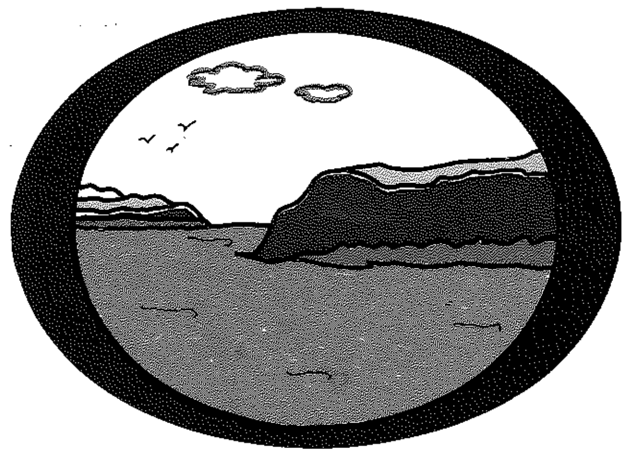
COPY

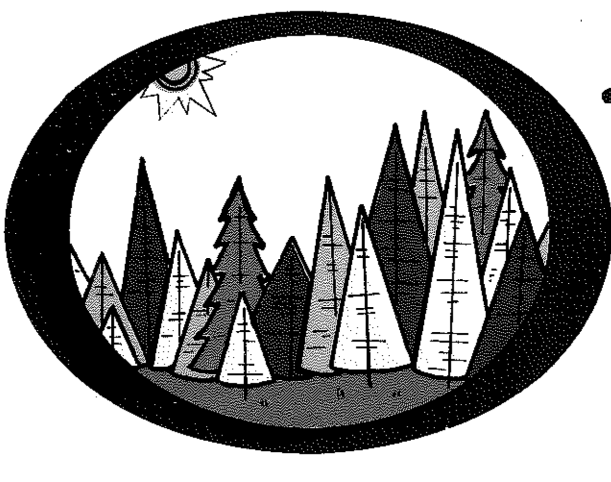
ARKANSAS STATE WATER PLAN



WATER AND RELATED LAND RESOURCES

APPENDIX "C"

RIVER BASIN PROBLEMS AND NEEDS

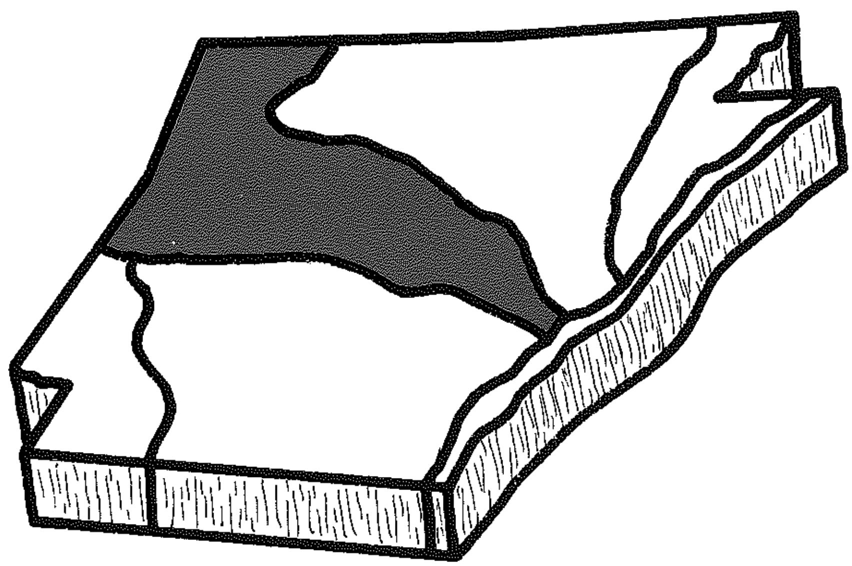


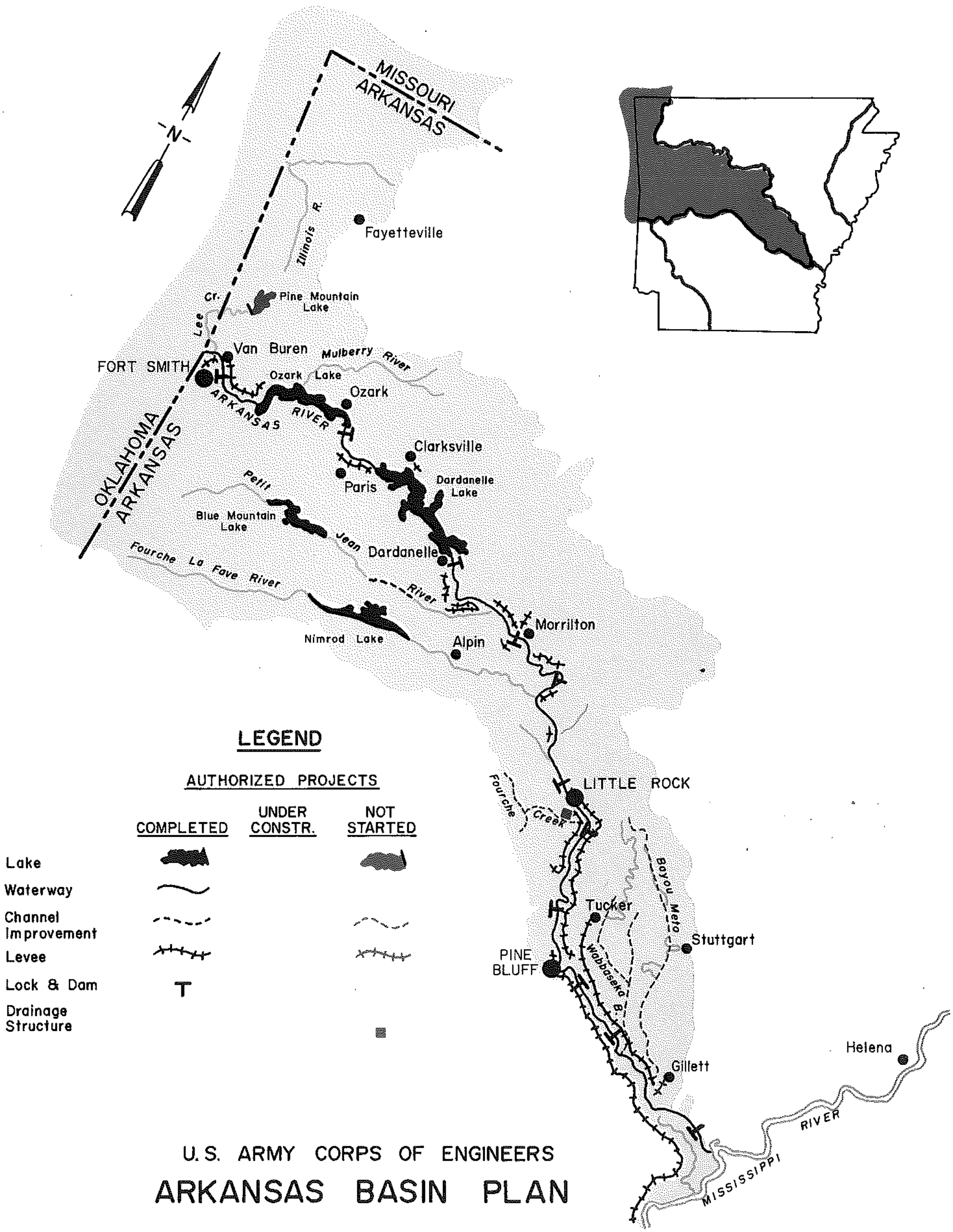
Department of Commerce
Division of Soil & Water Resources

CHAPTER I

ARKANSAS RIVER BASIN

PROBLEMS and NEEDS





Source: Water Resources Development in Arkansas 1973
By the U.S. Army Corps of Engineers, Dept. of the Army, Vicksburg, Mississippi

Arkansas River Basin

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ARKANSAS RIVER BASIN

INTRODUCTION

The Arkansas River originates in the Rocky Mountains of Colorado and flows generally eastward through Colorado, Kansas, Oklahoma and Arkansas. The River traverses some 1,450 miles before emptying into the Mississippi River in Desha County, Arkansas. Total drainage area for the entire basin is approximately 160,645 square miles and occupies parts of the States of Colorado, New Mexico, Kansas, Oklahoma, Texas, Missouri and Arkansas. The total area in Arkansas that drains into the Arkansas River is about 12,300 square miles.

The major tributaries to the Arkansas River within Arkansas are the Petit Jean, Mulberry, and Fourche LaFave Rivers and Bayou Meto.

One of the major problems concerning the basin is the lack of water and related land resource planning information that is available. Many water development projects have been installed within the basin but overall basin information on land treatment, flooding, drainage and water supply is inadequate. The Soil Conservation Service is in the process of developing a State Wide Type IV River Basin Report which should furnish needed information in these areas.

LAND TREATMENT

PROBLEMS

A large part of the Arkansas portion of the basin is covered with upland hardwood forests, which help control erosion on steep areas. However, in the plains areas of Oklahoma, Kansas, and Texas a considerable amount of erosion occurs on farmland; the resulting sediment is carried by the Arkansas River.

In Arkansas the most severe erosion occurs in the alluvial valley and along the banks of the river and its tributaries. This erosion occurs primarily during periods of high runoff. The McClellan-Kerr Navigation Project has had a major effect in reducing both streambank erosion and flooding on the Arkansas River.

Sediment is the direct result of erosion and can drastically affect land and water uses. It clogs waterways and streams, reduces capacities of reservoirs, reduces quality of water for irrigation, public supply, and recreational uses.

NEEDS

There is a need for continued treatment of critical areas in the upland regions of the basin. Much of the pasture and wood land should be improved.

subsoil or have sandy loam surface textures with clay layers in the subsoil. All these soils are slowly to very slowly permeable and are very productive when adequately drained. Many of the better bottom lands have protective levee systems and are intensively farmed for production of various truck crops, cotton, alfalfa, and other hays, soybeans, corn, pasture, and other crops.

NEEDS

A need for improved drainage exists on agricultural lands that are wet by nature in order to improve their capability to economically produce crops.

WATER RESOURCES PROBLEMS AND NEEDS

WATER SUPPLY PROBLEMS - PUBLIC

The only river within the Basin that has a continuous flow adequate to furnish significant municipal water is the Arkansas River. Other large tributaries do furnish small towns but cause problems during drought periods. The Arkansas State Health Department discourages the use of the Arkansas River as a public water supply because of its poor bacterial and chemical quality.

Groundwater sources in the upland part of the basin do not furnish adequate supplies for municipal and industrial uses. The Arkansas Valley alluvium is used for municipal water by a few of the smaller towns along the river; however, this water requires considerable treatment. Some areas in the basin have experienced water shortages during the summer months because of inadequate water supplies.

WATER SUPPLY NEEDS - PUBLIC

Several towns in the Arkansas River Basin have developed excellent municipal and industrial water supplies by impounding tributary streams. There is a need for more communities to develop surface impoundments for water supplies.

WATER SUPPLY PROBLEMS - SELF-SERVICED INDUSTRIES

The only appreciable amount of water used by self-serviced industries is in Jefferson County. Practically 100 percent of this water comes from ground water sources. Since the boundry between the Arkansas and Ouachita River Basins passes through approximately the middle of Jefferson County, the ground water use in Jefferson County affects both basins.

been working on projects to reduce natural salt pollution and should be encouraged to continue this work. Alternate sources of surface water for irrigation should be developed to serve the Grand Prairie Area of the State.

WATER SUPPLY PROBLEMS - FISH AND MINNOW FARMS

Most of the fish and minnow farming activity occurs in the lower portion of the basin. Lonoke county uses more water for fish and minnow farming than any other county in the State, Arkansas and Jefferson Counties rank four and ten respectively. Most of the water used in fish and minnow farming comes from ground water sources, mainly Quaternary aquifers. This additional withdrawal increases the rate of decline of water levels in the Quaternary aquifers.

WATER SUPPLY NEEDS - FISH AND MINNOW FARMS

Efforts need to be directed toward developing adequate surface water sources for fish and minnow farming.

WATER SUPPLY - FISH AND WILDLIFE IMPOUNDMENTS

Very little water is used specifically for filling these types of impoundments within the Arkansas River Basin. There is sufficient surface water available for this purpose.

WATER SUPPLY - FUEL ELECTRIC POWER

At the present time, electrical power is being produced at several locations along the Arkansas River. Hydroelectric power is produced on the Arkansas River at the Dardanelle and Ozark dams. Electric power is being produced near London, Arkansas by using nuclear fuel and taking cooling water from the Arkansas River. Large, coal fired generating plants are being constructed near Gentry in Benton County and near Redfield in Jefferson County. Other smaller generating plants are located within the Arkansas River Basin. Sufficient water is available within the Arkansas River Basin to furnish electrical power generation requirements for the foreseeable future.

WATER QUALITY PROBLEMS

The quality of water within the basin has been discussed to some extent in previous topics. As a general rule, water quality within the basin is good. The big exception is the Arkansas River which contains large amounts of sodium and other soluble salts. The River also contains high bacterial counts in certain reaches.

NATURAL AREA PRESERVATION - NEEDS

The Soil and Water Conservation Commission feels that many of the unique natural areas of the State should be preserved for future generations. It is the intention of the Commission to cooperate, to the extent possible under their authority in water and related land resource, planning, in preserving the States' natural areas.

OUTDOOR RECREATION - PROBLEMS

Water based outdoor recreation activity such as swimming, boating, skiing, fishing and hunting will no doubt increase in the future. The Arkansas River navigation project has provided an abundance of such recreational activities. However, in some parts of the basin this type of recreation facility is lacking. Also, because of water quality problems, some reaches of the Arkansas River are unsafe for water contact recreation.

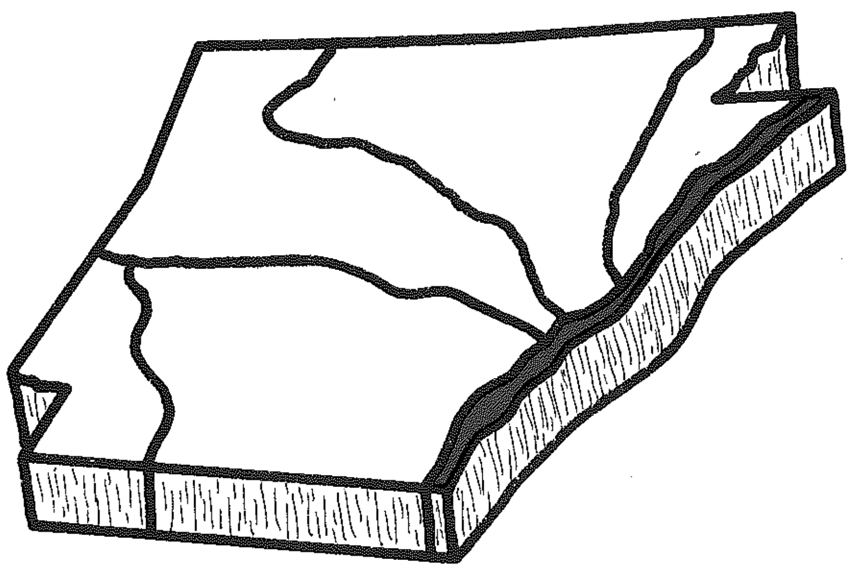
OUTDOOR RECREATION - NEEDS

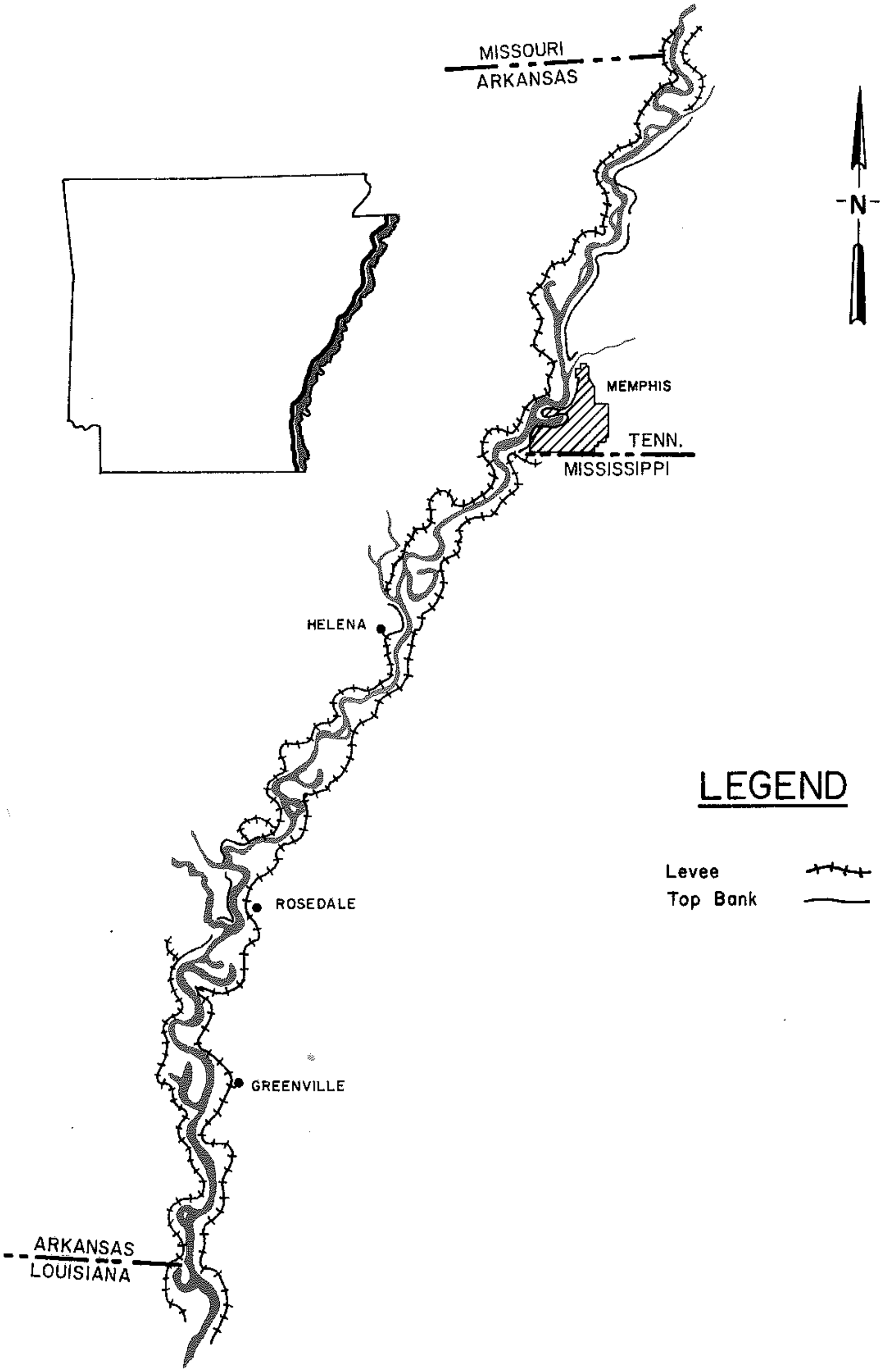
A need exists for additional outdoor recreation opportunities as pointed out in the Arkansas Statewide Comprehensive Outdoor Recreation Plan. The Soil and Water Conservation Commission will cooperate, to the extent possible, with all state agencies to meet the recreational needs of the basin.

CHAPTER II

MISSISSIPPI RIVER BATTURE LANDS

PROBLEMS and NEEDS





MISSISSIPPI RIVER BATTURE LANDS IN ARKANSAS

Source: Lower Mississippi Region Comprehensive Study

Mississippi River Batture Lands

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Needs

The Batture Lands are designed to be a floodway for the Mississippi River and will of necessity be subject to frequent flooding.

DRAINAGE

Problems

Drainage problems exist in those areas of the Batture Lands devoted to cropland. In some cases private landowners have provided the drainage necessary to farming operations. There are no extensive drainage projects within the area, nor are there any planned.

Needs

Drainage is not considered to be needed within the Batture Lands due to its location, its being subjected to severe and frequent flooding and since the land use in not expected to change significantly in the future.

WATER SUPPLY

Problems

The Mississippi is the nation's largest river with an average annual flow at Helena, Arkansas, of more than 450,000 cubic feet per second. Areas adjacent to the river depend on it for supplying such needs as water for navigation, fish and wildlife, recreation and fuel-electric power.

Needs

The Batture Lands have little or no water needs of its own except for recreation, fish and wildlife and possibly some isolated irrigation. These needs are adequately furnished by the river.

The Mississippi River furnishes large quantities of water for cooling in thermal-electric power plants. This use of water is expected to increase significantly in the future. The water used for cooling is not consumed but is returned to the river; therefore, no problems are expected in meeting this need.

WATER QUALITY

Problems

In describing stream pollution in the Lower Mississippi River, emphasis has been placed on the quantitative expression of organic waste discharges

Non-BOD wastewater discharage have a very serious effect on the water quality of the Mississippi River and its usefulness for public water supply, and for the preservation of fish, shellfish and wildlife. Important parameters in this respect are thermal wastewaters, heavy metals, nutrients, odor and taste, chemical oxygen demand, organic chemicals, pH, and oil and grease.

Groundwater

The water quality of major aquifers underlying the Batture Lands is not specifically considered in this report.

Needs

Two factors used in determining the water quality control needs in the Lower Mississippi Region are the waste assimilative capacities of the receiving streams and the degree of intermixing of waste discharges with the river water. The Mississippi River has a very large waste assimilative capacity; for example, at Memphis it is estimated at about 2,401,000 pounds of BOD_5 per day. At New Orleans the capacity is 1,892,000 pounds of BOD5 per day. Intermixing is assumed to be total; that is, complete mixing throughout the entire cross-sectional area of the river at the point of discharge. The very large waste assimilative capacity and the assumed total mixing at the point of discharge combine to nullify the impact of all organic waste discharges, including those from the three largest population and industrial centers in the Lower Mississippi Region: Memphis, Baton Rouge and New Orleans.

In reality, the waste assimilative capacity of the Mississippi River is exceeded at a number of locations. The reason for this lies in the physical fact that waste discharges into the Mississippi River tend to follow the river's edge for considerable distances forming in effect, a stream within a stream. Given sufficient distance of travel, measured probably in many tens of miles, intermixing may be adequate to prevent dissolved oxygen reduction to below 5 mg/1. However, until such intermixing has occurred, low oxygen levels may be expected to develop within these substreams of waste water, and until more detailed information on the water quality of the Mississippi River is available, the areas where these problems occur cannot be defined.

STREAM PRESERVATION

The Mississippi River is the only stream within the Batture Lands; therefore, stream preservation, as such, is not considered relavant. It is of utmost importance to preserve the Mississippi River because of its economic benefits to the state. The river will no doubt continue to be used for transporting goods, and receiving waste water. Even with these activities, the water quality of the river should be maintained at a standard that will propogate fish and wildlife and allow water contact sports.

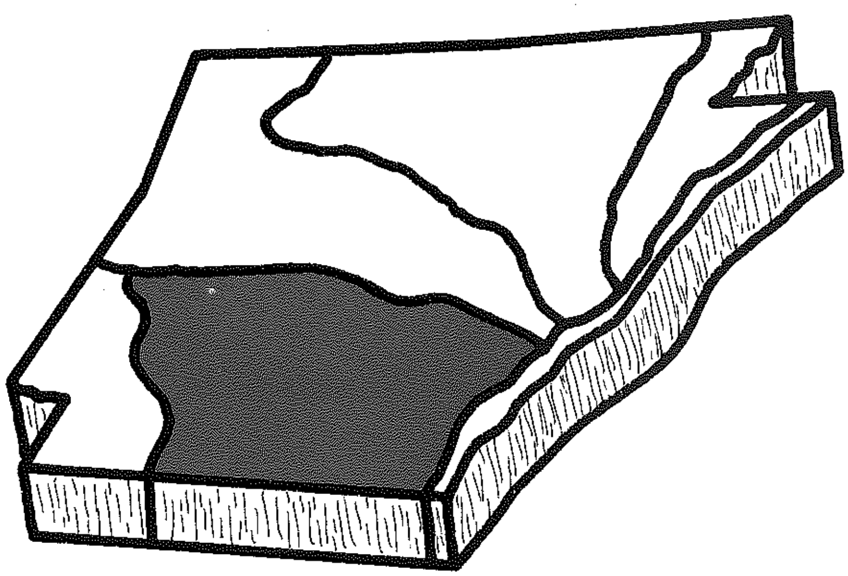
REFERENCES

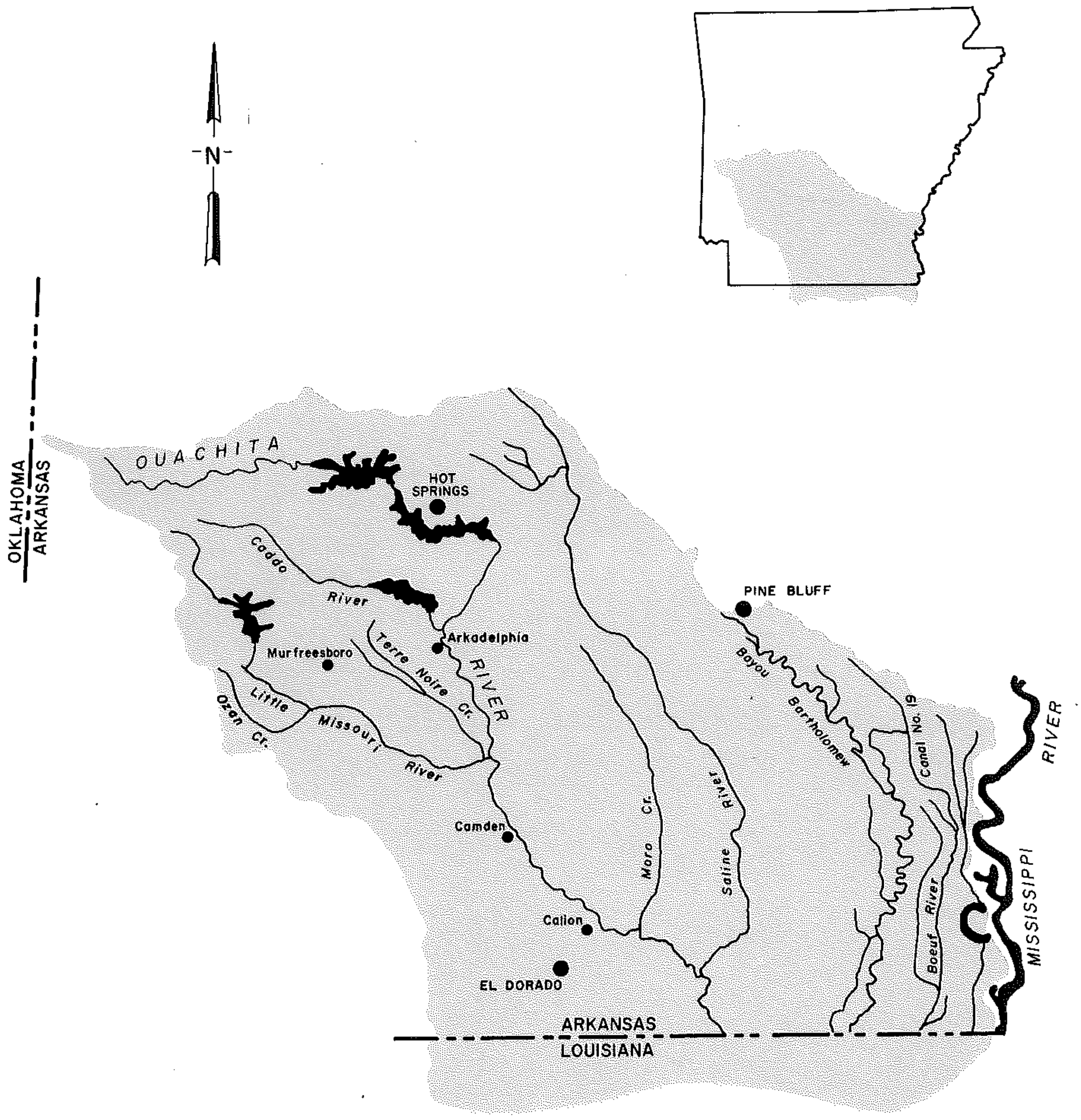
1. Lower Mississippi Region Comprehensive Study, Mississippi River Commission, Vicksburg, 1974.

CHAPTER III

OUACHITA RIVER BASIN

PROBLEMS and NEEDS





OUACHITA BASIN

Ouachita River Basin

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OUACHITA RIVER BASIN

INTRODUCTION

The Ouachita River Basin is the south eastern area of Arkansas which drains into the Ouachita River in Arkansas or Louisiana. The system outlets into Louisiana and comprises 14,437 square miles of drainage. Twenty-three counties of south eastern Arkansas are wholly or have a substantial part of their area in the Basin.

This Basin comprises 27.2 percent of the area of the state and in 1970 contained about 17.0 percent of the population. The economic activities of the area are agriculture and forest products, mining and processing of minerals and some manufacturing. The area is well served by railroads, federal highways, state and local highways, airlines and a 6.5 foot navigation channel from Camden to the mouth of the Ouachita River.

The Ouachita River and its major tributaries originate in the Ouachita Mountains of the Interior Highlands and flow southeasterly across the Forested Coastal Plains of the West Gulf Coastal Plain. The stream channels in the Ouachita Mountains are relatively steep with narrow flood plains. Rock outcrops, boulders and gravel are not uncommon in the channels. The drop in elevation from the headwaters west of Mena at Rich Mountain, elevation 1,615 feet mean sea level (msl), to Malvern at an elevation of 228 feet msl is 1,387 feet in about 160 miles. From Malvern to the stateline the flow is through the Forested Coastal Plains where channels and flood plains become wider. The Ouachita River crosses the stateline at an elevation 51 feet msl, which is a drop of only 177 feet in 200 miles through the Forested Coastal Plains.

There are 37 reservoirs of over 200 acres in surface area in the Basin. The Corps of Engineers have constructed three of the reservoirs, another one is authorized but the construction date has not been set. These reservoirs have storage allocations for flood control and hydroelectric power. The Arkansas Power and Light Company has two reservoirs for the production of hydroelectric power. There are in excess of 14,000 reservoirs and farm ponds in the area that have a surface area less than 200 acres. These reservoirs have a total surface area of approximately 24,000 acres and a total storage capacity of approximately 130,000 acre feet. Details of the structures in each county are given in Lakes of Arkansas; Arkansas Soil and Water Conservation Commission, 1968.

The exposed geology of the Basin ranges in age from Palezoic to Quarternary.

Quarternary: Alluvium and terrace deposits of quaternary age occur in the valleys and lowlands of the Ouachita River and its major tributaries. These deposits are generally less than 200 feet thick. The upper layers consist of silts and clays and are relatively impermeable, while the lower layers consist of sands and gravels and are a good source of ground water.

Five of the 12 major land resource areas of Arkansas are well represented in the Ouachita Basin Area. The following is a brief description of each of the land resource areas:

Ouachita Mountains: This area consists of a series of east-west trending mountain ranges. The soils are derived chiefly from quartzite, novaculite, sandstone, slate, and shale. Shallow soils occur on the hillsides and deep soils in the narrow valleys. Gravely silt loam is the dominant texture.

Most of the soils are moderately permeable. Surface relief ranges from moderately sloping to very steep. Elevations range from 500 to 2,700 feet MSL.

Blackland Prairies: This area consists of deep clay loam, slowly permeable soils, derived from marl, chalk and calcareous clay under a prairie grass vegetation. The surface relief is gently to moderately sloping. Elevations range from 300 to 500 feet MSL.

Forested Coastal Plain: This area is composed of deep sandy and clayey soils with permeable to slowly permeable subsoils. The surface relief is nearly level to moderately sloping. Elevations range from 80 to 500 feet MSL.

Bottomland and Terraces: This area consists of deep alluvial soils formed from sediments carried by major streams. Textures range from sands to clays; permeability from rapid to very slow. Surface relief varies from level to undulating. Elevations range from 60 to 300 feet MSL.

Loessial Plains: This area consists of deep, medium textured, very slowly or slowly permeable silty soils over alluvial sands or clays. The surface relief is nearly level to undulating. Elevations range from 80 to 150 feet MSL.

LAND TREATMENT

The soil resources of the Ouachita Basin are generally capable of high production of valuable crops. The soils of the Ouachita Mountains are derived from folded and fractured quartzite, novaculite, sandstone, slate and shale of Paleozoic Age. The slopes are steep and the valleys are narrow. The soils are well adapted to the production of mixed hardwoods and pine. The narrow flood plains and some flat ridge tops are adapted to the production of most row crops. The remainder of the area is in the Forested Coastal Plains, where the topography ranges from gently rolling to flat. The soils range from gravelly to very slowly permeable clays derived from alluvial deposits of Quaternary, Tertiary, and Cretaceous Age.

Narrows Dam on the Little Missouri River. A dam on the Muddy Fork of the Little Missouri River, known as the Murfreesboro Project, has been authorized but because of local opposition, is in an inactive status. Extensive studies have been made of possible control structures on the Saline River near Benton but a project has not been authorized. The Corps has also improved 312 miles of channel on the Ouachita River and its tributaries (112 miles of which is a 6.5 foot navigation channel on the main stem). Other channel improvements have been made on the lower reaches of the Little Missouri River, Ozan Creek, and Terre-Noire Creek.

The Soil Conservation Service has made studies of the needs for land-use management and flood prevention. Applications for watershed planning have been submitted by 31 watershed improvement districts to the Soil and Water Conservation Commission. Planning has been completed on 17 of the watershed and construction completed on 12 of them.

With the possible exception of Bayou Bartholomew and the Saline River, there does not appear to be an urgent need for additional flood-control works on the major streams at this time. Further consideration should be given to improved land-use practices and flood prevention on small watersheds.

DRAINAGE

PROBLEMS

Industrialization and urbanization of the area has generally been developed outside the flood-prone areas. Inadequate local drainage causes flooding in many of the cities, towns and villages. The drainage from the flat cropland is still a problem in some areas that have not completed drainage projects. The major remaining problem is the lack of lateral drains to direct the excess water to the drainage canals already constructed by the Corps of Engineers.

NEEDS

Lateral drainage systems are needed to compliment and take full advantage of the drainage canals constructed by the Corps of Engineers. When the need arises and these lateral drainage systems are complete, crop production will be possible on 5,473,185 acres or 60 percent of the land area. The local residents are very concerned with the maintenance of wildlife habitat and the forests areas and it is very doubtful that this area will ever be subject to this acreage of cultivation.

To prevent additional flood damage to industrial and urban developments, land-use regulations for such areas will be needed.

The municipal water needs will be increased by the rise in population, the continuous movement of people to municipal areas from rural areas, and the installation of centrally supplied rural water systems.

The total population of the Basin is expected to increase through 2020, while the population serviced by municipal water distribution systems will increase at a greater rate. It is expected that the conversion from self-supplied to centralized rural or municipal water service will result in 80 percent of the rural population and 100 percent of the urban population being serviced by central water systems by 2020.

Increased use of modern water-using appliances, and extra care in maintenance of possessions, i.e., watering lawns, washing cars, etc., will cause an increase in GPCD consumed and therefore is considered in projecting future water needs. The GPCD in the Basin was 111 in 1970 and is projected to increase to 128, 137, and 147 by the years 1980, 2000, and 2020, respectively

The projected future water requirements within the Basin are 43.1 M.G.D., 61.9 M.G.D., and 91.4 M.G.D. by the years 1980, 2000, and 2020, respectively.

SELF-SUPPLIED INDUSTRY

GENERAL

Industrial water pumpages within the Basin during 1970 required a daily average water withdrawal of 155.0 M.G.D. Ground water supplied 58.2 percent of this withdrawal and surface sources supplied 41.8 percent.

PROBLEMS

Wells in the Ouachita Mountains yield only small supplies and are generally only sufficient for rural domestic and livestock purposes. Although ground water resources are large, over-development has occurred in some local areas, particularly at El Dorado and Magnolia.

The natural quality of the water of the Ouachita River Basin is generally excellent; however, man-made pollution has seriously depleted the quality of water in some areas.

NEEDS

The per capita production in industry is forecast to show continuous strong growth. This increased productivity will result in an increase in the industrial water needs.

IRRIGATION

GENERAL

Agricultural withdrawals required 293.8 M.G.D. within the Basin during 1970. Ground water supplied 74.4 percent of this withdrawal and surface sources supplied 25.6 percent. The currently irrigated area in the Basin totals about 170,000 acres.

PROBLEMS

Practically all of this Basin's irrigated acres are watered by private systems. The sources of supply have usually been adequate to supply irrigation needs. The surface water sources, especially in drought periods or over development of source, have been less than adequate at times throughout most of the Basin. This has occurred in the past during extreme drought periods. There appears to be a plentiful supply of water in the Basin, however, with some problem in the distribution of water users.

NEEDS

Crops, with the exception of rice, can be produced in this Basin without irrigation. The total projected acreage of rice was considered as being irrigated since irrigation is a necessity for rice production. The remainder of the crops to be irrigated was projected from past trends. The acres expected to be irrigated within the Basin are 188,000, 207,500 and 220,300 acres by the years 1980, 2000 and 2020, respectively. Irrigation water needs for these expected acreages are 350,490, 386,840 and 410,700 acre feet, respectively.

The potentially available water supply that could be used to meet the needs for irrigation in this Basin are generally considered adequate. The problems associated with the distribution of water users, however, are expected to continue.

FISH AND MINNOW FARMS

GENERAL

Approximately 10 percent of total water used (314 M.G.D.) was for fish and minnow farming, an economically important and fast growing activity in many counties of the state. Of the 314 M.G.D., approximately 22 percent (69 M.G.D.) was diverted for use in the Ouachita Basin. Ground water supplied 82 percent of this diversion and surface sources supplied 18 percent.

PROBLEMS

There were no reported shortages of cooling water.

NEEDS

Thermoelectric water use requirements are expected to increase 534 percent by the year 2020. Thermoelectric water use requirements are projected to be 889.5, 2,277.4 and 3,392.6 M.G.D. by the years 1980, 2000 and 2020, respectively.

WATER QUALITY

GENERAL

Rivers, bayous, drainage ditches, sloughs, lakes, reservoirs, marshes, and swamps form a network of surface waters in the Ouachita River Basin. These surface waters, together with the extensive and productive fresh-water aquifers that underlie the Basin, constitute a vital part of the resource base that sustains life in the Basin. This resource is renewable in quantity through natural replenishment, and in some respects renewable in quality through natural processes of self-purification. However, the many and increasing uses to which water is put often results in degradation of natural quality which self-purification cannot correct. Proper development and effective management is essential if we are to insure the future maximum usefulness of this important resource.

The Department of Pollution Control and Ecology is the state agency responsible for the water quality management program in Arkansas. In fiscal years 1972 and 1973, the department expended approximately 39 man-years on water pollution control activities. The total budgets for water pollution control for fiscal years 1972 and 1973 were approximately $472,000 and $566,000, respectively.

Activities of the department in 1972 centered on implementation of a mandatory municipal sewage treatment plant operator certification system including inventory and classification of 229 municipal sewage treatment plants throughout the state, completion of 15 plants, pesticide monitoring and water quality stream surveys in the Upper Arkansas and Upper White River Basins.

Ongoing programs of the department include a permit issuance program for all point dischargers, municipal sewage treatment plant operator training, a statewide water quality monitoring network, data collection and analysis, surveillance and enforcement activities associated with industries, municipalities, oil field operations, etc., and river basin water quality management planning.

Chemical analyses of water from 11 streams in the Basin are listed in Table 1. Rather than representing the actual composition of an individual or composit sample of water from each river, the numerical values of the water quality parameters in Table 1 are maximum values selected from among individual analyses.

The purpose of this method of presentation is to emphasize potential water quality problem areas. The analyses included are intended to indicate the largest range in water quality variation at each sampling station that has occurred principally during the last 15 years (1955-1970). Important parameters are dissolved solids, chloride, sulfate, dissolved oxygen, and temperature. The selection of analyses having maximum and minimum mineral composition at each station is based on dissolved solids (or specific condustance when dissolved solids have not been determined). However, the highest or lowest numerical values for the other parameters do not necessarily occur in the same analysis having the highest or lowest dissolved solids. Analyses with high chloride or sulfate concentrations were occasionally given preference when the dissolved solids concentration of these samples was not necessarily the maximum.

Natural stream quality is not a constant condition, but varies along the course of a stream and with time. Numerous factors control the natural quality and these include rainfall, overland runoff, ground water seepage, the flow of the stream itself, daily and seasonal temperature variations, seasonal growth and decay of plants and daily and seasonal changes in the photosynthetic processes of plant life in the stream.

Turbidity, color, algae, and dead organic material are the principal natural pollutants in the Basin. Stream quality problems relating to these four parameters are assumed to occur on all the streams at one time or another.

Erosion is the principal cause of natural pollution of streams; however, this is not a serious problem at this time. It is the result of precipitation and surface runoff. Mechanical erosion involves the physical transport of rock, soil particles, and vegetation to receiving streams, causing turbidity, discoloration, and a load of dead organic matter. Chemical erosion involves the dissolving of organic and inorganic rock and soil material during leaching and flow over the land surface following rainfall. Consisting in part of nitrogenous and phosphorous compounds, these nutrients cause eutrophication or nutrient enrichment of streams which promotes algae growth and large daily fluctuations in the dissolved oxygen concentration of receiving streams.

One of the principal man-made pollution problems in the Ouachita River Basin in Arkansas has been that of chlorides from brines produced in conjunction with oil production from about 6000 oil wells. In 1958 and 1959, the Arkansas Pollution Control Commission issued orders requiring oil field operators to properly dispose of brines. These orders resulted in the chloride load in the Ouachita River at the Arkansas-Louisiana stateline being reduced by some 1,250,000 tons per

Under the ever increasing urban, suburban, industrial and agricultural development that is occurring nationwide, quality problems relating to ground water pollution are now emerging. Determining where such pollution is occurring is difficult and costly because in a literal sense the problem is under foot and out of sight.

NEEDS

Water quality control needs exist wherever pollutants are discharged to water supplies. Quantified needs herein are limited to organic or biodegradable wastes, and to bacteria. Organic pollutants are expressed in pounds of BOD_5 per day. Bacterial pollution is expressed in terms of flow in millions of gallons per day requiring treatment.

Municipal and industrial waste loadings are considered point loadings to streams, whereas 95 percent of agricultural loadings are considered non-point sources of pollution. Projected net loadings to streams to the year 2020 are based on calculated total raw waste production minus the quantity of BOD removed or quantity of effluent disinfected by present (1970) treatment held as a constant through the projected 50-year period. Table 3 displays municipal and industrial organic pollution control needs. Table 4 displays pollution control needs for estimated agricultural point sources, and Table 5 shows needs for control of harmful bacteria.

The unsatisfied or net need shown in the 1970 column of the tables indicates that significant pollution control problems exist in the Basin at the present time. The more notable of these problem areas are Pine Bluff and Camden.

Only five percent of the total agricultural BOD waste production is estimated as entering the surface waters as point sources of pollution. The remaining organic wastes are disposed of by such methods as direct land application, recycling, aerated lagoon-irrigation systems, holding tanks, or some combination of these. Nonetheless, the wastes can cause an ultimate surface water problem unless proper land management practices are instituted and maintained.

Bacterial pollution is probably persistant in stream reaches receiving nondisinfected effluent from population centers. The total nondisinfected discharge may increase by 2020 more than four-fold if present levels of disinfection are maintained.

TABLE 3 - MUNICIPAL AND INDUSTRIAL ORGANIC POLLUTION CONTROL NEEDS, OUACHITA RIVER BASIN

LOAD CATEGORY	1970	1980	2000	2020
		(pounds of BOD_5)		
Municipal				
Total	40,030	45,780	61,170	82,155
Exstg. Trmt.	32,060	32,060	32,060	32,060
Net Need	7,970	13,720	29,110	50,095
Industrial				
Total	477,550	594,040	1,053,160	2,049,970
Exstg. Trmt.	262,650	262,650	262,650	262,650
Net Need	214,900	331,390	790,510	1,787,320
Total				
Total	517,580	639,820	1,114,330	2,132,125
Exstg. Trmt.	294,710	294,710	294,710	294,710
Net Need	222,870	345,110	819,620	1,837,415

TABLE 4 - AGRICULTURAL ORGANIC POINT SOURCE LOADS, OUACHITA RIVER BASIN

	1970	1980	2000	2020
		(pounds of BOD_5)		
Waste Loads	28,720	36,570	49,440	65,510

TABLE 5 - BACTERIAL POLLUTION CONTROL NEEDS, OUACHITA RIVER BASIN

	1970	1980	2000	2020
	(M.G. of effluent per day)			
Total Discharge	20.1	24.1	31.5	44.3
Chlorinated	11.3	11.3	11.3	11.3
Net Need	8.8	12.8	20.2	33.0

NEEDS

If the significant environmental features of the Basin are to fulfill their potential for contributing to the aesthetic enjoyment and scientific knowledge of future resource users, there is a short-term (1980) need to solve major pollution problems and otherwise protect the environmental quality of more than 200 miles of scenic rivers and streams.

The location of water areas needed for preservation of the natural environmental quality of the Basin includes portions of the Saline River, Ouachita River, Moro Creek, Chemin-A-Haut Creek, Bayou D'Loutre, and Corney Bayou.

NATURAL AREA PRESERVATION

PROBLEMS

Many of the unique natural areas of the State are being destroyed through indescriminate land developments. The Arkansas Natural Area Plan points out areas in the state which should be preserved and managed for the enjoyment of the people. The Natural Area Plan points out several areas in the Ouachita River Basin that should be preserved including Wilderness Areas, Bottomland Hardwoods, Unique Geological Systems, and Unique Ecological Systems.

NEEDS

If the significant environmental features of the Basin are to fulfill their potential for contributing to the aesthetic enjoyment and scientific knowledge of future resource users, there is a short-term (1980) need to solve major pollution problems and otherwise protect the environmental quality of several unique geological and ecological systems, and about 160,000 acres of bottomland hardwoods. In addition, there is a need to provide acreage for open and green space in urban and built-up areas, and a need to solve problems associated with forest lands.

The locations of land areas needed for preservation of the natural environmental quality in the Basin are located primarily in the bottomlands of Bayou DeLoutre, Saline River, Ouachita River, Little Missouri River, and Bayou Bartholomew.

OUTDOOR RECREATION

PROBLEMS

Throughout the state, recreation planners have identified certain common problems: (1) lack of recreation financing, (2) the seemingly insatiable needs of the urban areas, (3) few recreation facilities to meet

REFERENCES

1. Lower Mississippi Region Comprehensive Study, Mississippi River Commission, Vicksburg, Mississippi, 1974.

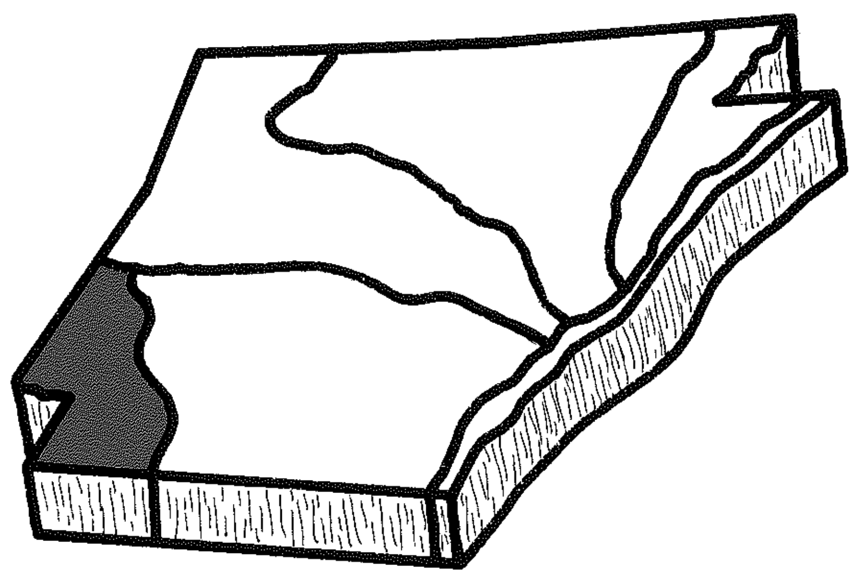
2. Water and Land Resources, Ouachita River Basin, Arkansas Soil and Water Conservation Commission, 1970.

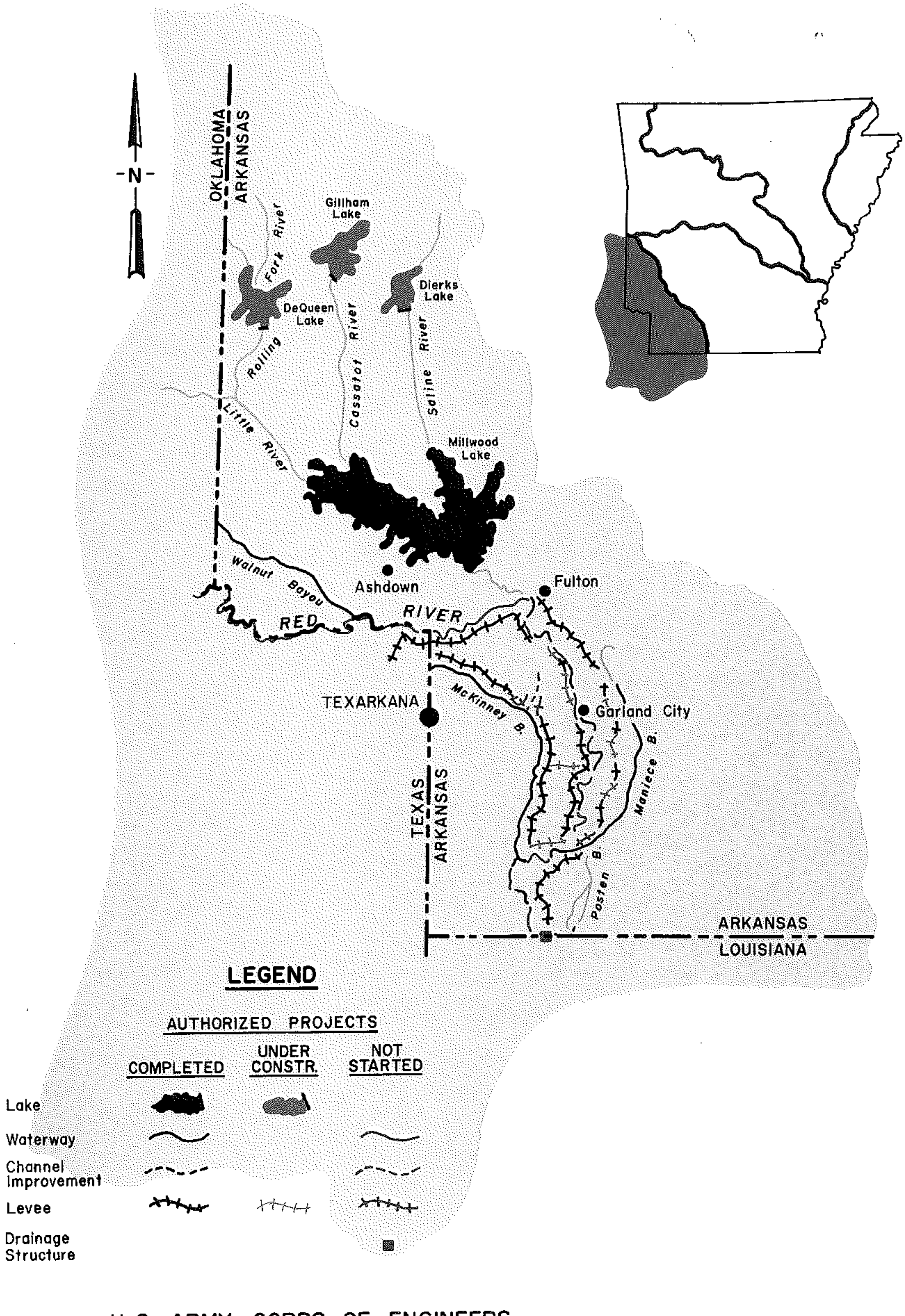
3. Water and Land Resources, Bartholomew-Beouf-Macon Basin, Arkansas Soil and Water Conservation Commission, 1972.

CHAPTER IV

RED RIVER BASIN

PROBLEMS and NEEDS





U. S. ARMY CORPS OF ENGINEERS

RED BASIN PLAN

Source: Water Resources Development in Arkansas 1973
By the U. S. Army Corps of Engineers, Dept. of the Army, Vicksburg, Mississippi

Red River Basin

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d. Ponding: Water may pond behind levees where drainage outlets are either inadequate or must be closed because of high stages on the Red River.

Since the basin is primarily rural in nature and has few large urban centers, most flood damages involve agricultural equipment and structures, lands, crops, and livestock. Roads, railroads, oilfield structures, bridges, utility lines, and urban developments also sustain damages.

Development of highly productive alluvial lands in the basin has been retarded by the flood threat. Future domestic demands and normal export trade will ultimately necessitate full utilization of and production for the productive bottomlands of this area.

In spite of decades of effort and the expenditure of more than $1 billion for flood control works, flood damages have taken an increasing toll. The increase is partially attributable to the construction of improvements in flood prone areas. The record offers abundant evidence that structural measures alone cannot prevent a continuing increase in flood losses.

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

BANK STABILIZATION

The sandy, silty soil of the alluvial plain of Red River Basin below Denison Dam is highly susceptible to bank caving and channel erosion. The river meanders in a series of irregular curves. Caving takes place along the concave sides of the bends as the overall configuration advances slowly downstream. Widely fluctuating stages, poor alignment of the stream, and friable soil all contribute to the caving problem. An average of over 500 acres of highly productive agricultural land is lost each year.

Levees, drainage systems, buildings, roads, bridges, pipelines and other improvements are lost as the bank recedes. Average annual damages for both land and improvements amount to over $4 million under current conditions and prices. Detailed information relative to bank stabilization is contained in the "Interim Report on Navigation and Bank Stabilization - Red River below Denison Dam," dated March 15, 1966, U. S. Army Corps of Engineers.

110-135 million cubic feet of merchantable wood annually by the year 2010. High-level sustained-yield management of an additional 337,500 acres of the most productive forest lands will be necessary to meet future needs.

d. The combined efforts of Federal, State, local organizations, and landowners and operators have played a major role in treating land resource problems. It is estimated that conservation measures, consisting of land use conversions and the common soil and water conservation practices, have been applied to about one-fourth of the study area.

DRAINAGE

Drainage is considered a problem when excess water is present in the plant root zone of the soil or on the soil surface in areas where normal precipitation, seepage, or excess irrigation water keeps the soil too wet for the most economical agricultural production. Factors that cause drainage problems on flatlands include low gradients, uneven land surfaces, and soils of low permeability. The main physiological effect of inadequate drainage is the lack of aeration of the soil. The net results are that crop yields are reduced and operations relating to crop production are adversely affected.

The problem of inadequate drainage on flatlands are considered inseparable from problems of flooding. Thus, the acreage with drainage problems is considered to have a combined problem of inadequate drainage and flooding. About 952,000 acres of soils in the study area suffer from inadequate drainage and flood problems. Of this total, 60,000 acres have had adequate improvements installed, leaving 892,000 acres with problems. Of these, improvements are feasible on 197,100 acres.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY

Urban water use in the basin averaged about 12.7 million gallons per day (m.g.d.) for domestic use, service and commercial business, and small industrial water supply purposes in 1965. The average per capita water use in the urban area was about 115 gallons per day for the same year. Industries in the basin used approximately 20.7 m.g.d. in their manufacturing processes in 1965. About 12 percent of this total was obtained from municipal water systems. The remainder was supplied from other public and private surface supplies.

Rural water use within the basin for domestic and livestock purposes was approximately 4 m.g.d. in 1965, which represented about 10 percent of the average daily water use in the basin. It is estimated that rural water demands, exclusive of irrigation, will increase to about 9.5 m.g.d. by 1980. The higher demand will result from maintenance

IRRIGATION

The uneven distribution of precipitation greatly adds to the risks involved in agricultural production and makes supplemental irrigation desirable. Irrigation is an expensive undertaking and requires a high level of management in order to be profitable to the operator even in suitable areas.

Although studies indicate that national needs do not justify proposing large areas for irrigation by early-action programs, other factors are involved. Many farmers have installed irrigation equipment to increase their yields and to provide crop insurance. The value of irrigation has been recognized by operators irrigating about 6,500 acres of cropland in the basin area.

Demands for quality control in vegetables, fruits, and specialty crops will increase irrigation development. With agriculture becoming increasingly competitive, it is anticipated that a real potential for increased irrigation exists.

Approximately 110,000 acres have a potential for irrigation development. Of the total area, approximately 86,000 acres are suitable for project-type development and 24,000 acres could be developed individually by landowners and operators.

HYDROELECTRIC POWER

Federal Power Commission Coordination Study Area K is the logical market area for power produced in the Red River Basin below Denison Dam. It includes all of Arkansas and Louisiana, practically all of Kansas and Oklahoma, southern half of Missouri, western half of Mississippi, and a small area in east Texas. Power supply areas as established by the Federal Power Commission for power market surveys hydroelectric power need and utilization studies, and other analyses of power supply and requirements are geographical areas substantially representing the electrical service areas of major electric utilities.

Farm and residential use of electric energy and consumption per commercial customer are all increasing. The increases reflect expanded use of all types of air-conditioning, refrigeration, heating equipment, and a wide range of applicances, diversification of retail outlets, advent of shopping centers, and increased recreational activities.

Presented in the following table are historical and estimated future data on energy for load, peak demands, and annual load factors for Study Area K. It is to be noted that the peak demand for Area K increased from 2,890 megawatts in 1950 to 13,070 megawatts in 1965. Estimated future load growth as developed for the National Power Survey is expected to reach 35,900 megawatts by 1980. This estimate

RECREATION

The Red River Basin below Denison Dam presently has several pressing problems of significant influence insofar as the outdoor recreation opportunities of the basin are concerned. Man, in his attempt to shape the environment for his convenience without first considering basic ecological principles and conditions, is, in many cases, partially responsible for these problems.

The Red River above Lake Texoma has substantial natural pollution because of brine emissions. Below Lake Texoma, the Red River main stem and some tributaries receive quantities of inadequately treated wastes from cities, industries, and agricultural operations. This situation restricts water contact recreation in many areas of the basin. If the Red River and affected tributaries are to offer additional significant recreational potential, the established water quality standards must be enforced.

Many of the existing lakes and fishable and boatable streams in the basin are not available to the public because of limited or restricted access. Access refers to roads or trails, as well as land and related facilities, needed to promote the utilization of water resources. The interstate highway system gives good access into and through the basin, but the secondary and primary systems must be expanded to allow people to take full advantage of the water based recreational opportunities.

Planning and development of recreational resources have not kept pace with expanding demand. Most of the cities in the basin have experienced population growth far exceeding the rate at which parks and playgrounds have been developed. Continued growth of population, along with increasing demands for land because of industrial, agricultural, and urban expansion, will doubtless cause annual decreases in land available for outdoor recreation. Sound recreation plans can only be developed through coordinated effort at all levels of Government, particularly at State and local levels.

Outstanding outdoor recreational opportunities are available in the Red River Basin, but these opportunities simply have not been developed to their potential. Of 242,000 acres of publicly-owned lands in the basin, about 1,500 acres are developed for outdoor recreation.

FISH AND WILDLIFE

Increased supplies of game and fish as well as new areas in which to hunt and fish will be needed in the Red River Basin as the population expands. Areas around large urban centers will be the first to feel this need, but all parts of the basin could be affected in the foreseeable major tributaries is practically nonexistent. Widely fluctuating stages, shifting beds and banks, and shoaling all militate against successful navigation. Controlling depths of the river from January to July are about 6 feet from the mouth to Alexandria, 5 feet to Shreveport, and 4 feet to Fulton. From August through December, controlling depths are 6.5 feet from the river mouth to the Black River, 4 feet to Alexandria, 1 to 2 feet to Shreveport, and less than 1 foot from Shreveport to Denison Dam.

While the existing transportation service provided by air, truck, and railroads systems is excellent, anticipated economic growth of the basin will require extensions or additions to all transportation media. Many types of industry depend upon low cost bulk transportation systems for their existence and, therefore, locate on waterways. This has been demonstrated repeatedly along the Ohio River, the Mississippi River, and Gulf Intracoastal Waterway to name a few. Each transportation medium has certain advantages over th others and all are required if the area is to enjoy a truly integrated mass transportation system.

In recent studies in connection with the "Interim Report on Navigation and Bank Stabilization - Red River below Denison Dam," dated March 15, 1966, and subsequent studies of the feasibility of extending navigation above Shreveport on the Red River to Denison Dam, it was determined that if a navigation channel 9 feet deep were provided, about 2.5 million tons of commerce suitable for waterway transportation would emanate from the areas in and adjacent to the Red River Basin by 1980. By 2030, the commerce which could use the waterway would increase to about 20.1 million tons. Detailed information relative to navigation from the mouth of Red River to Daingerfield, Texas, is contained in the referenced Interim Report.

REGIONAL DEVELOPMENT

In the last national census, the average per capita annual income for the basin area was revealed to be only $1,380 or 40 percent below the national average. As of 1968, half of the counties in the basin were classified by the Economic Development Administration of the United States Department of Commerce as being eligible for full financial assistance under the Public Works and Economic Development of 1965. The basin economy lacks the diversity and the industrial base required to ensure reasonable progress in closing this economic gap.

The basin possesses numerous sites which should be preserved. These offer not only striking natural beauty, but historical, cultural, and scientific significance, and essential wildlife habitat as well. They harbor three endangered species, the American Alligator, the Southern Bald Eagle, and the Red Wolf, which is very rare. In some cases, the type of habitat offered is already in short supply generally, and undergoing continuing progressive reduction both as to quality and quantity.

Annoyance problems are especially pertinent in connection with the development and utilization of outdoor recreational areas. Experience has demonstrated that scourges of mosquitos such as floodwater species (e.g. Aedes vexans) and ricefield mosquitos (Psorophora confinnis) can be a real impediment to recreational developments. Other groups of vectors that may create serious nuisance problems in recreational areas include: deer flies, biting midges (Culicoides), wasps, ticks (especially Lone-Star), chiggers, and rodents.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

This report presents a plan for the orderly development of the water and related land resources of the Red River Basin to satisfy the short- and long-range needs and goals of the area. The projects in the early-action plan are consistent with the comprehensive plan for basin development and are directed toward providing the optimum development fo water and related land resources to satisfy the immediate needs within the basin. They are economically and engineeringly feasible, both individually and as elements in the basin plan, and each purpose served by the projects is fully justified. The long-range plan is essentially a flexible framework for future development and should be kept current by the concerned Federal, State, and local agencies.

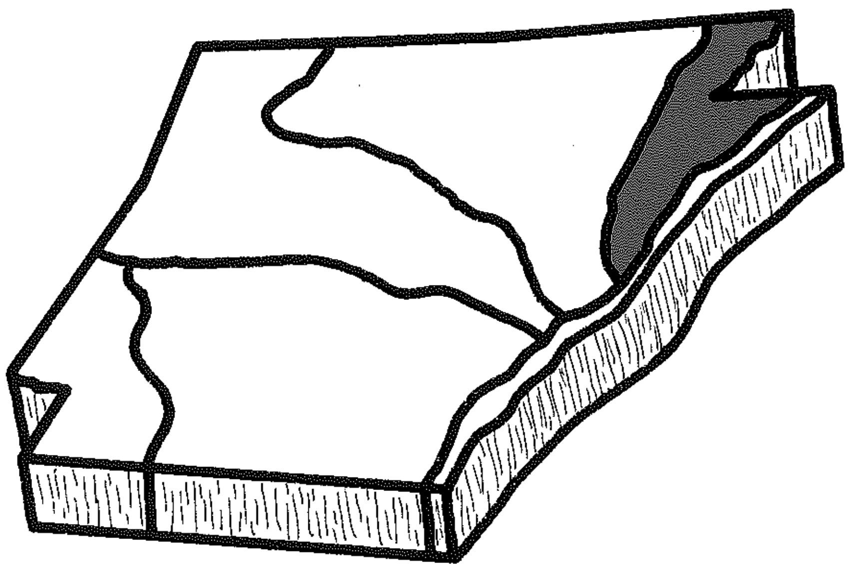
Implementation of the plan would assure adequate quantities of high quality water to meet the M&I needs of the basin through 2080; protect valuable urban and agricultural areas from damaging floods; promote maximum utilization of the agricultural potential of the basin; stimulate trade through the provision of low-cost barge transportation; provide the recreational opportunities required by an expanding population; make a major contribution towards satisfying demands for electric power; preserve areas of intrinsic natural beauty or unique environmental conditions; and promote economic development.

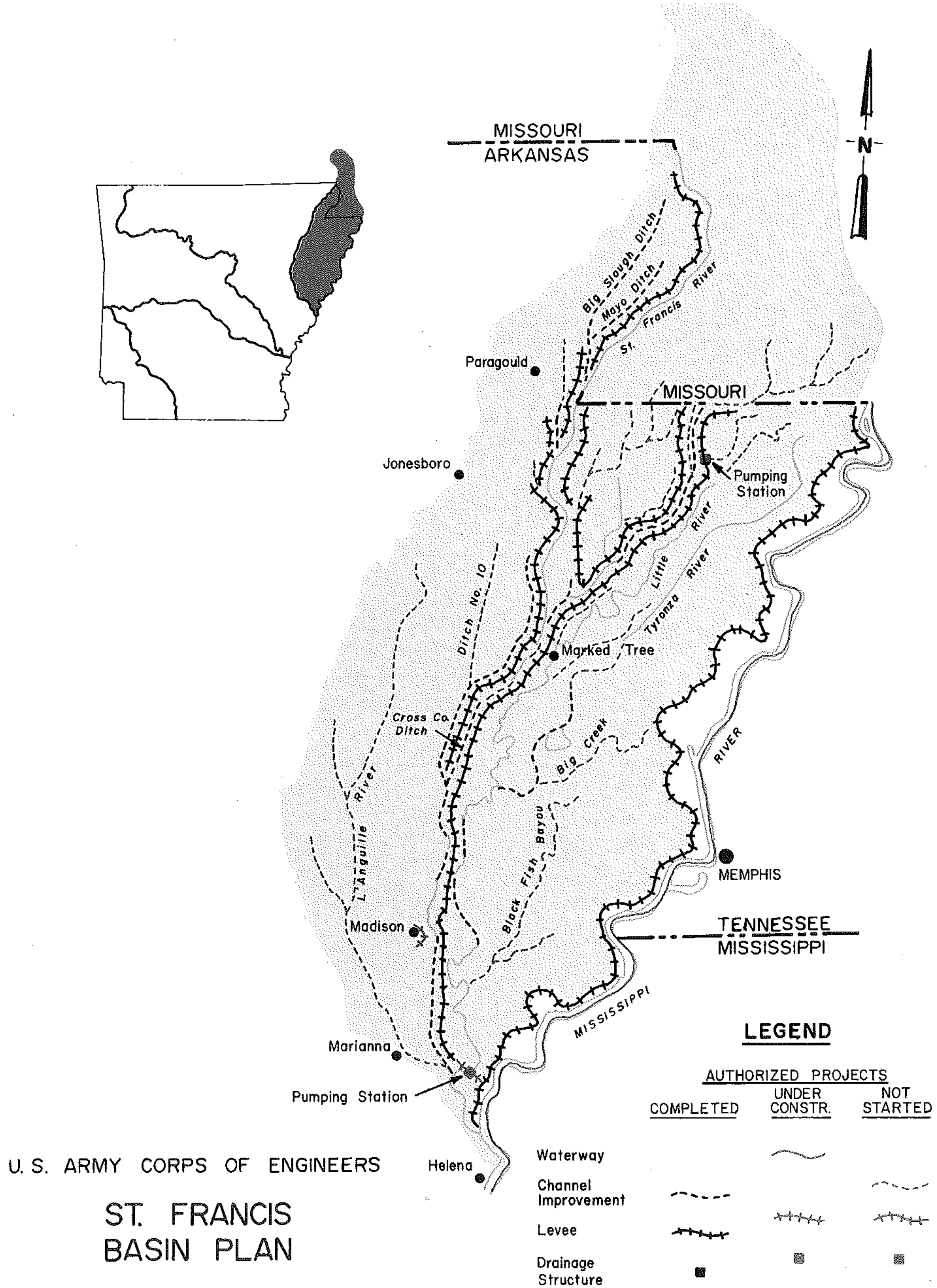
Implementation of the plan will further reduce already inadequate hardwood supplies for forest industries, but will help provide for adequate future supplies for other forest industries, and will maximize benefits for watershed protection on forest lands.

CHAPTER V

ST. FRANCIS RIVER BASIN

PROBLEMS and NEEDS





Source: Water Resources Development In Arkansas 1973
By the U. S. Army Corps of Engineers, Dept. of the Army, Vicksburg, Mississippi

St. Francis River Basin

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A soil loss, by erosion from cropland and pasture, of 3 to 5 tons per acre per year is not considered excessive unless it reduces the productive capability of the soil. However, sediment problems may be created even by these tolerable amounts.

Crowleys Ridge is a prominent escarpment that extends the full length of the basin. The ridge varies in width from about two to fifteen miles and elevations range from 180 to 540 feet m.s.l. Crowleys Ridge is a loess-capped, upland area that is particularly susceptible to erosion. The loess soils are not confined to the ridge and are prevalent throughout the basin. It is very difficult to control erosion on these soils especially when they lie on steep slopes.

Erosion is one of the major factors governing the amount of sediment produced. Sediment is a problem in the St. Francis River Basin, in that it causes destruction of fish and wildlife habitat, fills lakes and channels; reduces water quality and detracts from asthetic value. Sediment carries soil chemicals, pesticides, herbicides and fertilizers which may affect plant and animal life. As was mentioned earlier the L'Anguille River Subbasin had the highest erosion rates, this river also has the highest average annual sediment yield which is 3,209 tons per square mile per year.

Sedimentation is related to flood-plain flood problems and water management in that both are associated with high runoff. During floods overbank flow of high velocity water causes scour damages especially on cultivated lands. Sedimentation has increased as forest lands have been cleared and converted to cropland. During the floods of 1973 some sections of streambeds were completely filled with sediment. Frequent channel clearout is necessary to keep drainageway open.

NEEDS

The first step in solving land use need is to encourage proper land use. There is no doubt that the St. Francis' River Basin is predominately an agricultural area and will continue to be in the foreseeable future. There are areas within the basin which sould not be in cropland, for example, Crowleys Ridge should be devoted to forest and pasture. Overgrazing of pasture land must be avoided because of the extremely erosive nature of Crowleys Ridge. Critical areas such as gullies, road ditches, logging roads and denuded areas should receive special treatment. That portion of the St. Francis River Basin other than Crowley Ridge is generally suitable for crops, except some wet areas that should remain in natural cover.

Since cropland contributes more gross erosion and sediment than all other sources, it is imperative that it receives adequate treatment. Approximately 50 per cent of the basins lands have received adequate treatment. This leaves about 1.5 million acres that requires treatment.

NEEDS

Flood prevention measures are needed in varying degrees throughout the basin. Although there has been a considerable amount of flood prevention work done in the St. Francis River Basin, there is a need for much more, to reduce the flood losses. Major floods occurred in the basin in 1927, 1937, 1945, 1950, 1957, 1972 and 1973 with numerous smaller floods occurring almost annually. The 1973 flood caused an estimated loss of about 40 million dollars in the total basin including the Arkansas and Missouri portions.

There is a need for additional floodwater retarding structures in upland area of the basin. In addition many existing channels need enlarging or reworking, because of increased runoff, due to land use change. Structural measures such as levees, floodways and drainage pumping plants will be needed to help alleviate damages. Some of the major drainageways in the basin need enlargement which would provide outlets for smaller tributaries.

Non-structural methods of flood damage reductions such as zoning ordinances, subdivision regulations, construction codes and flood-proofing of existing structures need to be applied where practical.

DRAINAGE

PROBLEMS

Crops in the alluvial area receive extensive damages from poor surface drainage. Wetness problems cause delayed planting retarded growth, poor stands and disrupts cultivation and harvest operations. Many areas within the basin need improved drainage outlets, as well as improved on farm drainage systems. On farm drainage systems consist of land grading or smoothing to eliminate potholes and a collecting system for orderly removal of surface water. There is over one million acres of agricultural land, in the Arkansas portion of the St. Francis River Basin, that has a wetness problem. A portion of this land is flooded frequently and part has impaired drainage.

Erosion and stability problems exist in conjunction with drainage systems. Erosion and resulting unstable channels can cause serious problems in drainage systems. The capacity of many of the older drainage systems has been exceeded as a result of increased runoff from increased land clearing. Generally, when the drainage systems capacity is exceeded it causes high channel gradients and hence more erosion.

Levees have been used to protect against flood flows in the St. Francis River Basin, however, this generally results in blocked drainage on land adjacent to the levee. Drainage then must be accomplished with floodgates or drainage pumping plants.

supplies for public supply and irrigation. There are many towns in the basin that are without water systems or need to improve existing water systems.

WATER SUPPLY PROBLEMS - SELF SERVICED INDUSTRIES

Industry that supplies its own water uses approximately 9.4 million gallons per day from groundwater sources and only about 0.27 million gallons per day from surface water sources. Projected figures indicate that self supplied industries could be using over 90 million gallons per day, from groundwater sources by the year 2020. Projections show that surface water use by self supplied industries will only increase about 2 million gallons per day by year 2020.

WATER SUPPLY NEEDS - SELF SERVICED INDUSTRIES

In the future increased groundwater use by cities, towns and industries with irrigation demand, could deplete this source. There is a need for developing suitable surface water sources for self-serviced industries using large amounts of groundwater.

WATER SUPPLY PROBLEMS - RURAL USE

The total rural household and livestock water use was approximately 12.58 million gallons per day in 1970. Nearly 90 percent of the total water use was obtained from groundwater sources. Within the next 50 years water use for rural use is not expected to increase significantly.

WATER SUPPLY NEEDS - RURAL USE

As water supply systems become more fully developed, more rural areas will be served by water districts, thereby reducing the number of individual wells. This should improve the quality of water available to rural areas. Since no significant change in rural water use is expected in the next 50 years, no special needs are anticipated.

WATER SUPPLY PROBLEMS - IRRIGATION

The average annual rainfall in the basin varies from about 46 inches in the north to 50 inches in the south. This amount of rainfall is adequate for row crop production, however, poor distribution throughout the year causes reduced production. The months of July through October have the lowest normal annual rainfall and crops may suffer from lack of moisture. Many farmers use supplemental irrigation to insure against crop losses. In 1970, approximately 344 million gallons per day was used for irrigation.

WATER SUPPLY PROBLEMS - FUEL-ELECTRIC POWER

Most of the fuel-electric power plants are located on rivers and withdraw large quantities of water for cooling purposes. The water, used for cooling, is circulated once then returned to the river, therefore, the amount of water actually consumed is practically nil. The temperature of the water used for cooling is increased, however, the temperature rise is dissipated a few miles downstream.

WATER SUPPLY NEEDS - FUEL-ELECTRIC POWER

The need for electric power generation is expected to increase sharply in the future. Since fuel-electric power plants require large amounts of water for cooling, these plants must be located on a river that will yield a dependable water supply. The Mississippi River, which is adjacent to the St. Francis River Basin, is a dependable source of water and most of the future power plant development in the eastern part of the state is expected to be along the Mississippi River.

WATER QUALITY PROBLEMS

The St. Francis River has calcium bicarbonate type water. The surface water is generally suitable for irrigation and industrial uses. However, streams and rivers have a total coliform count which exceeds the Arkansas Health Department standards for outdoor bathing beaches.

Groundwater from the shallow alluvial and Wilcox acquifers (1400-foot sand) are the calcium bicarbonate types. This water is suitable for irrigation. The lower Wilcox acquifer contains a high percent of sodium and may not be suitable for irrigation. Most of the municipal water supplies come from deposits of the Quaternary Age and older deposits such as the Claiborne Group.

There is evidence that significant amounts of agricultural pesticides and fertilizers enter surface from aerial application and runoff.

WATER QUALITY NEEDS

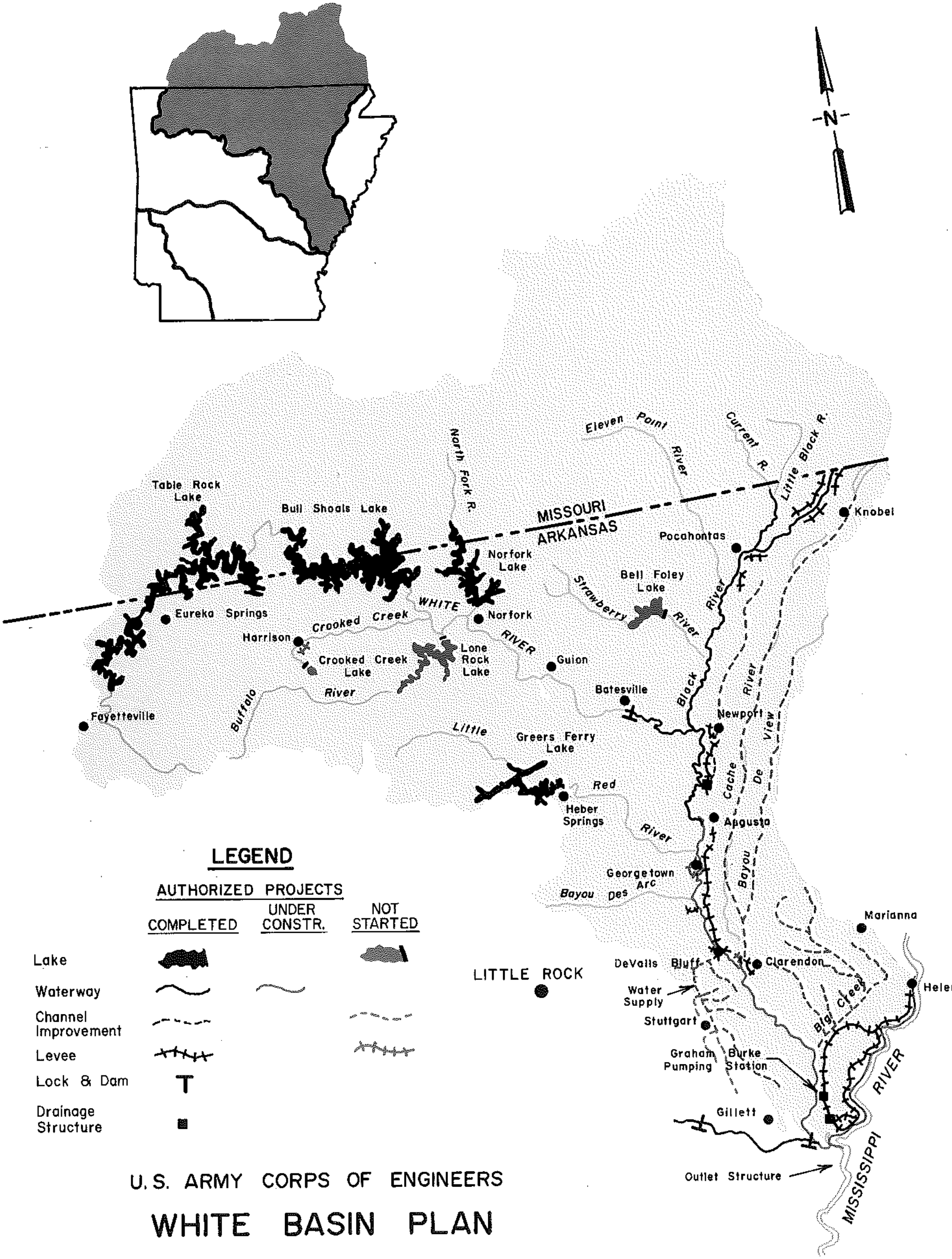
Provisions of Public Law 92-500 Federal Water Pollution Control Act of 1972, when fully implemented, should satisfy the water quality needs of the basin. Certain Federal and State regulations are enforced by the Arkansas Department of Pollution Control and Ecology. Provisions of Public Law 92-500 are enforced by the Federal Environmental Protection Agency.

OUTDOOR RECREATION - PROBLEMS

Outdoor recreation activity such as swimming, boating, water skiing, fishing and hunting will no doubt increase in the future. The St. Francis River Basin lacks sufficient distribution of large lakes near major urban areas. A large part of the fishing and boating recreation takes place on the Mississippi River and associated oxbow lakes, however, access to the river and lakes is limited. Hunting is confined generally to State Lands or Crowleys Ridge.

OUTDOOR RECREATION - NEEDS

A need exists for additional outdoor recreation apportunities as pointed out in the Arkansas Statewide Comprehensive Outdoor Recreation Plan. The Soil and Water Conservation Commission will cooperate, to the extent possible, with all state agencies to meet the recreational needs of the basin.



U.S. ARMY CORPS OF ENGINEERS

WHITE BASIN PLAN

Source: Water Resources Development in Arkansas 1973
By the U.S. Army Corps of Engineers, Dept. of the Army, Vicksburg, Mississippi

White River Basin

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WHITE RIVER BASIN 1/

INTRODUCTION

The White River Basin in Arkansas comprises about 17,143 square miles in the northern and eastern parts of Arkansas. The basin is fan-shaped, and varies in width from about 210 miles near the Missouri-Arkansas State line to about 50 miles in the southern part near the mouth of the river. The Ozark Plateaus Province covers about three-fourths of the basin and the remaining one-fourth lies in the Mississippi Alluvial Plain section of the Coastal Plain Province and the Ouachita Province. The escarpment of the Ozark Mountain runs generally southwestward across the basin from near Poplar Bluff, Missouri, crosses the White River near Batesville, Arkansas, and extends to near Cabot, Arkansas, on the southwestern watershed divide.

The Ozark Plateaus Province in the White River Basin is made up of the Salem Plateau in the northern part, the Springfield Plateau generally in the western, and the Boston "Mountains" in the southern part. The Salem and Springfield Plateaus are flat to rolling and are dissected by deep, narrow, meandering stream valleys. The Boston "Mountains" form the highest and most rugged features of the province. The geological formations consist mostly of Paleozoic sedimentary rocks, limestones, dolomites, chert, sandstones, and shales. Some Precambrian igneous rocks are interspersed with the other formations in the northeastern part of the province.

A very small area in the southwestern part of the basin is in the Ouachita Province. The rock formations in this province are Paleozoic sandstones and shales. The eastern part of the basin is in the Coastal Plain Province. The geological formations in this province consist, in general, of poorly consolidated or unconsolidated deposits of silt, clay, sand, and gravel of Tertiary and Quaternary age.

The White River rises in the Boston "Mountains" in the western part of the basin and flows in a generally northerly direction to the Missouri-Arkansas State line (mile 591.9), thence in a generally easterly direction for about 115 miles in southern Missouri and for about 30 miles along either side of the State line until it finally crosses into Arkansas at about mile 447.5. Downstream from that point, it flows in a generally southeasterly direction to the mouth of the Black River (mile 264.8) near Newport, Arkansas, and then in a southerly direction to join the Mississippi River at mile 599 above Head of Passes, Louisiana.

The total length of the White River is about 720 miles. The elevation at its source is about 2,050 feet above mean sea level and the low water elevation at the mouth is about 107 feet above mean sea level. The fall ranges from about 25 feet per mile near the source to about 0.4 foot per mile near the mouth. The fall of the streambed throughout the greater part in the Ozark Mountains is about 3 to 4 feet per mile. The White River

1/ Comprehensive Basin Study, White River Basin, Missouri and Arkansas, Appendix P, June 1968, White River Basin Coordinating Committee

TABLE 1

DRAINAGE AREAS AND RIVER MILES

Tributary	Drainage area (Square miles)		Location of mouth of tributary (river mile)	
	First tributary	Second tributary	White River	Tributary
Kings River (Mo.)	594		572.4	
James River	1,456		549.8	
Crooked Creek	466		394.9	
Buffalo River	1,338		387.7	
North Fork River	1,825		376.4	
Black River	8,520		264.8	
Current River		2,613		96.2
Eleven Point River		1,196		72.0
Spring River		1,215		72.0
Strawberry River		811		32.7
Little Red River	1,792		182.6	
Bayou Des Arc	682		149.3	
Cache River	2,025		101.2	
Bayou DeView		694		10.0
Big Creek	1,027		51.9	
La Grue Bayou	595		20.3	

Downstream from Newport, Arkansas, the large tributaries of the White River are Little Red River, Bayou Des Arc, Cache River, Big Creek, and LaGrue Bayou. All of these except the Little Red River are typical alluvial streams although the headwaters of Bayou Des Arc and La Grue Bayou drain areas in the Ozark escarpment. The Little Red River is a typical mountain stream until it enters Greers Ferry Reservoir.

PROBLEMS AND NEEDS

LAND TREATMENT

CROPLAND AND GRASSLAND

(1) Problems. Many problems exist concerning the conservation, treatment, and management of cropland and grassland in the White River Basin. Some of these problems are discussed in the paragraphs below.

(a) Many farms within the Ozark Plateaus of the White River Basin, because of size, are not efficient economic units. In many

(b) The same factors which have reduced the productivity of the forest lands in terms of timber and timber products have also had a corresponding detrimental effect on the hydrologic condition of the forest soils. The long history of destructive logging, widespread and repeated burning, and overgrazing, particularly in periods of prolonged drought, have seriously reduced soil cover and have contributed to the compaction of the upper portions of the soil profile. The result has been a reduction of the soils' ability to resist erosion and absorb and store water. Consequently, these soils contribute high rates of soil and water runoff during storms and reduced low flows during dry periods. Active erosion was present on nearly 5 percent of the areas that have been sampled. Table 2 shows hydrologic condition of forest soils.

TABLE 2

PRESENT HYDROLOGIC CONDITION OF FOREST SOILS

Hydrologic condition class	Public Lands	Private lands	Basin totals
	Percent		
Very good	3	1	1
Good	36	15	17
Fair	38	24	27
Poor	14	24	22
Very poor	9	36	33

(c) It is apparent, therefore, that, while a continued high level of protection and management is needed for public forest lands, the preponderance of forest lands in private ownership makes it essential that the levels of protection and management for these lands be increased. Only in this way will the forest lands of the basin be able to meet the wood fiber needs of the future and at the same provide the stabilizing influence to the soil and water resources of which they are capable.

(2) <u>Needs</u>.

(a) The public forest lands plus the small percentage of private forests currently being managed under good forestry practices cannot meet the demands foreseen for this resource. If the projected needs are to be satisfied, a high level of protection from fire, insect, disease, and grazing damages must be afforded all forest lands and purposeful management applied to that high percentage of the forest lands of the basin now being mistreated or ignored completely.

(b) It is estimated that 366,000 acres in the basin need tree planting measures. Hydrologic stand improvements should be implemented on about 1,076,000 acres.

TABLE 5

ACREAGE OF CROPLAND AND PASTURE WITH A DRAINAGE PROBLEM AND AVERAGE ANNUAL DAMAGES DUE TO INADEQUATE DRAINAGE

Crop	Acres Inadequately drained	Average annual damages due to inadequate drainage
Soybeans	468,610	$ 6,724,557
Cotton	92,253	3,528,300
Corn	12,959	341,270
Wheat	22,832	210,327
Oats	16,338	114,289
Alfalfa hay	2,871	70,317
All hay except alfalfa	29,696	184,582
Other cropland except rice	290,189	301,688
Rice	85,195	-
All crops	1,020,943	11,475,330
Pasture	102,143	12,257
Total	1,123,086	11,487,587

OUTDOOR RECREATION

RECREATION MARKET AREA

To determine the outdoor recreation needs that could be fulfilled by the resources of the White River Basin, a recreation market area was established. It is defined as the area where approximately 80 percent of the users of the White River Basin's recreational facilities reside. This area includes the 32 counties which lie entirely or principally within the drainage basin plus certain Standard Metropolitan Statistical Areas (SMSA's), as defined by the Bureau of the Budget in 1966. The selection of the SMSA's considered in this study was based on the knowledge that people from them seek recreation opportunities within the White River Basin and thereby contribute substantially to the total demand for outdoor recreation that is supplied by the basin.

DEMAND

Recreation demand is expressed in terms of the amount and kinds of outdoor recreation facilities and activities the public desires. True demand tends to lie somewhere between what people desire and what they are actually willing to accept. It is probably nearer the latter. The total estimated annual demand in activity occasions for the four major water related activities of swimming, boating, camping, and picnicking is 14 million in 1970; 20 million in 1980; 42 million in 2000; and 90 million in 2020.

(3) Needs. Table 6 shows the projected sport fishing needs for the basin by streams and impoundments, and by total opportunities. It should be noted that the total basin demand does not exceed the total basin supply during the 50-year projection period. This is due to the large capacity or supply of the existing impoundments. However, examinations of separate parts of the basin reveal that some areas have an excess supply of available facilities while others do not. Stream capacity is exceeded near the end of the projection period which is only because of the relatively large capacity of the alluvial stream. The Ozark streams will reach capacity levels for both trout fishing and warm-water fishing by 1980. Increased pressure on these waters will reduce the quality and degree of fishing success.

HUNTING

(1) Supply. Under present conditions the basin contains about 13,020,000 acres of wildlife habitat, including over 7,688,000 acres of forest lands which support populations of big game, including deer and turkey, and other forest game species. The Coastal Plain supports large waterfowl concentrations on flooded rice fields, natural overflow bottom lands, and permanent waters distributed throughout the area. Public lands controlled by Federal and State agencies comprise only 9 percent of the available terrestrial wildlife habitat, with the remaining 91 percent controlled by the private sector.

(2) Demand. The supply of hunting opportunities was evaluated on the basis of an available level and a potential level. The available level assigned equals the 1960 use (expressed demand), and recognizes that denial of public access, competing or conflicting land use, uneven distribution of hunters in the basin, and other legal or socio-economic factors which restrict use and management of the resource, will militate against realization of the full potential over the total basin area.

(3) Needs. The evaluation of hunting opportunities is based on the population density of wildlife per 1,000 acres of habitat, a sustained rate of harvest, and the hunting standards for the various types of habitat and type of game hunted. Projected hunting needs are shown in Table 7. The "A" data in the table indicate the supply and demand which can be expected to exist if current management levels and current restrictions on use continue. The "P" data indicate potential levels of supply and demand which could be achieved by removal of restrictions on use and higher levels of management. Under existing restrictions and management levels, demand for hunting opportunities will exceed supply in the very near future and throughout the projection period. However, with higher management levels and removal of use restrictions, supply could be expected to exceed demand.

TABLE 7

PROJECTED HUNTING NEEDS

STATE	YEAR	MAN-DAYS (THOUSANDS) BIG GAME	SMALL GAME	WATERFOWL	TOTAL
Arkansas	1960				
	A- Supply	203	1,174	120	1,497
	Demand	203	1,174	120	1,497
	Needs	0	0	0	0
	1980				
	A- Supply	173	1,082	113	1,368
	Demand	234	1,303	134	1,671
	Needs	-61	-221	-21	-303
	P- Supply	1,013	1,664	113	2,790
	Demand	234	1,303	134	1,671
	Needs	0	0	0	0
	2000				
	A- Supply	166	1,070	113	1,349
	Demand	260	1,452	150	1,862
	Needs	-94	-382	-37	-513
	P- Supply	974	1,661	113	2,748
	Demand	260	1,452	150	1,862
	Needs	0	0	0	0
	2020				
	A- Supply	160	1,056	113	1,329
	Demand	301	1,678	172	2,151
	Needs	-141	-622	-59	-822
	P- Supply	933	1,659	113	2,705
	Demand	301	1,678	172	2,151
	Needs	0	0	0	0

A - Supply - Available supply level with average existing level of management and restriction on use.

P - Supply - Potential supply level realized with a higher level of management and removal of restrictions on use.

TABLE 8

WATER SUPPLY REQUIREMENTS TO SATISFY FISH-FARMING NEEDS(1)

YEAR	SURFACE ACRES	ACRE-FEET
1964	42,221	168,000
1980	81,401	341,000
2000	110,262	464,000
2020	164,844	702,000

(1) Based on the expected pounds of fish produced per acre of water.

all of Kansas and Oklahoma, southern half of Missouri, western half of Mississippi, and a small area in east Texas. Coordination Study Area K is a logical combination of power supply areas inasmuch as it substantially represents the area covered by the Southwest Power Pool and associated systems.

POWER REQUIREMENTS

(1) The historical and estimated future data on energy for load, peak demands, and annual load factors for Study Area K are presented in Table 9. The peak demand for Area K increased from 2,890 megawatts in 1950 to 13,070 megawatts in 1965. Estimated future load growth as developed for the National Power Survey is expected to reach 35,900 megawatts by 1980. This estimate has been trended to the year 2020 for the White River Basin and the expected load at the time is estimated at 182,000 megawatts. The annual load factors decreased between 1950 and 1963. This was due principally to the advent of residential and commercial air-conditioning. This trend appears to be reversing at this time and moderate increases in load factors are expected in the future due partly to load-building activities of the electric utility industry.

TABLE 9

HISTORICAL AND ESTIMATED FUTURE POWER REQUIREMENTS
(Study Area K)

Date	Energy for load Million kw.-hr.	Peak Demand Megawatts	Annual load factor %	
1950	15,402	2,890	60.8	Aug., Sep., & Dec.
1955	27,519	5,347	58.8	July, Aug., & Sep.
1960	40,207	8,352	54.8	July & August
1965	62,687	13,070	54.8	July
1970	93,270	19,300	55.2	August
1980	178,900	35,900	56.7	August
2000	462,000	93,000	56.7	August
2020	904,000	182,000	56.7	August

(1) Depending on sub-area in Study Area K.

(2) Existing utility generating plants in Study Area K in 1965 had a dependable capacity of 15,730,941 kilowatts. Of this total, 84.6 percent or 13,314,340 kilowatts is steam-electric, 9.2 percent or 1,448,500 kilowatts is hydroelectric, 4.9 percent is internal combustion, and 1.3 percent is gas turbine capacity. Throughout Coordination Study Area K, a large number of industries own and operate their own generating plants. The installed capacity for industry-owned generation

developed from a limited waterway traffic survey and a study of production and consumption of the various commodities in the area. The preliminary estimate of commerce that would have been shipped on an improved waterway in 1965 was 3,221,000 tons. The major portion of this would be outbound commerce. Projection of waterborne commerce is based on the expected growth of economy within the area.

WATER SUPPLY

MUNICIPAL

In 1965, the urban areas of the White River Basin used an average of 30 million gallons of water per day (m.g.d.) for domestic, service and commercial business, and small industrial water supply needs, representing approximately 6 percent of the total water used in the basin. Based on the expected increase of population in the area and an expanding per capita water use, it is estimated that the water requirements for municipal purposes will increase to about 41 m.g.d. by 1980, and to about 87 m.g.d. by 2020. To date, existing facilities have been developed in the basin to supply approximately 101 m.g.d. for municipal supply from reservoirs, rivers, springs, and ground-water aquifers. One-third to one-half of the municipal supply in 1965 was obtained from ground water and spring flow. In viewing these water needs basin-wide it would appear that sufficient resources have been developed to supply the municipal and light industrial needs beyond the year 2020. However, there are areas which have insufficient water supplies to meet projected demands of even the immediate future due to their location, lack of ground-water availability, and anticipated rapid growth of urban population.

INDUSTRIAL

Water-using industries projected for the area will further increase the need for additional water resource development prior to the year 1980. Water demands for these industries, not generally supplied by public water supply systems, are expected to approach 47 m.g.d. by the year 1980, and 72 m.g.d. by the year 2020.

RURAL

Rural water use within the basin for domestic and livestock purposes was approximately 20 m.g.d. in 1965, which represented about 4 percent of the average daily water use in the basin. It is estimated that rural water demands, exclusive of irrigation, will increase to about 31 m.g.d. by 1980 and remain relatively constant to the year 2020. The higher demand will result from maintenance of higher living standards rather than any anticipated population growth. At present, about 90 percent of the rural water supply is obtained from privately owned wells. Other sources are from farm ponds, cisterns, and streams.

IRRIGATION NEEDS

Irrigation needs are estimated on the basis of lands which can profitably use additional water for crop production and are physically suited for irrigation. It is assumed that the lands will be essentially flood-free and adequately drained. Table 12 shows the historical and projected water requirements for the White River Basin, using the estimated annual water requirements shown in Table 11 for an average year and a drought year.

TABLE 12

PROJECTED IRRIGATED ACREAGE AND WATER REQUIREMENTS

Use	Irrigated area	Water requirement	
		Average year	Drought year
	1,000 acres	1,000 acre-feet	
1964			
Rice	233	466	582
Cotton	46	46	92
Soybeans	144	108	216
Other	13	13	20
Total	436	633	910
1980			
Rice	240	480	600
Cotton	80	80	160
Soybeans	300	225	450
Other	20	20	30
Total	640	805	1,240
2000			
Rice	235	470	588
Cotton	85	85	170
Soybeans	330	248	495
Other	25	25	38
Total	675	828	1,291
2020			
Rice	230	460	575
Cotton	90	90	180
Soybeans	340	255	510
Other	25	25	38
Total	685	830	1,303

REFERENCES

1. Comprehensive Basin Study, White River Basin Missouri and Arkansas. Appendix P, White River Basin Coordinating Committee, 1968.