24 and 25) is shown in Table 3.18. These groups are a part of the employment listed under other manufacturing industries, page 3.5. Employment in this group increased during the period 1930-1950. From 1950 to 2015 the employment in this group is projected to decrease.

Table 3.15. Timber inventory, annual growth, and annual cut of growing stock and sawtimber, Big Black Study Area, 1956 and projected 1980 and 2015

Year	Inventory			Growth			Cut		
	All species	Softwood	Hardwood	All species	Softwood	Hardwood	All species	Softwood	Hardwood
	Growing stock								
	Million cubic feet								
1956	897.3	170.4	726.9	64.7	17.8	46.9	65.8	16.0	49.8
1980	1,468.0	364.0	1,104.0	60.0	20.0	40.0	35.0	12.0	23.0
2015	1,187.0	218.0	969.0	52.0	14.0	38.0	57.0	26.0	31.0
	Sawtimber								
	Million board feet								
1956	2,922.0	606.0	2,316.0	196.7	53.4	143.3	248.9	60.8	188.1
1980	2,605.0	883.0	1,722.0	116.0	51.0	65.0	123.0	38.0	85.0
2015	1,961.0	666.0	1,295.0	102.0	40.0	62.0	143.0	63.0	80.0

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958. Projections are derived from study data.

Table 3.16. A comparison of estimated annual timber cut with annual timber growth of growing stock and sawtimber on commercial forest land, Big Black Study Area 1956 and projected 1980 and 2015

Item	1956	1980	2015
		Growing stock	
	Million cu. ft.	Million cu. ft.	Million cu. ft.
Annual cut			
Softwoods	16.0	12.0	26.0
Hardwoods	49.8	23.0	31.0
Total	65.8	35.0	57.0
Net annual growth			
Softwoods	17.8	20.0	14.0
Hardwoods	46.9	40.0	38.0
Total	64.7	60.0	52.0
Net annual growth less annual cut			
Softwoods	1.8	8.0	-12.0
Hardwoods	-2.9	17.0	7.0
Total	-1.1	25.0	-5.0
		Sawtimber	
	Million bd. ft.	Million bd. ft.	Million bd. ft.
Annual cut			
Softwoods	60.8	38.0	63.0
Hardwoods	188.1	85.0	80.0
Total	248.9	123.0	143.0
Net annual growth			
Softwoods	53.4	51.0	40.0
Hardwoods	143.3	65.0	62.0
Total	196.7	116.0	102.0
Net annual growth less annual cut			
Softwoods	-7.4	13.0	-23.0
Hardwoods	-44.8	-20.0	-18.0
Total	-52.2	-7.0	-41.0

Source: Forest Survey Release No. 81, Southern Forest Experiment Station, 1958. Projections derived from study data.

Table 3.17. Estimated value of growing stock and sawtimber cut, by species, Big Black Study Area, 1956 and projected 1980 and 2015

Species	Growing stock			Sawtimber		
	1956 1/	1980 2/	2015 2/	1956 1/	1980 2/	2015 2/
	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars
Softwood	2.4	1.1	2.3	1.9	0.8	1.4
Hardwood	3.5	1.5	1.4	2.9	1.3	1.2
Total	5.9	2.6	3.7	4.8	2.1	2.6

Source: Computed from study data.

1/ 1956 prices - softwood $31.90 per MBF, pulpwood $6.00 per cord. Hardwood $15.45 per MBF, pulpwood $2.10 per cord.

2/ Used 1965 prices - softwood $21.75 per MBF, pulpwood $3.90 per cord. Hardwood $14.90 per MBF, pulpwood $1.90 per cord.

The paper and allied products (SIC 26) employment has been extracted from the employment listed in major water-using manufacturing industries, page 3.5. This employment was small in 1950 and 1960. Projections for 1980 and 2015 show an increase in employment for this group (Table 3.18). The Study Area has commercial forest land and fresh water which are needed for the desirable location of a pulp and paper plant. Since Michael Baker, Jr., Inc., Jackson, Mississippi, made employment projections, the International Paper Company announced and built a pulp and paper mill at Vicksburg, Mississippi. This mill employs approximately 400 people.

Besides the previously identified groups, forestry employment includes those in forest management and timber harvesting. Forest management includes those engaged in protecting and managing forest lands for the production of timber and related products. Timber harvesting includes those engaged in harvesting and transporting timber and related products from forests to local points of delivery. Employment data for forest management and timber harvesting are presented in Table 3.19. The decline in employment in timber harvesting is caused by a decline in cut and an increase in efficiency in management services, methods, and timber harvesting techniques.

Table 3.18. Estimated employment in timber-based manufacturing industries by Standard Industrial Classes, 1930-1960, and projected 1965, 1980 and 2015

Year	Standard Industrial Class	
	Lumber and wood products, and furniture and fixtures SIC 24 and 25	Paper and allied products SIC 26
	Number	Number
1930	3,459	----
1940	4,645	----
1950	5,274	2
1960	4,283	80
1965	3,960	220
1980	2,700	300
2015	3,250	550

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.

Table 3.19. Estimated employment in forest management and timber harvesting, Big Black Study Area, 1954, 1958 and projected 1965, 1980 and 2015

Year	Employment in	
	Forest management	Timber harvesting
	Number	Number
1954	311	3,700
1958	357	2,170
1965	390	1,540
1980	430	910
2015	430	740

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

A variety of wood industries are located throughout the Study Area as shown in Figure 3.1. They include sawmills, wood preserving mills, a veneer plant, charcoal, cooperage, handle stock, shuttle-block mills, and a fiber and cement board mill.

New industries announced for the Study Area include a pulp and paper mill at Vicksburg, Mississippi and a new southern pine plywood plant and particleboard plant at Louisville, Mississippi. The pulp and paper mill constructed by the International Paper Company uses 1,500 cords of pulpwood daily. Some of this wood is taken from company-managed land but a high percentage is purchased on the open market from tree farmers.

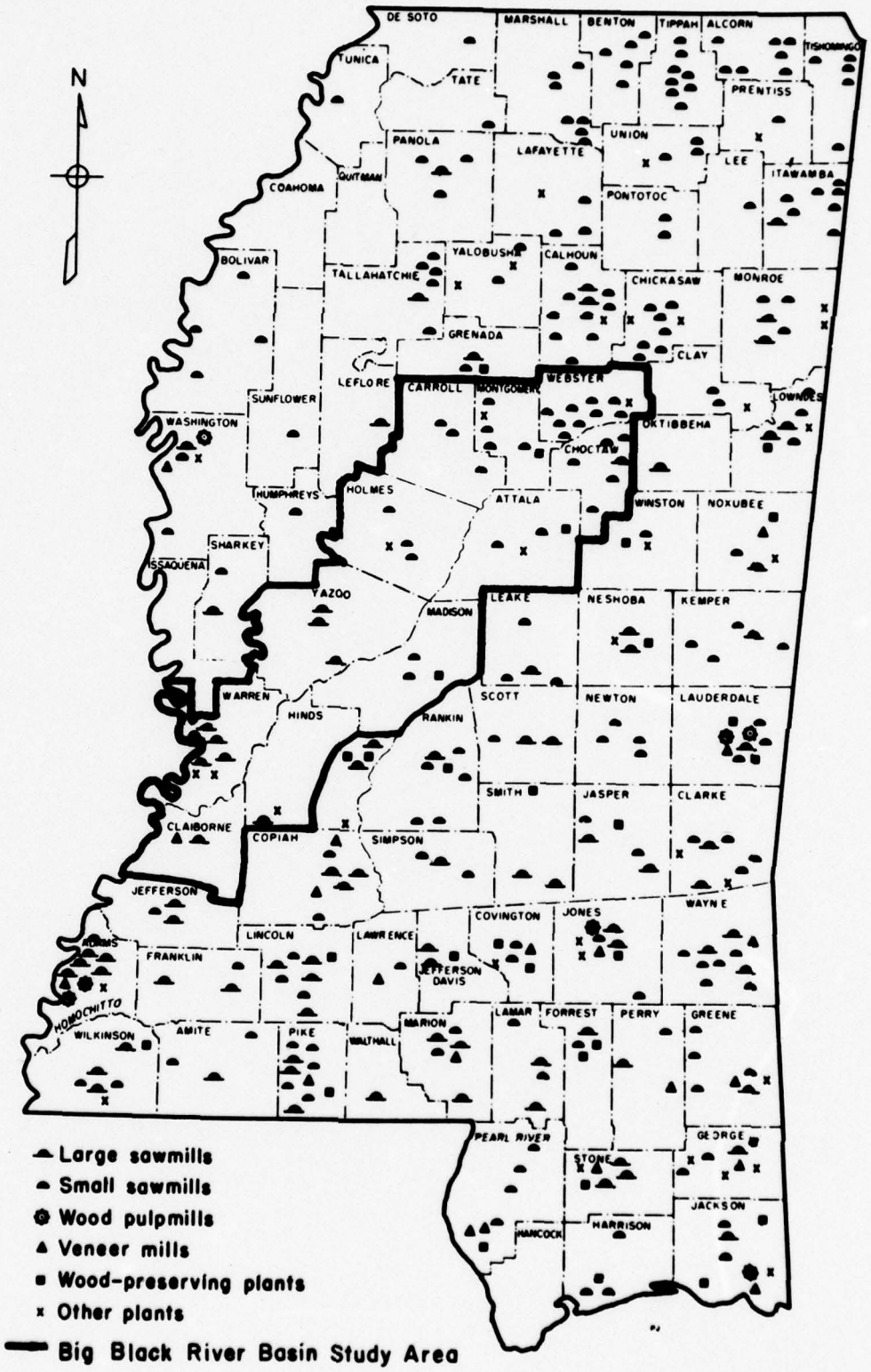
The mill has a paperboard machine with a capacity of 1,000 tons a day and makes unbleached and specialty Kraft liner board.

The two plants at Louisville, Mississippi are being constructed by the Georgia-Pacific Corporation. The plywood plant will employ about 250 persons with a payroll of more than one million dollars annually and will use about twenty-five million board feet of timber a year. Half of the timber used will come from Georgia-Pacific forest land and the other half from private forest land in Mississippi. The particleboard plant will be located near the plywood plant and will employ some 125 persons with an annual payroll of more than $500,000. The plant output is estimated at sixty-five million square feet annually and will manufacture floor underlayment, furniture core stock, and counter tops. The plant will use dry pine planer mill shavings as the raw material. This will be supplemented by dry veneer waste from other Georgia-Pacific facilities.

Outdoor Recreation and Related Economic Activity

Establishment and growth of recreational activities are dependent upon initial and continued development of natural resources. Forest lands and natural waters have long sustained the activities of hunting and fishing while management techniques for farm game and increased fish production have added to the supply. 1/ However, recent increases in participation and projected demands in these and other outdoor activities have made it imperative that all agencies concerned embark upon a coordinated long-range program if these recreational needs are to be met.

1/ Wildlife associated with farm type habitat.



Location of primary wood-using plants in Mississippi, 1962.

Figure 3.1

Federal agencies with responsibilities in the field of outdoor recreation either in action programs or planning include the Corps of Engineers, National Park Service, Fish and Wildlife Service, U. S. Forest Service, Soil Conservation Service and other agencies.

On the state level the Mississippi Park System and State Game and Fish Commission have active programs within the Study Area. The private sector, as revealed by the MASCD 1/ appraisal, has a potential for the establishment of 10,000 acres of recreational water by 1980. Existing water over 20 acres in size totals 21,136 acres but boating needs alone by 1980 will be 21,132 acres.

At present there is little development for public recreation on the part of the private sector. Existing developments consist mainly of boat rental services and overnight cabins for fishermen. The general decline in the natural fishery resource in parts of the Study Area and a loss of population in the northern part over the past five years have made the need for the development of water and complementing recreational resources and facilities of paramount importance. Recreational developments can play a large role as a segment of the economy and will be necessary if the future recreational demands are supplied.

Relationship of Economic Development and Water and Land Related Resource Development

The Big Black Study Area is comprised of lands once inhabited by the Choctaw Indians. These people lived principally along streams and derived their living from hunting, fishing and practicing a primitive type of agriculture.

Settlement by the white man began during the early 19th century and was hastened by treaties providing for the resettlement of the Indians to western reservations. The early white settlers were largely farmers. They first practiced a sustenance type of agriculture with cotton as the major cash crop. The agricultural economy of the Study Area became dependent upon the cotton industry. Other crops and livestock were important only as they contributed to the production of cotton. Only in recent years, have attempts been made to diversify agriculture and seek a balance between it and industrial development.

By 2015, the population of the Study Area is projected at 379,000, supported by $1.1 billion in personal income earned by 109,000 workers and entrepreneurs. This means that between 1960 and 2015, population will rise 57 percent, employment 47 percent and personal income 295 percent.

1/ Mississippi Association of Soil Conservation Districts.

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 Basin'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 of the Study Area will arise basically from the increase in population, expansion of industry and potential irrigation development projects. Water requirements, however, will be greater than indicated by projected levels of population and industrial employment because of several trends now evident in the Basin. 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 in the Study Area 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 reuse of water in industry, together with costly pollution treatment facilities is required, the Basin 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 in the Study Area 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 land and water 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 resources development.

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 solution 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 problems of the land are many and real. They began many years ago and were accelerated when the early settlers migrated into the Basin. Thousands of acres of the Basin's forests were cleared and the land planted to cotton, corn and other row crops. Problems as erosion, flooding, uncontrolled grazing, wildfires, insects and diseases, and other related problems thus became items to be coped with in the management of water and land resources.

On forest land and open land, attempts have been made to solve the various existing problems and progress is being made. Still, old problems remain and new ones appear. Additional constructive work is needed before the water and land related problems of the Basin are solved.

Major Water and Related Land Problems

Erosion

Erosion, while still a serious problem, is less intense now than in the past. This has been brought about largely by change in land use from row crops to pasture and forest.

Within the Study Area there are 2,413,976 acres of land that have an erosion problem or are susceptible to erosion (Table 4.1). Sheet erosion is moderately to severely active

Table 4.1. Nature of dominant conservation problems, by major land use categories, Big Black Study Area, 1958 1/

Land use 2/	Erosion	Excess water	Unfavorable soil	Land with no problems	Unclassified	Total
	Acres	Acres	Acres	Acres	Acres	Acres
Cropland	331,427	333,343	184,548	42,423	257	891,998
Pastureland	363,576	145,952	96,728	5,189	2,582	614,027
Forest - woodland	1,570,349	377,830	341,838	8,008	124,888	2,422,913
Other	148,624	35,422	32,539	2,537	767	219,889
Total 3/	2,413,976	892,547	655,653	58,157	128,494	4,148,827

Source: Mississippi Soil and Water Conservation Needs Inventory, 1958-1975, Mississippi Conservation Needs Committee, Jackson, Mississippi.

1/ Land susceptible to a problem.

2/ Land use estimates from 1958 Conservation Needs Inventory. These estimates are not necessarily comparable to those derived from Censuses of Agriculture. The relative differences are small and should not be construed as a serious constraint in the use of either set of data. Data are comparable with those in Table 5.1.

3/ These estimates exclude problems associated with non-inventory acreage.

on 331,427 acres of cropland and slightly to moderately active on 512,200 acres of pasture and other land. The balance, in forest, poses a lesser problem.

The magnitude of erosion problems on open and forest land is listed in Table 4.2. There are approximately 19,900 acres of forest land and 59,478 acres of open land deemed critical. Gully erosion is less active now than in the past. It still affects a considerable acreage and was included with that of the critical area. Erosion on 1,175 miles of roadbank causes moderate to severe deposition in road ditches, culverts, and channels.

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

Table 4.2. The magnitude of erosion problems on open and forest land, Big Black Basin, 1965

Item	Unit	Total
Critical area		
Open	Acres	59,478
Forest	Acres	19,900
Logging roads and trails		
Open	Acres	0
Forest	Acres	10,150
Roadbanks		
Open	Miles	1,175

Source: Derived from study data.

Floodwater

There are 276,000 acres of land subject to overflow in upland watersheds. The total direct annual damages from flooding is $2,336,900. Of this amount $1,990,700 are damages to crops and pastures, $127,400 are damages to minor fixed improvements on farms and $218,800 are damages to public roads and bridges. Damages to urban and industrial areas are relatively insignificant.

Investigation shows that extensive damage occurs in all of the Basin. All or parts of 32 watersheds have land and water problems that naturally affect the use, management and production of crops and pastures. The five watersheds in the lower part of

the Basin are affected to a lesser extent and the problems are not considered of such magnitude as to constitute a serious community or land problem.

Within the 32 watersheds 258,000 acres of floodplain lands are inundated on an average of three to four times during the growing season. The floods cause an estimated damage of $1,930,000 annually to crops and pastures and $331,300 damage to public roads, bridges and on farm minor fixed improvements.

Estimates of crop and pasture damages in the other five watersheds in the Basin are $60,700 annually and damages to roads, bridges and other fixed improvements are $14,900 annually.

Sediment

Deposition of sediment is a relatively minor problem. It does, however, contribute to flooding by filling stream channels; thereby causing added damages to crops, pastures and fixed improvements. Monetary damages were evaluated and combined with those of flood damage.

Studies of annual gross erosion and sediment yields indicate annual sediment yields from the various sub-watersheds of the Basin as ranging from around 700 tons to over 2,000 tons per square mile of drainage area. The greater amount of sediment enters the stream system from extensively gullied areas or from those having a high percentage of row crops. Eroding roadbanks contribute about 15 percent of the total sediment and are largely responsible for silting roadside ditches and culverts.

On-site investigations behind detention reservoirs indicate that annual soil moved in tons per acre for various land uses is as follows: 1/

Land use	Annual soil movement (Tons per acre)
Cultivated 2/	15.48 to 46.82
Pasture	3.53 to 10.13
Idle	2.40 to 7.50
Woodland	1.71 to 5.10

1/ This is expressed as average annual soil movement in average tons per acre for each structure site and land use. These figures do not show actual soil loss but they are significant in that they do not indicate the severity of the erosion problem.
2/ Excludes bottomland.

The amount of soil that is actually lost and deposited at any given point downstream from the various land uses is dependent on watershed characteristics and on distance traveled.

Impaired Drainage

Most of the channels in the upland watersheds have sufficient capacity to carry runoff from normal precipitation. However, the channels are usually inadequate when 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.

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

The Conservation Needs Inventory identified 435,000 acres of land in the Big Black Basin with a drainage problem. Of this amount, 248,000 acres are open land in crops and pasture and 187,000 acres are forests.

An economic analysis of the drainage problems was made to determine the total average yearly reduction in net farm income because of inadequate drainage with present cropping patterns and farming conditions. The estimated average annual reduction in net income from inadequate drainage of open land is $1.8 million. No analysis was made of drainage problems on forested lands.

Major Water and Land Development and Management Needs

Flood Control and Prevention

The problems of flooding are more severe in 32 upland watersheds in the central and upper 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 that are discussed under conservation treatment. Structural measures needed in conjunction with land treatment measures to further reduce flood damages include 186 floodwater structures, 17 multiple purpose structures (10 of which would have recreational facilities) and 937 miles of channel improvement. These structural and land treatment measures are needed in an early action program (1980). Also there is a need for additional floodwater retarding and multiple purpose structures along with channel improvement work in all or parts of the remaining five watersheds that are not presently economically feasible for project action by the year 2015.

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 4.3. The total land treatment needs are primarily associated with cropland, pasture land and other farmland in the 37 watersheds. Also included is the amount of each land treatment measure that is expected to be accomplished by project action in 32 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 13,528 acres of badly eroded land and 1,175 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 4.3 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

Table 4.3. Land treatment needs of open land, Big Black Basin, 1965

Item	Unit	Total Basin needs	To be installed in 10 PL-566 watersheds	To be installed by special legislation	Remaining needs
Conservation cropping system	Acres	384,600	49,652	191,111	143,837
Pasture planting	Acres	163,850	74,493	83,660	5,697
Pasture renovation	Acres	184,500	21,821	89,581	73,098
Diversion	Miles	950	225	473	252
Terracing, gradient	Miles	750	189	425	136
Grassed waterways	Acres	3,275	411	1,481	1,383
Drainage, main and lateral	Miles	1,025	143	553	329
Drainage, field ditch	Miles	1,975	261	1,142	572
Farm ponds	Number	4,650	642	2,567	1,441
Wildlife habitat development	Acres	13,900	3,128	7,318	3,454
Critical area planting 1/					
Grasses and legumes	Acres	13,528	1,653	9,480	2,395
Roadside erosion control	Miles	1,175	342	737	96

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

1/ Tree planting on open land and related practices are presented under conservation treatment - forest land.

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.

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 landowner.

Forest land - The degree of erosion on the forest land ranges from moderate sheet erosion to active gullies. Open land that should be planted to trees total 45,950 acres and 19,900 acres of forest land need treatment to reduce erosion. These areas need treatment

with trees, grasses, and wildlife food-cover plants. This is necessary to stop the loss of soil and reduce the flow of damaging sediment by giving protection, through litter, to the bare soil. Hardwood species such as black cherry, ash, elm, hickory, yellow-poplar, hackberry, redbud, sassafras and the red and white oaks are important humus builders. In time, humus will develop to aid in absorbing storm rainfall and carry water into the soil profile. Pines furnish good protective cover for many erodible areas. Grass and wildlife food-cover plants will serve to stabilize many areas plus provide food and cover to game birds and animals. Abandoned logging roads and trails need to be stabilized by revegetation of bare soil. To establish the needed cover on eroding land - critical areas, and logging roads and trails - approximately 42,000 acres of site preparation work is needed to prepare the land for trees and grasses and about 1,170 miles of fencing to protect these and other areas from grazing. Data pertaining to critical area stabilization on forest land is presented in Table 4.4.

Besides treatment of the critical areas on open and forest land, treatment for watershed protection is needed on many acres of forest land. Forest land measures such as tree planting, (conversion, inter and under) 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 more favorable tree species is needed on 123,460 acres of forest land. Tree planting - open, inter and under - is needed on 272,410 acres of open and forest land. The removal of undesirable species is needed on 416,110 acres. Approximately 207,900 acres of forest land should have merchantable timber removed and thereby provide growing room for the remaining timber (Table 4.4).

Management plans are needed on 960,310 acres. Practices such as growing the best species on the right site, removing the undesirable species, marking out the poor quality and poor form trees, and tree planting to put all the forest land into production, will give an increase in forest production. These and other practices also will increase recreation, wildlife and watershed values.

Insects and diseases are prevalent in the forests with resulting losses in timber production through a reduction in growth, lower quality, deformities, and death. Evidence of insects was not found on the forest land but insects can infest an area and move on before the damage is discovered. It requires the combined effort of all land-owners to locate and contain the infested areas while they are small.

Table 4.4. Land treatment needs on private forest land, Big Black Basin, 1965

Item	Unit	Total Basin needs	To be installed in 10 PL-566 watersheds	To be installed by special legislation	Remaining needs
Critical area stabilization					
Tree planting	Acres	65,850	4,577	48,220	13,053
Logging roads and trails	Acres	10,150	0	7,950	2,200
Site preparation	Acres	42,420	1,447	30,660	10,313
Fencing	Acres	46,710	3,250	33,870	9,590
	Miles	1,170	78	840	252
Tree planting					
Open	Acres	53,200	4,210	12,335	36,655
Conversion	Acres	123,460	820	8,820	113,820
Inter and under	Acres	219,210	3,520	14,980	200,710
Fencing	Acres	38,910	1,100	8,220	29,590
	Miles	689	38	141	510
Hydrologic stand improvement					
Conversion release	Acres	123,460	820	8,820	113,820
Underplanting release	Acres	92,920	800	1,230	90,890
Pine	Acres	209,420	7,770	16,190	185,460
Hardwood (upland)	Acres	113,770	1,470	3,870	108,430
Fencing	Acres	236,980	940	30,820	205,220
	Miles	1,907	9	226	1,672
Improvement cut	Acres	207,900	3,500	43,690	160,710
Management plans	Acres	960,310	40,700	261,370	658,240

Source: Derived from study data.

Scatterings of fusiform rust disease, Cronartium fusiforme, was found in two 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 of forest land is a practice that dates back to the early settlers of the Basin. It is a practice that is detrimental to forest

reproduction, to the production of timber, deterioration of stand quality, and reduction in wildlife habitat. It can result in damage to watersheds through soil compaction, increased runoff, and loss of soil. Currently, approximately 445,000 acres of upland forest are being grazed and damages to the forest land (timber, soil, etc.) ranges from light to severe. Approximately 2,600 miles of fencing is needed to keep the animals out of forested areas. About 40 percent of the grazed acres are under fence but cattle need to be removed from these forests. Education of landowners concerning the damage grazing does to forest land is needed and greater emphasis should be placed on improving permanent pasture land.

Fire on forest land has been 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." Mississippi Forestry Commission information shows that over 12 percent of the protected acreage in the State of Mississippi was destroyed by forest fires in 1927-28. Since that time the percentage of protected acres burned decreased to 0.43 percent in 1965-66. In the Big Black Basin a similar trend has taken place. Over the years all of the counties have come under the fire protection of the Mississippi Forestry Commission. For the past nine years, the annual burn of the protected areas ranged from 3,635 acres or 0.13 percent to 22,915 acres or 0.80 percent. The 1965-66 annual burn was 0.31 percent, which is just slightly higher than the State fire loss goal of 0.25 percent.

The cost of protecting the forest from fire (about $0.16 per acre) is money well spent. It is estimated that damage to forest by fire is $14.60 per acre. This includes damage to timber, forage, watershed, wildlife, and recreation. During the period 1957-66, monetary losses amounted to about $1,600,000. Without the protection provided by the Mississippi Forestry Commission this damage could have been much greater.

The Mississippi Forestry Commission's present equipment of 30 three-man crews and 27 look-out towers can handle all fires under normal conditions. In the future, with a build-up of forest fire fuels and forest values, additional manpower and suppression equipment will be needed. Fourteen additional units and crews will be needed by 1980. The initial cost for the new suppression units is estimated at $189,000.

Forest industries have a few fire fighting units located in various counties within the Study Area. All units - State and industry - combine into an effective fire fighting organization.

Wildfires damage all forest land the same regardless of ownership. A continuing need is to strengthen the cooperation between land protection agencies and private landowners. An effective continuing education program will keep the people informed of losses to forest resources caused by fires.

Irrigation

The combination of physical resources and climatic environment of the Study Area contributes to variation in conditions affecting irrigated crop production. Because of this, farm operators using irrigation are faced with decisions considerably more complex than those ordinarily encountered in areas of intensive irrigation use.

The average rainfall for the Study Area is approximately 50 inches. However, the lack of sufficient soil water during the growing season reduces yields and often causes crop failure. The immediate problem in the Study Area is not insufficient gross annual rainfall, but inadequate frequency and distribution of rainfall during the growing season.

A study by the Mississippi Agricultural Experiment Station reveals that interest in the use of irrigation in the Yazoo-Mississippi Delta is becoming more significant. 1/ The recent interest has been brought about by several factors, the more important are: (1) the relatively widespread drought conditions which existed in humid areas during critical growing periods for the past few years; (2) the generally improved capital position of farmers since World War II, which creates a favorable environment for venturing into the new and untried; (3) the generally favorable reports which have come from experience with the practice; (4) technological improvements in irrigation equipment; and (5) continued efforts on the part of producers to maintain total production on a restricted land base.

The study indicates that for irrigation to be profitable in the Delta Area of Mississippi (applicable to Study Area, also) the average farmer must be able to use an irrigation system which has a low development cost and a low operating cost such as syphon tube systems, on fairly level fields. If this is not possible then only exceptional managers who consistently make high yields should consider the practice. The outlook for irrigation in the Study Area should improve as more farmers become proficient at irrigating and if means could be found to offset some of the bad effects of irrigation in certain years.

Livestock and Rural Domestic Water

Water for rural domestic household and livestock uses is not a problem insofar as supply is concerned. Adequate water is available from wells, springs and streams in all parts of the Study Area.

1/ The Economics of Supplemental Irrigation in Cotton - Yazoo - Mississippi Delta, by Fred T. Cooke, Jr., Bulletin 669, Mississippi Agricultural Experiment Station, July 1963.

Also farm ponds, mainly for livestock water, either have been or can be constructed on most of the farms. Water for household use is mostly from wells located near the farm or rural residences. In some cases community water systems have been developed that use deep wells as a source of water supply. The quality of the water is usually good and presents no serious problem. Some of the industrial water systems use a filtering process to remove undesirable minerals from the water.

The supply of water is adequate, however, in some parts of the Study Area there is a need to develop this supply. Water and sewer projects are eligible for grants and loans from the Department of Housing and Urban Development, Department of Agriculture and the Economic Development Administration. Eligible water applicants are requested initially to fill out a simple referral form which will enable the three Federal agencies to determine which one should accept primary responsibility for the project. Thereafter, applicants will have to deal with only that one agency.

Fish, Waterfowl and Wildlife

The water and land resources of the Study Area were inventoried by fish and wildlife habitat type and evaluated in terms of potential capacity to provide fishing and hunting opportunities. Capacity is defined as the number of annual man-days of hunting that a given resource can satisfy and sustain. The criteria are based upon: (1) fish and wildlife population density per acre; (2) harvest ratio; (3) a level of success; (4) as assumed level of management; and (5) full utilization of all resource areas without regard to posting or zoning.

A list of the existing fish and wildlife areas and developed installations located in the Study Area is shown in Table 4.5. The types and acreages of fish and wildlife habitat, along with their estimated capabilities to provide fishing and hunting opportunities are shown in Tables 4.6 and 4.7. Present day fishery habitat in the Study Area totals approximately 40,000 acres capable of supporting 819,000 man-days of fishing. Assuming the fish habitat remains constant except for some projected increases in farm pond construction, the fish resource supply habitat will exceed the demand in 1980 and 2015.

The demand for hunting can also be satisfied throughout the period of analysis as indicated by the data in Table 4.7. However, in order to assure future public hunting opportunities for residents of the Study Area, a water plan should include development of the highest quality wildlife habitat available.

Table 4.5. Existing fish and wildlife areas and installations, Big Black Study Area, 1965

Type area	Administrative agency 1/	Total	Wetland	Water	Activity or purpose 1/
		Acres	Acres	Acres	
Federal					
Davis Island Wildlife Refuge	BSF&W	70	---	---	WP
Tombigbee National Forest	USFS	11,213	---	116	WP, F&H
Natchez Trace Parkway	NPS	13,860	---	---	WP
Vicksburg National Military Park	NPS	1,339	---	---	WP
State					
Choctaw Wildlife Management Area	MG&FC	17,000	---	---	WP, H&F
Pearl River Waterfowl Refuge	MG&FC	1,200	900	---	WP, and H
Holmes County State Park	MSPC	510	---	60	WP and F
County					
16th sections	CBS	46,489	---	---	WP, H&F
Raymond Lake	Hinds	65	---	50	F
Total	XXX	91,656	900	226	XXX

Source: A Report on the Fish and Wildlife Resources of the Big Black River Basin, Mississippi, Annex D, Bureau of Sports Fisheries and Wildlife Service, United States Department of the Interior.

1/ USFS - U. S. Forest Service
NPS - National Park Service
MG&FC - Mississippi Game and Fish Commission
CBS - County Board of Supervisors
MSPC - Mississippi State Parks Commission
F - Fishing
H - Hunting
WP - Wildlife Production

Table 4.6. Fresh water fishing areas and capacities, Big Black Study Area, 1960 and projected 1980 and 2015 situation 1/

Fish habitat	Area	1960 Demand	1960 Capacity	1960 Demand-capacity relationship	1980 Demand	1980 Capacity	1980 Demand-capacity relationship	2015 Demand	2015 Capacity	2015 Demand-capacity relationship
	Acres	Thou. man days	Thou. man days	Thou. man days	Thou. man days	Thou. man days	Thou. man days	Thou. man days	Thou. man days	Thou. man days
Small impoundments										
Farm ponds	11,982	---	240	---	---	2/268	---	---	3/320	---
Floodwater retarding	3,915	---	39	---	---	39	---	---	39	---
Lakes										
Artificial										
Managed	649	---	32	---	---	32	---	---	32	---
Unmanaged	1,006	---	20	---	---	20	---	---	20	---
Natural	13,068	---	392	---	---	392	---	---	392	---
Streams	9,114	---	96	---	---	96	---	---	96	---
Total	39,734	622	819	+197	614	847	+233	873	899	+26

Source: Derived from data in A Report on the Fish and Wildlife Resources of the Big Black River Basin, Mississippi, Annex D, Bureau of Sports Fisheries and Wildlife Service, United States Department of the Interior.

1/ Need exists when demand exceeds supply - It is assumed that in 1980 and 2015 the 1960 habitat area remains unchanged except for projected increases in farm pond construction.

2/ Farm pond capacity estimated on basis of 13,423 acres of water.

3/ Farm pond capacity estimated on basis of 15,996 acres of water.

Table 4.7. Hunting habitat and capacities, Big Black Study Area, 1960 and projected 1980 and 2015

Habitat type	Area	Demand	Capacity	Demand-capacity relationship
	Acres	Thou.man days	Thou.man days	Thou.man days
1960				
Pine	594.2	---	190.7	---
Pine-hardwood	371.3	---	154.1	---
Upland hardwood	841.8	---	473.9	---
Bottomland hardwood	668.5	---	494.7	---
Cropland	983.2	---	311.7	---
Pastureland	588.8	---	123.6	---
Total	4,047.8	372	1,748.7	+1,376.7
1980				
Pine	715.9	---	229.8	---
Pine-hardwood	419.7	---	174.2	---
Upland hardwood	864.0	---	486.4	---
Bottomland hardwood	469.0	---	347.1	---
Cropland	951.8	---	301.7	---
Pastureland	622.7	---	130.8	---
Total	4,043.1	353	1,670.0	+1,317
2015				
Pine	851.0	---	273.2	---
Pine-hardwood	607.8	---	492.8	---
Upland hardwood	875.3	---	252.1	---
Bottomland hardwood	97.3	---	72.0	---
Cropland	827.9	---	262.4	---
Pastureland	641.2	---	134.7	---
Total	3,900.5	464	1,487.3	+1,023.3

Source: Derived from data in A Report on the Fish and Wildlife Resources of the Big Black River Basin, Mississippi, Annex D, Bureau of Sports Fisheries and Wildlife Service, United States Department of the Interior.

Recreation Water, Land and Facilities

Many outdoor recreation activities are enhanced or directly dependent upon water. An adequate supply of clean water is necessary before full development of recreational activities can be realized.

There is a decided lacking of recreational facilities within the Study Area for all activities with the possible exception of canoeing. Canoeing water is not included in the supply estimates. Streams suitable for canoeing are found throughout the Study Area and this appears to be the only activity for which there is adequate water. A list of known recreation facilities is presented in Table 4.8.

Table 4.8. Existing recreational facilities, Big Black Study Area, 1965

Item	Unit	Type			Total
		Public	Private	National Forest	
Water	Acres	110	0	116	226
Beach	Acres	6	0	2	8
Swimming pools	Sq.ft.	14,680	0	0	14,680
Picnic	Acres	111.5	0	5	116.5
Picnic tables	Number	256	16	18	290
Camping units	Number	62	8	9	79
Group camping	Number	2	0	0	2
Cabins	Number	6	15	0	21
Water sports (Swimming and boating)	Acres	0	39	0	39

Source: A Report on the Recreation Aspects of the Big Black River Basin - Mississippi, Annex C, Bureau of Outdoor Recreation, Department of the Interior, February 1967; An Appraisal of Potentials for Outdoor Recreation Developments in Central Mississippi, Soil Conservation Service, United States Department of Agriculture, May 1967; and National Forest Recreation Survey, Forest Service, United States Department of Agriculture.

Existing and projected needs for outdoor recreation resources or facilities are the difference between demand for such outdoor recreational resources or facilities and the present or projected supply of such resources or facilities. The present and projected imbalance between demand and supply may be obtained from data presented in Table 4.9. A complete assessment of the many facets of recreation is in the detailed report. 1/

Pollution 2/

The major sources of pollution within the Basin are the untreated municipal waste discharges plus a small number of water using industries. There is no indication of significant agricultural pollution in the Basin. The main stem of the Big Black has been found to be a stream in good condition with a relatively small amount of pollution which does not degrade it. Even with the number of municipalities discharging untreated waste into the Basin, the water quality of the main stream remains above the minimum desired. Even with an increase in the amount of waste forecasted due to increased population, the addition of secondary treatment to all municipal and industrial waste will offset such an increase in waste loading. The only exception to the above in the foreseeable future, would be the possible expansion of the paper mill at Pickens on the main stem. If this should develop there is the possibility of low flow augmentation being required for this particular operation.

The situation on the tributaries is more severe. There are four streams (Hays, Bear, Fourteen Mile, and Bakers) which have water quality falling below the minimum desired level during periods of low flow. The sources of this pollution are several towns discharging raw untreated sewage into the streams. If Hays, Bear, Fourteen Mile, and Bakers Creeks are to be maintained of a quality suitable as a habitat for fish, the following minimum flows would be required at the points indicated.

Stream	Minimum flow cfs
Hays Creek	2.4 cfs below Winona
Bear Creek	20.8 cfs below Canton
Fourteen Mile Creek	0.2 cfs below Raymond
Bakers Creek	0.5 cfs below Raymond
	3.6 cfs below Bolton
	2.7 cfs below Clinton
	4.6 cfs below Edwards

1/ A Report on the Recreation Aspects of the Big Black River Basin-Mississippi, Annex C, Bureau of Outdoor Recreation, Department of the Interior, February 1967.

2/ Municipal and Industrial Water Supply and Water Quality Control Study, Big Black River Basin - Mississippi, Annex E, Federal Water Pollution Control Administration, United States Department of the Interior, June 1967.

Table 4.9. Present and projected annual demand, supply and needs for specified recreational activities, Big Black Study Area, 1965 and projected 1980 and 2015

Activity	Unit	1965			1980				2015		
		Demand	Supply	Demand versus supply	Demand	Supply 1/	USDA projects 2/	Demand versus supply	Demand	Supply 2/	Demand versus supply
		Thou.	Thou.	Thou.	Thou.	Thou.	Thou.	Thou.	Thou.	Thou.	Thou.
Water-dependent:											
Swimming	Activity occasion	1,380	360	-1,020	2,207	414	311	-1,482	7,140	725	- 6,415
Boating, water-skiing, sailing	Activity occasion	608	162	- 446	972	163	148	- 661	3,144	311	- 2,833
Canoeing	Activity occasion	25	---	---	40	---	---	---	129	---	---
Subtotal	Activity occasion	2,013	522	-1,491	3,219	577	459	-2,183	10,413	1,306	- 9,377
Water-enhanced:											
Camping	Activity occasion	197	36	- 161	315	55	35	- 225	1,019	90	- 929
Picnicking	Activity occasion	690	286	- 404	1,104	372	93	- 639	3,570	465	- 3,105
Subtotal	Activity occasion	887	322	- 565	1,419	427	128	- 864	4,589	555	- 4,034
Other activities	Activity occasion	12,926	---	---	20,674	---	---	---	66,883	---	---
Grand total		15,826	---	---	25,312	---	---	---	81,885	---	---
Water dependent & Water-enhanced		2,900	844	-2,056	4,638	1,004	587	-3,047	15,002	1,591	-13,411

Source: Derived from data in A Report on the Recreation Aspects of the Big Black River Basin - Mississippi, Annex C, Bureau of Outdoor Recreation, Department of the Interior, February 1967.

1/ The supply capacity in 1980 includes that existing in 1965 plus some expansion in facilities.

2/ Includes the recreational facilities to be developed in connection with the 32 feasible watershed projects and installed by 1980.

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These flows are those which would be required to assimilate waste expected by the year 2015 after such waste has been given treatment providing the removal of 90 percent of the biochemical oxygen demand.

If streams of a quality suitable for fish habitat are not desired, these effluents would require augmentation by one-third of the flows given in the above table to prevent the occurrence of nuisance conditions.

The following alternate of requiring tertiary treatment for all waste could be used to prevent nuisance conditions. The added treatment facilities would consist of finishing lagoons and aeration equipment.

City	Added cost for tertiary treatment
	Dollars
Clinton	40,000
Edwards	37,800
Raymond	17,000
Bolton	14,800
Canton	100,700
Winona	37,800

It should be pointed out that the Bureau of Sport Fisheries and Wildlife has determined that all of these tributaries have little or no potential for a fishery and wildlife habitat. Considering this, it would not be reasonable to further pursue the possibility of providing low flow augmentation for this purpose.

CHAPTER V

WATER AND LAND RESOURCE DEVELOPMENT POTENTIAL

Availability of Land for Development

The Big Black Study Area comprises 4,339,700 acres of land with a water surface area of 34,890 acres. The area devoted to Federal uses, urban uses and water comprises 190,873 acres. The remaining 4,148,827 acres are in farm and non-farm forests. Therefore, there currently exists a plentiful supply of land for a diversity of development purposes.

The 4.1 million acres in farm and non-farm forests (excluding Federal) is referred to as inventory acreage. In 1958, approximately 63 percent was suitable for cropland, i. e., land capability classes I, II, III and IV. The actual recorded use was 22 percent in cropland, 15 percent in pastureland, 58 percent in forest and 5 percent in other inventory uses. 1/

Potentially there are 2.6 million acres in the Study Area suitable for cultivation. Presently, less than one-half is being cultivated. Additional cropland requirements are not indicated at this time but should demands increase above those indicated lands suitable for cropland but now in forest or pasture could be shifted to cropland. Individual landowners undoubtedly will continue to shift land to crop use where it improves the efficiency and net income from the farm enterprise. Likewise, land now being cropped but better suited to pasture or woodland will be shifted to proper use as improved conservation farming is adopted. 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. Land capability estimates show that 695,758 acres of the 1958 cropland are Classes I - III land, which is suitable for regular cultivation with proper farming practices under good management. Of the present cropland suitable for full-time cultivation, 42,816 acres are Class I, or very good land which

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

requires no special erosion control or other practices; 342,526 acres are Class II, or good land which needs only simple erosion control practices and correction of fertility needs or other practices; and 310,416 acres are Class III land, which is sloping, moderately fertile, difficult to drain or irrigate, or which for some other reason needs extra good practices for permanent use as cropland. Another 146,288 acres of cropland are Class IV land, which is severely limited as to possibilities for cultivation. Most of it is suitable only for occasional cultivation in long-time rotations. In addition, 49,952 acres of Classes V - VII, or about 6 percent of the presently cultivated cropland, are not suitable for use as cropland. This land is too steep, too eroded, too stony or otherwise poorly adapted to cultivated crops. Thus, of the 891,998 acres of presently cultivated cropland, 78 percent is adapted to full time cultivation, and 16 percent can be cultivated to a limited extent if suitable precautions are taken.

Table 5.1. Use of inventory acreage by capability class, Big Black Study Area, 1958

Class	Cropland	Pasture-land	Forest	Other	Total	Distribution
	Acres	Acres	Acres	Acres	Acres	Percent
I	42,816	5,526	7,268	2,638	58,248	1.4
II	342,526	143,683	222,908	34,302	743,419	17.9
III	310,416	192,804	433,701	61,349	998,270	24.1
IV	146,288	176,225	433,701	51,454	807,668	19.5
V	9,812	9,211	14,538	1,320	34,881	.8
VI	17,840	15,351	101,762	7,037	141,990	3.4
VII	22,300	68,771	1,085,465	61,129	1,237,665	29.8
Unclassified	0	2,456	123,570	660	126,686	3.1
Total 1/	891,998	614,027	2,422,913	219,889	4,148,827	100.0

Source: Mississippi Soil and Water Conservation Needs Inventory, 1958-1975, Mississippi Conservation Needs Committee, Jackson, Mississippi.

1/ Excludes 190,873 acres classed as non-inventory.

Potential Shift of Grassland Pasture to Cropland

Additional areas shown by the land capability estimates as the most susceptible and physically feasible land for development for long-time regular cultivation, through plowing and improvement of the soil, consists of 342,013 acres of grassland pasture. Much of this grassland could be put into cultivation by plowing up the sod. Limited areas would require drainage and some would respond to irrigation, erosion control, or other improvements. Of the 342,013 acres of grassland suitable for full-time cultivation, 5,526 acres are Class I; 143,683 acres are Class II; and 192,804 acres are Class III land.

Development of suitable grassland pasture as cropland and its incorporation into the rotation would take several years. Time would need to be allowed for demand for the products from it to materialize. Plowing of pasture and use of cultivated crops would reduce the acreage available for pasture. It would substitute one kind of production for another, and changes in the systems of farming followed would be required. Apparently such a shift from grassland pasture to cropland will be neither necessary nor desirable in the near future in the Big Black Study Area.

Potential Shift of Forest Land to Cropland

If cleared and properly cultivated, 7,268 acres now in generally level and fertile forest land would make Class I cropland. Another 222,908 acres of forest land are suitable for regular cultivation as Class II cropland, if simple erosion control practices are followed, and if the moderate fertility is corrected by adding fertilizers or other soil amendments. An additional 433,701 acres of forest land can be converted into Class III cropland with permanent cultivation, but special erosion control and soil management practices will be needed. Here in the aggregate are 663,877 acres of forest land that could be converted to cropland.

The new areas of land suitable for farming that could be brought into cultivation primarily by clearing forest land and farm drainage are quite large. Much of the undeveloped wet land that is physically feasible to develop for farming requires both drainage and clearing.

The Big Black Study Area with its large acreage of suitable land is well adapted for production of additional food and feed crops. Alternative costs and returns of placing this land in cultivated crops and improved pasture over returns from production of timber products and grazing, however, needs to be studied before large scale clearing operations are undertaken. Desirable commercial timber species already on the forest land in the long run may give better returns than would clearing for cultivation.

Recommended Shift of Cropland to Grassland and Forest Land

Partly offsetting the potential shift of grassland and forest land to cropland are 49,952 acres of cropland which the Soil Conservation Service has classified as best suited to grassland and forest land. This is mainly land which has so much slope that it should be kept in continuous sod or tree cover. Assuming that the present cropland acreage of 49,952 acres were placed in continuous sod or tree cover, the remaining acreage in Class I, II and III would more than meet the needs of the indicated acreage requirements for crops in the Basin in both 1980 and 2015.

Surface Water Availability and Development Potential

Runoff

Surface water runoff or 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 ground-water runoff. There are, or have been, two stream gaging stations with satisfactory streamflow records in the Basin that could be used in the runoff analysis.

Sunface runoff analysis in this report is based on the period from the beginning of water year 1939 through water year 1963. The average runoff during this 25 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 runoff rate at each gaging station is shown in Table 5.2. The average annual runoff is 17.24 inches or 919 acre-feet per square mile above the Pickens gage and 16.51 inches or 880 acre-feet per square mile above the Bovina gage. The summary of annual runoff for each of the gaging stations for the water years 1939 through 1963 is shown in Table 5.3. The annual runoff can be expected to equal or exceed 9.75 watershed inches, 520 acre-feet or 16.9 million gallons per square mile in the Big Black River Drainage Basin in eight out of ten years.

Table 5.2. Maximum, minimum and average runoff rates at selected gaging stations, Big Black Basin, 1965

Gaging station	Drainage area	Watershed			Volume per square mile		
		Average	Maximum	Minimum	Average	Maximum	Minimum
	Sq.Mi.	Inches	Inches	Inches	Ac.ft.	Ac.ft.	Ac.ft.
At Pickens	1,460	17.24	32.69	5.30	919	1,743	283
Near Bovina	2,810	16.51	32.28	3.81	880	1,721	203

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

Table 5.3. Annual runoff rates, two gaging stations, Big Black Basin, 1939 - 1963

Water year	Gaging station and volume	
	Big Black River at Pickens	Big Black River near Bovina
	Inches	Inches
1939	10.91	9.04
1940	19.04	18.30
1941	12.82	14.42
1942	10.59	10.97
1943	6.89	7.91
1944	19.19	17.23
1945	18.49	17.36
1946	24.54	26.32
1947	24.18	21.85
1948	19.60	17.30
1949	32.69	32.28
1950	20.54	19.44
1951	27.84	24.68
1952	11.28	7.81
1953	13.37	14.63
1954	8.14	7.62
1955	11.53	10.72
1956	14.51	15.33
1957	16.56	14.43
1958	26.32	25.92
1959	13.18	11.86
1960	18.44	17.10
1961	15.14	15.89
1962	30.03	29.69
1963	5.30	3.81
Total	431.12	412.81
Average	17.24	16.51
Maximum	32.69	32.28
Minimum	5.30	3.81

Source: Surface Water Supply of the United States, 1939-63, Geological Survey, United States Department of the Interior.

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.

Table 5.4. Water use allocation by the Mississippi Board of Water Commissioners through July 1966, Big Black Basin

Area of use	Purpose for which water is allocated					
	Domestic	Industrial	Irrigation	Municipal	Recreation	Fish culture
	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.	Ac.ft.
Basin	3	18	2,282	0	0	0

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

Impoundments

The topography of the Basin is such that there are suitable physical sites in all portions of the Basin. Sufficient storage can be impounded so that the entire average annual runoff, minus water losses, could be made available for beneficial uses.

In the Kilmichael Reach the average physical storage capacity is about a 43.0 inch equivalent. The average sediment storage requirements are 0.58 inch equivalent and the average floodwater detention capacity requirement is 5.13 inch equivalent, leaving over 37.0 inch equivalent available for beneficial water storage.

In the West Reach the average physical storage capacity is about 37.6 inch equivalent. The average sediment storage requirement is 0.83 inch equivalent and the average floodwater detention capacity is 5.18 inch equivalent leaving about 31.6 inch equivalent available for beneficial water storage.

In the Bentonia Reach the average physical storage capacity is about 32.3 inch equivalent. The average sediment storage requirement is 1.33 inch equivalent and the average floodwater detention capacity is 5.72 inch equivalent. This leaves about 25.2 inch equivalent available for beneficial water storage.

In the Bovina Reach, the average physical storage capacity is about 37.8 inch equivalent. The average sediment storage requirement is 1.00 inch equivalent and the average floodwater detention capacity is 5.31 inch equivalent. This leaves about 31.5 inch equivalent available for beneficial water storage.

The average available storage for beneficial uses ranges from a low of about one and one-half times the average annual runoff in the Bentonia Reach up to a high of about two and one-fourth

times the average annual runoff in the Kilmichael 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 Big Black Basin for maximum feasible storage of water for beneficial use.

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 less than 10 feet to 2,400 feet. Diameters of casing in drilled wells range from 2 inches to more than 20 inches. In most wells a larger diameter casing is used in the upper part of the well than in the bottom. Various types, sizes, and lengths of well screen are used to hold the water-bearing sand in place while allowing water to enter the well. A pack of gravel placed between the screen and the aquifer is often used to increase the efficiency of a well.

Most wells yield less than 500 gpm (gallons per minute); however, a few yield more than 1,000 gpm. Over most of the Basin it should be possible to construct wells that will produce 2,000 gpm from the best aquifer underlying the locality.

Large quantities of water are available from the several artesian aquifer systems underlying the Basin. At most places in the Basin water in adequate quantity and of good quality is available for most needs. Much more ground water is available to each town in the Basin than is presently being used. Well fields producing as much as 10 mgd (million gallons per day) could be constructed at many places. As development continues in each aquifer the water level will drop and pumping lift will be greater.

Much more needs to be known about the geohydraulics of the aquifer in order to make accurate predictions of the effects of developments in them. More detailed ground-water investigations need to be made prior to large ground water developments.

1/ Geology and Water Resources of the Big Black River Basin, Annex F, Geological Survey, United States Department of the Interior, 1966.

The intended use of the water will have a large effect on the water potential at a given location. The deeper aquifers have water that may be good for domestic use but be unfit for irrigation water because of high sodium content. The shallow aquifers have water that may be good for irrigation but need treatment for iron removal and ph adjustment for domestic use.

Channel Improvements and Levees

The potential for use of channel improvements 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 improvements 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, 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 channel improvements; however, they could in the future, if sufficient thought 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 in the main stem will depend almost entirely on future development (agricultural and other) in the floodplain area. There are few locations for large flood control reservoirs available in the Basin. Therefore, the flood control achieved in the main stem floodplain will have to be realized from channels or a combination of channels and levees (with the exception of what protection can be given by improvements in the upstream watersheds).

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

Irrigation

There are about 89,000 acres of potentially irrigable land in the Big Black Basin. Of this amount, 51,000 acres are open land used for crops and pastures. The use of supplemental irrigation as

a production practice is limited. In some years, irrigation of some crops would increase net returns a substantial amount. This situation existed during the dry years of 1952 to 1954. There are other years in which the application of supplemental water would not be profitable.

C. H. M. van Bavel in his drought and water surplus studies of the Lower Mississippi Valley found that there would be some drought days in the period of March through November in practically every year for the soils and their corresponding soil-moisture storage capacity of the Big Black Basin. 1/ For those soils with a 2 inch soil-moisture storage capacity the minimum number of drought days can be expected in the driest 5 out of 10 years is about 80 and 120 for the driest 1 out of 10. For those soils with a 3 inch soil-moisture storage capacity the drought day is 70 and 105 respectively.

The feasibility and potential of irrigation in the Basin no doubt needs to be further investigated under present conditions. Changes in the future structure of agriculture will influence the need for supplemental water. The use of supplemental irrigation as a production practice will depend on many complex and varied factors, among which are: (1) development and availability of a higher level of management and labor; (2) development of crop varieties with better response to water; (3) development of better methods of irrigation; (4) development of the complimentary cultural practices for irrigation; (5) the development of a desire for and acceptance of irrigation by management and by labor; (6) capital; and (7) a change in relationship of costs and returns of farming enterprises.

There is a question, under present conditions, as to whether or not irrigation is a profitable production practice. However, irrigation may prove to be very profitable for some high value crops such as truck crops or other special uses. There appears to be sufficient ground or surface water available to meet the irrigation needs of the crops and special uses, thus project action does not appear to be justified within the next 10 to 15 years. The potential need or desire of water for supplemental irrigation after the 10 to 15 year period will need to be kept in mind in any allocation of water for other beneficial uses.

Because of the question of feasibility of applying supplemental water to major crops presently grown, a detailed economic analysis was not made. An examination was made, however, which

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1/ Drought and Water Surplus in Agricultural Soils of the Lower Mississippi Valley Area, Agricultural Research Service, United States Department of Agriculture, Technical Bulletin No. 1209, December 1959.

indicated that the total increase in net income that might presently accrue from irrigating cotton, corn and soybeans is $121,000. 1/ The cost of supplying supplemental water is not included and would reduce the estimate substantially.

Studies of the upstream watersheds indicate that some have potential for development of irrigation water supplies. However, no storage projects for irrigation water supply appears to be needed in the near future, except for some isolated or special cases. Development of the full irrigation potential will depend on future national, regional and local needs and changing economic conditions.

Water level control on forest land may be beneficial to tree growth. The Big Black Study Area has few or no forest areas in need of drainage. The irrigation of bottomland forest during dry years can significantly increase the radial growth of several southern hardwood species. A recent study shows how irrigation affected radial growth of sweetgum and other mixed hardwoods. 2/ The results are listed below.

Species and crown class	Radial growth	
	Irrigated	Non-irrigated
	Inches	Inches
Sweetgum		
Dominant	1.16	0.70
Co-dominant	.81	.53
Intermediate and suppressed	.58	.25
Dominant and co-dominant	1.00	.62
All classes	.91	.56
Other hardwoods 3/	.84	.56

During the six year study supplemental water increased sweetgum growth 62 percent and other hardwoods 50 percent. These increases were obtained in normal to wet years.

1/ Water Management Analysis of Big Black River Basin, Economic Research Service, United States Department of Agriculture, June 1966. Acreage irrigated -- cotton, 5,400 acres; corn, 5,400 acres; and soybeans, 1,800 acres.

2/ Hardwoods Respond to Irrigation, by Walter M. Broadfoot, Journal of Forestry, Volume 62, Number 8, August 1964.

3/ Nuttal oak, green ash, hackberry, persimmon, and overcup oak.

Recreational Developments and Fish and Wildlife

The potential of eleven types of recreational facilities was appraised in the Study Area under the auspices of the NASCD Commissioners. 1/ The method was one where a local group, composed of representatives from the several local, State and Federal agencies, and other interested organizations or persons discussed the various elements affecting different types of recreational facilities and appraised the potential for each type development within a county as high, medium or low. 2/

The estimated future number of private recreational facilities revealed by this assessment is presented in Table 5.5. Vacation cabins, cottages and homesites representing rural living rated high in Madison and Carroll Counties, reflecting the impact of the Jackson area population upon Madison County and the already constructed flood retarding structures in Carroll County. Other areas rated a medium potential with Hinds, Warren and Attala Counties being above average in this assessment.

Camping grounds have a medium to high potential in most of the Study Area with greatest assets in Warren and Madison Counties. Major tourist routes are key factors in determining the potential for transient campers and the construction of new interstate highways in progress will enhance camping potentials.

Picnic and field sports areas, a user oriented activity, received high ratings near heavy populations only while fishing waters potential rated highest of all activities. Madison and Hinds Counties exhibited good golf course development potential, again reflecting the population.

The potential for development of hunting areas rated medium to high. Much of the lower portion of the Study Area is good deer and turkey range with most lands under lease by private hunting and fishing clubs. An increasing need for accessible hunting areas will probably stimulate the development of wildlife habitat and the enterprise of fee hunting.

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

Table 5.5. Potential development of private recreational facilities, Big Black Study Area, 1980

Activity	Number
Vacation cabins	448
Camping ground sites	74
Picnic and field sports areas	364
Fishing water areas (including farm ponds)	3,075
Golf courses	36
Hunting areas	644
Natural, scenic and historic sites	29
Riding stables	66
Shooting preserves	27
Vacation farms	23
Water sports areas	126
Estimated new recreation water (includes managed farm ponds)	
Areas	1,027
Acres	1,000

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

Natural, scenic and historical areas received the best rating in Warren and Claiborne Counties. Several areas of historical and scenic significance are found in this vicinity. Abandoned Mississippi River ports, homes of famous people, and Civil War Battlefields are among the development possibilities.

Riding stables and horse boarding enterprises have a good potential near populated areas. Shooting preserve potential rates well in Hinds, Warren and Madison Counties. Actual development of shooting preserves will probably be related to the development of fee hunting on private lands.

Potentials for vacation farms rated low to medium. Madison County, with a number of long established farms, exhibited the best potential for this enterprise.

Water sports area potential rated well reflecting existing water areas in the form of large lakes in the western portion of

the Study Area. Estimated new water areas to be built for recreational purposes by 1980 numbered 1,027, totaling 10,000 acres.

The U. S. Forest Service provides some outdoor recreational facilities in the Tombigbee National Forest. The facilities are designed to meet probable increased needs from a growing local population. A list of planned recreational facilities within the Tombigbee National Forest lands is presented in Table 5.6. Accomplishment of planned development is contingent upon the availability of regular Forest Service funds for this purpose.

Forest industries own approximately 5 to 10 percent of the forest land in the Basin. Some of these acres are open to use by the public for hunting, stream fishing, camping and picnicking. This does not mean that a great number of campgrounds or picnic areas have been developed, or have the facilities desired by most campers and picnickers - drinking water, toilets, etc. For the most part, forest industry lands are intermingled with those of other owners and bear no distinguishing characteristics. Most industries simply do not post their properties and sportsmen are permitted to come and go at will. The companies themselves are engaged primarily in the business of growing the raw material for their plants. Some lands open today may be closed tomorrow because of logging operations or severe forest fire hazards. Forest industry and other large forest land owners are in a fine position to furnish future recreation areas. The recreational potential on these lands is considered good.

The identification of water and land resource development potential as expressed in this report does not take into consideration the assessment of development potential investigated by other Federal and Stage agencies.

Table 5.6. Inventory of planned recreational developments in the Tombigbee National Forest 1/, Big Black Study Area, 1980 and 2015

Activity	Planned facilities 2/		
	1980 3/	2015 4/	Potential 5/
Camping 6/	40 acres 120 F. U.	120 acres 360 F. U.	85 acres 255 F. U.
Picnicking 7/	35 acres 105 F. U.	35 acres 105 F. U.	10 acres 30 F. U.
Swimming	2 acres	10 acres	5 acres
Boating	4 acres launch 110 acres water	10 acres launch 223 acres water	2 acres launch 83 acres water
Fishing	110 acres	223 acres	83 acres
Hunting	11,213 acres	11,213 acres	--------

Source: Derived from internal data of the Forest Service, United States Department of Agriculture.

1/ That in Choctaw County only as revealed in the 1959 National Forest Recreation Survey.

2/ Estimates are not cumulative.

3/ These estimates are for facilities planned through June 1975.

4/ These estimates are for facilities planned through the year 2000.

5/ Area is suitable and available as defined by existing plans of U. S. Forest Service.

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

7/ 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, Big Black River Development Association and Others

The first Soil Conservation District in the Big Black Basin was organized in Claiborne County in December 1938. Since that date, Districts have been organized in all of the other counties that are 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 69 percent of the agricultural land. Farm plans have been prepared for 41 percent of the farms comprising 40 percent of the agricultural land. Practices carried out to date include conservation cropping systems, pasture planting and improvements, farm ponds, drainage, terracing, contour farming, critical area land treatment, tree planting, woodland management practices, etc. The land treatment measures applied on the land as of June 30, 1966, are shown in Table 6.1.

The first local water management district organized in Mississippi under Public Law 566 was Tackett Creek Watershed located in this Basin. A work plan was prepared for this watershed and it was approved for operation in October 1957. Since that time six other watersheds have organized and prepared work plans that have been approved for operation. They are: Ellison Creek, Mulberry Creek, Bentonia Creek, Persimmon-Burnt Corn Creeks, Bear Tilda Bogue and Long Creek. All of the structural measures and most of the land treatment measures to be applied with accelerated funds have been completed on Tackett Creek, Ellison Creek, Bentonia Creek and Persimmon-Burnt Corn Creeks Watersheds. To date none of the structural measures have been installed in Mulberry Creek and Long Creek. Work plans have been or now are in the process of being prepared on Five Creeks, Box Creek and Apookta Creek Watersheds. The status of planning, operation and installation for the 10 PL-566 watersheds is shown in Table 6.2 and Figure 6.1. In the watersheds now in operation, 21 floodwater retarding structures, 61 miles of channel improvement, 96 grade control structures, 110 debris basins, 3,473 acres of critical area planting and 4,470 acres of tree planting have been completed. (Table 6.1 and Figure 6.2.)

Table 6.1. Land treatment and structural measures now on the land, Big Black Basin, as of June 30, 1966

Practice	Unit	Going Programs (PL-46, ACP and other)	Accelerated programs (PL-566)	Total
Brush control	Acre	82,933	40,715	123,648
Conservation cropping system	Acre	164,198	37,156	201,354
Contour farming	Acre	72,136	13,758	85,894
Controlled burning	Acre	624	360	984
Cover and green manure crop	Acre	35,796	2,588	38,384
Critical area planting	Acre	8,798	3,473	12,271
Crop residue use	Acre	123,808	23,278	147,086
Diversion	Foot	1,374,465	311,886	1,686,351
Farm ponds	Number	8,033	2,245	10,278
Fire breaks	Foot	297,540	101,523	399,063
Fishpond stocking	Number	6,156	1,363	7,519
Fishpond management	Number	771	76	847
Grassed waterway or outlet	Acre	320	176	496
Irrigation storage reservoir	Number	15	14	29
Irrigation system sprinkler	Number	13	2	15
Land smoothing	Acre	3,756	63	3,819
Drainage main or lateral	Foot	3,570,414	308,490	3,878,904
Drainage field ditch	Foot	4,055,849	555,984	4,611,833
Pasture and hayland management	Acre	95,274	19,925	115,199
Pasture renovation	Acre	110,244	29,637	139,881
Pasture planting	Acre	182,038	31,886	213,924
Row arrangement	Acre	98,692	21,497	120,189
Terrace, gradient	Foot	3,070,391	879,687	3,950,078
Terrace, parallel	Foot	27,278	116,149	143,427
Tree planting	Acre	22,184	4,477	26,661
Wildlife habitat development	Acre	3,549	670	4,219
Woodland harvest cutting	Acre	30,224	2,712	32,936
Woodland intermediate cutting	Acre	68,362	3,480	71,842
Woodland interplanting	Acre	2,446	568	3,014
Woodland weeding	Acre	43,863	4,630	48,493
Debris basins	Number		110	110
Floodwater retarding structures	Number		21	21
Grade stabilization structures	Number		96	96
Stream channel improvement	Mile		61	61

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

Table 6.2. Status of PL-566 watersheds, Big Black Basin

Watershed	Planned	In the planning stage	In operation	Most of the measures installed
Tackett Creek	X	--	X	X
Ellison Creek	X	--	X	X
Mulberry Creek	X	--	X	--
Bentonia Creek	X	--	X	X
Persimmon-Burnt Corn Creek	X	--	X	X
Bear Tilda Bogue	X	--	X	--
Long Creek	X	--	X	--
Five Creeks	--	X	--	--
Box Creek	--	X	--	--
Apookta Creek	--	X	--	--

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

In addition to the 7 watersheds now in operation, 3 others are in the process of being planned and will be in operation soon. They are: Five Creeks, Box Creek and Apookta Creek. Structural measures to be built in these three watersheds and in Mulberry Creek and Long Creek are: 49 floodwater retarding structures, 2 multiple purpose structures with minimum basic facilities and 230 miles of stream channel improvement. Also, 1,653 acres of critical area land are to be planted to grasses and legumes and 4,577 acres to trees. Erosion control measures are expected to be applied on 342 miles of road banks. Physical and structural data along with costs and benefits by watersheds are shown in Table 6.3.

The total annual benefits for structural measures are $782,900. Of this amount, $419,700 is damage reduction benefits, $157,300 is from changed land use, $60,100 is from planned recreation in the two multi-purpose structures, $25,600 is incidental recreation in the floodwater retarding structures and $120,200 is secondary benefits. Benefits from recreation are based upon 53,050 annual visitor days. Incidental recreation benefits are based upon 25 annual visitor days per surface acre of water in the floodwater retarding structures and they are discounted for reduction in size because of sediment filling.

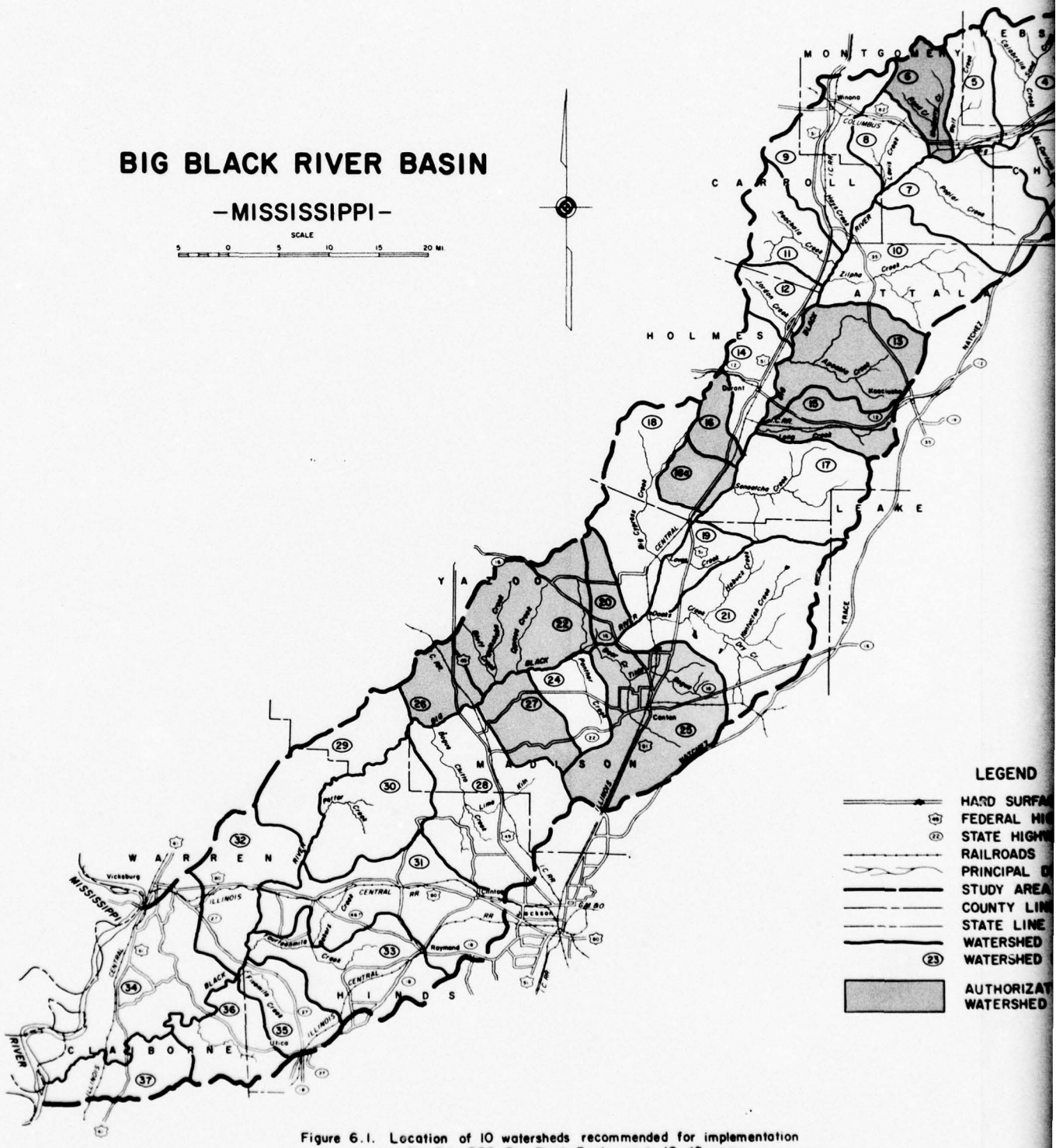

Figure 6.1. Location of 10 watersheds recommended for implementation under P.L. 566, Big Black Basin, next 10-15 years

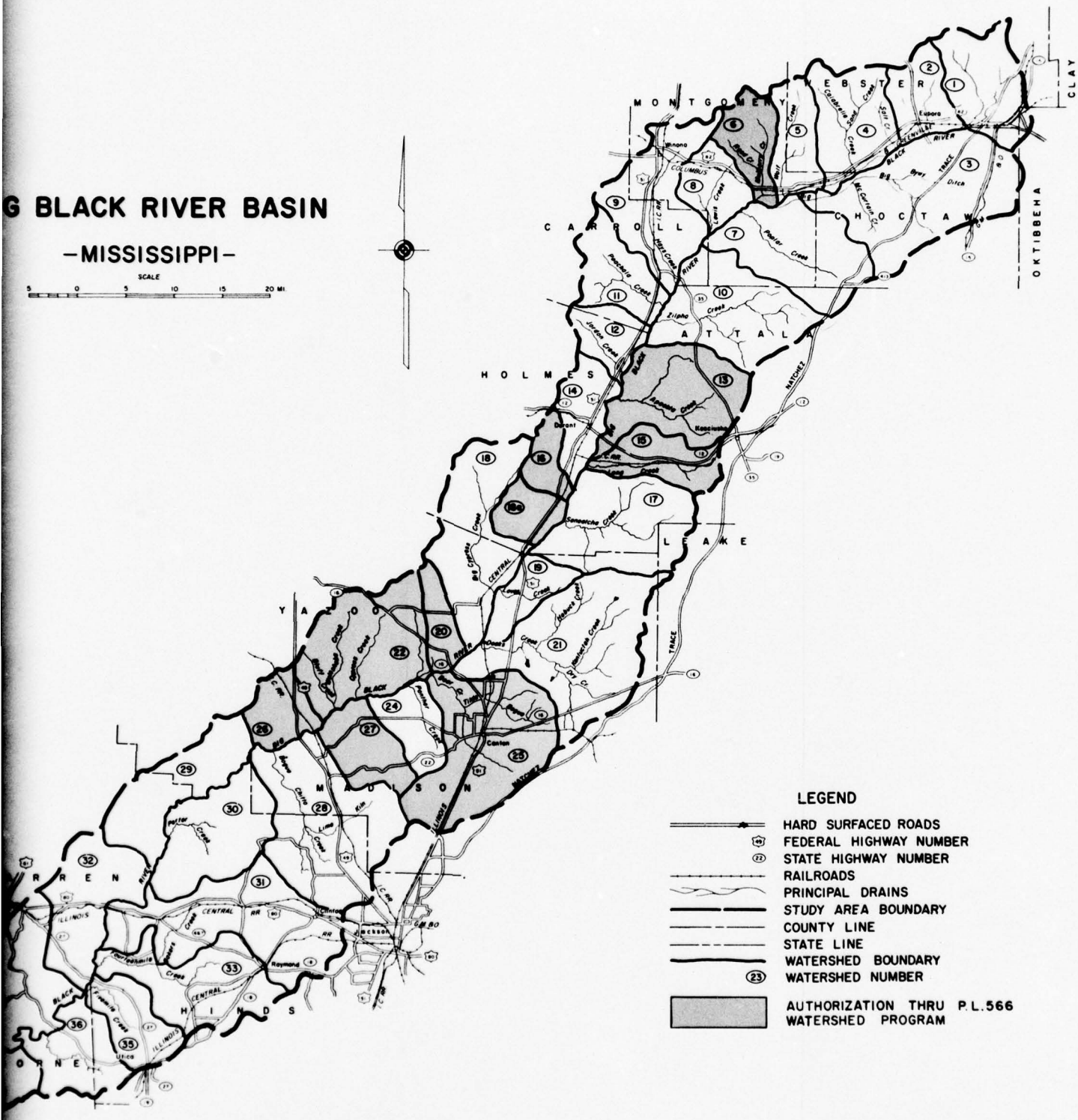

Figure 6.1. Location of 10 watersheds recommended for implementation under P.L. 566, Big Black Basin, next 10-15 years

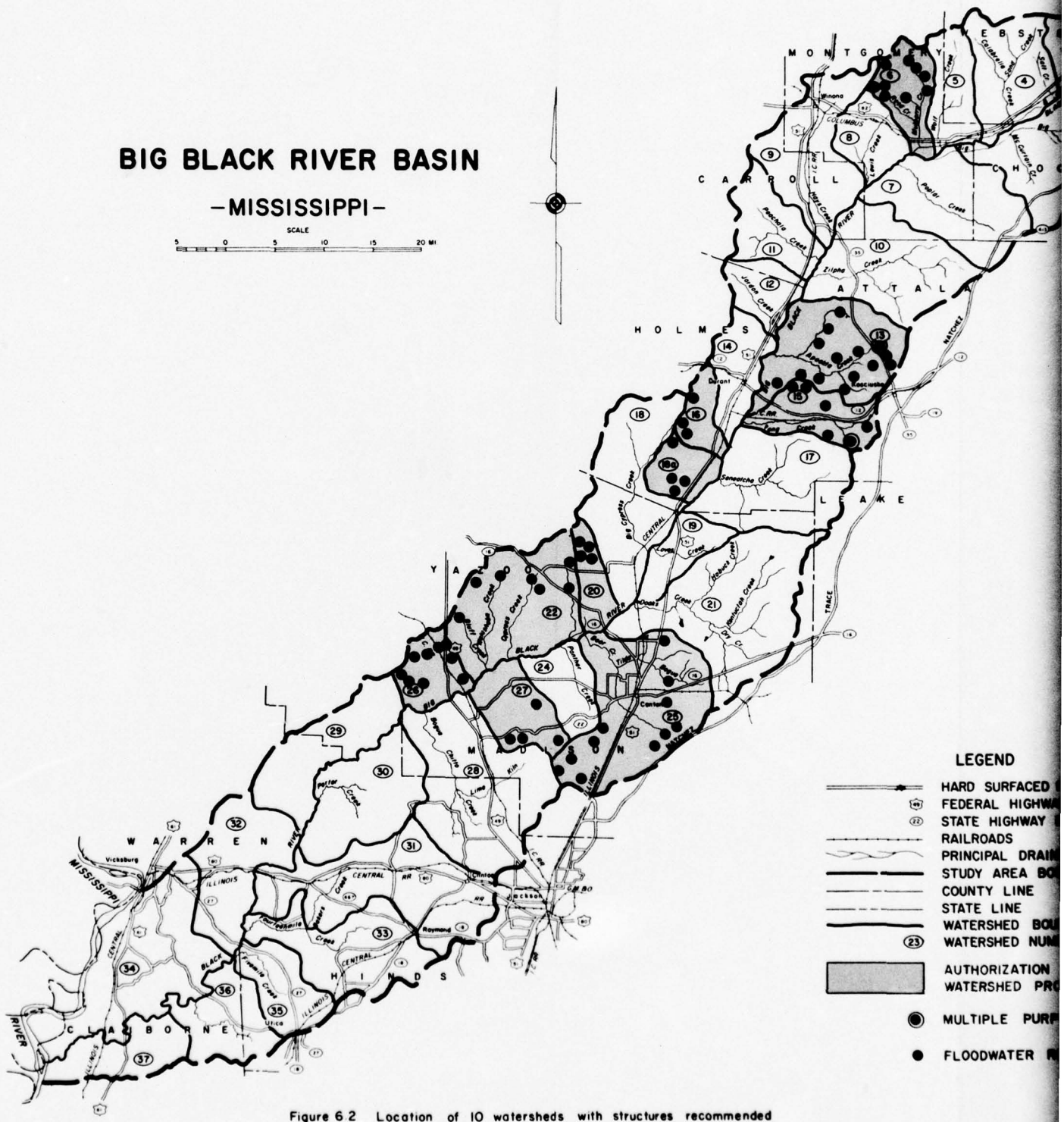

Figure 6.2 Location of 10 watersheds with structures recommended for implementation under P.L. 566, Big Black Basin, next 10–15 years.

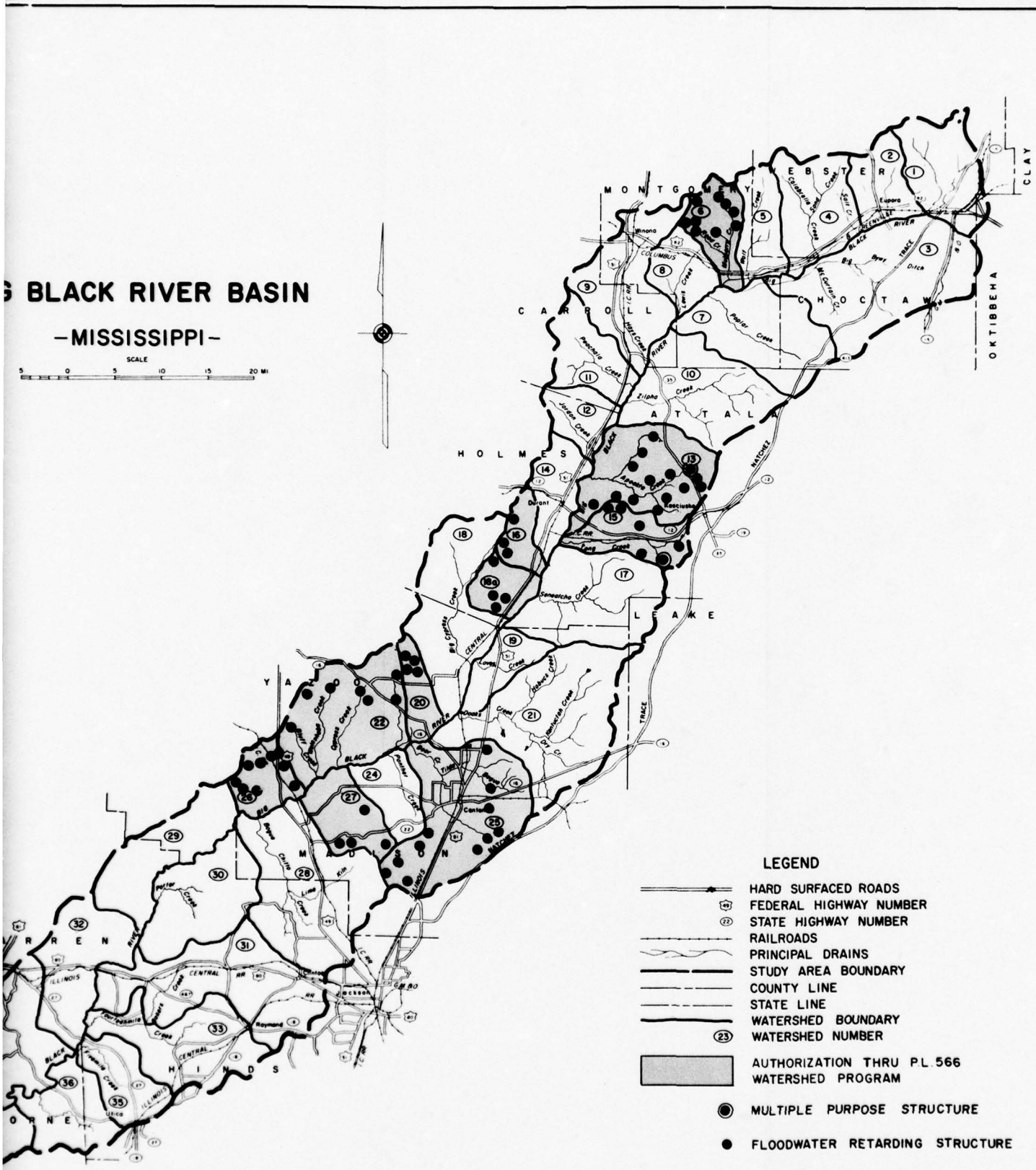

Figure 6.2. Location of 10 watersheds with structures recommended for implementation under P.L. 566, Big Black Basin, next 10–15 years.

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Table 6.3. Physical data, costs and benefits, by PL-566 watersheds, Big Black Basin

Watershed	Total area	Floodwater retarding and multi-purpose structures: Drainage area controlled	Floodwater retarding and multi-purpose structures: In-stalled	Floodwater retarding and multi-purpose structures: To be in-stalled	Channel improvement: In-stalled	Channel improvement: To be in-stalled	Total cost of land treatment measures yet to be installed	Total in-stallation costs of structural measures yet to be built	Annual benefits to struc-tural mea-sures	Annual cost of struc-tural mea-sures	Bene-fit cost ratio
	Acres	Acres	Number	Number	Miles	Miles	Thou. dollars	Thou. dollars	Dollars	Dollars	
Tackett Creek	8,900	3,800	4	-	7	-	25	-	-	-	-
Ellison Creek	23,000	2,700	4	-	18	-	73	-	-	-	-
Mulberry Creek	29,600	10,400	-	1/ 9	-	20	376	610	64,900	25,400	2.6:1
Bertonia Creek	31,300	8,800	9	-	18	-	73	-	-	-	-
Persimmon-Burnt Corn Creek	35,000	5,800	4	-	18	-	56	-	-	-	-
Bear Tilda Bogue	107,600	36,700	-	11	-	65	1,092	3,306	285,500	138,400	2.1:1
Long Creek	46,400	9,600	-	6	-	23	454	1,204	154,900	48,500	3.2:1
Five Creeks	98,700	29,700	-	7	-	63	712	2,210	118,400	83,500	1.4:1
Box Creek	21,800	5,400	-	3	-	13	199	365	30,500	15,300	2.0:1
Apookta Creek	68,200	27,700	-	1/15	-	45	558	1,611	128,700	79,300	1.6:1
Total	470,500	140,600	21	51	61	229	3,618	9,306	782,900	390,400	2.0:1

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

1/ Includes 1 multiple purpose structure with recreational facilities.

An accelerated land treatment program will be carried out in the PL-566 watersheds and the 22 watersheds and areas for Basin-wide authorization. A part of the remaining land treatment needs for water resource development as shown in Tables 4.3 and 4.4 will be met in the future by the regular going PL-46 and other programs. Summary data for the 10 PL-566 watersheds are shown in Tables 6.4 through 6.11.

The Vicksburg District of the U. S. Army Corps of Engineers completed channel improvement work on the main stem of the Big Black in 1939. This work consisted mainly of 43 cut-offs, clearing and snagging, channel enlargement at the mouth of some of the tributary streams and 8 miles of drainage canal excavation. The Corps maintained this channel until 1955. Since that time it has deteriorated considerably. In addition to the main stem, channel clearing was performed on 14 tributary streams in Attala, Carroll, Montgomery, Choctaw, and Webster Counties. This work was completed in 1941.

Nine drainage districts were organized in the Basin between 1911 and 1924 covering 38,508 acres of land. By June 1939, these districts constructed approximately 70.5 miles of channels. These districts were mainly on tributary streams such as Dry Creek, Hays Creek, Bywy Creek and Cullabeta. Some of these districts are dormant and there has been little or no maintenance on channels.

The Mississippi Legislature passed a bill during the 1964 session that authorized the formation of a Big Black River Development Association. To form this association at least five counties in the Basin must join together in order for it to be a legally constituted body with authority to levy a tax to support its activities. Presently five counties have not come into the association.

The Natchez Trace Parkway enters the Basin north of Maben and travels in a southwestern direction. It crosses the boundary near the Choctaw County line and parallels the Basin to the vicinity of Jackson, Mississippi. It enters the Basin again northeast of Clinton, Mississippi and leaves it near Rocky Springs in Claiborne County. This is a Federally owned and maintained Parkway that will extend from Nashville, Tennessee to Natchez, Mississippi when complete. It is a scenic driveway with numerous recreational facilities such as camping and picnicking areas, nature trails, overlooks and historical sites located on it. Part of the Parkway southwest of Jackson is not complete but is now under construction.

Holmes County State Park is located in the Basin near Goodman. It has a 60 acre lake that is used for all of the water sports. In addition, there are facilities for camping and picnicking.

Table 6.4. Estimated installation costs of land treatment and structural measures for 10 PL-566 watersheds, Big Black Basin

Item	Unit	Amount	Estimated cost		
			Federal	Other 1/	Total
			Thou. dollars	Thou. dollars	Thou. dollars
LAND TREATMENT MEASURES					
Cropland and pastures					
Cropland	Acres	54,617	--	464	464
Grassland	Acres	79,947	--	1,733	1,733
Wildlife land	Acres	3,128	--	38	38
Critical area planting					
Grasses and legumes	Acres	1,653	74	39	113
Roadside erosion control	Miles	342	56	31	87
Technical assistance	--	--	524	114	638
Total-cropland and pastures	--	--	654	2,419	3,073
Forest land					
Private forest land	Acres	22,910	--	244	244
Critical area planting					
Tree planting	Acres	4,577	129	62	191
Technical assistance	--	--	79	31	110
Total-Forest land	--	--	208	337	545
Total-Land treatment measures	--	--	862	2,756	3,618
STRUCTURAL MEASURES					
Floodwater retarding structures	Number	49	3,070	--	3,070
Stream channel improvement	Miles	230	2,505	--	2,505
Multiple purpose structures	Number	2	180	41	221
Minimum basic facilities	Number	2	63	63	126
Sub-total-Construction		--	5,818	104	5,922
Installation services	--	--	1,873	19	1,892
Land easements and R.O.W.	--	--	48	1,350	1,398
Adm. of contracts & other	--	--	--	94	94
Total-Structural measures	--	--	7,739	1,567	9,306
TOTAL PROJECT	--	--	8,601	4,323	12,924

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, 10 PL-566 watersheds, Big Black Basin

Item	Construction and installation services		Other		
	Construction	Installation services	Land easement and R.O.W.	Adm. of contract and other	Total installation cost
	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	3,070	1,002	946	43	5,061
Channel improvement	2,505	788	357	46	3,696
Multiple purpose structures	221	65	77	3	366
Minimum basic facilities	126	37	18	2	183
Total	5,922	1,892	1,398	94	9,306

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

Table 6.6. Cost allocation and cost sharing summary, 10 PL-566 watersheds, Big Black Basin

Item	Purpose		
	Flood prevention	Recreation	Total
	Cost allocation		
	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	5,061	---	5,061
Channel improvement	3,696	---	3,696
Multiple purpose structures	183	183	366
Minimum basic facilities	---	183	183
Total	8,940	366	9,306
	Cost sharing		
	Federal	Non-Federal	
	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	4,072	989	5,061
Channel improvement	3,293	403	3,696
Multiple purpose structures	284	82	366
Minimum basic facilities	90	93	183
Total	7,739	1,567	9,306

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

Table 6.7. Structure data, 10 PL-566 watersheds, Big Black Basin

Item	Unit	Total
Drainage area	Sq. mi.	220
Storage capacity		
Sediment	Ac. ft.	18,900
Floodwater	Ac. ft.	60,600
Recreation	Ac. ft.	1/ 2,800
Potential water storage	Ac. ft.	214,500
Total	Ac. ft.	296,800
Surface area		
Sediment pool	Acre	3,600
Floodwater pool	Acre	11,400
Recreation	Acre	400
Potential water storage pool	Acre	17,100

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

1/ Includes 773 acre feet for sediment storage.

Table 6.8. Annual costs, 10 PL-566 watersheds, Big Black Basin

Measures	Amortization of installation cost	Operation and maintenance cost	Other economic cost	Total
	Dollars	Dollars	Dollars	Dollars
Floodwater retarding structures	162,000	16,200	4,600	182,800
Multiple purpose structures	11,900	1,200	200	13,300
Minimum basic facilities	5,800	17,200	---	23,000
Channel improvements	118,600	52,600	---	171,300
Total	298,300	87,200	4,800	390,400

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

Table 6.9. Estimated average annual flood damage reduction benefits, 10 PL-566 watersheds, Big Black Basin

Item	Estimated average annual damages		Damage reduction benefits
	Without project	With project	
	Dollars 1/	Dollars 1/	Dollars 1/
Floodwater			
Crop and pasture	441,200	89,500	351,700
Other agricultural	20,600	6,200	14,400
Non-agricultural			
Urban and industrial			
Road and bridge	48,200	16,100	32,100
Sub-total	510,000	111,800	398,200
Erosion, reduced road maintenance	9,800	3,400	6,400
Indirect	43,900	11,500	32,400
Total	563,700	126,700	437,000

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

1/ Price base - long term projected.

Table 6.10. Comparison of benefits and cost for structure measures, 10 PL-566 watersheds, Big Black Basin

Evaluation unit	Average annual benefits 1/							Average annual cost	B/C ratio primary benefits	B/C ratio total benefits
	Damage reduction	Changed and more intensive land use	Planned recreation	Incidental recreation	Total primary benefits	Secondary benefits	Total benefits			
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Flood prevention	419,700	157,300	—	25,600	602,600	114,200	716,800	361,100	1.7:1	2.0:1
Recreation	—	—	60,100	—	60,100	6,000	66,100	29,300	2.0:1	2.3:1
Total	2/419,700	157,300	60,100	25,600	662,700	120,200	782,900	390,400	1.7:1	2.0:1

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 $9,400, erosion (reduced road maintenance) benefits, $6,400, and indirect benefits, $1,500. Total benefits of $17,300 annually.

Table 6.11. Summary of physical and plan data, 10 PL-566 watersheds, Big Black Basin

Item	Unit	Quantity without project	Quantity with project
Watershed area	Sq. Mi.	735	735
	Acres	470,500	470,500
Area of cropland	Acres	109,600	103,100
Area of grassland	Acres	72,100	101,400
Area of woodland	Acres	249,200	233,800
Miscellaneous area	Acres	39,600	32,200
Floodplain area subject to inundation of maximum storm in evaluation series	Acres	64,200	---
Area of floodplain benefited by proposed structural measures			
Directly	Acres	---	39,200
Indirectly	Acres	---	12,200
Total	Acres	---	51,400
Woodland conversions	Acres	---	5,400
Watershed area controlled by floodwater retarding structures	Acres	---	140,600
	Percent	---	30

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

Cooperative State-Federal Forestry and Related Programs

There are a number of different forestry programs available through the cooperation of the State-Federal governments. 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 judgement 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 forest fire control (CM-2), for sale of forest-tree planting stock at low cost (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 boundary of the Southern Forest Experiment Station which is headquartered in New Orleans, Louisiana. Just north of Vicksburg, Mississippi, in the loess hills is the Bluff Experimental Forest. This area is under the supervision of the Southern Hardwoods Laboratory at Stoneville, Mississippi. Research on the upland hardwood such as soil-site-species relationship studies, stand conversion, natural stand treatment and growth, and genetics of hardwood species is being conducted. At other experimental forests in the South, research is done on watershed management, recreation, forest fire, range and wildlife habitat, forest products utilization and engineering.

The Soil Conservation and Domestic Allotment Act, passed in 1935, authorized the Secretary of Agriculture through the Soil Conservation Service to furnish technical assistance (forest 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 of navigable streams.

The Forest Pest 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 official 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 also that owned by other political subdivisions, corporations or individuals.

The Cooperative Forest Management Act of August 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 (P.L. 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; and (4) construction of firebreaks for forest land protection.

The Food and Agricultural Act of 1962 authorized a program to assist farmers in shifting their land to non-agricultural 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 Land and Water Conservation Fund Act (P.L. 88-578) became effective on January 1, 1965. The purposes of this Act are 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 protection from the suppression of all wild

forest fires, (3) forest 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 lane construction is available on a fee basis.

CHAPTER VII

PLAN FORMULATION - USDA

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. Through the Mississippi Legislature, in 1964 a bill was passed authorizing the formation of a Big Black Water Management District to provide the means of coordinating and participating in river basin planning and implementing recommendations. 1/ 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 Big Black River are for the beneficial use and general welfare of the entire people of the State. The association 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 would provide a necessary and opportune means of coordinating and formulating water resource development projects in upstream watersheds and on the mainstem and tributary streams in the Big Black Basin.

1/ At least five counties in the Basin must join together before this association can be a legally constituted body. To date enough counties have not voted to join the association for it to form.

Coordination with Public and Private Agencies

A Basin Coordinating Committee was formed of representatives of participating Federal Agencies and the State of Mississippi to serve as a means of achieving coordination in conducting the studies and formulating the proposed plan. The District Engineer of the Vicksburg District, U. S. Army Corps of Engineers, served as chairman. The State Conservationist of the SCS in Mississippi represented the USDA. The State of Mississippi is represented on the Committee.

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 their activities. These documents provided for special investigations needed by the Corps of Engineers 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 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.

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. Local interest viewpoints and needs were ascertained in other feasible watersheds while the study was in progress.

Any conflicts of interest in overlapping projects proposed by the Corps of Engineers and USDA were resolved through consultations. Modifications in plans were made to the satisfaction of the Corps of Engineers, USDA and local interest groups involved without compromising Basin objectives.

USDA Policy and Local Interest Considerations

Detailed 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 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 and cost sharing in any structure for purposes other than flood prevention, agriculture water management, recreation and fish and wildlife development; (4) No Federal financial or technical assistance will be provided within projects for separate or independent parts of drainage or irrigation systems, the primary purpose of which is to bring new land into agricultural production. Neither can assistance be granted to such projects where the benefits accrue primarily from bringing new land into production; and (5) 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, is channel improvement.

The extent of structural measures for flood prevention are a combination of detention reservoirs and channel improvement needed to meet the overall objectives of the local people. Fulfilling this objective would, in effect, maximize the net benefits for

flood prevention. 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.

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 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 an annual gross erosion and sediment yields for impoundments.

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 of existing fishery and wildlife habitat. Field biologists made on-site investigations in each feasible watershed to determine the damages, if any, to habitats from proposed project structural measures. Where damage to wildlife habitat would occur, provisions were made to mitigate damages.

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

Also, benefits 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.

Thirty-two watersheds were determined as being economically feasible watershed projects including PL-566 projects now in operation (Figure 7.1). Five watersheds are potentially feasible watershed projects.

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 central and upper portions 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

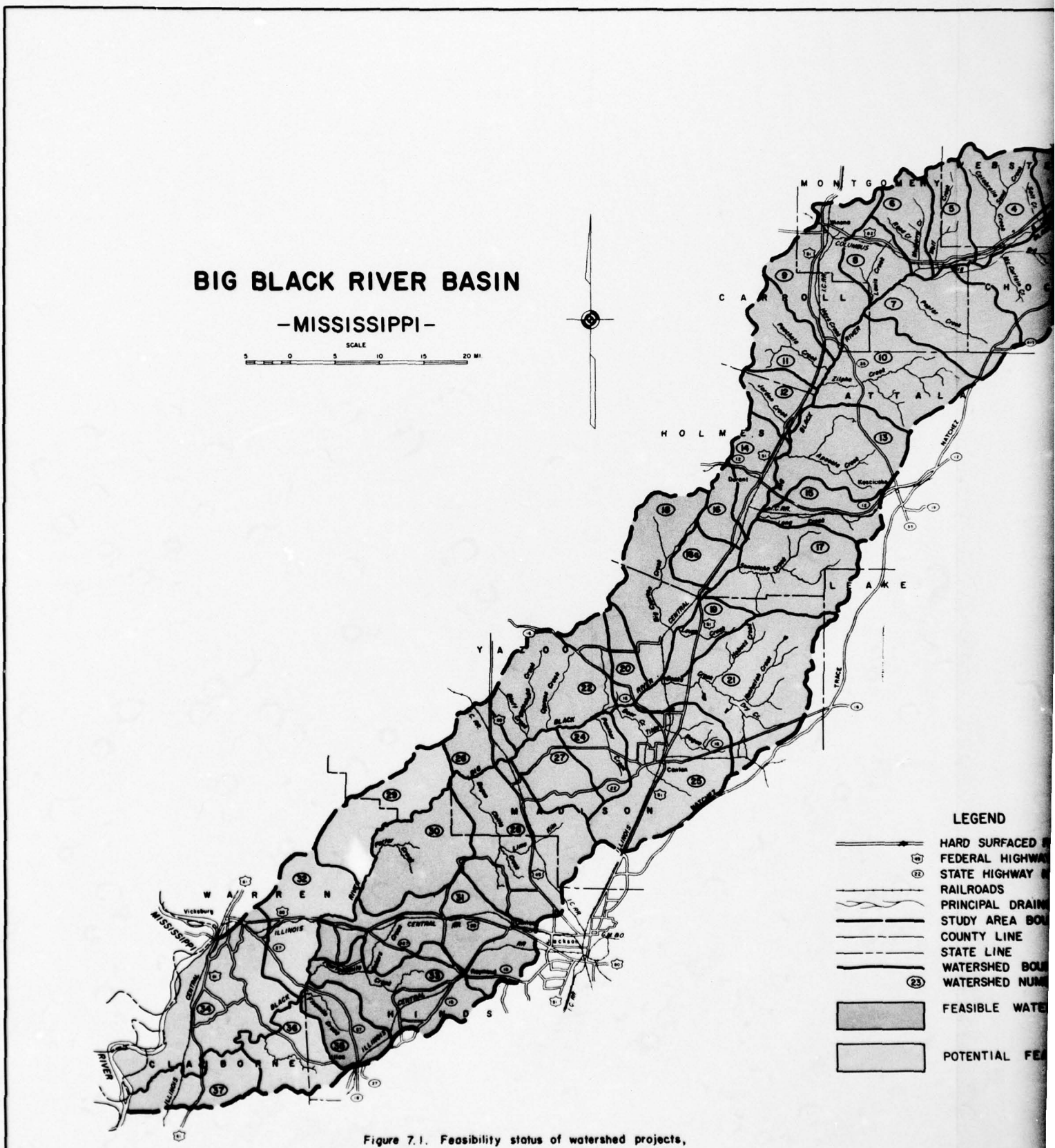

Figure 7.1. Feasibility status of watershed projects, Big Black Basin, 1965

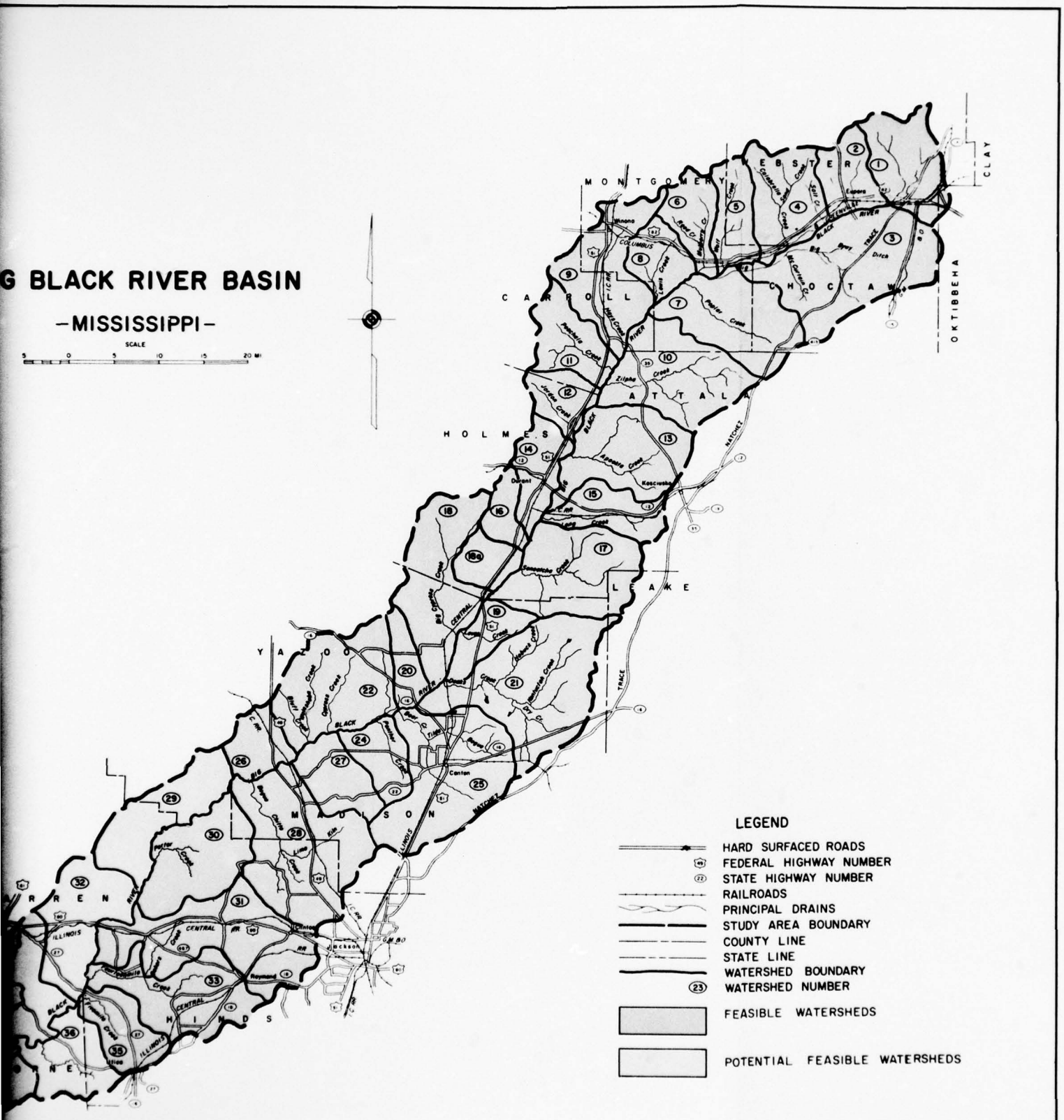

Figure 7.1. Feasibility status of watershed projects, Big Black Basin, 1965

action of the 32 feasible watersheds. Reducing the sediment pollution problem can only be achieved in the immediate action period with an accelerated program having 100 percent Federal participation 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 13 proposed floodwater retarding structures located in sample watersheds throughout the Basin. Land use, cover and slope conditions were recorded. Gullies, pits and caved road banks 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 1300 tons per acre-foot was used for submerged sediments and 1800 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. The methodology and planning criteria for determining the demand, supply and need 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 1980 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, camping) were made for each site. The annual activity occasions were calculated and divided by 1.5 to arrive at a recreation user day. 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 of 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, their financial capability to share the local costs, and the physical characteristics of the sites. Organic and inorganic pollutants were not problems in site selection. 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 Big Black 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 water-dependent and water-enhanced activities, other than for fishing and canoeing, in 1980.

Bacterial standards for swimming and other water contact sports are being proposed by State and Federal agencies. Water quality criteria for interstate streams for the State of Mississippi is 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.

Irrigation

The use of supplemental water for increasing the production of cotton, corn, soybeans or pasture to satisfy national or regional requirements is not now 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.

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 1000 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 floodplain 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

The need for group drainage to bring new land into production of row crops, grasses and legumes to satisfy the Basin's share of national requirements is not needed. The 1958 Conservation Needs Inventory data indicates that 248,000 acres of open land and 187,000 acres of forest land in the counties within the Basin have a drainage problem. However, most of this land can be drained with on-farm drainage systems. Outlets for farm drainage systems

are generally adequate and there is no need for project action for drainage. There are a few isolated cases where existing channels need to be deepened to improve drainage. Drainage as a purpose was not included in any of the upland watersheds.

Water Supply

Water storage potentials were studied on 12 sites for large intermediate type structures in the Basin. This information was used to develop storage curves. These will be useful in providing information on supplying large amounts of water in case there is a need for it.

Foundation investigations were made on one of these sites to obtain data on seepage losses and information for use in developing construction costs.

CHAPTER VIII

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

Plan Presentation

The plan proposed by the Department of Agriculture includes the ten watershed projects that are being, or are to be, implemented through the going PL-566 program (presented in Chapter VI) plus twenty-two projects proposed for Basin-wide authorization. The plan is the culmination of Departmental studies and contributing studies by other Federal, State and local agencies. The Agriculture Plan includes land and water resource developments in the headwater areas that contribute to meeting the needs projected to the years 1980 and 2015. Resource developments under construction or expected to develop under going programs are a necessary part of the plan to meet the needs. This chapter identifies project proposals (structural measures and land treatment) for development in the next 10 to 15 years under PL-566 and special Basin-wide authority.

PL-566 Watershed Projects

Projects that either have been or are to be carried out through existing programs (Public Law 566) include the ten watersheds listed in Chapter VI. These watersheds are; Tackett Creek, Ellison Creek, Mulberry Creek, Bentonia Creek, Persimmon-Burnt Corn Creeks, Bear Tilda Bogue, Long Creek, Five Creeks, Box Creek and Apookta Creek. Seven of these watersheds are planned and in operation with most of the planned measures installed. Three are in the planning stage. Included in these sub-watershed projects for installation are land treatment measures for watershed protection and critical area stabilization, 49 floodwater retarding structures, 2 multi-purpose structures with recreational facilities and 229 miles of channel improvement. Already installed are 21 floodwater retarding structures and 61 miles of channel improvement (see Table 6.3). The total installation costs of the works of improvement that are yet to be installed in these ten watersheds is $12,924,000, of which $8,601,000 is to be financed from Federal funds and $4,323,000 is to be from other funds. All of the floodwater retarding and multi-purpose structures will control runoff from 30 percent of the sub-watersheds. The two multiple purpose structures will provide 400 surface acres of water for recreation purposes. Approximately 51,400 acres of land will be benefited from a reduction in flooding from the total PL-566 program. Flood damages to crops, pastures and fixed improvements will be reduced by 78 percent. The total annual benefits from flood prevention and recreation for measures yet to be installed is $782,900, and the annual cost is $390,400. The benefit-cost ratio is 2.0:1. Summary data on these ten watersheds is shown in Table 8.1.

Table 8.1. Summary of plan data for ten watersheds being implemented under PL-566, Big Black Basin

Item	Unit	Amount		
		Installed	To be Installed	Total
Total area	Acres	---	---	470,500
Drainage area controlled by structures	Acres	---	---	140,600
Floodwater retarding structures	Number	21	49	70
Multi-purpose structures	Number	---	2	2
Basic recreational facilities	Number	---	2	2
Channel improvement	Miles	61	230	291
Cost of land treatment measures(Total)	Thou.dollars	---	3,618	3,618
Cropland and pasture	Thou.dollars	---	3,073	3,073
Forest land	Thou.dollars	---	545	545
Structural measures (Total)	Thou.dollars	---	9,306	9,306
Floodwater retarding structures	Thou.dollars	---	5,061	5,061
Multiple purpose structures	Thou.dollars	---	366	366
Basic recreational facilities	Thou.dollars	---	183	183
Channel improvement	Thou.dollars	---	3,696	3,696
Total project cost	Thou.dollars	---	12,924	12,924
Federal	Thou.dollars	---	8,601	8,601
Other	Thou.dollars	---	4,323	4,323

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

Basin-Wide Watershed Projects

Twenty-two upstream watersheds were identified and determined to be physically and economically feasible and are recommended for early action implementation under special Basin-wide authority (Table 8.2 and Figure 8.1). These are in addition to the ten watersheds physically and economically feasible that have been or are to be implemented through going programs (PL-566).

Table 8.2 Twenty-two watersheds recommended for Basin-wide authorization through special legislation, Big Black Basin, next 10 to 15 years

Name	Watershed number	Acres	Counties
Spring Creek	1	63,200	Webster, Oktibbeha
Little Black Creek	2	22,100	Webster
Big Bywy Creek	3	114,500	Choctaw, Montgomery
Calabrella Creek	4	59,000	Webster, Montgomery
Wolf Creek	5	37,400	Webster, Montgomery
Poplar Creek	7	82,800	Montgomery, Choctaw, Attala
Lewis and Betsy Creeks	8	45,900	Montgomery, Carroll
Hays Creek	9	64,900	Montgomery, Carroll
Zilpha Creek	10	80,700	Montgomery, Carroll, Attala
Peachahala Creek	11	29,500	Carroll
Jordan Creek	12	26,600	Carroll, Holmes
Durant Creek	14	35,900	Holmes
Seneatcha Creek	17	78,900	Attala, Leake, Madison
Big Cypress Creek	18	95,300	Holmes, Yazoo
Love's Creek	19	39,500	Madison
Doak's Creek	21	114,200	Madison, Leake
Panther-Hanging Moss Creeks	24	33,200	Madison
Bogue Chitto - Lime Kiln Creeks	28	143,300	Madison, Hinds
Porter Cox Creeks	30	52,600	Madison, Hinds
Baker's Creek	31	93,600	Hinds
Fourteen Mile Creek	33	84,800	Hinds
Five Mile Creek	35	34,300	Hinds
Total	XX	1,432,200	XXXX

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

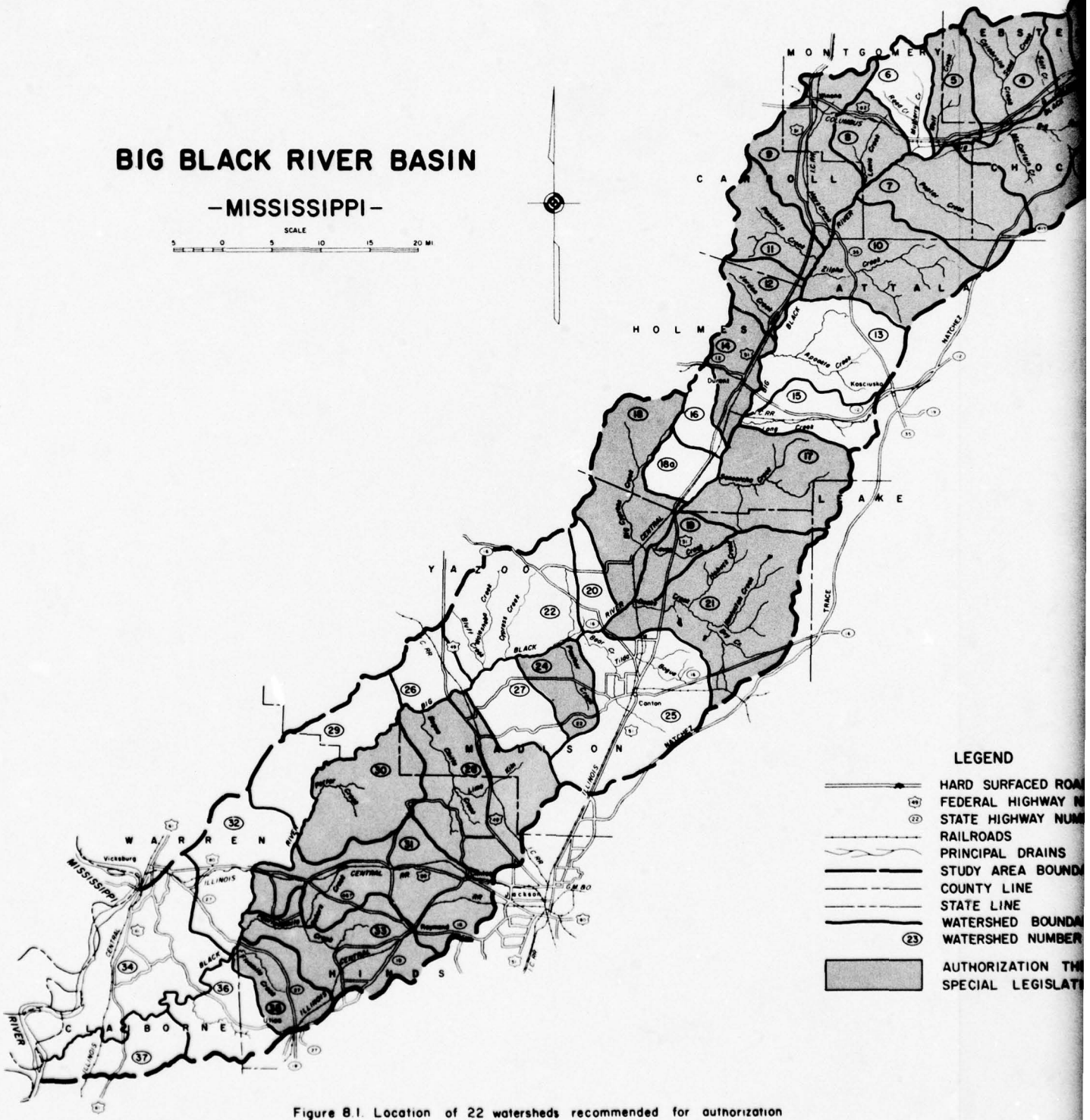

Figure 8.1. Location of 22 watersheds recommended for authorization under special Basin-wide legislation, Big Black Basin, *next 10-15 years.*

Figure 8.1. Location of 22 watersheds recommended for authorization under special Basin-wide legislation, Big Black Basin, next 10-15 years.

Land Treatment Measures

Watershed Protection 1/- Land treatment measures for watershed protection were considered as a basic element in formulating projects within the 22 watersheds recommended for Basin-wide 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 improvements of forest lands. 2/ The cost of applying these measures will be financed by local, but including some funds such as ACP. There will be cost sharing on technical assistance between Federal, local and State.

Private forest land treatment 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, and the Agricultural Conservation Program as presented in Chapter VI.

The land to be treated for watershed protection includes 178,600 acres of cropland, 160,200 acres of grassland, 82,900 acres of wildlife and 109,900 acres of forest (Table 8.3).

Critical Area Treatment 3/- Land treatment measures for land stabilization are important features of the Basin-wide 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.

1/ Includes just the 22 watersheds recommended for Basin-wide authorization. Measures for the 10 PL-566 watersheds are identified in Chapter VI and the remaining Basin in Chapter IV.
2/ The improvement of forest hydrologic conditions through the release of desirable soil building species, release of underplanted trees from undesirable overstory and improvement cuts to improve stand quality.
3/ Includes the entire Basin with the exception of the 10 PL-566 watersheds identified in Chapter VI.

Table 8.3. Estimated land to be treated by watershed and for the remaining areas, Big Black Basin, next 10-15 years

Watershed	Land Treatment						
	Watershed protection				Critical area		
	Cropland	Grassland	Wildlife	Forest	Grasses and legumes	Roadside erosion	Trees
	Acres	Acres	Acres	Acres	Acres	Miles	Acres
Spring Creek	6,000	4,700	3,600	4,900	748	57	2,500
Little Black Creek	2,100	1,600	1,200	2,300	286	9	960
Big Bywy Creek	10,200	5,700	8,100	13,700	1,348	104	30
Calabrella Creek	5,700	4,200	3,200	6,000	720	21	2,550
Wolf Creek	3,400	2,600	2,100	3,500	458	13	2,350
Poplar Creek	7,100	4,700	2,600	12,500	1,058	75	550
Lewis and Betsy Creeks	4,900	3,200	4,300	7,100	544	16	3,580
Hays Creek	8,100	4,600	6,000	3,800	749	23	4,910
Zilpha Creek	7,000	6,900	4,900	6,100	964	73	2,320
Peachahala Creek	3,700	2,300	3,600	3,600	325	11	1,850
Jordan Creek	3,800	2,700	2,400	3,800	296	18	1,330
Durant Creek	3,800	8,600	2,500	3,100	348	25	1,390
Senseatcha Creek	8,300	7,300	4,500	4,900	943	51	2,150
Big Cypress Creek	15,800	6,300	6,000	3,000	1,041	25	2,000
Love's Creek	6,300	5,700	2,500	2,200	401	25	440
Doak's Creek	18,200	16,100	7,300	4,200	1,107	28	6,110
Panther-Hanging Moss Creeks	5,300	4,800	2,100	900	349	8	300
Bogue Chitto-Lime Kiln Creeks	21,400	23,900	6,800	4,300	1,369	11	2,050
Porter Cox Creeks	7,400	10,000	1,500	4,300	548	14	820
Baker's Creek	13,200	16,100	4,300	6,900	929	57	1,400
Fourteen Mile Creek	12,100	12,600	1,500	5,300	882	52	1,030
Five Mile Creek	4,800	5,600	1,900	3,500	367	21	510
Subtotal - 22 Basin-wide authorization	178,600	160,200	1/82,900	109,900	15,780	737	41,130
Other 2/	—	—	—	—	3,805	83	7,090
Total	178,600	160,200	1/82,900	109,900	19,585	820	48,220

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 in the 10 PL-566 watersheds.

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. The Soil Conservation Service will supervise the installation of critical area treatment for most of the grasses and legumes and roadside erosion control (Table 8.2).

The total installation cost of land treatment measures is $19,450,000. Approximately $8,237,000 will be financed by Federal funds and $11,213,000 by other funds. (Tables 8.4 and 8.8).

Federal funds are for additional technical assistance to accelerate the land treatment for watershed protection program, 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.

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 137 floodwater retarding structures planned for the 22 watersheds. The approximate location of each structure in each watershed is shown in Figure 8.2. The estimated installation costs are $14,704,000, of which $12,712,000 would be financed by Federal funds and the remaining $1,992,000 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 - Improvement of stream channels was the second combination of structural measures planned for further reduction in floods and damages to floodplain land in upland watersheds. Channel improvement consists of snagging and shaping, clearing and snagging and channel enlargement or excavation.

Approximately 707 miles of channel improvement are planned in the 22 watersheds. The total installation cost is $7,494,000 (Table 8.5). Of this amount, $6,578,000 is to be financed by Federal funds and $916,000 by local interests. Federal funds include cost of construction, engineering services and general administrative costs. Local interest costs are for easements and rights-of-way, administration of contracts and administrative costs.

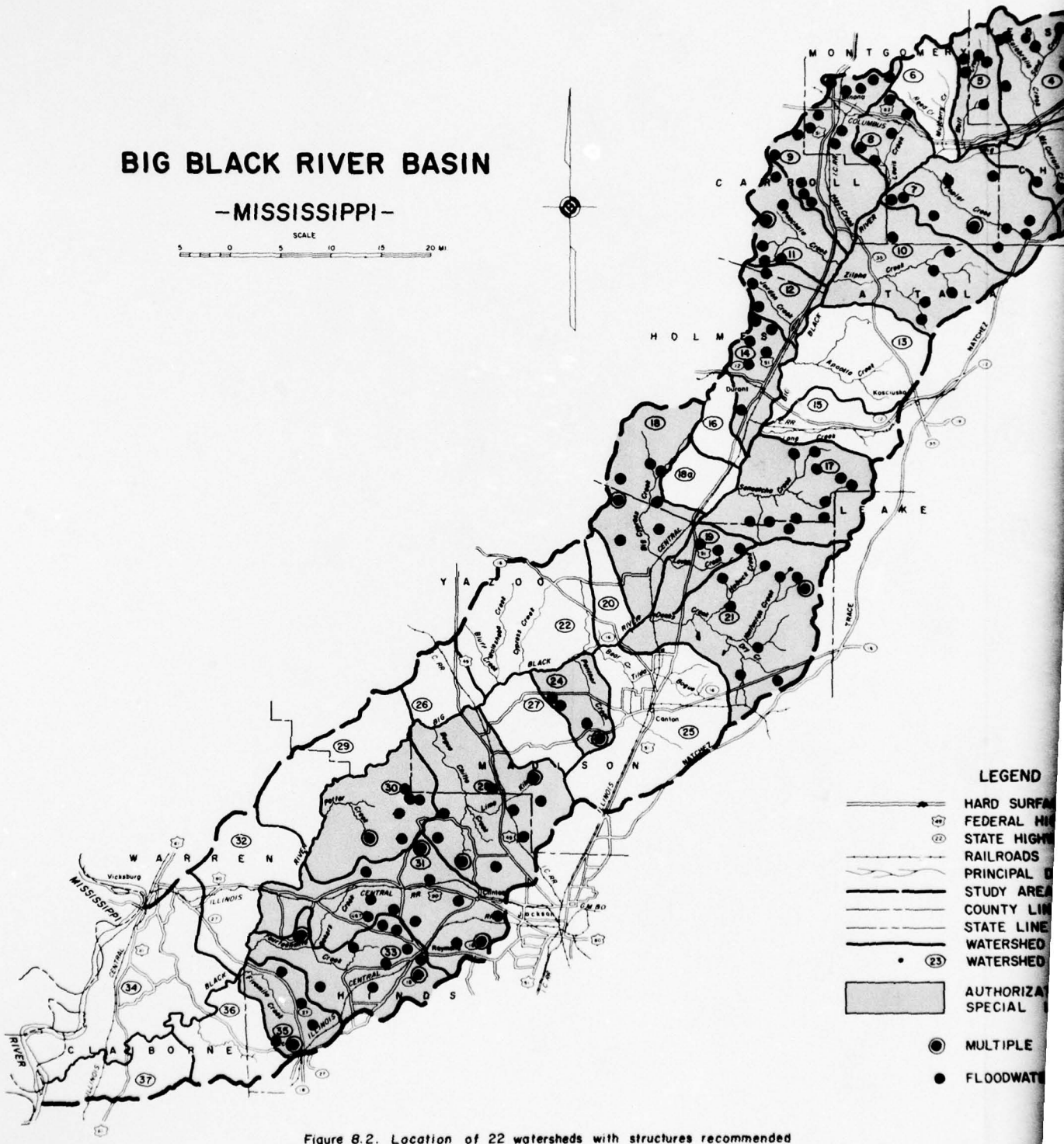

Figure 8.2. Location of 22 watersheds with structures recommended for authorization under special Basin-wide legislation, Big Black Basin, next 10-15 years.

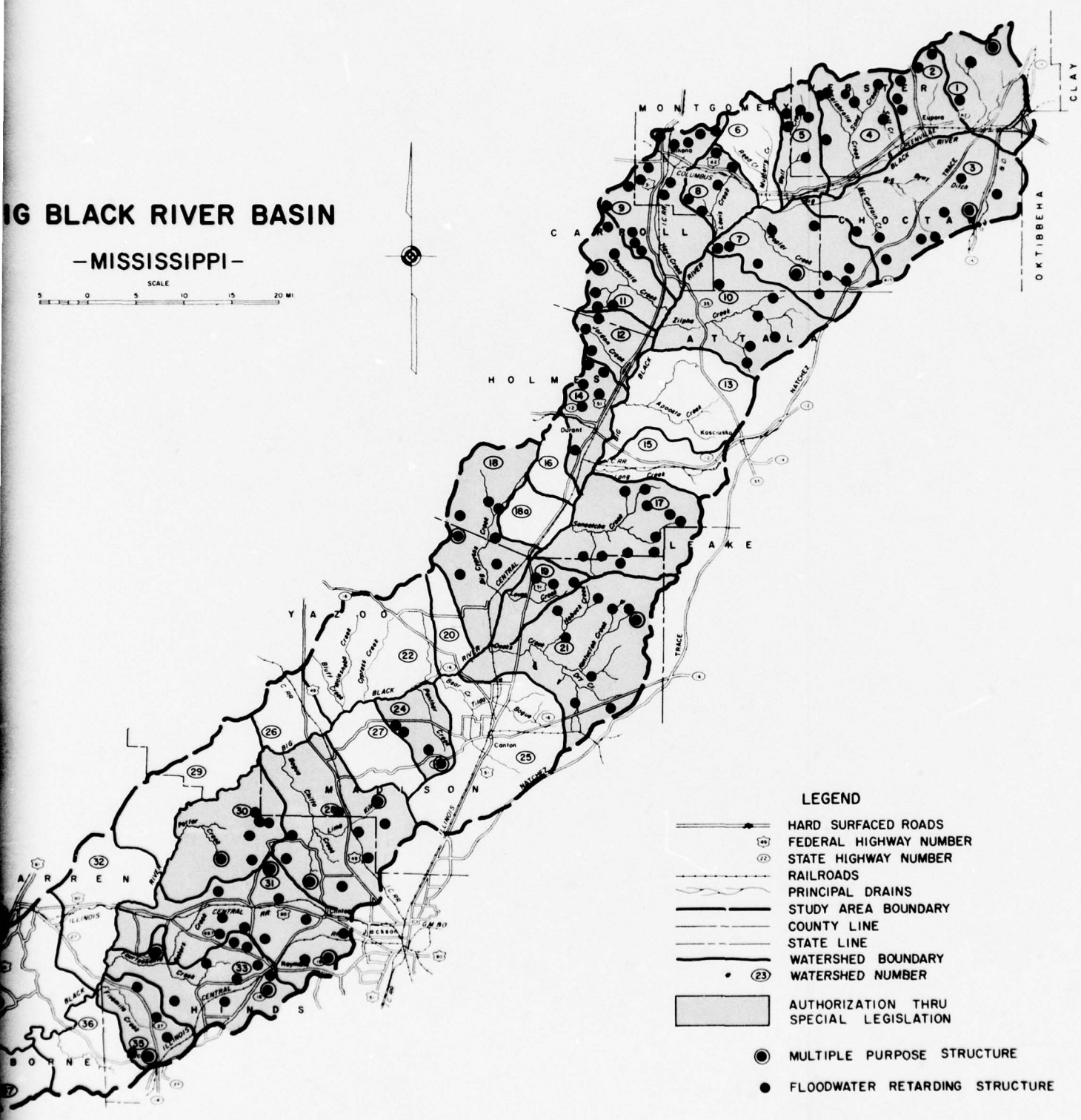

Figure 8.2. Location of 22 watersheds with structures recommended for authorization under special Basin-wide legislation, Big Black Basin, next 10-15 years.

Table 8.4. Estimated costs for land treatment measures, by watershed, Big Black Basin, next 10 to 15 years

Watershed	Watershed number	Land treatment for watershed protection	Critical area treatment	Technical assistance SCS & FS	Total
		Thou. Dollars	Thou. Dollars	Thou. Dollars	Thou. Dollars
Spring Creek	1	253	286	198	737
Little Black Creek	2	87	103	72	262
Big Bywy Creek	3	686	173	351	1,210
Calabrella Creek	4	209	268	192	669
Wolf Creek	5	144	239	126	509
Poplar Creek	7	309	180	267	756
Lewis and Betsy Creeks	8	239	359	166	764
Hays Creek	9	295	495	209	999
Zilpha Creek	10	401	337	249	987
Peachahala Creek	11	177	195	99	471
Jordan Creek	12	160	147	87	394
Durant Creek	14	333	163	109	605
Seneatcha Creek	17	435	308	185	928
Big Cypress Creek	18	571	291	272	1,134
Love's Creek	19	257	91	87	435
Doak's Creek	21	891	685	342	1,918
Panther-Hanging Moss Creek	24	254	63	90	407
Bogue Chitto-Lime Kiln Creek	28	1,289	304	389	1,982
Porter Cox Creek	30	448	126	156	730
Bakers Creek	31	598	231	271	1,100
Fourteen Mile Creek	33	557	190	239	986
Five Mile Creek	35	234	86	106	426
Sub-total		8,827	5,320	4,262	18,409
Other areas 1/		---	962	79	1,041
Total		8,827	6,282	4,341	19,450

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

1/ Includes all other critical area in the Basin except in the 10 PL-566 watersheds.

Table 8.5. Number of floodwater retarding structures, miles of channel improvement and estimated cost, by watershed, Big Black Basin, next 10 to 15 years

Watershed	Floodwater retarding structures		Channel improvement	
	Number	Cost	Channels	Cost
		Thou. dollars	Miles	Thou. dollars
Spring Creek (1)	2	284	38	340
Little Black Creek (2)	5	355	22	199
Big Bywy Creek (3)	8	980	54	599
Calabrella Creek (4)	7	611	29	234
Wolf Creek (5)	5	460	21	300
Poplar Creek (7)	8	1,105	27	443
Lewis and Betsy Creeks (8)	5	372	24	146
Hays Creek (9)	14	1,206	13	75
Zilpha Creek (10)	6	826	35	557
Peachahala Creek (11)	5	394	26	358
Jordan Creek (12)	3	320	11	67
Durant Creek (14)	5	354	21	142
Seneatcha Creek (17)	11	1,268	35	330
Big Cypress Creek (18)	6	1,029	49	425
Love's Creek (19)	3	166	9	83
Doak's Creek (21)	8	1,291	48	526
Panther-Hanging Moss Creeks (24)	3	215	21	247
Bogue Chitto-Lime Kiln Creeks (28)	7	720	65	875
Porter Cox Creeks (30)	5	498	26	191
Baker's Creek (31)	9	880	58	688
Fourteen Mile Creek (33)	8	860	51	487
Five Mile Creek (35)	4	510	24	182
Total	137	14,704	707	7,494

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

Multiple Purpose Structures for Flood Prevention and Planned Recreation - A total of 15 multiple purpose structures for flood prevention and for recreation are planned in 12 of the watersheds. 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 joint costs were allocated between flood prevention and recreation by the "Use of Facilities" method. The specific costs were allocated directly to the purpose they are to serve.

The total installation cost of these structures is $3,701,000 (Table 8.6). The Federal cost for multiple purpose structures is $2,428,000 and the local cost is $1,273,000.

Table 8.6. Number of multiple purpose structures and planned basic recreational facilities, surface pool area and estimated cost, by watershed, Big Black Basin, next 10 to 15 years

Watershed	Multiple purpose structures			Planned basic recreational facilities		Total cost
	Quantity	Surface pool	Cost	Quantity	Cost	
	Number	Acres	Thou. Dollars	Number	Thou. Dollars	Thou. Dollars
Spring Creek (1)	1	250	241	1	188	429
Big Bywy Creek (3)	1	250	221	1	183	404
Poplar Creek (7)	1	250	226	1	187	413
Peachahala Creek (11)	1	200	188	1	173	361
Big Cypress Creek (18)	1	250	223	1	212	435
Doak's Creek (21)	1	250	207	1	212	419
Panther-Hanging Moss Creek (24)	1	500	371			371
Bogue Chitto-Lime Kiln Creeks (28)	2	750	677			677
Porter Cox Creek(30)	1	300	258			258
Baker's Creek (31)	2	475	438	1	269	707
Fourteen Mile Creek(33)	2	500	482	1	231	713
Five Mile Creek (35)	1	175	169			169
Total	15	4,150	3,701	8	1,655	5,356

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

Basic Facilities for Recreation - Planned recreational facilities on which there is to be Federal cost sharing are to be constructed on eight of the multiple purpose structures in eight of the watersheds. 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 $1,655,000 (Table 8.5). Of this amount, $820,000 will be financed by Federal funds and $835,000 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.

In addition to the above, some facilities are to be built on the 7 remaining multiple purpose structures. These facilities will consist of boat ramps, access roads, parking areas and toilets. These costs are included in construction costs and are to be financed one-hundred percent with local funds. A summary of the distribution of installation costs of structural measures is as follows:

	Federal cost	Other costs	Total cost
Floodwater retarding structures	$12,712,000	$1,992,000	$14,704,000
Channel improvement	6,578,000	916,000	7,494,000
Multiple purpose structures	2,428,000	1,273,000	3,701,000
Minimum basic facilities	820,000	835,000	1,655,000
Total	$22,538,000	$5,016,000	$27,554,000

The estimated cost of preparing work plans for the twenty-two watersheds recommended for Basin-wide authorization is $1,072,000. 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 cost of installing the recommended projects in the twenty-two watersheds is $48,076,000. This includes land treatment and structural measures along with the cost of preparing the watershed work plans. Of this amount, $31,847,000 is to be financed with Federal funds and $16,229,000 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 are estimated to be $1,313,600 annually. Approximately 13,200 acres of land now

in woodland would be cleared and used for crops and pastures if flooding was reduced. The annual changed land use benefits would be $267,600. In addition, the surface water area in the permanent pools of the floodwater retarding structures would provide $86,300 in annual incidental recreation benefits. The total flood prevention primary benefits are $1,667,000. Secondary benefits from increased trade activity that can be expected to accrue locally due to the flood prevention are $290,400. The total benefits for flood prevention for the twenty-two watersheds are estimated to be $1,957,900 annually.

The total cost of structural measures for flood prevention is $24,089,000. This includes $14,704,000 for 137 floodwater retarding structures, $7,494,000 for 707 miles of channel improvement and $1,891,000 for that portion of the 15 multiple purpose structures that is allocated to flood prevention. The annual costs of these measures for flood prevention, including operation and maintenance, is estimated to be $1,015,100.

A comparison of total annual benefits to total annual costs for all structural measures for flood prevention in the twenty-two watersheds gives a benefit-cost ratio of 1.9:1.

Recreation - The future annual demand by 1980 for water-dependent and water-enhanced recreational facilities in the Basin is estimated to be 4,638,000 activity occasions. Much of this demand will be in the vicinity of Jackson, Mississippi. Annual benefits from planned recreation are estimated to be $526,400. An additional $52,600 in secondary benefits, because of increased trade activity, are expected to accrue from recreation. The total recreational benefits are $579,000.

The total installation costs of structural measures for recreation are estimated to be $3,465,000. Of this amount, $1,810,000 is the portion of multiple purpose structures allocated to recreation and $1,655,000 is for planned basic recreation facilities on which there is to be Federal cost-sharing. The annual cost of recreation, including operation and maintenance, is $262,300.

A comparison of total annual benefits to total annual cost for structural measures for recreation gives a benefit-cost ratio of 2.1:1. The total annual benefits for flood prevention and recreation is $2,536,900. The total annual costs, including operation and maintenance, is $1,277,400.

A comparison of total annual benefits to total annual costs in the twenty-two watersheds gives a benefit-cost ratio of 2.0:1. A comparison of annual benefits to annual cost for each of the twenty-two watersheds is shown in Table 8.6. Specific summary data not previously referred to are presented in Tables 8.7 through 8.15.

Table 8.7. Comparison of annual benefits to annual costs for twenty-two upland watersheds recommended for Basin-wide authorization, Big Black Basin, next 10 to 15 years

Watershed	Annual benefits			Annual cost			Benefit-cost ratio
	Flood prevention	Recreation	Total	Flood prevention	Recreation	Total	
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	
Spring Creek (1)	102,400	45,900	148,300	37,900	25,600	63,500	2.3:1
Little Black Creek (2)	57,900	---	57,900	23,700	---	23,700	2.4:1
Big Bywy Creek (3)	140,800	43,900	184,700	75,100	25,600	100,700	1.8:1
Calabrella Creek (4)	70,700		70,700	35,100	---	35,100	2.0:1
Wolf Creek (5)	39,300	---	39,300	31,900	---	31,900	1.2:1
Poplar Creek (7)	89,000	45,900	134,900	68,500	25,800	94,300	1.4:1
Lewis & Betsy Creek (8)	51,600	---	51,600	21,600	---	21,600	2.4:1
Hays Creek (9)	140,900	---	140,900	46,900	---	46,900	3.0:1
Zilpha Creek (10)	105,300	---	105,300	59,300	---	59,300	1.8:1
Peachahala Creek (11)	43,100	41,000	84,100	35,500	23,400	58,900	1.4:1
Jordan Creek (12)	32,300	---	32,300	15,800	---	15,800	2.0:1
Durant Creek (14)	40,600	---	40,600	20,700	---	20,700	2.0:1
Seneatcha Creek (17)	90,400	---	90,400	68,100	---	68,100	1.3:1
Big Cypress Creek (18)	150,500	60,800	211,300	64,100	27,200	91,300	2.3:1
Love's Creek (19)	28,300	---	28,300	11,200	---	11,200	2.5:1
Doak's Creek (21)	170,000	60,800	230,800	76,000	27,400	103,400	2.2:1
Panther-Hanging Moss Creeks (24)	56,000	28,900	84,900	27,200	8,800	36,000	2.4:1
Bogue Chitto-Lime Kiln Creeks (28)	182,000	43,300	225,300	85,400	13,000	98,400	2.3:1
Porter Cox Creek (30)	39,400	17,300	56,700	35,100	6,000	41,100	1.4:1
Baker's Creek (31)	142,600	98,300	240,900	74,800	38,600	113,400	2.1:1
Fourteen Mile Creek (33)	138,600	82,800	221,400	70,300	36,600	106,900	2.1:1
Five Mile Creek (35)	46,200	10,100	56,300	30,900	4,300	35,200	1.6:1
Total	1,957,900	579,000	2,536,900	1,015,100	262,300	1,277,400	2.5:1

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

Table 8.8. Estimated installation cost of land treatment and structural measures proposed for authorization under special legislation, Big Black Basin, next 10 to 15 years

Item	Unit	Amount	Estimated cost		
			Federal	Non-Federal	Total
			Thou. dollars	Thou. dollars	Thou. dollars
LAND TREATMENT MEASURES					
Watershed protection 1/					
Cropland and pasture					
Cropland	Acres	178,600	---	1,444	1,444
Grassland	Acres	160,200	---	6,052	6,052
Wildlife land	Acres	82,900	---	220	220
Technical assistance	---	---	2,482	718	3,200
Total cropland and pasture	---	---	2,482	8,434	10,916
Forest land					
Private Forest land	Acres	109,900	---	1,111	1,111
Technical assistance	---	---	473	139	612
Total Forest land	---	---	473	1,250	1,723
Total Watershed	---	---	2,955	9,684	12,639
Critical area treatment within the 22 watersheds for Basin-wide authorization					
Cropland and pasture					
Grasses and legumes	Acres	9,480	616	332	948
Roadside erosion control	Miles	737	242	130	372
Technical assistance	---	---	161	---	161
Total cropland and pasture	---	---	1,019	462	1,481
Forest land					
Private forest land	Acres	47,430	3,200	800	4,000
Technical assistance	---	---	289	---	289
Total Forest land	---	---	3,489	800	4,289
Total - 22 Watersheds	---	---	4,508	1,262	5,770

Continued

Table 8.8. Estimated installation cost of land treatment and structural measures proposed for authorization under special legislation, Big Black Basin, next 10 to 15 years (Continued)

Item	Unit	Amount	Estimated cost		Total
			Federal	Non-Federal	
			Thou. dollars	Thou. dollars	Thou. dollars
Critical area treatment					
Remaining area					
Cropland and pasture					
Grasses and legumes	Acres	2,155	140	76	216
Roadside erosion control	Miles	---	27	15	42
Technical assistance	----	---	29	---	29
Total cropland and pasture	----	---	196	91	287
Forest land					
Private Forest	Acres	8,740	528	176	704
Technical assistance	----	---	50	---	50
Total Forest land	----	---	578	176	754
Total remaining area	----	---	774	267	1,041
Total critical area treatment	----	---	5,282	1,529	6,811
TOTAL - Land Treatment	----	---	8,237	11,213	19,450
STRUCTURAL MEASURES					
Floodwater retarding structures	Number	137	9,774	---	9,774
Multiple purpose structures	Number	15	1,619	553	2,172
Minimum basic facilities	Number	8	584	584	1,168
Stream channel improvement	Miles	707	5,056	---	5,056
Sub-total - Construction	----	---	17,033	1,137	18,170
Installation services	----	---	5,235	173	5,408
Land easements and rights-of-way	----	---	270	3,399	3,669
Administration of contracts and other	----	---	---	307	307
Total - Structural measures	----	---	22,538	5,016	27,554
Work plan preparation	----	---	1,072	---	1,072
Total project	----	---	31,847	16,229	48,076

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

1/ Includes the 22 watersheds recommended for Basin-wide authorization only.

Table 8.9. Estimated structural cost distribution, 22 watersheds, Basin-wide authorization, Big Black 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	9,774	2,938	1,843	149	14,704
Multiple purpose structures	2,172	602	899	28	3,701
Minimum basic facilities	1,168	346	126	15	1,655
Channel improvement	5,056	1,522	801	115	7,494
Total	18,170	5,408	3,669	307	27,554

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

Table 8.10. Cost allocation summary, 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Purpose		
	Flood prevention	Recreation	Total
	Thou. dollars	Thou. dollars	Thou. dollars
	Cost allocation		
Floodwater retarding structures	14,704	---	14,704
Channel improvement	7,494	---	7,494
Multiple purpose structures	1,891	1,810	3,701
Basic facilities	---	1,655	1,655
Total	24,089	3,465	27,554

	Cost-sharing		
	Accelerated Federal funds	Other funds	Total
	Thou. dollars	Thou. dollars	Thou. dollars
Floodwater retarding structures	12,712	1,992	14,704
Channel improvement	6,578	916	7,494
Multiple purpose structures	2,428	1,273	3,701
Basic facilities	820	835	1,655
Total	22,538	5,016	27,554

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

Table 8.11. Structure data, 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Unit	Total
Drainage area	Sq. mi.	664
Storage capacity		
Sediment	Ac. ft.	24,300
Floodwater	Ac. ft.	196,800
Recreation	Ac. ft.	1/ 27,700
Potential water storage	Ac. ft.	1,121,900
Total	Ac. ft.	1,370,700
Surface area		
Sediment pool	Acre	8,000
Floodwater pool	Acre	31,800
Recreation	Acre	4,200
Potential water storage pool	Acre	83,800

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

1/ Includes 5,082 acre feet for sediment storage.

Table 8.12. Annual costs, 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Amortization of installation cost	Operation and maintenance cost	Other economic cost	Total
	Dollars	Dollars	Dollars	Dollars
Floodwater retarding structures	465,400	51,200	16,500	533,100
Multiple purpose structures	117,100	25,900	1,000	144,000
Minimum basic facilities	52,400	132,400	---	184,800
Channel improvements	237,200	178,300	---	415,500
Total	872,100	387,800	17,500	1,277,400

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

Table 8.13. Estimated average annual flood damage reduction benefits, 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Estimated average annual damages		Damage reduction benefits
	Without project	With project	
	Dollars 1/	Dollars 1/	Dollars 1/
Floodwater			
Crop and pasture	1,488,700	424,500	1,064,200
Other agricultural	98,800	33,800	65,000
Non-agricultural			
Urban and industrial			
Road and bridge	163,700	51,000	112,700
Sub-total	1,751,200	509,300	1,241,900
Erosion			
Reduced road maintenance	47,000	14,900	32,100
Indirect	179,800	52,400	127,400
Total	1,978,000	576,600	1,401,400

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

1/ Price Base - Long term projected.

Table 8.14. Comparison of benefits and cost for structure measures, 22 watersheds, basin-wide authorization, Big Black 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	Total benefits			
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars		
Flood prevention	1,313,600	267,600	—	86,300	1,667,500	290,400	1,957,900	1,015,100	1.6:1	1.9:1
Recreation	—	—	526,400	—	526,400	52,600	579,000	262,300	1.9:1	2.1:1
Total 2/	1,313,600	267,600	526,400	86,300	2,193,900	343,000	2,536,900	1,277,400	1.7:1	2.0:1

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 $47,700, erosion (reduced road maintenance) benefits, $32,100, and indirect benefits, $8,000. Total benefits of $87,800 annually.

Table 8.15. Summary of physical and plan data, 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Unit	Quantity without project	Quantity with project
Watershed area	Sq. mi.	2,238	---
	Acres	1,432,200	---
Area of cropland	Acres	280,300	260,100
Area of grassland	Acres	254,800	335,900
Area of woodland	Acres	766,000	730,400
Miscellaneous area	Acres	131,100	105,800
Floodplain area subject to inundation of maximum storm in evaluation series	Acres	193,800	---
Area of floodplain benefited by proposed structural measures			
Directly	Acres	---	116,600
Indirectly	Acres	---	38,500
Total	Acres	---	155,100
Woodland conversions	Acres	---	13,200
Watershed area controlled by floodwater retarding structures	Acres	---	429,400
	Percent	---	30

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

Installation Costs 1/

Installation cost of land treatment measures to be installed in the Basin is $19,450,000. Approximately $8,237,000 will be financed by accelerated Federal funds and $11,213,000 will be financed from other funds.

Federal funds are for additional technical assistance to accelerate the land treatment for watershed protection program, 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 cost for the 137 floodwater retarding structures is $14,704,000, of which $12,712,000 will be financed by Federal funds and the remaining $1,992,000 by local funds.

Federal cost includes construction, engineering services and general administrative costs. Local cost includes easements and rights-of-way, administration of contract and general miscellaneous costs. The estimated structural cost distribution identifies these costs for all structural measures in the 22 watersheds.

The 707 miles of flood prevention channels will be installed at an estimated total cost of $7,494,000. Of this amount, $6,578,000 is to be financed by Federal funds and $916,000 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 contract and administrative costs.

Installation cost of the 15 multiple purpose structures is $3,701,000. Of this amount, $2,428,000 will be financed by Federal funds and $1,273,000 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. Specific costs for recreation include land purchases and relocation. Primary joint costs are associated

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1/ 1964 costs.
1.0357 = factor for converting from 1964 to 1965 prices.
1.0777 = factor for converting from 1964 to 1966 prices.

with the construction of the structure. In seven of the structures some recreational facilities such as boat ramps, access roads, parking areas, etc., were included in the construction costs as a specific cost allocated to recreation.

The cost of basic facilities for planned recreation sites for eight of the multiple purpose structures is $1,655,000. Of this amount, $820,000 will be financed by Federal funds and $835,000 by local funds.

The estimated cost of preparing a work plan on each of the 22 watersheds recommended for Basin-wide authorization is $1,072,000. These watershed work plans 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 $48,076,000. This includes land treatment and structural measures along with the cost of preparing the individual watershed work plans. Of this amount $31,847,000 is to be financed by Federal accelerated funds and $16,229,000 with other funds (Table 8.7).

Financing Project Installation

Special legislation is needed for implementing works of improvement on 22 watersheds in the Big Black 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 22 watersheds that are proposed for special authorization are those shown in Table 8.1 and Figure 8.1.

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 will be provided under special legislative authority granted by 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 $19,450,000. The cost of establishing land treatment measures for watershed protection on non-critical land is $12,639,000,

of which $2,955,000 is to be financed with Federal funds and $9,684,000 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 $6,811,000. Of this amount, $5,282,000 is to be financed with Federal accelerated funds and $1,529,000 is to be from other funds.

Structural measures are to be installed at a cost of $27,554,000. Of this amount, $22,538,000 is to be financed from Federal funds and $5,016,000 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 land owners or through local Soil Conservation Districts.

The estimated annual cost for operating and maintaining floodwater retarding structures, channel improvements, multiple purpose structures and basic facilities for recreation are shown in Table 8.16.

Table 8.16. Estimated annual operation and maintenance costs of structural measures and basic facilities in 22 watersheds, Basin-wide authorization, Big Black Basin, next 10 to 15 years

Item	Costs
	Dollars
Floodwater retarding structures	51,200
Channel improvement	178,300
Multiple purpose structures	25,900
Minimum basic facilities	132,400
Total	387,800

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

Institutional Arrangements for Carrying Out the Plan

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 with 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 249, General Laws of Mississippi, 1964, (House Bill 614) as amended by Chapter 271, 1966, created the Big Black River Basin District. This District comprises eleven counties in west central Mississippi, parts of which drain into the Big Black 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 known 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 twenty-two watersheds recommended for Basin-wide 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 problems 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.

Big Black River Development Association - The Big Black River Development Association, when completely organized, will probably act as co-sponsor to the local sponsoring organization in each watershed project. They will likely 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 Big Black Development Association will probably 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.

In addition, they will likely work with Soil Conservation Districts in the planning and carrying out of land treatment measures on critical areas above prepared structural measures.

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 possibly the Big Black River Development Association 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 10-15 years. Where such amendments may prove beneficial to proposed watershed projects or potentially feasible watershed projects as identified in the USDA Plan, the twenty-two watershed projects may be re-evaluated to include these in the next 10-15 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 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 stream banks 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 lands after installation in accordance with the provisions for 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 (s);

That the first estimate of costs for the installation of the upstream structural works of improvement, which includes land treatment measures for water protection and work plan preparation costs, is $41,265,000, of which $26,565,000 will be assumed by the Federal government and $14,700,000 will be assumed by other interests;

That the first estimate of costs for installation of the critical area stabilization measures is $6,811,000, of which $5,282,000 will be assumed by the Federal Government and $1,529,000 will be assumed by non-Federal interest."