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PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOU--ETC(U)
1963

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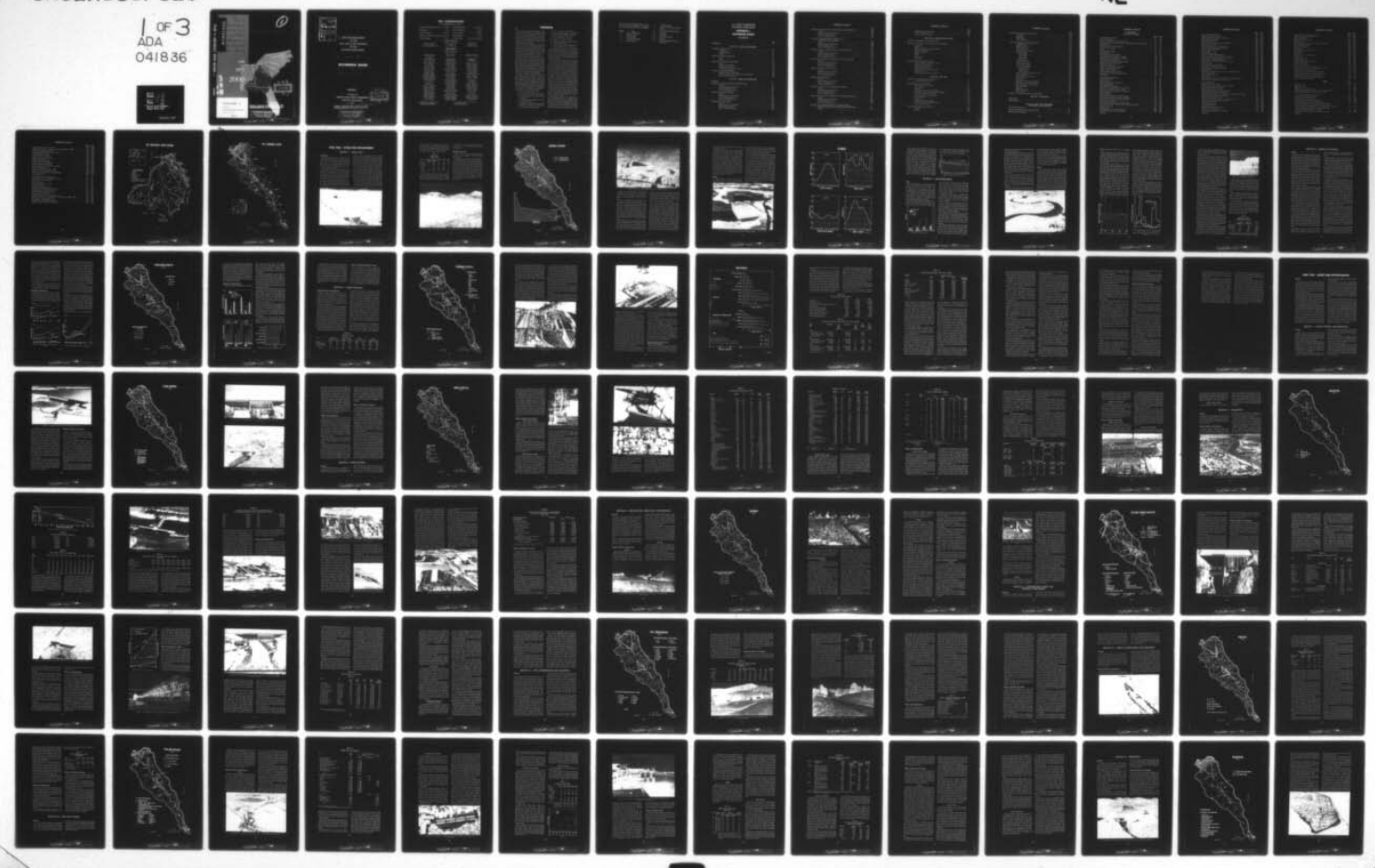

PLAN FOR SOUTHEAST RIVER BASINS — SAVANNAH

Plan for Development of the Land and Water Resources of the Southeast River Basins

1960

1975

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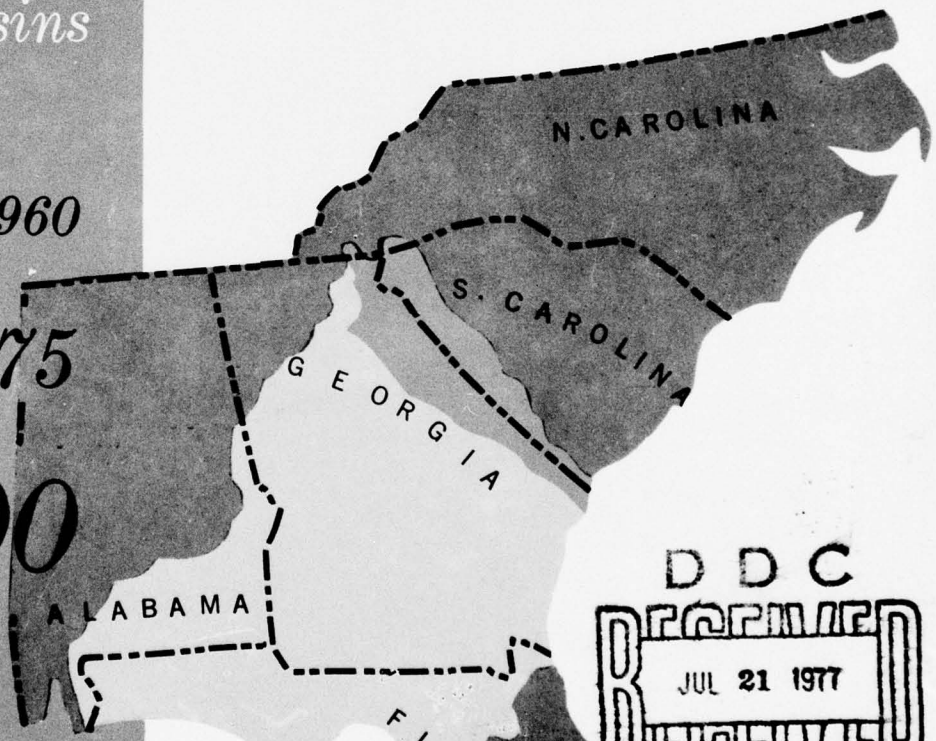
SAVANNAH BASIN



APPENDIX 1

To report of...

United States Study Commission

Southeast River Basins

1963

(6) PLAN FOR DEVELOPMENT
OF THE
LAND AND WATER RESOURCES
OF THE
SOUTHEAST RIVER BASINS.

Appendix 1.

SAVANNAH BASIN.

(9) Final rept.

APPENDIX I

TO REPORT OF
UNITED STATES STUDY COMMISSION
SOUTHEAST RIVER BASINS

(11) 1963 (12) 212 p.

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øø Deceased January 1963.

FOREWORD

This Appendix summarizes the results of studies made in formulating a comprehensive plan for the conservation, utilization, and development of the land and water resources of the Savannah basin. The plan for the Savannah basin is a part of the comprehensive plan for the development of the land and water resources of the Southeast River Basins.

Data relevant to the development of the land and water resources of the Savannah basin are summarized in six interrelated parts. The matter contained in each part is pertinent to the comprehensive plan. The reader is urged to consider the Report in the aggregate rather than to consider selected material out of context.

Part One includes a description of the area, a discussion of its resources, and a presentation of the present and future population and economy. Part Two presents the level of needs by purpose. Part Three describes planning procedures as applied to this study. Part Four presents the Savannah basin comprehensive plan, including a separate listing of improvements warranting early action; Part Five contains the conclusions; and Part Six acknowledges the assistance of public and private agencies and individuals.

The Report of the United States Study Commission summarizing the plan for the Southeast River Basins is made in response to the provisions of Public Law 85-850 (72 Stat. 1090) dated August 28, 1958, which established the United States Study Commission, Southeast River Basins. Public Law 85-850 is reproduced in Appendix 13.

The authorizing Act provides for an integrated and cooperative investigation to formulate a comprehensive and coordinated plan for:

(1) Flood control and prevention;
(2) domestic and municipal water supplies;
(3) the improvement and safeguarding of navigation;
(4) the reclamation and irrigation of land, including drainage;
(5) possibilities of hydroelectric power and industrial development and utilization;
(6) soil conservation and utilization;
(7) forest conservation and utilization;
(8) preservation, protection, and enhancement of fish and wildlife resources;
(9) the development of recreation;
(10) salinity and sediment control;
(11) pollution abatement and the protection of public health; and
(12) other beneficial and useful purposes not specifically enumerated in the Act.

The comprehensive plan for the Southeast River Basins was formulated to meet the needs of the area for land and water resources development to the year 2000. Projects and programs existing and under construction in 1960 are included in the plan, but only 1960-2000 developments are analyzed.

The plan for the development of the resources of the Southeast River Basins and the Savannah basin is the result of cooperative work of Federal, State, local, and private agencies having interest in the area and knowledge of its needs and requirements. Public hearings were held early in the planning process to obtain firsthand knowledge of conditions and problems in the study area and to secure suggestions for their solution. Throughout the study, liaison was maintained with interested groups and agencies by means of conferences, committees, and advisory groups. When a tentative plan was developed, public presentations were made by the Commission to inform interested persons and organizations and to request comments. These comments were considered in preparing the final plan and Report.

Although many individuals, groups, and agencies have participated in the studies, the Commission takes full responsibility for the plan and for the projections, assumptions, and analyses on which it is based.

The Commission plan for the Southeast River Basins is supported by data contained in 13 appendixes. Data on the plan for development of the resources in the eight geographic areas studied in the Southeast River Basins are contained in Appendixes 1 through 8. Technical data and information applicable to both the entire study

area and the several geographic areas are contained in Appendixes 9 through 13. The appendixes to the Commission Report are as follows:

Appendix	Title
1	SAVANNAH BASIN
2	Ogeechee Basin
3	Altamaha Basin
4	Satilla-St. Marys Basins
5	Suwannee Basin
6	Ochlockonee Basin
7	Apalachicola-Chattahoochee-Flint Basins
8	Choctawhatchee-Perdido Basins
9	Economics
10	Hydrology
11	Engineering and Cost
12	Planning
13	History and Organization of the Commission

U. S. STUDY COMMISSION
SOUTHEAST RIVER BASINS

APPENDIX 1
SAVANNAH BASIN

CONTENTS

CONTENTS—Continued

CONTENTS—Continued

CONTENTS—Continued

CONTENTS—Continued

ILLUSTRATIONS
(some titles are abridged)

*Photograph

CONTENTS—Continued

*Photograph

CONTENTS—Continued

TABLES

*Photograph

CONTENTS—Continued

THE SOUTHEAST RIVER BASINS

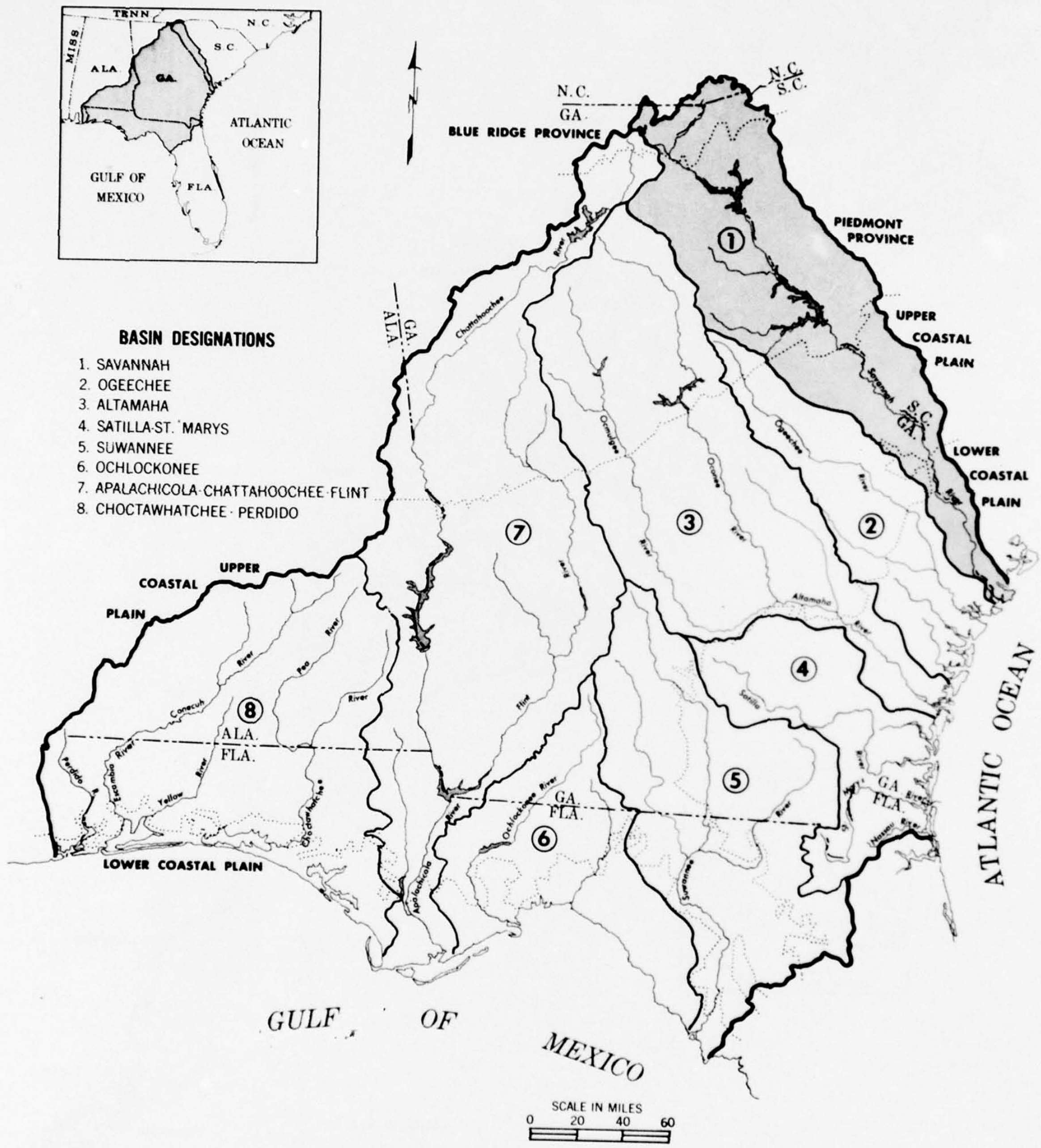


Figure 1.1

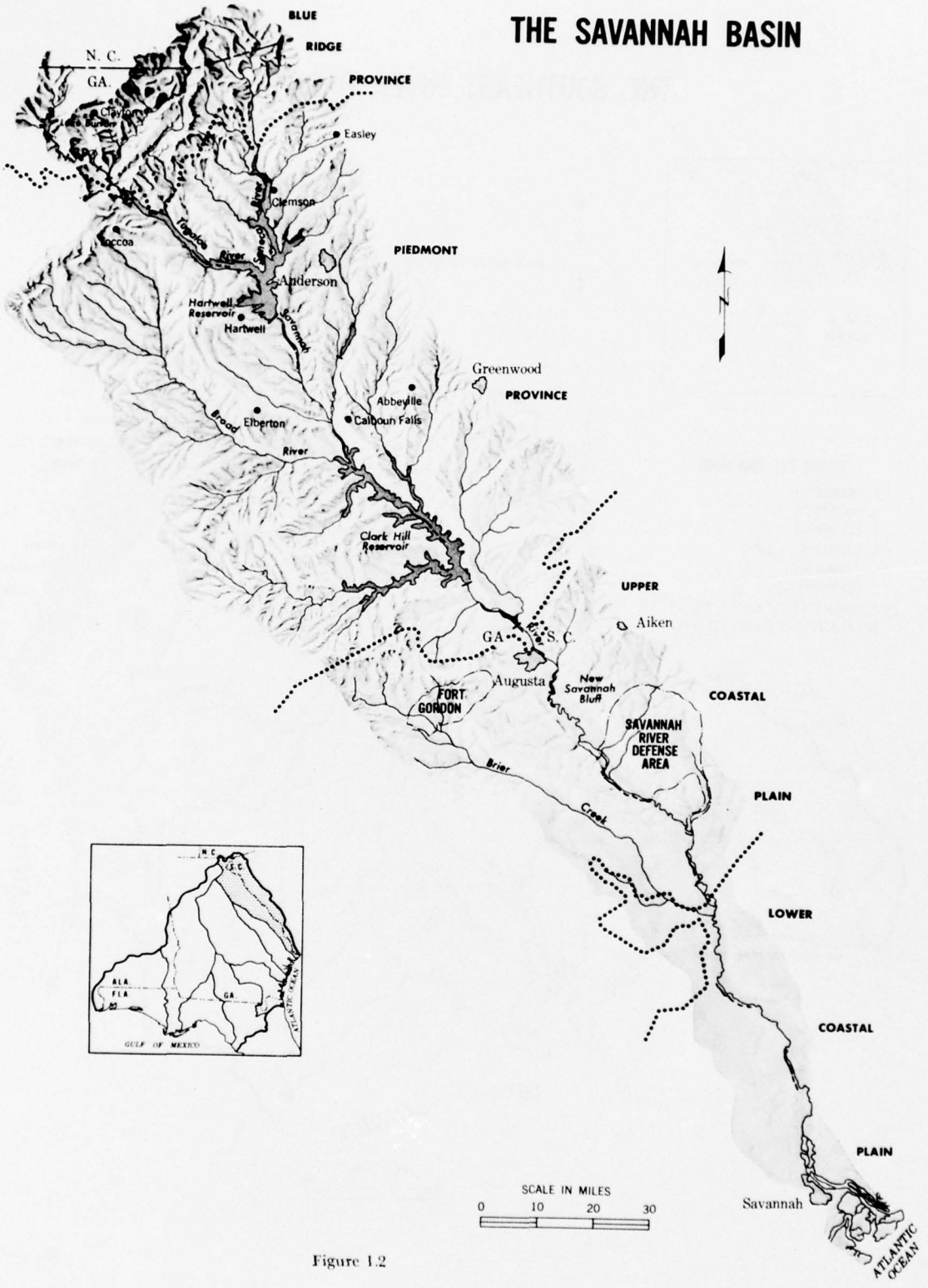

THE SAVANNAH BASIN
BLUE
RIDGE
PROVINCE
N. C.
GA.
Clayton
Easley
Clemson
Seneca River
Tugaloo River
Toccoa
PIEDMONT
Anderson
Hartwell Reservoir
Hartwell
Savannah
Greenwood
PROVINCE
Abbeville
Calhoun Falls
Broad River
Elberton
Clark Hill Reservoir
UPPER
Aiken
GA
S. C.
Augusta
New Savannah Bluff
FORT GORDON
COASTAL
SAVANNAH RIVER DEFENSE AREA
Brier Creek
PLAIN
LOWER
COASTAL
PLAIN
SCALE IN MILES
0 10 20 30
Savannah
ATLANTIC OCEAN
N
N. C.
S. C.
ALA.
FLA.
GA.
GULF OF MEXICO
ATLANTIC OCEAN

Figure 1.2

PART ONE – STAGE FOR DEVELOPMENT

SECTION 1 – BASIN AREA

Description

The Savannah basin has a surface area of 10,577 square miles. Of this, 175 square miles are in southwestern North Carolina, 4,581 square miles are in western South Carolina, and 5,821 square miles are in eastern Georgia. The land area of the basin, excluding large water bodies, is about 10,299 square miles.

The headwaters of the Savannah River are on the high forested slopes of the Blue Ridge Mountains in North Carolina, South Carolina, and Georgia. Tallulah and Chattooga Rivers, which form Tugaloo River on the Georgia-South Carolina State line, and Whitewater and Toxaway Rivers, which form Keowee River in South Carolina, start in the mountains of North Carolina. Keowee River and Twelvemile Creek join near Clemson, South Carolina, to form the Seneca River. The two principal headwater streams, the Seneca and Tugaloo Rivers, join near Hartwell, Georgia, to form the Savannah River. From this point the river flows about 300 miles south-southeasterly to discharge into the Atlantic Ocean near Savannah, Georgia. Chattooga, Tugaloo, and Savannah Rivers form the State boundary line between South Carolina and Georgia.

Three physiographic provinces transect the basin. These are the Blue Ridge province, where North Carolina, South Carolina, and Georgia converge and where elevations range from 5,500 feet, at the headwaters of the Tallulah River, to about 1,000 feet; the rolling and hilly Piedmont province, which descends from 1,000 feet along the mountain foothills to about 200 feet near Augusta, Georgia; and the gently rolling to nearly level Coastal Plain province extending

Figure 1.3 *Tugaloo and Yonah Dams on Tugaloo River, Upper Savannah Basin, Provide Water for Hydroelectric Power.*

from Augusta to the Atlantic Ocean. For descriptive purposes, the higher undulating portion of the Coastal Plain province is referred to as Upper Coastal Plain and the relatively flat, low-lying portion as Lower Coastal Plain.

TABLE 1.1

Basin Area
(square miles)

Province	North Carolina	South Carolina	Georgia	Total	Percent
Blue Ridge	175	502	363	1,040	10
Piedmont	0	2,654	3,306	5,960	56
Coastal Plain					
Upper	0	1,030	1,465	2,495	24
Lower	0	395	687	1,082	10
Total	175	4,581	5,821	10,577	
Percent	2	43	55		100

The two largest cities in the basin are metropolitan Savannah, Georgia, the Southeast River Basins largest deep-draft port, near the mouth of the Savannah River, and Augusta, Georgia, an inland port at the Fall Line which is the boundary line of the Piedmont and Upper Coastal Plain.

Geology and Soils

Bedrock in the mountains of the Blue Ridge province consists of gneisses, schists, quartzites, and granites.

The Piedmont province has deeply weathered bedrock which consists of ancient sediments intruded by granites and related basic and ultrabasic rock. The sediments, once shales and sandstones, are now quartzites, schists, and Carolina slate. Red soils with sandy clay and silty clay textures predominate. The dense geological formations do not transmit water freely except along fissures such as fault zones where the rock has been broken. These fault zones are numerous and provide water for domestic use; however, large quantities of ground water are seldom found.

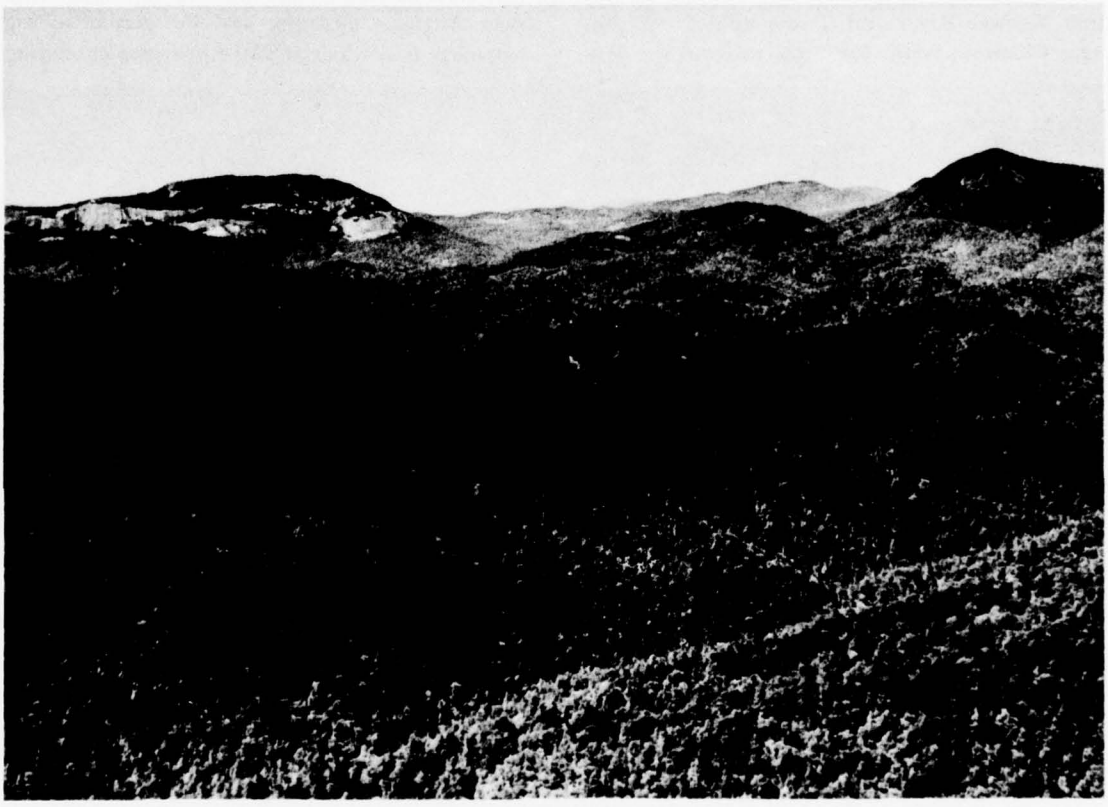


Figure 1.4 *Terrain near Headwaters of Chattooga River, North Carolina, Is Mountainous.*

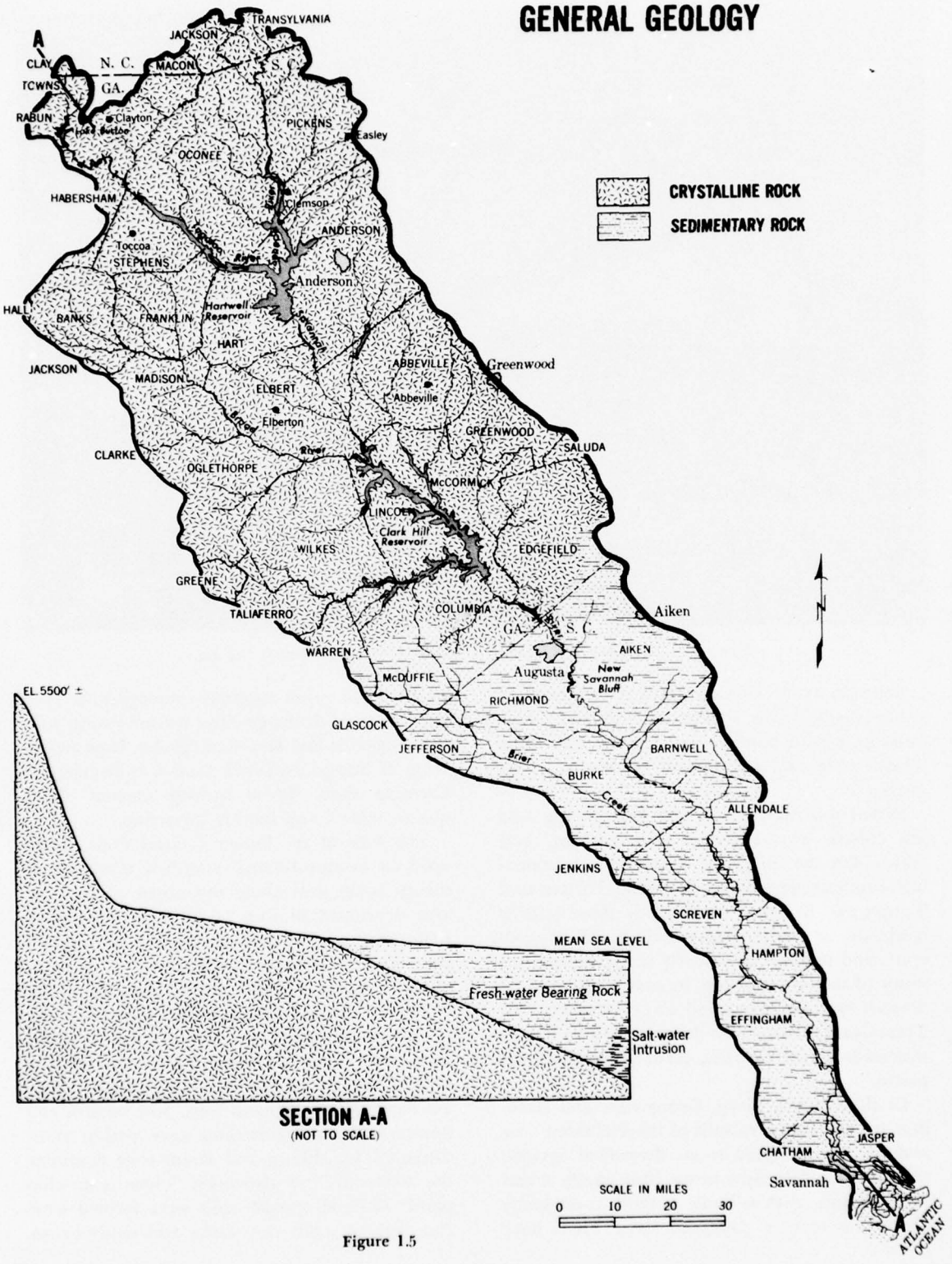

GENERAL GEOLOGY
CRYSTALLINE ROCK
SEDIMENTARY ROCK
TRANSYLVANIA
JACKSON
CLAY
TOWNS
RABUN
MACON
N. C.
S. C.
GA.
Clayton
Lake Burton
PICKENS
Easley
OCONEE
HABERSHAM
Clemson
ANDERSON
Toccoa
STEPHENS
Seneca
Keowee
Hartwell Reservoir
Anderson
HALL
BANKS
FRANKLIN
HART
JACKSON
MADISON
ELBERT
Elberton
Broad River
CLARKE
OGLETHORPE
ABBEVILLE
Abbeville
Greenwood
GREENWOOD
SALUDA
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
GREENE
TALIAFERRO
COLUMBIA
Savannah River
Aiken
AIKEN
WARREN
Augusta
New Savannah Bluff
McDUFFIE
RICHMOND
GLASCOCK
JEFFERSON
Brier Creek
BARNWELL
BURKE
ALLENDALE
JENKINS
SCREVEN
HAMPTON
EFFINGHAM
CHATHAM
JASPER
Savannah
ATLANTIC OCEAN
N
EL. 5500' ±
MEAN SEA LEVEL
Fresh-water Bearing Rock
Salt-water Intrusion
SECTION A-A
(NOT TO SCALE)
SCALE IN MILES
0 10 20 30

Figure 1.5

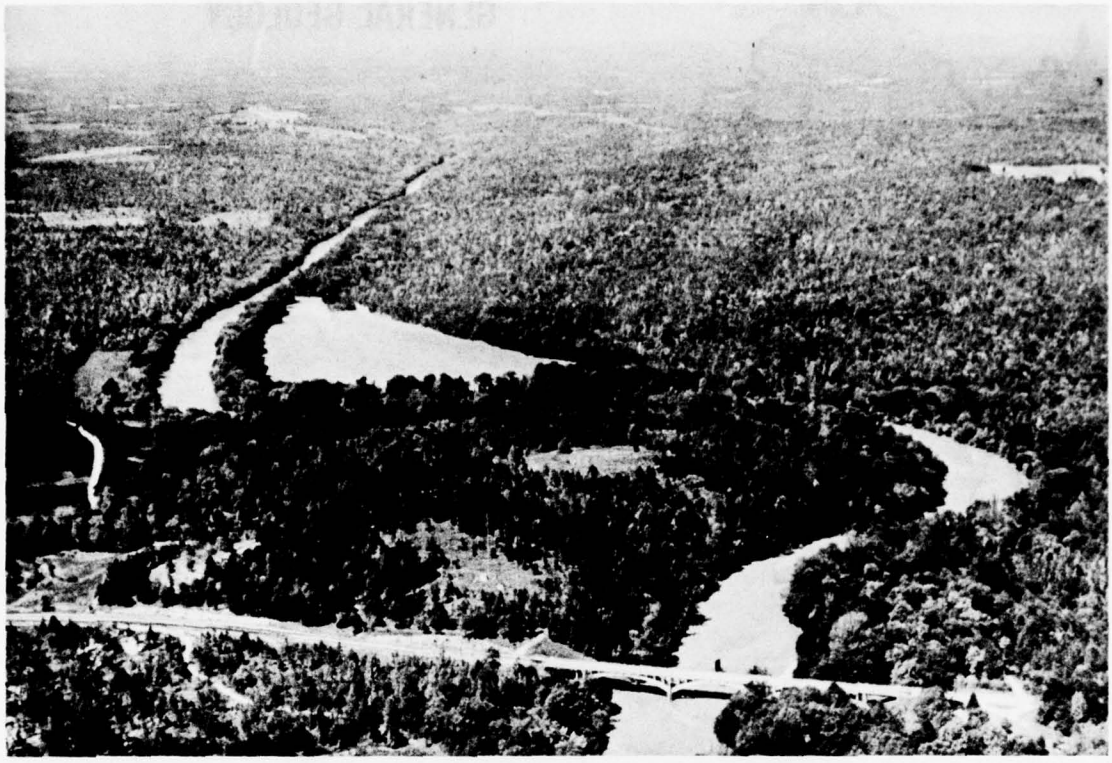


Figure 1.6 *Piedmont Terrain Along Broad River West of Elberton, Georgia.*

Bedrock in the Coastal Plain is composed of stratified silts, sands, limestones, and clays which outcrop in wide bands parallel to the Fall Line. These strata dip and thicken as they near the ocean.

Parent soil materials in the Blue Ridge area are chiefly weathered granites, gneisses, and schists. On the ridgecrests and slopes, representative soils are Halewood, Haysville, Porters, and Tusquittee. External drainage of these soils is moderate to rapid; internal drainage is moderate, and textures are usually sandy loams with stony phases outcropping in many places. The subsoils are clay loams and clays. Congaree and Transylvania soils, which develop from sediments washed from the uplands, occur along the flood plains.

Cecil, Madison, Lloyd, Georgeville, and Herndon are the dominant soils of the Piedmont area and are well adapted to its diversified agriculture. The surface soils range from sandy loams to silt loams, with subsoils ranging from sandy clay loams to silty clays and clays. These have moderate to rapid external drainage and moderate internal drainage. Silty textured soils, such as Georgeville and Herndon develop from weathering of fine-grained rock known collectively as Carolina slate. These include various slates, quartz, schists, and impure quartzites.

The soils of the Upper Coastal Plain developed in unconsolidated, stratified marine sediments. Some soils along the upper part of the area developed in thin layers from the underlying residuum of rock of the Piedmont province. Some soils best suited for agriculture occur along the ridge tops and slopes. These are of the Norfolk, Tifton, Orangeburg, Faceville, and Gilead series. They are loamy sand to sandy loam with sandy clay loam to sandy clay subsoils. The alluvial materials in stream valleys are derived from upland soils. Soil texture and drainage along the streams vary within short distances. Lynchburg and Rains soils dominate the lowlands and flatwoods. These somewhat poorly drained, grayish soils were formed from thin beds of sandy clay loams and sandy loams.

Surface runoff and internal drainage is slow in the broad flat areas.

The Lower Coastal Plain has unconsolidated sand and clay sediments of more recent origin than those of the Upper Coastal Plain. Both droughty and wet soils occur in the Lower Coastal Plain, depending on topographic position and drainage. However, the largest acreages are the flat or depressed areas which have slow surface runoff and poor internal drainage. Lakeland, Klej, Lynchburg, Bladen, and Plummer soils dominate. Lakeland and Klej soils are found throughout the area along the ridgecrests and slopes. Lynchburg, Bladen, Plummer, and associated soils occur in somewhat poorly drained areas. Many large and small swamps also occur throughout this part of the basin.

Climate

In the mountains, the summers are moderately cool, and the winters are cold. In the Piedmont province and the Coastal Plain, the summers are warm, and the winters are mild. Rainfall is generally plentiful throughout the year. Snow cover is rare except in the mountains.

The average daily temperature in the central areas varies from 47° Fahrenheit in December to 81° in July. The temperature drops below 32° in the central part of the basin about 25 times during an average year. In the coastal area, it drops below 32° about 10 times during the same period. In the mountains, the temperature drops below freezing more than 80 times in an average year. The record low is a minus 19° Fahrenheit at Highlands, North Carolina. The frost-free growing season ranges from 220 days in the Piedmont province to 280 days along the coast. Along the coast, the maximum temperature rises to 90° or more 50 days a year; in the mountains, this occurs about 20 days a year. The maximum temperature of record at Calhoun Falls, South Carolina, is 111°.

Figure 1.7 *Coastal Plain Farmland Northwest of Savannah, Georgia — 1959 Gross Receipts from Farming in the Basin Were About $100 Million.*

CLIMATE

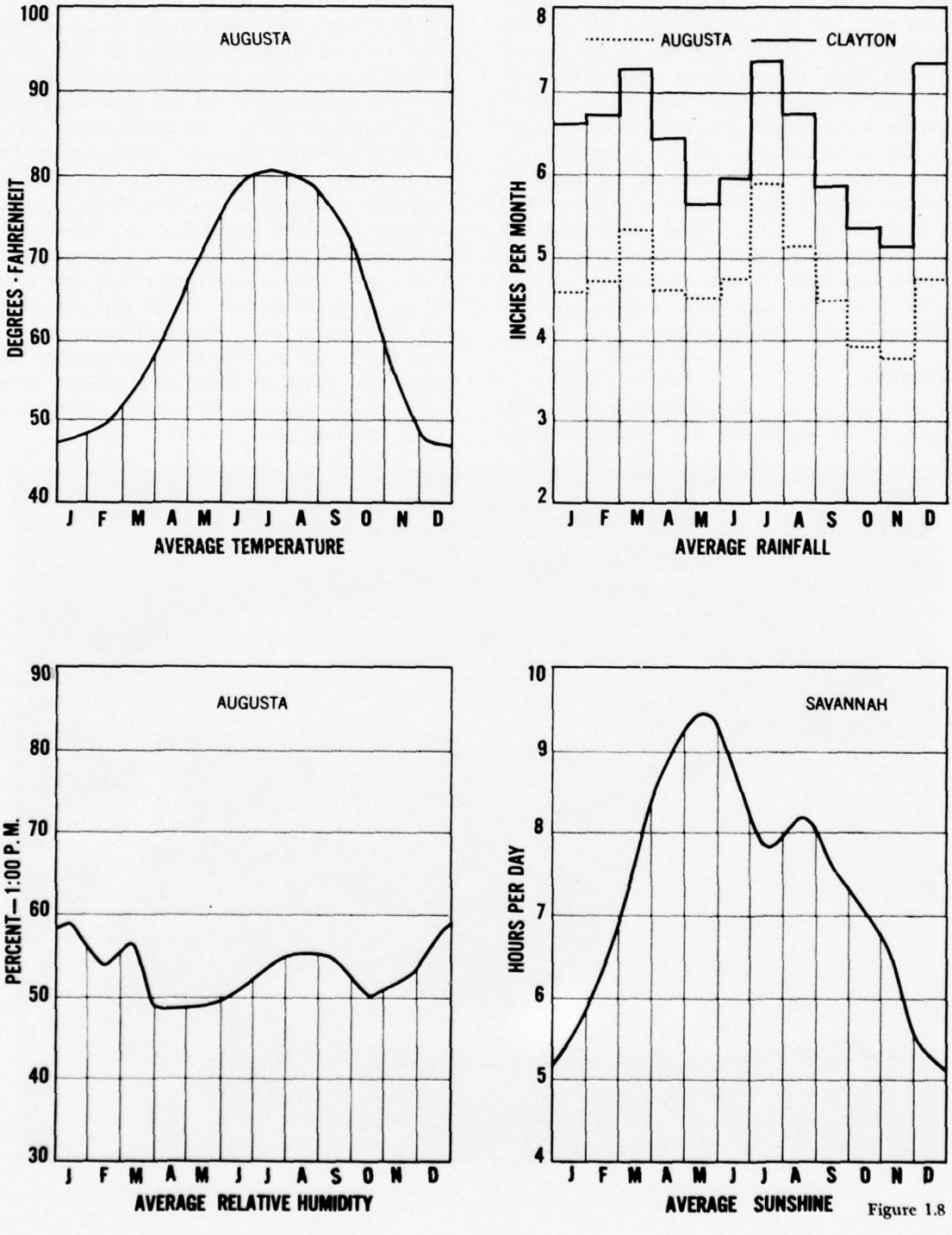


Figure 1.8

The average yearly rainfall varies from more than 80 inches in the mountains to 44 inches in the central area. On the coast it averages about 50 inches a year. Heavy rainfall in the mountains results from condensation of moisture in the air when it rises over the mountains. The rainfall is heavier near the coast than inland because the ocean acts as a moisture source and because hurricanes occasionally cross the coast. Rainfall at Augusta during the 3 summer months, June, July, and August, averages about 5 inches a month. Rainfall during the 2 driest months, October and November, averages about 4 inches a month. A maximum 24-hour precipitation of 11.88 inches was recorded at Jocassee, South Carolina, in July 1948. Severe droughts are uncommon, but supplemental irrigation may be desirable when moisture deficiencies occur due to unfavorable rainfall distribution.

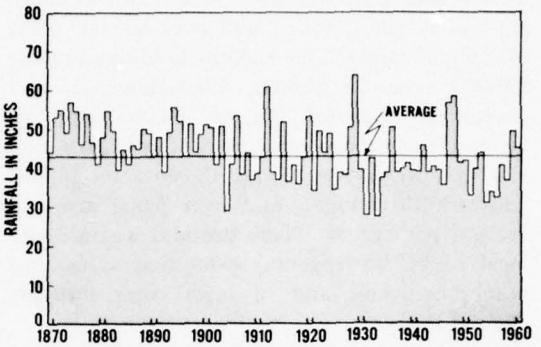


Figure 1.9 *Annual Rainfall — Augusta.*

SECTION II – BASIN RESOURCES

Land

The Savannah basin is predominantly forested. Some 4,508,000 acres or 68 percent of the 6,591,000 acres of land area are in forest cover. Crop production is an important part of the economy, particularly in the Upper Coastal Plain.

The small part of the basin in North Carolina is entirely in the mountains and is nearly 90 percent forested. Land use in South Carolina and Georgia is similar for comparable soil groups and physiographic provinces.

In 1959 cropland occupied 1,017,000 acres or about 15 percent of the land area. Major cropland uses in the order of their acreages were corn, small grain, cotton, and hay. About 60 percent of the cash farm income from crops comes from the sale of cotton. Commercial truck crops, soybeans, and cottonseed also supply substantial cash income to the farmers. About 26 percent of the cropland was idle, fallow, or had a crop failure in 1959.

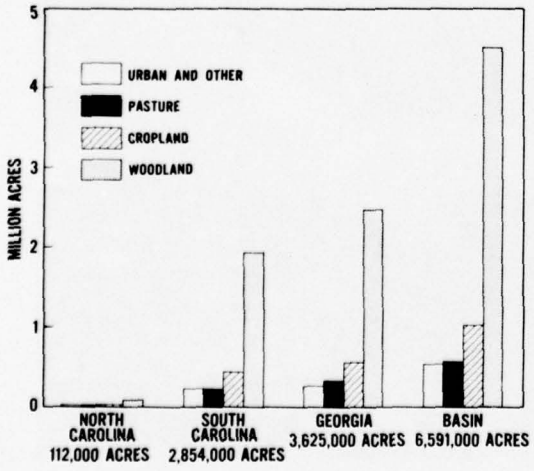


Figure 1.10 *Land Use — 1959.*

In addition to 252,000 acres of tillable land in improved pasture, some 291,000 acres are being used for other pasture. About 480,000 acres of woodland are also used, in varying degrees, for grazing.

About 8 percent of the basin land area is in other land use. This includes land for (1) transportation rights-of-way, such as railroads, airports, and highways; (2) urban and rural residential areas; (3) schools, industry, and service areas; and (4) other farmland.

The wildlife resources of the basin are many and varied. Most of the land supports game animals. Small game is found principally on the agricultural lands, and both large and small game are present in the forested areas. Wild ducks and geese are found in the swamps and marshes.

Recreational opportunities of the land areas extend from the mountains in the Blue Ridge province to beach areas along the Atlantic coast. The use of forest lands for recreational activities is usually confined to State parks, national forests, and roadside areas that form a small part

of the forest area, and to areas around Clark Hill and Hartwell Reservoirs.

Existing public recreation areas in the basin include about 2,400 acres of State lands in Georgia and South Carolina and over 500,000 acres of Federal lands. The Federal holdings include 397,000 acres in Sumter, Chattahoochee, and Nantahala National Forests; 86,000 acres in Federal waterways, principally Clark Hill and Hartwell Reservoirs; about 13,000 acres in fish and wildlife refuges; and over 5,000 acres in Federal park areas. There are also wayside and local parks, boating and swimming areas, and numerous scenic and historical sites throughout the basin.

A network of improved county, State, and Federal highways provides easy access to most of the developed areas. The larger towns have railway connections with trade and industrial centers and the principal seaport of Savannah. There are several major public airports and a number of company and privately owned small airports.

Industries which process and manufacture food and food products, textiles, apparels, lumber and wood products, brick and ceramics, chemicals, oil and gas, machinery, and many related products are located in the basin.

Fort Gordon, west of Augusta, occupies about 55,600 acres of land along the Fall Line which is mostly in forest. The Savannah River Plant of the Atomic Energy Commission in South Carolina south of Aiken occupies some 200,000 acres of land, mostly in forests.

Water

The combination of climate and physical characteristics usually produces an ample supply of ground and surface water throughout most of the basin. The Blue Ridge and Piedmont areas with their greater rainfall and relatively impermeable underlying rock contribute much more runoff per square mile than the Coastal Plain. The permeable limestone beneath the Coastal Plain is the major source of water for deep wells in the lower part of the basin. In the Coastal Plain, the layers of sand, gravel, and clay interposed between the ground surface and this per-

Figure 1.11 *The Savannah River Below Augusta Is Navigable.*

meable limestone provide water for shallow wells.

In the mountains, and to a lesser degree in the Piedmont, the Savannah River and its tributaries flow rapidly through steep, narrow valleys. Below the Fall Line, the river widens and the slope flattens to less than 1 foot of fall per river mile. The flood plain ranges up to 2 miles or more in width.

Hartwell and Clark Hill Reservoirs are used for power generation, flood control, recreation, flow regulation, and fish and wildlife. Their combined usable storage amounts to nearly one-half of the average annual runoff above Augusta. Clark Hill Reservoir alone controls the flow so that at Augusta, Georgia, the river will rarely flood; and the minimum flow will rarely be less than 3,000 cubic feet per second. Flood waves below Augusta travel about 20 miles per day. In addition to these two large reservoirs, there are many small lakes, small diversions, and farm ponds which have minor effects on streamflow.

Runoff averages about 15 inches annually for the entire drainage area. Runoff at Augusta averages about 19 inches. The United States average is about 8 inches. Annual runoff on Tugaloo River near Madison, South Carolina, averages 47 inches. Keowee River near Newry, South Carolina, averages 34 inches; Broad River near Carlton, Georgia, averages 25 inches; and Brier Creek at Millhaven, Georgia, averages 13 inches. These drainage areas range from 455 to 762 square miles in size. Total streamflow varies considerably from year to year. The highest measured annual flow at Augusta was in 1929; the runoff amounted to nearly 40 inches average depth over the 7,508 square miles of drainage area. The lowest measured annual runoff was equivalent to 10 inches in 12 months in the period 1954-55; the runoff may have been less had it not been for some regulation by storage.

In addition to the year-to-year variability in flow, there is also great variation within a year. Streams in the basin are typically high in the winter and early spring. With the advent of summer and warm weather, flows recede and remain low through autumn.

There are roughly four ground water zones in the basin. These are the crystalline rock zone of the Blue Ridge and Piedmont provinces, the 40-mile-wide zone of Tuscaloosa and other cretaceous formations immediately below the Fall Line, the principal artesian limestone aquifer, and the 40-mile-wide Pliocene-Miocene aquifer along the coast.

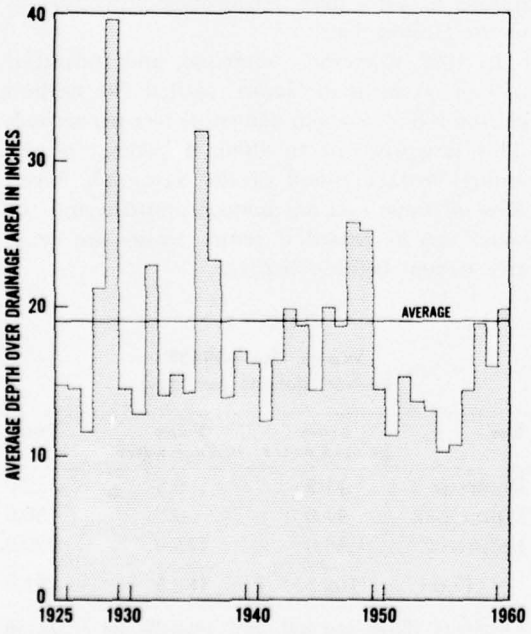


Figure 1.12 *Annual Runoff — Savannah River at Augusta.*

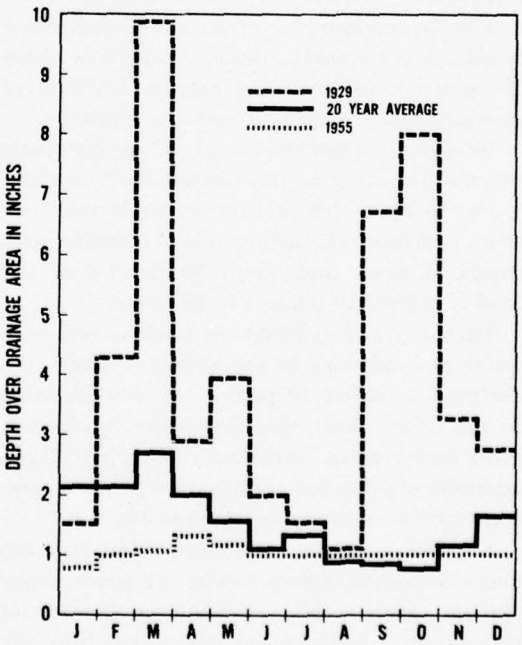


Figure 1.13 *Monthly Runoff — Savannah River at Augusta.*

In the Blue Ridge and Piedmont provinces, wells have typical yields of 25 gallons per minute, however, many others fail to intercept fissures which carry water.

The depth to water ranges from zero to nearly 500 feet. The water-bearing formations vary in thickness from a few feet to several hundred feet. In general, the depth and thickness of the formations increase toward the coast. Rainfall is readily absorbed by the more open strata where they are exposed. The subterranean water then flows down to the ocean. The strata of clays or other less permeable materials, above and below the open strata, confine the water to these permeable beds, and when combined with the slope to the ocean, produce an artesian condition. This artesian condition, or pressure head, provides flowing water along the coast from wells several hundred feet deep. In addition, the pressure head acts as a bulwark against intruding salt water from the ocean. There are many large springs and wells in the aquifer which yield several thousand gallons per minute.

In the sand aquifer of Pliocene age, the water table is usually within 30 feet of the land surface, and the water is of good quality. Water in the underlying and generally thicker Hawthorn formation is artesian and varies in quality.

The Savannah basin surface water is extremely soft. Average surface water hardness is about 20 parts per million. The average hardness of ground water is about 45 parts per million.

Sediment concentrations of 10 to 100 parts per million occur in the Coastal Plain streams. Up to 10 times this amount occurs in the Piedmont province. The sediment load increases with increased flows, and about 90 percent of the load is carried 10 percent of the time.

Turbidity at five Piedmont stations, representative of conditions in the Savannah basin, has declined to about 10 percent of that recorded in the 1930's. Since that time there has been a great reduction in cultivated row crop acreages, adoption of other soil conservation practices, and construction of many impoundments.

Tidal effects extend upstream about 20 miles above Savannah, Georgia. The salt-water wedge extends nearly as far, depending on the flow of the stream. Intrusion of salt water into the aquifer in the vicinity of Savannah may become a serious problem if heavy pumping is continued.

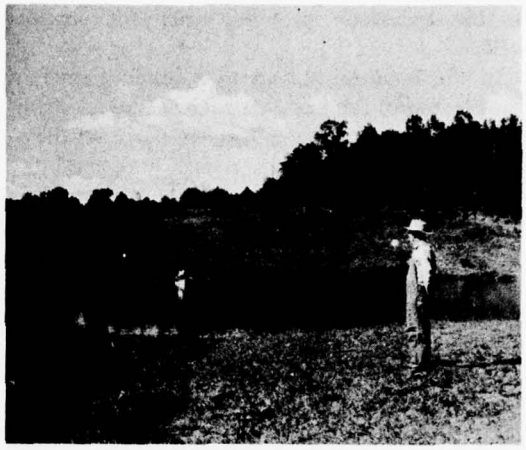


Figure 1.14 *Farm Ponds Have Multiple Uses.*

Water temperature in the larger streams varies from about 50° Fahrenheit in winter to 80° in summer. The smaller streams have an even greater range and a more rapid fluctuation. The ground water temperature ranges from about 50° in the mountains to nearly 70° near the coast.

While conditions vary greatly from place to place, generally the ground water is slightly alkaline. As with surface water, the ground water quality is better than that of most other regions of the United States.

In 1960, domestic, municipal, and industrial uses of water in the basin totalled 291 million gallons a day or about 450 cubic feet per second. This is equivalent to about 4 percent of the annual surface runoff of the Savannah River. Most of these uses are nonconsumptive and the water can be reused if return wastes are properly treated before discharge.

TABLE 1.2

Water Use—1960*
(million gallons per day)

Use	From ground water	From surface water	Total
Domestic	11.5	0.5	12.0
Municipal	41.0	9.0	50.0
Industrial	56.0	173.0	229.0
Total	108.5	182.5	291.0

* Excludes 12,700 acre-feet used annually for irrigation and 8 million gallons per day used for stock watering.

SECTION III – PEOPLE IN THE BASIN

History

Hernando de Soto briefly explored parts of the Savannah basin in 1540. At that time the Cherokee Indians occupied the mountains and the Creek tribes occupied the Coastal Plain. The Creeks had formed a somewhat indistinct confederation which did little more than determine hunting areas. While farming was practiced, it was not until the Spanish settled the area that agriculture became important.

By 1567, the Jesuits had built the first presidio on St. Catherines Island. These Jesuits were driven out within a few years by their Indian neighbors, but Franciscan friars soon succeeded them. The Franciscans met with greater success, and missions soon dotted the coastal islands. Under the Franciscans, the Indians became Christians and were introduced to agriculture. With soldiers and clerics the Spanish ruled the region for over a century.

James Edward Oglethorpe, with other supporters, applied to King George II of England for a trustee charter to settle Georgia with suitable colonists from the poor of London. The charter was granted July 30, 1732. In late 1732, Oglethorpe and more than 100 people set sail for Georgia in the good ship Anne of some 200 tons. The people on that ship and others to follow were mostly of hardy stock seeking religious freedom and new economic opportunities.

The settlers landed at Charleston, South Carolina, on January 13, 1733. Oglethorpe and William Bull selected a site on the Savannah River and settled the colonists there on February 12, 1733. The present modern city is located on that site. That day is celebrated as Georgia's birthday.

After considerable negotiation, Oglethorpe obtained all the land between the Savannah and Altamaha Rivers as far as the tide ebbed and flowed, except for Ossabaw, Sapelo, and St. Catherines Islands. This encompassed most of the Lower Coastal Plain. Fort Wymberley was established on the Isle of Hope, south of Savannah, as one of a string of defenses against the Spaniards.

Settlement of the area was slow until the trustee charter expired. Restrictions on landownership, slave holding, and agriculture foredoomed the philanthropic experiment to failure. Most of the successful farmers utilized slave labor.

Georgia became a royal colony in 1754, and by that time the main tide of in-migration from Virginia and the Carolinas had set in. Soon settlements were established all along the coast.

During the Revolutionary War, Savannah as the colonial seat of government changed hands several times. The British finally departed in the summer of 1778. After the war, the people began pushing against the Indian frontiers, and by 1790, Georgia extended down the coast to the St. Marys River, west to the Oconee River, and north along the Savannah River to its tributary, the Tugaloo River.

During the early eighteen hundreds, the river plantations flourished. Experienced rice and cotton planters cultivated the alluvial soil of the river deltas, and the lower basin became a prosperous agricultural, shipping, and business center. Savannah flourished as a seaport and cultural center. Economic progress also bloomed farther into the interior. With the invention of the cotton gin in 1793, great fields of cotton were planted up river, as were large fields of tobacco. During the period 1790-1860, with expulsion of the Indians and developments in agriculture, transportation, and industry, the State ceased being a frontier area. In 1860, the date separating two civilizations, Georgia raised over 28 million pounds of cotton.

South Carolina seceded from the Union in 1860 and Georgia in 1861. The Civil War began with the Confederate attack on Fort Sumter on April 12, 1861. During the early years of the war, the coast was subjected to a Federal blockade. In 1862, several islands were captured and the coastal towns burned. Fort Pulaski, on the Savannah River near its mouth, was taken by Federal forces on April 10, 1862. General Sherman, on his drive to the sea, marched through the basin and took Savannah on December 21, 1864.

The Civil War left most of the basin largely devastated. The structure of plantation life disintegrated, and the port nearly ceased to function. While some attempts were made to restore

the old order of things, it was not possible or economically feasible with post-war labor conditions. The cultivation of rice—the principal money crop of the coast—was unsuccessful and finally had to be abandoned when the great tidal wave of 1898 destroyed the dikes and flooded the fields. The post-reconstruction period was one of agricultural depression. Because of absence of money wages, the sharecrop system was established whereby tenants would work small acreages and divide the crop with the landlord. This system dominated agriculture well into the 20th century.

After World War I a new menace, the boll weevil, plagued the South. By the time the insect was adequately controlled it had contributed to the abandonment of some of the farmland.

Population Development

Following the engrossing, vital, and sometimes tumultuous events of early history and the devastation wrought by the Civil War, the people of the Savannah basin were able to establish a fairly stable economy by 1900. This economy was based on forestry, agriculture, shipping, and other industries. Small towns sprang up in the interior to service these activities. Savannah and Augusta continued to grow in population and in commercial and industrial activities, and in addition, served as the principal outlets for goods produced over a large part of the Southeast.

The Savannah basin has the third largest population of the eight Southeast River Basins. In 1960, the basin had a total population of 731,700, an increase of about 25 percent over the 1930 population. This is significantly below the 45 percent national average rate of population growth during the same period. It is also well below the 34 percent increase for the Southeast River Basins area for the same period.

The Georgia portion of the basin has about three-fifths of the population, and the South Carolina portion has a little less than two-fifths. Less than 1 percent lives in the North Carolina segment.

Rapid growth in the two large urban areas of the basin has accounted for much of the basin growth. The population of both Augusta and Savannah metropolitan areas has about doubled in the last 40 years and continued rapid growth is expected during the next 40 years. Other metropolitan areas located partly in the basin or close to it, such as Greenville, South Carolina, have influenced the growth of urban population in the basin.

Economic and social forces bringing about

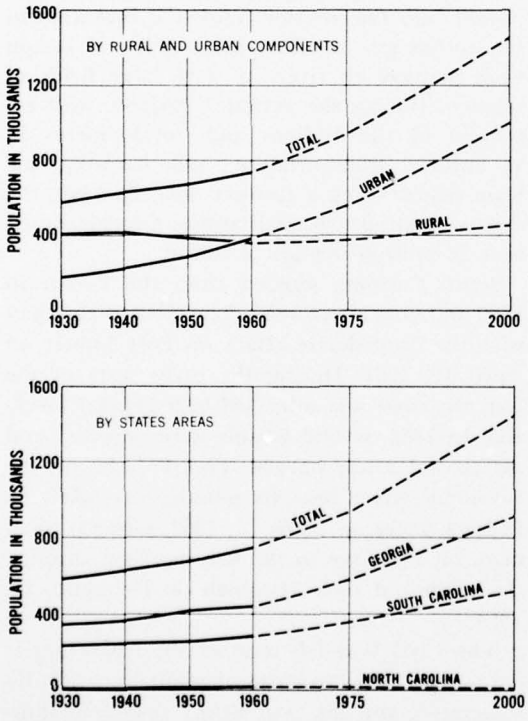


Figure 1.15 *Population Trends and Projections — 1930-2000.*

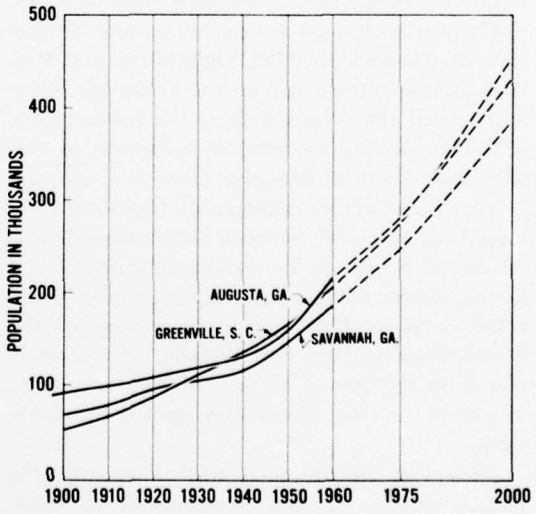


Figure 1.16 *Population — Major Urbanized Areas.*

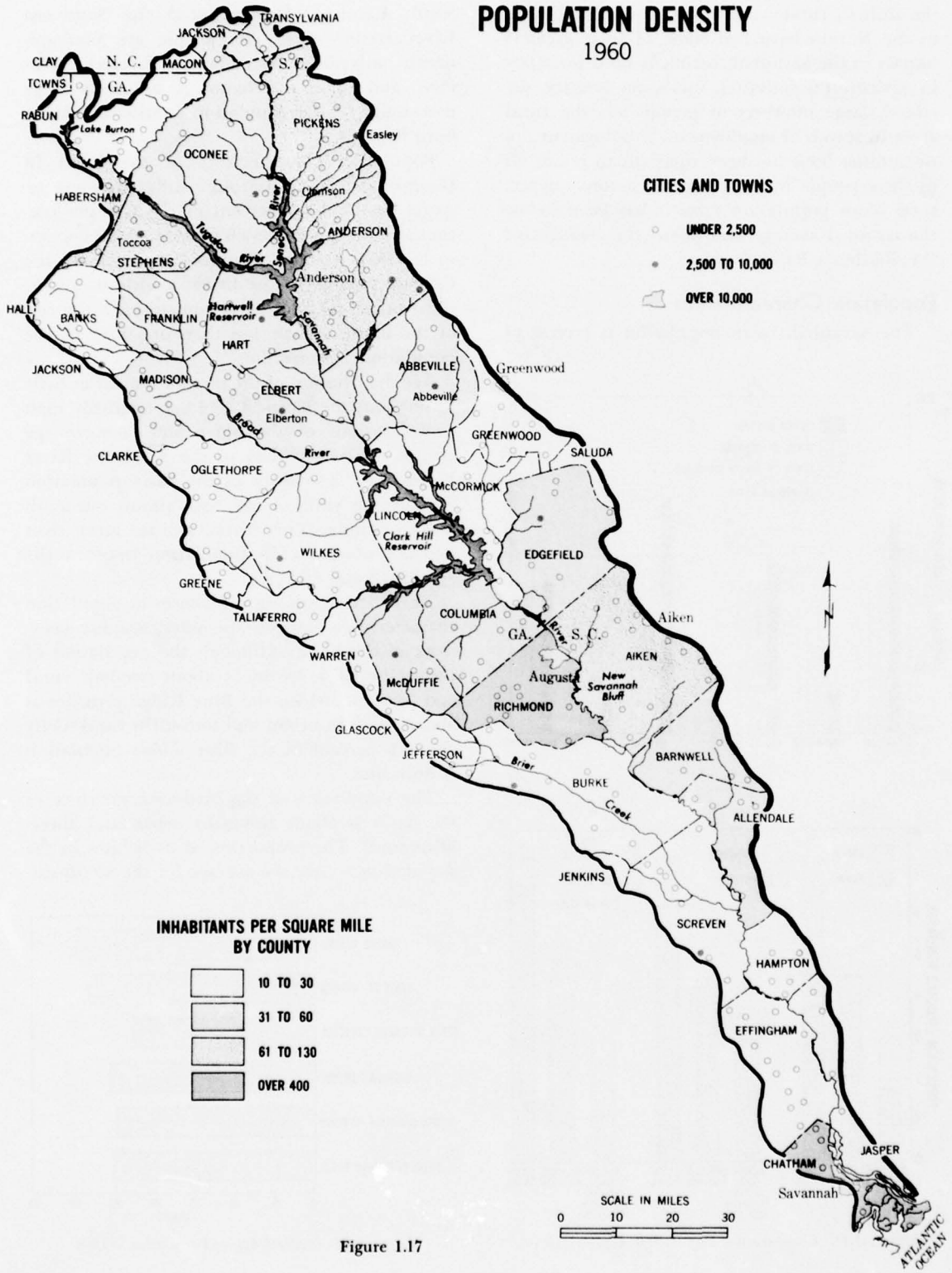

POPULATION DENSITY
1960
CITIES AND TOWNS
UNDER 2,500
2,500 TO 10,000
OVER 10,000
INHABITANTS PER SQUARE MILE BY COUNTY
10 TO 30
31 TO 60
61 TO 130
OVER 400
SCALE IN MILES
0 10 20 30
TRANSYLVANIA
JACKSON
CLAY
MACON
N. C.
S. C.
GA.
TOWNS
RABUN
Lake Burton
PICKENS
Easley
OCONEE
HABERSHAM
Clemson
Tugaloo River
Seneca River
ANDERSON
Toccoa
STEPHENS
Anderson
HALL
BANKS
FRANKLIN
Hartwell Reservoir
Savannah
HART
JACKSON
MADISON
ELBERT
ABBEVILLE
Abbeville
Greenwood
Elberton
Broad River
GREENWOOD
SALUDA
CLARKE
OGLETHORPE
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
GREENE
TALIAFERRO
COLUMBIA
Aiken
GA.
S. C.
Savannah River
WARREN
AIKEN
McDUFFIE
Augusta
New Savannah Bluff
RICHMOND
GLASCOCK
JEFFERSON
BARNWELL
Brier Creek
BURKE
ALLENDALE
JENKINS
SCREVEN
HAMPTON
EFFINGHAM
CHATHAM
JASPER
Savannah
ATLANTIC OCEAN

Figure 1.17

the shift in rural-urban population distribution in the Nation have had some of their greatest impact in the Savannah basin. As need for labor in agricultural activities, including forestry, declined, large numbers of people left the rural areas in search of employment. Employment opportunities have not been sufficient to retain all of these people in the basin. As a consequence, total basin population growth has been below the national average and below the average for the Southeast River Basins.

Population Characteristics

The Savannah basin population is typical of South Carolina, Georgia, and the Southeast River Basins area. The people are predominantly native-born descendants of farmers, craftsmen, and small merchants. A relatively large percentage of the population consists of native-born Negroes.

Population characteristics of the basin in Georgia and South Carolina differ in some respects. In 1960, 45 percent of the Georgia portion was rural, whereas 56 percent of the portion in North and South Carolina was rural. In the Georgia portion of the basin, a little over one-third of the population is nonwhite. In the rest of the basin, a little less than one-third of the population is nonwhite.

Age distribution of the population varies little throughout the basin. There are relatively high concentrations of the older and younger age groups. This is typical of the Southeast River Basins area. Two-fifths of the basin population is under 18 years of age, and almost one-tenth is 65 or more. This leaves a little more than one-half of the basin population between the ages of 18 and 65 years.

There are significant differences in population characteristics between the physiographic provinces of the basin. Although the population of the basin, as a whole, is about one-half rural and one-half urban, the Blue Ridge province is about one-fifth urban and four-fifths rural. Only about 5 percent of the Blue Ridge population is nonwhite.

The population of the Piedmont province of the basin is about two-fifths urban and three-fifths rural. The proportion of nonwhites in the population is near the average for the Southeast.

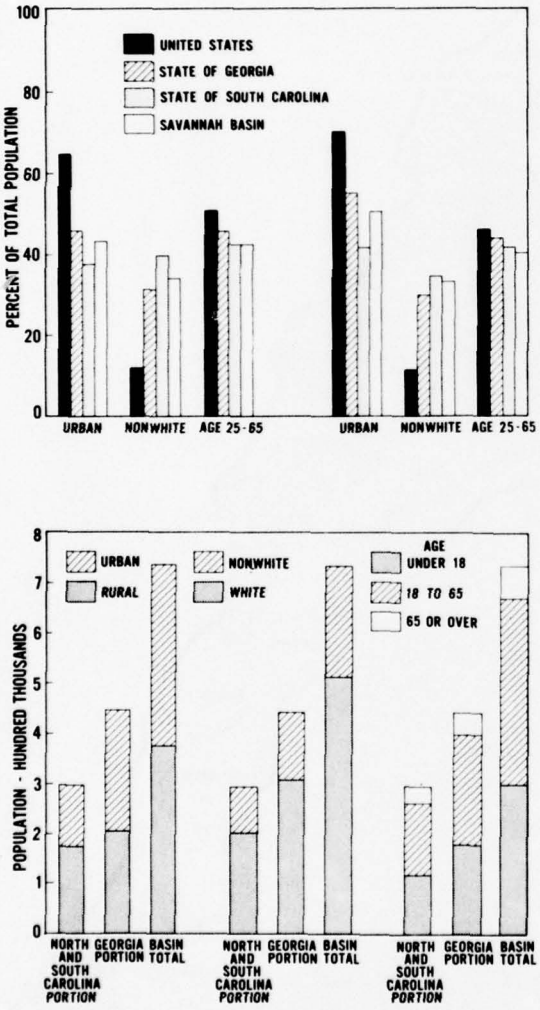


Figure 1.18 *Comparative Population Characteristics.*

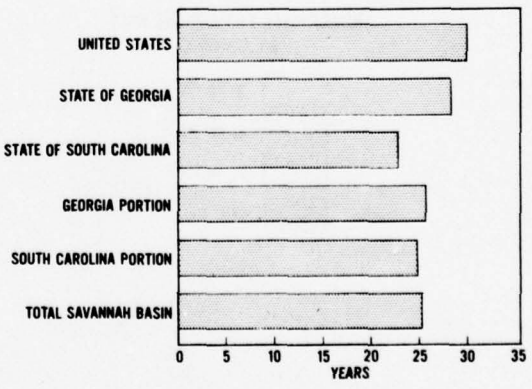


Figure 1.19 *Median Age of Population — 1960.*

The population of the Coastal Plain province of the basin is about 55 percent urban and 45 percent rural. The metropolitan areas of Augusta and Savannah account for a very large part of the urban population. Exclusive of the Augusta and Savannah metropolitan areas, the population of the Coastal Plain province is one-fifth urban and four-fifths rural. Although the population of the whole Coastal Plain area is almost one-half nonwhite, the population of the large metropolitan areas is only about one-third nonwhite.

Factors Affecting Population Change

With continued loss of young people from rural areas and the concentration of population in Savannah, Augusta, and other larger cities of the basin, future overall birth rates may decline. Such effects will be gradual, however, and a high birth rate is expected in the basin for the next several decades. This high birth rate, in-migration, and the increasing urban population are expected to offset out-migration and result in a continuing increase in total population.

SECTION IV – BASIN ECONOMY

Existing Economic Development

Current economic activity in the basin is reflected in the wide distribution of employment. In 1960 about 270,000 people were employed. A little more than one-eighth of these were employed in agriculture and about one-third were employed in manufacturing. A little more than one-half were employed in nonagricultural and nonmanufacturing activities.

Economic activity as reflected by employment varies by nature and type to some extent between the Georgia and South Carolina portions of the basin. In 1960, about three-fifths of total employment was in Georgia and two-fifths in South Carolina; well over one-half of the manufacturing employment was in South Carolina; and well over two-thirds of the nonagricultural and nonmanufacturing employment was in Georgia. This is due primarily to the location of numerous textile plants in the South Carolina portion of the basin and the location of the greater part of the large metropolitan areas of Savannah and Augusta in the Georgia portion of the basin.

Agricultural employment is widely distributed throughout the basin. A little more than 15,000 people were employed in agriculture in the South Carolina part of the basin and more than 20,000 in the Georgia part. Despite a wide distribution of agricultural employment in different parts of the basin, agricultural activities are most heavily concentrated in the Upper Coastal Plain and Piedmont areas of the basin. Only about one-fifth of the total employment in the small North Carolina portion of the basin was in agricultural activities. In 1959, the gross receipts from farming in the basin were about $100 million. In addition to crop and livestock products, there is a large amount of forestry production in the basin. Forestry production in 1959 is estimated to have been about 107 million cubic feet with an approximate value of $11 million, exclusive of naval-stores production.

An estimated 89,000 people are employed in manufacturing activities. The textile industries, with almost 34,000 employees, are by far the largest employer. The apparel or clothing industries are next with about 12,500 employees.

TABLE 1.3

Employment—1960

Area	Agriculture		Manufacturing		Other		Total	
	(1,000)	(percent)	(1,000)	(percent)	(1,000)	(percent)	(1,000)	(percent)
Georgia	20.4	7.6	40.6	15.1	100.5	37.3	161.5	59.9
South Carolina	15.3	5.7	47.8	17.7	43.0	15.9	106.1	39.4
North Carolina	0.4	0.1	0.5	0.2	1.1	0.4	2.0	0.7
Total	36.1	13.4	88.9	33.0	144.6	53.6	269.6	100.0

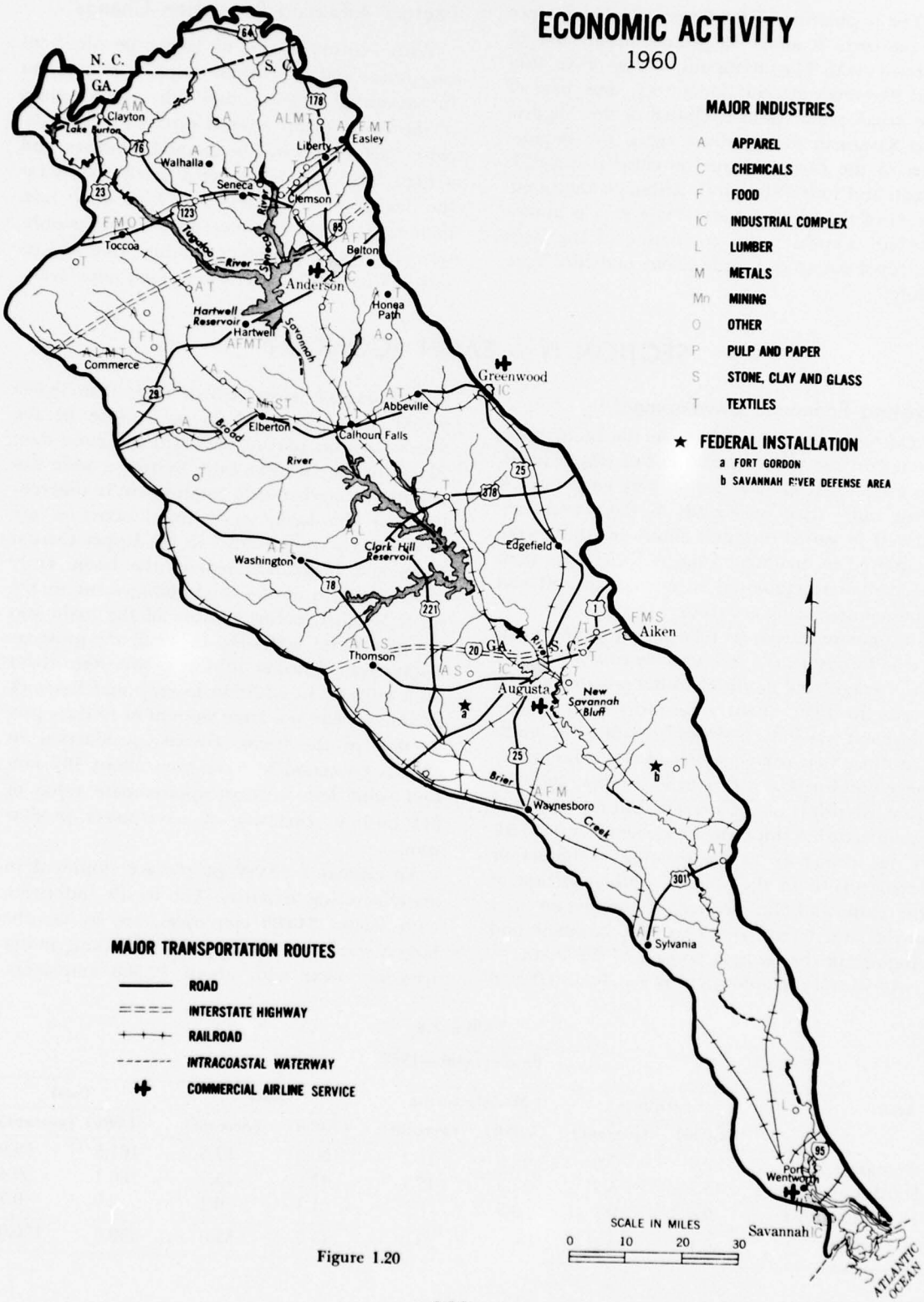

ECONOMIC ACTIVITY
1960
MAJOR INDUSTRIES
A APPAREL
C CHEMICALS
F FOOD
IC INDUSTRIAL COMPLEX
L LUMBER
M METALS
Mn MINING
O OTHER
P PULP AND PAPER
S STONE, CLAY AND GLASS
T TEXTILES
★ FEDERAL INSTALLATION
a FORT GORDON
b SAVANNAH RIVER DEFENSE AREA
MAJOR TRANSPORTATION ROUTES
ROAD
INTERSTATE HIGHWAY
RAILROAD
INTRACOASTAL WATERWAY
COMMERCIAL AIRLINE SERVICE
SCALE IN MILES
0 10 20 30
N
N. C.
S. C.
GA.
Clayton
Lake Burton
Walhalla
Seneca
Liberty
Easley
Clemson
Toccoa
Tugaloo River
Keowee River
Anderson
Belton
Honea Path
Hartwell Reservoir
Hartwell
Savannah
Commerce
Greenwood
Abbeville
Elberton
Calhoun Falls
Broad River
Clark Hill Reservoir
Washington
Edgefield
Thomson
Aiken
Augusta
New Savannah Bluff
Brier Creek
Waynesboro
Sylvania
Port Wentworth
Savannah
ATLANTIC OCEAN

Figure 1.20

Chemical industries employ 8,700 people and the metal industries employ 7,200 people. The pulp and paper industries employ 6,300 and the lumber and wood industries employ 5,700 people. The food industries have 5,700 employees. The stone, clay, and glass industries employ 4,600 people and printing and publishing activities employ about 1,000 people. The remaining manufacturing activities employ about 3,400 people.

In Georgia, three manufacturing classifications—food and food processing; stone, glass, and clay products; and metals, including machinery and transportation equipment—account for nearly 50 percent of the estimated 600 manufacturing establishments. These three groups of industries employ only about one-fourth of the 40,600 people in manufacturing. Textile, apparel, and pulp and paper industries employ over 50 percent of the employees in manufacturing in about 11 percent of the establishments.

In South Carolina, manufacturing employment, particularly in the Piedmont province, is dominated by the textile industries. There are about 60 plants employing about 26,400 people, or about 55 percent of the total employed in manufacturing. The Savannah River operations of the Atomic Energy Commission is of major importance in the chemical industries employment. Metal, including machinery and transportation equipment, and apparel industries combined account for about 20 percent of the total employment in manufacturing.

Textile, apparel, chemical, and metal industries in the basin account for about one-third of the nearly 1,000 manufacturing establishments and about 70 percent of the manufacturing employment.

In Georgia, Augusta and Savannah are centers of industrial complexes. Elberton is the center of the granite industry. About 60 plants are in the immediate area. In general, the remaining

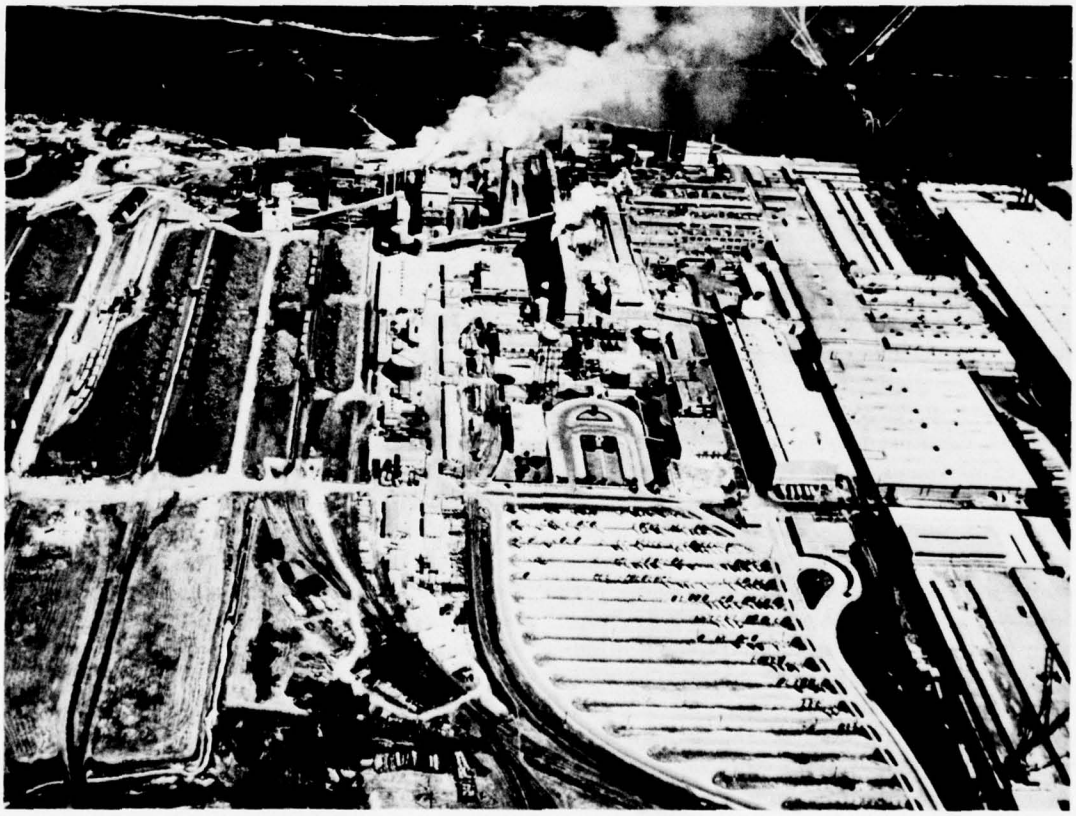


Figure 1.21 *Pulp and Paper Plant, Savannah — Wood Processing Industries Are Important to the Basin Economy.*

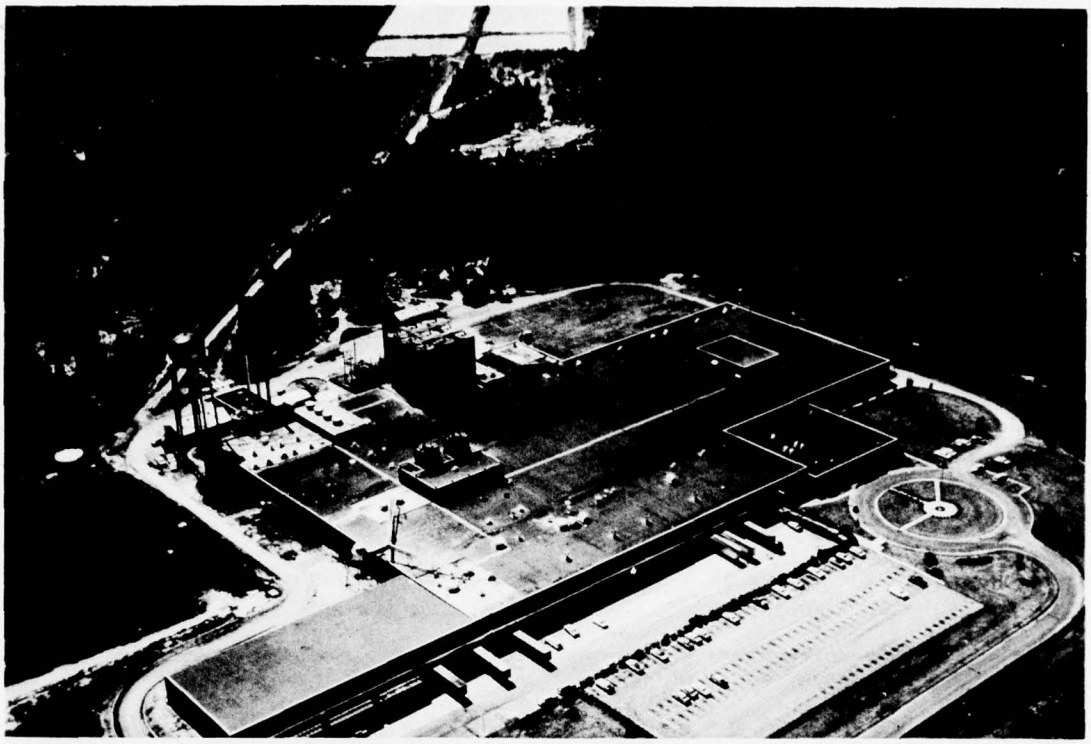


Figure 1.22 *Large Mill near Abbeville, South Carolina, Is One of Many Mills in the Basin.*

cities and towns rely on one or two large industrial plants for job opportunities.

Nearly every city and town in the South Carolina portion of the basin depends on textile or apparel plants for job opportunities in manufacturing. Anderson and Greenwood have some diversification of industry and job opportunities, but the major employment is in textile plants.

There are no large manufacturing plants in the North Carolina portion of the basin. Most of the employment, other than agricultural, is in trade, government, and service-type industries.

Food processing plants are generally market oriented locally except the seafood industry near Savannah. Textile and apparel products are made for regional and national markets. Pulp and paper plants process forest products from areas outside and within the basin. The end products are shipped to regional and national markets. Markets for the remaining industries are oriented regionally and locally.

More than one-half of current employment is in nonagricultural and nonmanufacturing activities. Some 38,500 are employed in wholesale and retail trade and finance, insurance, and real estate. Government activities, including the large military and national defense installations, employ 33,500 people.

Services employ 28,600 people, and a little more than 30,800 people are self employed or engaged in miscellaneous activities. About 12,000 people are employed in construction, and 1,200 people are employed in mining.

Personal income in the basin in 1960 is estimated to have been a little more than $500 million. However, in spite of the volume of resources and the size of present activities, the economy of the basin has not developed to a level commensurate with levels in the national economy, nor has it developed to a level commensurate with the basin potentials.

Future Economic Growth and Industrial Development

The economy of the Savannah basin is related not only to that of the Southeast but is also dependent upon the economy of the Nation. National trends in population, per capita income,

EMPLOYMENT

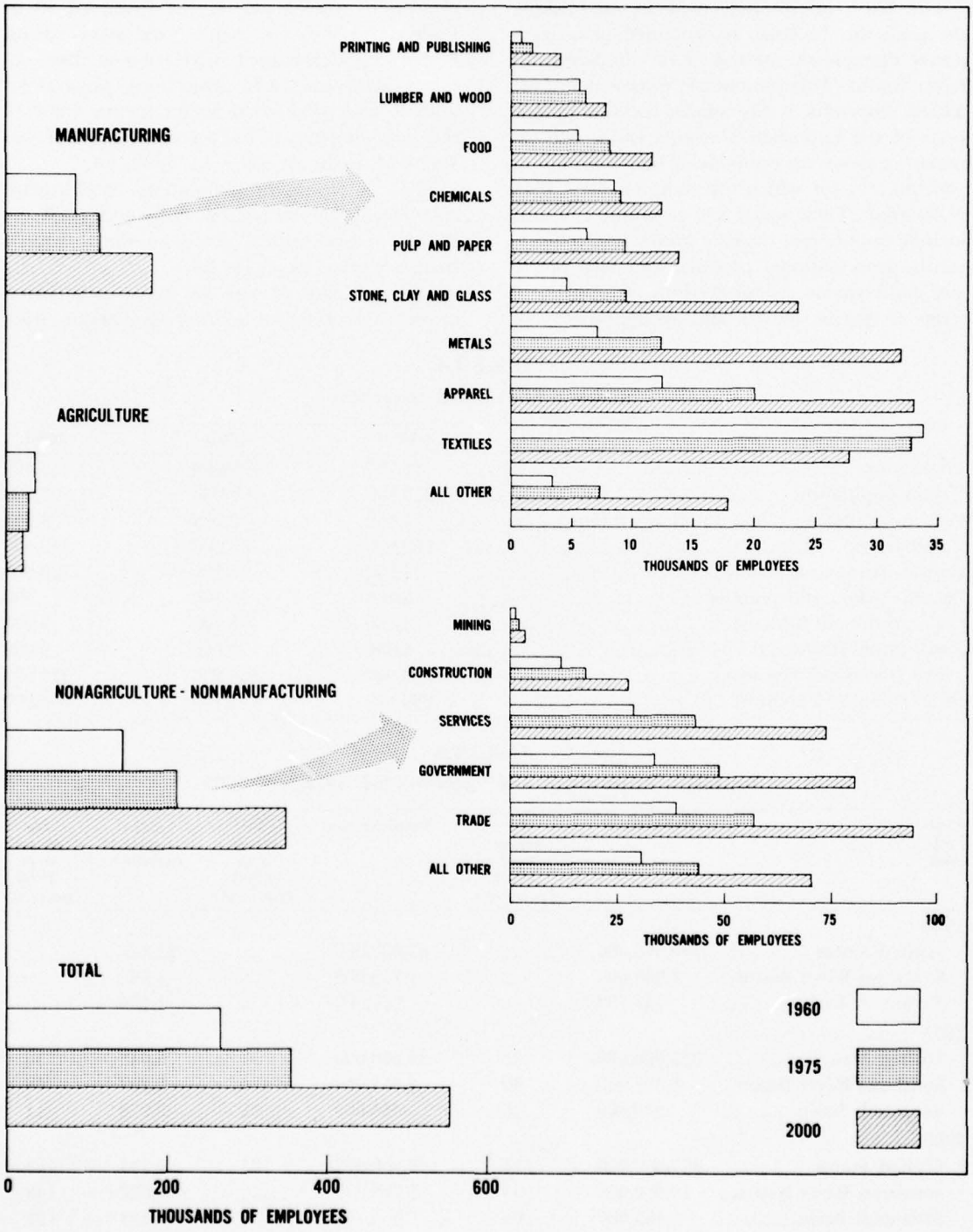


Figure 1.23

and employment will affect related trends in the basin.

The basic information used in establishing the goals for the basin is contained in an Economic Framework established for the Southeast River Basins. This framework, discussed in Part Three, Appendix 9, Economics, includes projections of the important elements which are expected to shape the economy of both the Nation and the area for which the comprehensive plan is designed. These social and economic elements include population, income, production requirements, gross national product, and labor force and employment. All projections were made in terms of specific criteria and assumptions.

After the national projections had been made and production requirements estimated, similar projections were made for the Southeast River Basins area and for each of the river basins. Needs were determined in relation to these national, area, and basin projections, physical resources, and production requirements. Some of the more important framework figures for the Savannah basin are given in Table 1.4.

The projections of population, employment, and income for the Nation, the Southeast River Basins, and additional detail on the Savannah basin are given in Table 1.5.

A large part of the projected population growth is expected to be in or near major cities,

TABLE 1.4

Economic Factors and Projections

	1960	1975	2000
Population	731,700	939,800	1,453,000
Urban population	369,500	562,000	1,004,000
Per capita income (1960 dollar equivalent)	1,469	2,073	3,398
Employment	269,600	356,600	555,400
Cotton (thousand pounds)	54,900	88,400	120,000
Peanuts (thousand pounds)	5,400	14,800	23,300
Corn (thousand bushels)	4,500	6,400	9,900
Small grain (thousand bushels)	4,500	5,900	9,600
Meat (thousand pounds)	293,000	368,800	724,600
Milk (thousand pounds)	239,300	413,700	690,900

TABLE 1.5

Population, Employment, and Income—1960, 1975, and 2000

Year and area	Population	Increase over 1960 (percent)	Employment	Increase over 1960 (percent)	Per capita income*	Increase over 1960 (percent)
1960						
United States	180,000,000	----	67,000,000	----	$2,222	----
Southeast River Basins	4,948,000	----	1,753,000	----	1,582	----
Savannah basin	731,700	----	269,600	----	1,469	----
1975						
United States	235,000,000	31	89,000,000	33	3,012	36
Southeast River Basins	6,408,000	30	2,343,000	34	2,202	39
Savannah basin	939,800	28	356,600	32	2,073	41
2000						
United States	380,000,000	111	148,000,000	121	4,733	113
Southeast River Basins	10,050,000	103	3,789,000	116	3,922	148
Savannah basin	1,453,000	99	555,400	106	3,398	131

*1960 dollar equivalent.

TABLE 1.6

Manufacturing Employment—1960, 1975, and 2000

Industry	Number of employees			
	1960	1975	2000	Net change 1960-2000
Metals	7,200	12,400	32,000	24,800
Apparels	12,500	20,000	33,100	20,600
Stone, clay, and glass	4,600	9,600	23,600	19,000
Pulp and paper	6,300	9,500	13,900	7,600
Food	5,700	8,300	11,700	6,000
Chemicals	8,700	9,200	12,500	3,800
Printing and publishing	1,000	1,700	4,100	3,100
Lumber and wood	5,700	6,200	7,900	2,200
Textiles	33,800	32,800	27,700	−6,100
All other	3,400	7,300	17,800	14,400
Total	88,900	117,000	184,300	95,400

notably Augusta and Savannah, Georgia, and Aiken and Anderson, South Carolina. The basin population is expected to double in 40 years.

The rate of growth in employment, as shown, is a little higher than the rate of growth in population. This reflects an anticipated increase in the proportion of the labor force to total population and a fuller utilization of the labor force as employment opportunities increase. Personal income is projected to increase from $1,075 million in 1960 to $4,937 million in 2000. Although the per capita income in the basin now is only about two-thirds of the national average, it is expected to be nearly three-fourths of the national average by 2000.

Manufacturing employment is expected to increase from 88,900 in 1960 to 184,300 in 2000.

The largest gains in manufacturing employment are expected in metal, apparel, and stone, clay, and glass industries.

Metal industries are the most important category of manufacturing activity in the United States in terms of employment. They are growing in importance throughout the Nation, and particularly in the Southeast and the Savannah basin. The basin has potential for continued rapid expansion of these industries. Among the more important factors contributing to this potential are growing markets, an abundant labor supply, good transportation facilities, including a deep-water port, and availability of water and other raw materials. Employment in the metal industries is expected to increase by almost 25,000 jobs, or about one-fourth of the projected total expansion of manufacturing employment.

Employment in the apparel industries is projected to almost triple in the next 40 years. The more important factors contributing to this expected increase are the growing market resulting from population growth in the basin and in the large metropolitan areas within market range, the growing popularity of the informal line of products manufactured, and the abundant supply of versatile labor. Small apparel plants requiring low capital investment are adaptable to the rural and small-town locations in the basin.

The Savannah basin has valuable resources basic to the stone, clay, and glass industries. There is already a considerable amount of this activity, particularly the stone business near Elberton, Georgia. A growing market demand for products of these industries for construction materials and allied products is expected. In response to this increased market demand, the available resources of the basin are expected to be utilized to provide an increase of 19,000 jobs in the stone, clay, and glass industries by the year 2000.

The Savannah River plant of the Atomic Energy Commission accounts for a large number of those employed in the chemical field. Further growth of the plant is not projected, but expansion of other activities in chemicals is ex-

pected. The potential appears particularly favorable for some extractive plants and for chemical formulating activities such as sanitary products, paints, cosmetics, pesticides, and textile sizing.

Although only modest gains are projected for the lumber and wood industries, this activity will continue to be important in the basin. Continued mechanization and increasing productivity will result in smaller employment gains relative to gains in production.

The textile industries are numerically the most important category of manufacturing employment in the basin. Although the textile industries are the only category of manufacturing activity not expected to show gains in employment, they are expected to continue to be a major activity, with continued automation and increasing productivity.

Population growth, particularly urban population, the changing market demand, and advancing technology are expected to expand employment. As economic growth proceeds, some increases in all other types of manufacturing activity are anticipated. Projected increases in other manufacturing activities would employ about 15,000 additional people. A large part of this is expected to result from new products and other innovations.

With population growth and significant increases in manufacturing activities, there will also be rapid expansion in all major categories of nonagricultural and nonmanufacturing activity. Large employment increases are expected in trade, services, and government.

The projected rate of population and economic growth will be accompanied by a rapid expansion in construction activities. Employment in this category is projected to about triple in the next 40 years. Only minor gains are expected for mining activities.

Agricultural employment is expected to decline as a result of further mechanization, consolidation, and improved production technology. Farms will continue to increase in size and decrease in number. In 1960, about 36,100 people were employed in agriculture in the basin. This employment is projected to decrease to about 27,600 in 1975 and to 21,100 by 2000.

Although agricultural employment is expected to decline, agricultural production will continue to increase to meet the food requirements of an expanding population.

Agricultural needs were estimated on the basis of an analysis of national and regional food and fiber requirements in relation to the economic potentialities of the basin resources. Current agricultural development and production in the basin and the historical production trends were analyzed. The projections, therefore, reflect the production needed from the basin and the production activity and resource use incident to meeting these needs within the framework of the economic potentialities of the basin.

Cash farm income amounts to about $100 million gross value and is projected to increase to about $170 million in 1975 and to about $261 million in 2000. This will involve a significant increase in the physical volume of both crop and livestock production as well as in farm woodland production.

The resources of the basin are more than adequate to meet these estimated needs if they are developed and utilized effectively. The projections anticipate continued improvement of production technology and continued resource development. Under these conditions, net farm income in this basin is expected to increase from the present $18 million to about $20 million in 1975 and about $35 million in 2000.

There is opportunity for many farmers to supplement farm income by developing certain lands for hunting, fishing, picnicking, hiking, and nature study, to help meet recreational needs of their communities and the basin. This will help conserve those lands suitable for crop production and continue to keep them available for that use when needed in the future.

The annual wood harvest is expected to more than double during the next 40 years. The annual cut in year 2000 will be more than 250 million cubic feet with a stumpage value of $25 million. Gum-naval-stores production is also expected to double and the leasing value of trees to be worked is expected to be over $100,000 in 2000.

Although both forestry and agricultural activities are dispersed throughout the basin, there is considerable difference between the basic characteristics of various areas. So that the basin economic characteristics and projections related to agriculture can serve as useful guides to

further development, the characteristics should be viewed with respect to variations among major areas of the basin.

Three-fifths of the basin farmland is in Georgia, almost two-fifths is in South Carolina, and less than 1 percent is in North Carolina. With few exceptions, farm activities and production are distributed among the State portions of the basin in about the same ratio.

Economic growth and industrial expansion in the basin is needed to afford adequate employment opportunities and increase personal income. For short-range planning to obtain immediate results, local resources should be examined and the possibilities for expansion under going programs determined. Many small industries may be able to expand with the help of local organizations.

The Small Business Administration, U. S. Department of Commerce, can make loans to finance the construction, conversion, or expansion of industrial plants and shipping centers for ownership or tenancy by small business concerns.

The Rural Development Program was established in 1955 as an interagency effort to solve some of the economic problems of rural underdeveloped areas. This program, now renamed the Rural Areas Development Program, is operating with renewed emphasis and involves cooperative efforts of many agencies, including those of the U. S. Department of Agriculture and State colleges and universities. The land-grant colleges of each of the five States of the Southeast River Basins area are active in this work.

The Area Redevelopment Act of 1961 is directed toward creating needed new employment opportunities through the development of facilities and resources. The program offers five broad types of assistance. These include loans, grants, technical assistance, planning, and occupational training.

There is also increased opportunity under the Federal Housing Act to rehabilitate blighted residential, industrial, and commercial areas, and to obtain technical assistance and planning aid in cities, small towns, and counties.

Under provisions of the Job Training Act of 1962, trainable unemployed workers, members of farm families with low income, and youths between 16 and 22 may be trained in those skills found to be in short supply.

The focal point in obtaining and utilizing assistance under these programs rests with local groups organized to effectively delineate the interests and objectives of the community and initiate action toward obtaining these objectives.

Social and Institutional Factors

The most important assets of the Savannah basin are its people and its abundant land and water. Although important steps have recently been taken in resource development, the basin significantly lags behind average conditions in the United States. The plan of development as outlined in this Appendix will aid in improving this position. The needs, desires, and actions of the people themselves will determine, to a great extent, the future economy of the Savannah basin.

Public and private action in developing and utilizing the resources of the basin will be affected by social and institutional factors, particularly educational levels, governmental structure, resource ownership and use patterns, and social customs.

Unfortunately, along with its many advantages, the basin has some obstacles which, if not adequately overcome, will impede economic development and progress. First, as a consequence of economic and social forces of the past, the level of economic development in the basin is below that for most of the rest of the Nation. This leaves the area with many underdeveloped and undeveloped natural resources and provides a somewhat restricted economic base upon which to build. In the competitive race for economic development, the citizens of the basin must work diligently to merely sustain their position and must exert increasing effort to obtain the desired gains.

Secondly, the competitive economic battle of the basin must be fought with the realization that its level of education and vocational training lags significantly behind that of the Nation, particularly among the nonwhites who comprise a relatively large part of the population. Increased and improved educational facilities will help provide the leadership, talent, and skills necessary to increase industrialization, and foster economic growth. Activities which now account

for most economic growth require not only a sufficient labor supply force, but also, one adequately educated and adaptable to modern technological skills.

The nature and stability of local governmental structures are important factors in economic development. The basin has numerous small local government units. Many of these are in rural areas where the shift to urban areas is causing a decline in population and economic activity. This severely limits the revenue sources from which public services are provided and makes it more difficult to maintain economic growth.

On the other hand, many of the urban areas are growing so rapidly that the need for public services strains available revenue sources. Local government units often do not have flexibility conducive to adapting to those transitory conditions. As a result, adequate financing of schools, medical facilities, and other social service facilities are often slow and difficult. Continued progress toward more efficient and coordinated local government appears desirable.

Some institutional factors often appear to be both a cause and consequence of the economic environment in the basin. Rapid transitions within agriculture have made the labor of many small farmers, tenants, and farmworkers marginal or surplus. Nonagricultural employment opportunities have not been sufficient to take up this slack, and out-migration from the basin has occurred. At the same time, landownership and tenancy patterns often tend to slow the rate of adjustment to more efficient and economic farming units and to alternative uses. Although progress is being made in this field, continued improvement is desirable.

PART TWO – NEEDS AND OPPORTUNITIES

General

Existing facilities and programs, needs and opportunities, and means of meeting the needs of the basin are discussed for each of the purposes listed in Public Law 85-850 in this Part. The discussion does not indicate or analyze the interrelationships of each purpose with the other purposes being studied.

Discussion of the existing programs and facilities generally provides inventory data and briefly outlines programs in which Federal and State agencies participate. Private and other public interests participate and cooperate in many of the same activities and, in addition, carry out many programs and projects not listed.

The discussions point out the needs, problems, and general opportunities for meeting the needs. Potential resource development is geared to (1) the needs for each purpose, considering the number of people and the economic level of activity expected to prevail in the basin as well as the rest of the Nation, and (2) the physical and financial abilities of the basin to produce the material goods that are needed. These limits are intended to insure that unneeded material goods will not be produced and that developments beyond the capabilities of the basin will not be proposed.

In the discussion of means of meeting the needs, the measures that probably could be effectively used are based on the assumption that available resources could be used for each purpose without regard to competition from other purposes. This was done to demonstrate possible ways of meeting the needs of each purpose and to permit treating all purposes on an equal basis when they are combined into a comprehensive plan.

Studies of the land and water resources of the Savannah basin have been made by the U. S. Department of Agriculture, the Corps of Engineers, and others. The reports on these studies are a valuable source of background data. These investigations and reports have resulted in the construction of Clark Hill Dam; Hartwell Dam; improvements to Savannah Harbor; New Savannah Bluff Lock and Dam; a navigation channel 9 feet deep and 90 feet wide between Savannah and Augusta; runoff and waterflow retardation and soil erosion prevention structures in the upstream watersheds; and numerous other works. Additional information on the past studies is included in Appendix 12, Planning.

SECTION I – FLOOD CONTROL AND PREVENTION

General

Except for part of the metropolitan area of Augusta, Georgia, all towns and cities in the basin are located above the flood plain. Augusta is now protected by Clark Hill and Hartwell Dams and Reservoirs and by levees.

Most of the existing flood problems occur in the upstream watersheds of the Blue Ridge and Piedmont provinces. In these areas, severe flood damages occur to cropland, pastureland, and fixed improvements, and cause loss of livestock. Flood hazards have caused much flood plain land to be taken out of production.

The flood plain of the Savannah River between its mouth and Augusta, Georgia, varies from 2 to 5 miles in width. The flood plain is 98 percent forested. The river banks range from 6 feet high in lower reaches to 15 feet high at New Savannah Bluff.

From the Fall Line near Augusta to Clark Hill Reservoir and upstream to Hartwell Reservoir the flood plain of the Savannah River ranges from about 600 to 1,800 feet in width and is about 45 percent forested.

Streamflow records including flood stages and volumes are being collected at 25 river gage stations shown on Figure 2.2 and at several others in upstream watersheds in the North Fork Broad River watershed. The length of record at these stations varies from a few years to more than 58 years at Augusta.

Figure 2.1 *Flood Damage Is Reduced by Clark Hill Dam and Reservoir.*

From 1900 to 1959, annual precipitation and annual runoff on the Savannah River above Augusta, Georgia, averaged 52 and 19 inches, respectively. Periods of high runoff generally occur in the headwaters from January through March, in July, and in November, and on the Savannah River near Augusta from November through May. Approximately 61 percent of the floods on the Savannah River near Augusta occur during January through April. Twenty-five percent occur during August through October, and the remaining 14 percent are fairly well distributed throughout the other months. The three highest floods of record occurred during the period from August through October. The largest flood of recent times at Augusta was on October 3, 1929, with a discharge of 350,000 cubic feet per second.

The time lapse between a storm and the passage of the flood peak is measured in hours rather than in days. This necessitates prompt flood forecasting and warning. The timelag between the end of heavy rainfall and the flood peak is 12 hours for the headwaters and 36 hours in the vicinity of Augusta.

Existing Facilities and Programs

The U. S. Weather Bureau makes flood forecasts on the Broad River near Carlton Bridge, Georgia; on the Savannah River at Calhoun Falls, South Carolina; and at Augusta, Millhaven, and Clyo, Georgia.

The 9-foot navigation channel constructed from Savannah Harbor to Augusta will have a minor effect on moderate floods. Augusta is protected by a levee, originally built by the city in 1916 and raised and strengthened by the Corps of Engineers in 1941. Flood protection at and below Augusta is also provided by multiple-purpose reservoirs at Clark Hill, completed in 1952, and at Hartwell. About 390,000 acre-feet of storage are reserved for flood control at Clark Hill and 295,000 acre-feet are reserved at Hartwell. Clark Hill has a total storage capacity of 2,900,000 acre-feet, and Hartwell has 2,858,000 acre-feet.

Sixteen flood prevention reservoirs have been constructed on small watersheds in the Piedmont and Blue Ridge provinces under the Pilot Watershed Program and the Watershed Protection and

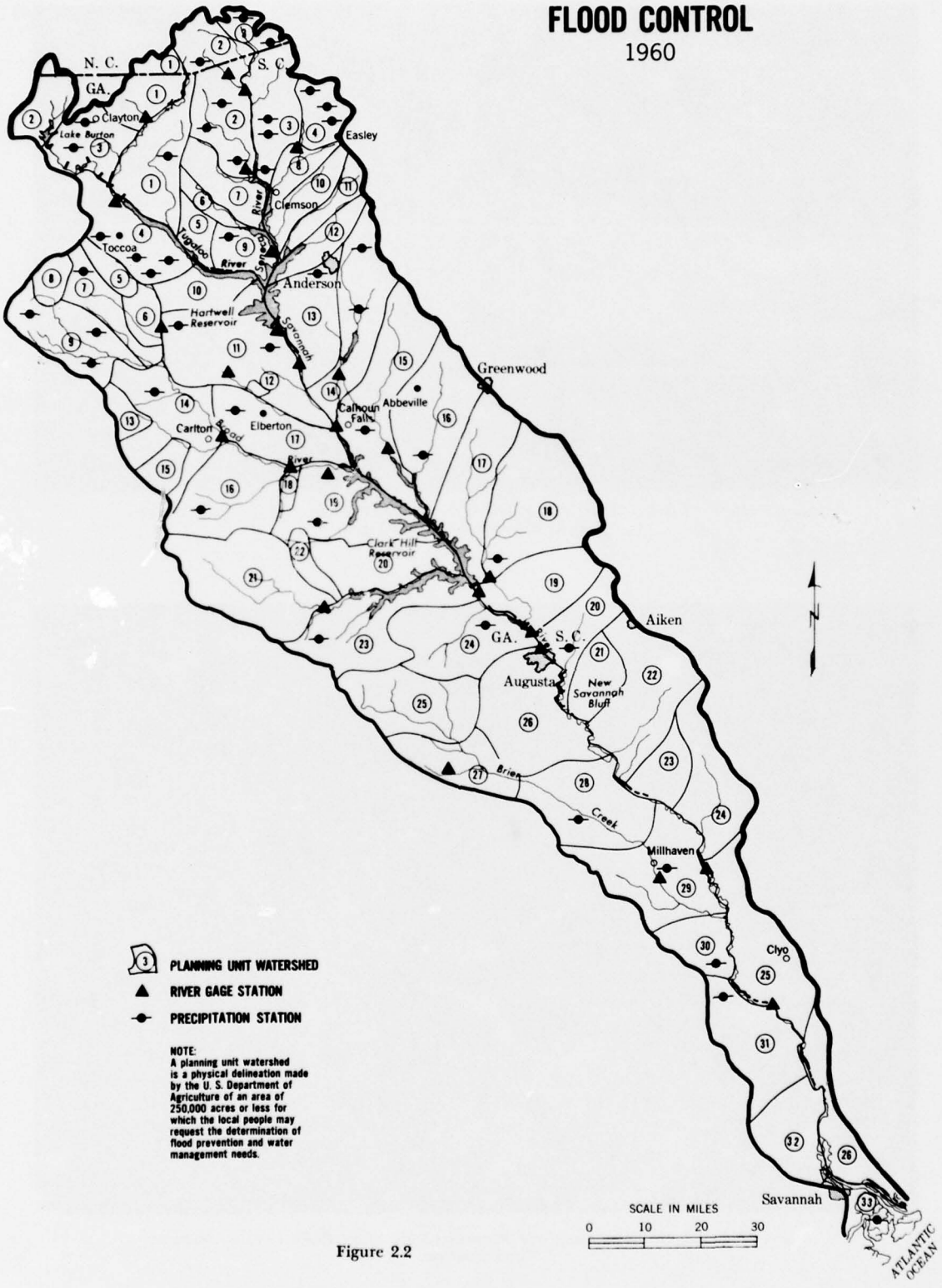

FLOOD CONTROL
1960
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Toccoa
Tugaloo River
Seneca River
Anderson
Hartwell Reservoir
Savannah River
Greenwood
Calhoun Falls
Abbeville
Carlton
Elberton
Broad River
Clark Hill Reservoir
Aiken
GA.
S. C.
Augusta
New Savannah Bluff
Brier Creek
Millhaven
Clyo
Savannah
ATLANTIC OCEAN
N
PLANNING UNIT WATERSHED
RIVER GAGE STATION
PRECIPITATION STATION
NOTE:
A planning unit watershed is a physical delineation made by the U. S. Department of Agriculture of an area of 250,000 acres or less for which the local people may request the determination of flood prevention and water management needs.
SCALE IN MILES
0 10 20 30

Figure 2.2

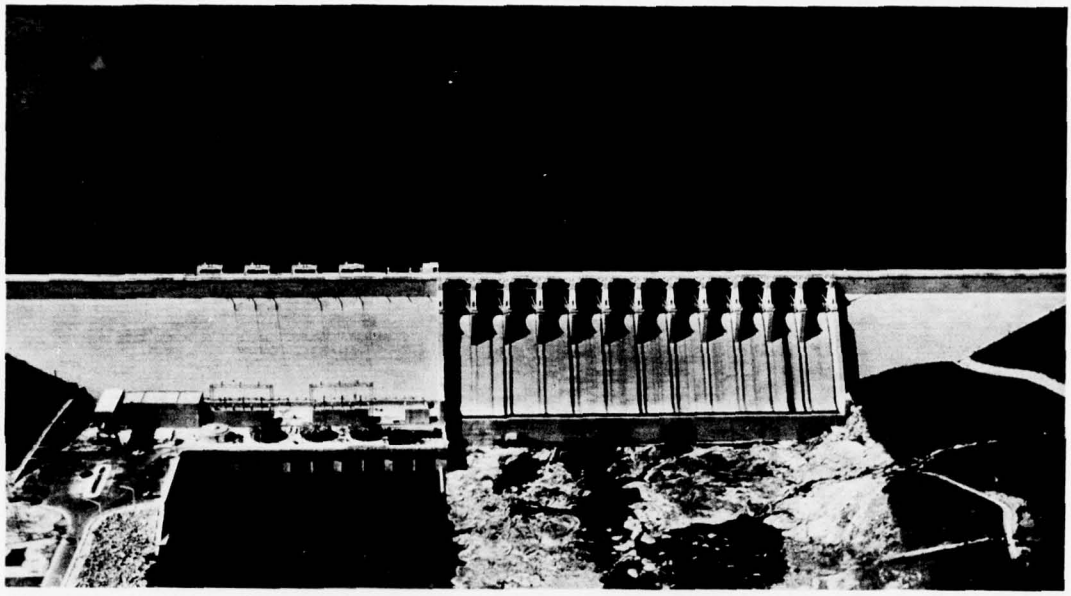


Figure 2.3 *Hartwell Dam — About One-Tenth of the Storage Capacity at This Mutiple-Purpose Project Is Reserved for Flood Control.*

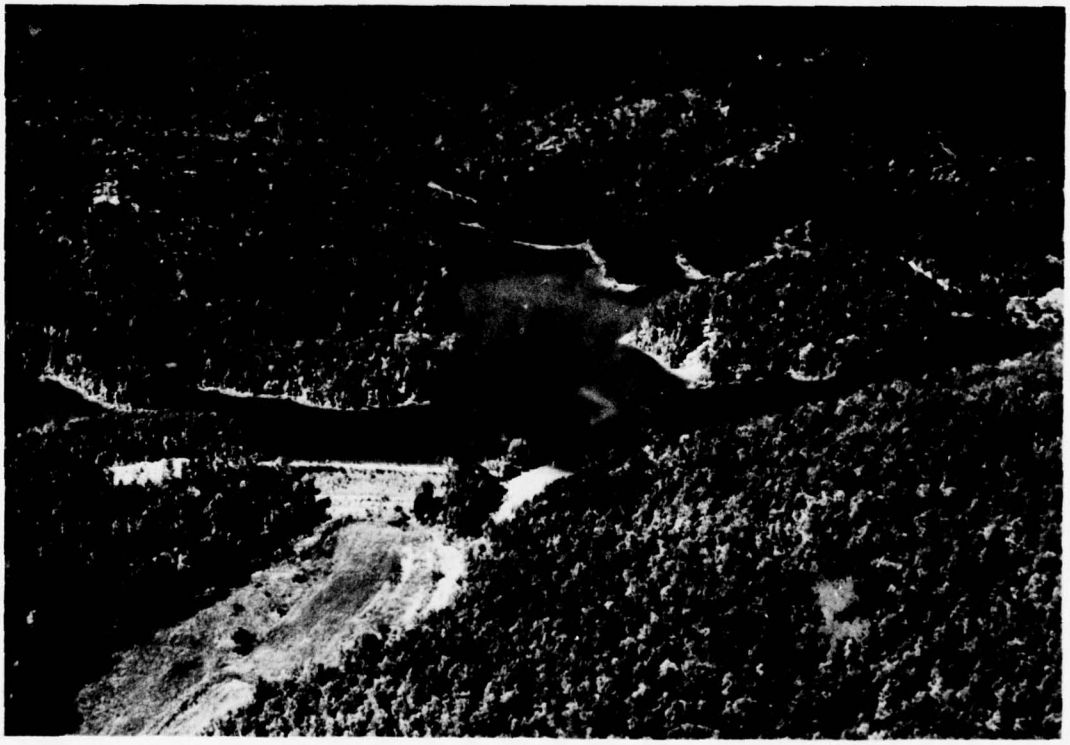


Figure 2.4 *Small Upstream Dams and Reservoirs Serve Many Purposes in Addition to Flood Control.*

Flood Prevention Act, Public Law 566, 83d Congress. The State Soil Conservation Committees in Georgia and South Carolina have received 29 applications for assistance under provisions of Public Law 566 as of December 1, 1961. Watershed protection and flood prevention plans have been made for seven of these small watersheds, and five of the seven have been approved for installation. In addition, the regular conservation programs of the U. S. Department of Agriculture contribute to the improvement of hydrologic conditions and the control of runoff and erosion. There are 13 group drainage projects, 10 in the Coastal Plain and 3 in the Piedmont. These vary in size from 510 to 4,200 acres and provide some flood protection for drained areas.

Needs and Opportunities

The history of floods and associated flood damages in this basin indicate that the more serious problems occur in the headwater areas of the Blue Ridge and Piedmont provinces. Annual flood damages in the headwater areas are estimated as $1,783,000, of which $588,000 occurs to crops and pasture, and $1,195,000 to fixed improvements. Studies of the Coastal Plain show that flood damages and potential benefits from reduction of flood damages to existing crops and pasture, roads and bridges, and farm buildings are small.

There are possibilities of providing combined flood control and drainage for small watersheds by minor channel improvements in the Coastal Plain.

Flood damages on the main stem of the Savannah River are estimated at $25,800 annually and on the Broad River at $6,400 annually. A large part of these damages is to crops, pasture, and livestock. Cattle are frequently trapped and drowned by major floods. A number of low cost homes and industrial establishments are subject to flood damage in the Hamburg area. Flood forecasting is particularly needed for proper operation of the gates in the levee at Augusta, Georgia. This was demonstrated in August 1940 when the gates were not closed at the proper time and 60 city blocks in Augusta were inundated. It is estimated that average annual flood damages along the Savannah River could increase $10,000 by year 2000, if additional flood protection or flood plain management is not provided.

Means of Meeting the Needs

In addition to other benefits, small watershed projects could provide flood relief and facilitate and encourage desirable land-use adjustments.

Maintenance of flood forecast points in the Savannah basin is desirable and minor changes are needed in the reporting network. Various plans of improvement for levees, channels, reservoirs, and diversion of floodwaters could be considered for the Broad and Savannah Rivers. Flood plains of these rivers are used mostly as woodland and pasture. Extensive conversion of the flood plains to cropland in the future is not expected. Flood control should be considered on the Broad and Savannah Rivers in conjunction with other purposes.

Cooperation is needed between local and State interests in determining the extent of the flood problems, particularly around Hamburg, South Carolina. The principles of flood plain management should be given consideration in regulating the future development and redevelopment of these areas. Flood control operation of Clark Hill has reduced the frequency of floods so that movement into the low areas may occur on the false assumption that Clark Hill will eliminate all flooding. Effort should be made by all counties and cities bordering the Savannah below Clark Hill Dam to inform local residents of the dangers involved in encroaching on the flood plain lands, especially in areas below the flow line of a 30,000 cubic feet per second discharge.

SECTION II –WATER SUPPLIES

General

The Savannah basin has an abundance of good water which with proper facilities can provide adequate supplies for maximum development throughout the basin. Ground water is limited in the Blue Ridge province but surface sources are available. Wells in the Piedmont province yield an average of about 25 gallons


WATER SUPPLIES
1960
TRANSYLVANIA
JACKSON
CLAY
N. C.
MACON
S. C.
TOWNS
GA.
RABUN
Pickens
Clayton
Lake Burton
PICKENS
Liberty
Cateechee
Tallulah Falls
OCONEE (4)
Central
Walhalla
Westminster
HABERSHAM
Newry
Clemson
Pendleton
Seneca
Tugalo
Tugaloo River
Seneca River
ANDERSON
LaFrance
Toccoa
Baldwin (2)
STEPHENS
Anderson
Belton
Honea Path
Lula
Carnesville
Lavonia
Canon (2)
Hartwell Reservoir
(13)
Gluck
HALL
Homer
BANKS
FRANKLIN
Donalds
Iva
Royston
HART
Hartwell
Savannah
Due West
Maysville
JACKSON
ABBEVILLE
MADISON
Danielsville
Bowman
ELBERT
Abbeville
Ila
Comer
Broad
Elberton (50)
Calhoun Falls (7)
Greenwood
Colbert
CLARKE
Carlton
River
GREENWOOD
SALUDA
OGLETHORPE
Crawford
Tignall
McCormick
McCORMICK
Lexington
Washington
LINCOLN
Edgefield
WILKES
Clark Hill Reservoir
Lincolnton
EDGEFIELD
Trenton
GREENE
Appling
Graniteville
TALIAFERRO
COLUMBIA
Camak
Grovetown
GA.
Langley
S. C.
Aiken
WARREN
Thomson (2)
Harlem
N. Augusta
Bath
AIKEN
River
Clearwater
McDUFFIE
Augusta
Dearing
a
(13)
New Savannah Bluff
New Ellenton
RICHMOND
Jackson
GLASCOCK
Hephzibah
b
Wrens
BARNWELL
JEFFERSON
Brier
BURKE
Creek
Waynesboro
ALLENDALE
Sardis
JENKINS
(1)
Sylvania
SCREVEN
Scotia
HAMPTON
Newington
Shawnee
EFFINGHAM
Springfield
Rincon
Port Wentworth
Hardeeville
Garden City
JASPER
CHATHAM
Pooler
Savannah
Savannah Beach
Thunderbolt
ATLANTIC OCEAN
N
WATER SYSTEMS
MUNICIPAL
G GROUND WATER
S SURFACE WATER
INDUSTRIAL
( ) NUMBER BY COUNTY
OTHER
★ FEDERAL INSTALLATION
a FORT GORDON
b SAVANNAH RIVER DEFENSE AREA
SCALE IN MILES
0 10 20 30

Figure 2.5

per minute. The ground water sources of the Coastal Plain are abundant. Wells in the Savannah metropolitan area produced approximately 60 million gallons of water a day in 1960. Increasing withdrawals have caused a lowering of the artesian head and there is growing concern about salt-water intrusion into the Savannah water supplies. Additional ground water supplies can be developed without significantly affecting yield of existing wells if new wells are drilled outside the circle of influence of existing wells.

The fresh surface waters of the basin are consistently suitable for municipal and industrial use, and with a minimum of treatment can provide excellent water supplies. In 1960, a number of the water supplies were obtained from surface sources.

Existing Facilities and Programs

Domestic Water Supplies

Domestic water supplies are defined as private individual supplies designed mainly to serve a single rural family. In 1960, an estimated 54,000 domestic water supplies served a rural population of 244,000 people. Water use, excluding that for watering stock and for irrigation purposes, averaged 50 gallons per person per day. About 73 percent of the domestic water supplies were equipped with pressure systems. Some households served by pressure systems used 75 gallons per capita per day.

Of the estimated 54,000 rural domestic water supplies, some 26,000 are dug wells ranging from 6 to 120 feet in depth and approximately 22,000 are drilled, driven, or bored wells ranging from 15 to 500 feet in depth. The remaining rural homes use natural springs or other sources for their water supplies.

Municipal Water Supplies

In 1960, 112 communities had municipal water systems. Commerce, Mt. Airy, and Winterville, in Georgia; and Greenwood, Easley, and Johnston, in South Carolina, obtained their water outside the basin. Twenty-four of the remaining 106 communities used surface water, 4 used both surface and ground water, and 78 used ground water.

In 1960, about 503,000 persons were served by municipal water supplies in the basin. These included some 16,000 people stationed at Fort Gordon, Georgia. Approximately 40,000 persons were served by systems obtaining water from sources outside of the basin. Sources of supply within the basin provided water to about 55,000 people living outside of the basin.

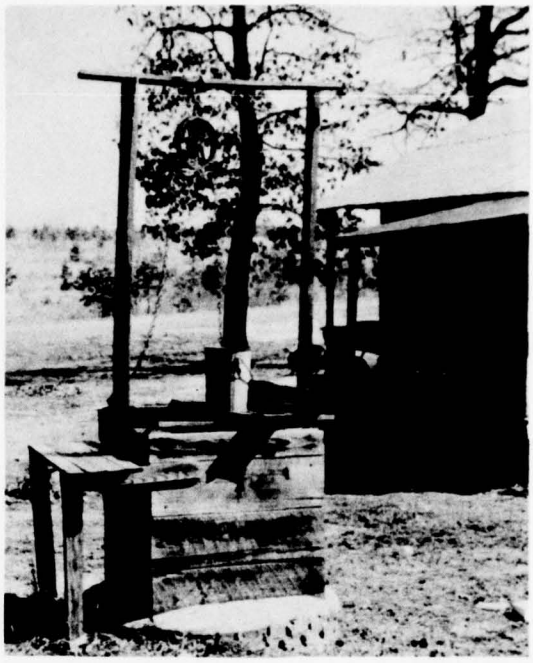


Figure 2.6 *Substandard Domestic Wells Require Improved Construction to Protect Domestic Water Supplies.*

Over 42 percent of an estimated 87.5 million gallons provided daily by municipal water systems in 1960 was used by industries. Excluding this industrial use, the average water use was 100 gallons per person per day. Many industries have their own water supplies. Numerous privately owned wells serve both municipal and industrial needs. These wells augment supplies but are not included in the above estimated 1960 per capita use.

The total number of semipublic water supplies providing services in 1960 was not estimated. However, 21 semipublic water supplies inventoried served an estimated 7,000 people with an average water use of 900,000 gallons per day. No treatment was provided for 15 of these supplies, 3 filtered the water, 3 were chlorinated, 2 were softened, and 1 provided for iron removal. The 21 semipublic water supplies examined represent most of the larger systems in Georgia, and 1 large system in South Carolina. Numerous smaller systems serve public and paro-

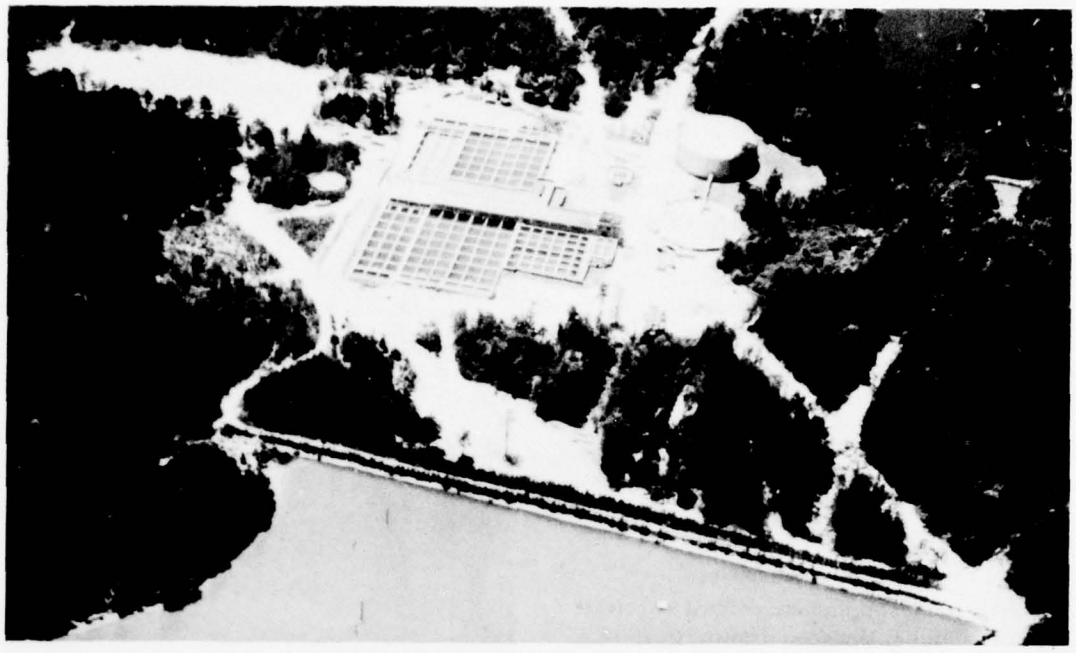


Figure 2.7 *An Adequate Water Supply Enhances Economic Development.*

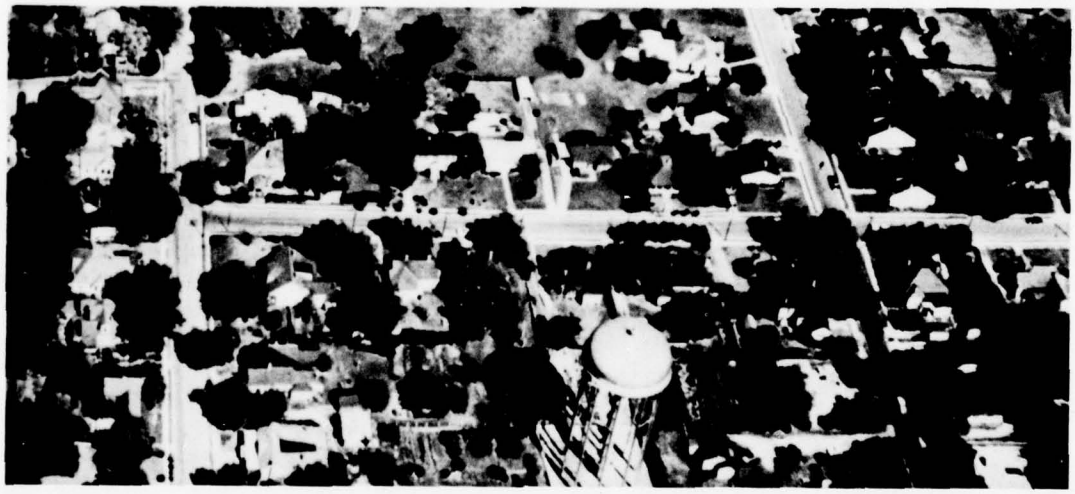


Figure 2.8 *Elevated Water Storage Tank — Elberton, Georgia.*

chial schools, motels, and other installations throughout the basin. Separate estimates were not made for future water demands of these semipublic water supply systems.

The bacteriological quality of municipal and semipublic supplies is under the surveillance of the respective State health departments. In 1960, some 54 municipal supplies were chlorinated for bacteriological control, 4 systems fluoridated their water supply, 27 had filtration plants, 26 provided corrosion control, and 3 used iron removal equipment. Some of the surface water sources did not meet recommended raw water-quality standards for municipal supplies. The municipal treatment plants, however, did produce water of satisfactory quality. Table 2.1 includes data on municipal water supply systems in the basin as of 1960.

TABLE 2.1

Municipal Water Supply Systems—1960

Municipality	Population served	Source*	Treatment*	Design capacity (m.g.d.)*	Average demand (m.g.d.)*
Georgia					
Appling (unincorporated)	100	S	None	--	0.004
Augusta	93,380	S	P	30.000	10.140
Fort Gordon Army Base	(served by Augusta)				
Baldwin	670	W	None	2.600	0.025
Bowman	654	W	None	0.150	0.065
Camak	240	W	None	0.039	0.009
Canon	500	W	D	0.077	0.020
Carlton	321	W	D	0.144	0.030
Carnesville	481	S	D	0.085	0.035
Clayton	1,745	S	P	0.820	0.360
Colbert	475	W	D	0.025	0.020
Comer	880	W	None	0.216	0.046
Crawford	596	S	P	0.250	0.060
Danielsville	392	W	DH	0.470	0.016
Dearing	411	W	D	0.130	0.025
Elberton	8,001	S	P	2.000	1.200
Garden City	5,451	W	None	1.650	0.200
Grovetown	1,336	W	None	0.288	0.065
Harlem	1,431	W	KD	0.140	0.125
Hartwell	4,699	S	P	1.000	0.600
Hephzibah	676	W	DHK	0.144	0.045
Mine Village	100	W	None	0.050	0.005
Homer	235	W	None	0.180	0.020
Ila	200	W	DI	0.180	0.009
Lavonia	2,388	W	None	1.000	0.158
Lexington	406	W	KD	0.865	0.025
Lincolnton	1,550	W	None	4.200	0.125
Lula	510	W	DA	0.103	0.035
Martinez-Lamkin (unincorporated)	2,400	W	None	0.350	0.150
Maysville	680	W	D	0.087	0.045
Newington	399	W	None	0.115	0.030
Pooler	1,500	W	None	0.430	0.080
Port Wentworth	3,085	W	D	1.400	0.160
Sawmill Village	225	W	None	0.087	0.018
Sugar Refinery Village	325	W	None	0.720	0.020
Richmond County	15,200	W	DKH	1.500	1.000
Rincon	850	W	None	0.072	0.054
Royston	2,403	W	D	0.330	0.125
Sardis	812	W	D	0.750	0.080
Savannah	150,000	W	D	45.000	15.000
		S	P	50.000	30.400
Lakeside Park Subdivision	360	W	None	Undetermined	0.032
Parkersburg Subdivision	600	W	None	0.600	0.050
Wymberley Subdivision	700	W	None	Undetermined	0.063
Wymberley on the Marsh Subdivision	90	W	None	0.430	0.009
Wilmington Park Subdivision	240	W	D	Undetermined	0.021
Rio Vista Subdivision	180	W	D	0.600	0.016
Savannah Beach	1,385	W	None	3.600	0.100
Springfield	860	W	D	0.800	0.031
Sylvania	3,400	W	None	1.750	0.500
Tallulah Falls	50	S	None	Undetermined	0.005
Thomson	4,972	S	P	1.000	0.500
Thunderbolt	2,005	W	None	1.370	0.160
Tignall	568	W	None	0.130	0.070
Toccoa	8,000	S	P	4.500	3.000
Tugaloo Village (unincorporated)	75	S	P	0.144	0.008
Washington	4,890	S	P	1.000	0.694
Waynesboro	5,420	S	P	1.000	0.700
Wrens	1,620	W	None	0.500	0.093
South Carolina					
Abbeville	6,000	S	P	3.000	1.700
Aiken	18,000	SW	P	4.100	1.570
Briar Cliff Acres Subdivision	80	W	None	2.260	0.008
Cloverville Valley Subdivision	300	W		0.500	0.030
College Acres Subdivision	700	W	D	0.290	0.025

(continued)

TABLE 2.1—Continued

Municipality	Population served	Source*	Treatment*	Design capacity (m.g.d.)*	Average demand (m.g.d.)*
Anderson (Equinax Mills, Orr Mill, Toxaway)	40,000	S	P	13.000	4.500
Bath (unincorporated)	1,300	W	K	0.860	0.181
Belton	5,800	W	None	0.600	0.400
Calhoun Falls	1,600	W	None	0.187	0.125
Cateechee (unincorporated)	600	W	IDK	2.000	0.145
Central	2,500	S	P	0.250	0.190
Clearwater (unincorporated)	1,400	S	P	5.000	3.800
Belcher Heights Subdivision	200	W	None	0.284	0.005
Clemson		S	P		
Clemson College	10,000	S	P	1.500	1.100
Donalds	400	W	None	0.500	0.075
Due West	1,200	W	None	0.500	0.150
Edgefield	2,750	SW	P	0.665	0.175
Gluck Village (unincorporated)	750	S	D	0.200	0.150
Graniteville (Vaudise, Warrenville)	5,000	S	P	1.370	0.530
Greenwood					
Panola Mill	500	W	None	1.300	0.130
Chinaquapin Subdivision	100	W	None	1.200	0.010
Stalmaker Heights Subdivision	120	W	None	0.072	0.005
Woodfield Subdivision	360	W	None	1.300	0.050
Hardeeville	1,200	W	None	0.288	0.040
Honea Path	5,400	W	DK	0.470	0.202
Iva (Jackson Mill Village)	1,900	W	None	0.208	0.075
Jackson	1,500	W	DK	0.500	0.040
La France (unincorporated)	1,200	S	P	1.000	1.000
Langley	1,600	SW	None	0.300	0.100
Liberty	3,500	S	P	1.250	0.450
McCormick	1,800	S	P	0.500	0.250
New Ellington	4,300	W	IH	0.720	0.400
Newry (unincorporated)	1,000	W	None	0.500	0.100
North Augusta	15,000	S	D	2.000	0.750
Belvedere Ridge Subdivision	1,200	W	None	0.300	0.070
Pendleton	2,500	W	None	0.250	0.110
Pickens	3,000	S	P	1.500	0.500
Pickens Mills	800	S	P	0.168	0.053
Scotia	100	W	None	0.010	0.004
Seneca (Londsdale, Utica)	8,500	S	P	1.000	0.650
Royal Acres Subdivision	20	W	None	0.040	0.001
Morningside Heights Subdivision	80	W	None	0.010	0.002
Trenton	400	W	None	0.029	0.007
Walhalla (West Union)	4,000	S	P	0.675	0.375
Morningside Heights Subdivision	120	W	None	1.370	0.005
Westminister	3,500	S	P	1.500	0.750
Total	503,467				87.535

* S —Surface supply
W —Ground water supply
A —Aeration
D —Disinfection
K —Water stabilization
P —Purification
H —Softening
I —Iron or manganese removal
m.g.d.—Million gallons per day

Industrial Water Supplies

Some industrial establishments in or near municipal areas obtain their water from the municipal systems. Others have developed private sources of supply. Exclusive of the water-use requirements of the Savannah River Atomic Energy Commission plant, the 1960 industrial water use, based on survey of major industry, totaled 229.4 million gallons per day. More than 37 million gallons of this was supplied by municipal water systems. Surface water is used by 16 plants for process water supplies, ground water is used by 47 industries, and 12 industries depend upon municipal supplies for process water. Surface water is used by 17 industries for cooling purposes; 39 plants use ground or a combination of ground and surface water sources; and 4 industries obtain water from municipal systems. Water recirculated in closed systems for cooling purposes has not been included. The industrial uses are primarily nonconsumptive and it was assumed that an equal volume is discharged as industrial waste unless water use and discharge data were available.

TABLE 2.2

Sources of Industrial Water Supplies

Industry	Number of plants	Water use							
		Process[1]				Cooling			
		Source[2]		Treatment[3]	Average demand (m.g.d.)	Source[2]		Treatment[3]	Average demand (m.g.d.)
		No.	Type			No.	Type		
Lumber	2	1	S	N	0.039	1	M	N	0.077
		1	W	H	0.070	1	W	H	0.146
Paper	5	1	M	N	12.015	1	S	N	6.000
		1	W	D	0.150	1	W	D	0.100
		1	MW	N	45.100	1	S	N	90.000
		2	S	P	14.530	1	S	P	5.000
Food	22	19	W	N	1.111	8	W	N	1.382
		1	S	N	0.002				
		1	W	N	0.230	1	W	N	0.057
		1	MW	N	3.600	1	R		
Chemical	9	8	W	N	0.318	8	W	N	4.110
		1	M	N	2.700	1	WS	N	18.600
Stone	50	50	WM	N	1.200				
Metal	3	1	M	N	0.129	1	S	N	0.840
		1	S	N	0.162				
		1	N	N	0.007	1	W	N	0.025
Apparel	1	1	S	N	0.012				
Textile	22	2	W	N	0.220	2	W	N	0.086
		1	WM	H	0.120	1	M	N	0.105
		1	M	N	0.089	1	S	N	0.050
		7	S	P	6.807	7	S	P	0.735
		8	W	N	3.805	6	W	N	0.571
		2	WM	N	3.450	2	WM	N	0.440
		1	S	D	0.144				
Miscellaneous	6	2	WS	N	1.458	1	S	N	0.070
		2	W	N	0.513	2	W	N	0.261
		1	WM	N	0.498	1	S	N	1.600
		1	WM	H	0.030	1	W	N	0.600

NOTES: [1] Drinking and boiler water included.
[2] Source—M—Municipal
S—Surface
R—Recirculated
W—Private well
[3] Treatment (all boiler water is treated)
D—Disinfection
P—Complete treatment (chlorination, filtration, etc.)
H—Softening
N—None

Needs and Opportunities

Domestic Water Supplies

In 1960, many of the wells were improperly sealed, uncovered, without pumps, or had pumps which were not self-priming. Poor construction and improper equipment afford little protection against contamination of the supply.

Of the limited number of domestic water supplies inventoried, less than 40 percent met sanitary standards of construction, 18 percent had unprotected sources, and 5 percent provided inadequate water supplies. About 26 percent of the domestic supplies reported a need for treatment to improve potability of the water.

Supplies that are subject to possible bacteriological pollution from improper well construction or handling of the water are a hazard to public health. Surface runoff entering unsealed wells after heavy rains results in turbidity and carries contamination into the water supply. Improved construction and proper sealing of the wells will provide protection against both contamination and turbidity. Most of the drilled wells were equipped with pressure systems and met sanitary standards of construction.

Some ground water supplies have objectionable amounts of sulfur, iron, and hardness. Removing these undesirable characteristics is practicable, but the expense involved may be more than individual owners desire to pay. Unless quality is seriously impaired, water users usually

adapt themselves quickly to the available water and give little consideration to its improvement.

By 1975, the average per capita water use by the rural population is expected to increase to 70 gallons per day. Domestic water supplies are expected to serve 193,000 people, and water use is expected to total 13.5 million gallons a day. By the year 2000, per capita consumption is expected to increase to 100 gallons a day. The domestic water supplies are expected to serve an estimated 148,000 people and the requirement is expected to total 14.8 million gallons per day.

Municipal Water Supplies

Future water supply requirements have been based on population projections with an estimated increased per capita daily demand ranging from 100 gallons in 1960 to 150 gallons in 1975 and 200 gallons in 2000.

Ground water resources will continue to be used in the lower portion of the basin where it is adequate in quantity, and supplies can be economically developed for the expected future water needs. Surface water will be used throughout the basin to augment the ground water sources. Adequate quantities of surface water which are available throughout the entire area should be developed for future needs, particularly in the Savannah metropolitan area, where additional development of ground water may increase the possibility of salt-water intrusion into the aquifer.

Some of the subdivisions with separate water systems in 1960 may incorporate with adjacent cities by 1975. Additional countywide water systems will be developed to serve rural population concentrations in areas where ground water sources are limited and community surface water supplies can be developed as economical alternatives to private wells.

Several municipalities need to improve their water systems. In addition, other facilities need to be enlarged to insure an adequate supply for the estimated growth and development of the communities. By 1975, the 88 municipal water systems in the basin would have an estimated total water demand of 112 million gallons a day and would serve an estimated 747,000 people. Sixty-one municipal systems need either new sources of supply, enlargement of existing sources, or treatment. Thirty-two of the 88 major water systems, expected by 1975, will need elevated storage tanks. Sixty-four will need distribution system extensions. Similar improvements will be needed between 1975 and 2000 to insure that

TABLE 2.3

Municipal Water Facility Needs

Population	Total number of places	Number of places requiring new or additional		
		Source or treatment	Elevated storage	Distribution system
1960 to 1975				
Under 2,500	48	30	13	30
2,500 to 10,000	33	27	17	28
Over 10,000	7	4	2	6
1975 to 2000				
Under 2,500	39	5	2	18
2,500 to 10,000	45	17	12	42
Over 10,000	13	13	8	12

	Number of places requiring					
	Wells	Treatment	Storage	Distr. system	Population served	Water usage (m.g.d.)*
Georgia–						
1960–1975	13	32	19	40	522,500	79
1975–2000	12	21	12	45	933,000	187
South Carolina–						
1960–1975	17	29	13	24	224,100	33
1975–2000	6	14	10	27	373,200	74

*Million gallons per day.

there are adequate facilities to provide for 1,306,000 people with a demand of 261 million gallons a day. These estimated average daily demands from municipal systems include water expected to be used for industrial purposes.

Industrial Water Supplies

Existing industries are expected to grow and many new industries undoubtedly will be added because of the natural advantages of the basin, including the abundant water supplies.

Estimated industrial water requirements from private owners approximate 242 million gallons a day by 1975 and 306 million gallons a day by the year 2000. These future estimates can be met by surface and ground water sources.

Means of Meeting the Needs

Domestic Water Supplies

Improvement of domestic water supplies is needed. All wells should be properly sealed and equipped with pressure systems. In areas where the ground water is limited, community systems may be needed to replace the individual wells.

To provide pressurized properly constructed water supply systems by 1975 would require construction of 10,000 new drilled wells to replace those having inadequate sources, physical improvement of 18,000 existing wells, and installation of 11,000 pressure systems. Assuming that this goal is met prior to 1975 a continued maintenance and rehabilitation program will assure adequate water for an estimated 33,000 domestic supplies by the year 2000.

Additional emphasis on rural water supply programs by the local health departments is needed to provide information and consultation to the owners. The selection of a good source, proper sanitary construction, and the installation of good pumps will provide protection and upgrade the quality of the domestic water supplies. The improved supplies, however, need to be checked chemically and bacteriologically to insure safety.

Municipal Water Supplies

Municipalities must plan and provide for their own needs. Technical assistance can and should

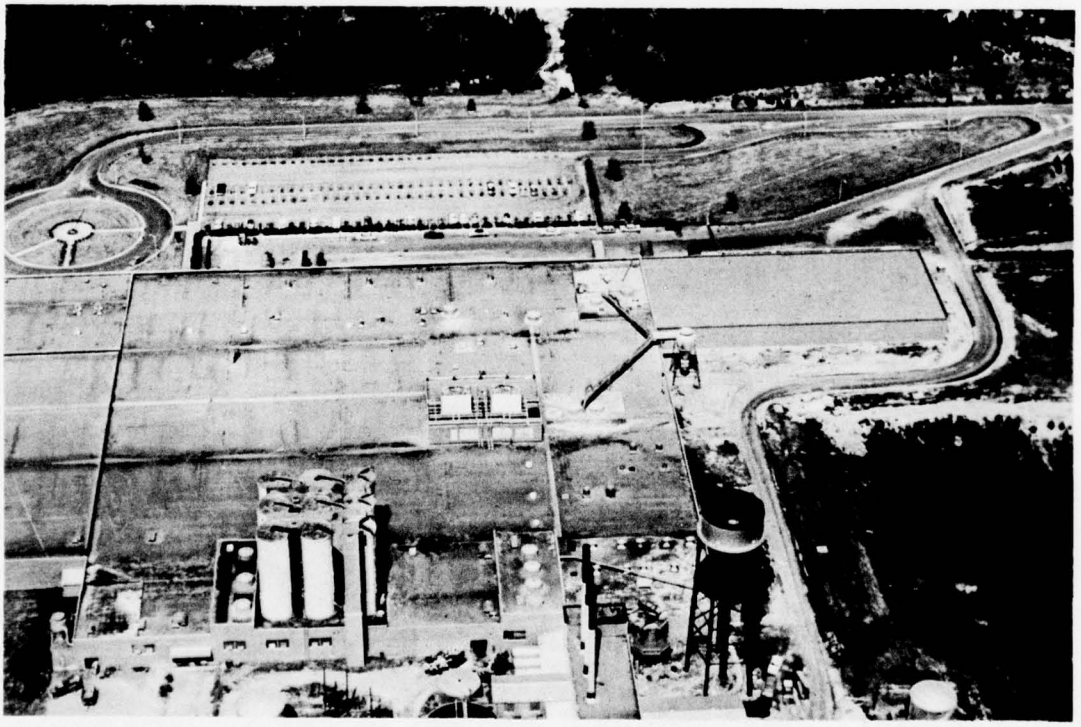


Figure 2.9 *Industrial Water Supply System near Abbeville, South Carolina — Industrial Expansion Will Require Additional Water Supply Facilities.*

be obtained from Federal, State, and private sources. Needs can be met by using readily available equipment and by following standard waterworks practices. There are no apparent unusual supply, development, or treatment problems.

Industrial Water Supplies

The expansion of facilities to provide adequate water supplies for normal growth of existing industries and the development of new industries will be required prior to 1975, and additional expansion will be needed prior to the year 2000. Needed facilities will include new wells, new surface water intakes, treatment plants, softening facilities, and improved water-handling equipment.

SECTION III – NAVIGATION

General

Navigation, which extends from the Atlantic Ocean up the Savannah River to the ports of Savannah and Augusta, has played an important part in the settlement and development of the Savannah basin.

Existing Facilities and Programs

Existing navigation facilities include deep-water port facilities at Savannah, the 12-foot deep Intracoastal Waterway crossing the coastal portion of the basin, the nearly completed 9-foot channel from Savannah to Augusta, and barge terminal facilities at Augusta.

The port of Savannah, an excellent harbor, is connected to open water by a 36-foot deep channel across the ocean bar. There are 50 piers and wharves which, with the use of dolphins, have a combined berthing space of over 28,400 feet. Depths alongside range up to 34 feet at mean low water. Water depths alongside 27 of these piers are more than 25 feet. The Georgia Ports Authority has just completed 3 new deep-water

Figure 2.10 *Port of Savannah Has Deep-Water Navigation Facilities.*

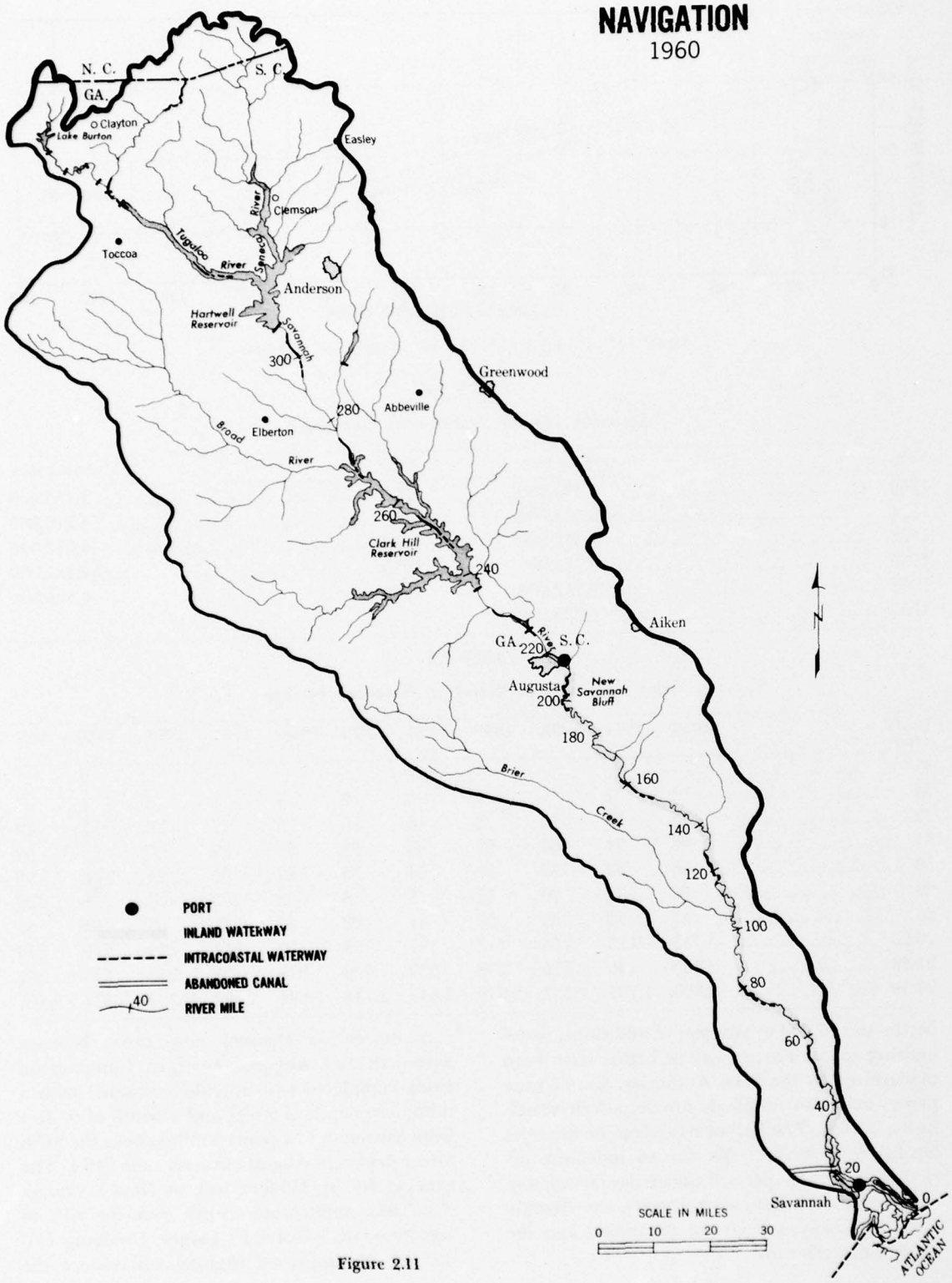

NAVIGATION
1960
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Seneca River
Tugaloo River
Toccoa
Anderson
Hartwell Reservoir
Savannah
300
Greenwood
280
Abbeville
Elberton
Broad River
260
Clark Hill Reservoir
240
Aiken
GA
220
S. C.
Augusta
200
New Savannah Bluff
180
Brier Creek
160
140
120
100
80
60
40
20
0
Savannah
ATLANTIC OCEAN
N
PORT
INLAND WATERWAY
INTRACOASTAL WATERWAY
ABANDONED CANAL
40
RIVER MILE
SCALE IN MILES
0 10 20 30

Figure 2.11

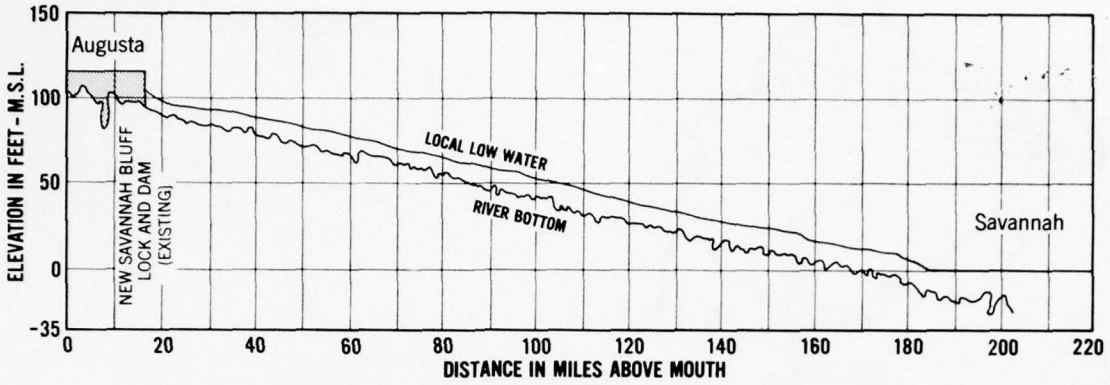


Figure 2.12 *Stream Profile, Savannah River Below Augusta.*

TABLE 2.4

Savannah Harbor Waterborne Commerce

Year	Short tons	Year	Short tons
1950	3,471,000	1956	4,157,000
1951	3,558,000	1957	4,210,000
1952	3,572,000	1958	4,087,000
1953	3,783,000	1959	4,181,000
1954	3,752,000	1960	4,325,000
1955	4,220,000		

TABLE 2.5

Trips by Drafts of Vessels at Savannah Harbor

Draft (ft.)	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
34				1	1					2	
33	1	1		1	2	2	1	5	5	1	7
32	18	13	10	9	18	16	15	17	22	33	49
31	68	74	60	67	66	63	55	69	59	64	58
30	38	32	32	30	34	50	49	51	35	68	59
29	54	72	70	75	59	88	93	100	103	76	107
28	47	70	69	57	81	62	68	78	68	63	84
26-28	113	125	146	117	181	169	199	211	238	219	240
24-26	125	140	175	233	227	226	244	195	259	271	251
24 or less	2,806	1,787	2,152	2,870	3,345	2,734	2,594	2,422	2,329	2,571	2,425

berths and 87,000 square feet of additional warehousing space. Three existing berths have been modernized by the Ports Authority. Six oil companies maintain terminals for deep-draft vessels in the harbor. The harbor has adequate facilities for handling barge traffic for an indefinite period. The port is operated under the jurisdiction of the Savannah District Authority, the Georgia Ports Authority, the city of Savannah, and the Federal Government.

A navigation channel now exists between Savannah and Augusta, Georgia. Construction being completed will provide a channel with a minimum depth of 9 feet and a width of 90 feet from Savannah to a point 3 miles above the Fifth Street Bridge in Augusta at river mile 219.4. The existing 56- by 360-foot lock at New Savannah Bluff has ample water depth over the sills to accommodate 9-foot-draft barges. Dredging cutoffs for the improved channel will reduce the

Figure 2.13 *New Savannah Bluff Lock and Dam Facilities Barge Navigation to Augusta.*

TABLE 2.6

Waterborne Commerce on Savannah River Below Augusta
(short tons)

Commodity	1953	1954	1955	1956	1957*	1958*	1959*	1960*
Petroleum products	21,376	14,053	38,281	52,837	51,473	53,543	60,064	52,971
Brick and tile	10,071	12,617	15,788	17,910	18,640	15,363	16,583	9,890
Other clay products							561	
Total	31,447	26,670	54,069	70,747	70,113	68,906	77,280	62,861

* Partial. Excludes movement of construction materials in connection with channel improvement.

distance between the upper harbor limit at Savannah and the head of navigation at Augusta from 197.4 to 183 miles. It would not be practical to extend navigation above Augusta due to the sharply rising gradient upstream from the Fall Line and the existing dams. Terminal facilities for barge traffic are provided at the port of Augusta. No such facilities exist between that city and Savannah, although there are several natural landings without wharves or rail connections. Several of these are near main highways or railroads and could be readily developed.

The Georgia Ports Authority owns and operates the Augusta State Docks, including a 200-foot wharf, a transit shed, and rail access. An adjacent wharf with limited use is owned by the city of Augusta. Plans have been made by the Authority to double facilities of the existing State Docks. Three private installations at the port serve two oil companies and a brick and tile manufacturing firm.

The basin encompasses 21 miles of the Atlantic Intracoastal Waterway which crosses the ship approach channel to Savannah from the sea.

TABLE 2.7

Waterborne Commerce on Atlantic Intracoastal Waterway
Port Royal Sound, South Carolina, to Fernandina Beach, Florida

Year	Short tons	Year	Short tons
1947	193,812	1954	820,883
1948	271,911	1955	879,882
1949	319,533	1956	974,906
1950	316,612	1957	990,025
1951	399,789	1958	1,020,283
1952	542,901	1959	1,125,551
1953	744,972	1960	973,748

Authorized minimum dimensions are for a 12-foot depth, a 90-foot width in land cuts and narrow streams, and a 150-foot width in open waters. At the end of 1960, controlling depths of less than 12 feet existed at scattered locations for a total distance of 6.7 miles. The minimum depth was 9 feet. Two reaches totaling 3¾ miles within the basin and two reaches totaling 5½ miles outside of the basin have a controlling width of 90 feet. Barge tieup and cargo handling facilities for traffic on the waterway are provided along the Savannah waterfront about 9 miles up the Savannah River from the ship channel crossing. Homeowners and other private interests have numerous small wharves along the waterway and its tributary streams. Commercial fishing interests have facilities near Savannah. These consist of pile and timber wharves and sheds for handling, processing, and storing seafood.

Needs and Opportunities

The impact of the port of Savannah on commerce in the Savannah River trade area is of major importance. Of the 4,181,000 tons handled through the port in 1959, 90 percent either originated or terminated within the study area. The principal commodities handled can be classified into 28 commodity groups. Ten of these account for 80 percent of the total tonnage. In the order

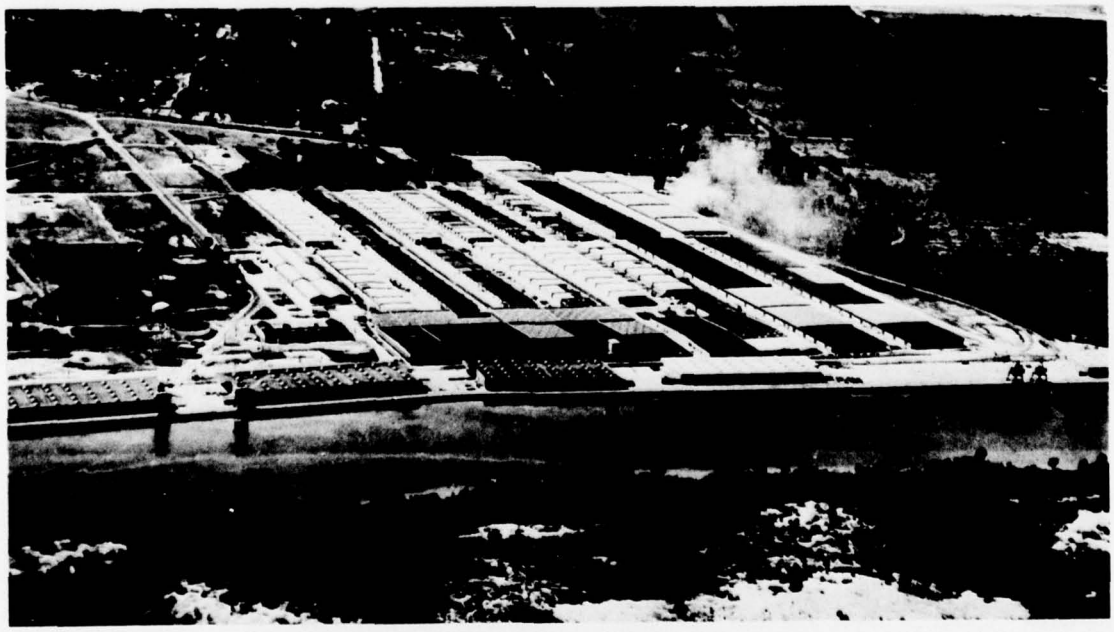


Figure 2.14 *Savannah State Docks — Garden City Terminal.*

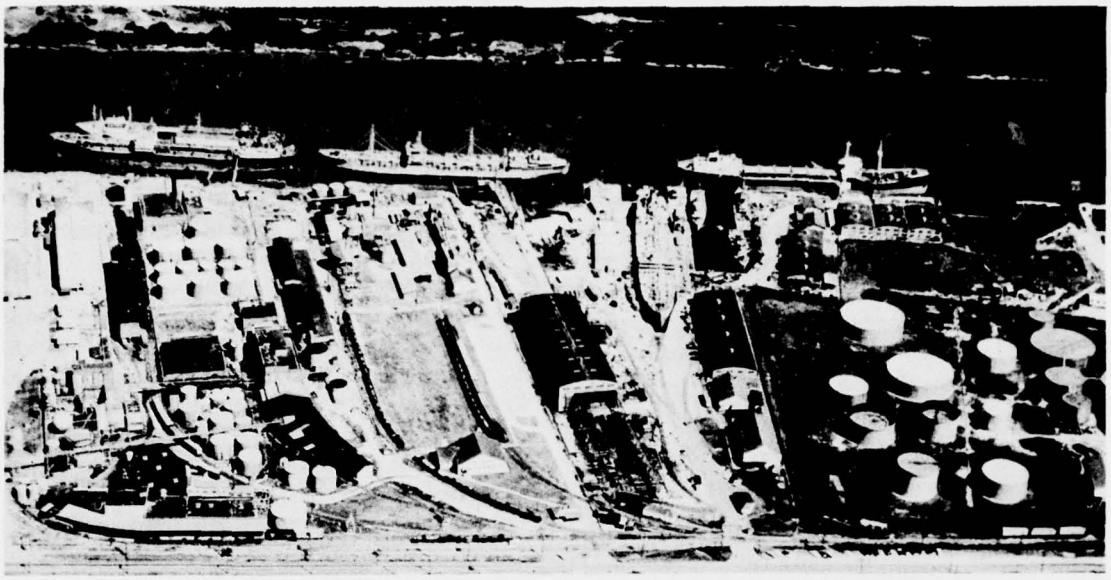


Figure 2.15 *Port Facilities at Savannah Are Important to the Economy of the Area.*

of magnitude, these are petroleum and its products, sugar, gypsum rock, paper products, fertilizer material, ammonium nitrate, nonferrous ores, sulfur, naval stores, and brick and tile. Petroleum and its products alone account for *over 50 percent of all the tonnages handled* through the port.

Projections indicate that the port of Savannah will handle 6,735,000 tons of waterborne commerce in 1975 and 11,740,000 tons in 2000. By the year 2000, it is estimated that the average vessel in the United States tanker fleet will have a dead weight of 37,000 tons and a draft of about 36 feet. The increased size of tankers and the greatly increased tonnages of petroleum, other bulk cargo, and general cargo moving through the port annually by the year 2000 will necessitate an increase in channel widths and depths and will require more and larger anchorage areas, turning basins, and terminal facilities.

Since 1946, waterborne commerce on the river below Augusta has shown a general increasing trend. Shipments of brick, tile, and other clay products downstream and petroleum products upstream by single shipping company account for all of the commercial traffic. These shipments have totaled between 54,000 and 78,000 short tons annually from 1950 to 1960. In addition, since 1957 when the 9-foot channel improvement was started considerable quantities of construction materials have moved on the river.

In 1960, a total of 178 barge round trips and 179 towboat round trips was made between Augusta and Savannah. Typical elapsed time for *a one-barge tow is 22 hours downstream* and 42 hours upstream.

There are seven highway and four railroad bridges over the Savannah River between the upper end of Savannah Harbor and the head of navigation at Augusta. The minimum horizon-

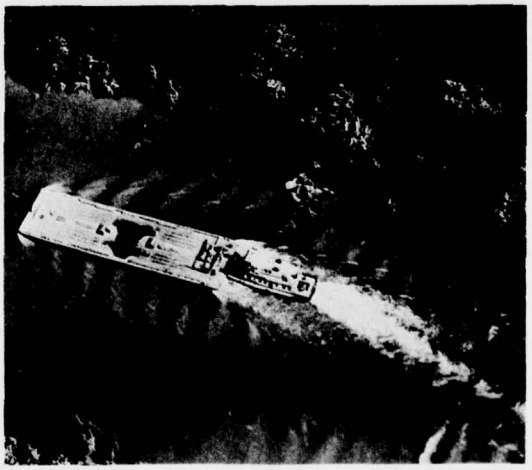


Figure 2.16 *Expansion of Waterborne Commerce on the Savannah River Will Require Additional Improvement.*

tal clearance is 68 feet at the Atlantic Coast Line Railroad crossing near Hardeeville, South Carolina, and the minimum vertical clearance is 39 feet above normal water elevation at the highway bridge near Clyo, Georgia. The minimum vertical clearance is considered satisfactory for barge traffic. The horizontal clearance at the Hardeeville crossing is too small to pass a tow with two modern barges abreast. However, it is not likely that such tows will use the river as now improved since they cannot pass in the 90-foot existing channel. The two bridges at Savannah provide deep-draft vessel clearances.

A survey was made late in 1960 and early in 1961 to determine the pattern of commercial freight shipments in the Savannah River tributary area. The tributary area was determined by a traffic analysis. The initial objective was to estimate the amount of waterborne traffic that could reasonably be expected to develop upon completion of the 9-foot project. This same tonnage was considered as the present potential for an assumed 12-foot project, with minor increases in shipments of kaolin, structural steel, and liquid nitrates.

Commercial traffic on the Atlantic Intracoastal Waterway increased about fivefold from 1947 to 1960. No annual count is made of pleasure craft, but the seasonal movements southward in the fall and northward in the spring have greatly increased. About 90 percent of the commercial movement is through traffic.

It is anticipated that the commercial traffic on the reach of the Waterway between Port Royal Sound, South Carolina, and Fernandina Beach, Florida, will be 2,543,000 tons by 1975 and 4,683,000 tons by 2000. The number and size of tows will be such that by 1975 maintenance of the full authorized 12-foot depth will be necessary. By the year 2000, widening of the 90-foot cuts to 150 feet will be needed.

Future technological improvements and construction of pipelines through the Savannah basin to carry gas and liquid fuels from the Gulf area to the heavily populated areas of the east undoubtedly will affect the tonnages of waterborne traffic.

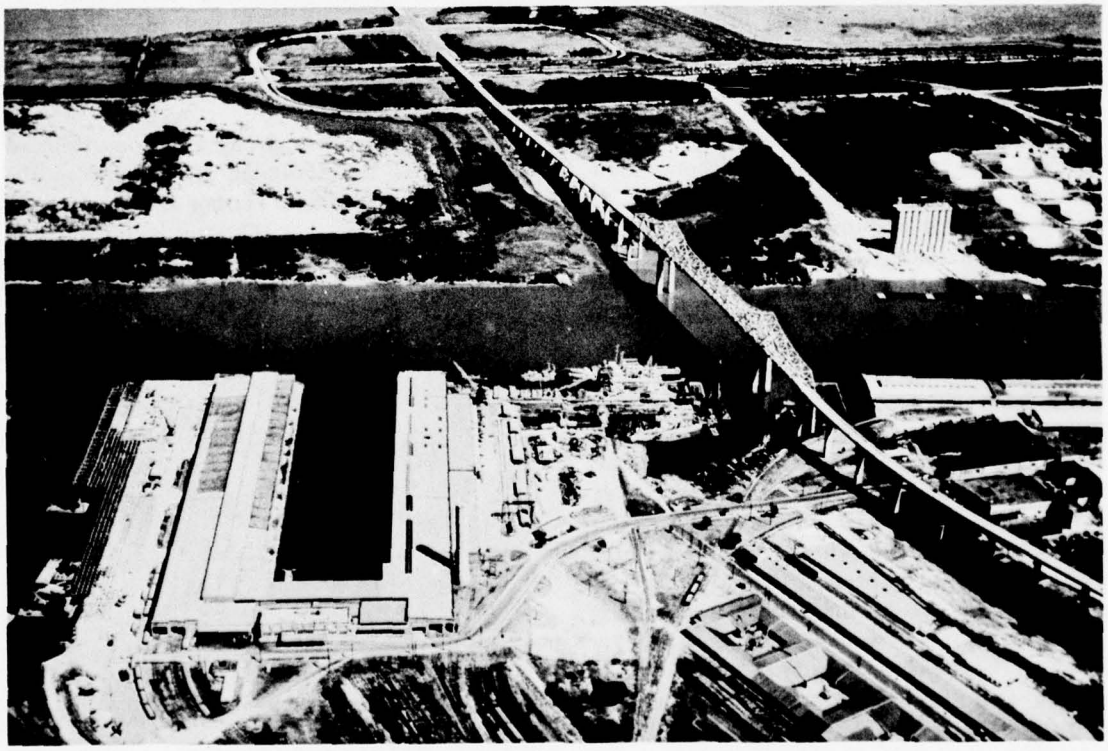


Figure 2.17 *Port Facilities — Eugene Talmadge Memorial Bridge, Savannah.*

TABLE 2.8

Projected Waterborne Commerce on Savannah River
by Major Commodity Group, 1975 and 2000
(short tons)

Major commodity group by destination	1959-1960*	Projected	
		1975	2000
Destination Augusta			
Petroleum and products	408,500	636,000	1,333,000
Sand, gravel, and rock	120,000	232,000	673,000
Iron and steel scrap	27,000	42,000	83,000
Fertilizers and materials	18,500	30,000	43,000
Structural steel	41,300	80,000	232,000
Brick and tile	20,000	39,000	112,000
Clays and miscellaneous	54,000	102,000	320,000
Subtotal	689,300	1,161,000	2,796,000
Petroleum products for other destinations			
Batesburg, South Carolina	80,900	126,100	263,900
Interchange at U. S. Highway No. 301	71,800	111,900	234,100
Total all commodities	842,000	1,399,000	3,294,000

*Tonnage estimated assuming a completed 9-foot channel.

Means of Meeting the Needs

Navigation could be improved between Savannah and Augusta by constructing two or three multiple-purpose dams with locks. This development, with necessary channel dredging for the deeper drafts, could provide 9-foot, 12-foot, or deeper slack-water navigation. In determining the most practical plan, consideration would have to be given to the amount of waterborne commerce that would develop under each alternative situation. Such development would increase shipments in Savannah Harbor, the Intracoastal Waterway, and between Savannah and Augusta. It would open up the vast area between Savannah and Augusta to industrial development.

Harbor improvements needed at Savannah include widening and deepening of channels, establishing new anchorage areas and turning basins, and establishing 12 new deep-draft berths and facilities to handle the expected commerce of 11,740,000 tons by the year 2000. The River and Harbor Act of 1962 authorized improvement of the Kings Bay turning basin which is a part of the needed improvements.

The Georgia Ports Authority is in the process of further modernizing the port facilities of Savannah to meet present and future needs. This is evident by new berths and transit sheds recently dedicated at the Garden City Terminal which now provides a total of seven general cargo berths. In addition, an 800,000 square-foot cold storage plant is being constructed for shippers of poultry and meat. By June 1963, three additional berths and a transit shed will be completed at the Ocean Terminal. These were started in February 1962.

In addition to the existing and planned facilities, the Whitehall Plantation, consisting of 390 acres adjoining the Georgia Ports Authority property, has been acquired for development of additional terminal facilities. The Georgia Ports Authority in conjunction with the Savannah District Authority has industrial prospects which will utilize this property.

The 9-foot open channel project now being completed between Savannah and Augusta appears to be adequate until 1975. Projected tonnages for the year 2000 may not be reached unless the travel time is decreased to better meet competition with other freight carrying facilities, principally trains and trucks. Slack-water navigation and channel straightening would reduce the round-trip travel time between Savannah and Augusta.

SECTION IV – RECLAMATION, IRRIGATION, AND DRAINAGE

General

Drainage is the principal method for reclaiming land for agriculture, forestry, or other uses in the basin. Reclamation and drainage are considered as being synonymous in this Report.

Drainage problems in the basin are caused by the accumulation of water in depressions and by water tables near the land surface. Clogging of natural and artificial drains as a result of vegetative growth and siltation, and the reduced effectiveness of major streams as drainage outlets resulting from sedimentation are the major causes of adverse drainage conditions in the basin.

In the humid Southeast, irrigation properly used to supplement rainfall provides opportunities for more efficient farming operations and stabilization of income.

Existing Facilities and Programs

Irrigation

Approximately 14,000 acres in the basin were irrigated in 1959 requiring about 12,700 acre-feet of water. Some 241 out of 22,100 farms used a total of 222 irrigation systems. The irrigation was entirely individual systems and none was by project development. Most of the onfarm acreage was served by sprinkler systems. About 12,000, 1,600, and 400 acres were supplied water from ponds, streams, and wells, respectively. Nearly 70 percent of the land irrigated was in the Piedmont province. In 1960, about one-half of the land irrigated in the basin was in Edgefield County, South Carolina.

The major crop irrigated in 1960 was orchard with more than 4,000 acres, or about one-third of the total irrigated area. Corn and pasture were irrigated in about equal amounts, totaling 4,700 acres. The remainder of the area irrigated in 1960 was mainly in grass, hay, and other field crops. Less than 1 percent of the pastureland and cropland was irrigated. Eight of the 45 counties in or partly in the basin reported no irrigation.

Drainage

More than 46,000 acres of land subject to excess water problems are adequately drained. Onfarm or individual drainage systems predominate and include open-main and lateral ditches, surface-field ditches, and tile drains.

Thirteen drainage facilities affecting 500 or more acres each have been developed and benefit about 18,000 acres. Ten of the facilities were installed by individual action; the other facilities were installed through cooperative action.

Figure 2.18 *Carrying Capacity Is Increased by Irrigation of Pasture in Edgefield County, South Carolina.*

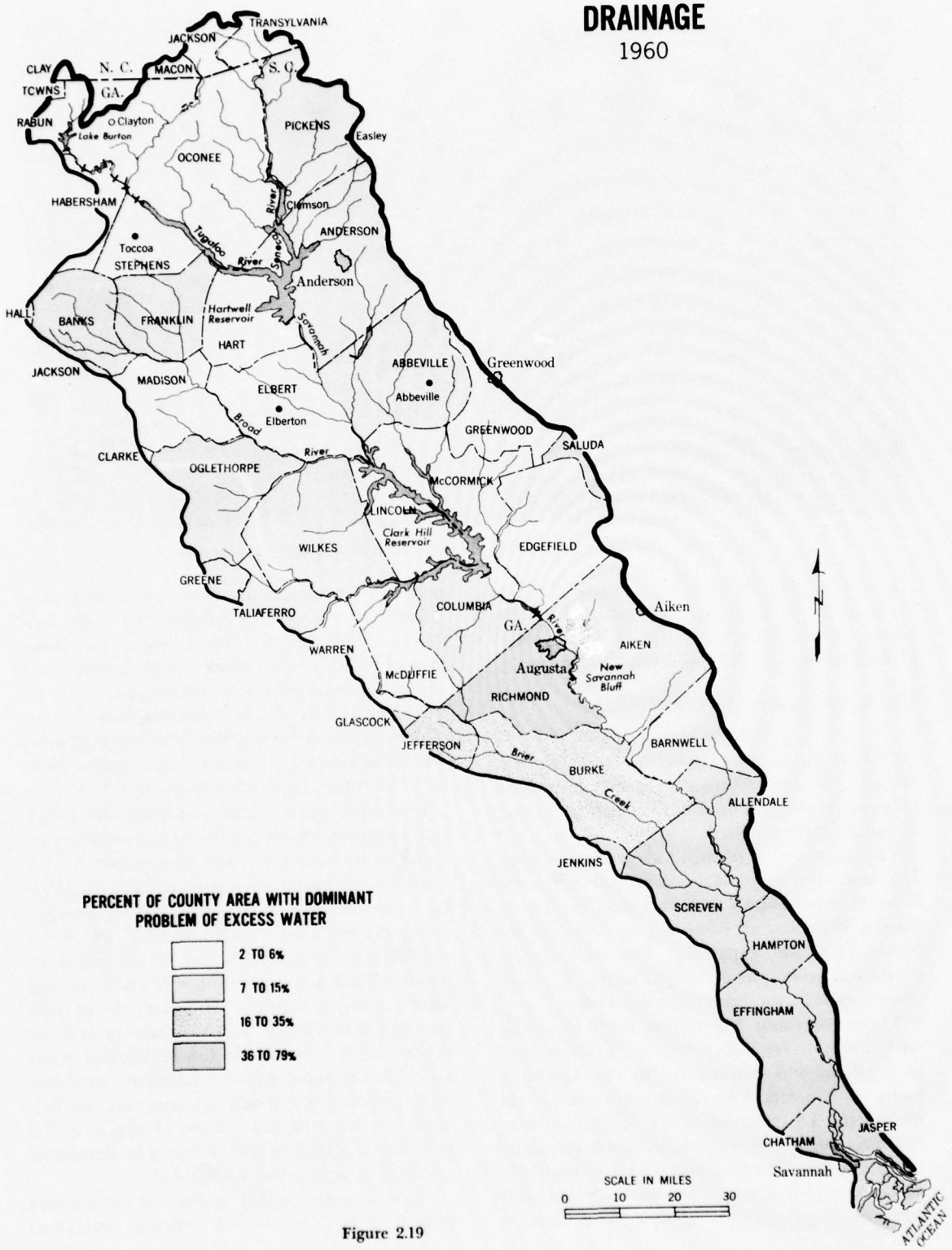

DRAINAGE
1960
TRANSYLVANIA
JACKSON
CLAY
N. C.
MACON
S. C.
TOWNS
GA.
RABUN
Clayton
Lake Burton
PICKENS
Easley
OCONEE
HABERSHAM
Clemson
Tugaloo River
Toccoa
STEPHENS
Seneca River
ANDERSON
Anderson
HALL
BANKS
FRANKLIN
Hartwell Reservoir
Savannah
HART
JACKSON
MADISON
ELBERT
Elberton
ABBEVILLE
Abbeville
Greenwood
GREENWOOD
SALUDA
Broad River
CLARKE
OGLETHORPE
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
GREENE
TALIAFERRO
COLUMBIA
Aiken
GA.
AIKEN
WARREN
Augusta
New Savannah Bluff
McDUFFIE
RICHMOND
GLASCOCK
JEFFERSON
BARNWELL
Brier Creek
BURKE
ALLENDALE
JENKINS
SCREVEN
HAMPTON
EFFINGHAM
CHATHAM
JASPER
Savannah
ATLANTIC OCEAN
N
SCALE IN MILES
0
10
20
30
PERCENT OF COUNTY AREA WITH DOMINANT PROBLEM OF EXCESS WATER
2 TO 6%
7 TO 15%
16 TO 35%
36 TO 79%

Figure 2.19

Figure 2.20 *Drainage Provides Extensive Opportunities for Land Improvement.*

Five of the facilities were in the Upper Coastal Plain in South Carolina; two facilities in the Lower Coastal Plain, two in the Upper Coastal Plain, and four in the Piedmont in Georgia.

Needs and Opportunities

Irrigation

Crop yields vary from year to year with irrigation. Costs and returns vary greatly from farm to farm. Farm potential for irrigation should be individually analyzed.

The combination of such factors as soils, farm and field size, crop adaptation, and the proximity to water supply indicates that the Lower Coastal Plain has an undeveloped potential for future irrigation expansion. Extensive opportunity for expansion of irrigation pits as water sources exist in the Lower Coastal Plain.

There are about 3.4 million acres of potentially irrigable land, including 1.3 million acres of cropland and pastureland in the Savannah basin. Of the total, about 1.9 million acres are in Georgia, 1.4 million acres in South Carolina, and less than 14,000 acres are in North Carolina. Based on the 1954-60 trend and the available water supply, it appears that more than 46,000 acres of crop, pasture, orchard, and nursery might be irrigated by 1975, and more than 102,000 acres might be irrigated by 2000. Irrigation might be established where the incremental return to the farmer would at least equal the incremental operation, maintenance, and replacements costs without consideration of secondary effects or intangibles. The irrigated acres would require a high level of conservation treatment for protection and efficient use.

Generally, ample water is available for irrigation purposes. Water requirements could be provided by wells, streams, and farm ponds.

Studies of upstream watershed areas indicate that some of them have a potential for development of irrigation water supplies on about 123,000 acres by project action. Of the potential, about 47,000 acres are in South Carolina and 76,000 acres in Georgia. However, no projects for irrigation water supply alone would be needed in the foreseeable future. Further study and investigations will be necessary to determine conclusively if the projects are feasible under future conditions. Most of the potential projects involving irrigation could be developed by small groups or by individuals.

Improvements needed in some of the existing irrigation facilities include efficient irrigation

practices and improved equipment. Dissemination of more information is needed so that landowners who irrigate may obtain the facts required for proper use of irrigation water.

Drainage

As of 1959, some 1.0 million acres of land had a dominant problem of excess water. Of the total, Georgia has about 600,000 acres, South Carolina 400,000 acres, and North Carolina has less than 5,000 acres with excess water problems. Since only 46,000 acres of the 1 million acres of land with excess water problems have already been drained, the opportunity remains for treating about 1 million acres. However, the need for maximum production is not expected prior to 2000. Of this acreage, about 400,000 acres can be drained by individual farm drainage systems and 600,000 acres would require project facilities.

In estimating the agricultural production which could be realized from the basin in the year 2000 without new drainage and other resource development, consideration was given to land which might be withdrawn from agricultural use for other uses. Nonagricultural uses of land, amounting to about 523,000 acres in 1960 are projected to be about 650,000 acres, an 8-percent increase by 2000; a similar trend is expected throughout the Nation. The reduced land available for food and fiber production must meet the increased needs to the year 2000. There are, therefore, opportunities for additional drainage to help meet the projected production needs as well as to increase per capita income. A significant part of the projected increased need for 5.5 million bushels of corn and 6.5 million pounds of cotton from 1960 to 2000, can be provided through drainage.

In 1958, more than 160,000 acres of the cropland had a dominant problem of unfavorable soil condition such as low fertility, stoniness, shallowness to rock or some other condition that limits root development, or low moisture holding capacity. By 2000 only 101,000 acres of such land will probably be used for cropland. The loss of the above 59,000 acres could be offset by draining wetlands better suited for crop production and for facilitating soil conserving adjustments in land use elsewhere. Such land use conversions and improved drainage will provide opportunities for increasing income, replacing marginal farmland, and increasing the efficiency of farm operations.

Few tile drains have been installed, but if more intensive use is made of the wetland soils, additional opportunities exist for the installation of tile drains on some soil types.

Pump-type drainage has a potential where gravity outlets are not available in the Lower Coastal Plain.

About 32,000 acres of wetland included in the land-use classification of "other" were excluded from the studies since such land will remain primarily in nonagricultural use.

Alleviation of the excess water problem on agricultural land presents an opportunity to facilitate farm operations, restore or convert water problem areas to more favorable use for wildlife, cropland or other purposes, and to increase production. If maximum production becomes necessary, drainage facilities for the removal of excess water could ultimately be provided for most of the wetland not previously drained.

Many of the facilities required to effect the drainage consist of measures now in use, with expected improvements resulting from additional experience and dissemination of research results.

Means of Meeting the Needs

Irrigation

No large irrigation projects are expected in the foreseeable future. Indications are that irrigation will be carried out on an individual farm basis. Most of the irrigated acreage will consist of scattered or isolated tracts throughout the upland and along minor tributaries. Development of the full irrigation potential will depend upon future national, regional, and local needs; changing economic conditions; and the decisions and desires of potential beneficiaries.

The continuation of the technical, loan, and cost-sharing assistance available through the programs of the U. S. Department of Agriculture could expedite the realization of full benefits of irrigation developments and water management principles and techniques.

Accelerated educational services could be provided as technological advances in equipment and irrigation practices and research findings are known.

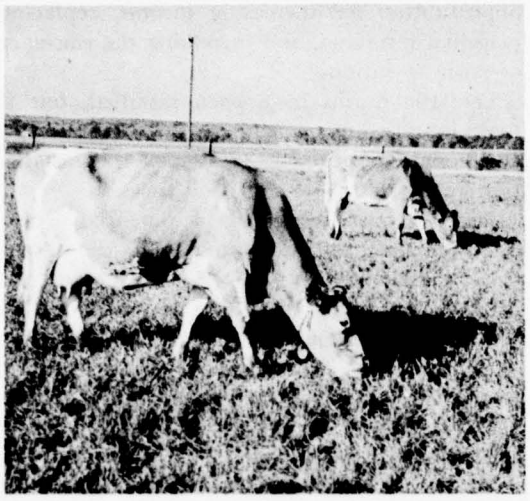


Figure 2.21 *Irrigation Improves Grazing Conditions and Protects the Soil by Maintaining Adequate Vegetative Cover.*

To facilitate irrigation development, further study should be made on water requirements and consumptive use of water by agricultural crops; the moisture extraction pattern within the crop root zone; water intake rates; hydraulic characteristics of surface methods of irrigation; available waterholding capacities in soil profiles; and on climatological records correlated with soil-moisture-holding capacities and plant use.

There appears to be no urgent need to promote large-scale irrigation project development in the Savannah basin for increased crop production to the year 2000. However, individuals in the future, as in the past, will prefer to undertake irrigation as one of the means of increasing net economic returns from agricultural land use.

Drainage

Development of farm drainage systems and farm-by-farm application of water management principles and techniques should be considered to realize the full benefits of drainage. These programs could result from private initiative and expenditures. Individual farm outlet channels, mains, laterals, and surface field ditches would continue as the major types of systems used. Drainage works required on individual farms, together with minor lateral ditches and other works required to serve a group of farms, are generally considered a non-Federal responsibility within the financial capabilities of local interests. Additional tile mains and laterals and pumping should also be considered in applicable areas.

In addition to the individual drainage systems, multiple-purpose flood prevention and drainage projects could be used to alleviate drainage problems requiring project facilities.

Development of the wetlands will require: (1) Full participation by landowners who have the responsibility of deciding whether or not to drain; (2) provision for adequate outlets for all individual farm and small group drainage; (3) drained land capable of producing food and fiber more efficiently than alternative lands; and (4) markets adequate to handle increased production due to drainage.

Alternative plans for drainage could involve essentially a change in areas drained, or adoption of other technological improvements or other management practices. Full consideration should be given by landowners and governmental interests involved to all alternative uses before detailed plans are decided upon.

The existing technical and financial assistance programs of the U. S. Department of Agriculture could be utilized in the installation of drainage facilities. Accelerated educational services could facilitate drainage developments by making known the results of studies and field trials on drainage practices, methods, equipment, operations, and management. Study findings on drainage problems and solutions could facilitate drainage developments.

SECTION V – HYDROELECTRIC POWER AND INDUSTRIAL DEVELOPMENT

General

Navigation, railroads, highways, abundant water, and low-cost electrical energy have played a vital role in the industrialization of the Savannah basin. Rural, urban, and industrial supplies of electrical energy have been an impetus

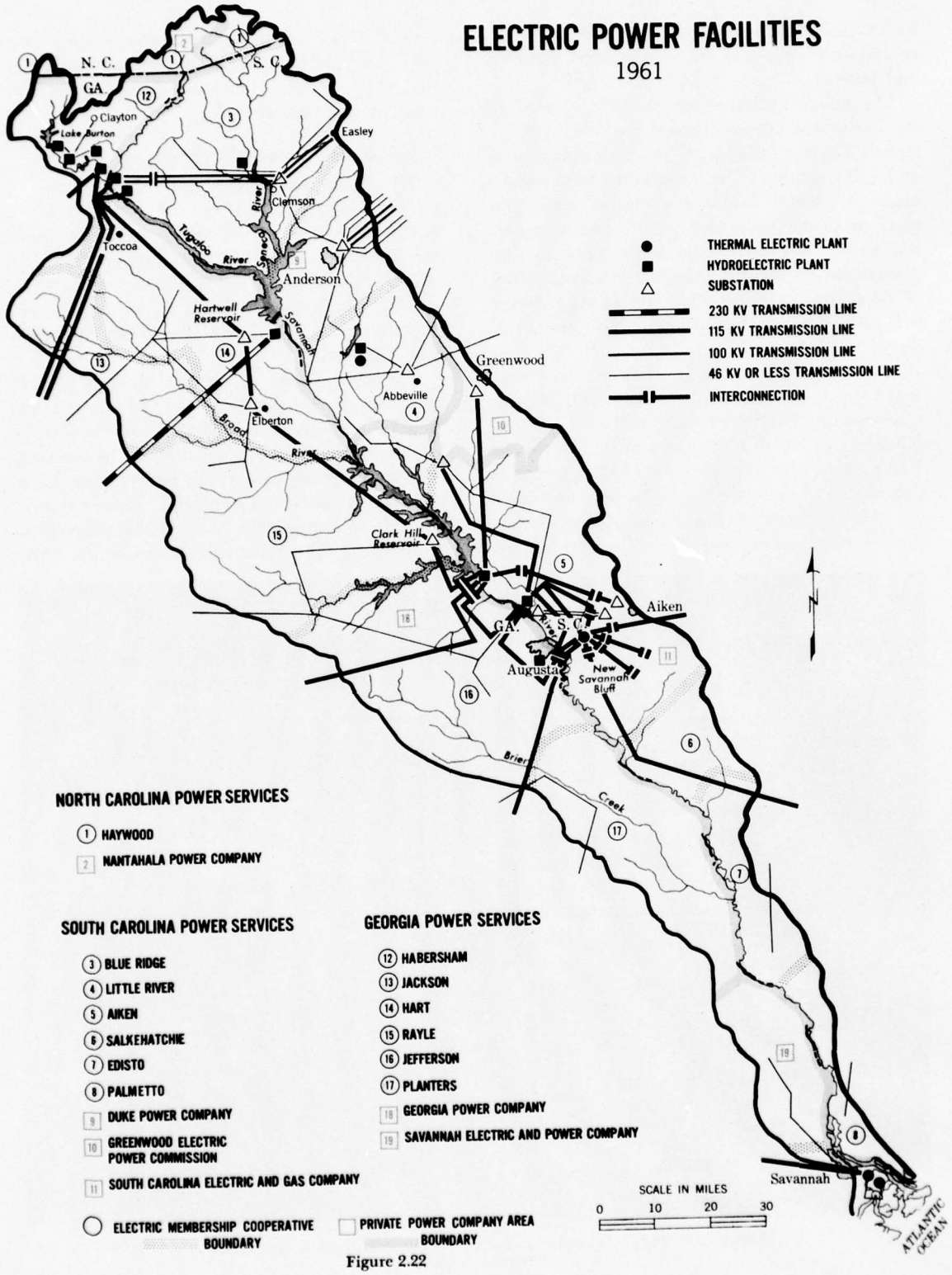

ELECTRIC POWER FACILITIES
1961
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Toccoa
Tugaloo River
Seneca River
Anderson
Hartwell Reservoir
Savannah
Greenwood
Abbeville
Elberton
Broad River
Clark Hill Reservoir
Aiken
Augusta
New Savannah Bluff
Briers Creek
Savannah
ATLANTIC OCEAN
THERMAL ELECTRIC PLANT
HYDROELECTRIC PLANT
SUBSTATION
230 KV TRANSMISSION LINE
115 KV TRANSMISSION LINE
100 KV TRANSMISSION LINE
46 KV OR LESS TRANSMISSION LINE
INTERCONNECTION
N
SCALE IN MILES
0 10 20 30
NORTH CAROLINA POWER SERVICES
1 HAYWOOD
2 NANTAHALA POWER COMPANY
SOUTH CAROLINA POWER SERVICES
3 BLUE RIDGE
4 LITTLE RIVER
5 AIKEN
6 SALKEHATCHIE
7 EDISTO
8 PALMETTO
9 DUKE POWER COMPANY
10 GREENWOOD ELECTRIC POWER COMMISSION
11 SOUTH CAROLINA ELECTRIC AND GAS COMPANY
GEORGIA POWER SERVICES
12 HABERSHAM
13 JACKSON
14 HART
15 RAYLE
16 JEFFERSON
17 PLANTERS
18 GEORGIA POWER COMPANY
19 SAVANNAH ELECTRIC AND POWER COMPANY
ELECTRIC MEMBERSHIP COOPERATIVE BOUNDARY
PRIVATE POWER COMPANY AREA BOUNDARY

Figure 2.22

for extensive changes in the standard of living, communications, and in employment patterns and potentials.

The major industries which have located in the basin area are textile and apparel establishments. These industries are the major employers and will continue to be important to the overall economy. Metal fabrication; stone, clay, and glass products; pulp and paper; and chemical industries will increase in importance as employers during the study period. The availability of adequate water supplies and electric power will be one of the factors considered in the industrial expansion.

Most of the Savannah basin is in two power supply areas as designated by the Federal Power Commission. The upper watershed of the Tallulah River in North Carolina is in the Tennessee Valley Authority market area. Electric power is distributed to ultimate customers by municipalities, electric membership cooperatives, electric power commissions, and utility companies. Although this Section mainly concerns hydroelectric power, other energy sources are included that combine with the hydroelectric energy to meet power requirements.

Existing Facilities and Programs

The Nantahala Power and Light Company markets electricity to the Haywood Electric Membership Cooperative which serves the basin area in North Carolina. This company operates 98,200 kilowatts of hydroelectric capacity in western North Carolina and is tied to and operated as part of the Tennessee Valley Authority power system.

The Duke Power Company markets electric power in the northwestern part of South Carolina in the basin and imports electric energy from its generating sources adjacent to the area. The Greenwood County Electric Power Commission supplies electric energy in an area around the city of Greenwood. Part of the Greenwood service area is in the basin. South of the Duke

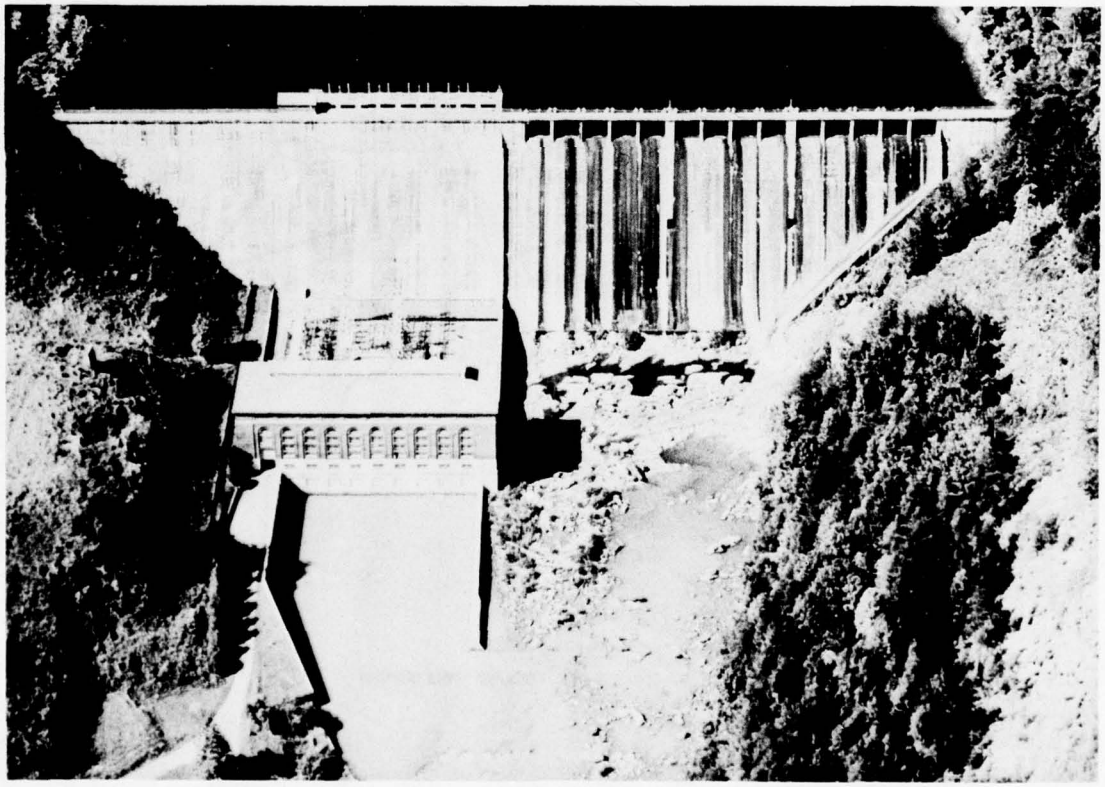


Figure 2.23 *Tugaloo Dam and Powerplant — 110 Million Kilowatt-Hours Are Generated Annually.*

and Greenwood service areas, the South Carolina Electric and Gas Company and the South Carolina Public Service Authority supply electric energy. The South Carolina Public Service Authority furnishes power to the Central Electric Power Cooperative, Inc., which in turn furnishes the requirements of the Aiken, Edisto, and Salkehatchie Electric Cooperatives as shown on Figure 2.22.

The city of Abbeville operates a 2,800-kilowatt capacity hydroelectric plant and a 1,100-kilowatt capacity internal combustion plant. These plants furnish part of the city energy requirements. Greenwood County Electric Power Commission furnishes the remaining requirements.

The Greenwood County Electric Power Commission operates two plants, a 15,000-kilowatt capacity hydroelectric plant and a 16,000-kilowatt capacity thermal-electric plant. In addition, the Greenwood Power Commission receives part of the output of the federally operated Clark Hill hydroelectric plant and buys part of its needs from Duke Power Company.

The South Carolina Electric and Gas Company operates the 18,900-kilowatt Stevens Creek hydroelectric plant. The company distributes the energy generated at the 250,000-kilowatt capacity thermal-electric plant operated by the South Carolina Generating Company near Augusta.

The South Carolina Public Service Authority distributes part of Clark Hill energy supplemented by energy from its system to electric membership cooperatives in the southeastern part of the basin.

The Georgia part of the basin is served by the Georgia Power Company, municipalities, electric membership cooperatives, and Savannah Electric and Power Company. The Georgia Power Company operates six hydroelectric plants on the Tallulah and Tugaloo Rivers with a combined capacity of 166,420 kilowatts. The company transmits energy for the Federal Government and purchases a part of the Clark Hill allocation for its own use.

The Savannah Electric and Power Company

TABLE 2.9

Principal Electric Powerplants—Savannah Basin—1960

Plant	Operator	River	Gross head (ft.)	Capacity (kw.)	Average annual generation (million kw.-hr.)
Hydroelectric					
Enterprise	Graniteville Company	Savannah	30	1,200	6.2
Sibley	Graniteville Company	Savannah	30	2,100	11.0
Stevens Creek	South Carolina Electric and Gas Company	Savannah	29	18,880	90.0
Clark Hill	Corps of Engineers	Savannah	136	282,000	700.0
Yonah	Georgia Power Company	Tugaloo	70	22,500	51.0
Tugaloo	Georgia Power Company	Tugaloo	144	45,000	110.0
Tallulah Falls	Georgia Power Company	Tallulah	603	72,000	170.0
Terrora	Georgia Power Company	Tallulah	189	16,000	46.0
Nacoochee	Georgia Power Company	Tallulah	61	4,800	14.0
Burton	Georgia Power Company	Tallulah	114	6,120	20.9
Abbeville	Abbeville	Rocky	80	2,800	9.2
Courtenay Mill	Abney Mill	Little	25	1,200	2.4
Hartwell*	Corps of Engineers	Savannah	185	330,000	453.0
				804,600	
Steam-electric					
Riverside	Savannah Electric & Power Company			105,500	392.8
Port Wentworth	Savannah Electric & Power Company			44,000	299.0
Urquhart	South Carolina Generating Company			250,000	1,177.8
				399,500	

* Under construction in 1960.

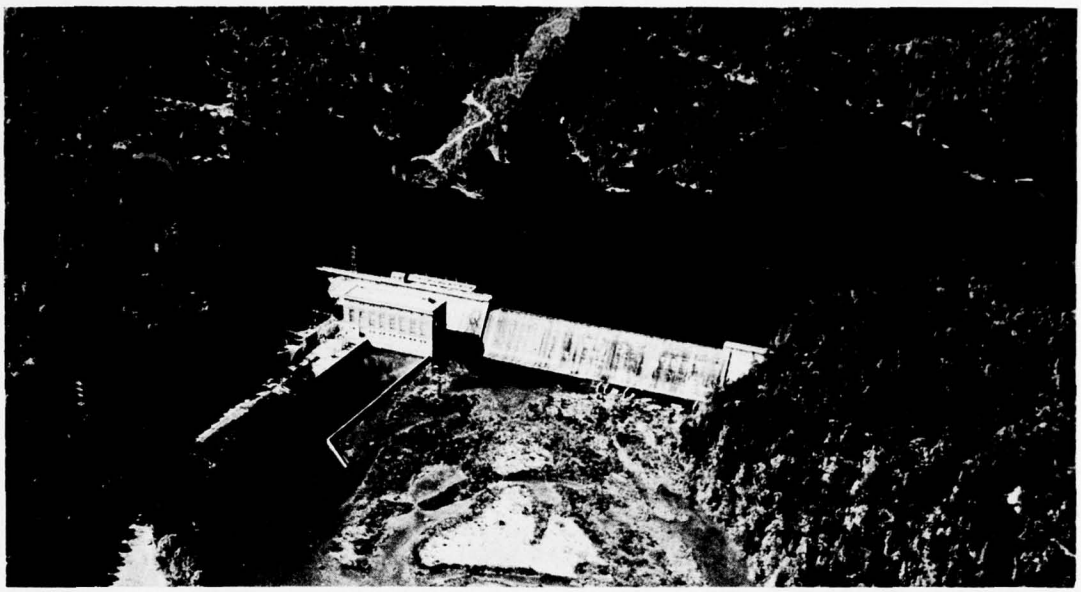


Figure 2.24 *The Powerplant of Yonah Dam, Tugaloo River, Is Used Primarily for Peaking Purposes.*

operates two thermal-electric plants with a combined capacity of 150,000 kilowatts. The company serves the area in and around the city of Savannah.

Several industries in South Carolina and Georgia operate electric generating facilities for their own use. The total capacity of these plants is about 68,000 kilowatts. The industrial plants are tied into the major utility company systems serving in the area.

Within the service areas of the various utility companies, distribution to the ultimate customer in most rural and some suburban areas is by electric membership cooperatives. Distribution in urban and most suburban areas is by the municipalities and utility companies. Among power companies and power-producing agencies, electric energy is exchanged over high-voltage transmission tielines of 100 to 230 kilovolts. In case of emergency, or to meet normal loads, electric energy is readily transmitted from one area to another.

The Atomic Energy Commission at the Savannah River plant operates 156,500 kilowatts of thermal-electric generating capacity and purchases an additional 95,000 kilowatts of capacity. The Savannah River plant of the Atomic Energy Commission is discussed separately at the end of this Section.

Needs and Opportunities

In order to establish future electric energy requirements, an analysis of historical load growth was made as to type of customer and as to use per customer. Based on these analyses, projected demands were estimated for 1975 and 2000, at the same time recognizing the projected population growth and shifts, extensive use of electrical appliances, changes in agricultural patterns, changes in industrial and commercial activities, and saturation of electric service. Rapid electrical load growth has occurred in several urban areas which are commercial and industrial centers of the basin. This growth can be expected to continue until at least 1975. For a long-range forecast, load saturation, especially in residential loads, must be recognized. Commercial establishments will tend to level off as installation of improved lighting, air conditioning, and self-service equipment reaches a high level of saturation. The use of labor-saving equipment, including automation and improved manufacturing methods, will continue the growth of the industrial load.

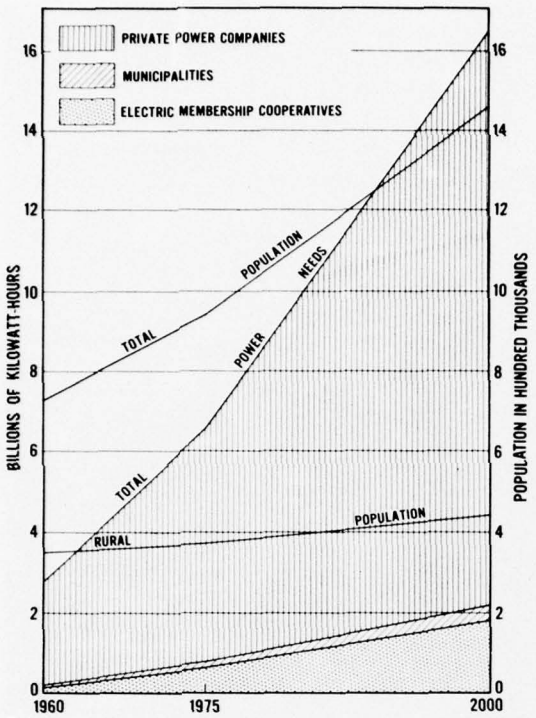


Figure 2.25 *Power Needs and Population.*

The electric energy requirements within the basin, excluding the Savannah River plant of the Atomic Energy Commission, are estimated to increase from 2.6 billion kilowatt-hours in 1959 to at least 6.5 billion kilowatt-hours by 1975 and to 16.4 billion kilowatt-hours by 2000. The demands, based on load factors of 59.6 percent for 1960, 62.4 percent for 1975, and 62.7 percent for 2000, are 504,500 kilowatts, 1,180,000 kilowatts, and 2,983,000 kilowatts, respectively.

Means of Meeting the Needs

Hartwell powerplant is under construction on Savannah River by the Corps of Engineers. The gross head of this plant will be 185 feet. The first unit of 66,000 kilowatts was operated initially in April 1962. The fourth 66,000-kilowatt unit is scheduled for operation in January 1963. There is an additional penstock and an open bay in the powerhouse for a fifth unit. The average annual generation will be about 450 million kilowatt-hours.

The power head between the Clark Hill Reservoir and the Hartwell Dam could be developed by a project at the Trotters Shoals site. This site is an alternative to the previously proposed Goat

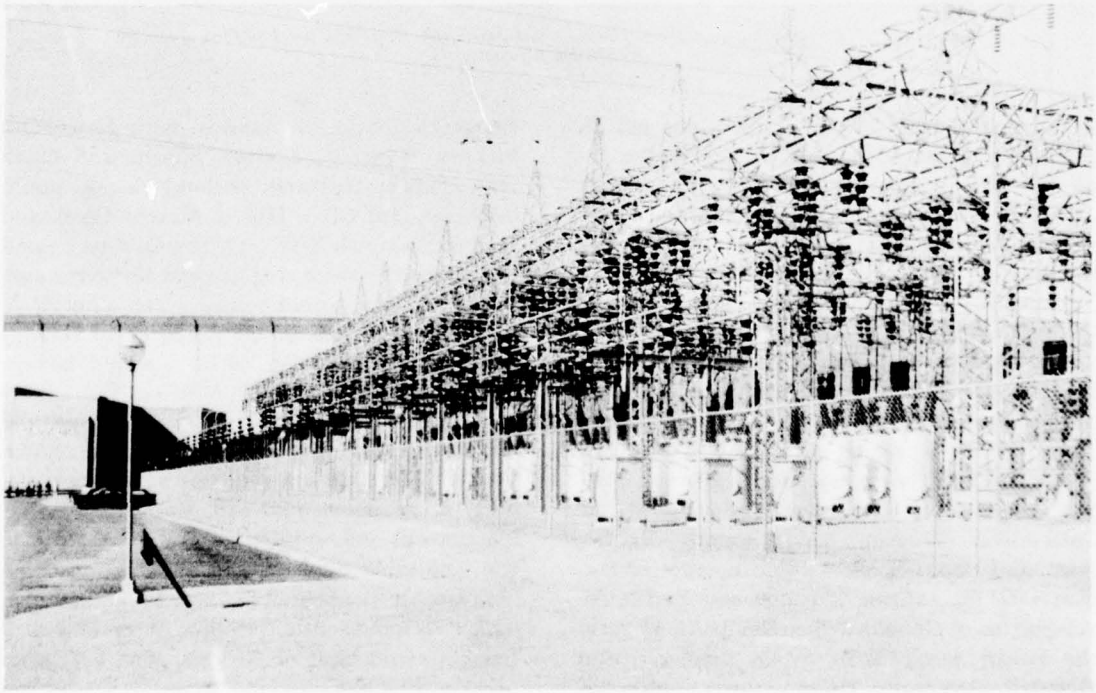


Figure 2.26 *Clark Hill Switchyard Permits Electricity to be Transmitted to Many Areas.*

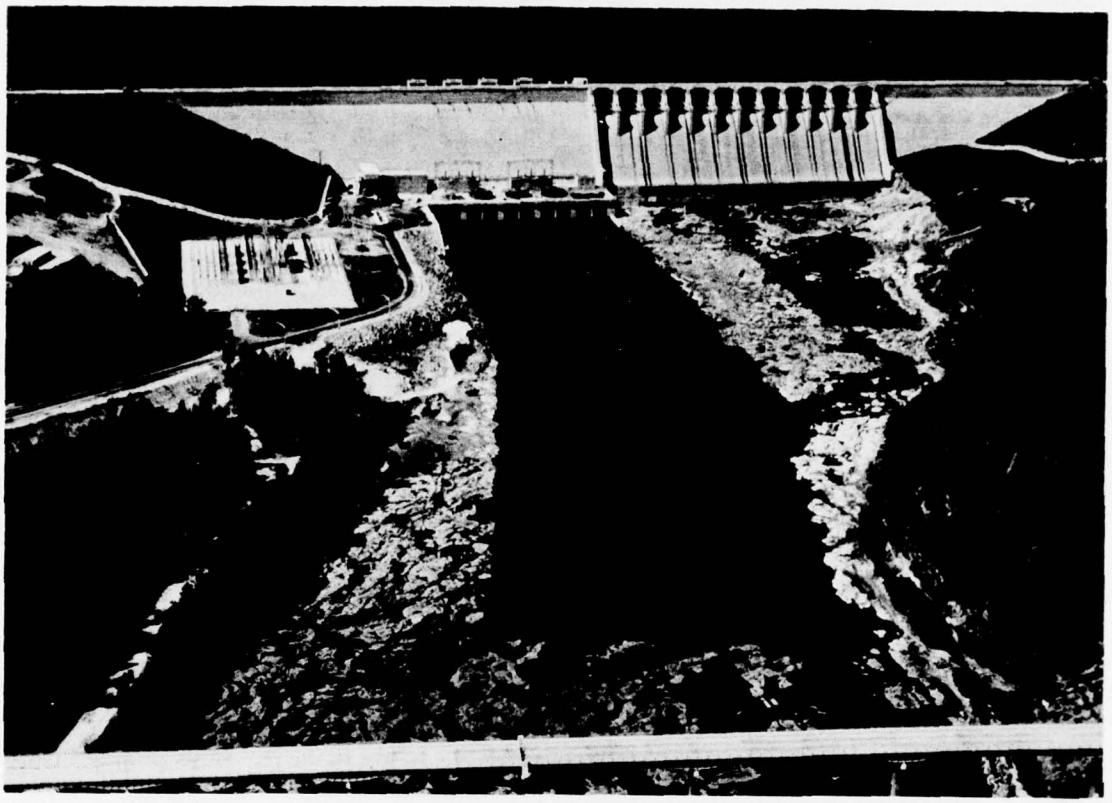


Figure 2.27 *Hartwell Dam and Powerplant on the Savannah River Has an Installed Capacity of 330,000 Kilowatts.*

Island and Carters Island or the Goat Island-Middleton Shoals sites. Preliminary studies indicate that pump storage would be economically feasible at the Trotters Shoals site at such time as load requirements justify such additions to the project.

Operation of the potential projects would involve coordination of the water supply, power, and related purposes, since all units involve releasing of water from one reservoir down to another one. The upper Chattooga River project is a high head plant which has been considered but is not included in the comprehensive plan. The other Chattooga River units – War Woman, Sand Bottom, Rogues Ford, and Camp Creek – would operate in tandem with the existing Tugaloo and Yonah developments of Georgia Power Company. In turn, the Yonah development would discharge into Hartwell Reservoir. Horsepasture would discharge to Jocassee in tandem with Newry-Old Pickens, Hartwell, Trotters Shoals, and Clark Hill. Tallow Hill and Anthony Shoals would discharge into Clark Hill to Stevens Creek and then to Savannah River. There would be a small loss of head between Augusta and Burtons Landing. The latter would release water directly to Stokes Bluff, which would discharge to Gaffney Landing, where 20 feet of head would be lost to the Atlantic Ocean.

Basinwide coordinated operation of all the units with the relatively large storage regulation will decrease drawdowns and increase stability of operations and will benefit power, recreation, fish and wildlife, navigation, flood control, and other uses.

Savannah basin exports power to market areas which include South Carolina, most of North Carolina, and most of Georgia. The hydroelectric power potentials in Savannah basin can

meet only a small part of these market area needs.

The Duke Power Company has plans to construct a steam-electric powerplant on the Savannah River at Middleton Shoals downstream from Hartwell Dam. The planned ultimate capacity is 2 million kilowatts. The proposed Trotters Shoals project would be compatible with construction of this plant.

Construction of the developments herein discussed would require construction of high-voltage transmission lines from the generating sources to load centers and ties to existing transmission grids. As the electric load grows, additional transmission and distribution lines would be constructed. Substations would be enlarged and new stations built to meet the shifting load patterns. Transmission and distribution of energy from source to user will pose no unusual problems.

In addition to Clark Hill, Hartwell, and Trotters Shoals projects, seven other projects were approved by the Flood Control Act of 1944. These projects are Anthony Shoals and Tallow Hill on the Broad River; Newry-Old Pickens on Little and Keowee Rivers; and four integrated units on the Chattooga River – Camp Creek, Rogues Ford, Sand Bottom, and War Woman. There are several other potential hydropower sites on the upper tributaries of the Keowee and Chattooga Rivers. Of the several developments and combinations of projects investigated, at least two in the Keowee River basin and one in the Chattooga River basin warrant additional study. The Jocassee site at the headwaters of the Newry-Old Pickens reservoir would develop a gross head of 300 feet and be able to generate an average of 77.1 million kilowatt-hours annually in a 150,000 kilowatt-capacity powerplant. With Newry-Old Pickens reservoir, additional capacity could be installed through pump storage. The Horsepasture project on Horsepasture River would develop a gross head of 1,860 feet above the Jocassee reservoir. The Horsepasture powerplant would be able to generate an average of 88.5 million kilowatt-hours annually in a 58,000-kilowatt capacity powerplant. A project on Whitewater River at the lower Whitewater Falls would develop a gross head of 900 feet and be able to produce an average of 28.2 million kilowatt-hours annually in a 22,000-kilowatt capacity powerplant. Another unit at upper Whitewater Falls could develop a gross head of 800 feet and

TABLE 2.10

Potential Hydroelectric Powerplants

(1961 data)

Project	River	Normal pool elevation (ft.)	Power storage (acre-ft.)	Gross head (ft.)	Installed capacity (kw.)	Average annual generation (million kw.-hr.)
1. Hartwell[1]	Savannah	660	1,427,000	185	330,000	453.0
2. Horsepasture	Horsepasture	2,960	11,400	1,860	58,000	88.5
3. Upper Whitewater	Whitewater	2,800	5,000	800	12,000	19.6
4. Lower Whitewater	Whitewater	2,000	5,800	900	22,000	28.2
5. Jocassee	Keowee	1,100	182,000	300	150,000	77.1
6. Newry-Old Pickens	Little Keowee	800	542,000	140	150,000	93.8
7. Upper Chattooga	Chattooga	2,600	12,000	960	38,000	45.3
8. War Woman	Chattooga	1,640	87,500	182	80,000	50.3
9. Sand Bottom	Chattooga	1,458	Pondage	141	66,000	42.8
10. Rogues Ford	Chattooga	1,317	5,300	246	120,000	77.5
11. Camp Creek	Chattooga	1,071	5,000	180	100,000	75.0
12. Tallow Hill	Broad	610	560,000	190	172,000	113.0
13. Anthony Shoals	Broad	400	113,000	70	100,000	61.5
14. Trotters Shoals	Savannah	[2]475	63,000	145	310,000	471.4
15. Burtons Landing	Savannah	103	90,000	48	100,000	345.0
16. Stokes Bluff	Savannah	55	110,000	35	60,000	197.0
			3,219,000	6,382	1,868,000	2,239.0

NOTES: [1] Dam completed, powerplant under construction.
[2] Alternative elevation of 480 feet should be studied.

would have an installed capacity of 12,000 kilowatts, which would produce about 19.6 million kilowatt-hours annually. One development on the Chattooga River, the Chattooga project, upstream from the War Woman reservoir would develop a gross head of 960 feet and be able to produce an average of 45.3 million kilowatt-hours annually in a 38,500-kilowatt capacity powerplant.

Two potential sites, Stokes Bluff and Burtons Landing, could develop 160,000 kilowatts of capacity, generate about 542 million kilowatt-hours of energy annually, and develop 83 feet of head between New Savannah Bluff Lock and Dam and tidewater above Savannah.

Gross static head of the potential projects would total 6,382 feet, and the installed capacity would amount to 1,868,000 kilowatts. Production would average 2,239 million kilowatt-hours annually and 3,219,000 acre-feet of usable power storage in 15 reservoirs would be provided.

Pump Storage

The feasibility of pump storage depends on the availability of off-peak energy and on the physical advantages of each site. The annual load factor of electric usage is expected to increase in the future. This will tend to decrease the availability of off-peak energy that comes from steam-electric generation, which is in excess of base-load requirements.

It is estimated that about 290,000 kilowatts of pump storage capacity could be developed in connection with the Trotters Shoals project. Preliminary studies indicate that about 80,000 kilowatts of pump storage capacity could be installed in the Jocassee project. The drawdown of the Newry-Old Pickens project would be decreased from about 40 feet to 20 feet. Pump storage capacity could be installed in the four lower projects on the Chattooga River and possibly at other sites.

Atomic Energy Commission Savannah River Plant

The Savannah River plant of the Atomic Energy Commission was established in 1950 on 200,831 acres of land in Aiken, Allendale, and Barnwell Counties, South Carolina. The primary purpose of the Savannah River plant is the production of plutonium and other special nuclear materials.

In 2 years, about 6,000 persons were relocated outside the plant boundaries. At the time the area was acquired, about 33 percent of the acreage was open land, including pastureland and cropland, and 66 percent was woods, including cutover woodland.

During construction, the peak work force totaled 38,582 people. About 7,900 people are employed under present plant operations. Slightly over 200 of these work for the Atomic Energy Commission. The rest, 6,730 in operations and 970 in construction, are employed by the operating contractor, the E. I. du Pont de Nemours and Company. About 35 percent of the employees live in Aiken, South Carolina, and 25 percent live in North Augusta, South Carolina, and Augusta, Georgia.

To ease the impact of the Savannah River plant and to a lesser extent the military installations in the area, the Government has made grants and loans to many of the political and administrative subdivisions. These grants and loans to counties immediately adjoining the plant site totaled $23,354,000 as of July 1, 1962. The monies have been used for school construction, operation, and maintenance; for water and sewage systems; for police and fire protection; and for access-road construction.

The total expenditures for the plant through December 31, 1961, have been in excess of $2,020 million. This includes $409 million in wages and salaries. The base construction including land acquisition has amounted to about $1,237 million. The current average annual operating expenditure amounts to about $90 million, about half of which is employee wages.

To furnish power for pumping and processing and to furnish steam for processing, the plant operates 156,500 kilowatts, nameplate capacity, of steam-electric capacity in five installations. The plant has a contract with the South Carolina Electric and Gas Company for an additional 95,000 kilowatts. In 1961 the plant used about 1.9 billion kilowatt-hours of which about 1.1 billion kilowatt-hours were purchased.

The plant, in addition to its defense activities, is actively engaged in research on atomic products for peaceful purposes. These areas of research include studies on the economic use of atomic energy for production of electric energy, irradiation of cobalt for treatment of cancer and

for medical research, sale and lease of heavy water for use in power reactors, supplying uranium metal to colleges and universities for educational purposes, furnishing on-the-job training for nuclear science students, preserving foods by irradiation, and studies of atomic power sources for space vehicles.

Atomic wastes are either stored in underground tanks or buried. The Atomic Energy Commission maintains a continuing program of monitoring the air, surface waters, and underground waters to make sure that the radioactive materials will not create a health problem in the surrounding area.

In the areas not utilized by the plant operations, a forest management program has been initiated by the Atomic Energy Commission, under arrangements with the U. S. Forest Service which supervises the pine plantations consisting of around 80 million seedlings planted since 1952. This is to control erosion, noxious weeds, and grasses; to reduce potential fire hazards; to improve the existing timber stands; and to develop a timber management and sales program.

Impacts – The initial impacts of moving people off the land and the influx and outflow of a large construction force were enormous. A stabilized operating labor force is now established. Operations of the plant are not expected to increase in the foreseeable future with the current number of production employees expected to be maintained. The economy of the communities and cities in the area adjacent to the plant will continue to prosper. Much of the activity will be in services and trades, oriented to meet the needs of the labor force. Industry, particularly nuclear and electronically oriented, will be attracted to the area because of the research facilities, the nuclear materials, and nuclear waste disposal facilities available at the Savannah River plant. High standards set for technical workers and training facilities established in the area for meeting those standards will also attract industry.

SECTION VI – SOIL CONSERVATION AND UTILIZATION

General

Soil conservation and utilization consists of both enduring and recurring practices to protect the basic land resource and to provide a stable base for permanent agriculture. Enduring conservation practices include critical area planting, land smoothing, terracing, pond construction, grassed waterways, and various types of more or less permanent plantings. Recurring conservation practices include conservation cropping systems, contour farming, and cover cropping. This Section is largely confined to a discussion of soil conservation and utilization of cropland and pastureland.

Until the 1930's, agriculture in the Savannah basin consisted largely of a row-crop economy. By the mid-1930's erosion had damaged much of the cropland. Since then, interest in soil conservation measures has grown steadily. As a result, considerable progress has been made in conservation of cropland and pastureland. Combined Federal, State, and local agricultural efforts have aided this progress. Conversion of erodible cropland to grassland and woodland has been most rapid in the last two decades. This conversion has been aided by incentive payments to farm operators, by comparatively high livestock and wood-products values, and by technological improvements in agricultural practices and measures. However, the use of land-treatment practices has not been rapid enough to overcome or minimize past damages and, at the same time, protect the present basic land resource. Protection of the land resource is needed in the interest of present day agriculture and as a step in developing the land to meet the expected growing demands for agricultural products.

Although agricultural land has many classifications, the Land Capability Classification of the U. S. Department of Agriculture is used to illustrate the type and degree of land problems. This capability classification is an interpretive grouping of soils for agricultural purposes. The groupings are based on a physical inventory of the soil characteristics, the slope, and the degree of erosion. Soils in each class have limitations and management problems of about the same degree.

Soils in Classes I, II, III, and IV are suitable for cultivated crops, pasture, range, woodland,

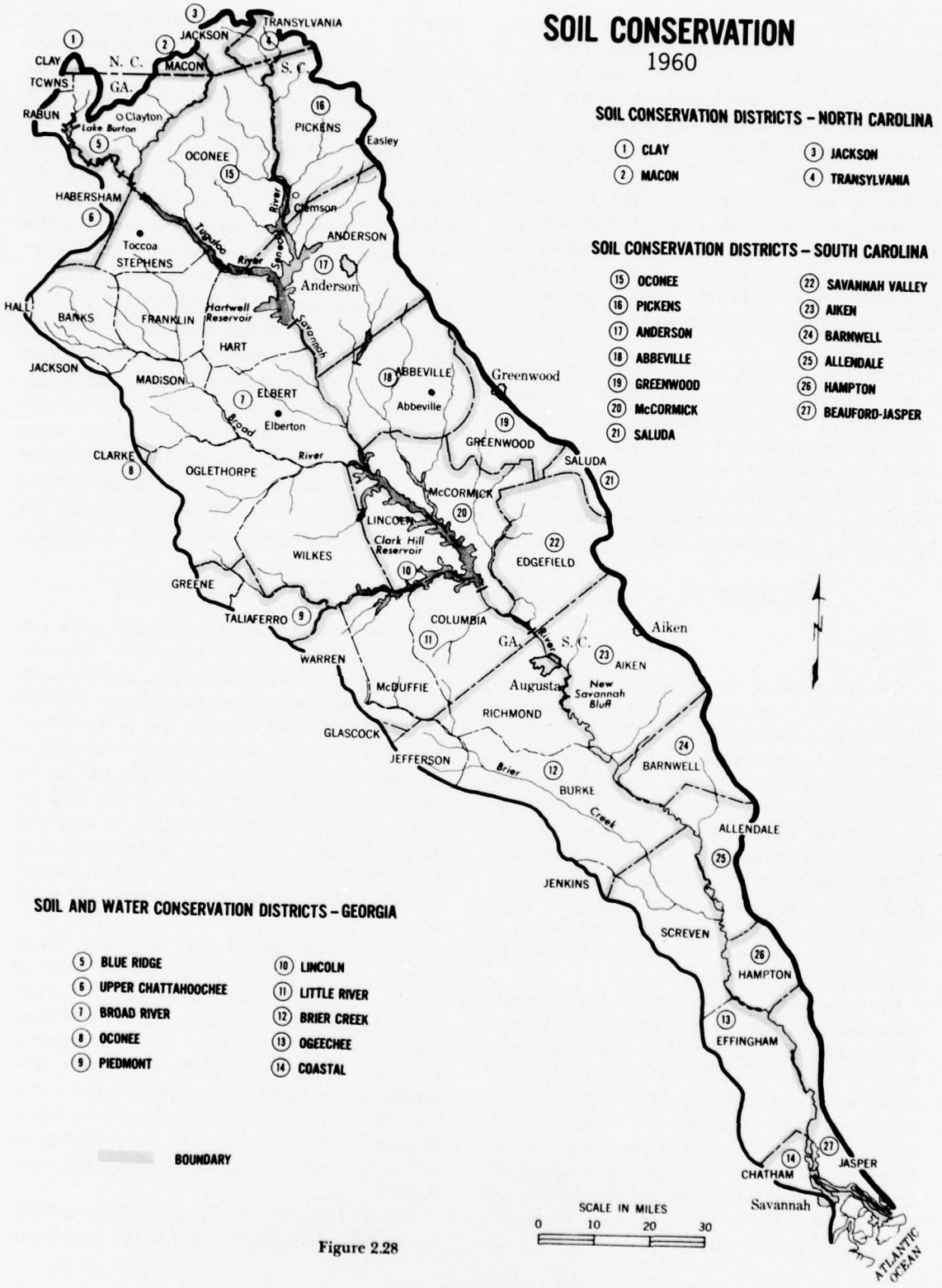

SOIL CONSERVATION
1960
SOIL CONSERVATION DISTRICTS – NORTH CAROLINA
1 CLAY
2 MACON
3 JACKSON
4 TRANSYLVANIA
SOIL CONSERVATION DISTRICTS – SOUTH CAROLINA
15 OCONEE
16 PICKENS
17 ANDERSON
18 ABBEVILLE
19 GREENWOOD
20 McCORMICK
21 SALUDA
22 SAVANNAH VALLEY
23 AIKEN
24 BARNWELL
25 ALLENDALE
26 HAMPTON
27 BEAUFORD-JASPER
SOIL AND WATER CONSERVATION DISTRICTS – GEORGIA
5 BLUE RIDGE
6 UPPER CHATTAHOOCHEE
7 BROAD RIVER
8 OCONEE
9 PIEDMONT
10 LINCOLN
11 LITTLE RIVER
12 BRIER CREEK
13 OGEECHEE
14 COASTAL
BOUNDARY
TRANSYLVANIA
JACKSON
CLAY
MACON
N. C.
S. C.
GA.
TOWNS
RABUN
Clayton
Lake Burton
PICKENS
Easley
OCONEE
HABERSHAM
Clemson
Tugaloo River
Toccoa
STEPHENS
ANDERSON
Anderson
Seneca River
HALL
BANKS
FRANKLIN
Hartwell Reservoir
Savannah
HART
JACKSON
MADISON
ELBERT
Elberton
ABBEVILLE
Abbeville
Greenwood
GREENWOOD
Broad River
CLARKE
OGLETHORPE
SALUDA
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
GREENE
TALIAFERRO
COLUMBIA
Aiken
Savannah River
AIKEN
WARREN
McDUFFIE
Augusta
New Savannah Bluff
RICHMOND
GLASCOCK
JEFFERSON
Brier Creek
BARNWELL
BURKE
ALLENDALE
JENKINS
SCREVEN
HAMPTON
EFFINGHAM
CHATHAM
JASPER
Savannah
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
N

Figure 2.28

and wildlife. Class I soils have few limitations that restrict use. Class II soils have some limitations that reduce the choice of plants or require moderate conservation practices. Class III soils have severe limitations that reduce the choice of plants, or require special conservation practices, or both. Class IV soils, if cultivated, require very careful management and are not suitable for row crops year after year.

Classes V, VI, and VII soils normally should be used for pasture or range, for woodland, or for wildlife. Class V soils have little erosion hazard, but they have other limitations that restrict the kind of plants that can be grown and prevent normal tillage of cultivated crops. Class VI soils have severe limitations that make them unsuited for cultivation of crops. Class VII soils have severe limitations that make them unsuited for cultivation of crops and restrict their use largely to grazing, woodland, or wildlife.

Class VIII soils have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

Existing Facilities and Programs

As of January 1958, some 22,300 acres of cropland, about 13,100 acres of pastureland, and about 3,000 acres of other land had no problems

TABLE 2.11

Distribution of Land Use by Land Capability Classification – 1958
(percent)

Land use	Land capability classification								Basin average
	I	II	III	IV	V	VI	VII	VIII	
Cropland	40.3	40.3	23.5	11.9	1.5	4.4	1.2	0.8	16
Pasture	24.1	11.8	10.7	8.4	6.3	4.9	2.1	1.2	8
Forest	30.2	39.4	57.3	73.7	89.6	86.8	79.7	77.4	68
Other	5.4	8.5	8.5	6.0	2.6	3.9	17.0	20.6	8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100

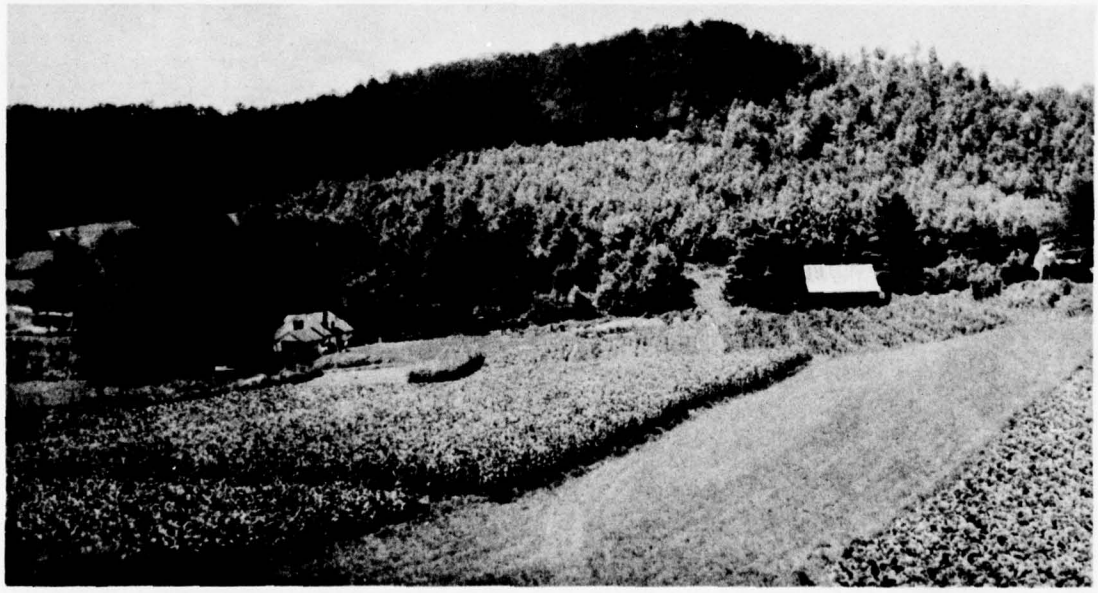


Figure 2.29 *Conservation Measures Practiced in Northern Georgia Protect the Land and Improve Farming Efficiency.*

that limited their use. At the same time, some 827,000 acres of cropland, about 372,500 acres of pastureland, and 243,700 acres of other land had erosion problems. Some 160,700 acres of cropland, 39,000 acres of pastureland, and 70,300 acres of other land had unfavorable soil condition problems.

As of 1960, some 5,400 farm ponds had been constructed in the basin for single or combination usages such as livestock water, irrigation water storage, fire protection, and fishing. They ranged in size from about 2 surface acres to a little over 3.5 surface acres and covered about 11,400 acres of land. About 28 percent of these ponds were used for livestock water, about 3 percent for irrigation water storage, and almost all of the ponds provided some fishing.

Erosion was, and is, a problem in the basin. Much of the land is hilly and many of the soils are easily eroded. Studies by the U. S. Department of Agriculture, Soil Conservation Service, reveal that 3,845,00 acres of land in the basin had an erosion problem. This represented 58 percent of the land area. The soil erosion problems were classified by degrees into five groupings. These groupings and the acreages in each are as follows:

TABLE 2.12
Land Erosion Classification
(1958)

Erosion group	Acres	Percent of total
1	515,000	13.4
2	2,117,000	55.1
3	1,001,000	26.0
4	197,000	5.1
5	15,000	0.4
Total	3,845,000	100.0

Group 1 is the least eroded land and has more than 75 percent of the original topsoil remaining. Group 2 land is moderately eroded and has from 25 to 75 percent of the original topsoil remaining. Group 3 land is severely eroded and has less than 25 percent of the original topsoil but 75 percent or more of the subsoil remaining. Group 4 land is very severely eroded and has lost all of its topsoil but has from 25 to 75 percent of the subsoil remaining. Group 5 land is severely gullied. Erosion groups 1, 2, and 3 soils could deteriorate to erosion groups 4 and 5 soils rather rapidly unless sound soil and water conservation practices are con-

Figure 2.30 *Kudzu Protects Roadbanks from Erosion.*

tinued. Where slopes are steep and topsoil depths are shallow, more extensive plant cover is needed. Generally, forest land and pasture have adequate cover. Adequate cover implies that plant food and soil characteristics are being maintained. An estimated one-fourth of the cropland in the basin has adequate cover.

In 1959, 16 percent of all land in the basin was used as cropland, 8 percent was in pastureland, 68 percent was in woodland, and 8 percent was in all other uses, including cities, roads, and other nonagricultural uses. Some 96 percent of all cropland was in Land Capability Classes I through IV. The remaining cropland was in Land Capability Classes V and VI. About 1 percent of all land in the basin is in Land Capability Class I. The remaining 99 percent of the land has some restrictions in use and normally has some erosion, unfavorable soil, or water problems.

Several major State and Federal soil and water conservation and utilization programs are in operation in the basin. These programs provide cost sharing, credit, technical assistance, and education and information services.

Twenty-seven soil and water conservation districts in the basin are under State charter and coordinate various kinds of State and Federal aid that are available to farmers. Many private organizations and groups make their services available to the farm operators in these districts.

Twenty-nine applications for Federal assistance for developing watershed projects under Public Law 566 had been submitted as of December 1, 1961. Other installations and developments which might affect, or be affected by, soil conservation and utilization programs include defense and other government installations, roads, and urban and industrial areas. Acreages in strip mining and related occupations are not a problem in the basin at present.

Needs and Opportunities

To meet the estimated food and fiber production needs estimated for the basin to the year 2000, overall agricultural production must more than double. The land area of the basin totals 6,591,000 acres. Of this, some 6,068,000 acres were used in the production of agricultural products, including forest products. By the year 2000, an estimated 5,740,000 acres are expected to be available for agricultural production. The 328,000 acres in the basin that will be lost to agriculture will be used for urban and industrial growth, new highways, airports, water development, and to supply other needs of a growing population. To meet the increased goals for agricultural production, there will be a need for some resource development, and for more efficient land use. Essential elements of resource development include improved levels of management, conservation practices, and the adoption of technological improvements.

The Savannah basin agriculture has long been a vital part of its economy. Row-crop acreages in the future may decrease slightly, but livestock numbers and pasture acreages may increase. Some 1,560,000 acres were in cropland and pastureland in 1959. By 2000, 1,815,000 acres are expected to be used as cropland and pastureland. This will increase the needs for conservation treatment of open land. By the year 2000, some 1,132,000 acres of cropland and pastureland, out of 1,815,000 acres in use, would be benefited by conservation treatment. Some 62 percent of all cropland and pastureland are expected to be in need of conservation treatment.

By 2000, it is expected that 554,000 acres of cropland will need treatment because of erosion problems. In addition, 102,000 acres of cropland are expected to need treatment because of an unfavorable soil condition. Some 475,000 acres of pastureland and rangeland are expected to need conservation treatment. Some of the treatments expected to be needed for pastureland by the year 2000 are as follows:

TABLE 2.13

Treatment Needed for Pastureland by 2000 (thousands of acres)

Treatment or control needed	
Establish or reestablish vegetation	296
Improve vegetative cover	142
Reduce overgrazing	152
Protect from fire	19
Erosion problems	40
Rodent control	3
Noxious plant control	103

In some cases, treatment or control measures

may be expected to be applied on the same acreage. Solutions include management of soil, water, livestock, and vegetation. By the year 2000, about 67 percent of the conservation treatment needs on both cropland and pastureland probably will be located in the Piedmont area of the basin.

Additional farm ponds will be needed in the basin to provide a share of the small impoundment fishing demands and provide water for livestock, irrigation, recreation, and a part of the conservation needs of many farms. By 2000, the number of farm ponds should increase to almost 21,600. This would provide some 43,300 acres of additional surface water on farms.

Land conversion, or the shift in type of land use, will be a continuous process in the basin. About 43,700 acres in Land Capability Classes V to VII were planted to crops in 1959. Most of this acreage will likely shift to land more suited to cropping. Other shifts will be needed to fit a particular crop to a specific soil type. Still other shifts will be needed to replace land lost to urban growth and development. By 2000, some 136,000 acres of land now in pasture, woods, and other uses will need to be converted to cropland. Also, 190,600 acres of cropland, woodland, and other land will need to shift to pastureland and rangeland.

Data on woodland needing conservation treatment are included in Section VII, Forest Conservation and Utilization.

Means of Meeting the Needs

The degree and rapidity that conservation measures will be installed will be affected by such factors as changing needs for agricultural products, general economic conditions, and future policies of Federal, State, and local agencies. Comprehensive soil conservation and utilization programs for large areas, with many variations in physical and economic conditions and with many types of ownership and management, cannot be expected to be applied in their entirety. The difference between complete installation of measures on areas needing conservation treatment and the degree of actual installation will entail a corresponding reduction in costs, quantities, and resulting effects.

To accomplish desirable land-use changes and improve the soil resource base to the minimum point where satisfactory levels of production would continue to be attainable will require high level management in connection with selection and application of soil conservation measures.

High-level management on cropland should include the following: (1) Selection and rotation of crops; (2) control of excess water with drainage, vegetated waterways, contour operations, and structures; (3) use of correct amounts of commercial fertilizer, lime, and manure; (4) maintenance of organic matter at high levels; (5) improvement and maintenance of soil workability; (6) conservation of soil materials, plant nutrients, and soil moisture; (7) selection of proper planting and seeding times; (8) use of improved tillage methods; (9) control of weeds, insects, and plant diseases; and (10) use of proper combinations of soil and water conservation practices and measures. These measures include multiple-use farm ponds.

High-level management for pasture and range includes management of water, soil, livestock, and vegetation. Soil and range management includes the application of lime, nitrogen, phosphate, potash, and other nutrients in the proper amounts as determined from the results of soil tests. Nutrients should be applied in sufficient quantities to grow plant cover that will protect the soil and provide livestock forage. The number of livestock and the grazing period should be regulated so that pasture plants can develop vigorously during the growing season. Vegetative management should include proper mowing, the use of chemicals for weed and brush control, and fire protection.

Technical assistance now available involves the development of complete conservation farm plans which include the needed conservation practices and measures required for use of the land within its capability. Assistance required for design, layout, and establishment of practices should continue to be provided. To carry out the soil and water conservation measures to meet the expected changes in land use, the technical assistance expected under the going programs can fulfill the demands for the planning and establishment of the practices necessary for conservation treatment of land according to its needs to year 2000.

Generally it is not practicable to develop project action for land treatment alone. However, land treatment in combination with structural

measures for flood prevention or similar purposes is often attractive to the farmer. Land-treatment measures usually improve hydrologic conditions, reduce sediment production, and assist in the reduction of runoff. Land-treatment measures are normally applied farm by farm under going agricultural and conservation programs. Accelerated land treatment and the stabilization of critical areas should be continued.

Increased emphasis should be given at local levels to financial assistance programs encouraging economically justifiable conservation practices which would provide the most enduring conservation benefits.

SECTION VII – FOREST CONSERVATION AND UTILIZATION

General

The Savannah basin is 68 percent forested and wood production and processing play a vital role in the basin economy. The expected demand for wood products indicates that timber production should be increased about two and one-half times by the year 2000. Gum-naval stores production should be about doubled to meet the expected needs.

Existing Facilities and Programs

Forests occupy 4,508,000 acres of the total 6,591,000 acres in the basin. About 18,000 woodland acres are not capable of producing merchantable timber or have been reserved for other uses and are classed as noncommercial. There are approximately 686,000 acres of forest land in Federal ownership, including 397,000 acres under national forest administration. Public non-Federal forest ownership accounts for another 38,000 acres. The remaining 3,766,000 acres of commercial woodland are in private ownership, including 527,000 acres owned or under long-term lease by pulp and paper companies and 3,239,000 acres about equally divided between farm and private nonfarm, nonindustrial holdings.

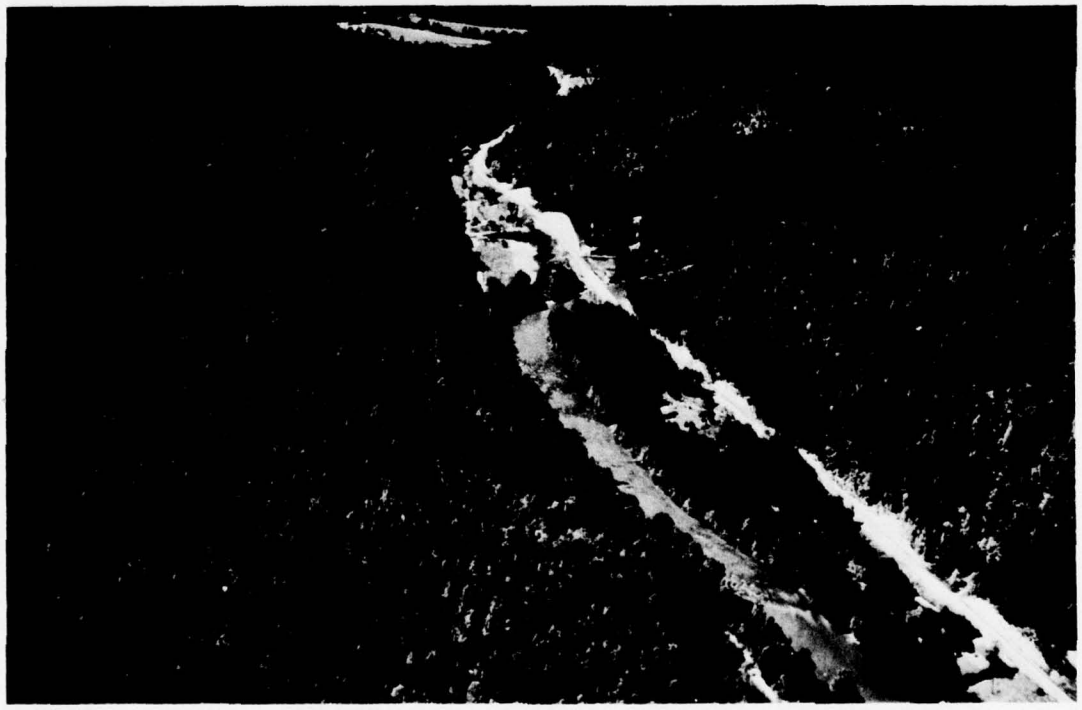


Figure 2.31 *Forests Along Keowee River in Upper Savannah Basin, South Carolina – 68 Percent of the Basin Is Forested.*

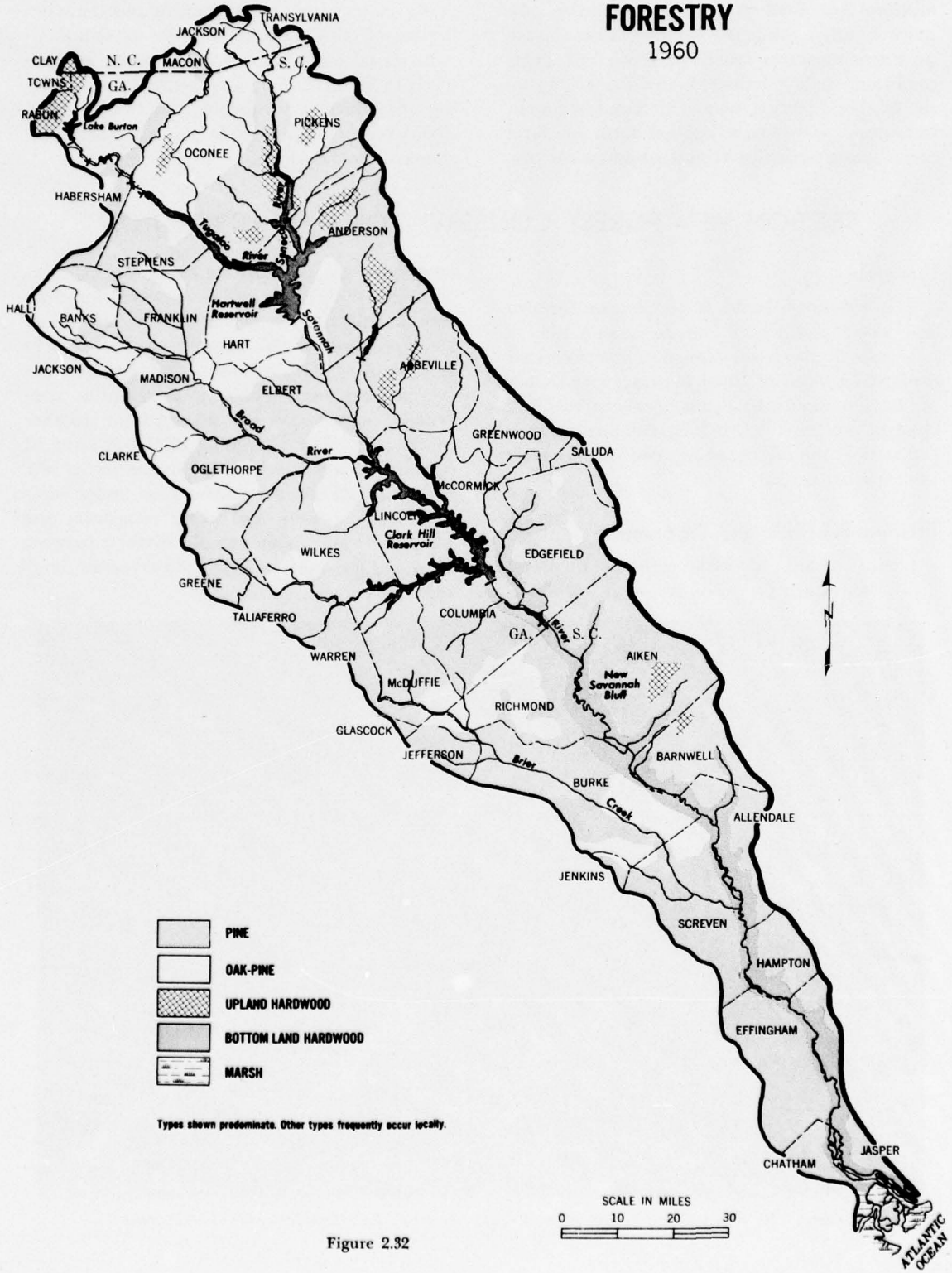

FORESTRY
1960
TRANSYLVANIA
JACKSON
CLAY
N. C.
MACON
S. C.
TOWNS
GA.
RABUN
Lake Burton
PICKENS
OCONEE
HABERSHAM
Tugaloo River
Seneca River
ANDERSON
STEPHENS
Hartwell Reservoir
Savannah
HALL
BANKS
FRANKLIN
HART
ABBEVILLE
JACKSON
MADISON
ELBERT
Broad River
GREENWOOD
SALUDA
CLARKE
OGLETHORPE
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
GREENE
TALIAFERRO
COLUMBIA
GA.
S. C.
Savannah River
AIKEN
WARREN
McDUFFIE
New Savannah Bluff
RICHMOND
GLASCOCK
JEFFERSON
BARNWELL
Brier Creek
BURKE
ALLENDALE
JENKINS
SCREVEN
HAMPTON
EFFINGHAM
CHATHAM
JASPER
ATLANTIC OCEAN
PINE
OAK-PINE
UPLAND HARDWOOD
BOTTOM LAND HARDWOOD
MARSH
Types shown predominate. Other types frequently occur locally.
SCALE IN MILES
0
10
20
30
N

Figure 2.32

Pine forests constitute nearly half of the commercial forest area. Longleaf and slash pine are the principal species in the Coastal Plain, loblolly and shortleaf pine predominate in the Piedmont, and white pine is important in the mountains. Virginia pine is locally important in certain sections of the upper Piedmont.

TABLE 2.14

Commercial Forest Acreage
(thousands of acres)

Forest-type group	North Carolina	South Carolina	Georgia	Total
Pine	14	1,021	1,124	2,159
Upland hardwoods	71	462	657	1,190
Oak-pine	11	154	260	425
Bottom land hardwoods	...	289	427	716
Total	96	1,926	2,468	4,490

Upland hardwoods, the second most important group, account for about one-fourth of the woodland area and consist mostly of upland oaks, hickory, yellow poplar, soft maple, and associated hardwoods. Some pine may be included in these forests but they comprise less than 25 percent of the stand.

Oak-pine and bottom land hardwood types cover the remaining 25 percent of the woodland area in nearly equal proportions. Bottom land hardwoods, mainly black and tupelo gum, cypress, ash, maple, and bottom land oaks, are normally found along major rivers and tributaries. Oak-pine stands are scattered throughout the basin and include the species normally found in the pine and upland hardwood types.

The commercial forest land contains 1,410 million cubic feet of merchantable softwoods and 1,238 million cubic feet of merchantable hardwoods. Some 107 million cubic feet of growing stock were cut in 1959 for all products. Sawlogs were the major product harvested, followed by pulpwood. The remainder of the growing stock that was cut went into miscellaneous bolts, fuelwood, piling, posts, and ties. The value of the wood before harvesting in 1959 was about $10.7 million.

Approximately 260,000 faces of slash and longleaf pine trees were worked for gum-naval stores in 1959. As the supply of wood-naval stores is exhausted, gum will become a more important source for meeting the expected future demand. Anticipating this, all major producers of wood-naval stores have now entered the gum-naval-stores production field.

The production of naval stores from pulpmill byproducts has increased considerably in recent years, but it is now approaching maximum output from existing mills. New mills or additions to existing mills will allow some increase in total production in the future.

There are a number of active programs for improving forestry practices and yields in the basin. Georgia, South Carolina, and North Carolina are accelerating their programs for management assistance, and more woodland owners are being interested in improving their woodland. In addition, both industry and consulting foresters help interested landowners manage and improve their forest lands.

Public and private organizations support research that relates to forest problems and needs of the basin. Included among the organizations are the agricultural experiment stations, the U. S. Forest Service, various State colleges, and universities, State forestry organizations, the wood-using industries, and several foundations. Protection, management, utilization, and genetic studies all receive emphasis.

Major emphasis on educational activities is provided by the State forestry organizations through field personnel and by trained district and central office specialists.

All of the woodland is under organized fire protection except for Glascock and Towns Counties, Georgia. Most of the protected counties in the basin have been protected for more than 10 years. Georgia, South Carolina, and North Carolina forestry organizations have done an effective job in reducing wildfire losses, but are not fully staffed or equipped to cope with critical fire periods.

Major tree planting programs are being carried out in the Georgia and South Carolina portions of the basin. The Georgia Forestry Commission and the South Carolina Commission of Forestry each distributed approximately 31 million tree seedlings in the basin during the 1959-1960 planting season. Other nurseries, mainly those owned by pulp and paper companies,

distributed an additional 20 million seedlings to the basin. An average of 800 trees were planted per acre, although planting prescriptions range from about 600 to 1,200 seedlings per acre. More than 95 percent of the seedlings were either slash or loblolly pine, and these two species were used about equally. Other species planted were white, shortleaf, and longleaf pine, red cedar, Arizona cypress, and yellow poplar.

The Naval Stores Conservation Program is administered by the U. S. Forest Service. The Service provides conservation payments for carrying out certain approved forestry practices on the land. Of the 32 producers in the basin, some 26 are enlisted in the Naval Stores Conservation Program and work 240,000 of the 260,000 faces now treated for naval-stores production.

There have been no recent major epidemics of insects or diseases in the woodlands of the basin but several severe infestations have occurred locally. Field technicians help detect outbreaks and report them for appropriate action.

Needs and Opportunities

The forests, if reasonably managed, can produce the estimated production requirements for wood and gum-naval stores. It is estimated that by the year 2000 approximately 252 million cubic feet of growing stock will need to be cut for processing into wood products.

Gum-naval stores will eventually replace wood-naval stores and production will have to be doubled to obtain the needed output of naval stores products for the year 2000. Enough slash pine and longleaf pine trees of a suitable size will be available for efficient production of this amount.

The woodland farm acreage is expected to decline, while nonfarm acreage is expected to increase. The overall effect will be a 13-percent decline in total acreage.

TABLE 2.15

Forest Production and Value (thousands)

Item	Unit	1959	1975	2000
Growing stock, annual cut	cu.ft.	107,000	161,000	252,000
Stumpage value	dollar*	10,700	16,100	25,200
Gum-naval stores	face	260	360	520
Net annual leasing value of faced trees	dollar*	52	72	104

* 1960 dollar equivalent.

Means of Meeting the Needs

Improved practices and coordinated individual and community efforts will be increasingly essential to the production program, as pressures for wood products mount.

On Federal lands, forest-management and protection programs could be accelerated by installation of facilities, roads, and buildings, the plantings of improved stock, and by carrying out stand-improvement measures.

Increased production on private land could be accomplished by intensified forest-fire protection, strengthening of forest insect and disease detection and control programs, building fence to control woodland grazing, tree planting, site preparation for natural regenerating, commercial and noncommercial timber-stand improvement work, either in conjunction with reforestation or as a separate measure, establishment of shelterbelts, woodland-drainage and water-control management, improved naval stores practices, more adequate programs for forest credit and insurance, and intensified education, research, and management-assistance programs.

SECTION VIII – FISH AND WILDLIFE

General

Fish and wildlife resources have contributed much toward meeting the needs for food, furs, and outdoor recreation within the Savannah basin. However, the relative importance of these uses has changed much since early colonial days when fish for food and animal pelts for clothes were of prime importance. Although commercial fishing along the coast continues to provide a livelihood to many people, nowadays the primary emphasis throughout the basin is on sport fishing and hunting.

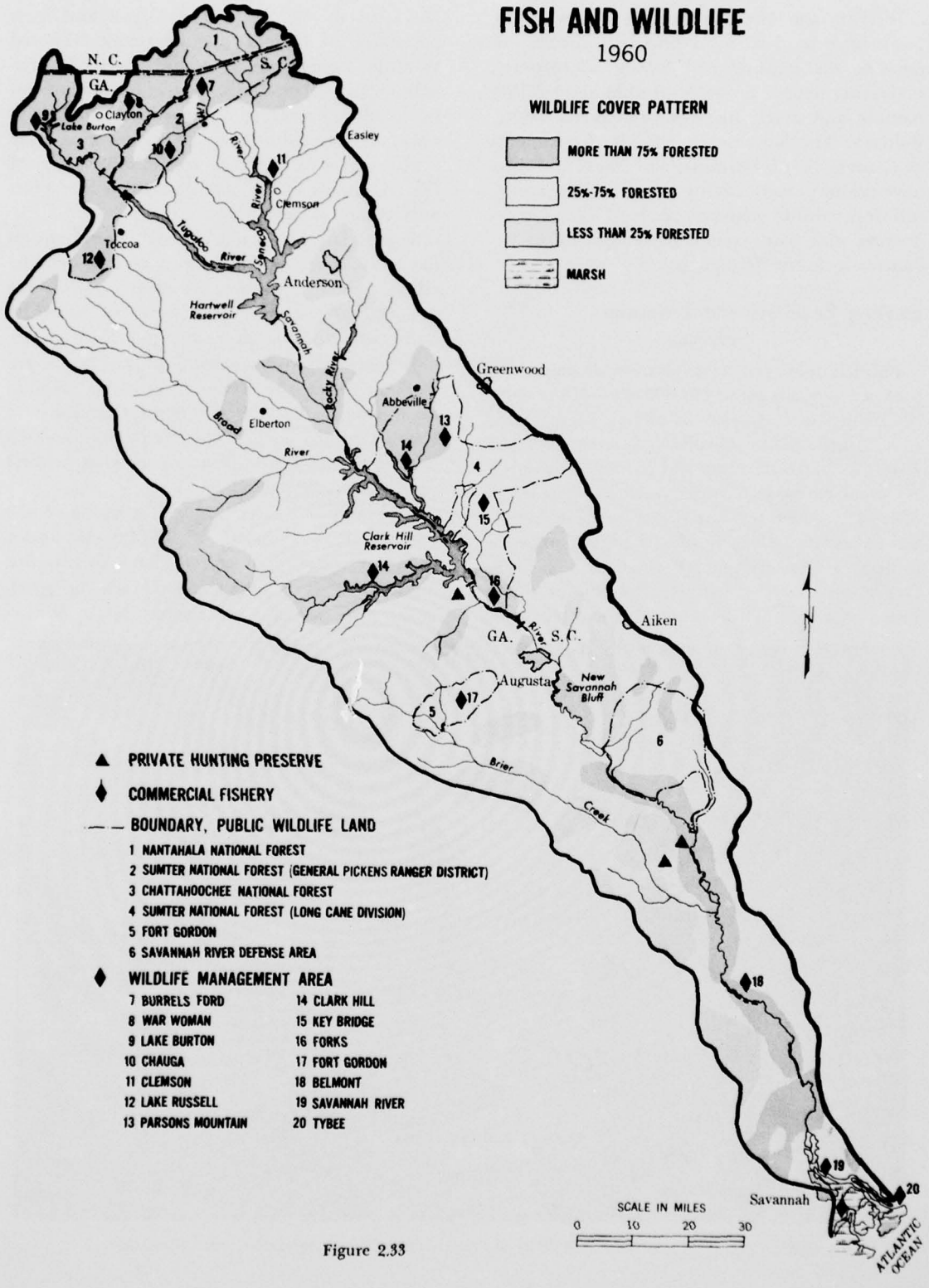

FISH AND WILDLIFE
1960
WILDLIFE COVER PATTERN
MORE THAN 75% FORESTED
25%-75% FORESTED
LESS THAN 25% FORESTED
MARSH
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Toccoa
Tugaloo River
Seneca River
Anderson
Hartwell Reservoir
Savannah
Rocky River
Greenwood
Abbeville
Elberton
Broad River
Clark Hill Reservoir
Aiken
Augusta
New Savannah Bluff
Brier Creek
Savannah
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
PRIVATE HUNTING PRESERVE
COMMERCIAL FISHERY
BOUNDARY, PUBLIC WILDLIFE LAND
1 NANTAHALA NATIONAL FOREST
2 SUMTER NATIONAL FOREST (GENERAL PICKENS RANGER DISTRICT)
3 CHATTAHOOCHEE NATIONAL FOREST
4 SUMTER NATIONAL FOREST (LONG CANE DIVISION)
5 FORT GORDON
6 SAVANNAH RIVER DEFENSE AREA
WILDLIFE MANAGEMENT AREA
7 BURRELS FORD
8 WAR WOMAN
9 LAKE BURTON
10 CHAUGA
11 CLEMSON
12 LAKE RUSSELL
13 PARSONS MOUNTAIN
14 CLARK HILL
15 KEY BRIDGE
16 FORKS
17 FORT GORDON
18 BELMONT
19 SAVANNAH RIVER
20 TYBEE

Figure 2.33

Wildlife and fish management efforts in the basin have been directed primarily toward increasing the hunting and fishing opportunity, preserving unique forms of wildlife and wildlife habitat, and developing the commercial fishing industry. The State game and fish departments of Georgia, South Carolina, and North Carolina have primary responsibility for administering the fish and wildlife resources. Federal agencies cooperate with State conservation agencies in advancing conservation programs.

Existing Facilities and Programs

Wildlife

Publicly managed wildlife areas of major importance contain about 691,000 acres of the wildlife habitat, exclusive of the atomic energy plant near Aiken, South Carolina. Sumter National Forest in South Carolina and the Chattahoochee National Forest in Georgia are the largest tracts of land in which wildlife resources are managed for public use. Next in size is Fort Gordon, a military area near Augusta, Georgia. The U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, administers three wildlife areas in the basin. The largest and most important of these is the Savannah National Wildlife Refuge which occupies several antebellum rice plantations. South Carolina owns two wildlife management areas in the basin and assists in the wildlife management of nine additional areas on Federal lands. The State of Georgia assists in the management of four areas on federally owned lands.

Several large privately owned plantations in the basin have been developed as hunting preserves. Land-use practices on these preserves are designed to improve the habitat for bobwhite quail, wild turkeys, deer, and mourning doves.

Habitat improvement and public hunts are carried on in the State-administered wildlife management areas. Georgia, South Carolina, and North Carolina have farm game programs which encourage and aid farmers in managing wildlife resources on their lands.

The land and water are well adapted to the production of a variety of wildlife. About 3.4 million acres of land are considered suitable for big game. This includes forested lands and woodlands interspersed with cleared lands. White-

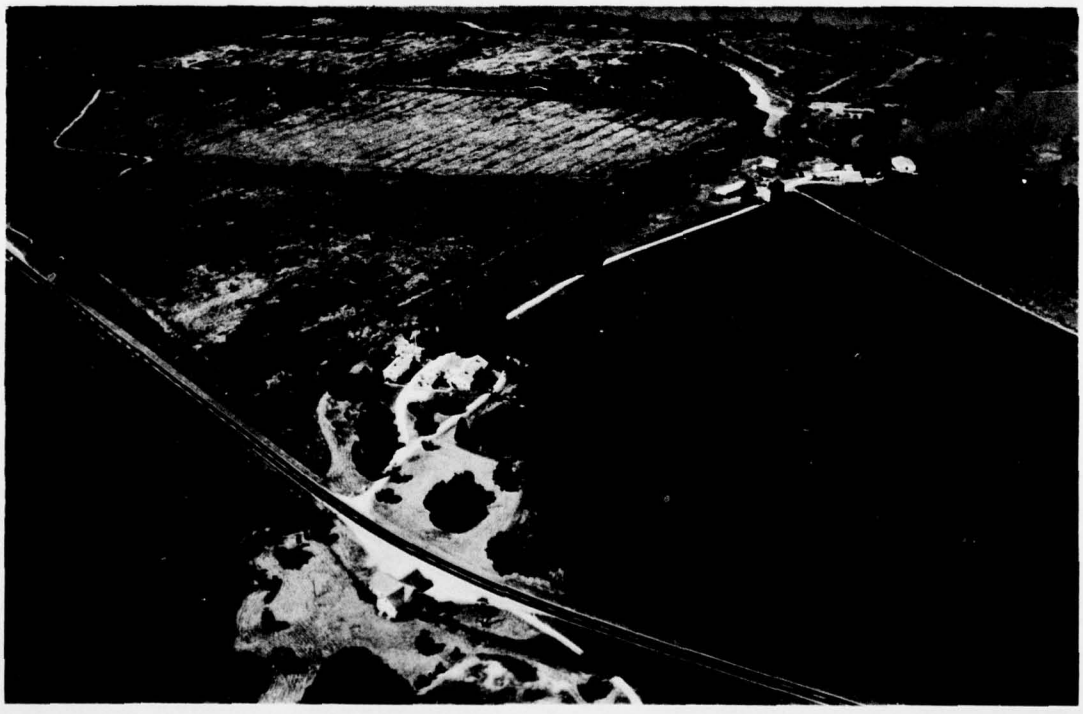


Figure 2.34 *Savannah National Wildlife Refuge Occupies Several Antebellum Rice Plantations.*

TABLE 2.16

Wildlife—Areas and Installations

Area	Acreage in basin	Present ownership (acres)		
		Public		Private
		Federal	Non-Federal	
Federally administered				
Savannah NWR[1]	12,689	12,689		
Oyster Bed Island-Tybee NWR[1]	100	100		
Sumter National Forest	184,500	184,500		
Chattahoochee National Forest	177,698	177,698		
Nantahala National Forest	32,566	32,566		
Fort Gordon	56,000	56,000		
Savannah River Atomic Energy Area	200,766	200,766		
Hartwell Reservoir	76,864	76,864		
Clark Hill Reservoir	150,442	150,442		
Total	891,625	891,625		
State Wildlife Management Areas[2]				
Clemson	10,000		10,000	
Clark Hill (South Carolina)	(12,000)	(12,000)		
Belmont	5,760		5,760	
Forks	(11,200)	(6,200)		5,000
Key Bridge	(8,300)	(7,900)		400
Parsons Mountain	(19,200)	(13,200)		6,000
Chauga	(11,300)	(11,000)		300
Burrels Ford	(15,000)	(15,000)		
Lake Burton	(15,000)	(15,000)		
Lake Russell	(17,000)	(17,000)		
War Woman	(14,000)	(14,000)		
Clark Hill (Georgia)	(16,000)	(16,000)		
Total	15,760		15,760	11,700
Private				
Millhaven Plantation	17,000			17,000
Wade Plantation	10,600			10,600
Brier Creek Lodge	1,000			1,000
Dogwood Plantation	1,000			1,000
Total	29,600			29,600

NOTES: [1] NWR—National Wildlife Refuge.
[2] Acreages in parentheses are included in federally administered land.

tailed deer and wild turkeys are found on about 2.6 million acres, or about 76 percent of the total habitat. An estimated 26,000 big game animals are in the basin or about 1 per 130 acres of suitable habitat.

Small game habitat totals approximately 6.1 million acres or over 90 percent of the total basin area. The principal upland species are bobwhite quail, mourning doves, squirrels, and rabbits. Rails are the dominant game bird of the coastal marshes.

Of the 311,000 acres of waterfowl habitat, about 5,600 acres are of high waterfowl value. The 1960 midwinter inventory recorded 70,000 waterfowl. This represents about 36 percent of the total 200,000 waterfowl in the Southeast River Basins. The majority were observed in and near the Savannah National Wildlife Refuge. Additional waterfowl utilized the inland lakes and swamps. The total autumn migration is estimated to number 86,000 birds. Mallard and black ducks were the principal species inventoried. The duck population of the inland lakes and swamps consists mostly of wood ducks. A remnant flock of Canada geese still uses the wetlands of the middle Savannah basin.

Fresh-Water Sport Fisheries

Fishery management has been concerned largely with technical advice, renovation, and restocking of natural lakes and farm ponds. Law enforcement and information-education programs are important facets of State and Federal activity.

Game fish for stocking purposes are produced in one State and seven Federal hatcheries. One State hatchery in Georgia and one Federal hatchery in South Carolina are located within the basin.

The principal streams which support fresh-water fisheries are Brier Creek, Savannah, Broad, Tugaloo, Rocky, Little, and Seneca Rivers and their tributaries. The Coastal Plain and Piedmont provinces include 510 miles of streams with 17,000 acres of surface area. In addition, there are about 500 miles of cold water tributaries in the mountains.

The clear turbulent mountain streams are famous for trout fishing. Tallulah River in Georgia; Whitewater, Thompson, Horsepasture, and Toxaway Rivers in North Carolina and South Carolina; Chauga River in South Carolina; and Chattooga River, draining portions of all three States, are of particular value in maintaining a trout fishery of regional importance. Brook, rainbow, and brown trout are the principal species in these streams.

The mountain streams plunge over falls and cataracts into rock strewn canyons as they course down the valleys. They provide some of the most exciting fishing in the Southeast River Basins.

As the streams enter the foothills, water temperatures rise, gradients flatten, and trout are replaced by redeye and smallmouth bass and red breasted sunfish. The sport fishing value of these streams generally diminishes downstream as water turbidity increases. Fishing has greatly improved below the large impoundments on the Savannah River because the turbidity has been reduced, minimum flows increased, and water temperatures lowered. At Savannah the stream is polluted by industrial and domestic wastes.

The warm, clear but stained streams of the Coastal Plain provide excellent sport fishing for pickerel, largemouth black bass, and crappie and other sunfish. Brier Creek in Georgia is the largest of the Coastal Plain streams in the basin.

There are several large reservoirs on the main stem of the Savannah River and its tributaries. While the main stem reservoirs are operated for hydroelectric power, flood control, navigation, recreation, and other purposes, sport fishing is a popular use of the impounded waters. Lake Burton, above Tallulah Falls, Georgia, supports trout and yellow perch in the deep, cold waters, and largemouth bass, red breasted sunfish, and crappie in the warm waters. Because minerals and nutrients are lacking, the produc-

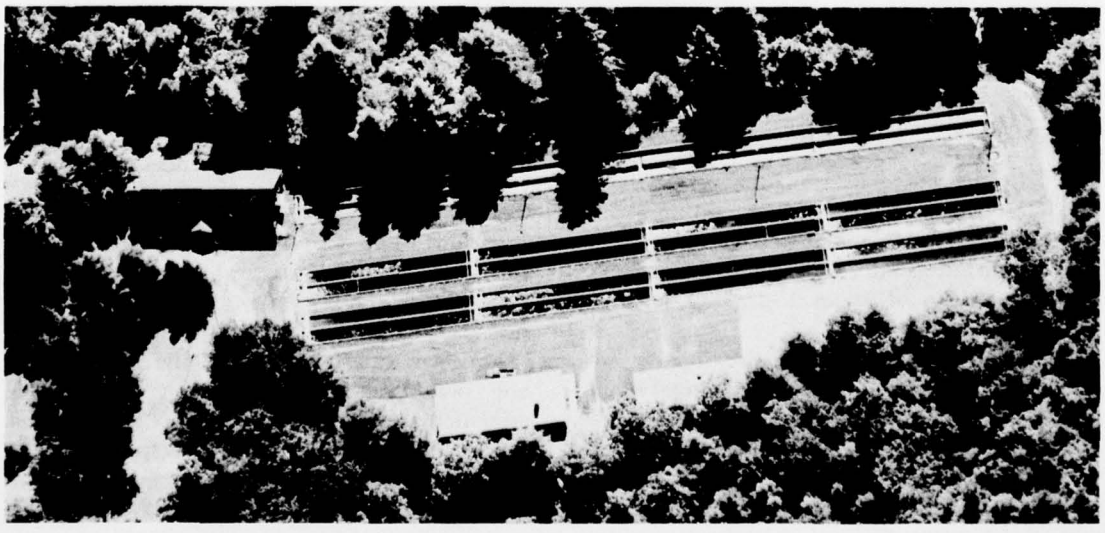


Figure 2.35 *Fish Are Reared at the Walhalla National Fish Hatchery, South Carolina for Stocking Purposes.*

tivity of these impoundments ranges from very low in the mountains to moderate in the Piedmont.

The basin has over 19,000 acres of small reservoirs, natural lakes, and farm ponds. Many of the ponds are used for sport fishing. Natural lakes in the flood plains of the lower basin subjected to annual overflow are productive and, when accessible to the public, are heavily utilized.

Salt-Water Sport Fisheries

The ocean coastline measures about 22 miles as shown on Figure 2.49. This includes part or all of the outer shores of Turtle and Oyster Bed Islands in South Carolina and Cockspur and Tybee Islands at the mouth of the Savannah River and in Wassaw Sound between Wassaw and Tybee Islands. The extensive coastal marshlands are dissected by an intricate system of tidal rivers, creeks, and bayous. During low tide the mud flats and scattered oyster reefs of the shallow inshore waters are exposed. Collectively, these lands and waters play an important role in the production of a variety of marine and freshwater fishes of sport and commercial value.

The surface area of inshore waters, including the zone of salt water influence in the major streams, totals approximately 25,000 acres. Arbitrarily extending the basin boundaries seaward for 12 miles, which is the recognized limit of nearly all fishing activity, adds an offshore area of 128,000 acres.

Principal fishes taken inshore include the speckled sea trout, channel bass, sheepshead, striped bass or rock fish, whiting, croaker, spot, pinfish, flounder, pompano, and several lesser bottom fishes. Cobia or ling and tripletail or eddy fish are sought by sport fishermen in the outer sounds near beaches and buoys, and under flotsam. Offshore, the principal species include sea bass, Spanish and king mackerel, bluefish, jack crevalle, little tuna, and angel fish. Amberjack, barracuda, sailfish, and marlin are less frequently caught.

Service industries associated with sport fishing and allied outdoor recreation include marinas, yacht clubs, fishing camps, cafes, and supply stores. Between 20 and 25 charter boats berthed principally at the Thunderbolt and Isle of Hope marinas and at Lazaretto Creek provide fishing accommodations.

Salt-water fisheries are administered by the South Carolina Wildlife Resources Commission and the Georgia Game and Fish Commission, with assistance of the U. S. Bureau of Commercial Fisheries. There are numerous programs for research, development, and service in the region, although few are headquartered in the basin.

Commercial Fisheries

Commercial fishing is one of the oldest enterprises in the basin.

From 1955 to 1959 the average annual commercial catch totaled 3.1 million pounds and was worth $581,000 to the fishermen. Finfish, consisting mainly of king whiting and American shad, accounted for about 4 percent of the total

TABLE 2.17

Commercial Fishing Effort[1]

Item	1936	1945	1950	1955	1959
Number of fishermen					
On vessels	31	172	226	332	454
On boats and shore[2]	716	773	766	515	731
Total	747	945	992	847	1,185
Number of fishing craft					
Vessels	10	75	112	164	226
Motorboats	49	76	54	241	491
Other	408	410	610	209	96
Total	467	561	776	614	813

NOTES: [1] Data reflect total for Chatham County, Georgia, and Jasper and Beaufort Counties, South Carolina.
[2] Includes regular and occasional fishermen.

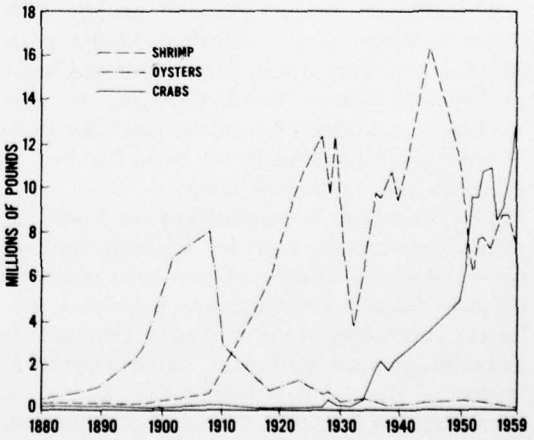


Figure 2.36 *Trends in Catch of Selected Shellfish in Georgia.*

Figure 2.37 *Shrimp Boats — Thunderbolt, Georgia — The 1955-59 Average Annual Shrimp Catch in the Basin Was 1,925,000 Pounds.*

catch by weight and value. Shellfish, principally shrimp, blue crabs, and oysters totaled 95 percent. While a portion of the catch is consumed locally, the bulk is processed and marketed throughout the eastern United States.

Thunderbolt, below Savannah on the Wilmington River, is the principal fishing port. Beaufort and Port Royal, just outside the basin in Beaufort County, South Carolina, are also used by vessels which fish in the basin. In 1959, 20 shore establishments in the basin handled or processed the commercial catch.

The Bears Bluff Laboratories of the South Carolina Commercial Fisheries Division conduct studies of marine fishes, with particular emphasis on pond culture of shrimp. The Brunswick Biological Laboratory of the Bureau of Commercial Fisheries conducts biological and hydrographic studies of the South Atlantic. The Bureau of Commercial Fisheries Laboratory at Beaufort, South Carolina, also conducts research on shellfish. Technological services are directed toward development of new markets for fishery products. The Bureau of Commercial Fisheries also provides market news service and assists the industry through loans to qualified fishermen.

Needs and Opportunities

In 1960, hunting and fishing afforded nearly 2 million user-days of outdoor recreation which represented only about two-thirds of the total demand. The annual value to the sportsman was estimated to be about $4 million.

By 2000, the demand for hunting and fishing is expected to increase to about 6.2 million user-days.

Population increases and the trend toward urbanization were considered to be decisive factors influencing total hunting and fishing demand. The per capita demand for hunting and fishing decreases as urbanization increases. This was readily apparent in comparative studies of hunting and fishing license sales in urbanized and rural counties.

A further decrease in rural population is expected while the urban population of Augusta, Savannah, and cities located just outside the basin is expected to expand rapidly. The net effect would be significant increases in hunting and fishing demands in spite of expected declines in per capita demands after 1975.

Use of publicly owned and managed areas will continue to increase at rates greater than the general increase in population and overall hunting and fishing effort. This reflects the impact of urbanization. Closure of more private lands to public use will make it increasingly difficult to find places to hunt, despite increases in travel, leisure time, and personal income.

Wildlife

Analysis of needs and desires for hunting and fishing opportunity in relation to resource trends led to the establishment of goals which place greater emphasis on big game production and utilization. While the numbers of big game are expected to be less than that required to satisfy the hunting demand by the year 2000, the habitat, if managed at a high level, is capable of sustaining around 82,000 white-tailed deer and wild turkey, or over three times the present population.

TABLE 2.18

Wildlife Needs and Supplies[1]
(thousands)

Year	Type of resource	Needs	Supplies		Deficits
		User-days	Acres of habitat	User-days capacity[2]	User-days
1960	Big game	118	3,426	130	0
	Small game	651	6,105	610	41
	Waterfowl	42	311	29	13
1975	Big game	168	3,563	230	0
	Small game	816	5,961	596	220
	Waterfowl	50	311	29	21
2000	Big game	409	3,759	260	149
	Small game	969	5,544	554	415
	Waterfowl	51	311	29	22

NOTES: [1] Estimated use in 1960, limited by needs or capacities, totaled 757,000 user-days.
[2] Based on existing and prospective numbers of game animals with normal expansion of going programs.

Small game resources are expected to continue to meet the greater portion of the demand for hunting, although some decline in general interest is expected as competition for available supplies becomes more intense and the better areas are closed to public use. It may not be economically feasible to increase substantially the number of small game animals over the basin as a whole. Practices have been developed and are being effectively employed in local areas to increase natural quail production, but costs of such management have prohibited extensive application.

Waterfowl resources cannot be expected to provide and sustain much increase in hunting unless means are found to increase the supply of ducks and geese. Present management technology is directed more toward the intensive development of a relatively small acreage of habitat. This has the tendency to concentrate the known supplies on areas where hunting is either prohibited or restricted to a limited number of sportsmen. The vast wetlands of the basin have great potentials if means can be found to make them more productive of resident waterfowl.

Sport Fisheries

An analysis of fishing needs and desires in relation to resource trends led to the establishment of goals which call for more complete development of the potentials of the streams and existing impoundments as well as the creation of new impoundments.

The trout streams could be expected to sustain almost five times their present utilization with more supplemental stocking of trout. The warm water streams would be utilized to their full capacity with improvement of access and water quality. The challenge of big waters such as Clark Hill and Hartwell Reservoirs can be expected to attract larger numbers of anglers. Fishing in farm ponds and other small, intensively managed fishing lakes should be counted on to sustain a significant portion of the fishing effort.

Salt-water sport fishing expanded at an unprecedented rate during the last 25 years after development of dependable outboard motors and the introduction of boat trailers. This trend is expected to continue.

TABLE 2.19

Sport Fishing Needs and Supplies[1]
(thousands)

Year	Type of water resource	Needs	Supplies		Deficits
		User-days	Acres of habitat	User-days capacity	User-days
1960	Streams, cold water	37	(494 miles)	37	0
	Streams, warm water	119	17	270	0
	Large impoundments	539	[2]63	317	222
	Small impoundments	1,441	19	370	1,071
	Salt water	210	153	765	0
1975	Streams, cold water	67	(494 miles)	37	30
	Streams, warm water	185	16	260	0
	Large impoundments	1,380	133	665	715
	Small impoundments	1,070	31	670	400
	Salt water	245	153	765	0
2000	Streams, cold water	177	(494 miles)	37	140
	Streams, warm water	201	16	260	0
	Large impoundments	1,756	133	665	1,091
	Small impoundments	2,270	51	1,170	1,100
	Salt water	391	153	765	0

NOTES: [1] Estimated use 1960, limited by needs or capacities, totaled 1,053,000 user-days.
[2] Exclusive of Hartwell Reservoir.

Commercial Fisheries

The demand for food fish landed at ports in the basin is expected to increase to 6.5 million pounds by 2000 or about 2.1 times the present catch. The average annual catch from 1955-59 is considered to be the current basin share of the United States market. The projected catch reflects the pounds of fish which must be caught to meet the basin share of the United States market in 1975 and 2000.

In making these projections, it was recognized that food fish production in the United States has declined since 1950, while food fish imports have steadily increased. Factors responsible for this decline are fluctuations in supply, increased costs, competition from other animal protein foods and imported fishery products, and lack of information about the sea and its resources. The annual per capita consumption of food fish, about 11 pounds edible weight, has remained constant.

The total catch of selected food fish landed at docks in the basin has doubled since 1936. The catch per unit of effort, however, has sharply declined as revealed by trends in the number of fishermen and fishing craft.

The shrimp fisheries industry expanded in the early 1940's in response to increased demand and because of improved techniques for processing and marketing shrimp. With full utilization of known supplies, however, further expansion of this industry was curtailed.

Oyster production reached its zenith in the early 1900's when there was an abundance of oysters and a demand for canned products. Production is now low, although the demand for quality meats is high and is expected to continue increasing in the future. A continued increase in the demand for crabmeat is also expected. An ample supply and a market potential

TABLE 2.20

Commercial Catch Requirements
(thousands of pounds)

Resource	1955-59 average	1975	2000
Finfish	125	162	235
Shrimp	1,925	1,983	2,118
Crabs	950	1,425	2,137
Oysters	120	140	180
Other	0	350	1,900
Total	3,120	4,060	6,570

for other fish appear to be available to fishermen if food products can be produced that will meet with wide public acceptance. Under these conditions, it was assumed that domestic production in the future will keep pace with the national population increase.

Means of Meeting the Needs

The demand for food and for hunting and sport fishing can be met by more intensive management and by making fish and wildlife resources more readily available. Some adjustment in wildlife and fish inventories and in the relative amount of pressure exerted on each resource will need to be made in recognition of resource trends and development opportunities.

Wildlife

Big game development affords one of the more promising ways to meet the future hunting demand. With more extensive management, the habitat can readily meet the anticipated big game demand, plus a considerable amount of the demand for small game and waterfowl hunting. The general trend of land use favors big game enhancement. Some habitat is expected to be lost to urban and industrial development, but this may be partially offset by conversion of other lands to forests. Some forestry practices involving destruction of hardwoods, planting of solid pine stands, and draining and clearing of mixed forest land tend to reduce the carrying capacity of habitat. Greater cooperation by forestry interests may be expected if continued emphasis is placed on a program involving private landowners, conservation agencies, and the sportsman. Greater emphasis on hardwood production in the future is also expected to favor wildlife management.

By 2000, an inventory of 82,000 head of big game would be adequate to meet the demand for such hunting. Around 52,000 head are expected with normal expansion of going programs. Therefore, big game programs need to be accelerated. Additional wildlife areas will be needed in Georgia and South Carolina to insure public use of the increasing number of big game animals.

Development of small game resources to meet the demand lies primarily with the landowners. Bobwhite quail and mourning doves, the most popular game bird species in the basin, are influenced greatly by land-use types and patterns. Agricultural practices which provide food and cover for wildlife should be encouraged.

Meeting the demand for waterfowl hunting is not a problem which can be effectively solved solely by more intensive management within the basin. The duck population in the Atlantic Flyway has resumed a gradual decline. However, the waterfowl value of the wetlands can be improved by wildlife development and habitat improvement.

Coastal marshes have waterfowl potentials which could be partially realized by replacing existing plants with more desirable vegetation. The waterfowl carrying capacity of the Savannah National Wildlife Refuge could be doubled by further development of marshlands within and near its present confines. Developments comparable to Bowden Pond, a private preserve on Brier Creek, Georgia, would increase the number of Canada geese wintering in the basin.

Local interests should be encouraged to establish regulated shooting preserves for small game and waterfowl hunting. These preserves offer reasonably satisfactory hunting areas which do not depend upon resident game supplies.

Sport Fisheries

A balanced program of stream and lake improvement and development is needed to meet present and future needs.

Continuation of the farm pond construction and management program is expected to partially meet future demands for the type of fishing afforded by small impoundments. Ponds are most effective if constructed near population centers. Expansion of the current fisheries programs would improve the quality of fishing afforded and location of ponds for public use near population centers would enhance fishing opportunities.

Sport fishing pressure on some existing large impoundments in the basin is relatively light. However, more effort and greater demands are expected as the resident population increases and fishery-management programs expand. It is estimated that a minimum of 100,000 additional acres of large impoundments, with management

at a low to medium level, will be required to produce the weight of fish needed to satisfy the expected fishing demands. Several sites are well adapted for construction of large reservoirs which would help satisfy the need for additional large impoundment areas. The development of impoundments within coastal marshes and conversion of saline waters to brackish waters by water control offers additional opportunities to meet these demands. Management to meet the demand for stream fishing depends largely upon improvement of existing habitat and development of facilities and public access to the streams.

Further development of facilities, services, and accommodations will be needed to meet the projected user-days of salt-water fishing. The marine waters of the basin are capable of producing more than the quantity of fish needed to meet the projected requirements, but fishing areas need to be accessible. While facilities for salt-water sport fishing are highly developed near Savannah, there is need and opportunity for further expansion at these and other points along the coast.

Where feasible, artificial fishing reefs should be developed to localize marine fish populations. The reefs should be appropriately marked for convenient location by sport fishermen and marine traffic. Such a program is gaining momentum and affords one of the better and more economical ways to improve the catch in the open sea.

Commercial Fisheries

Commercial fishery needs could be met by: (1) Expansion of existing operations; (2) rehabilitation of oyster producing reefs; (3) cultivation of shrimp, pompano, and other high quality food fishes under controlled conditions; (4) acceleration and expansion of existing facilities and going programs to achieve a more efficient harvest, better methods of handling and processing the catch, new sources of supply, sound regulations, and enforcement; (5) increasing the demand for domestic products; (6) abatement of pollution; and (7) adoption of realistic pollution standards.

The existing fishing fleet is adequate to harvest many more pounds of fish from the sea, if new sources of the more heavily utilized fishes could be found and the market increased for other fishes which are locally abundant, however, improved gear and expanded operations would be required.

Oyster production could be greatly increased. Old surveys reveal that the shallow inshore waters of the basin have many acres of oyster reefs which were formerly productive. In addition, there are many acres of bottoms which could be developed for oyster production with establishment of cultch and abatement of pollution.

Known shrimp resources are fully utilized at present. The catch along the Atlantic coast has not increased in recent years despite a marked increase in fishing pressure. More extensive knowledge is needed concerning the biology of the shrimp and the effects of fishing on the shrimp population. New sources of supply need to be discovered.

The crab fishery could help meet the requirements for shellfishes. This abundant fishery in the coastal waters of the basin has a growing market.

The finfish catch could be expanded to meet established goals. Methods of handling and processing of such species as mullet and speckled trout must first be improved, however, to create quality products that will compete with other animal protein and seafoods from other areas. With improved gear and methods of fishing, the yield per unit of effort can be increased and the operations expanded at reasonable cost.

The shallow inshore waters of the basin afford great potentials for seafood culture. Despite the productivity of the seas, it will become increasingly difficult to harvest the wild crop at costs which will enable the industry to compete with imports and the mass production and marketing methods of the meat and poultry industries. Results of experimental pond culture with shrimp and pompano, however, provide a sufficient basis for initiating experimental management programs. Extensive application of proven practices may be expected with practical demonstrations of this technology.

SECTION IX – RECREATION

General

The major recreation resources of the Savannah basin are its mountains, rivers, Hartwell and Clark Hill Reservoirs, and Savannah Beach. Lesser resources are located along the seacoast and throughout the rest of the basin.

The Savannah basin is experiencing the rapid changes so apparent over the United States. These changes include population increases and urbanization, commercial and industrial development, higher land values, increased income, greater mobility, and leisure time. The reservoirs have made available vast reaches of water for recreation use.

The Upper Coastal Plain and the Piedmont province have many land and water resources that are capable of being developed to meet future recreation needs.

The Blue Ridge province is partially developed but still remains a relatively untapped recreation resource of great potential. The scenic beauty of several waterfalls can be enjoyed when access roads and trails are made available. The landscape in this province needs additional development to make it more widely available to future recreationists.

Existing Facilities and Programs

In 1959, visitation at public recreation areas within the basin totaled about 4,300,000 user-days. Recreation opportunities are well distributed at present, except in the Blue Ridge province where facilities can accommodate only about 10 percent of the potential use and in the Central Coastal Plain where recreation facilities are inadequate. The Piedmont province, with Clark Hill and Hartwell Reservoirs, has become an important recreation area and offers great recreation opportunity at the present time.

Several agencies, particularly the U. S. Forest Service and the U. S. Corps of Engineers, have programs and studies to expand recreation op-

Figure 2.38 *Lake Toxaway on Toxaway River, North Carolina, Attracts Many Recreationists.*

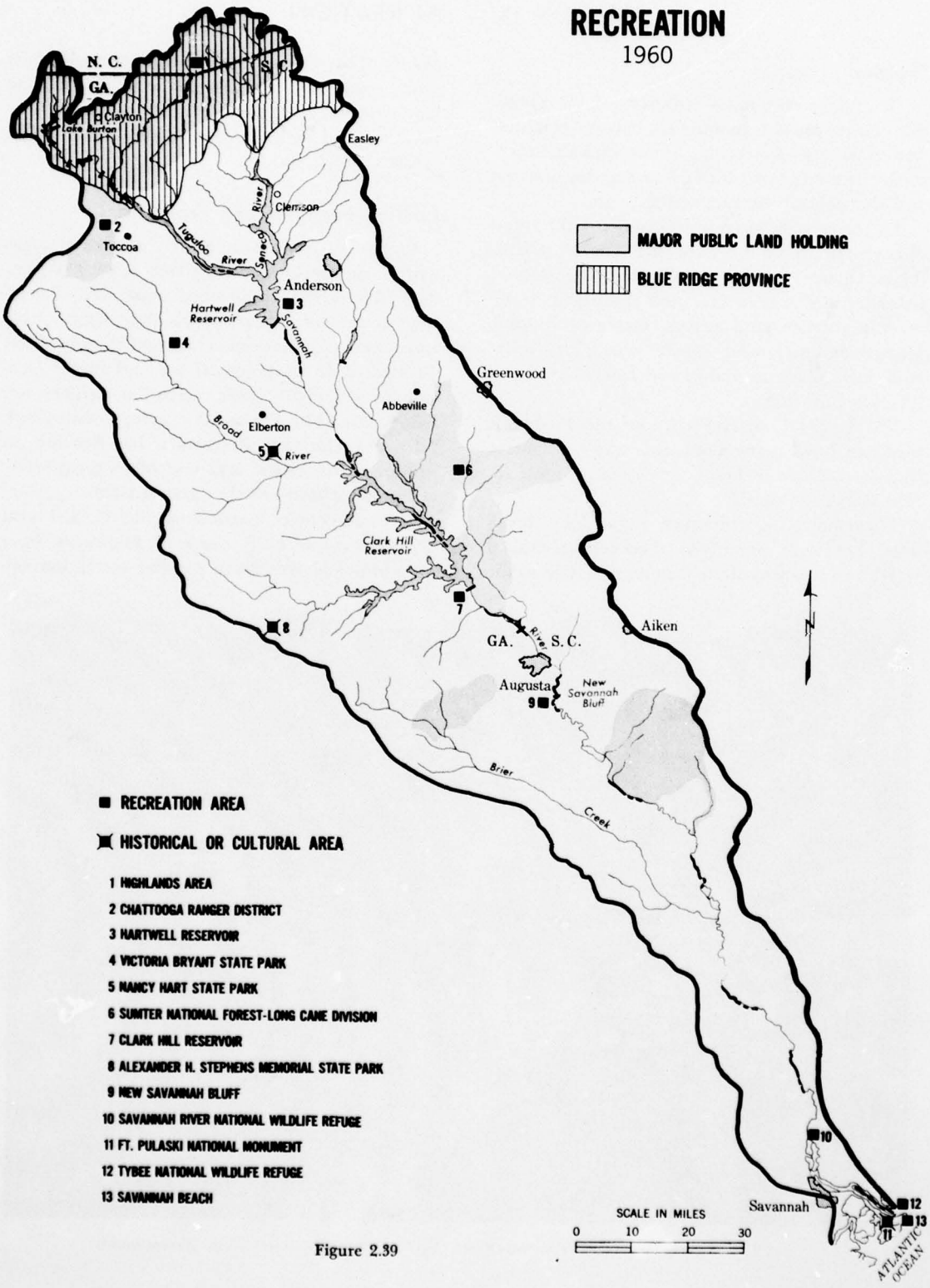

RECREATION
1960
MAJOR PUBLIC LAND HOLDING
BLUE RIDGE PROVINCE
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Tugaloo River
Toccoa
Anderson
Hartwell Reservoir
Savannah River
Greenwood
Abbeville
Elberton
Broad River
Clark Hill Reservoir
Aiken
Augusta
New Savannah Bluff
Brier Creek
Savannah
SCALE IN MILES
0 10 20 30
ATLANTIC OCEAN
RECREATION AREA
HISTORICAL OR CULTURAL AREA
1 HIGHLANDS AREA
2 CHATTOOGA RANGER DISTRICT
3 HARTWELL RESERVOIR
4 VICTORIA BRYANT STATE PARK
5 NANCY HART STATE PARK
6 SUMTER NATIONAL FOREST-LONG CANE DIVISION
7 CLARK HILL RESERVOIR
8 ALEXANDER H. STEPHENS MEMORIAL STATE PARK
9 NEW SAVANNAH BLUFF
10 SAVANNAH RIVER NATIONAL WILDLIFE REFUGE
11 FT. PULASKI NATIONAL MONUMENT
12 TYBEE NATIONAL WILDLIFE REFUGE
13 SAVANNAH BEACH

Figure 2.39

portunities in areas under their administration. These plans have been recognized and generally taken into consideration. A brief description of the existing public recreation areas of the basin follows.

Savannah Beach is a public beach on the Atlantic Ocean, 21 miles southeast of Savannah. Existing recreation is severely handicapped by pollution from the Savannah River.

New Savannah Bluff Lock and Dam provides a popular 48-acre recreation area used primarily for picnicking, boating, fishing, and observing boats and ships passing through the lock.

Victoria Bryant State Park is a 45-acre area near Royston, Georgia with tenting, trailer camping, and picnicking facilities. This park is being developed for greater recreation use.

Clark Hill Reservoir is a 70,000-acre multiple-purpose lake with 1,200 miles of shoreline. It is administered by the Corps of Engineers, U. S. Army. There are over 50 developed recreation areas around the reservoir. Several of these areas, such as Bobby Brown, Elijah Clark Memorial, and Keg Creek, are leased to the Georgia Department of State Parks.

Hartwell Reservoir is a 56,400-acre lake with 960 miles of shoreline. The reservoir was recently completed by the Corps of Engineers, U. S. Army. Facilities are being developed for all types of recreational opportunities. Some sites are leased to South Carolina and others to Georgia for park development.

The Highlands Area of the Blue Ridge province encompasses mountainous areas in North Carolina, South Carolina, and Georgia. The Nantahala National Forest in North Carolina is an area of superb beauty. It contains clear flowing rivers and several large waterfalls. Much of the area is still relatively undeveloped or is being developed as resort areas. These include Lake Toxaway, Cashiers, and Highlands. In South Carolina, the General Pickens Division of the Sumter National Forest, Oconee State Park which is a 1,165-acre general outdoor recreation area, the Walhalla National Fish Hatchery, and several large privately owned areas provide

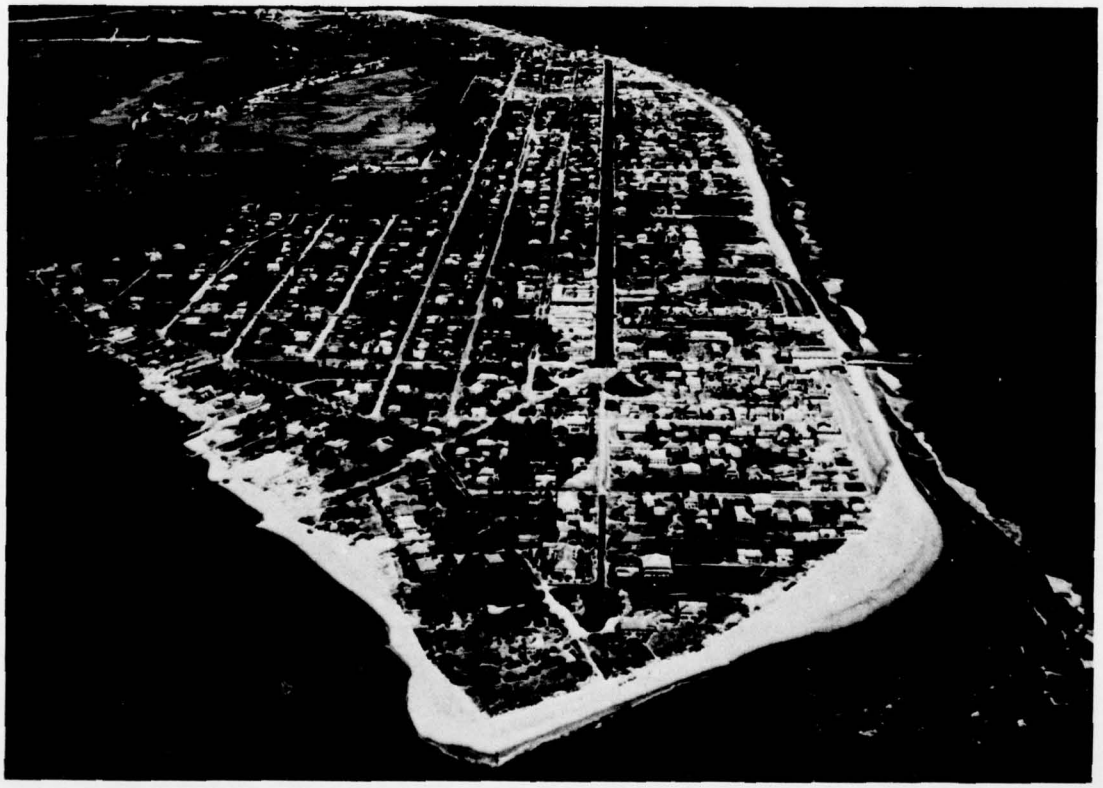
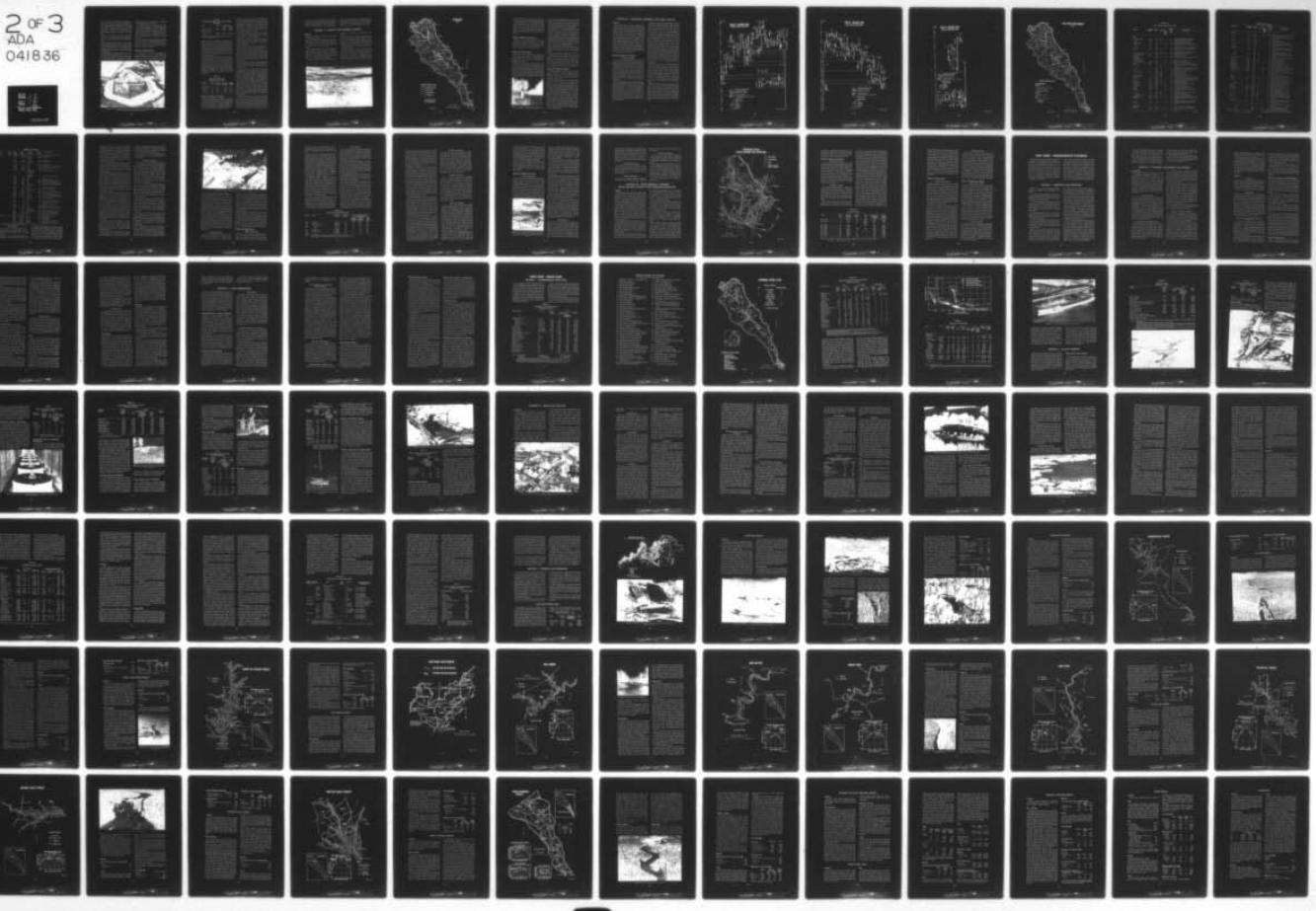


Figure 2.40 *Savannah Beach on Tybee Island Is a Popular Recreation Spot.*

AD-A041 836 UNITED STATES STUDY COMMISSION SOUTHEAST RIVER BASINS--ETC F/G 8/6
PLAN FOR DEVELOPMENT OF THE LAND AND WATER RESOURCES OF THE SOU--ETC(U)
1963

UNCLASSIFIED NL

2 OF 3
ADA
041836



a wide variety of scenic beauty, including waterfalls, rivers, and mountains. The Georgia portion contains part of the Chattahoochee National Forest, Lakes Burton and Rabun, and Tallulah Falls. The area has great scenic beauty and has developed as a summer resort. Rabun Bald, one of the highest mountains in Georgia, is located here.

Long Cane Division of the Sumter National Forest is a large forested natural environment area east of Clark Hill Reservoir in South Carolina.

The Chattooga Ranger District of the Chattahoochee National Forest is in northeast Georgia in the Piedmont province. It is a large natural environment recreation area with facilities for swimming, picnicking, hiking, camping, boating, and sightseeing.

Savannah National Wildlife Refuge and Tybee National Wildlife Refuge are areas near Savannah that have abundant wildlife. These refuges can accommodate few recreationists, but they offer opportunity for a wide variety of activities for people interested in wildlife.

Fort Pulaski National Monument, near Savannah Beach, Georgia, is a massive fortification which played a significant role in the Civil War.

Alexander H. Stephens Memorial, near Crawfordville, Georgia, is a 1,175-acre homesite of the Vice President of the Confederacy. It contains a museum, scenic drives, and recreation facilities.

Nancy Hart Historic site, near Elberton, Georgia, is a small area being developed as a State park. The Tyrus R. (Ty) Cobb Memorial at Royston, Georgia, will be an attraction to baseball fans and other sportsmen.

Needs and Opportunities

In estimating future basinwide demands for public outdoor recreation, it was assumed that residents of the Southeast River Basins who leave the area to recreate are balanced by those non-

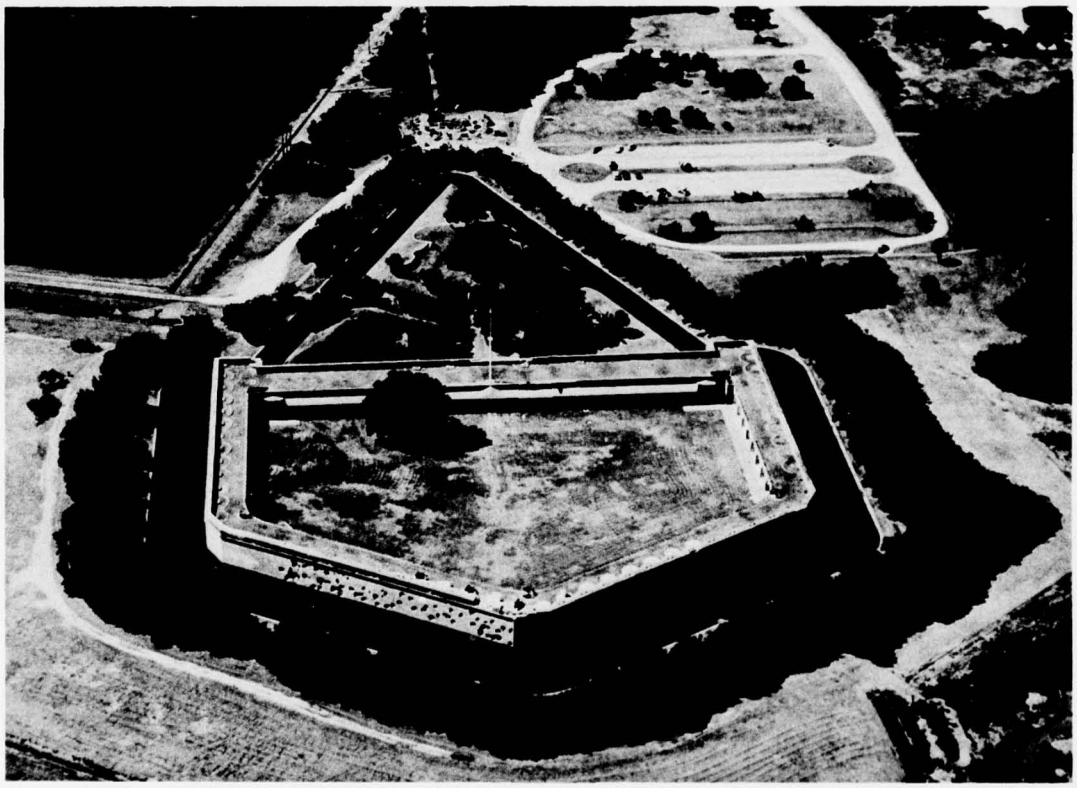


Figure 2.41 *Fort Pulaski on Cockspur Island, Georgia, Which Played a Significant Role in the Civil War, Typifies a Historic Recreational Development.*

TABLE 2.21

Recreation User-Days—1960, 1975, and 2000 (thousands)

Area	1960	Projected use	
		1975	2000
Savannah basin	*7,230	14,000	35,000
Southeast River Basins	35,000	95,000	230,000

* Facilities available for 7,230,000 user-days. Actual use in 1959 was 4,300,000 user-days.

residents who come into the area to recreate. However, there are many recreationists who pass through the basin, and as much as 60 percent of these travelers seek some type of outdoor recreation enroute. The Savannah basin has adequate coastal, inland water, and mountain resources to attract recreation-seeking people from the entire United States if adequate facilities and promotion are provided.

Recreation use in the basin is expected to grow to 35 million user-days in 2000, including 1.6 million user-days by tourists and others passing through. Facilities at existing recreation areas are adequate for about 7.2 million user-days. Principal use occurs in the summer months, although the spring and fall are becoming increasingly significant for outdoor recreation. Skiing and ice skating potentials exist in the mountains.

TABLE 2.22

Recreation Facility Needs (thousands of user-days)

Facilities	1960	Increase to 1975	Increase 1975-2000	Total 2000
Enlarging existing areas	7,230	2,125	11,795	21,150
New areas		4,645	9,205	13,850
Total	7,230	6,770	21,000	35,000

Means of Meeting the Needs

Facilities providing opportunity for a fivefold increase in public outdoor recreation facilities in terms of user-days are required. Demands can be partially satisfied by expanding existing facilities. New developments would be required to satisfy additional recreation opportunities.

The scenic mountain areas, or highlands, in the upper Savannah basin, if adequately developed to take advantage of the superb natural environment, could provide varied recreational opportunities. Additional opportunities could be created by an extension of the Blue Ridge Parkway from near Mt. Toxaway, North Carolina to Blood Mountain, Georgia.

Clark Hill and Hartwell Reservoirs, with additional facilities, could supply greater water-oriented recreation opportunities.

Expansion of the Savannah Beach area for public outdoor recreation would go a long way in meeting projected demands for recreation in the Savannah area.

The remaining existing areas could be expanded to provide opportunities for recreationists attracted by historic and cultural areas.

Several undeveloped areas could be developed to provide access and facilities for public swimming and picnicking by day-use recreationists. Progressive development to the year 2000 would assure that facilities would continue to meet the growing needs.

Studies indicate that the remaining estimated user-days of annual demand could best be met by development of facilities at presently undeveloped areas.

General outdoor recreation areas could include development of a wide variety of uses and could be located on multiple-purpose reservoirs or elsewhere. Their special features include facilities and access for activities such as sightseeing, picnicking, swimming, boating, and cultural pursuits. Access areas ranging in size from 10 to 75 acres could serve local and regional needs and would vary in size to meet local conditions. Thirteen access areas could be located in the lower half of the basin. Twenty general outdoor recreation areas, similar to the larger existing State and county parks, could be located in those areas and counties where there are at present no such facilities.

Historic and cultural areas could be developed to provide for recreationists who seek areas of these types. These sites could supply new recreational opportunities. Several sites which could be developed for limited public recreation, in addition to their primary cultural values, are: (1) Estatoe Archeological Site, an 18th century Chero-

kee town on the Tugaloo River; (2) Keowee Archeological Site on the Keowee River, Oconee County, South Carolina; (3) Burt Mansion in Abbeville, South Carolina; (4) Hopewell near Walhalla, South Carolina; (5) Old Stone Church at Clemson, South Carolina; and (6) Long Cave Massacre Site near Troy, South Carolina. Other similar sites are located throughout the basin.

SECTION X – SALINITY AND SEDIMENT CONTROL

General

Salinity and sediment problems are localized in the Savannah basin.

Salinity problems occur when enough salt accumulates in the soil to impair crop productivity, or when salt water intrudes into fresh-water areas and interferes with water use or availability.

Two counties have soil salinity. These are Jasper County, South Carolina, with 6,000 acres and Chatham County, Georgia, with 27,000 acres, a total of 33,000 acres in the tidal marshes. There is no foreseeable need for using such lands for crops before the year 2000.

Salt-water intrusion of ground water supplies may become a problem in the vicinity of Savannah.

Because of physical, cultural, and other factors, rates of erosion and hence sediment yields vary widely in the basin. The sediment problem is more acute in the Piedmont province where agricultural production incurs the most damage. The sediment problem is generally minor in the Coastal Plain.

Sediment deposits can destroy the usefulness of land, but produce fertile alluvial bottoms in some places. Sediment often limits use or increases the cost of water to municipal and industrial users of surface waters, although a small amount of sediment sometimes helps to precipi-

Figure 2.42 *Marshlands and Abandoned Rice Fields — Jasper County, South Carolina.*

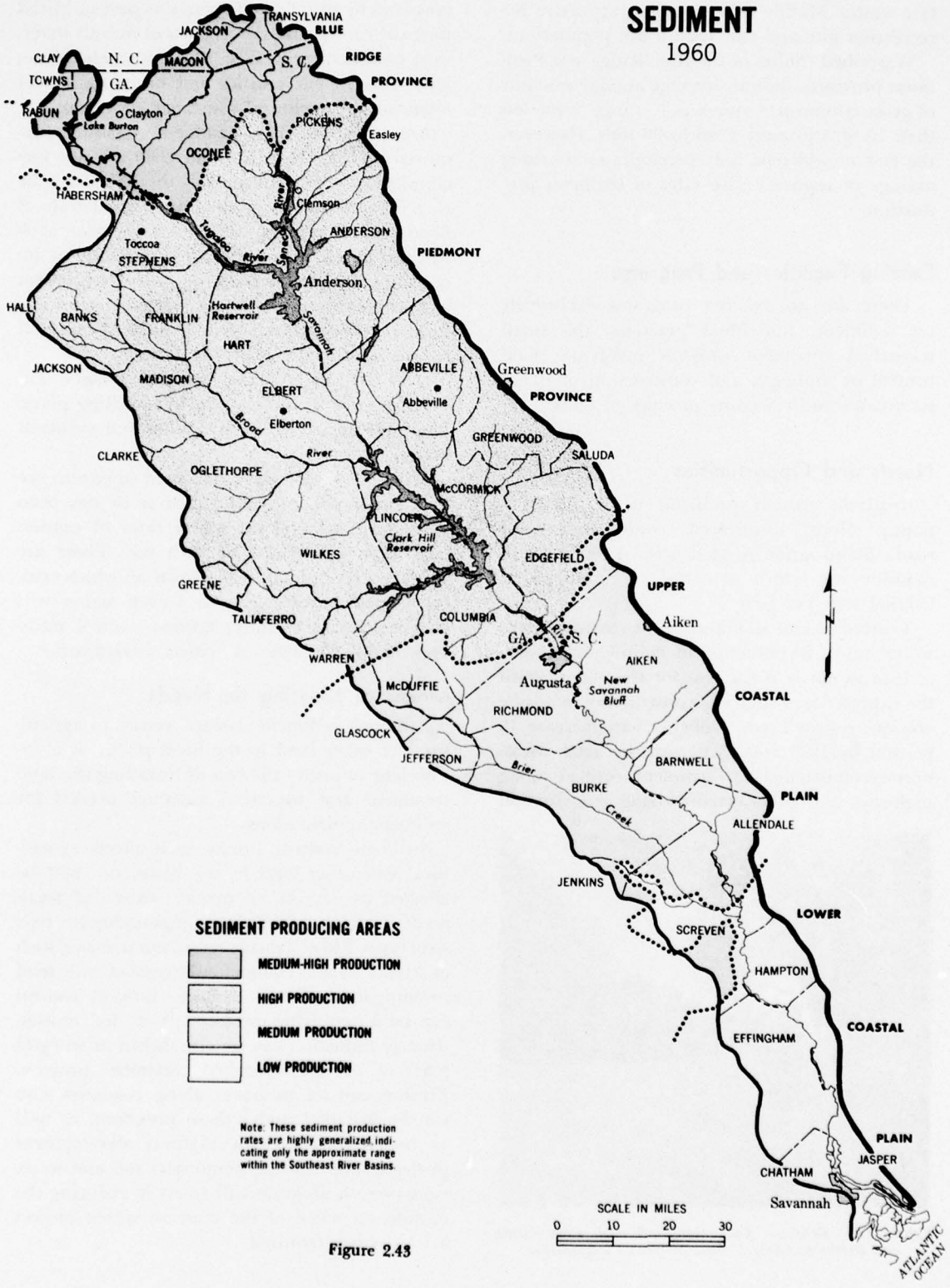

SEDIMENT
1960
TRANSYLVANIA
BLUE
RIDGE
PROVINCE
JACKSON
CLAY
N. C.
MACON
S. C.
TCWNS
GA.
RABUN
Clayton
Lake Burton
PICKENS
Easley
OCONEE
HABERSHAM
Clemson
Tugaloo River
Seneca River
ANDERSON
PIEDMONT
Toccoa
STEPHENS
Anderson
HALL
BANKS
FRANKLIN
Hartwell Reservoir
Savannah
HART
JACKSON
MADISON
ELBERT
ABBEVILLE
Greenwood
PROVINCE
Abbeville
Elberton
Broad River
GREENWOOD
SALUDA
CLARKE
OGLETHORPE
McCORMICK
LINCOLN
Clark Hill Reservoir
WILKES
EDGEFIELD
UPPER
GREENE
TALIAFERRO
COLUMBIA
Aiken
GA.
S. C.
Savannah River
AIKEN
WARREN
McDUFFIE
Augusta
New Savannah Bluff
COASTAL
RICHMOND
GLASCOCK
JEFFERSON
Brier Creek
BARNWELL
BURKE
PLAIN
ALLENDALE
JENKINS
LOWER
SCREVEN
HAMPTON
COASTAL
EFFINGHAM
PLAIN
JASPER
CHATHAM
Savannah
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
SEDIMENT PRODUCING AREAS
MEDIUM-HIGH PRODUCTION
HIGH PRODUCTION
MEDIUM PRODUCTION
LOW PRODUCTION
Note: These sediment production rates are highly generalized, indicating only the approximate range within the Southeast River Basins.

Figure 2.43

tate wastes. Muddy waters are not attractive for recreation uses and may reduce fish populations.

Watershed studies of the Blue Ridge and Piedmont provinces indicate average annual amounts of gross erosion per square mile range from less than 10 tons to more than 5,000 tons. However, the lack of adequate data precludes establishing average or representative rates of sediment production.

Existing Facilities and Programs

There are no existing programs exclusively for sediment. Individual practices, the small watershed treatment projects involving flood control or drainage, and construction of mainstem dams and reservoirs produce benefits.

Needs and Opportunities

Roadside erosion problems occur predominantly along unsurfaced county-maintained roads. Stabilization is needed for 4,300 miles of roadside for which soil loss is estimated at 697,000 tons per year.

Treatment and stabilization of roadside areas would result in reduction of maintenance costs, at least as much as the cost for treatment. With the expected new highway construction, roadside erosion control needs probably will increase 15 percent by 1975 and 25 percent by 2000. Measures recommended for sediment control along highways and other earth-moving construction areas can be installed effectively as part of initial highway construction or as parts of overall watershed treatment programs. This approach utilizes local government entities and other sources of financial and technical assistance programs.

Figure 2.44 *Roadside Cuts Stabilized with Love Grass and Bermuda Grass Reduce Sediment Deposition.*

Although the land-treatment measures required by the years 1975 and 2000 are not specifically for sediment control, the effect will be to reduce sediment production. Installation of flood control projects will result in more agricultural development, and the possibility of incurring sediment damages for such development will be greater. However, such flood control features as structures and channel enlargement will reduce most of the sediment damage.

Over the past 20 years, farmland conservation practices and the increase in tree-seedling plantings have greatly reduced erosion and sediment loads.

Much of the sediment delivered to stream systems originates on land which is or has been used for crops and on which rates of erosion have been accelerated by such use. There are 348,000 acres of land in the basin on which critical erosion problems occur. Group action will be necessary to establish erosion control measures on 107,000 acres of critical eroded areas.

Means of Meeting the Needs

Although sediment damage occurs to agricultural or other land in the flood plains, it is insufficient to justify the cost of installing the land treatment and structural measures needed for sediment control alone.

Sediment control, insofar as it affects agricultural and other land in the basin, can best be effected as part of an overall watershed treatment program, including impoundment type structures. Flood damage reduction features, such as structures and channel enlargement, will tend to mitigate sediment damage. Erosion control for land requiring project action for erosion damage reduction can be established as integral parts of overall watershed treatment projects. Erosion control measures along roadways also can be installed under these programs, as well as in connection with highway development projects. The existing nonproject soil and water conservation program will result in reducing the erosion on much of the land on which project action is not required.

SECTION XI – POLLUTION ABATEMENT AND PUBLIC HEALTH

General

Only those phases of public health directly related to land and water resource developments are included in this study. Items discussed in this Section include the abatement of water and air pollution, vector control, radiation monitoring, and the collection and disposal of community and industrial solid wastes. The development and protection of potable water supplies, as discussed in Section II, also are an important part of the public health program. The basic objective of all these phases of public health is the protection of the community health through the control of man's environment. Establishing an adequate coordinated public health program is essential for the optimum utilization of land and water resources of the basin.

Existing Facilities and Programs

Pollution Abatement

The waters of the Savannah River above Clark Hill Dam are relatively free of pollution. Bacterial contamination resulting from the discharge of municipal wastes has, however, caused localized pollution conditions in several of the tributary streams of the upper part of the basin. The waters of the main stem of the Savannah River in the reach from Clark Hill Dam to the estuary are of good quality, except for the zones immediately below the Augusta sewer outfalls and in the reach of river at and below metropolitan Savannah.

The Savannah River below Port Wentworth is heavily polluted by the discharge of untreated municipal and industrial wastes from the Savannah metropolitan area. The river downstream from Savannah is at times entirely depleted of its dissolved oxygen content. Sludge banks up to 12 feet in depth are reported to roll back and forth with the change of tide in the river immediately below Savannah. This condition restricts the upstream movement of American shad and striped bass.

Oyster and other shellfish growing areas in the lower Savannah basin have been closed to commercial fishing because the waters are contaminated by municipal wastes. In 1960, an estimated 11,000 acres of coastal water in the Savannah area were closed to commercial fishing.

Organic and inorganic pollution have been reported in Eastanollee Creek which drains into the Tugaloo River below Yonah Dam. The effects of this pollution have been severe in Eastanollee Creek, but no serious effects have been reported in the Tugaloo River. Most of the major mountain streams of the basin are free from pollution and offer excellent trout fishing. Mine wastes from operations in South Carolina have been reported as major sources of pollution in the Augusta area. Waste discharged in Beaverdam Creek near Royston, Georgia, may be adversely affecting the quality of water used for municipal water supply downstream. Full impact of pollution on the economy of the Savannah basin has not been evaluated because data are lacking.

Thirteen municipalities with 1960 populations of 800 or more do not have sewage collection systems. The 1960 population of the 62 municipalities with sewerage systems totaled approximately 383,000 people. However, these systems served some additional nearby areas and a total population of 405,000. Industrial wastes discharged to the municipal sewerage systems increased the polluting effect of the combined waste to an estimated population equivalent of 537,000.

Eighty-three industrial plants maintained separate waste systems in 1960. Thirty-nine of these industries provided some treatment for their liquid waste. Partial treatment provided by some, however, did little to reduce the polluting effect of these wastes on the receiving streams. Observation of the streams below the waste discharge points and reports of stream conditions indicate unsatisfactory handling of waste in some areas.

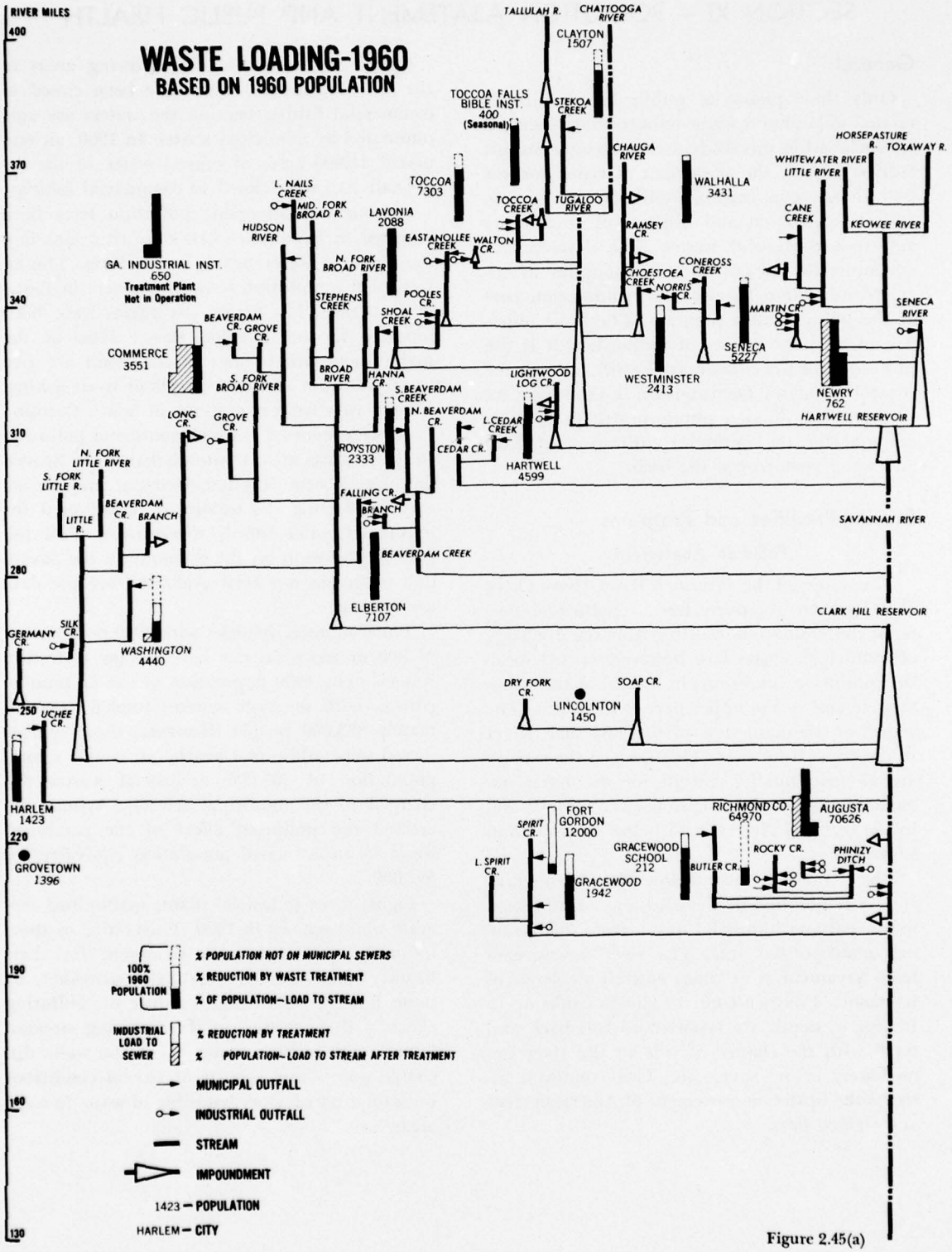

WASTE LOADING-1960
BASED ON 1960 POPULATION
RIVER MILES
400
370
340
310
280
250
220
190
160
130
TALLULAH R.
CHATTOOGA RIVER
CLAYTON 1507
TOCCOA FALLS BIBLE INST. 400 (Seasonal)
STEKOA CREEK
CHAUGA RIVER
WALHALLA 3431
HORSEPASTURE R.
TOXAWAY R.
WHITEWATER RIVER
LITTLE RIVER
KEOWEE RIVER
CANE CREEK
L. NAILS CREEK
MID. FORK BROAD R.
HUDSON RIVER
LAVONIA 2088
TOCCOA 7303
TOCCOA CREEK
TUGALOO RIVER
RAMSEY CR.
EASTANOLLEE CREEK
WALTON CR.
N. FORK BROAD RIVER
GA. INDUSTRIAL INST. 650
Treatment Plant Not in Operation
STEPHENS CREEK
POOLES CR.
SHOAL CREEK
CHOESTOEA CREEK
NORRIS CR.
CONEROSS CREEK
MARTIN CR.
SENECA RIVER
BEAVERDAM CR.
GROVE CR.
COMMERCE 3551
S. FORK BROAD RIVER
BROAD RIVER
HANNA CR.
S. BEAVERDAM CREEK
N. BEAVERDAM CR.
LIGHTWOOD LOG CR.
L. CEDAR CREEK
CEDAR CR.
WESTMINSTER 2413
SENECA 5227
NEWRY 762
HARTWELL RESERVOIR
LONG CR.
GROVE CR.
ROYSTON 2333
HARTWELL 4599
N. FORK LITTLE RIVER
S. FORK LITTLE R.
LITTLE R.
BEAVERDAM CR. BRANCH
FALLING CR. BRANCH
SAVANNAH RIVER
BEAVERDAM CREEK
ELBERTON 7107
CLARK HILL RESERVOIR
GERMANY CR.
SILK CR.
WASHINGTON 4440
DRY FORK CR.
SOAP CR.
LINCOLNTON 1450
UCHEE CR.
HARLEM 1423
GROVETOWN 1396
SPIRIT CR.
FORT GORDON 12000
L. SPIRIT CR.
GRACEWOOD 1942
GRACEWOOD SCHOOL 212
BUTLER CR.
ROCKY CR.
PHINIZY DITCH
RICHMOND CO. 64970
AUGUSTA 70626
100% 1960 POPULATION
% POPULATION NOT ON MUNICIPAL SEWERS
% REDUCTION BY WASTE TREATMENT
% OF POPULATION—LOAD TO STREAM
INDUSTRIAL LOAD TO SEWER
% REDUCTION BY TREATMENT
% POPULATION—LOAD TO STREAM AFTER TREATMENT
MUNICIPAL OUTFALL
INDUSTRIAL OUTFALL
STREAM
IMPOUNDMENT
1423 — POPULATION
HARLEM — CITY

Figure 2.45(a)

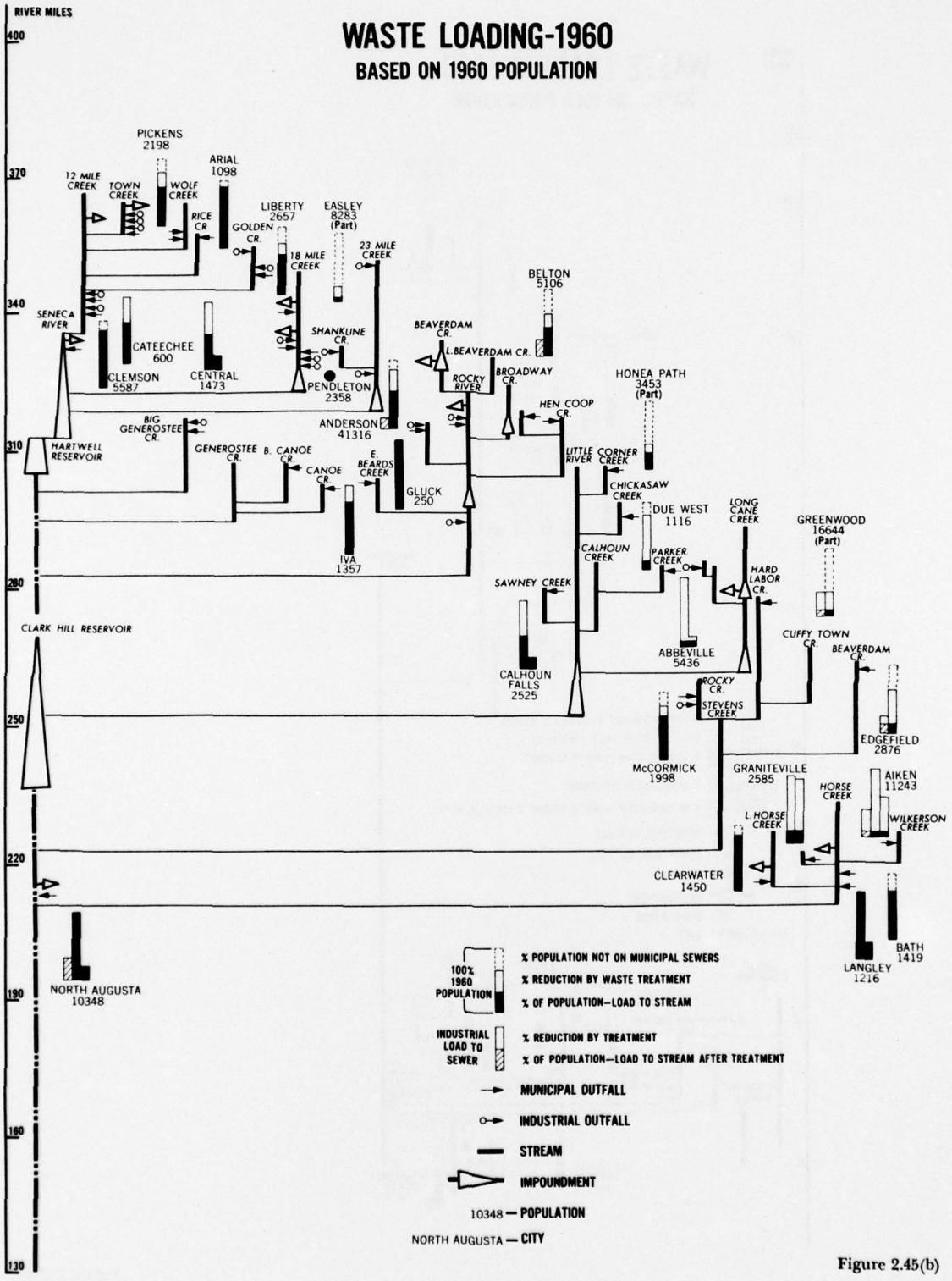

WASTE LOADING-1960
BASED ON 1960 POPULATION
RIVER MILES
400
370
340
310
280
250
220
190
160
130
PICKENS 2198
ARIAL 1098
12 MILE CREEK
TOWN CREEK
WOLF CREEK
RICE CR.
GOLDEN CR.
LIBERTY 2657
EASLEY 8283 (Part)
18 MILE CREEK
23 MILE CREEK
BELTON 5106
SENECA RIVER
CATEECHEE 600
CLEMSON 5587
CENTRAL 1473
SHANKLINE CR.
PENDLETON 2358
BEAVERDAM CR.
L. BEAVERDAM CR.
ROCKY RIVER
BROADWAY CR.
HONEA PATH 3453 (Part)
HEN COOP CR.
BIG GENEROSTEE CR.
HARTWELL RESERVOIR
GENEROSTEE CR.
B. CANOE CR.
CANOE CR.
E. BEARDS CREEK
ANDERSON 41316
GLUCK 250
IVA 1357
LITTLE CORNER CREEK
CHICKASAW CREEK
DUE WEST 1116
LONG CANE CREEK
GREENWOOD 16644 (Part)
CALHOUN CREEK
PARKER CREEK
HARD LABOR CR.
SAWNEY CREEK
ABBEVILLE 5436
CUFFY TOWN CR.
BEAVERDAM CR.
CLARK HILL RESERVOIR
CALHOUN FALLS 2525
ROCKY CR.
STEVENS CREEK
EDGEFIELD 2876
McCORMICK 1998
GRANITEVILLE 2585
HORSE CREEK
AIKEN 11243
L. HORSE CREEK
WILKERSON CREEK
CLEARWATER 1450
BATH 1419
LANGLEY 1216
NORTH AUGUSTA 10348
100% 1960 POPULATION
% POPULATION NOT ON MUNICIPAL SEWERS
% REDUCTION BY WASTE TREATMENT
% OF POPULATION—LOAD TO STREAM
INDUSTRIAL LOAD TO SEWER
% REDUCTION BY TREATMENT
% OF POPULATION—LOAD TO STREAM AFTER TREATMENT
MUNICIPAL OUTFALL
INDUSTRIAL OUTFALL
STREAM
IMPOUNDMENT
10348 — POPULATION
NORTH AUGUSTA — CITY

Figure 2.45(b)

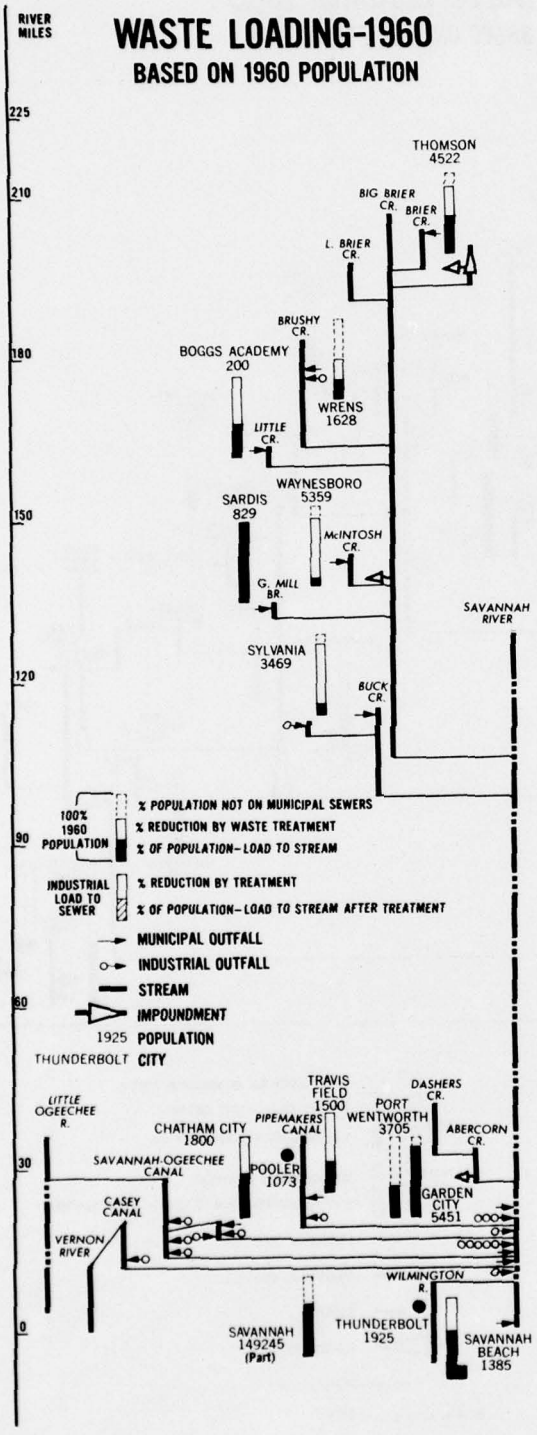

RIVER MILES
WASTE LOADING-1960
BASED ON 1960 POPULATION
225
210
180
150
120
90
60
30
0
THOMSON 4522
BIG BRIER CR.
BRIER CR.
L. BRIER CR.
BRUSHY CR.
BOGGS ACADEMY 200
WRENS 1628
LITTLE CR.
WAYNESBORO 5359
SARDIS 829
McINTOSH CR.
G. MILL BR.
SAVANNAH RIVER
SYLVANIA 3469
BUCK CR.
100% 1960 POPULATION
% POPULATION NOT ON MUNICIPAL SEWERS
% REDUCTION BY WASTE TREATMENT
% OF POPULATION-LOAD TO STREAM
INDUSTRIAL LOAD TO SEWER
% REDUCTION BY TREATMENT
% OF POPULATION-LOAD TO STREAM AFTER TREATMENT
MUNICIPAL OUTFALL
INDUSTRIAL OUTFALL
STREAM
IMPOUNDMENT
1925 POPULATION
THUNDERBOLT CITY
LITTLE OGEECHEE R.
CHATHAM CITY 1800
PIPEMAKERS CANAL
TRAVIS FIELD 1500
PORT WENTWORTH 3705
DASHERS CR.
ABERCORN CR.
SAVANNAH-OGEECHEE CANAL
POOLER 1073
GARDEN CITY 5451
CASEY CANAL
VERNON RIVER
WILMINGTON R.
SAVANNAH 149245 (Part)
THUNDERBOLT 1925
SAVANNAH BEACH 1385

Figure 2.45(c)


POLLUTION ABATEMENT
1960
TRANSYLVANIA
JACKSON
CLAY
N. C.
MACON
S. C.
TOWNS
GA.
RABUN
Clayton
Lake Burton
Cateechee
Walhalla
PICKENS
Liberty
Pickens
Arial
Easley
OCONEE
Newry
Central
Westminster
HABERSHAM
Seneca
Clemson
Tugaloo River
Toccoa
STEPHENS
ANDERSON
Belton
Lavonia
Anderson
Honea Path
HALL
BANKS
FRANKLIN
Hartwell Reservoir
Hartwell
Iva
Blue West
Royston
HART
JACKSON
MADISON
ELBERT
ABBEVILLE
Abbeville
Calhoun Falls
Greenwood
Elberton
Broad River
CLARKE
OGLETHORPE
GREENWOOD
SALUDA
McCormick
McCORMICK
Washington
LINCOLN
Clark Hill Reservoir
Edgefield
EDGEFIELD
WILKES
GREENE
TALIAFERRO
COLUMBIA
Augusta
Graniteville
Aiken
Thomson
WARREN
Harlem
Bath
AIKEN
Clearwater
Langley
McDUFFIE
Augusta
New Savannah Bluff
RICHMOND
Richmond County
GLASCOCK
Wrens
JEFFERSON
BARNWELL
Brier Creek
Waynesboro
BURKE
ALLENDALE
Sardis
JENKINS
Sylvania
SCREVEN
HAMPTON
EFFINGHAM
Port Wentworth
Garden City
JASPER
CHATHAM
Savannah
Savannah Beach
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
REPORTED STREAM POLLUTION
WASTE DISCHARGES
MUNICIPAL
NO TREATMENT OR SEPTIC TANK
PRIMARY TREATMENT
SECONDARY TREATMENT
INDUSTRIAL
( ) NUMBER BY COUNTY
OTHER
FEDERAL INSTALLATION
a FORT GORDON
b TRAVIS FIELD

Figure 2.46

TABLE 2.23

Sources of Municipal Pollution—1960

Municipality	Municipal population	Population served	Treatment		Untreated waste load	Receiving stream
			Type[1]	Design capacity PE[2] (1,000)	PE[2] (1,000)	Load to stream
Georgia						
Alto						
Industrial Institution	650	650	none	--	--	Tributary, Hudson River, Broad River; PE 800
Augusta	70,626	85,000	none	--	127.5	Tributaries, Savannah River; PE 127,500
Airport	75	75	0	[3]	0.1	Butler Creek, Savannah River; PE 75
Boggs Academy	200	200	3	0.4	0.2	Tributary, Little Creek, Brier Creek; PE 80
Clayton	1,507	1,200	1	0.8	1.5	Stekoa Creek-Chattooga River, Tugaloo River; PE 1,000
Commerce	3,551	3,500	1	5.0	11.5	Grove Creek, Hudson River, Broad River; PE 9,800
Elberton #1	7,107	3,500	none	--	3.5	Tributary, Beaverdam Creek, Savannah River; PE 3,500
#2	--	3,500	none	--	3.5	Tributary, Falling Creek, Broad River; PE 3,500
Fort Gordon Army Base	12,000	12,000	2	40.0	12.4	Spirit Creek, Savannah River; PE 1,236
Franklin Springs College	160	160	0	[3]	0.2	Branch-Broad River; PE 145
Garden City	5,451	4,750	none	--	4.8	Savannah River; PE 4,750
Chatham City	--	1,800	1	[3]	1.8	Tributary, Dundee Canal, Savannah River; PE 1,000
Gracewood School for Mentally Retarded	1,942	1,942	2	1.2	2.2	Spirit Creek, Savannah River
Gracewood School for Boys	212	212	2	[3]	0.2	Butler Creek, Savannah River; PE 170
Harlem	1,423	1,350	1	1.0	1.4	Tributary, Uchee Creek, Savannah River; PE 1,000
Hartwell #1	4,599	760	none	--	0.8	Tributary, Lightwood Log Creek, Hartwell Reservoir; PE 760
#2	--	3,000	none	--	3.8	Tributary, Cedar Creek, Savannah River; PE 3,800
Lavonia #1	2,088	1,500	0	[3]	1.5	Branch Shoal Creek, Hartwell Reservoir; PE 1,500
#2	--	500	0	[3]	0.5	Unawattie Creek, Broad River; PE 500
Port Wentworth #1	3,705	1,500	none	--	1.5	Savannah River; PE 1,500
#2	--	1,500	none	--	1.5	Ditch to Savannah River; PE 1,500
(Sawmill Village)	--	225	none	--	0.2	Savannah River; PE 225
Richmond County	--	15,000	none	--	18.8	Rocky Creek, Savannah River; PE 18,750
Royston #1	2,333	1,000	0	[3]	1.0	Tributary, Broad River, Savannah River; PE 1,000
#2	--	1,000	0	[3]	1.0	South Beaverdam Creek, Savannah River; PE 1,000
Sardis	829	829	none	--	0.8	Chandlers Hill Branch, Brier Creek; PE 829
Savannah (part)	149,245	105,000	none	--	155.0	Savannah River; PE 155,000
Travis Field	1,500	1,500	1	10.0	1.5	Pipe Makers Canal, Savannah River; PE 700
Savannah Beach	1,385	3,000	1	5.0	3.0	Savannah River; PE 1,950
Hotel	350	350	0	[3]	0.4	Turners Creek, Wilmington River; PE 300
Sylvania	3,469	3,000	2	5.0	3.0	Buck Creek, Savannah River; PE 450
Thomson	4,522	3,825	1	5.0	3.9	White Creek, Big Brier Creek, Savannah River; PE 2,225
Toccoa #1	7,303	4,800	none	--	5.7	Eastanollee Creek, Hartwell Reservoir; PE 5,700
#2	--	1,200	none	--	1.2	Toccoa Creek, Hartwell Reservoir
Toccoa Falls Institute	400	400	0	[3]	0.4	Toccoa Creek, Hartwell Reservoir; PE 360
Washington	4,440	2,800	2	10.0	3.5	Rocky Creek, Little River, Savannah River; PE 2,000
Waynesboro	5,359	4,400	2	8.0	4.5	McIntosh Creek, Big Brier Creek, Savannah River; PE 450
Prison	152	75	0	[3]	0.1	Tributary, McIntosh Creek, Brier Creek; PE 60
Wrens	1,628	800	1	2.2	0.8	Brushy Creek, Big Brier Creek, Savannah River; PE 400
South Carolina						
Abbeville	5,436	6,000	2	8.0	6.0	Parker Creek, Little River, Savannah River
Aiken	11,243	18,000	2	15.0	22.5	Wilkerson Creek, Horse Creek, Savannah River; PE 1,800

(continued)

TABLE 2.23—Continued

Municipality	Municipal population	Population served	Treatment		Untreated waste load	Receiving stream
			Type[1]	Design capacity PE[2] (1,000)	PE[2] (1,000)	Load to stream
South Carolina						
Anderson	41,316	20,160	1	10.0	26.0	Big Generostee Creek, Savannah River; PE 13,000
		15,600	1	15.0	17.0	Rocky River, Savannah River; PE 11,900
Arial	1,098	1,000	0	[3]	1.0	Rice Creek, 12 Mile Creek, Hartwell Reservoir; PE 1,000
Bath	1,419	1,000	none	--	1.0	Horse Creek; PE 1,000
Belton #2	5,106	1,500	2	[3]	1.7	Hen Coop Creek, Rocky River; PE 1,250
#3	--	1,500	2	[3]	2.5	Cupboard Creek, Rocky River; PE 2,000
Calhoun Falls	2,525	2,900	2	[3]	2.9	Sawney Creek, McKenley Creek, Savannah River; PE 1,500
Cateechee	600	600	1	[3]	0.6	12 Mile Creek, Hartwell Reservoir; PE 470
Central #1	1,473	780	1	[3]	0.8	5 Mile Creek, 18 Mile Creek, Hartwell Reservoir; PE 280
#2	--	400	1	[3]	0.4	12 Mile Creek, Hartwell Reservoir; PE 280
#3	--	600	1	[3]	0.6	18 Mile Creek, Hartwell Reservoir; PE 480
Clearwater	1,450	1,200	none	--	1.2	Little Horse Creek, Horse Creek, Savannah River; PE 1,200
Seminole Mills Village	500	500	none	--	0.5	Branch, Horse Creek, Savannah River; PE 500
Clemson	1,587	700	0	[3]	0.7	Hartwell Reservoir; PE 560
Clemson College	4,000	4,000	none	--	4.0	Hartwell Reservoir; PE 4,000
Due West	1,116	1,000	2	2.5	1.0	Chickasaw Creek, Little River; PE 150
Easley (part)	8,283	1,860	3	1.9	1.9	18 Mile Creek; PE 280
Edgefield	2,876	1,800	1	[3]	2.5	Beaverdam Creek, Stephens Creek; PE 800
Gluck Mill Village	250	250	0	[3]	0.2	Beaverdam Creek, Rocky Creek; PE 250
Graniteville	2,585	5,000	2	10.0	5.0	Wise Creek, Horse Creek, Savannah River; PE 500
Greenwood (part)	16,644	6,000	2	15.0	12.0	Hard Labor Creek, Stephens Creek; PE 1,200
Honea Path (part)	3,453	1,200	1	[3]	1.2	Corner Creek, Little River; PE 960
Iva #1	1,357	650	1	[3]	0.6	Canoe Creek, Generostee Creek, Savannah River; PE 420
#2	--	400	0	[3]	0.4	East Beards Creek, Rocky River; PE 400
#3	--	300	0	[3]	0.3	Canoe Creek, Generostee Creek; PE 290
Langley	1,216	1,500	none	--	1.5	Horse Creek, Savannah River; PE 1,500
Liberty #1	2,657	1,000	1	[3]	1.0	Branch, Golden Creek, Hartwell Reservoir; PE 800
#2	--	350	0	[3]	0.4	15 Mile Creek, Hartwell Reservoir; PE 320
#3	--	350	0	[3]	0.4	18 Mile Creek, Hartwell Reservoir; PE 320
#4	--	300	0	[3]	0.3	Branch, Hartwell Reservoir; PE 170
McCormick	1,998	1,600	1	[3]	1.6	Rocky Creek, Stevens Creek; PE 1,300
Newry	762	1,200	none	--	2.0	Little River, Hartwell Reservoir; PE 1,970
North Augusta	10,348	13,000	none	--	16.3	Savannah River; PE 16,300
Pickens #1	2,198	1,400	1	[3]	1.4	Wolf Creek, Hartwell Reservoir; PE 1,100
#2	--	300	0	[3]	0.3	Town Creek, Hartwell Reservoir; PE 240
#3	--	100	0	[3]	0.1	Wolf Creek, Hartwell Reservoir; PE 80
Seneca #1	5,227	700	none	--	0.7	Coneross Creek, Hartwell Reservoir; PE 700
#2	--	4,000	none	--	4.0	Martin Creek, Hartwell Reservoir; PE 4,000
Walhalla #1	3,431	2,530	none	--	2.5	Cane Creek, Little River, Hartwell Reservoir; PE 2,500
#2	--	950	1	[3]	1.0	Coneross Creek, Hartwell Reservoir; PE 850
Westminister #1	2,413	600	1	1.0	0.6	England Creek, Choestoea Creek, Hartwell Reservoir; PE 540
#2	--	1,800	1	1.5	1.8	Norris Creek, Coneross Creek, Hartwell Reservoir; PE 1,440
#3	--	200	1	1.2	0.2	Moss Creek, Hartwell Reservoir; PE 160
#4	--	200	0	1.2	0.2	Miller Branch, Hartwell Reservoir; PE 180
#5	--	200	0	0.8	0.2	Sheldon Creek, Hartwell Reservoir; PE 180

NOTES: [1] Type
1—Primary
2—Secondary
3—Stabilization pond
0—Septic tank

[2] PE—Population equivalent based on biochemical oxygen demand.
[3] Undetermined.

TABLE 2.24

Industrial Wastes Discharged to Streams[1]

Type of industry	Number of plants	Volume of waste (m.g.d.)[2]	PE or type of waste[2]	Type of treatment	Waste to stream PE[2]	Receiving stream
Chemical	13	2.690	Inorganic	Oil removal	--	Savannah River
		0.004	Inorganic	Settling	--	Pond
		0.650	Inorganic	None	--	Savannah River
		0.145	Inorganic	None	--	Savannah River
		0.001	Inorganic	Neutralized	--	Savannah River
		25.000	Inorganic	Lagoon	--	Savannah River
		0.005	Inorganic	None	--	Ogeechee Canal, Savannah River
		1.600	Inorganic	None	--	Pipe Makers Canal, Swamp
		0.700	Inorganic	None	--	Casey Canal, Savannah River
		0.004	Inorganic	None	--	Marsh, Oates Creek
		0.090	Inorganic	Lagoon	--	Pond (no outlet)
		0.002	200	None	200	Mockingbird Branch, Horse Creek
		0.016	120	Neutralized	30	Whitner Creek, Generostee Creek
Paper	4	19.000	90,000	None	90,000	Savannah River
		0.014	75	None	75	Savannah River
		40.000	1,110,000	None	1,110,000	Savannah River
		17.000	150,000	Stabilization pond	30,000	Savannah River
Food	18	0.017	1,100	None	1,100	Ogeechee Canal, Savannah River
		0.105	2,640	Catch basin	2,640	Canal, Savannah River
		2.500	150,000	None	150,000	Savannah River
		0.214	6,000	Catch basin	6,000	Ogeechee Canal, Savannah River
		0.025	5,000	None	5,000	Savannah River
		0.525	Vegetable oils	Oil removal	[3]	Savannah River
		0.003	50	Septic tank	45	South Fork Broad River
		0.006	120	Primary	75	Buck Creek, Savannah River
		0.001	40	Septic tank	30	Branch, Savannah River
		0.015	1,620	Catch basin	1,620	Rocky Creek, Butler Creek
		0.570	6,000	None	6,000	Branch, Beaverdam Creek
		0.080	2,720	None	2,720	Augusta Canal, Savannah River
		0.018	360	None	360	Canal, Savannah River
		0.001	Vegetable oils	None	[3]	Rhodes Creek, Savannah River
		0.001	600	Broad land irrigation	--	None
		0.008	160	Septic tank	130	Branch, Rocky Creek
		0.004	960	Septic tank	620	Wolf Creek, Rocky Creek
		0.023	1,000	Stabilization pond	--	No discharge
Lumber	2	0.030	Inorganic	Oil removal	--	Branch, Savannah River
		0.208	Inorganic	Oil removal	--	Rocky Creek, Butler Creek
Metal	5	0.005	Inorganic	None	--	Canal, Savannah River
		0.100	Inorganic	Oil removal	--	Lightwood Log Creek, Hartwell Reservoir
		0.140	Inorganic	Settling lagoons	--	Lake Louise
		0.025	Inorganic	Chemical precipitation	--	Whitner Creek, Generostee Creek
		0.100	Inorganic	None	--	Town Creek, Hartwell Reservoir
Textile	36	1.920	10,150	Settling	7,650	Eastanollee Creek, Hartwell Reservoir
		0.190	1,500	None	1,500	Beaverdam Creek, Savannah River
		0.040	750	None	750	Pooles Creek, Broad River
		0.050	936	Septic tank	840	Grove Creek, Broad River
		0.150	90,000	None	90,000	Savannah River
		0.015	500	None	500	Canal, Savannah River

(continued)

TABLE 2.24—Continued

Type of industry	Number of plants	Volume of waste (m.g.d.)[2]	PE or type of waste[2]	Type of treatment	Waste to stream PE[2]	Receiving stream
Textile	36	1.500	4,250	None	4,250	Blue Hill Creek
		0.610	20,500	Stabilization pond	3,000	Rocky Creek
		0.001	50	None	50	Horse Creek
		3.910	50,000	Stabilization pond	32,800	Little Horse Creek
		3.410	89,411	None	89,411	Horse Creek
		0.001	120	None	120	Whitner Creek, Generostee Creek
		0.001	100	None	100	Cemetery Creek, Rocky Creek
		0.600	4,020	None	4,020	Rocky Creek
		0.337	14,300	Chemical precipitation, activated sludge	140	Betsy Creek, Rocky Creek
		0.001	120	Stabilization pond	20	4 Mile Creek, Rocky Creek
		0.001	25	None	25	Silverbrook Creek
		0.040	3,900	None	3,900	Cupboard Creek, Rocky Creek
		1.100	4,500	None	4,500	23 Mile Creek, Hartwell Reservoir
		1.300	19,500	None	19,500	18 Mile Creek, Hartwell Reservoir
		0.007	400	Stabilization pond	20	18 Mile Creek, Hartwell Reservoir
		0.001	50	None	50	Branch, Savannah River
		0.250	4,000	Chemical precipitation	3,000	Branch, Savannah River
		3.000	34,000	None	34,000	Martin Creek, Hartwell Reservoir
		0.009	300	None	300	Little River, Hartwell Reservoir
		0.001	Inorganic	Neutralize	--	Coneross Creek, Hartwell Reservoir
		0.001	25	None	25	Coneross Creek, Hartwell Reservoir
		0.350	850	Stabilization pond	400	Oconee Mill Branch
		0.001	50	None	50	12 Mile Creek, Hartwell Reservoir
		0.001	300	None	300	Golden Creek, 12 Mile Creek, Hartwell Reservoir
		0.001	50	None	50	Branch
		0.001	100	None	100	Brushy Creek, Hartwell Reservoir
		0.150	1,200	Chemical precipitation	200	18 Mile Creek, Hartwell Reservoir
		0.075	1,500	Neutralize filter	225	18 Mile Creek, Hartwell Reservoir
		0.004	300	Septic tank	240	Town Creek, Hartwell Reservoir
		0.001	600	None	600	Town Creek, Hartwell Reservoir
Stone	50	0.500	Inorganic	None	--	Various streams (50 plants)
Miscellaneous	5	0.500	15,200	None	15,200	Savannah River
		1.600	Inorganic	Oil removal	--	Savannah River
		0.045	5,000	None	5,000	Savannah River
		0.520	Inorganic	Settling	--	Phinizy Canal, Savannah River
		1.440	Inorganic	Settling	--	Cedar Creek, Savannah River

NOTES: [1] Industries discharging to land surface or watercourse.
[2] m.g.d. = Million gallons per day; PE = population equivalent based on biochemical oxygen demand.

Vector Control

Vector control is concerned with disease-carrying vermin, primarily mosquitoes and secondarily flies, fleas, chiggers, ticks, rats, and other pests.

In 1960, there were 12 countywide vector control programs in South Carolina. Operations were mainly centered around mosquito control by killing adult mosquitoes and on residual spraying of homes and outbuildings in selected rural areas where malaria transmission was most likely to occur. The killing of mosquito larva and permanent mosquito-control work is also carried out in various towns. The county health

departments conduct or assist with rodent control programs both in towns and rural sections. The State Department of Public Health spent $105,000 in 1960 for insecticides furnished to local government units. The State also furnishes trucks, technical consultation, and assistance to these local programs. Rodenticides are purchased in quantity by the State and sold at cost to local government units.

In the Georgia portion of the basin, vector control programs consist of several city mosquito-control programs and the Chatham County Mosquito Control Commission. Most of the urban mosquito control activities are limited to killing adult mosquitoes.

The Chatham County Commission has constructed water management ditches which drain about 1,800 acres of salt marsh and about 100 acres of fresh-water mosquito breeding areas, and is pioneering in the routine use of new Paris green pellets for controlling mosquito larvae by both aerial and ground application. The Paris green pellets were used extensively and routinely at Fort Pulaski National Monument and naturalists have observed no toxic effects on crops, fish, wildlife, or cattle.

Salt-marsh ditches are constructed for the management of water in the upper portions of the marshes. Over 95 percent of the area in the salt marshes does not require drainage because it is covered daily by tidewater which prevents breeding of salt-water mosquitoes. The ditches are usually a minimum of 8 to 9 feet wide and at least 2 feet deeper than the mean low water level. These ditches abound with minnows and other fish. They enhance fish propagation and have little or no deleterious effect on waterfowl habitat. Care should be taken not to drain large permanent bodies of water in the marshes which encourage duck populations and which do not provide breeding areas for salt-water mosquitoes or sand flies.

Extensive studies on rat problems in Grady, Thomas, Brooks and Decatur Counties in Georgia were made prior to 1960 by the Public Health Service. There are many economic and health benefits derived from countywide rodent control programs.

Federal installations of the basin have vector control programs. A mosquito control program at Clark Hill Reservoir includes contract aerial larviciding supplemented by minor drainage and shoreline maintenance work. There is a program for control of mosquitoes, eye gnats, and rodents at the Savannah River Atomic Plant.

The small private power impoundments in the upper basin do not provide breeding areas for mosquitoes.

Air Pollution Monitoring

The major sources of industrial air pollution are in Chatham and Richmond Counties, Georgia. Some discomfort to the general public has been caused by release of varying amounts of dust, gases, smoke, fly ash, and unpleasant odors to the atmosphere near 5 pulp and paper mills, 8 chemical and fertilizer plants, and 4 kaolin and brick manufacturing plants. There are also reports of air pollution from burning garbage and refuse at city dumps. This unsatisfactory method of disposal has been used principally by the smaller communities.

National Air Network sampling stations are located at Augusta and Savannah. The Georgia and South Carolina Departments of Public Health cooperate with the U. S. Public Health Service in this program. In addition to this continuous network sampling, a statewide survey to locate all sources of air pollution in Georgia was made in 1961.

The Industrial Hygiene Service of the Georgia Department of Public Health has maintained records of complaints of industrial air pollution problems since 1945. Investigations have been made of all complaints. The State agency works cooperatively with industries in developing satisfactory solutions to all air pollution problems of the area.

In 1960, the South Carolina legislature established a committee to make a continuous study of industrial expansion, including industrial air pollution. State health regulations prohibit the discharge into the atmosphere of fumes which are offensive or dangerous to the health of human beings.

The Savannah River project of the Atomic Energy Commission has continuously monitored the large area surrounding the plant site to control any air or water pollution which might result from their operations. Authorized Federal and State agencies work cooperatively with the

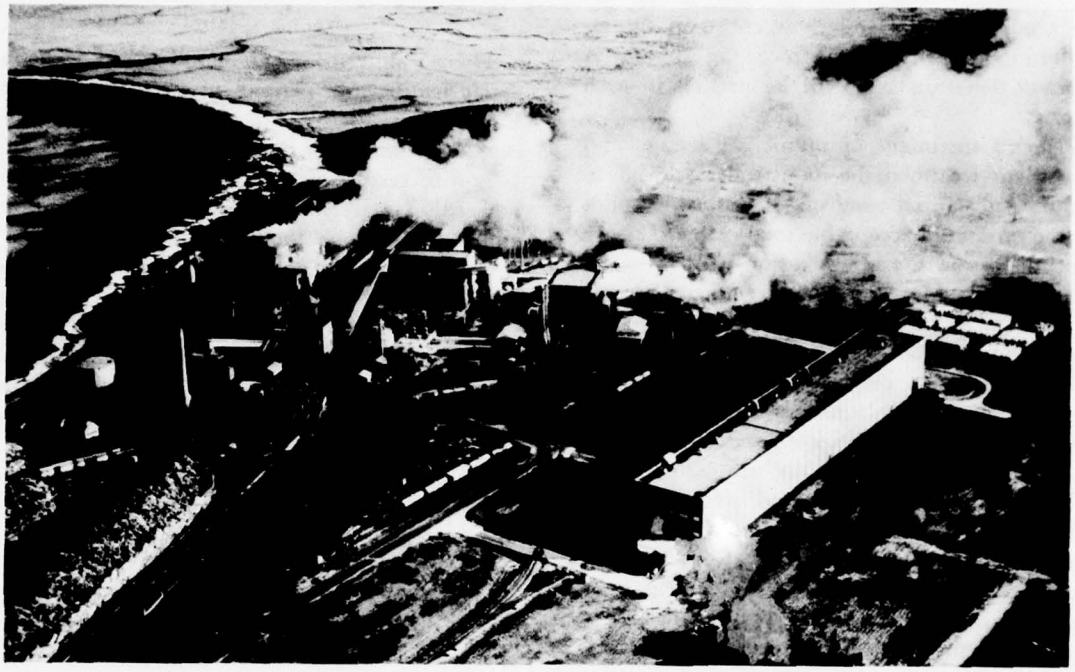


Figure 2.47 *Air Pollution Causes Discomfort to the General Public.*

Commission and plant staff in maintaining satisfactory monitoring of radioactivity levels.

There are numerous medical research and industrial users of radioisotopes in the basin. The use of these materials is concentrated chiefly around Clemson and Anderson, South Carolina, and around Augusta and Savannah, Georgia.

Progress reports prepared by the Health Physics Section of the du Pont Company, prime contractor for operation of the Savannah River Plant, stated that, "the concentrations of radioactive materials found in 1958-60 in the environs of the Savannah River Plant through the release of radioactive wastes by the plant were so small that in most cases they could not be definitely distinguished from that due to natural background or to debris from nuclear weapons tests. Monitoring of domestic water supplies, fish, milk, and foods in the vicinity of the plant has shown no levels of radiation that are of health significance."

Solid Waste Disposal

Most of the communities in the basin collect and dispose of solid waste as a public service. In a few instances, however, the collection and disposal is left to the individuals producing the waste or to private collectors who charge a fee for the service. Of approximately 100 communities in the Savannah basin, only 11 were reported to have satisfactory methods for refuse disposal in 1960. They were Augusta, Fort Gordon, Savannah, and Thomson in Georgia, and Abbeville, Aiken, Anderson, Greenwood, Liberty, Walhalla, and the Savannah River Plant in South Carolina.

Open dumps and burning were the usual methods of disposal. Garbage and refuse provide food and shelter for insects and rodents. Smoldering piles of waste material produce an odorous smoke which creates a widespread nuisance. Proper disposal of these materials in sanitary landfills costs little more than the operation of open dumps and will eliminate nuisances and prevent the development of health problems.

Needs and Opportunities

Pollution Abatement

There is general need for pollution prevention as well as pollution abatement for both organic and inorganic wastes. The type of handling or treatment required will depend upon

the kinds of wastes and their effect on the assimilating capacity of the receiving stream. A separate determination will be needed in each case.

Primary treatment of municipal sewage and equivalent treatment of industrial waste affecting the substantial removal of settleable solids are the minimum acceptable treatments to assure continued growth and expansion within the Savannah basin. More complete treatment is needed in many areas. Where critical streamflows are not adequate to assimilate the effluent from secondary treatment plants and water quality is impaired, either additional water to augment the low flows or a higher degree of treatment will be needed to adjust the waste loading to the minimum streamflow conditions.

In estimating sewage treatment needs, all towns with population over 800 have been included. Also included are 5 nonmunicipal systems, smaller towns which had existing sewerage systems in 1960, and sewerage districts serving densely populated suburban areas. In addition to primary treatment or its equivalent, secondary treatment with chlorination is planned wherever the assimilating capacity of the receiving stream is inadequate to handle the effluent of the primary treatment plant.

A need exists in the Savannah basin and throughout the Southeast River Basins area for studies to determine the effects of pollution resulting from use of insecticides, pesticides, and herbicides and to develop methods of control.

A detailed study of the lower Savannah River is one of the first obvious needs of the basin.

Vector Control

There is a need for more emphasis to be given to larviciding and permanent control measures. Eastern encephalitis or sleeping sickness has caused serious losses among horses in the basin. Mosquito vectors of this often fatal human and horse disease are most prevalent in the swamps and marshes along the coast.

Primary local malaria transmission has been at extremely low levels in recent years. The number of malarial mosquitoes remains about the same as when widespread malaria transmission occurred in the area. Malaria could again become a very serious health problem if malaria parasites were introduced.

Continued effective pest control in urban areas and more effective control of rats in rural areas are desirable and will play an important part in halting typhus transmission.

The coastal area, with its extensive tidal marshlands, has multitudes of biting insects. In this area, salt-marsh mosquitoes occur in large numbers and annoy the residents and visitors to recreational areas. At times these insects occur in such numbers that outdoor activities are limited. Large broods of salt-marsh mosquitoes frequently occur after unusually high tides or heavy rains. About 5,000 acres of salt marsh could be drained to alleviate this condition.

Fresh-water swamps, marshes, and low-lying areas that receive floodwater are also sources of mosquitoes. Approximately 3,000 acres, mostly in pastureland, could be advantageously drained.

Throughout the basin, numerous small patches

TABLE 2.25

Municipal Sewerage Facility Needs[1]

Period	State	Population served	Number of places	Places requiring additions or new construction		
				Primary treatment facilities	Secondary treatment facilities	Collection systems
1960	Georgia	515,000	43	9	20	31
to	South Carolina	220,000	40	6	26	28
1975	Total	735,000	83	15	46	59
1975	Georgia	930,000	49	7	10	33
to	South Carolina	370,000	45	2	11	24
2000[2]	Total	1,300,000	94	9	21	57

NOTES: [1] Includes Federal and State installations and the people they serve.
[2] Places included for this period may also be included in the 1960-75 period.

of alligator weed and water hyacinths are found in the small ditches and drainage creeks. Both of these noxious weeds were introduced from tropical areas into the United States and are spreading throughout the basin. Profuse growths of the weeds tend to clog drainage ditches, canals, and ponds, and create conditions favorable for malaria mosquitoes. Quantities of similar aquatic plants are present.

Inadequate sanitation causes vector problems in both urban and rural areas. In urban areas, vector problems are frequently associated with improper disposal of sewage wastes. Severe mosquito problems have developed in the past where communities discharged improperly treated sewage wastes into swampy or impounded areas near town. In about 15 percent of the towns studied, overflowing septic tanks left ideal places for breeding mosquitoes. Sewage stabilization ponds are being constructed in the basin and could cause mosquito-breeding problems if they are not properly operated and kept free of vegetation. There are now three sewage oxidation ponds in Savannah successfully handling sewage from outlying subdivisions. None of these has occasioned mosquito breeding.

Many housefly, rodent, and roach problems in some cities are associated with inadequate refuse storage and collection practices both in residential and business sections. Daily collection service in business areas and twice-a-week service in residential areas are needed for effective vector control. Savannah has recently joined other cities in implementing a new effective type of refuse collecting system which features large waterproof containers that can be mechanically emptied on the spot into a large truck.

About 25 percent of the homes in the urban areas do not now meet minimum sanitation standards; many of these have associated fly, rat, and mosquito problems. Savannah and Augusta have excellent minimum housing programs administered by their county health departments. Approximately 10 percent of the estimated 13,000 substandard housing units in Savannah have been brought up to standard. In 3 years of program operation, 279 housing units were razed, and 18 were vacated. In Augusta, after 6 years of operation, about 4,000 houses were brought up to standard with 8,000 more units scheduled for correction during the next few years.

Air Pollution Monitoring

Legislation to control and suppress air pollution in Georgia and South Carolina is needed. The pollution to be controlled includes, but is not limited to, smoke, toxic and radioactive substances, fumes, vapors, gases, odors, and dust. These may constitute a nuisance or a danger to public health or plant life, or may impair public comfort and convenience. The control of noxious weeds whose pollens pollute the atmosphere and add to the discomfort of man should be a part of the total program and could be handled by the local health agencies.

Radiation Monitoring

There is a need for continuous monitoring by State and Federal agencies of the radiation hazards associated with the use of radioisotopes and the disposal of radioactive wastes in the basin. Levels of radiation should be reported and continuous monitoring employed to detect any increase in radiation which could directly affect development of the land or water resources. The State departments of health have programs in radiological health which include air and water monitoring and there are other monitoring programs to measure the total radiation concentration. Continuation and expansion of these programs is needed.

Solid Waste Disposal

Low marsh areas can be utilized for landfill operations. Landfill disposal, properly controlled, will prevent the breeding of flies, roaches, and rodents, and would eliminate the nuisances of burning open dumps. The amount of solid waste produced nationally averages about 1 cubic yard, or 650 pounds, per person per year. Disposal of waste by sanitary landfill requires about 1 acre per 10,000 persons per year. The total per capita cost of collecting solid wastes, acquiring needed land, and operating sanitary landfills varies inversely with the size of the city from $1.50 to about $4.50 per year. Landfill methods of disposal afford an opportunity to reclaim low marshy or swampy areas for other uses.

Cities of more than 50,000 population and with limited land area available for disposal of solid waste may require incinerators. The construction costs of large incinerators range from $2,000 to $4,000 per day per ton capacity. An

estimated 1,000 persons in a large metropolitan area will contribute a ton of refuse per day. Operational costs are approximately $1.50 per ton, and collection costs are approximately $1.50 per person per year. The ashes and noncombustible material remaining after incineration will require approximately 1 acre per 30,000 people per year for proper disposal in landfills.

State and local health departments have adequate authority to control the storage, collection, and disposal of refuse; however, it is usually considered and handled as a local problem after consultation with State and local health departments.

Means of Meeting the Needs

Pollution Abatement

Prior to 1975, an estimated 330,000 additional people will be served by municipal sewerage systems. Between 1975 and the year 2000, 565,000 additional persons, or a total of about 1,300,000, are expected to be served by municipal sewerage systems. In order to provide facilities for handling of these wastes, the following improvements would be needed before the year 1975: 15 primary plants, 18 secondary plants, 28 stabilization ponds, and new collection systems or extensions to existing systems for 59 places.

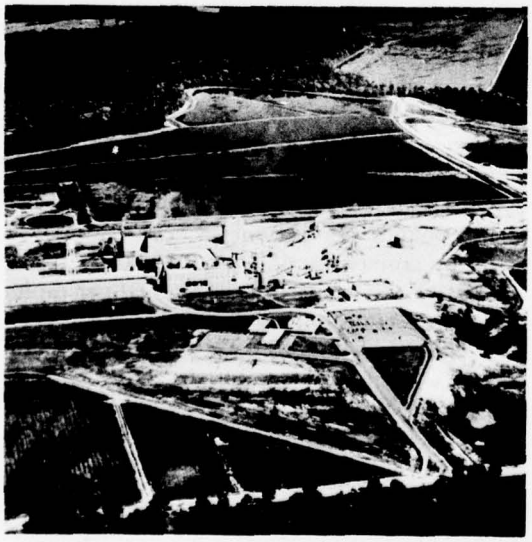


Figure 2.48 *Industrial Plant near Augusta with Excellent Waste Treatment Facilities. Other Similar Facilities Will Be Required in the Basin to Maintain Desirable Water Quality.*

By the year 2000, additional improvements including 9 primary plants, 9 secondary plants, 12 stabilization ponds, and extensions to 57 distribution systems will be required. Some of the sewage treatment plants in operation in 1960 may require complete rehabilitation or replacement prior to 2000.

By 1975, new or improved treatment facilities are expected to be needed for 29 existing sources of industrial waste. New plants which will require waste-treatment facilities are also expected to be established. As industrial development in the basin continues to expand from 1975 to 2000 other new and enlarged treatment facilities will be needed to handle adequately all industrial wastes.

In estimating municipal and industrial waste-treatment facilities, the development of the area was taken into consideration. As development occurs, field studies will be necessary to determine the degree and type of treatment required to prevent pollution of the receiving streams. In some instances, it may be economical to treat industrial waste combined with the domestic sewage. Low-flow augmentation will be required in some instances to maintain desired water quality in streams. However, low-flow augmentation should be considered only after secondary treatment of all wastes has been provided.

In some areas it is not feasible to provide sufficient water for assimilating treated wastes because of the volumes of waste discharged. In such areas, other methods or means must be developed for handling the waste discharges. Such situations require individual study. Additional treatment may be needed or another possibility may be collection and diversion of wastes to another stream or water course where the effluent can be satisfactorily handled after treatment without damage to the water resources.

Vector Control

In the interest of efficiency and economy, mosquito-control programs should be operated on a district or county basis. Increased implementation of the programs by State aid to county health departments, including purchase of insecticides and equipment, technical consultation, and assistance in coordinating the programs is needed. The State or Federal Governments can best handle research, technical super-

vision, training of personnel, and assistance to district personnel. Legislation that would enable establishment of statewide mosquito or other vector control districts would be beneficial. Coordination between all agencies concerned is essential in order that the vector control programs will be compatible with multiple-purpose functions.

Air Pollution Monitoring

The State air pollution abatement program could be expanded. Full cooperation of industries and municipalities with the State agencies will be needed to assure a coordinated and effective program.

Radiation Monitoring

A survey to establish background levels of radiation should be made. Continuous monitoring then would indicate any hazardous increase in radiation.

Solid Waste Disposal

Adoption of solid waste collection and proper disposal programs is needed in all communities of 500 or more population. This could best be accomplished by municipal or countywide programs.

The sanitary landfill and incinerators are acceptable methods for solid waste disposal. A total of 69 landfill operations will be needed to serve an estimated 700,000 people in 1975. By the year 2000, 72 landfill operations will be needed to serve a population of approximately 1,300,000 people. Because of the limited land area, it may be necessary for some of the cities to construct incinerators for the handling of solid waste.

SECTION XII – OTHER BENEFICIAL PURPOSES
BEACH EROSION CONTROL AND HURRICANE PROTECTION

General

The Savannah basin shoreline extends about 22 miles along the Atlantic Ocean. Tybee Island, Georgia, on which famous Savannah Beach is located, is the only public beach in the basin. Turtle and Oyster Bed Islands in South Carolina are unpopulated. Fort Pulaski National Monument, on Cockspur Island in Georgia, has a few inhabitants who maintain the monument.

Tybee Island lies immediately south of the mouth of the Savannah River and about 17 miles east of the city of Savannah. The island is about 7.5 miles long and averages about 2.5 miles in width. It is separated from the mainland by meandering tidal streams, which are fringed by extensive marshlands. The mean tidal range is about 7 feet.

U. S. Highway No. 80, providing access to the island from Savannah, crosses four rivers via drawbridges and other streams via fixed bridges. The lowest point on this highway, about 6.8 feet above mean sea level, is east of Bull River bridge at the beginning of a long stretch of exposed causeway.

The shoreline of the island is exposed to the maximum effects of winds from the northeast, east, south, and southeast. The prevailing winds in the spring are generally from the southeast, but from September to November they are from the northeast. The average velocities of the southeast winds are 10 knots, and the northeast winds are from 8 to 9 knots. Occasionally, they increase to moderate gale force.

In general, the predominant direction of currents and movement of material along the coast is from north to south. There are local reverses resulting from the configuration of the shoreline and short-time reverses caused by changes in the direction of waves.

Since 1700, at least 54 storms of hurricane intensity have affected Tybee Island. Most of these occurred in August, September, or October. Statistics are available on 9 very destructive storms that have affected Tybee Island since 1881.

Savannah Beach occupies a strip of the island about 1 mile in width, extending along the ocean for about 3.5 miles. The permanent Savannah Beach population totals about 2,000. During the recreation season from May to September, the average population increases to 8,000 or 10,000. As many as 25,000 people visit on holiday weekends. Shops and other facilities and about 1,500 cottages, hotels, and homes serve

HURRICANE PATHS
BEACH EROSION AND ACCRETION

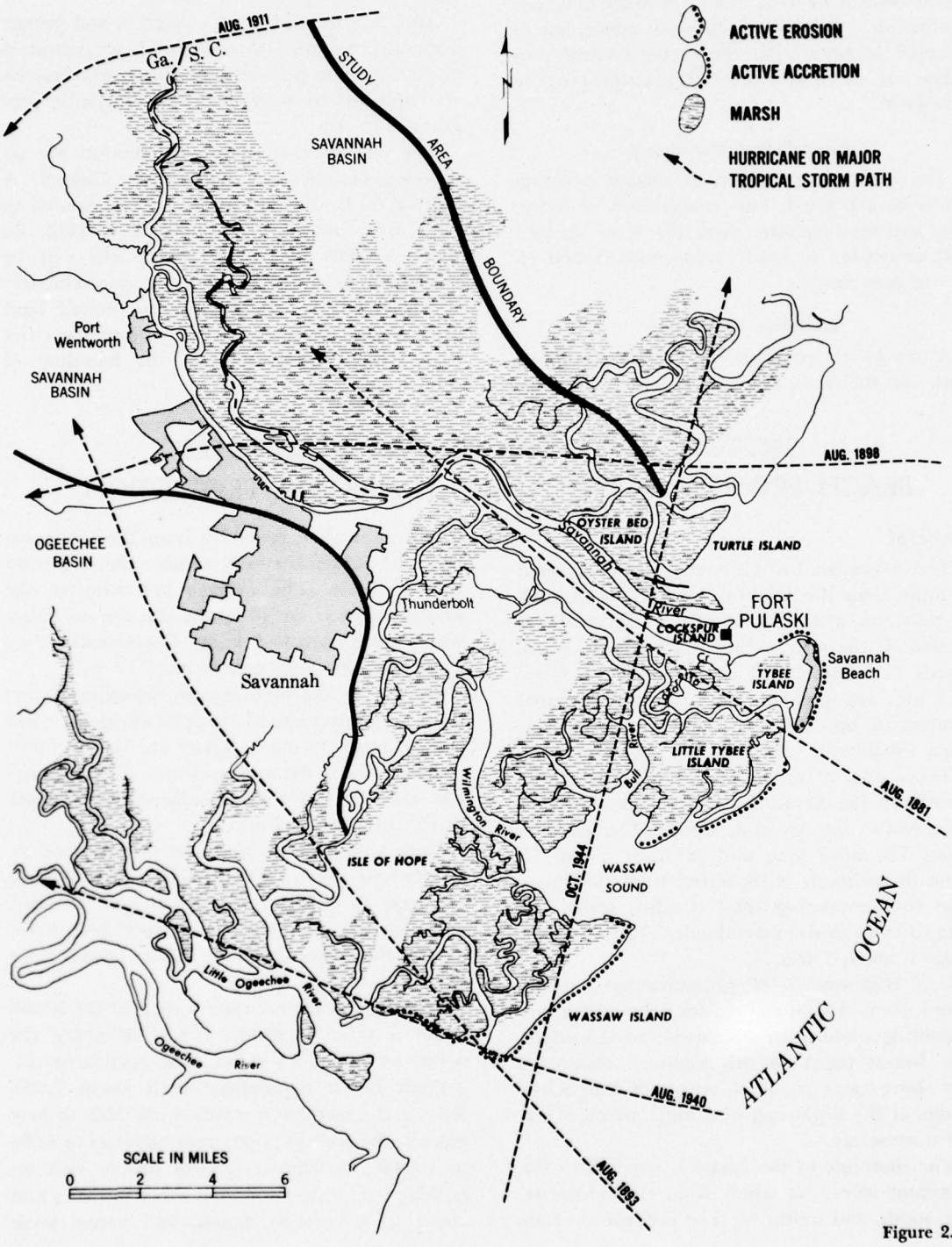


Figure 2.49

the temporary and permanent populations. Noncommercial, commercial, and public property values on the island are estimated at $9 million, $1 million, and $1.2 million, respectively.

Existing Facilities and Programs

Beach Erosion Control

The Federal Government constructed about 0.7 mile of bulkhead along Savannah Beach during the period from 1931 through 1933. Local interests, with the assistance of the Works Progress Administration, constructed a bulkhead, mostly of concrete, at an average elevation of 8.5 feet above mean sea level along the northeast and eastern shore of Tybee Island for a distance of 2.5 miles. In addition, local interests constructed a system of low impermeable groins along the full length of the island to retard erosion along the shore.

Hurricane Protection

The existing bulkhead system is adequate to protect the beach against moderate storm attack and ordinary beach erosion. Structures capable of protecting the beach from severe hurricane attack would be costly and, to a large extent, would mar the beauty of the beach and make property less desirable from a recreational standpoint.

In the absence of direct protection from severe hurricane attack, evacuation to safe shelters on the mainland is necessary to reduce the hazard to life. The evacuation problem is complicated because U. S. Highway No. 80 could be blocked by floodwaters before flooding becomes critical on the island. In recent years, when notified by the Weather Bureau that evacuation was advisable, the mayor of Savannah Beach, acting in his capacity as director of civil defense on the island, has ordered evacuation. Police have alerted the residents, and the bus company has furnished additional busses for individuals without transportation. The Weather Bureau, in carrying out its responsibilities for improving hurricane warning services, has been instrumental in having the Georgia State Civil Defense organization and the Chatham-Savannah Defense Council assume direction of operational procedure in natural disasters for Chatham County and the Georgia and lower South Carolina Tidewater District. Problems of communication, welfare, transportation, policing, and rescue have been investigated locally and solutions found. The Civil Defense Division of the Georgia Department of Defense has conducted conferences and organized a disaster district. This district consists of people responsible for hurricane relief activities in the Georgia coastal counties of Bryan, Camden, Chatham, Glynn, Liberty, and McIntosh; and the South Carolina counties of Beaufort, Hampton, and Jasper. Hurricane warning service for all of these counties is supplied by the Savannah office of the Weather Bureau. The

TABLE 2.26

Georgia Hurricanes[1]

Date	Wind velocity	Pressure (inches of mercury)	Tide height[2]	Loss of lives	Surge and wave damage ($1,000)	Total damage ($1,000)
Aug. 1881	----	29.08	20	335	300	2,000
Aug. 1893	72	28.31	22	2,000 to 2,500	2,000	4,000
Sept. 1896	75	29.00	----	25	400	3,000
Aug. 1898	76	29.23	----	----	100	1,000
Oct. 1898	60	29.46	20-B	200	1,700	8,020
Aug. 1911	88	29.02	----	----	100	600
Aug. 1940	90	28.78	11	----	150	10,000
Oct. 1944	88	28.94-J	12	----	300	460
Oct. 1947	95	28.77	11.5	----	200	2,000

NOTES: [1] At Savannah, Georgia (except as noted: B — Brunswick, Georgia; J — Jacksonville, Florida).
[2] Tide height = feet above mean low water.

Weather Bureau issues warnings and the district disaster organization notifies responsible persons.

During the last 4 years, press, radio, and television publicity on hurricane emergencies has been disseminated in Chatham County by the Weather Bureau, Red Cross, and Civil Defense authorities. Residents of the coastal islands should be aware of potential hurricane hazards. Plans have been completed for evacuation during emergencies. Although forced evacuation is not contemplated, arrangements have been made by local authorities for the occupants of each house to be alerted and for transportation to be provided when needed for evacuation from Tybee Island.

Needs and Opportunities

Beach Erosion Control

Beach erosion involves the removal or shifting of beach materials by wind and wave action, tidal currents, or coastwise currents. A beach is transitory and is molded and remolded with every breaking wave. Where shores are undeveloped, or where development occurs well back from the shore, variations in the beach cause little concern. However, beaches, dunes, and the low areas adjacent to the shore are becoming increasingly important for development of recreation and for construction of homes. Prevention of shoreline erosion is needed.

The history of the erosion and accretion periods of the shoreline for many hundreds of years can be read in the pattern of the beach ridges. The most recent story of the changes is available on maps and charts covering the last hundred years. The northern end of Tybee Island is one of general accretion. The shoreline fronting the community of Savannah Beach has fluctuated seaward and landward. At the southern limit of Savannah Beach, a spit has formed and disappeared over the years. The spit grows from north to south and causes the channel of Tybee Creek to move southward. Between Tybee Creek and Little Tybee Creek, radical changes have occurred over the last hundred years. Barrier islands formed, along with lagoons. Later the barrier islands disappeared as the shoreline advanced some 700 to 800 feet. The southern end of the island has shown gradual erosion of the shoreline.

Hurricane Protection

Tybee Island is subject to direct assault by hurricane wind, waves, and tidal surge. The hurricane of October 15, 1947, was accompanied by waves estimated at 15 feet in height on the coast at Savannah Beach. Damages totaled about $2 million. Recurrence of hurricanes such as those of 1881 and 1893, which were particularly severe in the Tybee Island area, could result in damages amounting to $5 million or $10 million under existing conditions of development. Hurricane damage and frequency studies, considering the probability of occurrence of severe hurricanes in particular localities at normal high tide cycles, indicate that average annual hurricane damages at Tybee Island will approximate $115,000.

Means of Meeting the Needs

Beach Erosion Control

Beach erosion protection can be accomplished by artificial placement of sand, possibly augmented by auxiliary structures. Artificial placement of sand has the least adverse effect on a locality and appears to offer the best solution for restoring a beach, provided a sufficient quantity of sand for beach nourishment is available. Wind erosion protection can be provided by vegetation or sand fences. Both are effective in forming and stabilizing dunes. Dunes act as barriers to high water and strong onshore winds, but they are more important as a source of beach material.

The Federal Government, through several agencies, cooperates with the States and other public groups in beach erosion studies. Because of the many factors involved in beach erosion and the possible effects of one beach upon another, no specific remedial measures can be proposed for erosion problems of the Savannah basin beaches without such a study.

Hurricane Protection

In addition to active participation in planning hurricane preparedness, it would be advisable for local interests to protect the sewage disposal plant on Tybee Island from flooding, to provide an auxiliary power supply, and to enforce present building codes which forbid construction of buildings in low areas subject to flooding. A program for improving U. S. Highway No. 80 is underway. An additional avenue of escape from the island is also needed.

PART THREE – COMPREHENSIVE PLANNING

The procedures used in developing the comprehensive and coordinated plan are briefly summarized in the following four steps: (1) An inventory was made of basic resources and related developments within the basin; (2) needs for goods and services were projected to the year 2000 for the Savannah basin; (3) alternative ways to meet needs for each purpose were studied; and (4) projects and programs that would best serve all purposes and meet requirements for resource conservation, utilization, and development were selected.

The character and effect of plans in other basins were considered in connection with the formulation of the Savannah basin plan, and adjustments were made to permit optimum interbasin uses. Throughout the planning process, many factors such as those associated with geology, hydrology, engineering practices, and social characteristics were expressed in economic terms for convenience in making comparisons. Additional data on planning and plan formulation are provided in the Planning, Economics, Hydrology, and Engineering and Cost Appendixes.

SECTION I – OBJECTIVES AND GUIDELINES

Objectives and specific planning guidelines adopted to govern the study and Report are as follows:

(1) A coordinated comprehensive plan for the development of the land and water resources of the Southeast River Basins through the year 2000 will be presented in the Report.

(2) The comprehensive plan will be recommended to the Governors and legislatures of the States of the study area and to the President and the Congress for use as a guide for land and water resources development in the Southeast River Basins.

(3) The plan will set forth an early action phase which will include projects and programs found to be needed, feasible, and desirable for accomplishment by 1975.

(4) It will be recognized that additional studies of recommended projects and programs may be required to support specific requests for State and Federal support and for development by private agencies.

(5) All of the purposes enumerated in the Act will be given equal attention. In the completed plan, each purpose will be developed to that level consistent with the needs and economic capacity of the individual basin. Treatment of industrial development will be limited generally to indications of the effects of the plan on rates of development and to development implied in the projections of manufacturing employment. Recreation studies will be limited to public outdoor recreation related to land and water resources and to types beyond those normally provided by individuals and municipalities. Public health studies will be oriented toward determining the effects upon public health associated with the development of land and water resources.

(6) In determining the composition of the comprehensive plan, each separable component will be considered on the basis of the contribution that it makes in net benefits to the Savannah basin, the Southeast River Basins, and the Nation. When intangible considerations play a major part in the decisions affecting an element of the program, they will be explained as fully as possible in narrative form.

(7) The comprehensive plan will: Provide information on benefits and costs, including monetary and nonmonetary values; contain information on the expected economic impacts created by the recommended elements of the plan; include general recommendations on cost sharing, reimbursement, and project payout; designate whether recommended developments should be implemented primarily by non-Federal or Federal entities; and designate which of the Federal agencies has the major responsibility for the Federal aspects of a project or program.

(8) The comprehensive plan will recognize and protect the rights and interests of individuals and of the States in determining the development of land and water resources and the preservation and protection of established uses.

(9) The comprehensive plan will include the existing, authorized, and formally proposed works and programs of the Federal and non-Federal agencies with proposed modifications limited to those found desirable, feasible, and consistent with the study objectives.

(10) Recommendations will be made for periodic review of the comprehensive plan. This review will serve as a basis for keeping the plan current and for subsequent action.

SECTION II – PLANNING ASSUMPTIONS AND CRITERIA

Assumptions

The comprehensive plan is based upon a series of assumptions. The broadest of these are: (1) That the Nation is entering a period of relative stability in international relations with no worsening of the cold war and no widespread outbreak of hostilities; and (2) that throughout the period covered by the plan, to the year 2000, the Federal Government and non-Federal interests will cooperate in encouraging and implementing economic growth and development throughout all segments of society and all areas of the Nation.

Population Growth

Three principal assumptions concerning the rate of national population growth were adopted: (1) The present fertility level, 1955-57 average, will remain constant to sometime between 1975 and 1980, then decline to the 1949-51 level by 2005-2010; (2) there will be moderate declines in mortality rates to the end of this century; and (3) net migration from abroad will be constant at about 300,000 per year. State and area population estimates were made in conformance with the general assumptions, but special attention was given to conditions reflected by study and analysis of individual areas.

Economic Growth and Development

The assumptions concerning trends toward world peace and United States and regional population growths are paralleled by assumptions of upward trends in employment, production, consumption, and foreign trade. For planning purposes, gross national product was projected to increase from about $500 billion in 1960 to $888 billion by 1975 and to $2,300 billion by the year 2000.

A continuation of the trend in the human diet toward more red meats and more of some fruits and vegetables is reflected in the projections and plans for food production and land use. It was assumed that per capita consumption of food will increase until about 1975 and then remain about constant.

In line with the general expansion of the national and regional economy, it was assumed that investment capital required to attain projected industrial growth and resource development will be available and that the education and technical skills necessary for an expanding industrial economy also will be available. It was further assumed, as a working procedure for preliminary studies, that land and water resources and electric power supply would not be limiting factors in attaining the projected economy of the Savannah basin.

It was recognized in the study that the economy of the Savannah basin is an integral part of the regional and national economies.

National and Regional Viewpoints

Because of the widespread effects of land and water resource development, a responsibility falls on government at all levels and on the private economy to participate in resource planning and in the execution of resource programs.

In developing the Southeast River Basins plan, future needs for food and fiber and for services are included at those levels warranted by the comparative advantage and existing economic potential of the Southeast River Basins area in relation to national resources and needs. Thus, the primary benefits shown for projects and programs provide a means of indicating project efficiency from the national point of view as well as a principal measure of regional and local

benefits. Secondary benefits and impact studies provide additional evidence of the regional and local effects of resource development.

In developing projects and programs in the Savannah basin plan, consideration was given to national policy guides pertaining to land and water resources development that have resulted from legislation and to administrative policies or decisions that have prevailed. Policy guides and statements of national objectives used in the planning processes are discussed in the technical appendixes.

Criteria

Price Levels

Price levels prevailing in or about January 1960 were used for evaluating present and future benefits and costs, except that an adjustment was made in agricultural prices based upon an assumption of a long-range parity ratio of 89 between prices paid and prices received by farmers.

Interest Rates

An interest rate of 2⅝ percent was used as far as practicable in analyzing costs and benefits in project formulation. In certain instances, benefits and costs were extracted from available data, and it was impractical to adjust this interest rate when the interest rate mix of the data was uncertain. The 2⅝ percent interest rate meets the need for a relatively risk-free and inflation-deflation-free rate and use in evaluation of the economic effects of Federal resource projects and programs. For converting certain non-Federal costs and benefits to an annual equivalent basis, a 4¼ percent interest rate was used.

Life of Projects and Period Covered by Analysis

The period of analysis used in the studies for this Report was the economic life of each project or 50 years, whichever was the lesser. The possibility of a longer maximum period, up to 100 years, was considered in recognizing certain long-range effects of intangibles and other impacts, but effects beyond 50 years were not evaluated in monetary terms.

The plan was formulated to meet only those needs expected to develop to the year 2000, and the evaluations generally reflect no increase in use of facilities after the year 2000. Needs will naturally continue to grow after the year 2000, and many of the proposed projects and programs, by adding facilities, will have the capacity to absorb some of the growth. The potential of the plan to meet needs that develop after the year 2000 has not been evaluated.

The assumptions and criteria used are considered conservatively low. If more liberal criteria had been used, such as a period of analysis of 100 years and an increasing need after the year 2000, the projects and programs included in the plan would appear even more favorable.

Basis for Comparison of Projects Effects

Comparison and evaluation of the proposed projects and programs in the plan were made to determine the most effective use of economic resources, such as land, water, labor, and materials. In this way, actions and opportunities throughout the economy form a check on what is economically justified in the way of new plans and efforts.

The value of the projects or programs included in the plan are computed on the basis of future conditions "with" the projects or programs included in the plan as compared to future conditions "without" the projects or programs included in the plan.

The future "with" conditions for individual project or program analysis include all development which would be expected to occur during the period of analysis with the project in existence.

The future "without" conditions include all developments that are existing or under construction as of January 1960 assuming adequate operation and maintenance of those developments. Technological gains not directly associated with the projects and programs in the basin plan were recognized as part of the "without" condition. It was assumed that no part of the projects or programs would develop in the absence of the project or program. This is not to deny that, in the absence of the proposed plan, other plans would develop which might include many features similar to those in the recommended plan.

Timing of Development

Plans covering long periods into the future provide for needs which have not yet developed.

Not all developments are needed at once or at the same time. Plan implementation should, therefore, be scheduled to meet the needs as they occur. A precise schedule of year-to-year development was not considered necessary, but a general order of priority was established. Those developments needed first are included in an early action phase and are generally based on filling the needs to the year 1975. If need arises, however, projects scheduled in the 1975-2000 period may and should be initiated earlier. Likewise, the rate of project initiation may be slowed down if conditions warrant slower action.

Discount Principles

Program or project benefits and costs, which are estimated to accrue at different times and over varying periods of time, were converted to annual equivalent values by use of compound interest or discount rates. The resulting values reflect the present worth at the inception of each program or project and provide a common basis of measurement.

Benefits

The ultimate aim of resource projects and programs, in common with all other productive activity, is to satisfy human needs and desires. Goods and services are produced to achieve this end. These goods and services have value in accordance with the demand for them and their availability. Benefits are of two general kinds, primary and secondary. Primary benefits are the increase in the value of goods or services directly resulting from a project, less all associated nonproject costs incurred in their realization. Primary benefits are usually evaluated at the first point in the chain of effects of a project where the goods or services produced have an actual or estimated market value. Secondary benefits are the value of goods and services created in secondary activities affected by the project, less all associated costs incurred in their realization. The major part of the value of these goods and services is not measured from the national public point of view because it is assumed that an investment similar to that made in the project would create a similar effect in secondary activities if invested in other projects or other areas. However, overall secondary benefits are considered appropriate in illustrating the significance of projects from a regional point of view.

Primary Benefits

The primary tangible benefits, which in this Section are referred to as primary benefits, represent the estimated increase in the value of goods or services directly resulting from the projects and programs of the comprehensive plan. The benefits used in the monetary analyses reflect only the actual goods, services, and satisfactions of a project or program expected for the period under study and from which any induced losses to other projects or programs have been deducted.

The facilities included in the plan for drainage, irrigation, and soil conservation are based on the increased net return to the farmer from the estimated production response.

The primary benefits from drainage and flood-loss prevention, resulting from the upstream watershed projects, are derived from net values for expected changes in land use, the increased productivity of land, the reduction of direct damage to agricultural crops and fixed improvements, and reduction of management costs.

The primary benefits from hydroelectric power are estimated as the cost of equivalent power from a modern steam-electric powerplant.

Primary benefits from the forestry program are estimated as the net stumpage value of increased production and the net leasing values received from the increased number of faces expected to be worked for production of gum-naval stores.

The primary benefits from the commercial fisheries program are the estimated value of increased landings of commercial fish.

Primary benefits from the sport fisheries and wildlife program are the estimated value of projected increases in user-days of hunting and fishing.

Benefits used in the monetary evaluation of the recreation program consist of the estimated value of increased user-days of recreational activity.

The benefits from domestic, municipal, and industrial water supplies are assumed to be at least equal to the cost of obtaining water of similar quality and quantity from the cheapest alternative source.

Primary benefits from flood control are derived from the difference between flood losses "with" and "without" protection. For upstream watershed and local protection projects, enhancement and restoration benefits are also included where applicable.

Benefits from navigation are taken to be the savings in rate differential; the savings in shipping time; the reductions in operation and maintenance costs; the value of any filled land obtained through spoiling; and, for new deep-draft harbor facilities, the increased gross revenues (increased costs associated with cargo handling are included as project costs); and savings due to use of larger tankers.

Justification of programs for vector control, solid-waste collection and disposal, air pollution and radiation monitoring, and pollution abatement, except storage for augmenting low streamflows, is found in intangibles. In multiple-purpose projects, including storage to provide for low-flow augmentation, the pollution abatement benefits were taken as equal to the average cost of the tertiary treatment to provide the same improvement or protection of water quality as that obtainable by dilution.

Secondary Benefits and Impacts

Although for purposes of this study a monetary evaluation of secondary economic effects of various resource projects and programs was not made, the importance of these secondary effects of resource development was recognized.

The projects and programs involving increased production of commodities will require additional raw materials, processing equipment, and services to sustain the processing operation. These increased activities will extend throughout the basin. Trades and services especially would be stimulated by recreation, sport fishing, and wildlife developments. These impacts would particularly affect fishing camps, marinas, commercial boat docks, motels, sporting goods stores, service stations, boat dealers, restaurants, and many related new businesses.

Construction projects create a temporary influx of workers who spend money in local areas, but at the same time, such projects create problems of housing, schooling, transportation, and other community services. The solution of these short-term problems could result in long-range gains with construction factilities that would be needed to meet future expansion.

There are 25 counties out of a total of 45 counties either wholly or partially within the Savannah basin which have been designated redevelopment areas by the Area Redevelopment Administration of the U. S. Department of Commerce. Of the 25 counties, 2 are in North Carolina, 6 are in South Carolina, and 17 are in Georgia. These counties were so designated because of varying reasons such as low median family income and persistent and substantial unemployment or underemployment. Development of the plan for the Savannah basin would assist in the relief of these conditions, and aid in raising the economic level of the people. Substantial net secondary benefits are most frequently realized in areas where resource development projects make it possible to utilize unemployed and underemployed labor and unused facilities and resources.

Intangible Benefits

Intangible benefits are those which are not evaluated in monetary terms. Like tangible benefits, these may be primary or secondary in character. Many programs and projects make substantial contributions to public security, to private and public health, and to public safety and tranquility, all of which include large elements of intangible value. Intangible benefits and costs are recognized in programs and projects analyses.

Costs

Costs are the value of labor, goods, and services exchanged to gain goods and services valued more highly. Where the costs are tangible values, the assumption is made that the needs of the project are taken from present uses at marginal unit prices and, therefore, the values foregone represent the least important uses that the market would allow. In a resource program as complex as that recommended for the Southeast River Basins, there are also many intangible costs involved.

The costs of proposed projects and programs include the initial investment which would be incurred in one or more stages of construction and the annual expenditures required for operation, maintenance, and replacements. Taxes which would be paid by a private utility were included

as a project cost for hydroelectric power projects without regard to whether governmental or private interests would develop the project. Investment costs include the capital expenditures associated with constructing a project and carrying out a program. However, interest during construction is omitted where the period of construction was not expected to exceed 2 years. Where the period of construction was estimated to be more than 2 years, the investment included simple interest on one-half of the construction costs for the period of construction.

Capital investment and operation and maintenance costs of multiple-purpose projects were allocated to the several purposes served so as to form a basis for reimbursement and cost-sharing arrangements that may be required.

Intangible Costs

In evaluating resource programs and projects, many important program and project effects cannot be adequately measured in monetary terms. Loss of scenic values is an example of an intangible cost frequently associated with resource development. Treatment of these intangible effects has been subjected to many of the requirements applicable to tangible effects. These include: (1) Considering effects in terms of differences "with the project" and "without the project," and (2) considering intangible costs to the same degree or extent as intangible benefits.

Cost Sharing

Cost sharing is concerned primarily with the distribution of costs among the participating interests. The division of cost is shown in two groups: Federal and non-Federal. For each specific project or program, the actual division of cost among the Federal and non-Federal interests was determined by the nature of the development and on the basis of circumstances expected to prevail during the evaluation period.

Generally, where the impacts of projects and programs are largely local, the costs are the responsibility of non-Federal interests. Projects and programs of national significance are the responsibility of the Federal Government. Between these two extremes there are a number of projects and programs where the costs are to be shared by the Federal and non-Federal groups.

In determining the degree of Federal participation in programs and projects of less than national significance, consideration was given to: (1) The need for demonstrating new approaches to resource development and use; (2) the usefulness of a local project or program in research and experimentation which has more than local implications; (3) the support of projects or programs which by policy or legislation have become accepted as Federal or part Federal responsibilities, such as flood control; and (4) the possible justification for Federal participation in the cost of local works and improvements where counties, areas, or regions are designated as distressed and in need of economic assistance.

Financing

Determination of effective ways for financing land and water development is an essential part of resource planning. Financing, as used here, relates to the immediate source of funds needed for construction and management of proposed works. Financing requirements were developed only as Federal and non-Federal although in the analyses, State, county, municipal, and private financing were considered. Special groupings for purposes of financing, such as development corporations and special improvement districts, are also discussed.

The following criteria were used in determining appropriate methods for financing land and water resource developments.

(1) Developments of natural resources that do not involve national consideration will be the responsibility of private, local, and State interests.

(2) Where the costs of projects and programs are to be shared between the Federal and non-Federal interests, each will provide for the financing of its share, except as noted under item (3) following. The Federal share will be provided under such laws and regulations as are applicable at the time of financing. In addition to direct government and private appropriations for the non-Federal share, development funds, authority funds, special bond issues, and revenue bonds are available for financing.

(3) For projects such as hydroelectric power and water supply, Federal financing may be needed, with provision for reimbursement from non-Federal beneficiaries, as is now practiced.

Federal financing may also be required for projects of the types not adequately covered by traditional approaches. This includes large-scale recreation projects and some types of fish and wildlife work.

(4) When the Federal Government assumes the full cost of a project or program, the Federal Government will be responsible for full financing of the work.

SECTION III – PLAN FORMULATION

Selecting and fitting planning 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 overall plan required extensive analysis. By a series of approximations, using the incremental approach and limited by consideration of alternatives and judgment, a plan was formulated containing those programs and projects that are expected to result in maximum benefits above costs in meeting needs to the year 2000.

General Character of Resource Planning

Generally, resource planning recognizes the consequences of land and water resource development and the need to anticipate the future requirements for land and water essential to growth and welfare. The physical and economic aspects of the planning task have been emphasized, particularly as they relate to the scale, sequence, and timing of development plans. However, these considerations have been tempered by the recognition of social, legal, and political factors.

The plan has been developed on the basis that free enterprise persists in the area and the Nation with Federal and State Governments undertaking those tasks which are beyond individual or voluntary group capacity or which require such action for special physical, economic, social, or other reasons. Local and regional viewpoints were recognized in formulating the plan.

Guides for Plan Formulation

A number of general land and water resource development guides and planning aids were used in weighing and selecting those alternatives which were fitted into an effective plan. In all cases, the effective use of these guides and planning techniques required careful adherence to the assumptions and criteria outlined in Section II.

Plan Evaluation

Comparison of benefits with costs was one of the principal guides used in plan formulation. These comparisons attempted to cover all beneficial and adverse effects. While favorable primary tangible benefit-cost relations were generally the principal basis used in selecting programs and projects, intangible costs and benefits were also considered in making the plan. Measurements made reflected existing and probable future economic conditions, including estimates of the probable needs for the many goods and services which land and water development makes possible. Benefit-cost data were applied to a range of interdependent physical and social possibilities and the resulting scale used for judging and selecting the means of development, the scope of facilities needed, and the site or area involved.

Increments and the Scale of Development

To achieve a reasonable scale of development, it was necessary in the formulation process to divide the work into manageable units. Planning units, usually called separable segments or increments, were the smallest units on which there was a practical opportunity for inclusion in or omission from the plan.

To meet the general objectives of maximizing net economic returns and satisfactions from the economic resources used in the plan, each part of the plan was formulated to include each separable segment or increment which would provide benefits at least equal to the cost of that segment or increment with full consideration of intangible values. Plan formulation was completed when analyses demonstrated that: (1) There was need for the goods and services produced, (2) total benefits exceeded total costs, (3) each separable segment or purpose provided benefits at least equal to its cost, (4) the scale of development was such as to provide the maxi-

mum net benefits, and (5) there were no more economical means of accomplishing the same purposes.

The Nucleus Plan and the Multiple-Purpose Concept

A specific initial proposal generally was chosen as the nucleus around which planning proceeded. This nucleus usually represented a project or program which seemed to offer promise of meeting a major objective or objectives.

After the initial proposals of development were selected for analysis, and benefits and costs measured, consideration was given to larger or smaller scales of development. Variations in the scope of each separable increment were made and tested, and the possibility of additions or omissions examined. Early in this process, the possibility of multiple-purpose projects was considered. By the process of elimination, the most promising combination of projects and programs was identified and tested to determine where a justified nucleus had been found. The incremental analysis was continued by adding segments of size, purpose, or means, and by evaluating the resulting increments of benefits and costs. Thus, the incremental analysis was a series of comparisons of alternative plans "with" and "without" the inclusion of particular segments. Short cuts were frequent and necessary but these principles were followed. By this fitting process, modifications were made in the initial plan. This process was continued within practical limitations until the best combination was evolved to meet the established needs.

Sequence of Development

The sequence of project development is basic to maximizing overall project benefits. Project benefit and cost comparisons are misleading unless they represent the incremental benefits and costs of projects in a specified sequence of development. This problem was recognized in the studies by dividing proposed developments into those requiring early action and those which could be accomplished by later action. Further refinement in timing could lead to some changes in incremental benefits and costs.

General Information and Basic Data

Some of the general information essential to planning in the basin was available, but not always in the most useful form. Much of it required reorganization prior to analysis. While little original research was undertaken, professional interpretation of data and problems was frequently sought in the planning processes. The available data on past and current programs and on resource plans underway by Federal, State, and, to some degree, private agencies became a part of the basic planning information.

As the studies progressed, the lack of certain basic data became increasingly evident. Adequate topographic maps with satisfactory contour intervals and horizontal scales for planning, such as the 7½-minute quadrangle sheets, were available for about one-third of the basin. Hydrologic data are available, on at least a short-term basis, for most major streams, but data for tributaries are inadequate. Ground water and water quality information are meager. Geologic information, which is very important, is limited to local areas and to generalized data. Pertinent economic statistics have been less than adequate, except during the last few years. Much of this lack of data can be attributed to the fact that the basin has never approached full development of its resources. Consequently, there has been minimum effort to collect basic data. However, greater competition for resource use is beginning, and selection between uses will be increasingly important as the demands increase. Adequate basic data are essential in making proper selections; therefore, steps need to be taken to insure that information will be available when it is needed.

Single-Purpose Planning

Single-purpose planning for each purpose was carried to the point of establishing needs and determining most likely ways of meeting the needs with the least expenditure of resources. Studies for some purposes were carried into more detail than others in examining alternative ways of meeting needs. Where it was apparent that a single-purpose plan could be used without major modification in the comprehensive plan, the single-purpose studies were carried to more detail than in those cases where the purpose would be included, with perhaps major modifications in a multiple-purpose development.

Multiple-Purpose Planning

Information developed in single-purpose planning and the special problems of the area were the initial bases for development of a multiple-purpose plan for the Savannah basin.

The programs and projects which served as nuclei for the initial planning were based on the character of the resources, the nature of the problems, and the nature of the land and water projects already established or planned as portrayed in the single-purpose plans. Proposals considered for the inclusion in the plan came from many sources. Citizens throughout the area and local development organizations expressed interest in projects of many kinds and suggested combinations of resource use and development which they believed would meet particular needs. Federal and State agencies were also the source of much information on possible projects and project combinations.

Consideration was given to complementary land and water uses. Following the development of single-purpose ways for meeting needs, studies of compatible resource uses and areas of potential conflict in resource use were made. It was found that needs for forestry, recreation, and fish and wildlife could frequently be met by proper utilization of the same land resource. Similarly, water resource development plans could acceptably serve the purposes of flood control, hydroelectric power, water supply, fishing, and recreation, although operating adjustments had to be considered so that the most favorable multiple-purpose operating arrangements could be assured to maximize overall net benefits.

When sufficient preliminary study had been made, a series of detailed studies were undertaken to choose from among those alternatives filling the needs most effectively. In this process, the problem of deciding among competing uses sometimes arose and there was always present the need to seek arrangements whereby the greatest plan of complementary values would occur. This process involved a repetitious series of adjustments, in varying degrees of refinement, combined with progressively refined economic, hydrologic, and engineering comparison, until the best combination of proposed developments was found.

Nature and Treatment of Alternatives

In resources planning, comparison of alternatives is a vital part of the planning process. It is necesary to understand the nature of projects and programs rejected and the reasons for rejection, as well as the character of those accepted in the plan. Information on alternatives considered is summarized in Part Four. Additional detail concerning the nature of the alternatives considered and the reasons for their acceptance or rejection in the final plan are included in Appendix 12, Planning.

Competitive Uses

Many resource uses are competitive in character. The principal guidelines established and generally followed in determining the use of land and water resources are summarized as follows: (1) Resource utilization was based on and limited to the projected future needs, and (2) economic efficiency was a major governing criterion in deciding between alternative uses of a given resource, with due consideration given to social, political, and physical factors. Some of the situations requiring special attention are: (1) Existing, reserved, or special use land and water resources; (2) public health; (3) special requirements involving areas that provide a particular type of land or water use that cannot be duplicated elsewhere at a reasonable cost; and (4) those resources to which priority considerations should be given because of long established or firmly fixed development trends.

Adjustment Among Basins In Planning

Interbasin relations were recognized, to the extent practicable, when Southeast River Basins needs were developed and distributed among basins to provide planning objectives for each basin. For example, user-days of recreation demand for a given population center were distributed to all basins within reasonable travel distance from the center, rather than being allocated exclusively to the basin within which the center lies. A check was made to insure that the overall cost of meeting each need was not inflated by unreasonable disparities in unit costs. Adjustments between the Savannah and other basins were made where reasonable alternatives were available and where overall efficiencies could be improved by the adjustments.

PART FOUR – BASIN PLAN

SECTION I – COMPREHENSIVE BASIN PLAN

The comprehensive and coordinated plan for the Savannah basin includes land and water resource developments that contribute to meeting the needs projected to the year 2000. Resource developments existing and under construction as of 1960 are a necessary part of the plan to meet the needs. However, only proposals for new developments and for expansion of existing developments to be made during the period 1960-2000 are presented in Part Four and their costs and benefits evaluated.

Projects and programs included in the plan in addition to those in existence in 1960 are shown in Tables 4.1 and 4.2. Specific data on the projects are shown in Table 4.3. More detailed data pertinent to projects and programs are shown on the basin plan map, Figure 4.1, the Savannah basin profile, Figure 4.2, and in descriptions included in subsequent Sections.

The projects, which represent about 55 percent of the total cost, include several units of the plan of development, described in House

TABLE 4.1

Comprehensive Plan for Development
(thousands of dollars)

Project or program	Purpose[1]	Benefits[2]	Costs		
		Annual equivalent	Annual equivalent		Investment
			Total	Operation, maintenance, and replacements	
Highlands Project Area					
Highlands	R, F&W	6,365	3,594	2,217	52,400
Horsepasture	P, R	2,614	1,748	319	25,330
Jocassee	P, R, F&W	3,881	3,742	354	59,440
Newry-Old Pickens	P, R, F&W	4,224	3,787	368	60,530
Chattooga	P, R	9,576	8,961	944	138,300
Tallow Hill	P, R, F&W	4,827	4,567	408	78,750
Anthony Shoals	P, R, F&W	3,111	2,644	350	42,330
Trotters Shoals	P, R, F&W	12,980	6,919	1,014	94,630
Lower Savannah	P, R, F&W, N	14,140	8,291	1,725	197,800
Savannah Pollution Abatement	PA	[3]	1,286	314	27,000
Savannah Harbor	N	11,730	8,735	7,300	31,650
Intracoastal Waterway	N	50	45	20	730
Water-access areas	R, F&W	886	292	168	3,440
Upstream watersheds	FC, D	3,062	2,183	582	44,300
Water supplies	WS	[4]	8,969	6,157	122,100
Irrigation	I	588	504	434	1,945
Drainage[5]	D	284	44	29	417
Soil conservation	SC	3,148	2,590	1,781	22,370
Forest conservation	F	5,039	3,438	1,214	92,080
Fish and wildlife[5]	F&W	4,635	2,908	2,867	2,100
Recreation[5]	R	7,703	1,971	1,202	32,530
Pollution abatement[5]	PA	[3]	2,563	766	83,680
Public health[6]	PH	[3]	1,608	1,596	460

NOTES: [1] FC—Flood control; I—Irrigation; F&W—Fish and wildlife
WS—Water supplies; P—Hydroelectric power; R—Recreation
N—Navigation; SC—Soil conservation; PA—Pollution abatement
D—Drainage; F—Forest conservation; PH—Public health

[2] Primary tangible only; intangible and secondary benefits and impacts considered are presented in narrative.
[3] Justification is based largely on intangible benefits.
[4] Benefits are assumed to be equal to at least the cost of the cheapest alternative, but are not assigned monetary values.
[5] Data presented are exclusive of benefits and costs associated with multiple-purpose projects.
[6] This is principally an annual operation program and does not have any investment costs except for one incinerator.

SAVANNAH BASIN PLAN FEATURES

(key to numbers shown on Figure 4.1)

– Highlands Project Area (see Figure 4.15)
1 Blue Ridge Parkway
2 Horsepasture Reservoir
3 New Fish Hatchery
4 War Woman Wildlife Refuge
5 Federal Fish Hatchery
6 Jocassee Reservoir
7 War Woman Reservoir[1]
8 Burrels Ford Wildlife Management Area
9 Lake Burton Wildlife Management Area
10 State Fish Hatchery
11 New Fish Hatchery
12 Sand Bottom Reservoir[1]
13 Rogues Ford Reservoir[1]
14 Blue Ridge Wildlife Management Area
15 Old Pickens Reservoir
16 Keowee Archeological Site
17 Camp Creek Reservoir[1]
18 Chauga Game Management Area
19 Newry Reservoir
20 Clemson Game Management Area
21 Black Mountain Wildlife Management Area
22 Estatoe Archeological Site
23 Hopewell Historic Site
24 Old Stone Church Historic Site
25 Chattooga Ranger District Recreation Area
26 Lake Russell Wildlife Management Area
27 Stephens County Recreation Area
28 Anderson County Recreation Area
29 Franklin County Recreation Area
30 Hartwell Lake Recreation Area
31 Banks County Recreation Area
32 Wynn Mountain Wildlife Management Area
33 Victoria Bryant State Park Recreation Area
34 Rocky River Wildlife Management Area
35 Broad River Wildlife Management Area
36 Tallow Hill Reservoir
37 Abbeville County Recreation Area
38 Sumter National Forest (Long Cane Division)
39 Parsons Mountain Game Management Area
40 Nancy Hart State Park Recreation Area
41 Anthony Shoals Reservoir
42 Trotters Shoals Reservoir
43 Burt Mansion Historic Site
44 Long Cave Massacre Historic Site
45 Clark Hill Game Management Area
46 Federal Fish Hatchery
47 Fishing Creek Wildlife Management Area
48 Key Bridge Game Management Area
49 Elijah Clark Memorial State Park Recreation Area
50 Clark Hill Wildlife Management Area
51 Williams Creek Wildlife Management Area
52 Alexander H. Stephens Memorial State Park Recreation Area
53 Warren County Recreation Area
54 Forks Game Management Area
55 Fort Gordon Wildlife Management Area
56 Augusta Port
57 New Savannah Bluff Lock and Dam
58 Navigation Channel Improvement
59 Savannah River Defense and Game Management Area
60 Burtons Landing Reservoir[2]
61 Hampton Wildlife Management Area
62 Belmont Game Management Area
63 Stokes Bluff Reservoir[2]
64 Gaffney Lock and Dam[2]
65 Savannah River National Wildlife Refuge and Recreation Area
66 State Fish Hatchery
67 Savannah Port Improvement
68 Tybee National Wildlife Refuge
69 Tybee National Wildlife Refuge Recreation Area
70 Fort Pulaski National Monument
71 Savannah Beach Recreation Area
72 Commercial Fisheries
73 Atlantic Intracoastal Waterway

NOTES: [1] Included in Chattooga project.
[2] Included in Lower Savannah project.

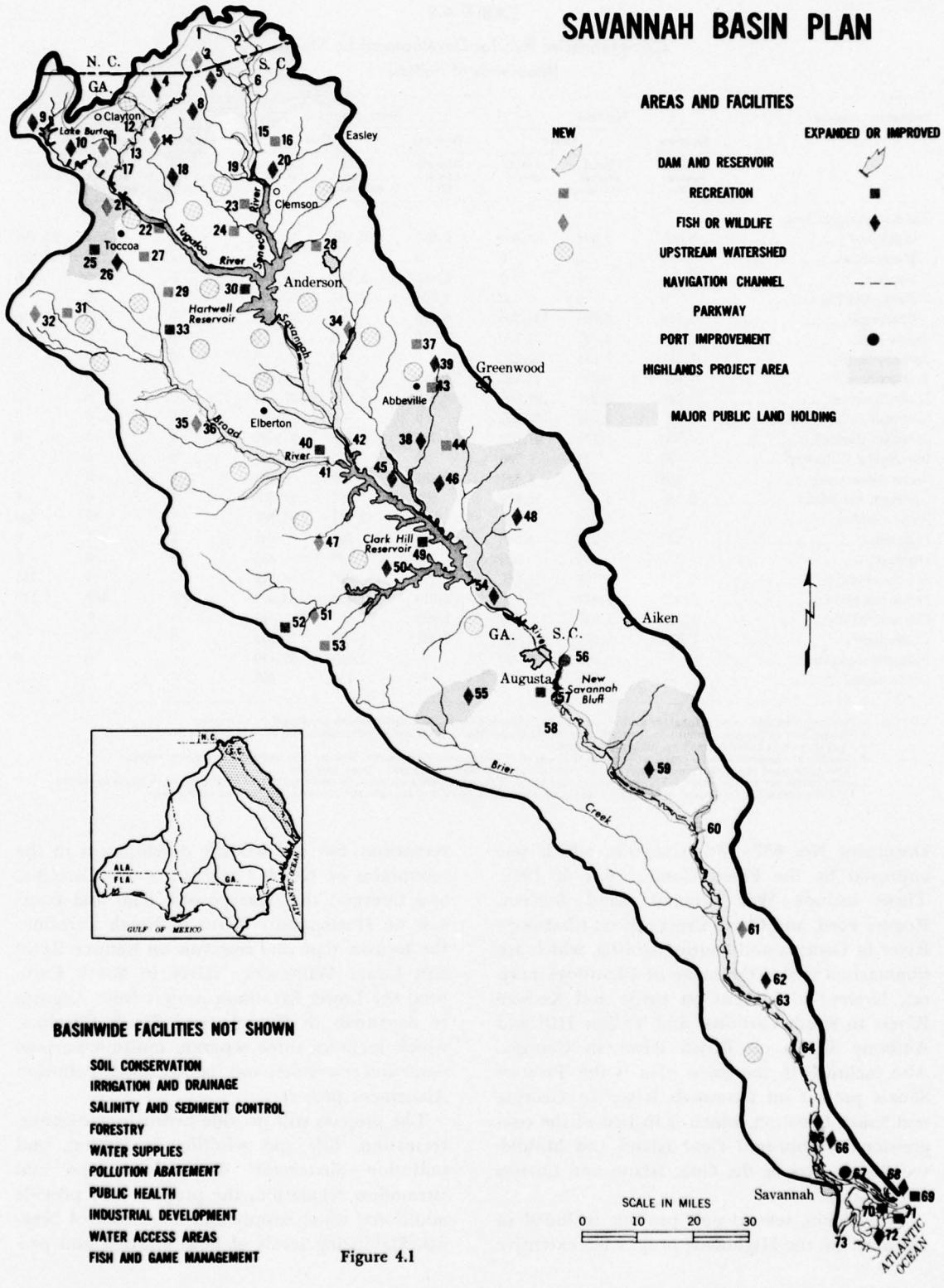

SAVANNAH BASIN PLAN
AREAS AND FACILITIES
NEW
EXPANDED OR IMPROVED
DAM AND RESERVOIR
RECREATION
FISH OR WILDLIFE
UPSTREAM WATERSHED
NAVIGATION CHANNEL
PARKWAY
PORT IMPROVEMENT
HIGHLANDS PROJECT AREA
MAJOR PUBLIC LAND HOLDING
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Toccoa
Tugaloo River
Seneca River
Anderson
Hartwell Reservoir
Savannah
Greenwood
Abbeville
Elberton
Broad River
Clark Hill Reservoir
Aiken
Augusta
New Savannah Bluff
Brier Creek
Savannah
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
ALA.
FLA.
GA.
GULF OF MEXICO
ATLANTIC OCEAN
BASINWIDE FACILITIES NOT SHOWN
SOIL CONSERVATION
IRRIGATION AND DRAINAGE
SALINITY AND SEDIMENT CONTROL
FORESTRY
WATER SUPPLIES
POLLUTION ABATEMENT
PUBLIC HEALTH
INDUSTRIAL DEVELOPMENT
WATER ACCESS AREAS
FISH AND GAME MANAGEMENT

Figure 4.1

TABLE 4.2

Comprehensive Plan for Development by States
(thousands of dollars)

Project or program	Georgia			South Carolina			North Carolina		
	Benefits	Costs		Benefits	Costs		Benefits	Costs	
	Annual equivalent[1]	Total annual equivalent	Investment	Annual equivalent[1]	Total Annual equivalent	Investment	Annual equivalent[1]	Total annual equivalent	Investment
Highlands Project Area									
Highlands[2]	6,365	3,594	52,400	6,365	3,594	52,400	6,365	3,594	52,400
Horsepasture	0	0	0	0	0	0	2,614	1,748	25,330
Jocassee	0	0	0	3,881	3,742	59,440	0	0	0
Newry-Old Pickens	0	0	0	4,224	3,787	60,530	0	0	0
Chattooga[2]	9,576	8,961	138,300	9,576	8,961	138,300	0	0	0
Tallow Hill	4,827	4,567	78,750	0	0	0	0	0	0
Anthony Shoals	3,111	2,644	42,330	0	0	0	0	0	0
Trotters Shoals[2]	12,980	6,919	94,630	12,980	6,919	94,630	0	0	0
Lower Savannah[2]	14,140	8,291	197,800	14,140	8,291	197,800	0	0	0
Savannah Pollution Abatement	[3]	1,286	27,000	0	0	0	0	0	0
Savannah Harbor[2]	11,730	8,735	31,650	11,730	8,735	31,650	0	0	0
Intracoastal Waterway[2]	50	45	730	50	45	730	0	0	0
Water-access areas	404	137	1,631	482	155	1,809	0	0	0
Upstream watersheds	2,130	1,601	32,690	932	582	11,610	0	0	0
Water supplies	[4]	6,704	87,620	[4]	2,247	33,980	[4]	17	500
Irrigation	317	272	1,048	269	230	889	2	2	8
Drainage[4]	155	24	229	127	20	185	2	0	3
Soil conservation	2,017	1,669	13,620	1,114	906	8,619	17	15	131
Forest conservation	2,821	1,932	53,910	2,016	1,394	36,060	202	112	2,110
Fish and wildlife[5]	3,206	1,822	755	1,429	1,086	1,345	0	0	0
Recreation[5 6]	7,373	1,814	30,430	5,608	1,272	17,930	0	0	0
Pollution abatement[5]	[3]	1,366	51,010	[3]	1,197	32,670	0	0	0
Public health[7]	[3]	877	--	[3]	731	460	0	0	0

NOTES: [1] Primary tangible only; intangible and secondary benefits and impacts considered are presented in narrative.
[2] The project or program would be located in more than one State; total costs and benefits are shown in each State.
[3] Justification is based largely on intangible benefits.
[4] Benefits are assumed to be equal at least to the cost of the cheapest alternative, but are not assigned monetary values.
[5] Data presented are exclusive of benefits and costs associated with multiple-purpose projects.
[6] State totals are not additive. Entire benefits and costs of developments on State boundaries are included for each State involved.
[7] This is principally an annual operation program and does not have any investment costs except for one incinerator.

Document No. 657, 78th Congress, which was approved by the Flood Control Act of 1944. These include War Woman, Sand Bottom, Rogues Ford, and Camp Creek, all on Chattooga River in Georgia and South Carolina, which are summarized under the name of Chattooga project; Newry-Old Pickens on Little and Keowee Rivers in South Carolina; and Tallow Hill and Anthony Shoals on Broad River in Georgia. Also included in the basin plan is the Trotters Shoals project on Savannah River in Georgia and South Carolina, which is in lieu of the congressionally approved Goat Island and Middleton Shoals sites or the Goat Island and Carters Island sites.

In addition, several new projects included in the plan are the Highlands project for extensive recreation, fish and wildlife development in the mountains of North Carolina, South Carolina, and Georgia; the Horsepasture dam and reservoir on Horsepasture River in North Carolina; the Jocassee dam and reservoir on Keowee River and Lower Whitewater River in South Carolina; the Lower Savannah project from Augusta to Savannah in Georgia and South Carolina, which includes three separate multiple-purpose dams and reservoirs; and the Savannah Pollution Abatement project.

The projects will provide hydroelectric power, recreation, fish and wildlife, navigation, and pollution abatement. Through storage and streamflow regulation, the projects may provide additional water supply and flood control benefits. Stabilizing levels of both existing and pro-

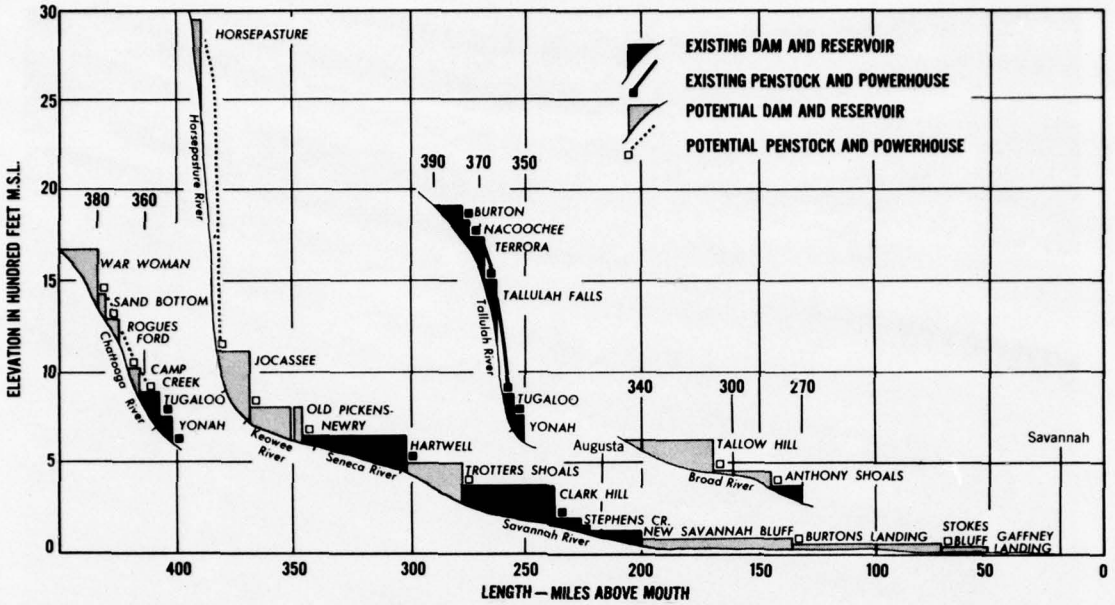


Figure 4.2 *Savannah Basin River Profiles.*

TABLE 4.3

Project Data—Savannah Basin

Project	River	Drainage area (sq. mile)	Operating elevation (ft.)[1]	Reservoir			Power		Recreation increase (user-day)	Fish and wildlife increase (user-day)
				Area (acre)	Capacity (acre-ft.)	Drawdown (ft.)	Installed capacity (1,000 kw.)	Output average annual (million kw.-hr.)		
Highlands Project Area										
Highlands[2]	--	--	--	--	--	--	--	--	8,100,000	375,000
Horsepasture	Horsepasture	33	2,960	475	22,000	30	58	88.5	650,000	—500
Jocassee	Keowee	147	1,100	7,000	1,080,000	30	150	77.1	100,000	10,500
Newry-Old Pickens	Little and Keowee	451	800	18,400	920,000	20	150	93.8	250,000	41,800
Chattooga										
War Woman	Chattooga	163	1,640	3,110	147,500	35	80	50.3	100,000	100
Sand Bottom	Chattooga	178	1,458	115	5,040	1	66	42.8	45,000	—660
Rogues Ford	Chattooga	193	1,317	253	11,300	25	120	77.5	60,000	—970
Camp Creek	Chattooga	258	1,071	260	15,000	20	100	75.0	55,000	3,300
Tallow Hill	Broad	749	610	18,500	1,020,000	40	172	113.0	250,000	44,300
Anthony Shoals	Broad	1,490	400	14,400	245,000	9	100	61.5	300,000	34,900
Trotters Shoals	Savannah	2,890	475	21,800	845,000	3	310	471.4	3,000,000	46,900
Lower Savannah										
Burtons Landing	Savannah	8,650	103	59,000	730,000	2	100	345.0	3,000,000	120,000
Stokes Bluff	Savannah	9,850	55	55,000	750,000	2	60	197.0	2,000,000	286,400
Gaffney Landing	Savannah	10,000	20	2,800	20,000	--	--	--	450,000	1,600
Total				201,113	5,810,000		1,466	1,692.9	18,360,000	962,670

NOTES: [1] Feet, mean sea level.
[2] Includes area of Blue Ridge province in Savannah and Apalachicola-Chattahoochee-Flint basins; 7,180,000 recreation and 282,000 fish and wildlife user-days in Savannah and 920,000 recreation and 93,000 fish and wildlife user-days in Apalachicola-Chattahoochee-Flint basins.

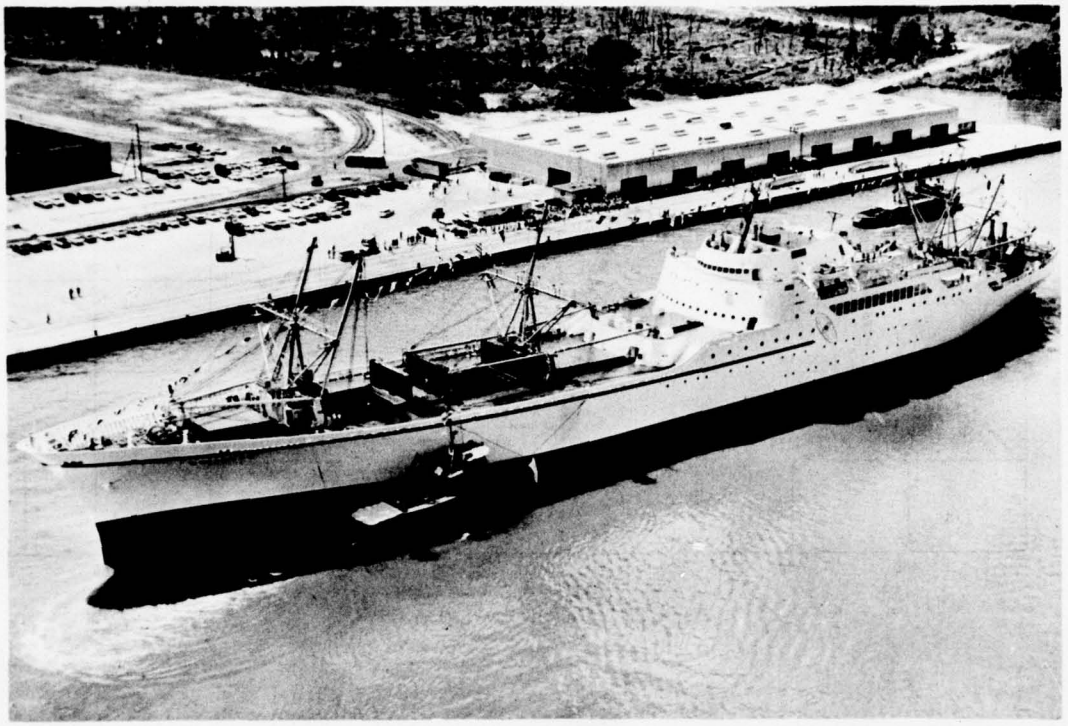


Figure 4.3 *Nuclear Ship Savannah at Home Port of Savannah.*

posed reservoirs, through coordinated multiple-use operation, would greatly enhance hydroelectric power, recreation, fish and wildlife, and navigation benefits beyond the monetary values credited in the plan. The small dams and reservoirs in the headwater streams and related conservation practices, likewise, would add stability and increase benefits to several purposes.

Programs that are either basinwide or extend over large areas represent about 45 percent of the cost of the plan of development. These include water-access areas, upstream watershed developments, water supplies, navigation, irrigation and drainage, soil conservation, forest conservation, fish and wildlife, recreation, pollution abatement, public health, and beach erosion control and hurricane protection. Most of these programs are underway and the anticipated changes involve intensity or magnitude rather than type of development.

SECTION II – PLAN BY PURPOSE

Many of the proposals in the plan involve benefits and costs associated with more than one purpose. The plan is designed to meet needs of many purposes; it takes advantage of joint use efficiencies wherever practicable. The summaries that follow cover the entire plan for each purpose listed in Public Law 85-850. Details of the multiple-purpose developments and additional data for the single-purpose proposals are included in Section V.

Flood Control and Prevention

The flood prevention benefits summarized in the plan of development are only those resulting from upstream watershed projects. A small amount of flood prevention benefits may be provided by the larger project reservoirs, but these benefits would be small compared to benefits from other purposes and were not evaluated in the studies.

TABLE 4.4

Plan by Purpose
(thousands of dollars)

Purpose	Benefits	Costs		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Flood control	2,989	2,146	572	43,420
Water supplies	[1]	8,968	6,156	122,100
Navigation	12,580	9,607	7,400	70,480
Reclamation, irrigation, and drainage	945	585	473	3,242
Hydroelectric power and industrial development	37,870	34,970	3,257	573,400
Soil conservation	3,148	2,590	1,781	22,370
Forest conservation	5,039	3,438	1,214	92,080
Fish and wildlife	6,364	4,678	3,593	36,280
Recreation	29,930	8,948	5,004	139,800
Salinity and sediment control	[2]	[2]	[2]	[2]
Pollution abatement and public health	[3]	5,457	2,676	111,140
Other beneficial purposes[4]	----	----	----	----

NOTES: [1] Benefits are assumed to be equal at least to the cost of the cheapest alternative but are not assigned monetary values.

[2] Included with soil conservation, forest conservation, and flood control.

[3] Justification is based largely on intangible benefits except for pollution abatement resulting from dilution water provided by multiple-purpose development for which monetary benefits are assumed equal to the average cost of tertiary treatment to provide water of similar quantity and quality.

[4] Includes beach erosion control and hurricane protection; additional studies necessary, but no specific development program included in the plan.

Figure 4.4 *Small Upstream Dams and Reservoirs Minimize Downstream Flood Damages.*

TABLE 4.5

Flood Control Benefits and Costs
(thousands of dollars)

Project or program	Benefits	Costs		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Upstream watersheds*	2,989	2,146	572	43,420

* Flood control benefits and allocated costs only.

Water Supplies

The water supply program proposed for installation to the year 2000 includes additional and improved supplies for domestic, municipal, and industrial uses. The domestic supply program includes new drilled wells, sealing and covering of existing wells, and power pumps and pressure systems. The program would serve about 148,000 people and would provide about 14.8 million gallons of water per day. The municipal supply program includes source treatment, elevated storage, and enlarged distribution systems. About 1,305,000 persons requiring 261 million gallons per day would be served by the program.

The industrial supply program includes new sources of supply, additional treatment plants, increased storage, and other water-handling equipment. Industrial water requirements of 306 million gallons per day would be provided.

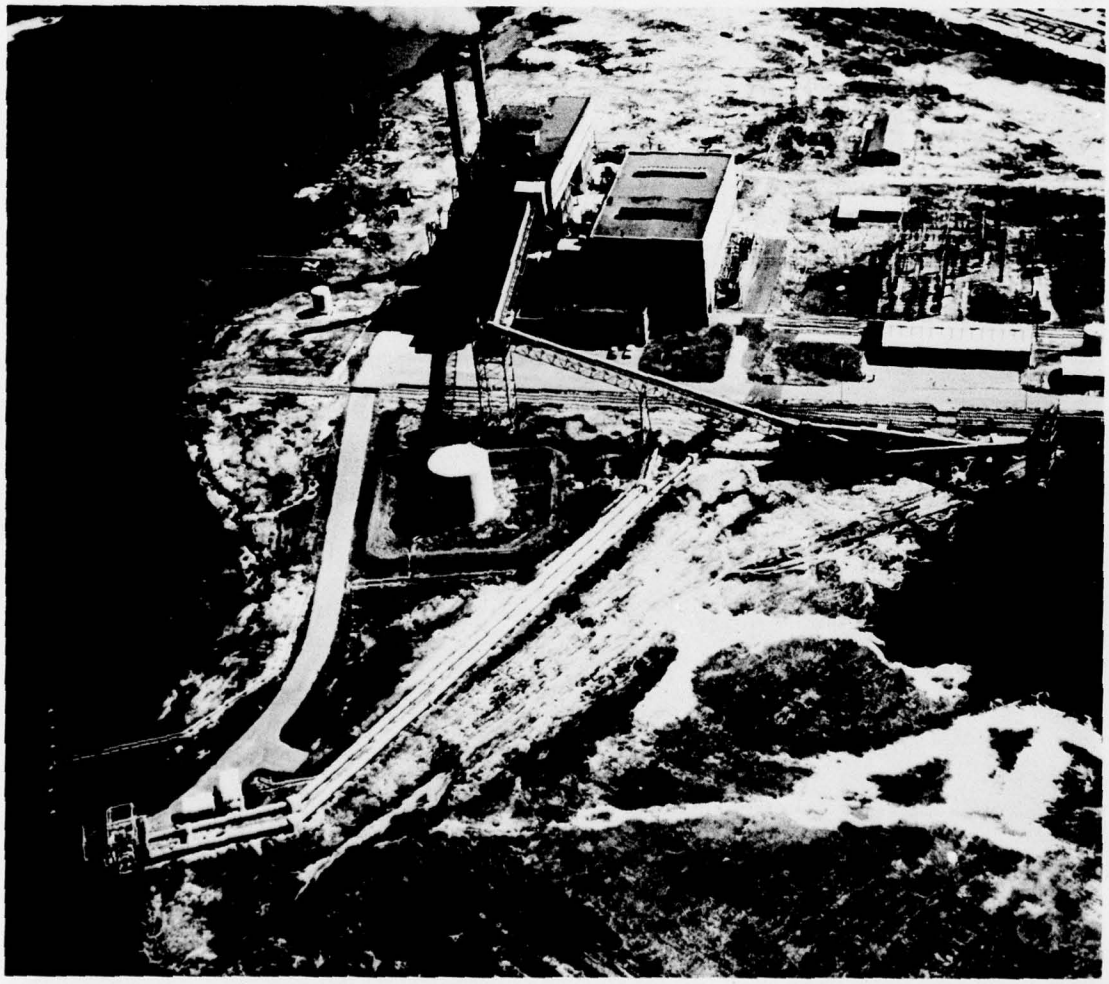


Figure 4.5 *Steam Powerplant, near Savannah, Showing Intake and Other Water Supply Facilities.*

TABLE 4.6

Water Supplies Costs
(thousands of dollars)

Project or program	Costs		
	Annual equivalent		Investment
	Total	Operation, maintenance, and replacements	
Domestic	870	168	23,400
Municipal	6,908	5,040	88,480
Industrial	1,191	949	10,220
Total	8,969	6,157	122,100

The benefits from providing a suitable water supply are assumed to equal or exceed the costs of obtaining, from the cheapest and most likely alternative source, a supply that is adequate in quantity and quality. Both surface and ground waters are likely alternative sources of supply although ground water is not always plentiful in portions of the upper basin area.

Navigation

Navigation improvements include (1) 12-foot slack-water navigation from Savannah to Augusta as part of the Lower Savannah project; (2) deepening of the Atlantic Intracoastal

TABLE 4.7

Navigation Benefits and Costs
(thousands of dollars)

Project or program	Benefits	Costs		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Lower Savannah[1] [2]	800	827	80	38,100
Atlantic Intracoastal Waterway[1]	50	45	20	730
Port of Savannah[1]	11,730	8,735	7,300	31,650
Total	12,580	9,607	7,400	70,480

NOTES: [1] Benefits and costs are in addition to those associated with existing facilities.
[2] Nine-foot navigation already established from Savannah to Augusta. Costs include portion of dam and reservoirs, and the 12-foot locks.

Figure 4.6 *Navigation Improvements on Savannah River Permit Navigation to Augusta.*

Waterway to a full 12-foot navigation depth, and widening the 90-foot cuts to 150 feet for a total of 9.25 miles; and (3) widening and deepening the harbor at Savannah, establishing new anchorage areas and turning basins, and establishing new deep-draft berths and related facilities. The last two items are included as single-purpose developments for navigation.

Reclamation, Irrigation, and Drainage

In this Appendix, reclamation and drainage are considered synonymous. Most of the irrigation and drainage included in the plan involves individual actions by the farm owners or farm operators and is largely financed by them. Irrigation of about 13,600 acres of additional cropland and drainage of about 28,000 acres of cropland, pastureland, woodland, and other land are included in the plan. In addition, the plan incorporates upstream watershed projects in drainage areas totaling about 2.5 million acres to provide for drainage in combination with flood prevention. Woodland drainage is included in the forest conservation program.

TABLE 4.8

Irrigation and Drainage Benefits and Costs
(thousands of dollars)

Project or program	Benefits	Costs		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Irrigation	[1]588	504	434	1,945
Drainage				
Individual farm	[1]284	44	29	417
Upstream watersheds[2]	73	37	10	880
Subtotal	357	81	39	1,297
Total	945	585	473	3,242

NOTES: [1] Annual returns to farmers.
[2] Drainage benefits and allocated costs only.

Hydroelectric Power and Industrial Development

Hydroelectric power is included in the Horsepasture, Jocassee, Newry-Old Pickens, Chattooga units (War Woman, Sand Bottom, Rogues Ford,

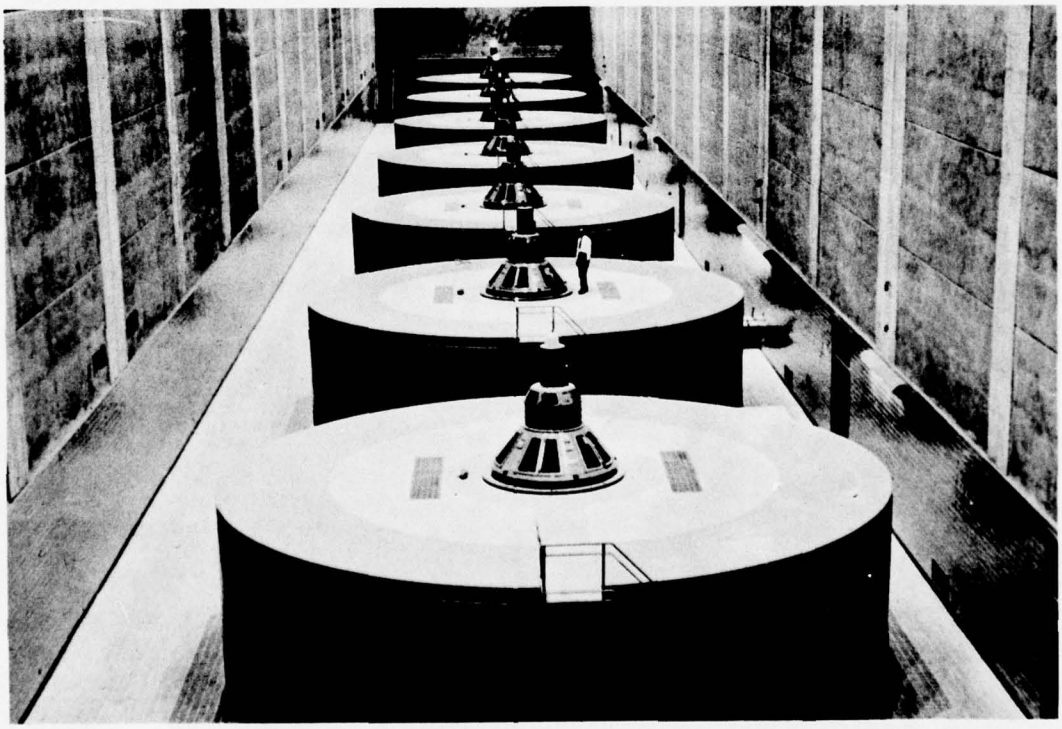


Figure 4.7 *Generator Room, Clark Hill Powerplant, Where 700 Million Kilowatt-Hours Are Generated Annually.*

TABLE 4.9

Hydroelectric Power Benefits and Costs
(thousands of dollars)

Project or program	Benefits	Costs			
	Annual equivalent	Annual equivalent			Investment
		Total	Operation, maintenance, and replacements	Taxes foregone	
Horsepasture	1,596	1,450	169	481	20,830
Jocassee	3,718	3,676	325	1,245	58,400
Newry-Old Pickens	3,763	3,585	308	1,245	56,440
Chattooga units	9,228	8,839	873	3,038	136,900
Tallow Hill	4,278	4,326	339	1,324	73,980
Anthony Shoals	2,476	2,407	266	770	38,090
Trotters Shoals	8,527	5,760	488	2,573	74,970
Lower Savannah	4,284	4,928	489	1,090	113,800
Total (rounded)	37,870	*34,970	3,257	11,770	573,400

* Includes $11,770,000 for taxes foregone.

and Camp Creek), Tallow Hill, Anthony Shoals, Trotters Shoals, and in the Lower Savannah project (Burtons Landing and Stokes Bluff). The total installed capacity would be 1,466,000 kilowatts, and the average annual energy output would be 1,693 million kilowatt-hours.

Industrial development is expected to increase in the basin and be enhanced by including the abundant supplies of water and provision for hydroelectric power in the resources development plan. Manufacturing employment projections for the basin show increases in all manufacturing categories by 2000 except textiles. Textile and apparel establishments are the major employers in the basin and will continue to be important to the overall economy. Metal fabrication; stone, clay, and glass products; pulp and paper; and chemicals will increase in importance as employers during the study period.

Soil Conservation and Utilization

The plan includes soil conservation measures and practices for about 890,000 acres of cropland, pastureland, and rangeland. It also makes an allowance for expected land-use conversions and the installation of 16,000 additional farm ponds. Annual returns to the individual farmers for soil conservation and land-use conversions are expected to be $3,148,000. Annual equivalent costs are estimated to be $2,590,000 of which about $1,781,000 are for operation, maintenance, and replacements costs. It is estimated that investment costs will be $22,370,000.

Figure 4.8 *Soil Conservation Practices Are Important in Providing Good Pastures and Protecting the Soil and Water Resources.*

Forest Conservation and Utilization

The forestry program is mainly developed, financed, and administered by the landowners, with technical assistance from Federal agencies and some Federal participation in fire prevention and other aspects of the program. The program for the 4,508,000 acres of woodland in the

basin includes woodland drainage and water control, in addition to fire protection, grazing control, tree planting, forest road installations, timber-stand improvement, and other measures. The program would provide for an annual timber cut of 252 million cubic feet and about 520,000 faces for gum-naval-stores production by the year 2000.

Annual equivalent benefits of the program are expected to be $5,039,000. The estimated annual equivalent costs are $3,438,000 of which operation, maintenance, and replacements costs total $1,214,000. The projected investment costs of the program are $92,080,000.

Fish and Wildlife

The fish and wildlife program extends throughout the basin. The overall program includes both single-purpose activities and fish and wildlife features in multiple-purpose projects.

The commercial fisheries program would consist of expansion of existing operations; cultivation of shrimp, oysters, pompano, and other high-quality seafoods; and acceleration and expansion of existing facilities and going programs.

TABLE 4.10

Fish and Wildlife Benefits and Costs (thousands of dollars)

Project or program	Benefits	Costs		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Highlands*	838	784	607	5,340
Jocassee*	21	20	2	500
Newry-Old Pickens*	86	72	8	1,790
Tallow Hill*	60	63	6	1,590
Anthony Shoals*	49	43	6	1,030
Trotters Shoals*	100	40	6	940
Lower Savannah*	486	660	50	21,700
Water-access areas*	89	88	41	1,290
Single-purpose programs				
Sport fisheries and wildlife	4,283	2,609	2,570	2,040
Commercial fisheries	352	299	297	60
Total	6,364	4,678	3,593	36,280

* Fish and wildlife benefits and allocated costs only.

Figure 4.9 *Fishing on the Savannah River Provides Many Good Catches.*

Accomplishment of the plan by the year 2000 would provide annually some 1.4 million user-days of hunting, about 4.8 million user-days of sport fishing, and about 6.6 million pounds of commercial fish.

Programs installed in the period 1960-2000, by the end of the period, would provide for an annual increase of 0.67 million user-days of hunting, 3.7 million user-days of sport fishing, and about 3.5 million pounds of commercial fish. In providing the projected increases in use, it was necessary to offset losses of 77,000 user-days of hunting and 158,000 user-days of fishing that would result from inundation of habitat.

Recreation

Development of the Highlands project area; continuation of the development at Savannah Beach; expansion of facilities in the national and State forests; construction of facilities at natural and historical locations; development of 9 water-access areas; and construction of 9 multiple-purpose projects provide a well-balanced program to meet future recreation needs.

The proposed and existing facilities included in the plan would provide for a projected need of 35 million user-days by the year 2000. Development of existing facilities would accommodate about 21,150,000 user-days at beaches and natural environment areas of State and national forests.

TABLE 4.11

Recreation Benefits and Costs (thousands of dollars)

Project or program	Benefits[1]	Costs[1]		
	Annual equivalent	Annual equivalent		Investment
		Total	Operation, maintenance, and replacements	
Highlands	[2]5,527	[2]2,810	[2]1,610	[2]47,060
Horsepasture	1,022	298	150	4,500
Jocassee	142	46	27	540
Newry-Old Pickens	375	130	52	2,300
Chattooga units	369	122	71	1,400
Tallow Hill	489	178	63	3,180
Anthony Shoals	586	194	78	3,210
Trotters Shoals	4,353	1,119	520	18,720
Lower Savannah	8,567	1,876	1,104	24,200
Water-access areas	797	204	127	2,150
Single-purpose recreation	7,703	1,971	1,202	32,530
Total (rounded)	29,930	8,948	5,004	139,800

NOTES: [1] Recreation benefits and allocated costs only.
[2] Includes all of Highlands project recreation costs and benefits both in Savannah and Apalachicola-Chattahoochee-Flint basins.

Figure 4.10 *Sailing on Clark Hill Reservoir Is Increasing in Popularity.*

New developments would accommodate some 13,850,000 user-days by the year 2000.

Projects and programs for recreation development during the period 1960-2000 would provide for 27,770,000 user-days – 13,920,000 user-days with expanded facilities over those existing in 1960 and 13,850,000 user-days at new areas.

Salinity and Sediment Control

Salinity of land is not a major problem in the Savannah basin, and no programs or projects are proposed exclusively for its control. Saltwater intrusion in the municipal water supply at Savannah may become a problem if heavy concentrated pumping from ground water is sustained. Sediment is still a problem in portions of the Piedmont and Blue Ridge provinces. The upstream watershed projects and the forestry and soil conservation programs are effective in meeting these needs. Although there would be some benefit to sediment control as a result of these programs and from the multiple-purpose storage developments, benefits and costs have not been evaluated separately.

Pollution Abatement and Public Health

The program for pollution abatement consists of new and extended sewerage systems for approximately 1,300,000 persons. By the year 2000, there is expected to be 24 primary plants, 70 secondary plants including stabilization ponds, and new sewerage systems or extensions to existing sewerage systems serving 94 places. Sewerage facility needs for the Federal and non-Federal institutional installations in the basin were not included in the program.

The public health program consists of drainage and spraying for vector control, 1 incinerator for solid-waste disposal, sanitary landfill at 72 places for fly and rodent control, and continuation of statewide programs for air pollution and radiological monitoring. The health aspects of other projects and programs relate to the prevention of additional hazards to health and these costs are, therefore, included in the other purpose costs. These pollution abatement and public health programs are expected to contribute to the general health and welfare of residents, tourists, and vacationists, including fishermen and hunters.

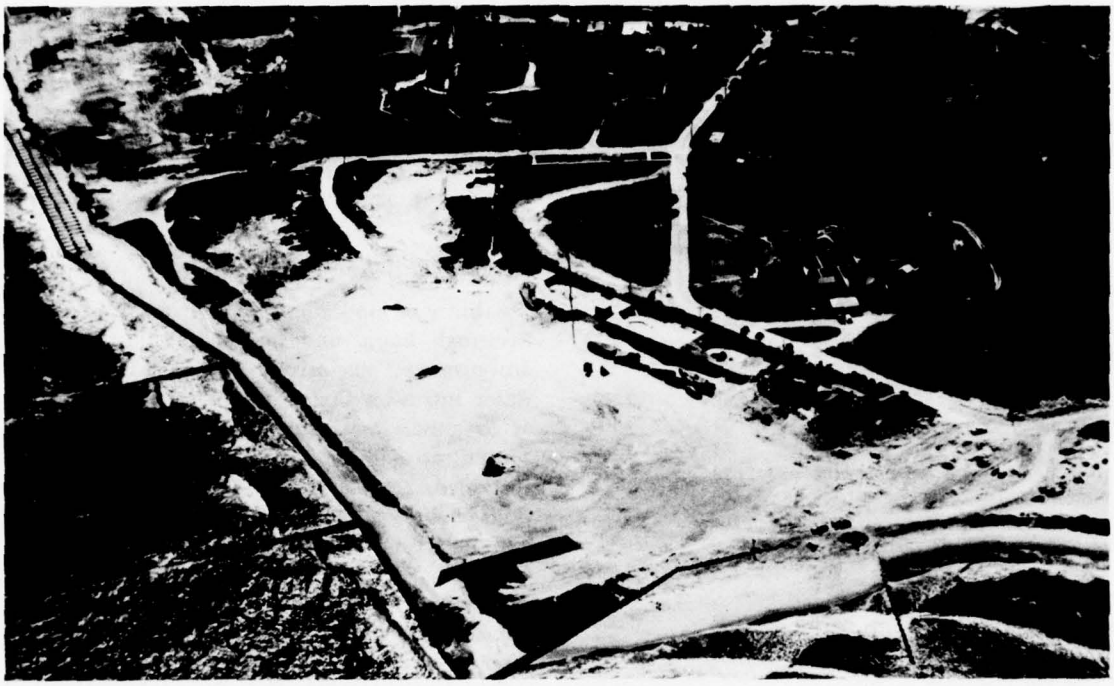


Figure 4.11 *Jetties at Savannah Beach Help Prevent Damages Resulting from Beach Erosion.*

TABLE 4.12

Pollution Abatement and Public Health Costs
(thousands of dollars)

Project or program	Costs		
	Annual equivalent		Investment
	Total	Operation, maintenance, and replacements	
Savannah Pollution Abatement project	1,286	314	27,000
Single-purpose pollution abatement	2,563	766	83,680
Public health	1,608	1,596	460
Total	5,457	2,676	111,140

Other Beneficial Purposes

There are beach erosion and hurricane damage problems in the basin. These are expected to increase as coastal areas develop. The plan provides for existing hurricane warning systems to continue to be improved, and proposes studies of beach erosion control and hurricane protection possibilities. Also proposed are programs for obtaining topographic and geologic mapping, hydrologic data, data on water quality and water use, and on land use changes to improve and add to the store of basic data on the area resources.

The forecasting of streamflow is essential in the proper management of water resources. Flood forecasting is well known for reservoir operation and for warnings in areas unprotected by physical control of floodwater. Future use and regulation of streams will require forecasts of flow, both high and low, as far in advance as practicable. All river-related purposes, such as recreational boating, fishing, navigation, hydropower operation, water supply, pollution abatement, public health, irrigation, and flood control, are benefited by advance information as to the expected flows. The costs of forecasting are relatively small and are included in the overall project and program costs. The benefits are also included in the assumption that the best possible forecasts will be available. These benefits are not achieved automatically. A deliberate program which recognizes the necessary lead time for development of reporting network and other facilities is required.

SECTION III – IMPACTS OF THE PLAN

Economic

A major objective of the plan is to improve the environment of the basin for people and industry. These improvements are not all measurable in tangible terms. Identifiable primary tangible benefits have been used for monetary evaluation of the projects and programs in this plan. The greater use and greater value, however, might very well stem from benefits not identified or fully recognized in the monetary evaluations. These nonevaluated benefits may be either or both primary and secondary in nature.

The impact of programs and projects which involve increased production of commodities would be felt in the general community by requiring additional production materials and processing equipment, and more services to provide the material, maintain the equipment, and sustain operations. The increased activities would stimulate a large exchange of money throughout the basin. Similarly, it is expected that there will be very sizable impacts from recreation and sport fishing and wildlife projects and programs. Fishing camps, motels, sporting goods stores, service stations, boat dealers, restaurants, and related new businesses would be required.

The extent to which river basin developments will influence the economy of adjacent areas is difficult to predict, but such development could affect the entire Southeast River Basins area and the States of Georgia, South Carolina, and North Carolina. Certain impacts could be felt over a much wider region. The more significant impacts, for each purpose served by the plan of

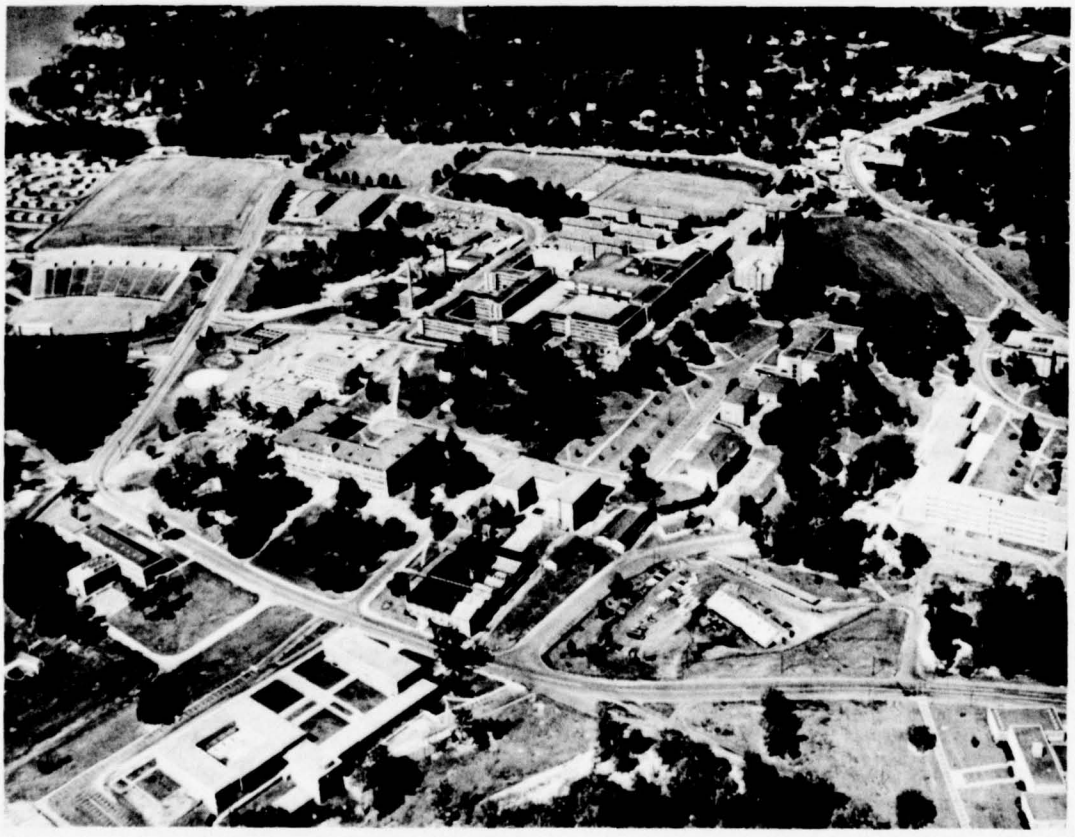


Figure 4.12 *Clemson College, Clemson, South Carolina – Hartwell Reservoir Shows in Extreme Upper Left Corner.*

development, are discussed in the following paragraphs.

Flood Control

Clark Hill and Hartwell Reservoirs and the Augusta levees substantially protect the metropolitan areas that have been damaged by floods in the past. The upstream watershed conservation programs, including small reservoirs and farm ponds, would also improve the regimen of the downstream valleys. No existing towns or cities are located in areas which would be flooded by reservoirs considered for development.

Water Supplies

In this study, benefits from water supply were assumed to be at least equal to the cost of obtaining water of similar quantity and quality from the cheapest and most likely alternative source. In this basin, the most likely alternative sources are the ground water aquifer in the Coastal Plain and both ground and surface water in the Blue Ridge and Piedmont provinces.

The availability of water, however, should not diminish its value and its benefits. Water is the common denominator of all human activity. The availability of good quality water in ample quantities determines to a considerable extent the degree of community and industrial development. In reality, the value of water to an area is much greater than the cost of obtaining it.

Navigation

The plan for 12-foot slack-water navigation between Savannah and Augusta and harbor improvements in the port of Savannah would create economic values exceeding the savings in freight costs. Growth of Savannah as a major port and industrial city and Augusta as an inland port would be assured. Foreign commerce is very important to Savannah. Improved port facilities would facilitate the flow of this commerce.

The areas on both sides of the river north of Savannah to Augusta could benefit from improved navigation. The major exporting industries of the basin, paper and allied products, textiles, food products, chemicals, and lumber and wood products, could utilize the river for shipping purposes. Augusta would benefit by improving its position as a wholesale trade center for a larger portion of Georgia and South Carolina. The Augusta area also could increase its industrial growth when improved navigation is coupled with existing hydroelectric power developments.

Industries that supply or consume large amounts of bulk commodities suitable for water transport generally find it advantageous and profitable to locate on navigable inland waterways or adjacent to improved harbors. These improved waterways or harbors become parts of mass production lines for the moving of bulk materials, component parts or finished commodities at low cost. If other factors, such as raw materials, markets, land transportation, power, and suitable sites are favorable, industrial development could very well be an outgrowth of waterway or harbor improvement. It is in this subsequent development that the real economic impacts are found.

Agriculture

The Savannah basin has long depended upon agriculture to support a major segment of its economy. It is expected that employment in agriculture will decline but that production will nearly double by 2000.

Some agricultural crops such as cotton, peanuts, corn, and small grain are expected to more than double. Livestock products are expected to increase in almost all categories. Certain expenditures will have to be made in the basin to achieve this production, and these expenditures would in themselves generate added economy. By 2000, the basin farmers are expected to spend $73 million for feed annually, $20 million for livestock, $5 million for seed, $23 million for fertilizer and lime, $25 million for repairs and maintenance, and $33 million for labor. Total annual expenditures for production are expected to exceed $225 million. These items would have a tremendous impact on the basin economy by generating trade in the smaller communities.

Only a portion of the total agricultural program involving soil conservation and utilization, reclamation, drainage, irrigation, and upstream watershed improvements is included in this basin plan.

The benefits, primary and secondary, from the agricultural programs will create a portion of the economic impacts of the total agricultural program. They, like the impacts from other aspects of the agricultural program, will have real and lasting effects on the basin communities.

Benefits from the agricultural programs considered in the plan will accrue through improved efficiencies of farm operations; reduction of turbidity of many streams; prolongation of the useful life of surface reservoirs; some alleviation of flood and sediment damage to roads, bridges, roadfills, and real and personal property; improved wildlife habitat and recreation facilities; and abatement of stream pollution. They also facilitate proper utilization of agricultural lands by protecting land from erosion, permitting more intensive utilization, and contribute toward adequate agricultural and nonagricultural water supplies for the people of the basin.

Hydroelectric Power and Industrial Development

Water and electric power are two economic elements carefully considered by industry in looking for a place to expand or establish a plant. The hydroelectric power facilities included in the comprehensive plan of development combined with expansion of steam generation by private utilities would provide the Savannah basin with liberal quantities of these elements. Many additional transmission lines, substations, and related facilities will be needed to meet the growing demands.

Since water and power from the plan of development extends from the mountains in North Carolina to the plains in South Carolina and Georgia, the attraction to industries is basinwide. Other factors such as transportation, markets, labor, raw materials, climate, taxes, and community attitude then become governing elements. Industrial location in the basin will be determined largely by these factors.

Several outstanding examples already exist in the basin of the economic effects resulting from industrial development. Examples include the Savannah River Atomic Energy Commission plant in the Augusta-Aiken area, a large papermill at Greenwood, South Carolina, and a large basic chemical plant at Anderson, South Carolina. Industrial development goes beyond mere creation of new manufacturing employment; it fosters the development of other types of employment.

Capital expenditures for industrial expansion in the basin are expected to average about $28 million a year. This and the projected average increase of 2,400 new manufacturing employees per year should create economic growth in wholesale and retail trade, services, government, finance, construction, and other supporting trades and services at an average rate exceeding 5,000 new jobs per year. Total personal income and disposable income increases will provide a direct stimulus to business activities throughout the community. New employees will require new homes, cars, furniture, appliances, food, drugs, and other essential commodities and services.

New manufacturing employees and those in supporting trades and services also pay taxes and demand governmental services for their tax dollar. With economic progress comes a community demand for services. Communities that keep ahead, or even abreast, of these demands are the communities that will grow.

The economic impact of industry is not limited to a city or even the basin. Its effects are far-reaching, and larger trading centers are affected by this activity.

Industrial development in the Savannah basin depends on many factors, but the real success of any industrial development depends on the resourcefulness and initiative of the people. Community attitude and enthusiasm, above all else, are the determining factors. The Savannah basin, with its heritage, its industrial capabilities, and its resource development potential could become outstanding in the South in economic development.

Forest Conservation and Utilization

Forest conservation and management are important in the Savannah basin because the raw materials are needed to advance the manufacturing potential. The pulp and paper industries as well as the lumber and wood products industries hold promise for employment growth. These industries depend on raw materials to assure this growth potential.

Income from forestry practices can be of great importance to the smaller rural communities. Processing of the material locally would mean increased manufacturing employment and increased expenditures for equipment, supplies, taxes, and services. Harvesting and transporting timber products and raw materials would also provide additional employment and equipment investments.

In addition, the forestry program would im-

prove the condition of the soil and reduce erosion and storm runoff. Recreation possibilities would be enhanced, and better fish and wildlife habitat would be provided.

Fish and Wildlife

The expenditures of hunters and fishermen in the project areas, as well as in the towns or cities where they reside, often add much to the economy. Additional employment opportunity would be afforded by many small businesses engaged in operation of fishing and hunting camps and in services and sales of food, gasoline, arms and ammunition, fishing tackle, live bait, and other sporting goods and supplies.

Benefits are derived by general enhancement of the recreational opportunities afforded by a given locality. The growth of many towns and cities in this part of the Southeast will depend to a great extent on their attractiveness and proximity to lands and waters offering good hunting and fishing.

Table 4.13 summarizes some of the types and percentages of expenditures which could be expected from hunting and fishing. These are compiled from national averages and are only *illustrative.*

TABLE 4.13

Percentage Distribution of Expenditures Hunting and Fishing—1960

Expenditure item	Hunting	Fishing
Food	7	8
Lodging	2	2
Transportation	15	14
Equipment	49	48
Licenses, tags, permits	5	2
Leases, fees, other	22	26
Total	100	100

The commercial fisheries industry generally is plagued by the vagaries of weather, seasonal fluctuation of supply, precarious market conditions, lack of good conservation practices, and competitive products. As a result, this industry is not attracting energetic young men. The benefits which could be realized, however, are of such magnitude as to justify a vigorous effort toward attracting new men into the industry.

Secondary benefits include increased employment in the fishing and seafood industries and in boat building, boat maintenance, and boat-supply enterprises. More services would be required, and sales of food, gasoline and oil, fishing supplies, and other equipment would increase.

Recreation

Public outdoor recreation is big business and the Savannah basin can develop and share further in this enterprise. Recreation activities contribute to economic stability of many areas of our Nation. Several segments of industry, such as boat building, recreation equipment, and camping equipment, depend almost entirely upon outdoor recreation pursuits and have shown phenomenal growth in the last decade.

Outdoor recreation produces many benefits. Some of these benefits are not of a tangible nature. Recreation provides the healthful exercise needed for physical fitness. It promotes mental health, offers esthetic values and encourages interest in nature. With these concepts in mind, the benefits have been computed on the basis of value to the user.

Recreation also produces secondary benefits. These secondary benefits are reflected in the economy of the area, the community, and the Nation. Some of these secondary benefits are:

(1) Stimulation of travel and travel expenditures;

(2) development of business activity in areas within, adjacent to, or enroute to recreation areas, increasing retail trade and new construction;

(3) stimulation of recreation equipment manufacturing;

(4) increased property values in the immediate vicinity of the recreation area; and

(5) increased miscellaneous net tax revenues after allowing for increased governmental expenditures for needed additional governmental services.

A monetary calculation of these secondary benefits is difficult. Surveys have been made of recreational and related expenditures in many areas but the effectiveness of these surveys depends upon how they were developed and for what purpose. Some of the survey estimates show individual expenditure ranging from $4 to $7 per day. These expenditures are reflected in the economic activities mentioned above.

Figure 4.13 *Adequate Reservoir Access Areas Are Important to the Recreation Plan.*

Water-based recreation is of special importance to outdoor recreation due to the current popularity of water sports and waterfront living. Clean, unpolluted reservoirs, lakes, streams, and ocean beaches generate more recreational activity than any other recreation factor. A recent 10-year study of selected counties in the Arkansas-White-Red River Basins with significant reservoir shorelines showed an increase in per capita income of 57 percent, an increase in bank deposits of 57 percent, and an increase in tax levies of 64 percent. Also significant was an increase in investment in overnight lodging facilities, annual expenditure on private home construction, and new school construction. Counties in the same areas without shorelines fell far short of this rate of growth.

While all of the economic gains in those reservoir counties cannot be directly attributed to the presence of new lakes, it cannot be overlooked that the new recreational activities had a pronounced effect. The reservoir counties are better off by nearly all economic yardsticks. However, it should be pointed out, also that these counties were comparatively depressed prior to the construction of the reservoirs. The impact of the recreation dollar was more dramatic in this situation than it would be in an area of greater economic activity.

Pollution Abatement and Public Health

A clean stream enhances the well-being of people and is a factor which influences people as to their choice of place of residence, employment, and recreation. It is important in sustaining a healthy environment and in attracting others to the basin.

There are varying degrees of pollution resulting primarily from municipal and industrial waste discharges into the streams of the Savannah basin. Pollution abatement is frequently needed to maintain suitable water quality necessary to realize fishing, hunting, and recreational opportunities. Clean streams improve land and property values which have a great impact on economic development. Industries are particularly interested in establishing new plants where pollution problems can be handled effectively.

It is difficult to assess the impact of an effective pollution abatement program. There are many tangible, intangible, and secondary benefits from improved water quality. Where recreation is so important to the future economic development, water quality assumes even greater importance. Pollution abatement presently needed would constitute insurance for future usefulness of the resource.

Public health programs for control of vectors, mainly mosquitoes and gnats, are also very important. The coastal areas of the Savannah basin with its tidal marshlands, as well as the entire length of the basin with its numerous ponds and wetlands afford breeding places for mosquitoes and other vectors. Control of these undesirable vectors could mean the difference in some places between success or failure in the efforts to improve the area economy. Sanitary landfill for solid-waste disposal can increase the effectiveness of the vector program.

Other Economic Impacts

Besides the impacts of the functional programs, other economic impacts are noteworthy. They relate to several or all of the purposes served. These impacts are: (1) Those stemming from increased land values or land enhancement impacts; (2) impacts from tax revenues; (3) those stemming from the actual construction of project facilities; (4) those relating to in-migration of labor force and skills; and (5) impacts to redevelopment or distressed areas.

Land enhancement impacts—Land and water resources improvements have not been planned specifically for enhancement of land. However, the land enhancement benefits that would result from reservoir construction and certain other projects would be considerable. Many public costs are associated with rising land values, so that the entire amount of these values cannot be looked upon as net benefits. Waterfront property, particularly that suitable for homesites and recreation and industrial development, is generally marketable at a higher value than nonwaterfront property with all other factors being equal. Land that was previously woodland is subdivided into more expensive lots. Other areas become important for industrial property because of stable, ample, and unpolluted water supplies.

Rapid development of lakeshore property for

Figure 4.14 *Good Boating Facilities — Advance Planning Permits Logical and Proper Reservoir Development.*

recreation and commercial use has followed reservoir development throughout the Southeast River Basins area. This development, with resultant increase in property values, has naturally been greater and more rapid in those areas located near major population centers. Reconnaissance studies in the Lake Lanier area suggest that property values in the vicinity of reservoirs used extensively for recreation have increased tenfold during the first 10 to 12 years of development.

This is not to claim that all land enhancement values of projects outlined in the comprehensive plan will be of the same magnitude. Several factors influence land enhancement and are: (1) Proximity to urban population; (2) shoreline topography; (3) fluctuation in water level; (4) water quality; (5) accessibility and shoreline ownership; and (6) size of water body, in case of reservoirs.

In the future as waterfront property becomes scarce as a result of increases in population and leisure time, the enhancement of land will be an even greater secondary effect of water project development.

Impact from tax revenues—Increased tax revenues usually come as a result of increased economic activity, increased land and resource productivity, more intensive land use, and more real property. Counties that today have uniform or declining economic activity, low level forest and farm productivity, poor land use, and little new construction are not in a favorable position to realize greater tax revenues. Even tax equalization is difficult under such a situation. Without sufficient tax revenues, government efficiency and extension of community services are almost impossible.

Development of projects and programs envisioned in the comprehensive plan will do much toward alleviating this situation. Increased economic activity will follow as a result of the implementation of the projects and programs. The forestry program will result in increased forest productivity. The soil conservation, reclamation, irrigation, and drainage programs will mean increased farm productivity. Increased economic activity will result in more residential and business construction. All of these effects coupled with judicious tax equalization will mean increased tax revenues.

Inundated reservoir lands and lands taken out of production for other projects and purposes may create a loss in taxable property to the county tax rolls. However, these tax revenue losses do not necessarily have to be permanent. In the case of reservoir lands through proper development and management of the shoreline area, the land enhancement and new construction resulting will practically always outweigh the losses. In the previously mentioned study of selected counties following reservoir construction in an underdeveloped area in the Arkansas-White-Red River Basins, it was found that taxes levied were up 64 percent at the end of 10 years. Nearby counties without reservoirs increased less than 4 percent in tax revenues. This study also pointed out that the 10-year average annual revenues paid to the counties in lieu of taxes far exceeded the first year tax loss from inundated property. In some cases, this average annual revenue amounted to over 10 times the first year tax loss. On the whole, the average annual revenue was a gain of over 320 percent above the first year tax loss. This revenue is in addition to the 64-percent increase in taxes levied discussed above.

Impacts from construction activities—The construction of storage works and other facilities will provide an economic stimulus to the local area during the construction period. This is brought about by the temporary influx of workers for the project who desire housing, food, services, and entertainment and by the fuller employment and higher payment to workers from the local labor force. Much of this economic activity, stemming from wages and salaries, is felt locally.

It has been estimated that about 60 percent of the total construction cost is labor cost. Whether or not this would be spent mostly locally would vary with the individual projects and their proximity to urbanized areas. The remaining 40 percent is for materials, equipment, maintenance, and services; and most of these costs would affect a larger area, even the national economy. Substantial cost may result from the increase in population engaged in construction, and this cost must be considered in appraising the benefits.

Impacts from migration—A high birth rate, a relatively dense population for an agricultural area, and limited employment opportunities have produced in the Southeast River Basins an

extremely mobile population. This out-migration and regional urbanization have been good, in many respects, as safety valves which have prevented population pressures from reaching even more undesirable proportions in the rural areas. Migration since the 1930's has also brought about a loss to the area. These out-migrants represent lost manpower and lost expenditures to the area for the rearing, educating, and training of the migrants.

At the same time, the Southeast River Basins area has evidenced a growing amount of in-migration. Generally, the amount of education, training, and income represented on a per capita basis by this group has been relatively higher than that for the out-migrants. As a result, the economic losses from out-migration have been tempered a little by the economic gains from in-migration.

A migration study was made for the Southeast River Basins area as a whole. The results of that study did not provide data to show the economic effect of migration on the Savannah basin. However, the trends indicated by the study are assumed to be applicable to the Savannah basin.

The study shows that during the period of 1960-75 out-migrants should continue to outnumber in-migrants but not to the extent which was evident from 1930-60. Because the in-migrants are expected to be better educated and skilled than the out-migrants, the area should evidence an economic gain when comparisons are made of the cost of rearing, training, and educating the migrants. During the period of 1975-2000, this economic gain should be even greater because the in-migrants should then begin to outnumber the out-migrants.

Another comparison was made of the personal income of the migrants and anticipated migrants. Under this comparison, the period of 1960-75 should show an economic loss but certainly not nearly as great as that evident during the 1930-60 period. However, during the period of 1975-2000, the area should start to gain economically in this comparison of personal income.

Impacts to redevelopment areas—Of the 45 counties falling wholly or partially in the Savannah basin, 25 had been designated redevelopment areas as of April 1962 under Section 5 (b) of the Area Redevelopment Act of 1961. These were so designated because of low median family income, low farm family income, and persistent and substantial unemployment.

Some of the projects and programs proposed for the basin should help remedy these conditions. For instance, the food and fiber programs will improve farm and forest production and income throughout the basin, increasing per capita income, especially for farm families. The commercial fisheries program will increase fish production and assist in increasing employment in the coastal counties. The projects to provide more and better recreational areas will increase per capita income, as well as provide additional employment in the vicinity of the individual projects. Many of the projects will create temporary employment during the actual construction phase.

Assistance is available to these counties under the provisions of the Area Redevelopment Act. This assistance is in the form of loans for industrial and commercial projects, loans and grants for public facilities, technical assistance, occupational training, and subsistence payments while retraining.

Physical

The comprehensive plan for the Savannah basin has four regional aspects.

First, the mountain areas of North Carolina, South Carolina, and Georgia offer outstanding possibilities for recreation development because of the spectacular mountain scenery, the waterfalls, and the excellent trout fishing. The Highlands project, including the extension of the Blue Ridge Parkway to the basin, is proposed to develop and preserve these values.

Second, the Piedmont and the upper part of the Coastal Plain are being developed steadily both by industry and agriculture. Consequently, there are several additional multiple-purpose reservoir projects in the plan of development which will furnish water and power, as well as recreation and fishing, to this great zone of the basin.

Third, the outstanding advantages of the lower portion of the basin include navigation, which extends from the ocean to Savannah and Augusta. This advantage needs to be supplemented by additional works to keep these cities competitive with other localities and capable of meeting the needs for the expected growth. Navigation improvements and those for power,

industry, agriculture, recreation, and fish and wildlife have resulted in a proposal for further development of the Lower Savannah project.

Fourth, is the development of the many purposes studied throughout the entire river basin which will round out development. This will be through programs principally for the lands, forests, and streams which harmonize with the multiple-purpose plans on the main streams covered in the first three regional aspects.

Implementation of the proposed plan of development will provide the facilities required to permit efficient use of the available resources within the framework of projected requirements. There will still be some flooding, some pollution problems, and some legal and institutional difficulties; but the plan, if carried out, will enhance the basin economy. However, such developments will occur only if the proposed plan or one producing similar results is pursued with vigor and completed on a schedule geared to the needs of the area.

Generally, the needs for all functions in the basin are compatible. There will be increasing competition for land in the future, but the availability of land is not expected to be a limiting factor. More intensive forest management will be required to produce the needed output. The limit of productive capacity will not be reached during the next 40 years. The proposed reservoirs will inundate some lands that are now valuable for timber production and other uses and will also inundate a few fishing streams that range from poor in quality to some of the best in the basin; but they will, in addition to their specific uses, improve land values around their borders and improve fishing conditions in the streams below them. The reservoirs themselves, together with associated improved access, generally create fishing values greater than those of the stream reaches they replace. Control of floodwaters for release in low-flow periods is beneficial to nearly all functions.

The physical developments proposed will be located throughout the basin and all areas will benefit from their construction. The initial impact from the construction itself will accrue to all three States. The benefits from the regulation that the reservoir system would provide would accrue to the Nation generally and to the three States specifically, but Georgia and South Carolina will receive the greater share of the benefits and costs. The entire system of reservoirs has both physical and economic effects on each project or unit in the system. This does not mean that the proposed system could not be improved by more thorough study or could not be developed in stages over a number of years. Further investigation may result in desirable adjustments in the proposed plan. Such studies should be made before any major segment of the plan is constructed. Additional basic data, such as streamflow records, are needed on several units before final plans can safely be adopted.

SECTION IV – PLAN IMPLEMENTATION

Cost Sharing

Resource development costs should be shared so as best to serve the public interest by: (1) Encouraging sound resource development and economic and social stability and growth; (2) promoting maximum efficiency in use of private and public funds; (3) obtaining an equitable relationship between the incidence of costs and benefits; (4) preventing avoidable waste, unwarranted windfall gains, and undesirable competition; (5) encouraging desirable types and sizes of enterprises; (6) securing consistency between the various purposes of resource development; and (7) promoting public understanding and cooperation in resource development.

Two types of costs are shown for cost-sharing analyses: (1) Investment costs, which include all of the costs of project construction including lands and rights-of-way, estimated for the period of development through the year 2000; and (2) operation, maintenance, and replacements costs, shown as an annual cost, and estimated on the basis of development at the year 2000.

Operation, maintenance, and replacements costs for use in cost-sharing determinations are based on full use of the facilities that are specifically proposed. Since the ultimate need during the period studied will not normally develop until the year 2000, the full operation, maintenance, and replacements costs for the facilities included in the plan are shown as "OM&R at year 2000." The comprehensive plan is designed to

meet needs to the year 2000, so additional needs, costs, and benefits that may develop after that year have not been evaluated. This does not ignore or preclude the possibility of adding facilities after the year 2000 to the then existing projects and programs to meet additional needs.

Cost-sharing data shown in Table 4.14 are only suggestive. Further study may result in different costs and cost-sharing arrangements. It should be recognized that for all of the purposes listed here there are important non-Federal expenditures which are in no way covered by this Report as they are outside the problem areas considered by the Commission. An example is the conservation of private lands by owners without relation to Federal or State programs.

Of the total investment costs, about 16 percent is estimated to be borne by the Federal Government and about 84 percent by the non-Federal interests. For operation, maintenance, and replacements costs, approximately 20 percent would become the responsibility of the Federal Government and 80 percent would be borne by the non-Federal groups involved in land and water developments. The fact that hydroelectric power projects play a very important role in this basin accounts for the relatively high proportion of non-Federal cost sharing.

The cost for hydroelectric power is the largest item in the Savannah basin plan, accounting for

TABLE 4.14

Cost Sharing—Comprehensive Plan

Purpose or project	Investment costs					Annual operation, maintenance, and replacements costs at year 2000				
	Total ($1,000)	Federal ($1,000)	Federal (pct.)	Non-Federal ($1,000)	Non-Federal (pct.)	Total ($1,000)	Federal ($1,000)	Federal (pct.)	Non-Federal ($1,000)	Non-Federal (pct.)
Purpose*										
Flood control	43,420	23,880	55	19,540	45	572	--	--	572	100
Water supplies	122,100	--	--	122,100	100	11,250	--	--	11,250	100
Navigation	70,480	56,384	80	14,096	20	7,475	6,006	80	1,469	20
Irrigation	1,945	486	25	1,459	75	434	--	--	434	100
Drainage	1,297	324	25	973	75	39	--	--	39	100
Hydroelectric power	573,400	--	--	573,400	100	3,382	--	--	3,382	100
Soil conservation	22,370	6,710	30	15,660	70	1,781	--	--	1,781	100
Forest conservation	92,080	32,230	35	59,850	65	1,607	482	30	1,125	70
Sport fisheries and wildlife	36,220	15,212	42	21,008	58	5,044	155	3	4,889	97
Commercial fisheries	60	36	60	24	40	530	318	60	212	40
Recreation	139,800	32,300	23	107,500	77	6,491	1,150	18	5,341	82
Pollution abatement	110,680	21,200	19	89,480	81	1,686	--	--	1,686	100
Public health	460	--	--	460	100	1,678	--	--	1,678	100
Other purposes	--	--	--	--	--	--	--	--	--	--
Project*										
Highlands Project Area										
Highlands	52,400	14,440	28	37,960	72	3,569	536	15	3,033	85
Chattooga	138,300	--	--	138,300	100	947	--	--	947	100
Horsepasture	25,330	1,130	25	24,200	75	353	28	15	325	85
Jocassee	59,440	--	--	59,440	100	355	--	--	355	100
Newry-Old Pickens	60,530	--	--	60,530	100	380	--	--	380	100
Tallow Hill	78,750	--	--	78,750	100	410	--	--	410	100
Anthony Shoals	42,330	--	--	42,330	100	352	--	--	352	100
Trotters Shoals	94,630	5,150	5	89,480	95	1,201	107	15	1,094	85
Lower Savannah	197,800	47,400	24	150,400	76	2,086	345	15	1,741	85
Savannah Pollution Abatement	27,000	8,100	30	18,900	70	314	--	--	314	100
Savannah Harbor	31,650	25,320	80	6,330	20	7,300	5,840	80	1,460	20
Intracoastal Waterway	730	585	80	145	20	20	19	95	1	5
Water-access areas	3,440	1,376	40	2,064	60	168	25	15	143	85
Upstream watersheds	44,300	24,100	54	20,200	46	582	--	--	582	100

* Costs for purposes and projects are not additive. Costs of projects are included as part of the costs by purposes.

about 46 percent of the total investment costs. About $573 million in investment costs and annual operation, maintenance, and replacements costs of about $3.4 million are expected to be required for full development of the hydroelectric portion of the plan. Under suggested cost-sharing policies, the costs of the hydroelectric portion of the plan would initially or ultimately be 100 percent non-Federal.

The recreation program is the second largest item of investment costs in the Savannah basin, totaling about $140 million, which is over 11 percent of the total investment cost of the plan.

The pollution abatement program is the third largest investment item in the plan, accounting for about $138 million or 11 percent of the investment costs of the total plan.

Financing

In 1960, Federal, State, county, local, and private expenditures for resource development in the Savannah basin totaled about $40 million. This was equivalent to about 4 percent of the basin total personal income of $1,075 million. An estimated 15 percent of this expenditure was for training, technical aid, and other items not included in the comprehensive plan. Thus, the equivalent of 3.4 percent of the personal income was expended on types of endeavor corresponding to those in the plan.

The projects and programs covered by this Report involve some private expenditures and some items of public expenditures which have been made since January 1, 1960, the starting date used for the evaluation. During the period of analysis, the annual personal income in the basin is expected to be about $1,948 million by the year 1975 and about $4,937 million by the year 2000. If the current proportion of personal income is continued to be invested in resource development to the year 2000, then such funds would be more than adequate to accomplish the plan.

The annual rate of expenditure needed to accomplish the early action phase of the plan, in total and in relation to personal income, is higher than the previous or current rate during the first 10 to 15 years and diminishes slightly during the last 25 years. This is due to: (1) An immediate demand for facilities not now developed; and (2) the omission of some developments which undoubtedly will be needed in the latter portion of the 1975-2000 period, but which were not planned for because the projections of population, income, employment, and resources needs were not carried beyond the year 2000.

During the first 10 to 15 years of plan implementation, therefore, there is expected to be need for additional financing at a rate considerably higher than that presently prevailing. The developments that should be undertaken are consistent with the needs and opportunities within the basin expected to prevail during the next 40 years.

Studies indicate that the early action plan to expedite developments now in demand involves capital outlay and operation, maintenance, and replacements costs during the 1960-75 period which would exceed the normal increase of these expenditures at all levels of private and governmental activity by increasing the annual expenditures about $20 or $25 million above the amounts which would normally be available for work in this basin. The exact amount would depend upon the promptness in implementing the early action phase of the plan. Improvements in the plan to be constructed during the period 1975-2000 would require about $10 million additional annually.

It is expected that the Federal expenditure rate in the Savannah basin will be slightly increased, thus providing part of the needed funds. The remaining funds for this acceleration period are expected to come from non-Federal sources such as State and local governments, individuals, and private enterprises. In the case of State and local government, in order to avoid over-stressing the current tax base and to enable funds in the hands of individuals and private enterprises to be currently available for the non-Federal components of the plan, the additional funds could come from bond issues, development funds, and State agency financing.

Responsibility

The basic responsibility for initiating the plan rests with the State and local interests. Even in those fields where a Federal agency is normally the organization which actually performs the detailed planning and construction, the impetus for the planning study must originate with those whom the programs and facilities will benefit.

The comprehensive plan for the Savannah basin is a combination of projects and programs formulated to meet the needs of the people for land and water resource development. In most cases, the Commission studies have not been carried beyond the reconnaissance level and thus additional detailed planning is required prior to implementation of the plan. The authorizing Act specifically provides that the Commission plans shall not include final project designs and estimates.

The proposed assignment of responsibility for initiating the developments is made in the knowledge that timely and active interest on the part of the State and local leadership is required.

The designations included in Table 4.15 are made in accordance with the following criteria:

(1) If an existing project or program is to be expanded by the addition of facilities, or acceleration of activity, then the assignment of major responsibility for planning, construction and/or development, and operation is to the agency already having jurisdiction over the existing project or program. For example, if additional recreation facilities are to be provided at a project such as Hartwell which is already a Federal project under the administrative supervision of the Corps of Engineers, then this agency would be given major responsibility for planning and construction even though the work might be actually done by other Federal or non-Federal entities.

(2) Where additional facilities are proposed at a project already under non-Federal jurisdiction, then the non-Federal interest is assigned the major responsibility. Exception may be made in the case of installation of navigation locks in non-Federal dams which would be worked out by joint agreement between the non-Federal entity and the Corps of Engineers.

(3) Non-Federal programs such as forestry, soil conservation, recreation, fish and wildlife, reclamation, drainage, irrigation, public health, and pollution abatement would continue under non-Federal sponsorship except where such programs apply to national forests, military reservations, and other Federal holdings. Where a clear-cut conclusion is not readily apparent, then selection is to be made on a case-by-case basis, giving due weight to the pertinent circumstances.

(4) New projects or programs are assigned to Federal agencies for planning, construction, and operation where there is a substantial involvement of hydroelectric power and navigation since this is the general historical pattern. Exceptions are made in the application of this general rule for certain hydroelectric power facilities where it was found desirable that such facilities be constructed by non-Federal interests either in their entirety or by contractual agreement with Federal interests.

(5) Historical patterns are also observed in the case of flood control. If the project involves the provision of local protection works on the main stream, then the Federal interests would be responsible for construction and non-Federal interests would be responsible for operation and maintenance. In the case of flood plain management and small reservoir developments located in headwater areas to serve flood control purposes, planning, construction, and operation are designated as non-Federal, although local groups may call upon Federal agencies for assistance in planning.

(6) In the application of the general rule and the cited exceptions, the incidence of benefits is considered in determining appropriate responsibility. Where benefits are of national significance, Federal responsibility is indicated; where they are local, non-Federal responsibility is indicated. Where these benefits are of regional significance, the matter is decided on a case-by-case basis, considering all of the related circumstances.

(7) In the designation of non-Federal and Federal interest for the major responsibility, there is no intention that such selection would ignore the other interests that may be concerned in planning the details of the proposed program or project. This applies also to construction and operation.

The designation of Federal agencies to have major responsibility for projects and programs generally is made on the basis of the agency usually associated with the purpose having the largest portion of the total allocated costs except for projects involving hydroelectric power and substantial mainstem flood control which are assigned to the Corps of Engineers.

Where projects and facilities have been historically constructed by Federal agencies and turned over to local groups for operation and maintenance, it is intended that this practice be

continued. An example of this is a local flood protection levee on a principal stream.

The non-Federal or Federal interests with the major responsibility for accomplishment, including coordinating the preauthorization planning, obtaining final approval or authorization of specific works or facilities, budgeting for appropriations or other funding, design of structures, administration of construction or installation, and other matters pertinent to planning and construction are indicated in Table 4.15. The designation of Federal and non-Federal is not intended to prejudice joint non-Federal and Federal development when and if a proposal is presented to Congress for final resolution.

Designation of a Federal agency as having the major responsibility for the Federal aspects of each project, regardless of the magnitude of these Federal aspects, is not intended to reflect any lack of interest by other Federal agencies in a project; in fact, most of the Federal land and water agencies have some interest in each of the projects.

In the general programs not shown in Table 4.15, the division between non-Federal and Federal principal responsibility is made on the basis of ownership of the land or area involved. For example, wildlife or soil conservation programs on non-Federal lands are the principal responsibility of non-Federal entities; forestry programs on a military reservation or national forest are a principal Federal responsibility; and recreation programs on a Federal multiple-purpose reservoir project, which envisions Federal acquisition of the general reservoir area, are a principal Federal responsibility.

Early Action Phase

In order to meet immediate requirements for developing the basin resources in an orderly manner and to help stimulate growth in the economic structure of the basin, certain projects and programs included in the comprehensive plan should be initiated as quickly as detailed plans can be prepared for them and necessary financing and other arrangement can be made.

TABLE 4.15

Responsibility for Implementing Projects

Major responsibility for implementing designated projects		Project	Early action phase[1]	Purpose[1]	Federal agency with major responsibility for Federal aspects
		Highlands Project Area			
--	Federal	Horsepasture	E	P, R,	Corps of Engineers
--	Federal	Jocassee	--	P, R, F&W	Corps of Engineers
--	Federal	Newry-Old Pickens	--	P, R, F&W	Corps of Engineers
		Chattooga			
--	Federal	War Woman	--	P, R	Corps of Engineers
--	Federal	Sand Bottom	--	P, R	Corps of Engineers
--	Federal	Rogues Ford	--	P, R	Corps of Engineers
Non-Federal	--	Camp Creek	--	P, R	Federal Power Commission
--	Federal	Highlands (FS lands)	E	R, F&W	Forest Service
Non-Federal	--	Highlands (other)	E	R, F&W	Bureau of Outdoor Recreation, and National Park Service[2]
Non-Federal	--	Tallow Hill	--	P, R, F&W	Federal Power Commission
Non-Federal	--	Anthony Shoals	--	P, R, F&W	Federal Power Commission
--	Federal	Trotters Shoals	E	P, R, F&W	Corps of Engineers
		Lower Savannah			
--	Federal	Burtons Landing	E	N, P, R, F&W	Corps of Engineers
--	Federal	Stokes Bluff	--	N, P, R, F&W	Corps of Engineers
--	Federal	Gaffney Landing	--	N, R, F&W	Corps of Engineers
Non-Federal	--	Savannah Pollution Abatement	E	PA	Public Health Service
--	Federal	Intracoastal Waterway	--	N	Corps of Engineers
--	Federal	Savannah Harbor	--	N	Corps of Engineers

NOTES: [1] E—Early action phase development.
P—Hydroelectric power, R—Recreation, F&W—Fish and wildlife
N—Navigation, PA—Pollution abatement.
[2] Designated agency depends on the established division of responsibility between the Bureau of Outdoor Recreation and National Park Service.

Basinwide programs for conserving, developing, and utilizing land and water resources have been in operation for some time. Their continuation, expansion, and improvement form an important part of the comprehensive plan.

Action for implementing these programs would continue for the life of the plan and would generally increase gradually in proportion to population and economic growth. However, there are certain components of the programs on which action should be started early. Included in this category are improvement works having a long timelag between initial action and full utilization, activities for conserving and protecting resources for future use, and items that require special emphasis or action to bring them in balance with general development.

Table 4.16 indicates that about 40 percent of the investment costs of the plan of development for the Savannah basin should be expended between 1960 and 1975.

Early action should be initiated on the Highlands, Horsepasture, Trotters Shoals, Lower Savannah, and Savannah Pollution Abatement projects. Feasibility grade studies on the Trotters Shoals project are practically completed.

Full development of the Highlands project area will not be reached for many years. However, this project should be undertaken in orderly stages to keep abreast of the growth in mountain recreation and fishing. By 1975, about one-half of the project should be developed. One of the first steps, after more intensive cooperative planning by all concerned and establishing details of the plan, would be to acquire needed lands in fee or by easement to assure attainment of the main objectives of the plan. This would reserve for posterity the outstanding mountain recreation potentials that are now relatively undeveloped. Initial construction should start on key features before all the details are worked out on secondary features.

The Horsepasture project is in the heart of the Highlands area. It would help to meet the needs for power and recreation in the upper Savannah area. Its development should be coordinated with other developments in the Highlands project area. Releases would be made to retain the esthetic value of Drift, Rainbow, and Windy Falls as well as other falls and cascades. This also is necessary for sustaining fish in pools along the river below the damsite. Horsepasture project could be completed by 1975 except for a portion of the recreation facilities.

Trotters Shoals would provide substantial power, recreation, and fish and wildlife development in the area between Hartwell and Clark Hill. It would utilize the remaining head between those two projects, and would provide a relatively stable water surface which would enhance industrial and recreation developments around the reservoir area. Except for the later phases of its recreation features, full development could be attained by 1975 if construction is undertaken soon.

Economic development at and between Augusta and Savannah will depend to a considerable extent on improvements in navigation, recreation, and fishing in this area. The Lower Savannah project would provide the backbone for such development. Initially, Burtons Landing dam, lock, and powerplant would be completed and recreation and fish and wildlife facilities would be installed. Stokes Bluff, Gaffney Landing, channel work, modification of New Savannah Bluff lock and dam, and related portions of the recreation facilities would be completed after 1975.

TABLE 4.16

Summary of Early Action Investment Costs (thousands of dollars)

Project or program	Investment to 1975
Project	
Highlands	[1]27,920
Horsepasture	24,240
Trotters Shoals	88,850
Lower Savannah	111,300
Savannah Pollution Abatement	27,000
Program	
Water-access areas	1,614
Upstream watersheds	28,600
Water supplies	51,250
Irrigation	845
Drainage[2]	154
Soil conservation	8,950
Forest conservation	52,450
Fish and wildlife[2]	1,085
Recreation[2]	10,170
Pollution abatement	37,610
Public health	460

NOTES: [1] Includes costs in both Savannah and Apalachicola-Chattahoochee-Flint basins.
[2] Exclusive of investments associated with multiple-purpose projects or programs.

The Savannah Pollution Abatement project and various alternatives should be studied for pollution abatement of municipal and industrial wastes from the metropolitan area of Savannah. A solution of this problem will set a favorable stage for much greater economic developments in the area. Its development at an early date should result in a favorable chain reaction from improvements of fishing and recreation as well as from expansion of industries and transportation.

Early action or continued emphasis is needed on practically all of the program items. Dollar-wise, the most important emphasis is on pollution abatement, forest conservation, water supplies, upstream watersheds, and recreation.

The upstream watershed projects program has increased substantially during the last year. The rough terrain of the Piedmont and Blue Ridge provinces provides both the need and opportunity for practical upstream development in the basin. This program offers important opportunities to fishing and recreation, as well as to flood control and drainage.

Development of water supplies, pollution abatement, and public health programs must be continued to meet the needs throughout the basin. These programs deal with the general welfare of people, and the general welfare of people largely determines how fast other elements of the economic structure will grow. Emphasis must be directed to these programs to assure continued success in other programs.

SECTION V – PROJECTS AND PROGRAMS

The comprehensive and coordinated plan for the Savannah basin includes land and water resource developments that contribute to meeting the needs projected to the year 2000. These developments have been identified as projects, which usually are multiple purpose in concept and specifically identified and located, and as programs which generally are basinwide in scope. Resource developments existing and under construction as of 1960 are a necessary part of the plan to meet the needs. However, only proposals for new developments and for expansion of existing developments to be made during the period 1960-2000 are presented and their costs and benefits evaluated.

Features of single-purpose projects and programs are discussed under Plan by Purpose in Section II of this Part. Only the pertinent parts of multiple-purpose developments are covered by the plan-by-purpose summaries. In order to bring other pertinent data for multiple-purpose developments together, each project or program involving joint uses of facilities is described in the pages that follow.

A more detailed summary of some existing and proposed single-purpose facilities are also included to provide additional background for the comprehensive plan. An analysis of functions by States and the early action phase of development are shown.

The details of the projects and programs are summarized in the same order as they appear in the Comprehensive Plan for Development, Table 4.1.

HIGHLANDS PROJECT AREA

The Highlands project area contains all the land and water within the Blue Ridge province of the Southeast River Basins study area. This area is in two basins, the Savannah and the Apalachicola-Chattahoochee-Flint, and in three States, North Carolina, South Carolina, and Georgia. The Highlands, Horsepasture, Jocassee, and Chattooga projects and a portion of the Newry-Old Pickens project are located within the project area. The principal purposes of the Highlands project are recreation and fish and wildlife. The remaining developments are multiple-purpose reservoir projects. Each of these projects is described separately.

Highlands Project Area — Acres

State	Savannah basin	Apalachicola-Chattahoochee-Flint basins	Total
North Carolina	112,000	....	112,000
South Carolina	315,000	....	315,000
Georgia	228,000	150,000	378,000
Total	655,000	150,000	805,000

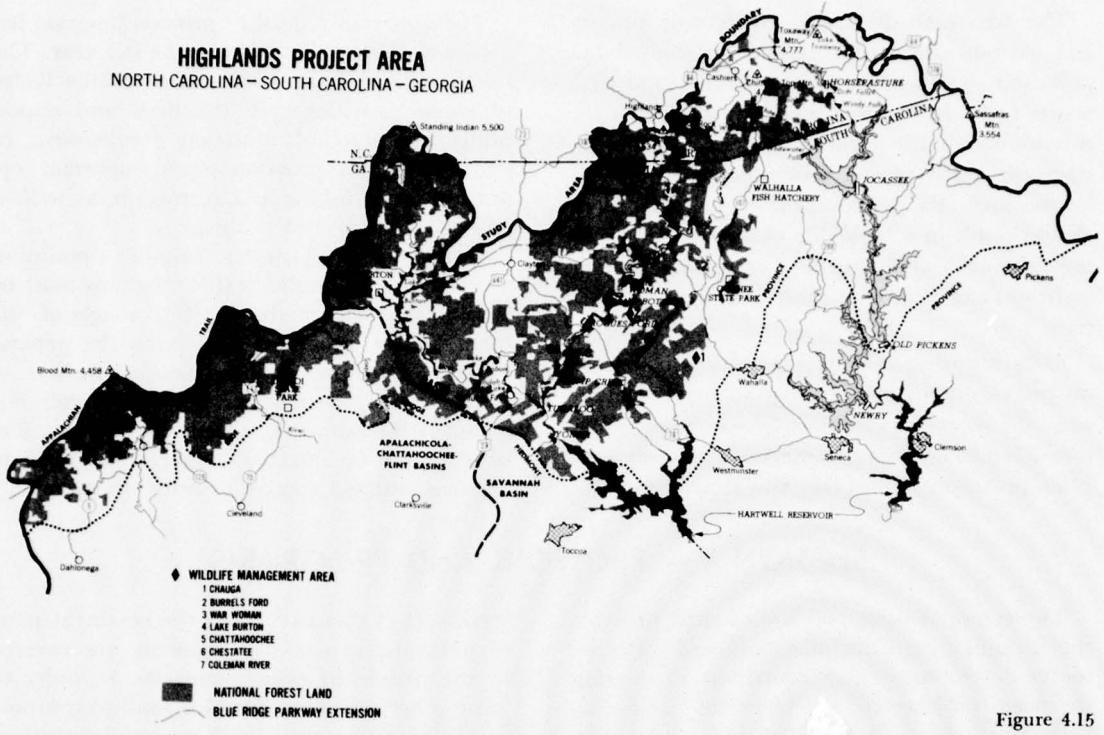


Figure 4.15

Figure 4.16 *Rainbow Falls, Horsepasture River, Is One of Many Beautiful Falls in the Highlands Project Area.*

HIGHLANDS PROJECT

Location

The Highlands project is described here. However, the costs and benefits would be assigned to the Savannah and Apalachicola-Chattahoochee-Flint basins approximately in proportion to the respective drainage areas.

The area is typically rugged, mountainous topography, drained by numerous clear streams and rivers which cascade from the Blue Ridge Mountains to the Piedmont province. The maximum difference in elevation is from 5,500 feet at Standing Indian Mountain in North Carolina to about 800 feet where the major streams flow into the Piedmont province. Generally the streams fall about 2,000 feet in a few miles with occasional falls dropping as much as 400 feet. The streams and rivers provide about 640 miles of trout fishing waters of which 500 miles are in the Savannah basin and 140 miles in the Apalachicola-Chattahoochee-Flint basins.

Over 90 percent of the area is forested. The principal economic returns are realized from forestry, summer homes, recreation, and fish and wildlife. Only limited farming is carried out on the cleared lands. Several small industries and hydroelectric power installations also contribute to the area income.

The U. S. Forest Service administers about 350,000 acres, or about 45 percent of the total area, and has multiple-use programs for the national forests under development which have been recognized and which would be expanded. The States of Georgia and South Carolina use about 127,000 acres of the 350,000 acres for fish and wildlife management on seven areas.

Plan and Data

The plan provides for a 40-mile extension of the Blue Ridge Parkway to the upper Savannah and Apalachicola-Chattahoochee-Flint basins; construction of 90 miles of other access roads,

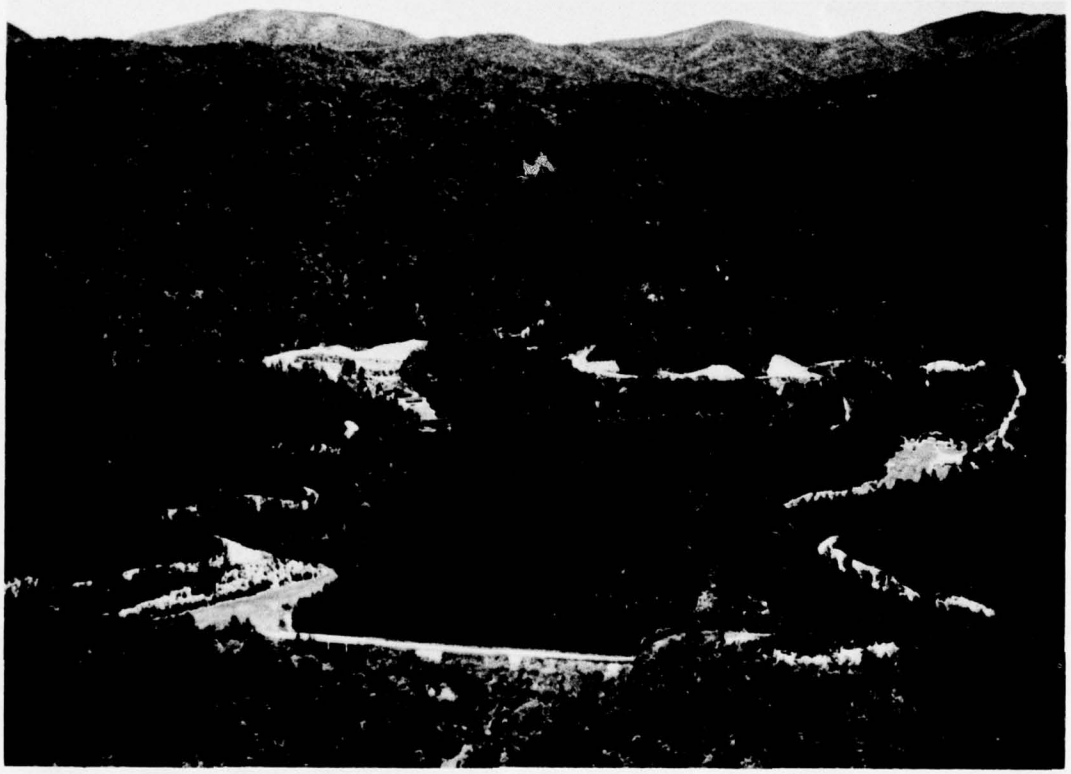


Figure 4.17 *Unicoi State Park, Georgia, Has Facilities for Varied Activities.*

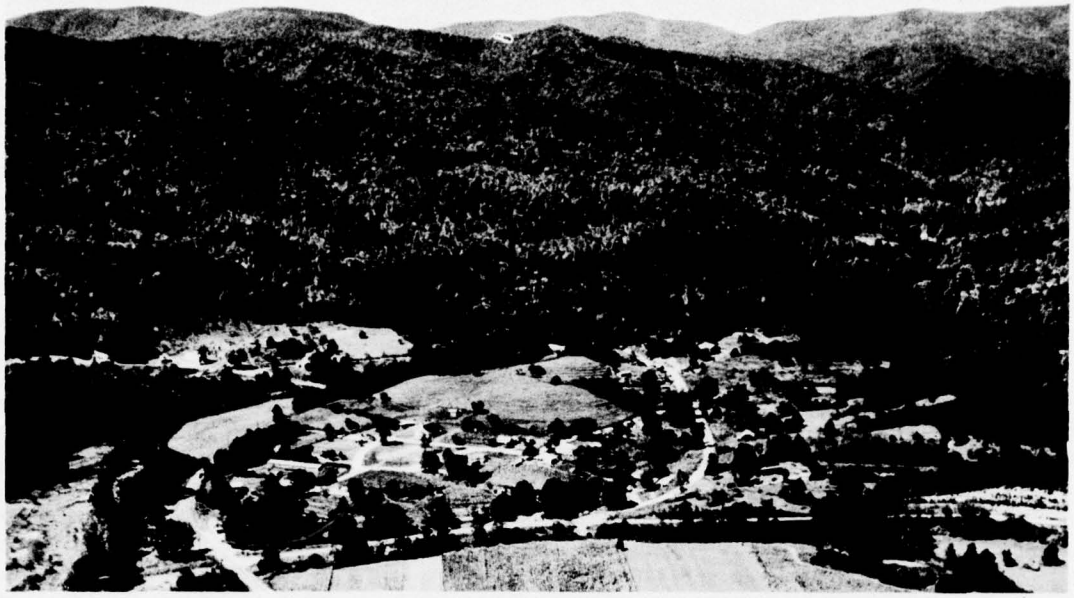


Figure 4.18 *Blue Ridge Mountains of North Georgia — These Scenic Mountains Have a Great Recreation Potential.*

vista points, foot trails, parking areas, camping areas, fish hatcheries, and related facilities; acquisition of 98,140 acres; easement on 148,500 additional acres of lands needed for the developments; and management of the areas for recreation and fish and wildlife to assure success of the project.

The annual increased use of the area by the year 2000, exclusive of use at the Horsepasture and Chattooga reservoir developments, is estimated as follows:

	Increase in annual user-days — 1960-2000
Fishing	268,000
Hunting	107,000
Recreation	6,100,000
Blue Ridge Parkway	2,000,000
Total increase	8,475,000

Benefits

Annual Equivalent Primary Tangible ($1,000)

Recreation	5,527
Fish and wildlife	838
Total	6,365

Impacts

The economic benefits resulting from this project would be largely related to the direct as well as the indirect benefits attributable to recreational use and fish and wildlife activities. This project would provide for numerous outdoor recreation activities—camping, hiking, swimming, boating, fishing, hunting, pleasure driving, enjoyment of natural scenic beauty, and others.

Figure 4.19 *Lower Whitewater Falls, South Carolina.*

The principal impacts would be felt by those establishments which are set up to feed, lodge, and cater to the millions of users per year. Considerable secondary benefits from photography, clothing, and sporting goods sales, guide services, and other special services would result from the development. Actual construction and maintenance of access roads, vista points, foot trails, parking areas, camping areas, fish hatcheries, and other related facilities would create an immediate impact on the area. The employment to be provided by implementation of this project would be of great importance.

Intangible benefits associated with preservation of the clear trout streams and native flora and fauna would include a continued opportunity for the recreationist, nature lover, and outdoor sportsman to see, enjoy, and use a semi-wilderness area of natural beauty and grandeur. The intangible benefits associated with the area would be equally important in inducing visitation, appreciation, and preservation of this special setting.

Costs ($1,000)

	Early action	Total
Investment		
Land acquisition or easement	11,950	12,850
Blue Ridge Parkway including 40 miles of highway construction	3,760	10,047
Construction of 90 miles of other roads	2,820	7,800
Other recreation facilities	7,390	19,703
Other fish and wildlife facilities	2,000	2,000
Total	27,920	52,400
Annual Equivalent		
Investment		1,377
Operation, maintenance, and replacements		2,217
Total		3,594

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Recreation	47,060	2,810	1,610	2,644
Fish and wildlife	5,340	784	607	925
Total	52,400	3,594	2,217	3,569

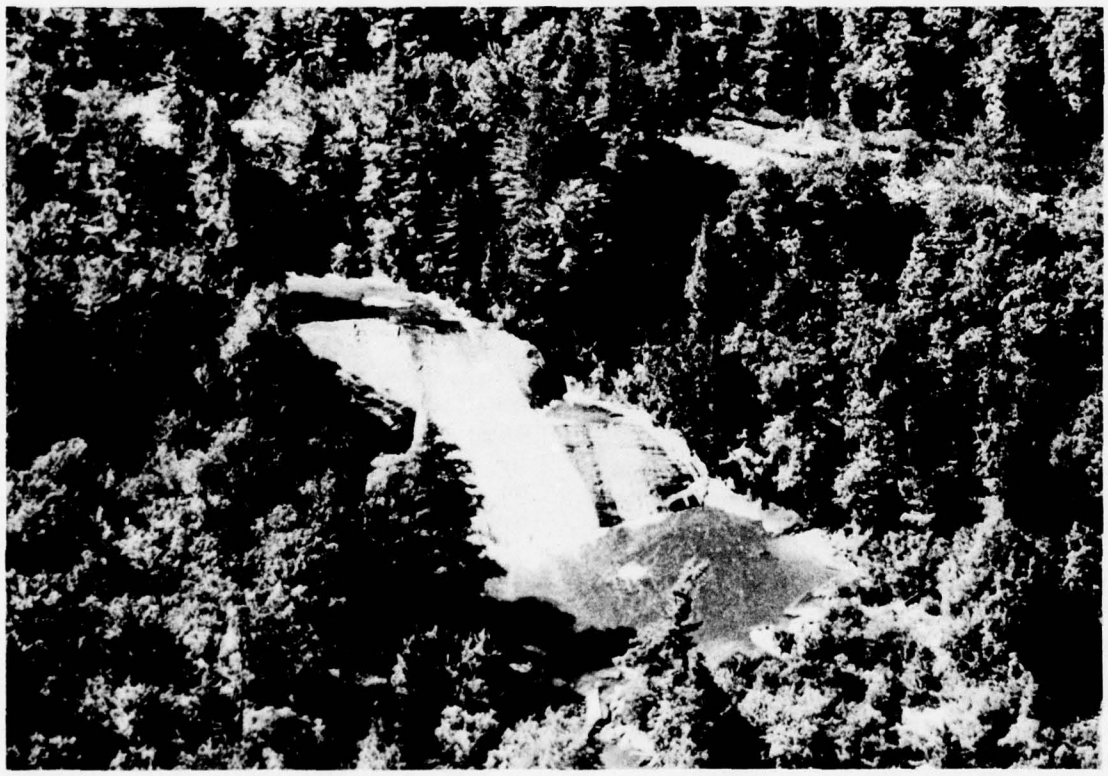


Figure 4.20 *Drift Falls, Horsepasture River, Adds to the Attractiveness of This Area.*

HORSEPASTURE PROJECT

Location

This potential hydroelectric power and recreation project would be located on Horsepasture River about 2 miles south of Oakland in Transylvania County, North Carolina. The Horsepasture project is located on Horsepasture River in the heart of the Highlands project area. Drift Falls, Rainbow Falls, and Windy Falls are located below on Horsepasture River.

This project was studied along with similar potential hydroelectric power developments located on the Whitewater River, Toxaway River, and the Chattooga River above the War Woman site. The Horsepasture project appears to be the best development and can be made compatible with other water uses by adjusting the operating schedule.

Plan and Data

The project would consist of a dam about 190 feet high, forming a reservoir of 475 acres with a capacity of 22,000 acre-feet. The drainage area above the damsite would be about 33 square miles. The reservoir would be maintained as nearly as practicable at elevation 2,960 feet during the early spring and summer, but would be lowered about 30 feet, starting about September. A spillway with an effective length of 136 feet would have a design discharge of about 66,000 cubic feet per second. Releases from Horsepasture reservoir would sustain fish and preserve the esthetic value of the downstream falls and cascades by maintaining a minimum of 5 cubic feet per second in the stream below the dam. During normal or wet years, considerably more water could be released for recreation and fishing.

Diversion from Horsepasture reservoir would be through a tunnel about 18,150 feet long with a design discharge of 485 cubic feet per second and a penstock to a powerplant on Horsepasture River near elevation 1,100 feet or at the operating level of the potential Jocassee project. This provides a gross power head of 1,860 feet (2,960-1,100). The average operating head would be about 1,780 feet. With a 10-percent plant load factor and assumed operating conditions like those prevailing in the critical dry periods of 1954 and 1955, the powerplant would have an installed capacity of 58,000 kilowatts. The annual generation would be about 89 million kilowatt-hours. This would be primarily a peaking plant. The proposed project would have the highest power head east of the Rocky Mountains. It would be a great attraction and contribute additional power capacity and help meet growth demands.

The Horsepasture reservoir would be a prime recreational asset. It is estimated that 650,000 user-days a year could be accommodated at the reservoir.

Construction of the Horsepasture project would change the open stream fishing to reservoir fishing and eliminate a very small acreage of wildlife habitat and standing timber.

This unit should be developed in harmony with the recreation potential of the surrounding area. Development would be made with proper regard to recreation and fishing, and diversion of water to the powerplant would recognize certain minimum flows for fish life in the stream.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	1,596
Recreation	1,022
Fish and wildlife	−4
Total	2,614

Impacts

The economic impacts of this project as they relate to recreation and fish and wildlife are similar to those discussed for the Highlands project.

In addition, there would be impacts stemming from hydroelectric power production as well as construction activity. A substantial portion of the construction costs would be spent locally for wages, services, and materials, providing a temporary impetus to the local economy.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	13,040	13,040
Power facilities	9,555	9,555
Recreation facilities	1,630	2,720
Fish and wildlife facilities	15	15
Total	24,240	25,330

(continued)

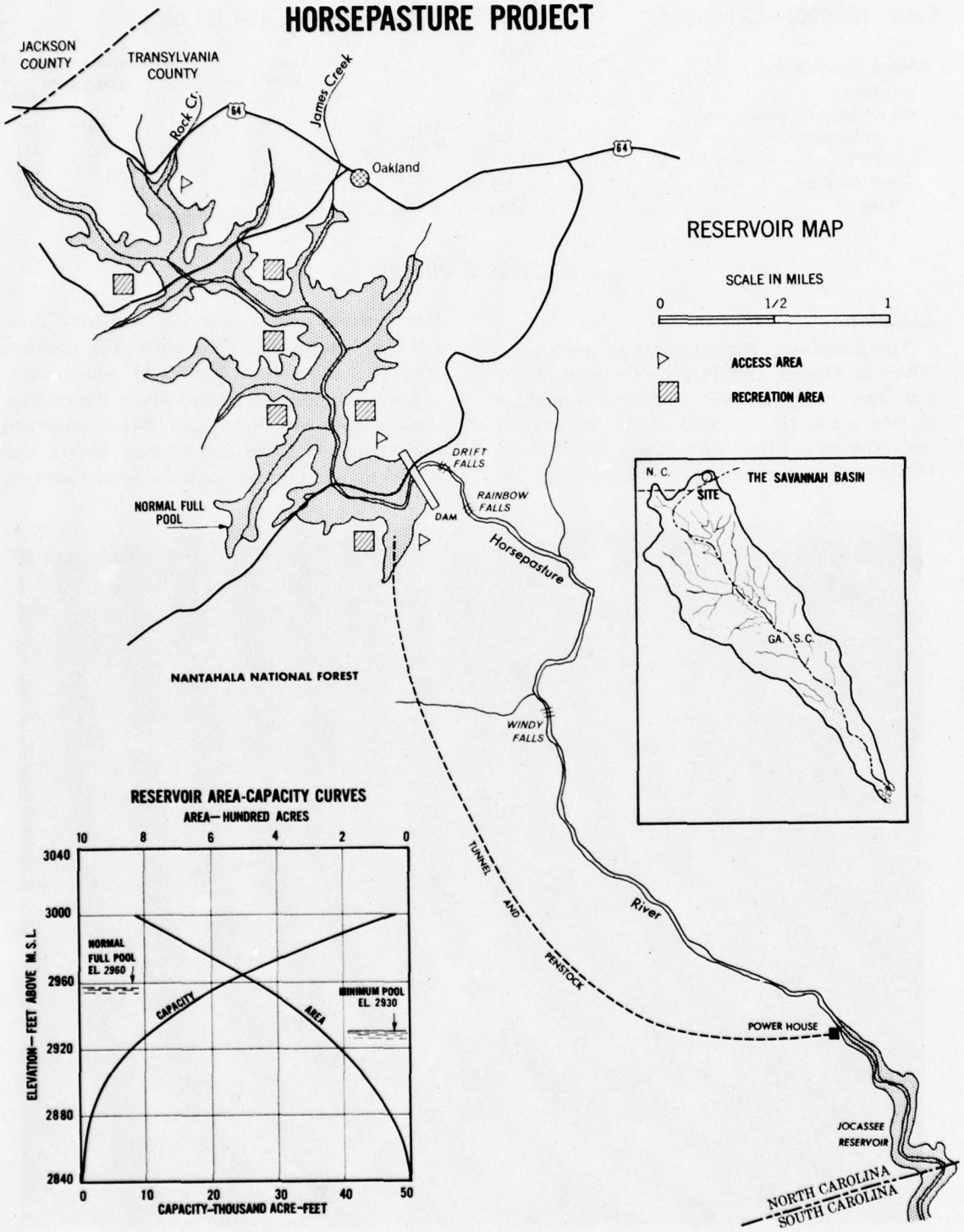

HORSEPASTURE PROJECT
JACKSON COUNTY
TRANSYLVANIA COUNTY
Rock Cr.
James Creek
64
Oakland
RESERVOIR MAP
SCALE IN MILES
0
1/2
1
ACCESS AREA
RECREATION AREA
DRIFT FALLS
RAINBOW FALLS
DAM
NORMAL FULL POOL
Horsepasture
NANTAHALA NATIONAL FOREST
N. C.
SITE
THE SAVANNAH BASIN
GA.
S.C.
WINDY FALLS
TUNNEL AND PENSTOCK
River
POWER HOUSE
JOCASSEE RESERVOIR
NORTH CAROLINA
SOUTH CAROLINA
RESERVOIR AREA-CAPACITY CURVES
AREA—HUNDRED ACRES
10
8
6
4
2
0
3040
3000
2960
2920
2880
2840
ELEVATION—FEET ABOVE M.S.L.
NORMAL FULL POOL EL. 2960
MINIMUM POOL EL. 2930
CAPACITY
AREA
0
10
20
30
40
50
CAPACITY—THOUSAND ACRE-FEET

Figure 4.21

Costs ($1,000)—Continued

Annual Equivalent	Total
Investment	948
Operation, maintenance, and replacements	319
Subtotal	1,267
Taxes foregone	481
Total	1,748

Allocation of Costs ($1,000)

	Investment	Annual equivalent Total	Annual equivalent OM&R	OM&R at year 2000
Power	20,830	*1,450	169	169
Recreation	4,500	298	150	184
Total	25,330	*1,748	319	353

* Includes $481,000 for taxes foregone.

JOCASSEE PROJECT

Location

The Jocassee project is located on the Keowee River in Oconee and Pickens Counties, South Carolina, near Jocassee. The dam would be located below the junction of the Whitewater and Toxaway Rivers just below the Keowee bridge and the reservoir would back up the Horsepasture and Toxaway Rivers into Transylvania County, North Carolina. The drainage area above the damsite is about 147 square miles.

Jocassee damsite is located above the congressionally approved Newry-Old Pickens reservoir project on the Little and Keowee Rivers, also in Pickens and Oconee Counties, South Carolina.

Figure 4.22 *Jocassee Site — Keowee River. Whitewater Falls on Whitewater River Shows in the Distant Background.*

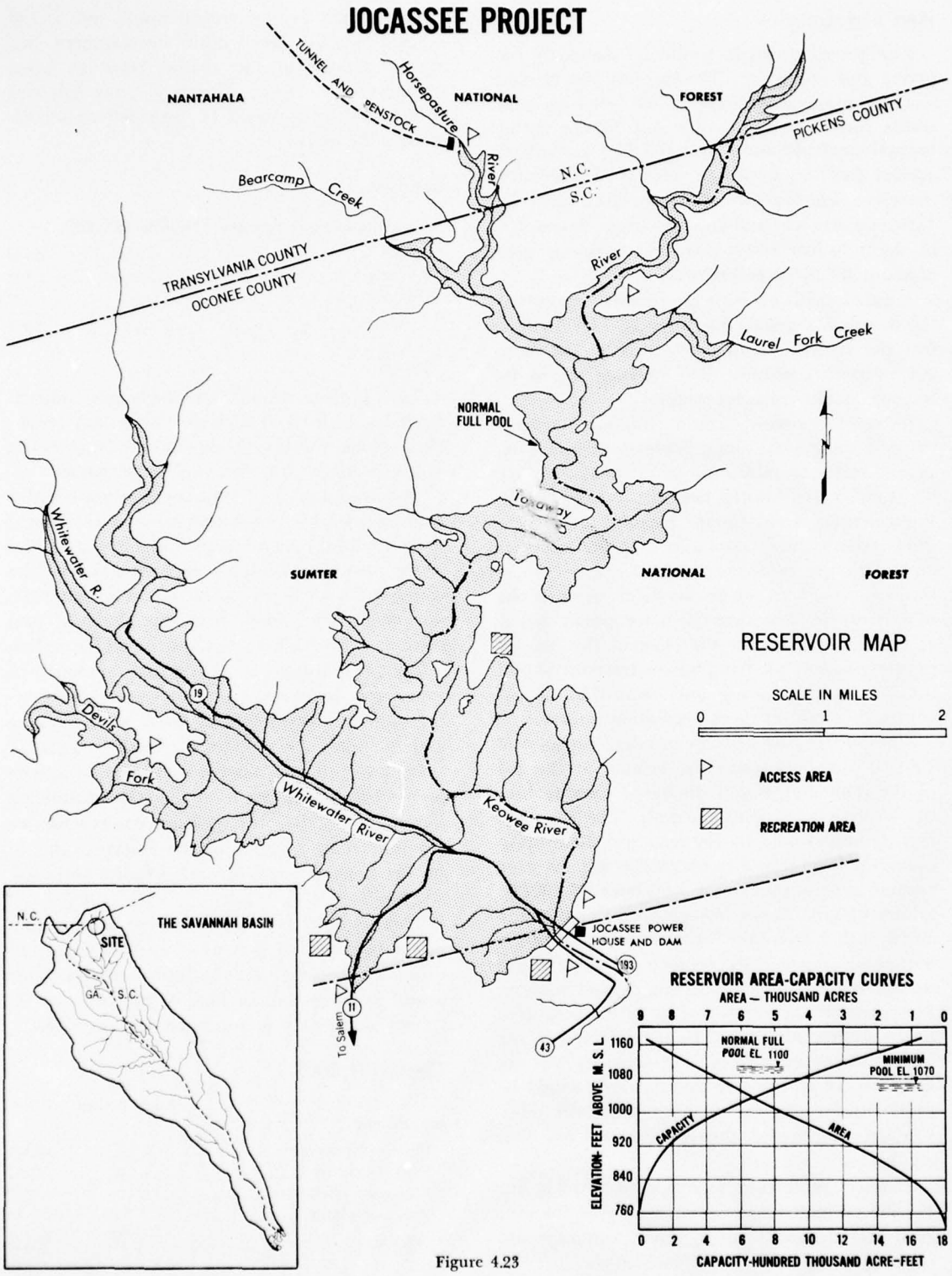

JOCASSEE PROJECT
NANTAHALA
NATIONAL
FOREST
TUNNEL AND PENSTOCK
Horsepasture River
Bearcamp Creek
N.C.
S.C.
PICKENS COUNTY
TRANSYLVANIA COUNTY
OCONEE COUNTY
River
Laurel Fork Creek
NORMAL FULL POOL
Whitewater R.
SUMTER
NATIONAL
FOREST
RESERVOIR MAP
SCALE IN MILES
0 1 2
ACCESS AREA
RECREATION AREA
Devils Fork
Whitewater River
Keowee River
JOCASSEE POWER HOUSE AND DAM
To Salem
N.C.
THE SAVANNAH BASIN
SITE
GA.
S.C.
RESERVOIR AREA-CAPACITY CURVES
AREA — THOUSAND ACRES
9 8 7 6 5 4 3 2 1 0
NORMAL FULL POOL EL. 1100
MINIMUM POOL EL. 1070
CAPACITY
AREA
ELEVATION-FEET ABOVE M. S. L.
1160
1080
1000
920
840
760
0 2 4 6 8 10 12 14 16 18
CAPACITY-HUNDRED THOUSAND ACRE-FEET

Figure 4.23

Plan and Data

The Jocassee project would be primarily for power and recreation. This project would consist of a concrete dam about 360 feet high that would form a reservoir of about 7,000 acres at normal pool elevation of 1,100 feet and recreational facilities would be developed along the shoreline. The capacity of the reservoir would be 1,080,000 acre-feet and the maximum drawdown of about 30 feet would provide a usable storage of about 182,000 acre-feet.

A gated spillway with an effective length of 112 feet and a design discharge of 78,000 cubic feet per second would be located at the dam. An additional uncontrolled spillway would be located in the adjacent saddle.

Jocassee reservoir would inundate several small farming areas along Whitewater and Toxaway Rivers. In addition, some homes, mostly for summer use, located near the damsite are in the reservoir area. Camp Jocassee, a church-sponsored summer camp, also is in the reservoir area. Suitable replacement locations for these facilities could be made available around the new reservoir. The drawdown for power generally would occur after the close of the regular camping season, so that Jocassee reservoir would provide ample boating and recreation opportunities during the peak recreation period.

The powerplant with an installed capacity of 150,000 kilowatts would be located at the toe of the dam and would discharge directly into the Newry-Old Pickens reservoir. The gross operating head would be 300 feet, and the average operating head would be about 276 feet. Average annual generation would be about 77,100,000 kilowatt-hours. Pump storage operations coordinated with Newry-Old Pickens are a future potential advantage of the project. Although pump storage was not included in the project analysis, the potentials of pump storage were recognized in the studies and should be reconsidered in the future whenever further investigations are undertaken. In addition to power which would be primarily for meeting peaking loads, the reservoir releases would provide downstream flow regulation.

Planned recreation facilities to provide for 100,000 estimated user-days annually by the year 2000 include access roads, docks, camping and parking areas, and related facilities.

The project as now viewed would not be significant as a fish and wildlife development, primarily because of the change from an open stream to a reservoir. However, some fish and wildlife facilities would be provided to accommodate the users.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	3,718
Recreation	142
Fish and wildlife	21
Total	3,881

Impacts

This project would have economic impacts attributable to hydroelectric power and recreation. There would also be impacts from better access facilities and increased land values.

The provision of a 7,000-acre reservoir coupled with the nearby 18,400-acre Newry-Old Pickens reservoir would create recreational opportunities in the area. The resultant recreational activities could stimulate local business and increase the sale of gasoline, food, beverages, lodging, and recreation and fishing equipment and supplies.

The availability of substantial amounts of water and hydroelectric power would enhance the industrial development potential of the area and facilitate the economic growth in general.

Construction activities would provide a temporary impetus to the local economy. Following completion of the project, home construction in the immediate vicinity of the reservoir should further benefit the construction trades and local economy.

There would be an increase in land values in the reservoir vicinity as a result of increased utility of the area and the improvements. This would broaden the tax base of the counties involved and result in increased tax revenue.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	0	34,130
Power facilities	0	24,830
Recreation facilities	0	450
Fish and wildlife	0	30
Total	0	59,440

(continued)

Costs ($1,000)—Continued

Annual Equivalent	Total
Investment	2,143
Operation, maintenance, and replacements	354
Subtotal	2,497
Taxes foregone	1,245
Total	3,742

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	58,400	•3,676	325	325
Recreation	540	46	27	28
Fish and wildlife	500	20	2	2
Total	59,440	•3,742	354	355

• Includes $1,245,000 for taxes foregone.

NEWRY – OLD PICKENS PROJECT

Location

The Newry-Old Pickens project was approved as a part of the plan of development of the Savannah basin by the Flood Control Act of 1944. It is located on both the Little River above the Courtenay Powerplant and Mill near Newry and the Keowee River in Pickens and Oconee Counties, South Carolina. The project includes two dams which would form a single reservoir joined hydraulically at a low divide between Little and Keowee Rivers. The drainage area above the damsites is about 451 square miles. One powerplant would be installed at the Old Pickens site on Keowee River. See Figure 4.25.

Plan and Data

This project would be developed primarily for power, recreation, and fish and wildlife. The normal full reservoir pool would have a total area of 18,400 acres at elevation 800 feet above mean sea level and a total storage of 920,000 acre-feet. The anticipated annual drawdown would be about 20 feet. The dams would be about 160 feet high, and the powerplant would have 150,000 kilowatts of installed capacity. Average annual generation would be 93,800,000 kilowatt-hours. Discharge from the powerplant would be into Hartwell Reservoir at elevation 660 feet. The power would be for peaking and should be coordinated with production at Hartwell and other projects.

Recreation facilities for parking, camping, boat ramps, access roads, and related facilities needed for an estimated 250,000 user-days annually would be provided. Fish and wildlife facilities for 41,800 user-days annually also would be provided.

The Newry-Old Pickens project would have pump-storage possibilities. It would receive some regulation from the upstream Jocassee site and would discharge directly into Hartwell Reservoir and provide some downstream stability through its storage and coordinated operations.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	3,763
Recreation	375
Fish and wildlife	86
Total	4,224

Impacts

This project would have economic impacts stemming from recreation, fish and wildlife, and hydroelectric power. There would also be im-

Figure 4.24 *Courtenay Powerplant and Mill, Newry, South Carolina, Is Located Just Downstream from the Newry Site.*

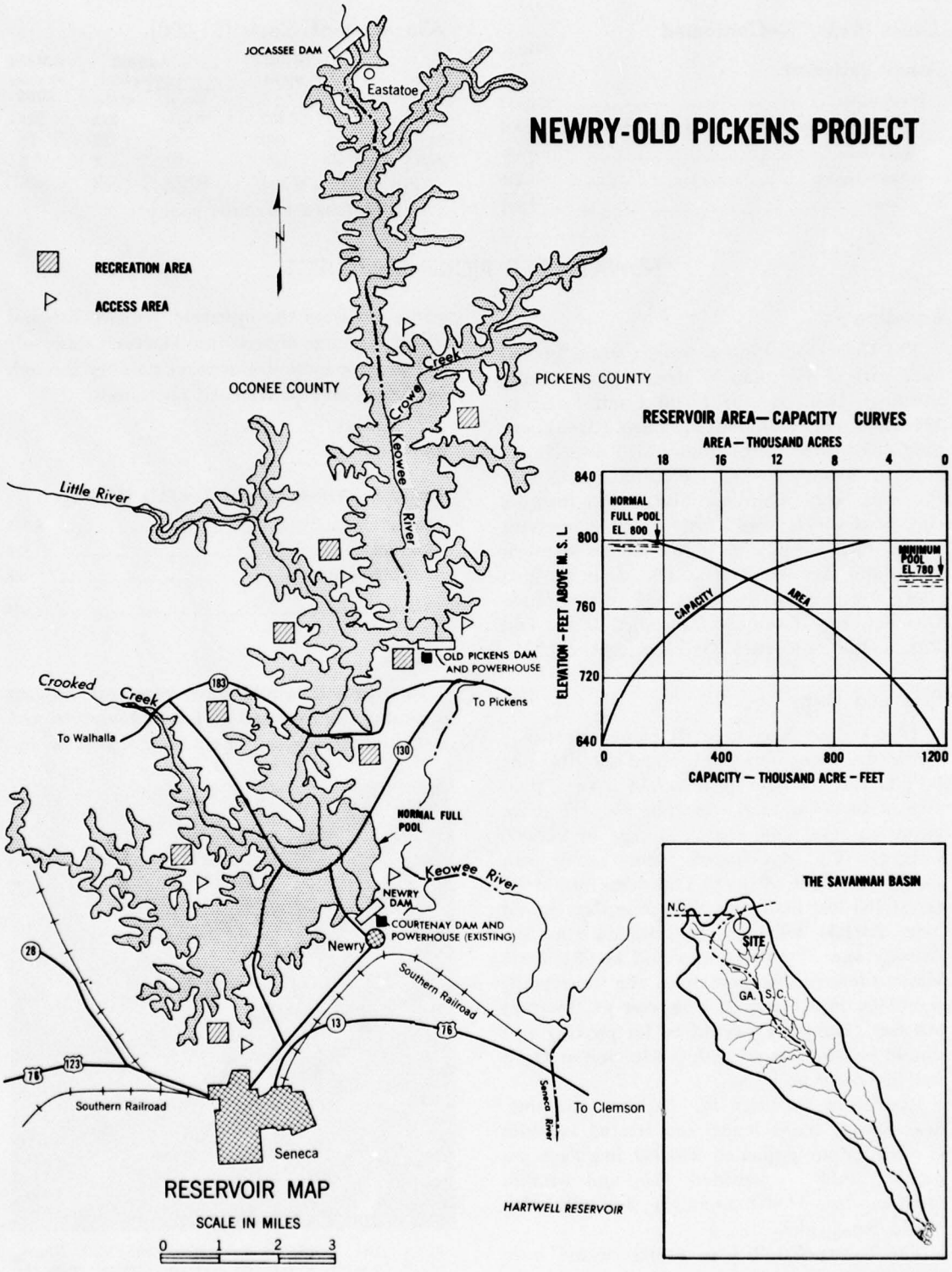

NEWRY-OLD PICKENS PROJECT
JOCASSEE DAM
Eastatoe
RECREATION AREA
ACCESS AREA
OCONEE COUNTY
PICKENS COUNTY
Crowe Creek
Keowee River
Little River
OLD PICKENS DAM AND POWERHOUSE
To Pickens
Crooked Creek
To Walhalla
183
130
NORMAL FULL POOL
Keowee River
NEWRY DAM
COURTENAY DAM AND POWERHOUSE (EXISTING)
Newry
28
Southern Railroad
13
76
123
Southern Railroad
Seneca River
To Clemson
Seneca
RESERVOIR MAP
SCALE IN MILES
0 1 2 3
HARTWELL RESERVOIR
RESERVOIR AREA— CAPACITY CURVES
AREA — THOUSAND ACRES
18 16 12 8 4 0
840
800
760
720
640
ELEVATION - FEET ABOVE M. S. L.
NORMAL FULL POOL EL. 800
MINIMUM POOL EL. 780
CAPACITY
AREA
0 400 800 1200
CAPACITY — THOUSAND ACRE - FEET
THE SAVANNAH BASIN
N.C.
SITE
GA
S.C.

Figure 4.25

pacts from increased values and from the construction activities.

The provision of an 18,400-acre reservoir, coupled with the nearby 7,000-acre Jocassee reservoir, would attract recreationists and fishermen to the area. The resultant recreation activities would stimulate local business, increasing the sale of gasoline, food, beverage, lodging, and recreation and fishing equipment and supplies.

The availability of substantial amounts of clear water and hydroelectric power enhances the industrial development potential of the area and also facilitates the economic growth in general.

The construction activities would provide a temporary impetus to the local economy since a substantial portion of the construction costs would be spent locally for wages, services, and materials. Following completion of the project, home construction in the immediate vicinity of the reservoir should further benefit the construction trades and local economy.

Increases in land values in the vicinity of the reservoir as a result of increased utility of the area and the improvements would be expected. This would broaden the tax base of the counties involved and result in increased tax revenues without increasing the tax rates.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	0	35,060
Power facilities	0	24,470
Recreation facilities	0	925
Fish and wildlife facilities	0	75
Total	0	60,530
Annual Equivalent		
Investment		2,174
Operation, maintenance, and replacements		368
Subtotal		2,542
Taxes foregone		1,245
Total		3,787

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	56,440	*3,585	308	308
Recreation	2,300	130	52	65
Fish and wildlife	1,790	72	8	7
Total	60,530	*3,787	368	380

* Includes $1,245,000 for taxes foregone.

CHATTOOGA PROJECT

Four dam and reservoir projects, War Woman, Sand Bottom, Rogues Ford, and Camp Creek, approved by the Flood Control Act of 1944 as a part of the development of the Savannah basin constitute the Chattooga project. These four projects are located on the lower Chattooga River in Oconee County, South Carolina, and Rabun County, Georgia, as shown on Figure 4.26. Their operation would be integrated and coordinated. Accordingly, they have been analyzed as one project. Each of the four projects is described separately.

War Woman

The War Woman project would be located on Chattooga River east of Clayton in Oconee County, South Carolina, and Rabun County, Georgia. Chattooga River forms the Georgia-South Carolina State line. The drainage area above the damsite is about 163 square miles. Its primary purposes are power and recreation.

The project would also provide regulation of the water supply for the downstream Sand Bottom, Rogues Ford, and Camp Creek sites on the Chattooga River. These four projects, accordingly, must operate together for maximum overall efficiency. The War Woman project would be constructed first to provide streamflow regulation for the three downstream sites.

The dam at this site would be 195 feet high and would form a reservoir of 3,110 acres at elevation 1,640 feet above mean sea level with a capacity of 147,500 acre-feet. This would regulate runoff from 163 square miles for a power installation of 80,000 kilowatts at the damsite and for power installations located downstream on Chattooga River at the Sand Bottom, Rogues Ford, and Camp Creek sites. The gross power head at War Woman would be 182 feet between elevation 1,640 and 1,458 feet mean sea level. The maximum drawdown would be about 35 feet. This unit would produce 50,300,000 kilo-

CHATTOOGA DEVELOPMENT

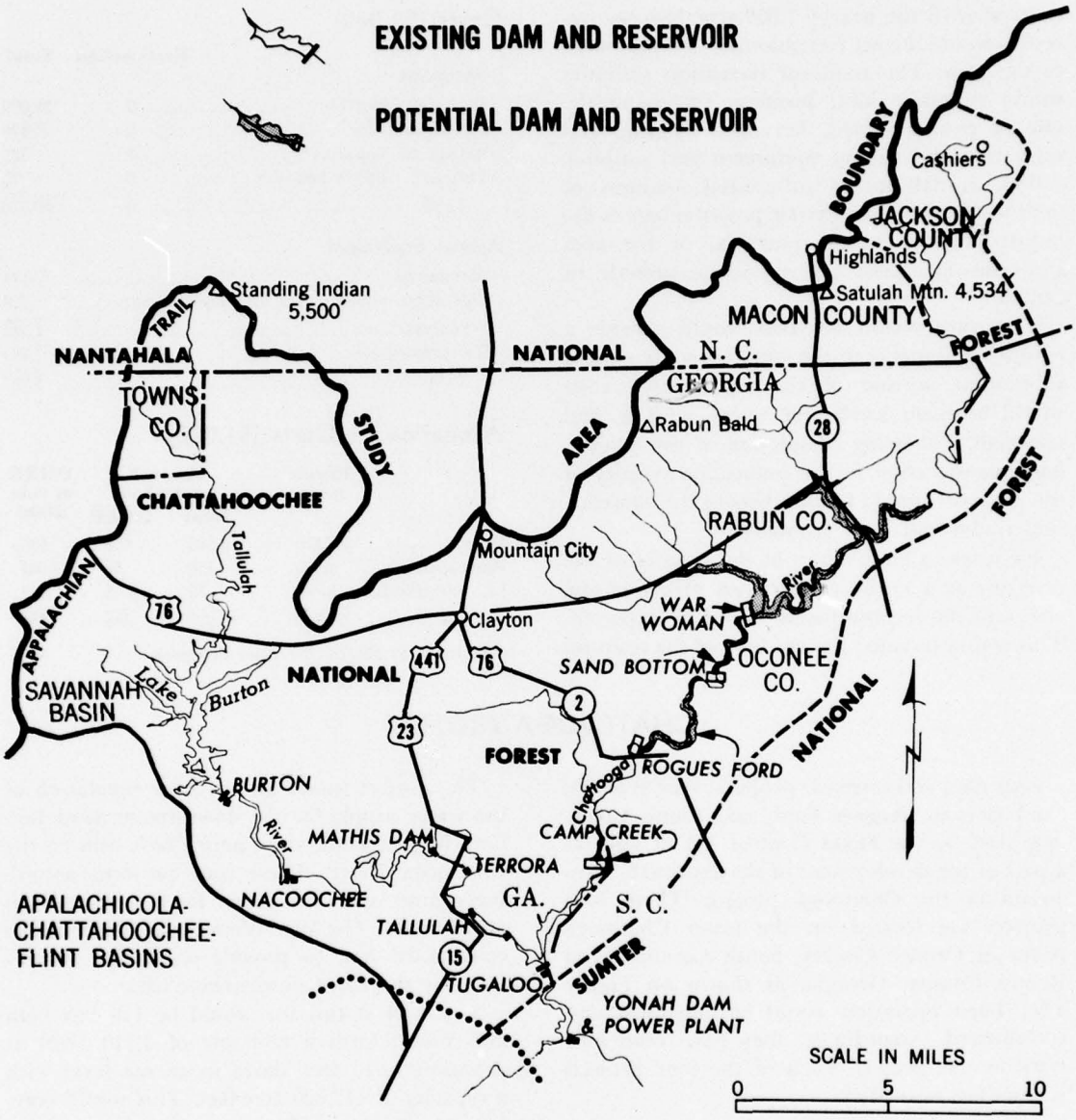
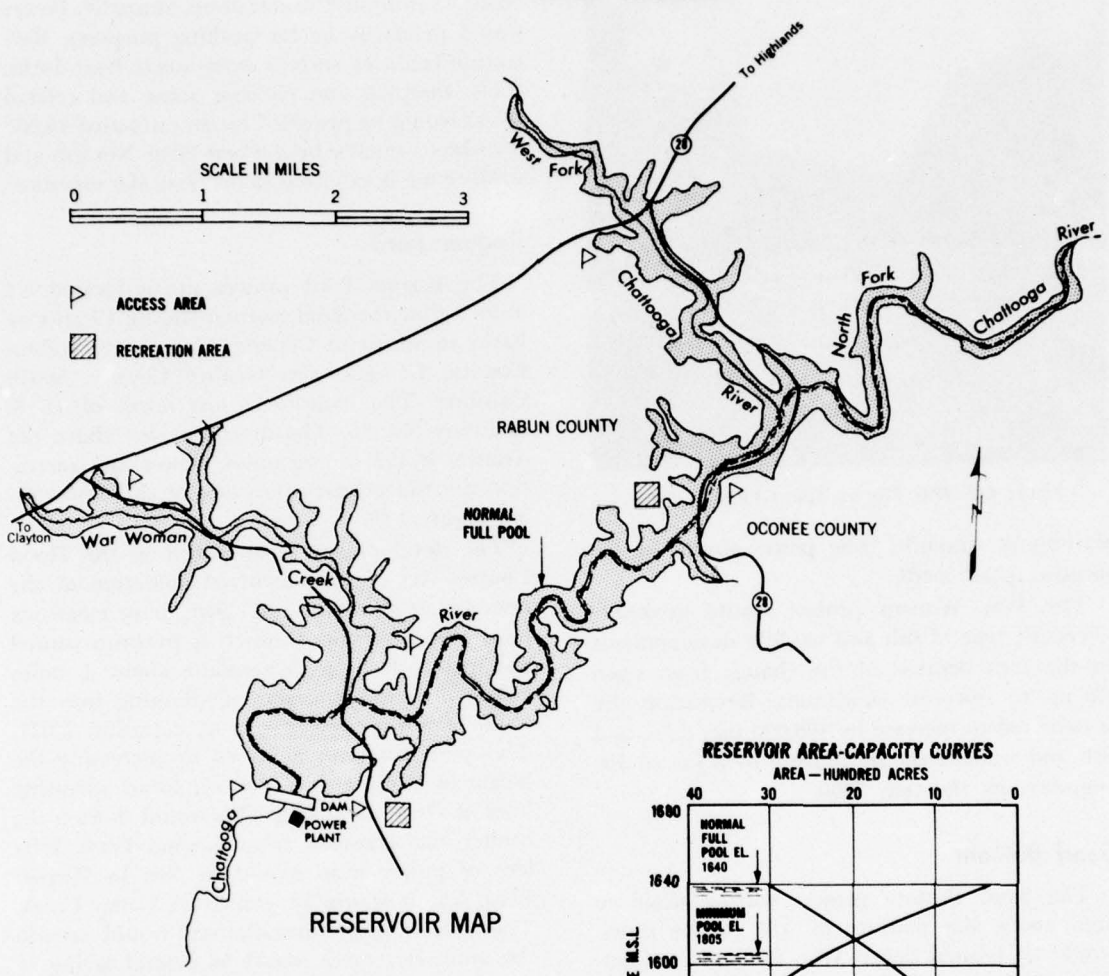
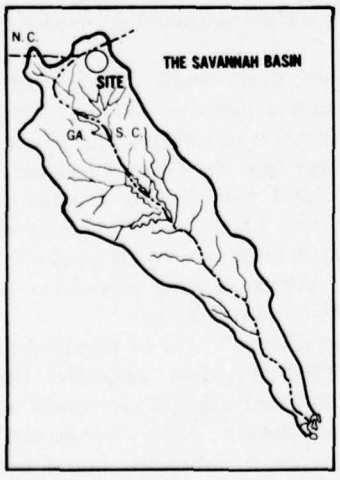


Figure 4.26


WAR WOMAN
To Highlands
West Fork
Chattooga River
North Fork
Chattooga River
SCALE IN MILES
0 1 2 3
ACCESS AREA
RECREATION AREA
RABUN COUNTY
OCONEE COUNTY
NORMAL FULL POOL
To Clayton
War Woman Creek
River
DAM
POWER PLANT
Chattooga
RESERVOIR MAP


N.C.
SITE
GA
S.C.
THE SAVANNAH BASIN

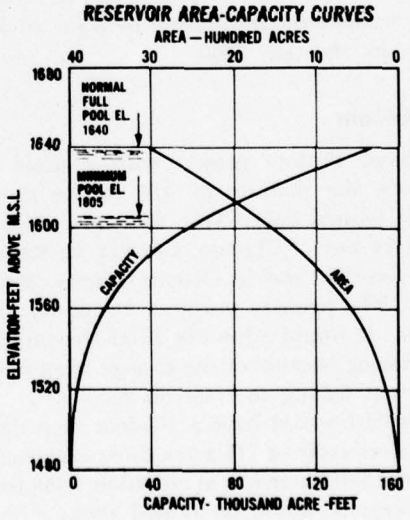

RESERVOIR AREA-CAPACITY CURVES
AREA — HUNDRED ACRES
40 30 20 10 0
1680
1640
1600
1560
1520
1480
NORMAL FULL POOL EL. 1640
MINIMUM POOL EL. 1605
CAPACITY
AREA
ELEVATION-FEET ABOVE M.S.L.
0 40 80 120 160
CAPACITY- THOUSAND ACRE -FEET

Figure 4.27

Figure 4.28 *War Woman Site, Chattooga River.*

watt-hours annually. The power would be for meeting peak loads.

The War Woman project would adversely affect the type of fish and wildlife developments in the area because of the change from open stream to reservoir conditions. Recreation use is expected to increase by 100,000 user-days, and fish and wildlife use to increase by a net of 100 user-days by the year 2000.

Sand Bottom

The Sand Bottom project with a drainage area above the damsite of 178 square miles, would be located below War Woman on Chattooga River east of Clayton, Georgia, in Rabun County, Georgia, and in Oconee County, South Carolina. The primary purposes are power and recreation. It would adversely affect the present type of fishing because of the change from open stream trout fishing to reservoir fishing.

The project would have a 105-foot high dam forming a reservoir of 115 acres. Storage capacity would total 5,040 acre-feet at elevation 1,458 feet. The powerplant would be located about a mile below the dam at the headwaters of the Rogues Ford reservoir site at elevation 1,317 feet. The drawdown would only be about 1 foot. Water from Sand Bottom reservoir would be diverted through a 1,600-foot long pressure tunnel which would cut through a bend in the Chattooga River. The powerplant would have an installed capacity of 66,000 kilowatts and would generate about 43 million kilowatt-hours annually. Power would primarily be for peaking purposes. Recreation facilities, such as access roads, boat docks, trails, camping and parking areas, and related works would be provided for an estimated 45,000 user-days annually by the year 2000. Net fish and wildlife use is expected to decrease 660 user-days.

Rogues Ford

The Rogues Ford project site is located 6.4 miles below the Sand Bottom site on Chattooga River southeast of Clayton, Georgia, in Rabun County, Georgia, and Oconee County, South Carolina. The damsite is just north of U. S. Highway No. 76. The drainage area above the damsite is 193 square miles. Power and recreation are the primary purposes of this reservoir. See Figure 4.30.

The development as approved in the Flood Control Act of 1944 involved operation of the reservoir at elevation 1,317 feet above mean sea level and diversion through a pressure tunnel and penstock to a powerplant about 4 miles below with the diversion discharging into the Camp Creek reservoir site at elevation 1,021. This plan has been modified by increasing the height of Camp Creek reservoir to an operating level of about 1,071 feet. This would shorten the tunnel and penstock from Rogues Ford. Fifty feet of power head would be lost in Rogues Ford, but it would be gained in Camp Creek. The overall power installations would remain the same, but there would be a total saving in construction costs, thus improving the entire system. The anticipated annual drawdown would be 25 feet.

Rogues Ford dam would be 133 feet high and would form a reservoir of about 253 acres with 11,300 acre-feet of storage. The powerplant would discharge into the Camp Creek reservoir at elevation 1,071 feet, leaving a gross power head of 246 feet. The installed capacity would be about 120,000 kilowatts, which would be used for peaking. Average annual generation would be 77,500,000 kilowatt-hours.

Recreation facilities would be provided for an estimated 60,000 user-days annually. Present open stream fish and wildlife use would be adversely affected because of the reservoir, but facilities for access to fishermen would be pro-

SAND BOTTOM

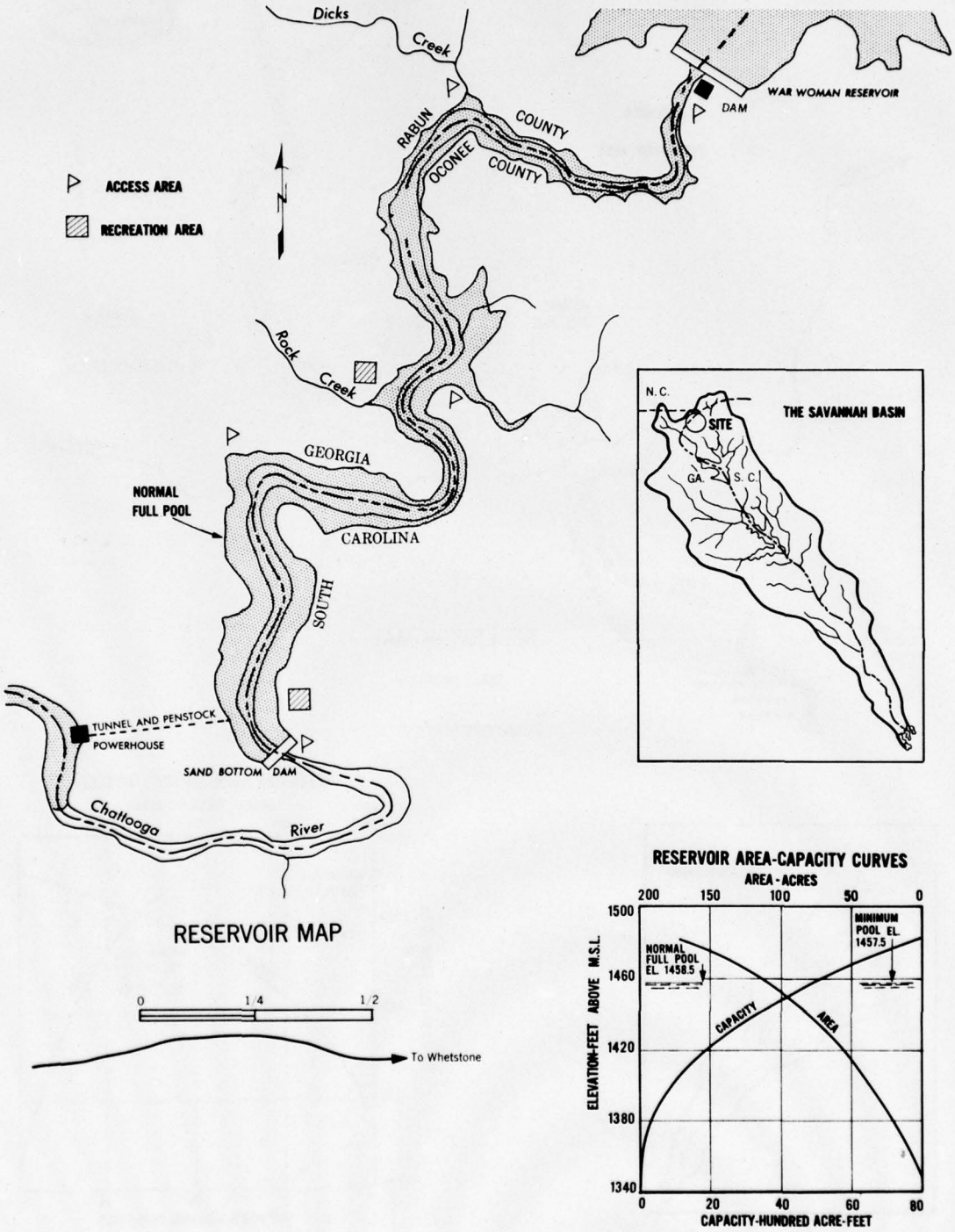
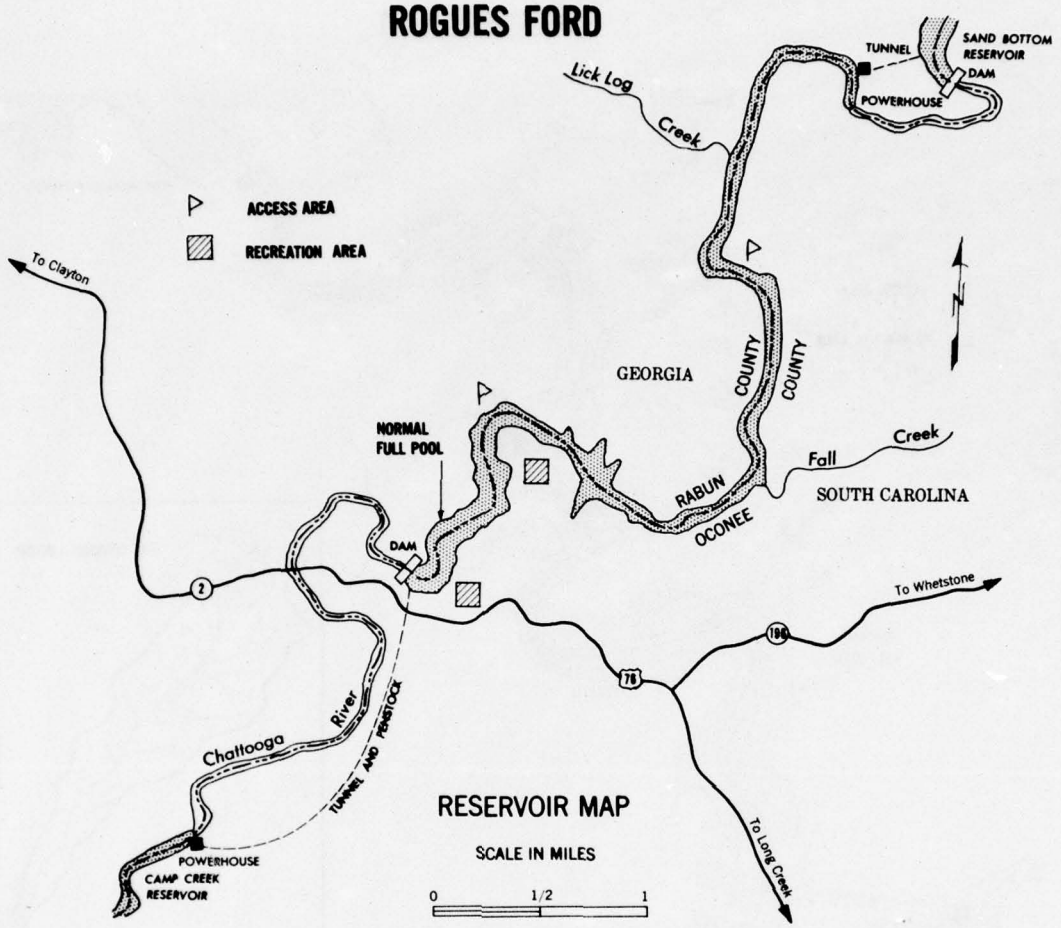
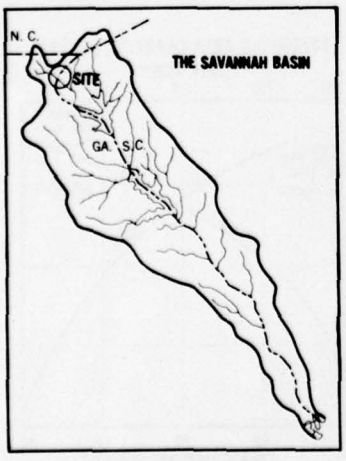


Figure 4.29


ROGUES FORD
TUNNEL
SAND BOTTOM RESERVOIR
DAM
POWERHOUSE
Lick Log Creek
ACCESS AREA
RECREATION AREA
To Clayton
GEORGIA
COUNTY
COUNTY
NORMAL FULL POOL
Fall Creek
RABUN
OCONEE
SOUTH CAROLINA
DAM
2
To Whetstone
198
78
Chattooga River
TUNNEL AND PENSTOCK
RESERVOIR MAP
SCALE IN MILES
0 1/2 1
To Long Creek
POWERHOUSE
CAMP CREEK RESERVOIR


N. C.
SITE
THE SAVANNAH BASIN
GA
S.C.

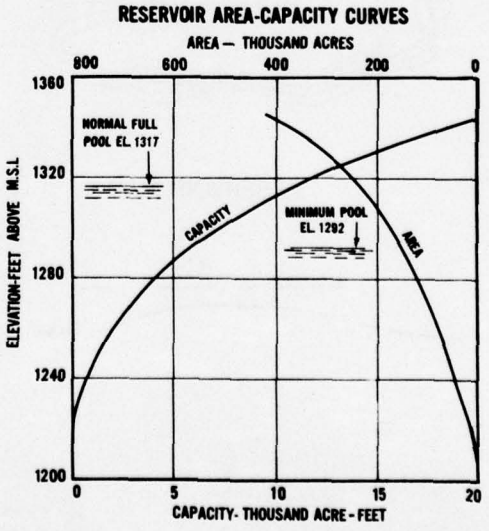

RESERVOIR AREA-CAPACITY CURVES
AREA — THOUSAND ACRES
800
600
400
200
0
1360
1320
1280
1240
1200
NORMAL FULL POOL EL. 1317
MINIMUM POOL EL. 1292
CAPACITY
AREA
ELEVATION-FEET ABOVE M.S.L.
0
5
10
15
20
CAPACITY- THOUSAND ACRE-FEET

Figure 4.30

vided. Net fish and wildlife use is expected to decrease 970 user-days by the year 2000.

Camp Creek

The Camp Creek project would be on the Chattooga River 6.2 miles below the Rogues Ford site and about 5 miles northeast of Tallulah Falls, Georgia, in Rabun County, Georgia, and Oconee County, South Carolina. It would develop power and provide recreation and fishing opportunities. The Camp Creek powerplant would discharge into existing Tugaloo Reservoir at elevation 892 feet, while providing a gross power head of about 180 feet. See Figure 4.32.

Camp Creek dam would be 126 feet high and would form a reservoir with 260 acres and a capacity of about 15,000 acre-feet. The drainage area above the damsite is 258 square miles, and the drawdown would be 20 feet.

The powerplant would have an installed capacity of 100,000 kilowatts for peaking purposes. Average annual generation would be 75,000,000 kilowatt-hours. Part of the 180 feet of gross head would be obtained by utilizing a tunnel and penstock to gain the head in the river between Camp Creek and Tugaloo Reservoir. Thus, this plant would complete the continuous chain of projects from War Woman downward to Sand Bottom, Rogues Ford, Camp Creek, then into the existing Tugaloo, Yonah, and Hartwell Reservoirs.

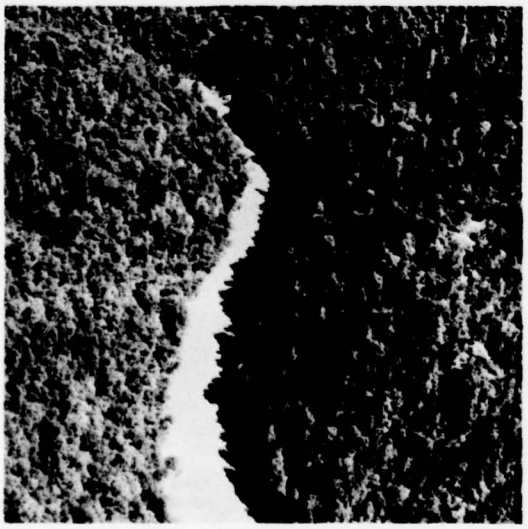


Figure 4.31 *Looking Upstream at the Camp Creek Site, Chattooga River.*

Recreation facilities would be provided for an estimated 55,000 user-days annually. Fish and wildlife use is expected to increase a net of 3,300 user-days by the year 2000.

Summary

The four Chattooga River projects, War Woman, Sand Bottom, Rogues Ford, and Camp Creek, would flood a portion of the lower Chattooga valley. The valley now has limited development, except for small areas of agricultural land, principally in the War Woman site and some highways and roads. This series of units would be comparable to the developments on the Tugaloo and Tallulah Rivers which have created substantial recreation and fishing uses, even though development was expressly for hydroelectric power. However, available data estimates indicate some damages could occur to fish and wildlife and to recreation by development of the Chattooga River projects. The limited data on these projects need review in light of what has occurred as a result of quite similar development on the Tallulah River. Benefits, costs, and allocations follow for the four Chattooga units.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	9,228
Recreation	369
Fish and wildlife	−21
Total	9,576

Impacts

The four projects comprising the Chattooga River developments would provide benefits of primary and secondary nature attributable to recreation and hydroelectric power. The economic impacts of the projects would come largely from these two project purposes. There would also be impacts stemming from the construction activities and from land enhancement benefits.

Business, present and potential, would benefit from the increased recreational activity in the area. There would be increased sales of gasoline, food, lodging, beverages, and recreational equipment and supplies.

The hydroelectric power development and regulated water would enhance the industrial

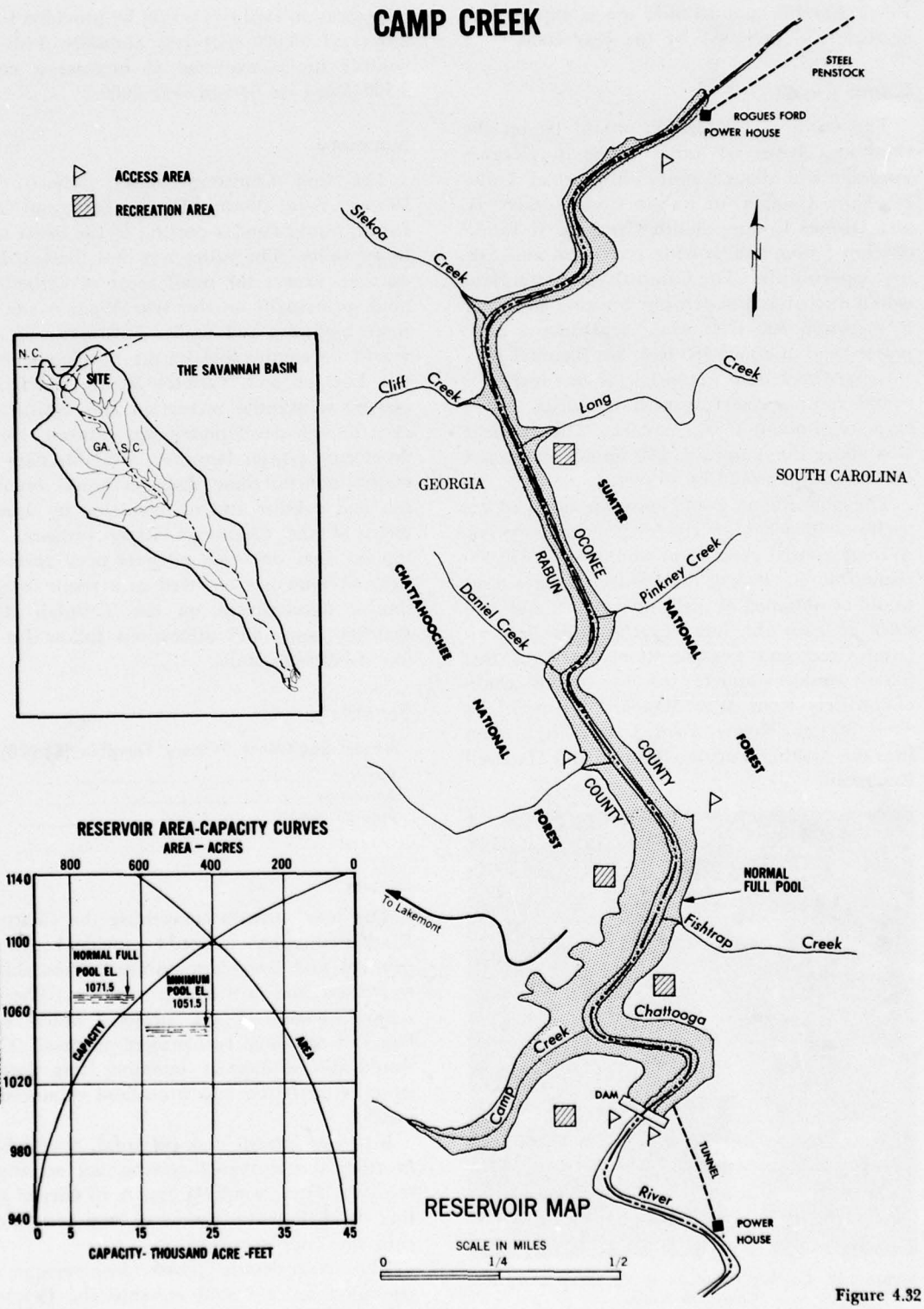

CAMP CREEK
STEEL PENSTOCK
ROGUES FORD POWER HOUSE
ACCESS AREA
RECREATION AREA
Stekoa Creek
Cliff Creek
Long Creek
GEORGIA
SOUTH CAROLINA
SUMTER
OCONEE
RABUN
CHATTAHOOCHEE
NATIONAL
FOREST
Daniel Creek
Pinkney Creek
COUNTY
NORMAL FULL POOL
To Lakemont
Fishtrap Creek
Chattooga
Creek
Camp
DAM
TUNNEL
River
POWER HOUSE
N. C.
S. C.
GA.
SITE
THE SAVANNAH BASIN
RESERVOIR AREA-CAPACITY CURVES
AREA – ACRES
800
600
400
200
0
1140
1100
1060
1020
980
940
NORMAL FULL POOL EL. 1071.5
MINIMUM POOL EL. 1051.5
CAPACITY
AREA
ELEVATION-FEET ABOVE M.S.L.
0
5
15
25
35
45
CAPACITY- THOUSAND ACRE -FEET
RESERVOIR MAP
SCALE IN MILES
0
1/4
1/2

Figure 4.32

development potential of the area and also facilitate the economic growth in general.

The construction activities would provide a temporary impetus to the local economy. A substantial part of the construction costs would be spent locally for wages, services, and materials. Following completion of the project, home construction in the immediate vicinity of the reservoirs should further benefit the construction trades and local economy.

There would be an increase in land values in the vicinity of the reservoirs as a result of increased utility of the area and the improvements. This would broaden the tax base of the counties involved and result in increased tax revenues.

Costs ($1,000)

	Early action	Total
Investment		
Joint cost	0	*45,410
Power facilities	0	91,720
Recreation facilities	0	1,170
Total	0	*138,300

* Includes $60,000 for fish and wildlife facilities to mitigate fish and wildlife losses.

Annual Equivalent

Investment	4,979
Operation, maintenance, and replacements	944
Subtotal	5,923
Taxes foregone	3,038
Total	8,961

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	136,900	*8,839	873	874
Recreation	1,400	122	71	73
Total	138,300	*8,961	944	947

* Includes $3,038,000 for taxes foregone.

TALLOW HILL PROJECT

Location

Tallow Hill damsite is on Broad River some 35 miles above the Clark Hill Reservoir. It is about 10 miles west of Elberton. The reservoir is in Madison, Franklin, and Elbert Counties, Georgia. See Figure 4.33. Drainage area above the damsite is 749 square miles. This and the downstream Anthony Shoals project on Broad River were approved by the Flood Control Act of 1944 as a part of the plan of development of the Savannah basin.

Plan and Data

The primary uses of this project would be for hydroelectric power, recreation, and fish and wildlife. Sediment control could be a benefit as well as potential water supplies and river regulation which would be in addition to the benefits shown in this analysis.

The dam would be 215 feet high and would form a reservoir of 18,500 acres with a storage capacity of 1,020,000 acre-feet at elevation of 610 feet. It would be operated with a maximum drawdown of about 40 feet which would usually occur late in the year. This would provide regulation for the downstream Anthony Shoals project and also to a lesser degree would enhance power and navigation on the Savannah River.

The powerplant would have a gross head of 190 feet. The installed capacity would be 172,000 kilowatts for peaking purposes. Average annual generation would be 113 million kilowatt-hours. Operation would be coordinated with other powerplants in the basin.

Recreation use by year 2000 is estimated at 250,000 user-days annually, and fish and wildlife use, upon completion of the project, is expected to be about 44,300 user-days annually.

Total benefits from the Tallow Hill project exceed the costs although project costs are slightly higher than the justifiable investments as determined by the cheapest single-purpose alternatives. This project has been retained in the long-range basin plan, however, because of its contribution to the system regulation of flow, of which it is an integral part. A steam generation plant, used as the alternative for power purposes, would not provide any streamflow regulation. Therefore, the same total results could not be obtained from the selected alternative even though the power output would be comparable. Regulation of streamflow resulting from the Tallow Hill project would be a benefit to the downstream Anthony Shoals project. Although stream regulation has not been ana-

TALLOW HILL PROJECT

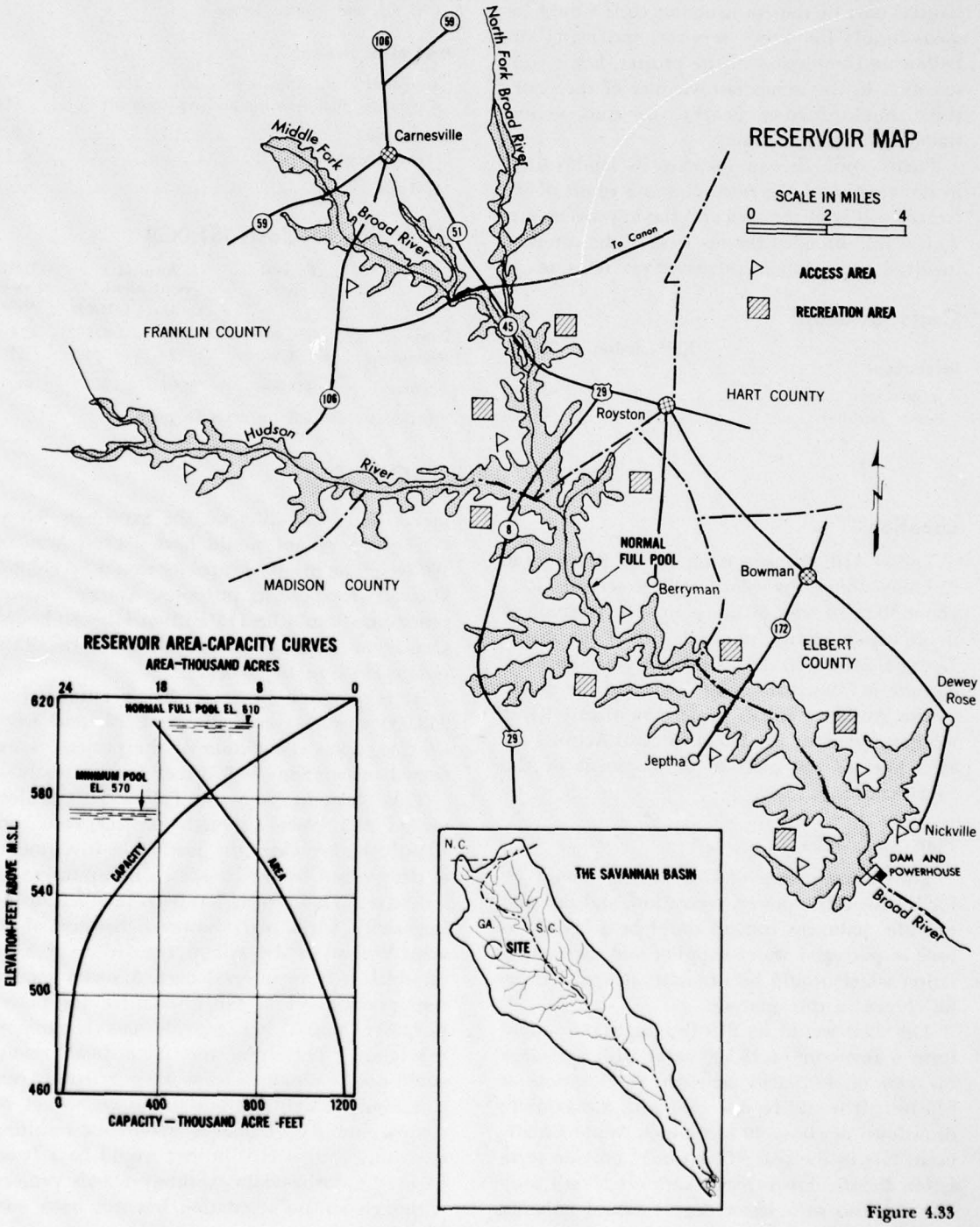


Figure 4.33

lyzed monetarily, it is estimated that with coordinated operation of these two Broad River projects, the power benefits from both units would exceed the power costs.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	4,278
Recreation	489
Fish and wildlife	60
Total	4,827

Impacts

There would be economic impacts from this project from the primary and secondary benefits of recreation, fish and wildlife, and hydroelectric power. There would also be impacts from the construction activities and land enhancement.

The construction activities would provide a temporary impetus to the area economy. Since two of the counties in which the project is located have been designated distressed area counties, such economic activity would be most beneficial in provision of employment and purchase of materials and services. A large part of the total construction costs would be spent locally for wages, services, and materials.

The provision of an 18,500-acre reservoir would further supplement recreation and fishing in the area. There would be an increase in business as a result of increased sales of gasoline, food, lodging, beverages, and recreational and fishing equipment and supplies.

Availability of hydroelectric power and a regulated water supply would enhance the area potential for industrial development as well as facilitate economic development in general. There would be increased land values and home construction in the project vicinity. This would broaden the tax base resulting in increased tax revenues to the counties involved.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	0	48,820
Power facilities	0	28,960
Recreation facilities	0	925
Fish and wildlife facilities	0	45
Total	0	78,750

Annual Equivalent

Investment	2,835
Operation, maintenance, and replacements	408
Subtotal	3,243
Taxes foregone	1,324
Total	4,567

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	73,980	*4,326	339	339
Recreation	3,180	178	63	65
Fish and wildlife	1,590	63	6	6
Total	78,750	*4,567	408	410

* Includes $1,324,000 for taxes foregone.

ANTHONY SHOALS PROJECT

Location

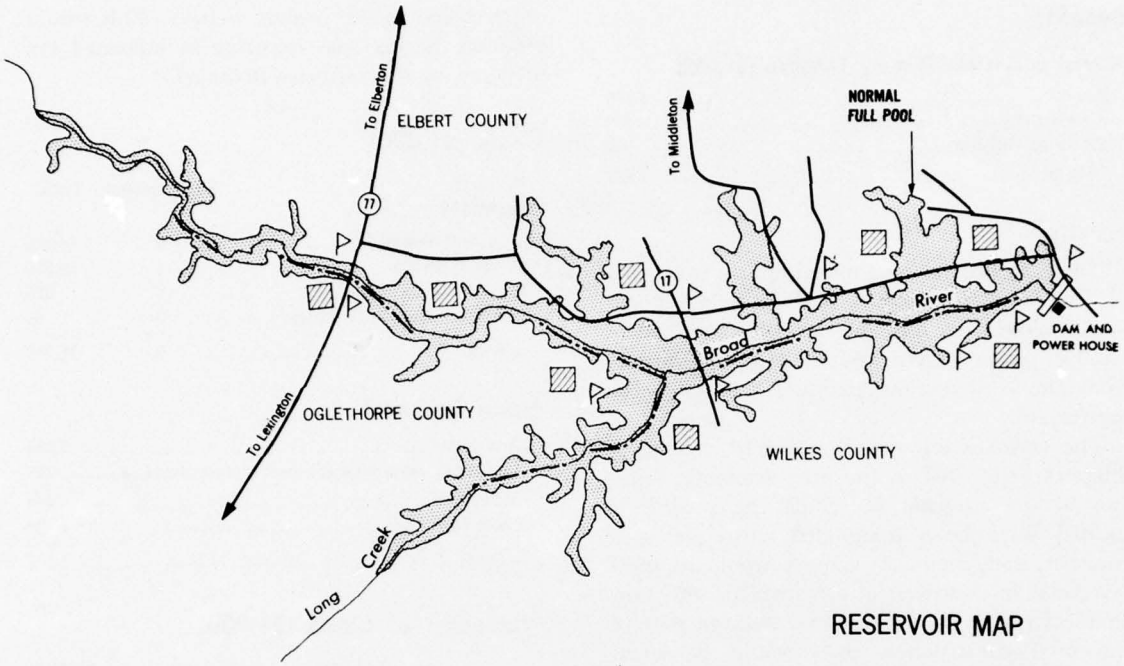
The Anthony Shoals project site is on Broad River near its junction with the existing Clark Hill Reservoir, about 31 miles below the Tallow Hill site. Drainage area above the damsite is 1,990 square miles. The reservoir would be located in Elbert, Wilkes, and Oglethorpe Counties, Georgia. See Figure 4.34.

Plan and Data

The primary uses of the Anthony Shoals project would be for hydroelectric power, recreation, and fish and wildlife development. The dam would be about 77 feet high and would form a reservoir of 14,400 acres with 245,000 acre-feet capacity. The normal operating level of the reservoir would be 400 feet above sea level. This is 65 feet above the normal operating level of Clark Hill Reservoir, and the maximum drawdown would be 40 feet. The powerplant would have an installed capacity of 100,000 kilowatts and would be used largely for peaking. Average annual generation would be 61,500,000 kilowatt-hours.

Anthony Shoals and Tallow Hill would operate in tandem, and accordingly their operation

ANTHONY SHOALS PROJECT



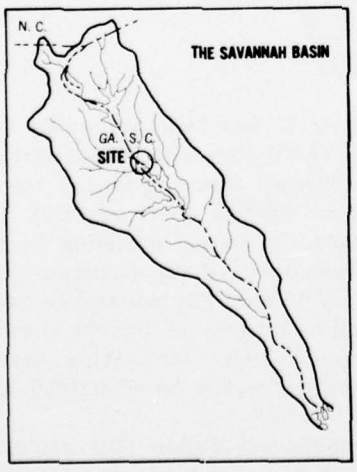
RESERVOIR MAP

SCALE IN MILES

0 2 4

ACCESS AREA

RECREATION AREA



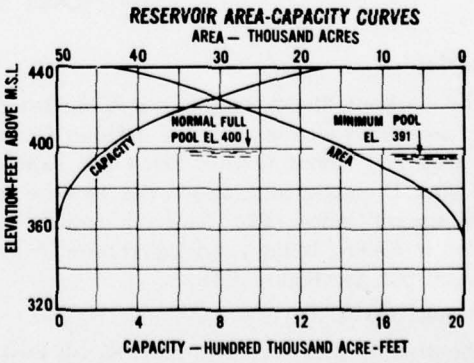


Figure 4.34

Figure 4.35 *Anthony Shoals Site — Broad River.*

would be closely coordinated along with the operation of Clark Hill Reservoir.

There is a possibility of raising the operation level of Anthony Shoals above the 400-foot level without encroaching on the upstream Tallow Hill site. Future investigations should consider raising the operating level which would benefit both capacity and energy at Anthony Shoals.

Recreation use by year 2000 is estimated to be 300,000 user-days annually and increased fish and wildlife use about 34,900 user-days annually.

A summary of benefits, impacts, costs, and allocations of Anthony Shoals follows.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	2,476
Recreation	586
Fish and wildlife	49
Total	3,111

Impacts

This project would provide economic impacts stemming from the primary and secondary benefits of recreation, fish and wildlife, and hydroelectric power. There would also be impacts from the construction activity and land enhancement.

Construction of the project would provide a temporary impetus to the local economy and would be welcomed in the area since all of the counties have been designated distressed area counties. Such a project would be beneficial in the provision of employment and increasing the per capita income.

Following completion of the project, there would be construction of homes and commercial buildings and operation of the project, giving added impacts to the local economy. These improvements, coupled with a general increase in land values, would broaden the tax base and increase the tax revenues.

The availability of regulated water and hydroelectric power would enhance industrial development.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	0	18,340
Power facilities	0	22,870

(continued)

Costs ($1,000)—Continued

	Early action	Total
Recreation facilities	0	1,075
Fish and wildlife facilities	0	45
Total	0	42,330

Annual Equivalent

Investment	1,524
Operation, maintenance, and replacements	350
Subtotal	1,874
Taxes foregone	770
Total	2,644

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	38,090	*2,407	266	266
Recreation	3,210	194	78	80
Fish and wildlife	1,030	43	6	6
Total	42,330	*2,644	350	352

* Includes $770,000 for taxes foregone.

TROTTERS SHOALS PROJECT

Location

The Trotters Shoals project would be located between the Clark Hill Reservoir and the Hartwell Dam on Savannah River. Trotters Shoals damsite is located at the upstream end of Clark Hill Reservoir in Abbeville County, South Carolina, and Elbert County, Georgia, a short distance below Highway No. 72 and about 4 miles southwest of Calhoun Falls, South Carolina. The drainage area above the damsite is 2,890 square miles.

Plan and Data

The Trotters Shoals project would develop the remaining head between Clark Hill and Hartwell Reservoirs. Clark Hill Reservoir normally is operated at about 330 feet above mean sea level. Estimates for the Trotters Shoals project are based on operation at 475 feet. Preconstruction studies, however, should consider an alternative operation at elevation 480 feet. The project would be mainly for hydroelectric power, recreation and fish and wildlife development.

Trotters Shoals is an alternative for the Goat Island-Middleton Shoals developments approved by the Flood Control Act of 1944 and for the Goat Island-Carters Island development presented in Senate Document 6, 87th Congress. Studies of Trotters Shoals indicate that the Trotters Shoals unit is a better investment than either the Goat Island-Middleton Shoals or the Goat Island-Carters Island developments. Accordingly, this unit is included in the plan of development in lieu of the units approved in the Flood Control Act of 1944 and in Senate Document 6.

Based on an operation at 475 feet, the Trotters Shoals dam would be about 170 feet high and would create a reservoir with a surface area of 21,800 acres and a reservoir volume of 845,000 acre-feet. The average power head of 146 feet would generate some 471,400,000 kilowatt-hours annually from an installed capacity of 310,000 kilowatts.

The Trotters Shoals reservoir would be operated normally with a drawdown of 3 feet. This would make an excellent recreation and fishing reservoir. Estimates made for this study indicate that by 2000 the user-days for recreation would total 3 million annually, and the fishing and hunting use about 46,900 user-days annually.

The Trotters Shoals unit would complete development of the total head between Clark Hill and Hartwell Reservoirs. It appears to be a very worthy project that should be developed as soon as possible, and accordingly has been scheduled for early construction in these studies.

A summary of benefits, impacts, costs, and allocations follows.

Benefits

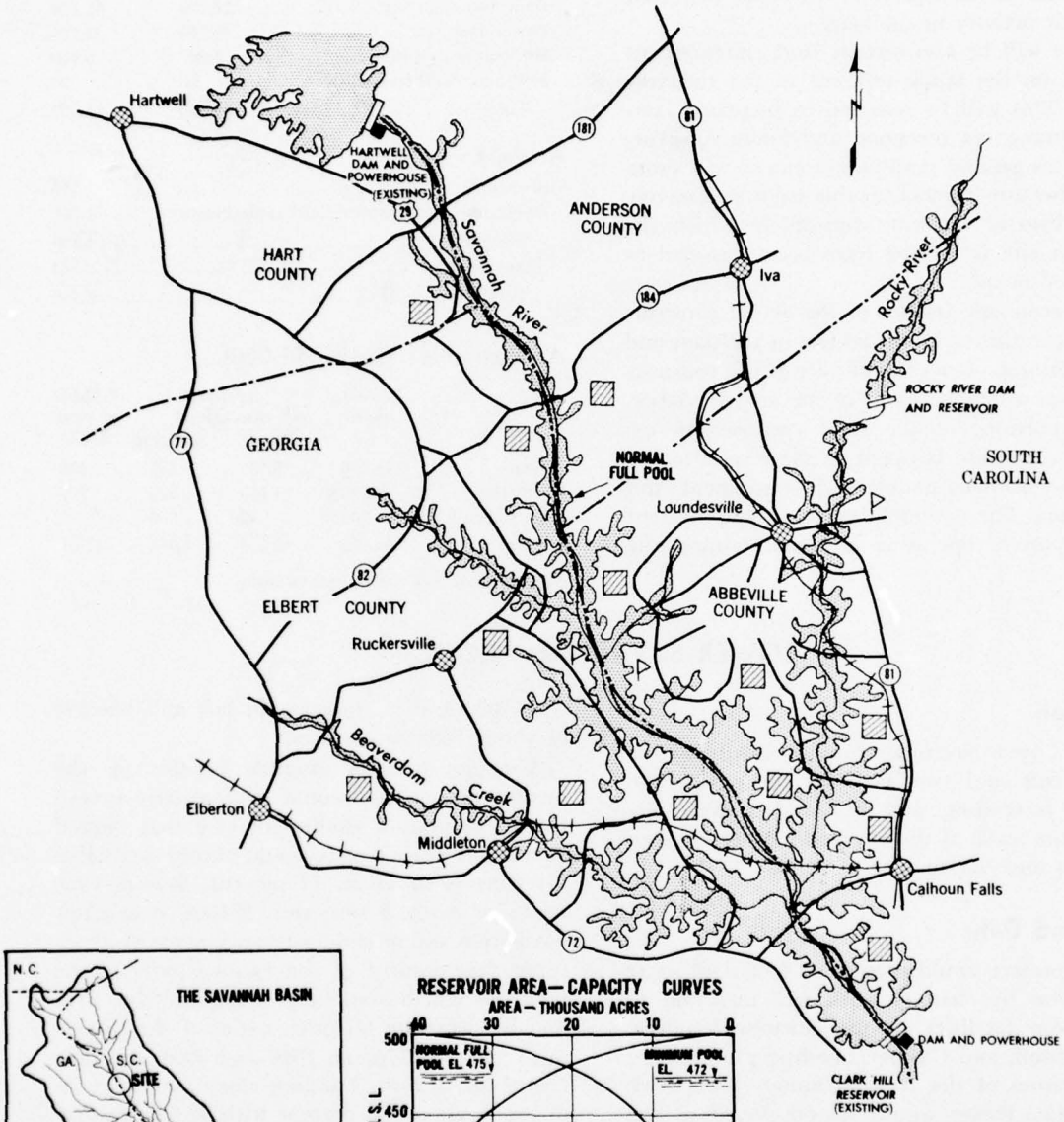
Annual Equivalent Primary Tangible ($1,000)

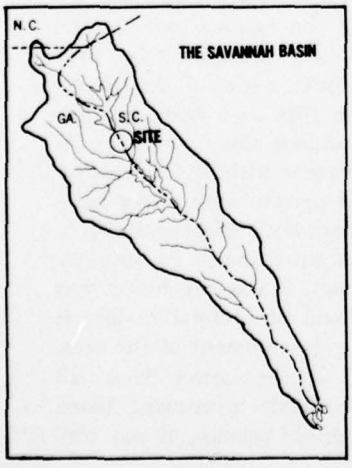
Power	8,527
Recreation	4,353
Fish and wildlife	100
Total	12,980

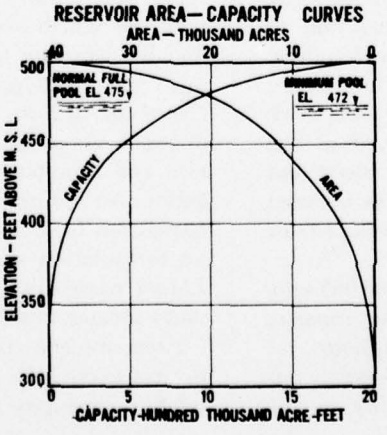
Impacts

The economic impacts from the Trotters Shoals project would stem largely from power production, recreational uses, and fish and wildlife activities. Power production coupled with

TROTTERS SHOALS PROJECT







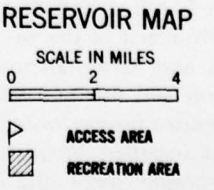


Figure 4.36

stable water levels would create opportunities for industrial development, particularly industries dependent on water and power. Recreational uses of the reservoir will mean increased economic activity in the area.

There will be also certain land enhancement benefits on the lands adjacent to the reservoir shores. This will be reflected in increased land values, more tax revenues, and home construction. This general land enhancement will more than offset any losses of taxable lands to reservoir areas. Two of the four counties in which the reservoir site is located have been classified as depressed areas.

The economic impact of the actual construction expenditures would be felt in the dam and reservoir area. A significant part of the construction costs would be spent in the area for labor. Other portions of the total construction expenditures would be spent in the area, also, for materials, services, maintenance equipment, and operation. There would be steady employment for employees operating and maintaining the project.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	51,170	51,170
Power facilities	33,730	33,730
Recreation facilities	3,860	9,640
Fish and wildlife facilities	90	90
Total	88,850	94,630
Annual Equivalent		
Investment		3,332
Operation, maintenance, and replacements		1,014
Subtotal		4,346
Taxes foregone		2,573
Total		6,919

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	74,970	*5,760	488	488
Recreation	18,720	1,119	520	707
Fish and wildlife	940	40	6	6
Total	94,630	*6,919	1,014	1,201

* Includes $2,573,000 for taxes foregone.

LOWER SAVANNAH PROJECT

Location

The Lower Savannah project, involving improvements and new facilities for navigation, power, recreation, and fish and wildlife, includes the reach of the Savannah River between Augusta and Savannah.

Plan and Data

The project would provide 12-foot slack-water navigation by channel work and inclusion of navigation facilities in the Burtons Landing, Stokes Bluff, and Gaffney Landing projects and modification of the New Savannah Bluff Lock and Dam. Power would be developed at the Burtons Landing and Stokes Bluff projects and the entire reach of the Savannah River between Augusta and Savannah would be developed for recreation and fish and wildlife.

The entire project would include 160,000 kilowatts of installed hydroelectric power capacity and generate 542 million kilowatt-hours of energy. It would provide for an increase in recreation of 5,450,000 user-days annually by the year 2000 and an increase in fish and wildlife of about 408,000 user-days.

Although primary tangible benefits for the project as a whole would substantially exceed costs, formulation studies indicate that annual equivalent project costs would exceed justifiable investments by about 11 percent. Studies were made of both 9-foot and 12-foot slack-water navigation and of various arrangements of scheduling development of the various parts of the plan. By scheduling Burtons Landing for 1975 and by deferring all other units of the project until 2000, or between 1975 and 2000, this deficiency for Burtons Landing alone would be reduced to about 6.8 percent with 12-foot navigation and to about 6.4 percent with 9-foot navigation. Accordingly since both 9-foot and 12-foot navigation have about equal merits in the project formulation analyses, it was concluded that 12-foot navigation would be preferable since it offers greater ultimate development of the area.

Even though costs of the Lower Savannah project exceed the justifiable investment, based solely on primary tangible benefits, it was con-

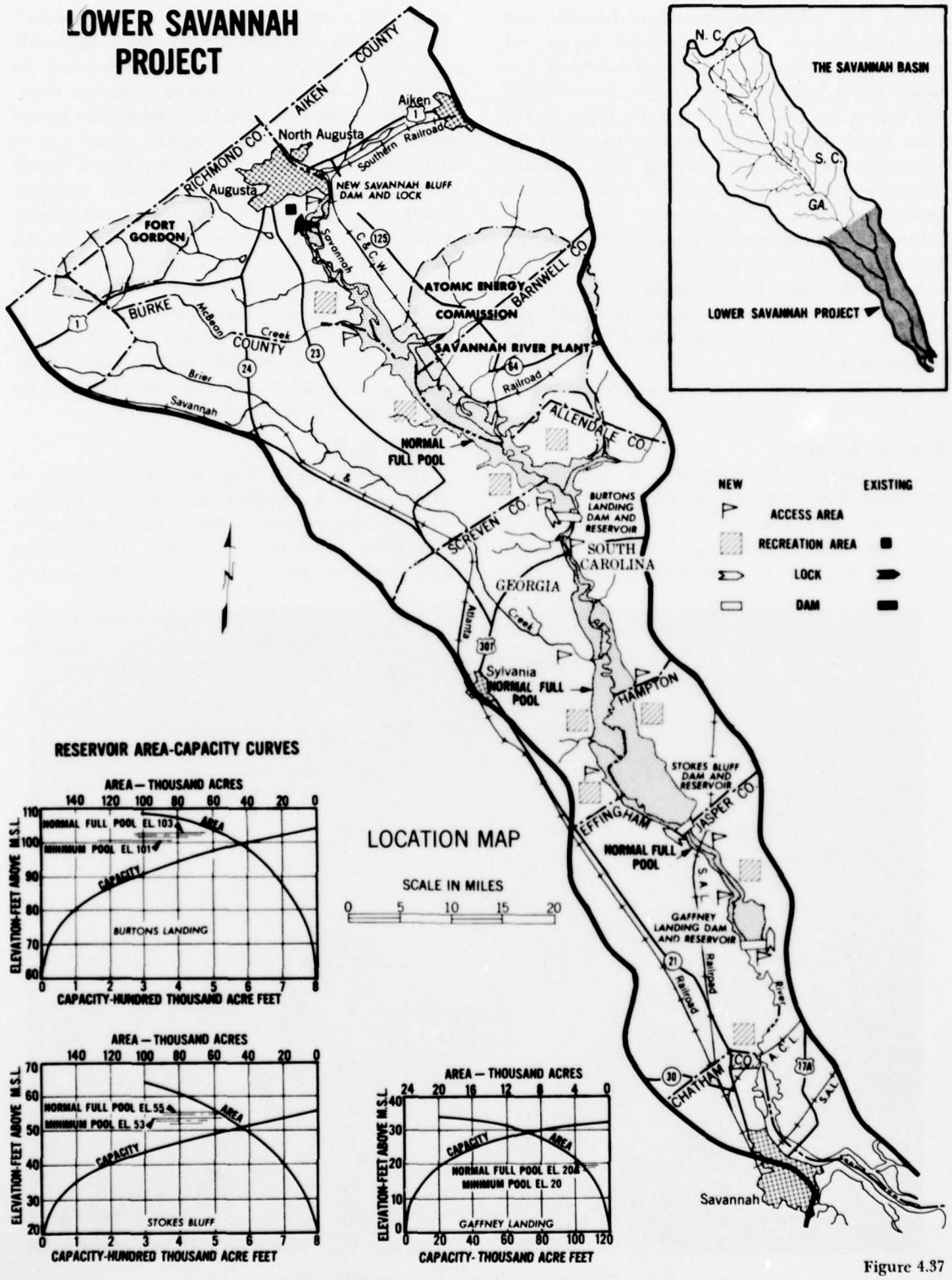

LOWER SAVANNAH PROJECT
AIKEN COUNTY
RICHMOND CO.
North Augusta
Aiken
Augusta
Southern Railroad
NEW SAVANNAH BLUFF DAM AND LOCK
FORT GORDON
Savannah
C & C. W
ATOMIC ENERGY COMMISSION
BARNWELL CO.
BURKE COUNTY
McBean Creek
Brier
Savannah
SAVANNAH RIVER PLANT
Railroad
ALLENDALE CO.
NORMAL FULL POOL
BURTONS LANDING DAM AND RESERVOIR
SCREVEN CO.
SOUTH CAROLINA
GEORGIA
Atlanta
Creek
Sylvania
NORMAL FULL POOL
HAMPTON
STOKES BLUFF DAM AND RESERVOIR
JEFFINGHAM
JASPER CO.
NORMAL FULL POOL
S A L
GAFFNEY LANDING DAM AND RESERVOIR
Railroad
Railroad
River
A C L
CHATHAM CO.
Savannah
N. C.
S. C.
GA.
THE SAVANNAH BASIN
LOWER SAVANNAH PROJECT
NEW
EXISTING
ACCESS AREA
RECREATION AREA
LOCK
DAM
LOCATION MAP
SCALE IN MILES
0 5 10 15 20
RESERVOIR AREA-CAPACITY CURVES
AREA — THOUSAND ACRES
140 120 100 80 60 40 20 0
ELEVATION-FEET ABOVE M.S.L.
NORMAL FULL POOL EL. 103
MINIMUM POOL EL. 101
AREA
CAPACITY
BURTONS LANDING
CAPACITY-HUNDRED THOUSAND ACRE FEET
AREA — THOUSAND ACRES
140 120 100 80 60 40 20 0
ELEVATION-FEET ABOVE M.S.L.
NORMAL FULL POOL EL. 55
MINIMUM POOL EL. 53
AREA
CAPACITY
STOKES BLUFF
CAPACITY-HUNDRED THOUSAND ACRE FEET
AREA — THOUSAND ACRES
24 20 16 12 8 4 0
ELEVATION-FEET ABOVE M.S.L.
CAPACITY
AREA
NORMAL FULL POOL EL. 20
MINIMUM POOL EL. 20
GAFFNEY LANDING
0 20 40 60 80 100 120
CAPACITY- THOUSAND ACRE FEET

Figure 4.37

cluded that additional secondary benefits and favorable impacts to the area from the project over the single-purpose alternatives would outweigh the additional project costs. Accordingly, the Lower Savannah project is included in the plan based on 12-foot navigation and early development of Burtons Landing and later development of other features. Future studies should be made to obtain more accurate estimates and to integrate the project physically and financially with other multiple-purpose developments in the plan. The economic welfare of this part of the basin is so interwoven with the Savannah River that these problems justify further attention.

Each of the principal structures is briefly described in the following.

Burtons Landing

The Burtons Landing site is located on Savannah River west of Allendale, South Carolina. The project would have a dam about 65 feet high and, at operating level 103 feet mean sea level, would form a reservoir of about 59,000 acres with a capacity of about 730,000 acre-feet. The reservoir would be in Allendale, Barnwell, and Aiken Counties, South Carolina, and in Screven, Burke, and Richmond Counties, Georgia. Part of the riverside facilities to the Savannah River plant would require relocation or improvement because of the reservoir. It would have a 100,000-kilowatt powerplant capacity which would generate 345 million kilowatt-hours annually with a gross head of about 48 feet. An 83- by 600-foot lock with a 48-foot lift and 12-foot navigation depth is included. Drawdown of the reservoir would be about 2 feet. Recreation facilities for an estimated 3 million user-days annually and fish and wildlife facilities for a net increase of 120,000 fish and wildlife user-days would be provided.

Stokes Bluff

The Stokes Bluff dam and reservoir site is below Burtons Landing in Jasper, Hampton, and Allendale Counties, South Carolina, and in Effingham and Screven Counties, Georgia. The dam would be about 55 feet high and, operating

Figure 4.38 *Burtons Landing Site – Savannah River.*

at 55 feet above sea level, it would create a reservoir of about 55,000 acres, with a storage capacity of about 750,000 acre-feet. A 60,000-kilowatt powerplant would be installed to generate about 197 million kilowatt-hours annually. The navigation lock would be 83 feet wide, 600 feet long, and would have a lift of 38 feet. Drawdown of the reservoir would be about 2 feet. Recreation facilities would be provided for 2 million user-days and fish and wildlife facilities for 286,400 user-days.

Gaffney Landing

The Gaffney Landing site is below Stokes Bluff on the Savannah River in Jasper County, South Carolina, and Effingham County, Georgia. The reservoir, with about 2,800 acres of water surface, would operate normally at elevation 20 feet above mean sea level and have storage of about 20,000 acre-feet. Its primary purposes are for navigation, recreation, fish and wildlife, and regulation of power releases from Stokes Bluff.

This dam and reservoir probably could be replaced by rather heavy channel excavation for navigation, but such excavation may exceed its estimated cost of $15,064,000. By the year 2000, it is estimated that there would be 450,000 user-days of recreation for which facilities would be constructed and there would be a net increase in fishing of 1,600 user-days annually.

Benefits, impacts, costs, and allocations for the entire Lower Savannah project are summarized in the following. Costs of the Burtons Landing unit for early action also are included.

Benefits

Annual Equivalent Primary Tangible ($1,000)

Power	4,284
Recreation	8,567
Fish and wildlife	486
Navigation	803
Total	14,140

Impacts

The Lower Savannah project, involving construction of three dams and reservoirs, would have economic impacts stemming from navigation, recreation, power production, and fish and wildlife. There would also be benefits from construction expenditures and land enhancement. Probably the most important of these to the long-range economic picture is that provided by navigation.

By 2000, over 3 million tons are expected to be shipped on the river between Augusta and Savannah based on the existing 9-foot navigation. Twelve-foot navigation would increase this tonnage. Industries dependent on water transportation would be attracted to locate here. Industries concerned with economical, stable, and ample supplies of both water and electrical power also would be attracted. The existence of navigation, hydroelectric power, and an already existing industrial base at both extremities would make the entire area desirable for industrial locations.

The construction expenditures for the three projects would provide a temporary impetus to the area economy. A significant part of the construction costs would be spent locally for wages, services, and materials. The recreational uses of the reservoirs and the land enhancement of the shorelines would also be realized in dollars and cents on the entire reaches of the lower Savannah River. Expenditures by operation and maintenance personnel would add to the economic development of the area.

Costs ($1,000)

	Early action	Total
Investment		
Dam and reservoir	55,960	105,600
Power facilities	25,440	42,200
Recreation facilities	9,640	17,850
Fish and wildlife facilities	120	350
Navigation facilities	20,140	31,800
Total	111,300	197,800

Annual Equivalent

Investment	5,476
Operation, maintenance, and replacements	1,725
Subtotal	7,201
Taxes foregone	1,090
Total	8,291

Allocation of Costs ($1,000)

	Investment	Annual equivalent		OM&R at year 2000
		Total	OM&R	
Power	113,800	•4,928	489	613
Recreation	24,200	1,876	1,104	1,259
Fish and wildlife	21,700	660	50	59
Navigation	38,100	827	82	155
Total	197,800	•8,291	1,725	2,086

• Includes $1,090,000 for taxes foregone.

SAVANNAH POLLUTION ABATEMENT PROJECT

Location

Facilities of the Savannah Pollution Abatement project would be located along the lower Savannah River and on the nearby salt-water marsh areas.

Plan and Data

Untreated municipal and industrial wastes from the Savannah metropolitan area are discharged into the Savannah River. This results in damage to sport and commercial fishing and to the general recreation use in the lower Savannah area. Adequate waste treatment and abatement of this pollution by construction of separate treatment facilities by each contributor of pollution would be difficult to accomplish because of the close quarters on lands adjacent to the river. In order to obtain the approximate magnitude of costs involved, a combined project was studied based on available data. The suggestions made here are intended to indicate the magnitude and significance of the problem and to provide a basis for general estimates. Further study may result in changes in the suggested plan but it is believed that desirable changes could be made within the limits of the costs that are being considered.

Abatement of this pollution could be accomplished by construction of an intercepting sewer paralleling the waterfront which could discharge into a series of stabilization ponds located on the unused salt-water marsh areas of the lower Savannah River. This is only one of several possible solutions to the problem. In the year 2000, an estimated 130 million gallons a day of waste could be diverted and treated in such stabilization ponds which would be located away from the populated areas. This plan would require utilization of about 10,000 acres of the salt marshlands.

Benefits and Costs

Benefits of this plan would come from the pollution abatement itself and from improvements in sport and commercial fishing and recreation in the lower Savannah area. The stabilization pond would reduce the mosquito breeding area and enhance the natural esthetic values of this metropolitan area.

The estimated cost of this development, for the purpose of illustrating the project, totals $27 million for construction and $314,000 for annual operation and maintenance. The benefits are assumed to equal or exceed the costs. These total the equivalent of $1,286,000 annually.

Further study, including several alternative methods of handling wastes, is needed. The project has been noted here because it represents an important part of the development needed in the basin.

Impacts

Clean streams are important to the well-being of the people. This sense of well-being determines where people like to live, work, and play. Therefore, it is important to the economic activity of a locality.

The Savannah Pollution Abatement project is a logical solution to a growing problem. Solving this problem will mean continuing economic growth for the city. Such economic growth would be difficult to measure but it is only logical to assume that such would be the case. One has only to imagine the effects on economic growth if the pollution problem is ignored.

WATER ACCESS AREAS

Location

Water-access areas would be located along rivers and streams, along coastal waters, at small reservoirs available for public use, and at lakes located principally in the Piedmont and Blue Ridge provinces. These areas are in addition to the access areas adjacent to the proposed large dam and reservoir sites.

Plan

Four different kinds of access areas would be developed. Type A, Type B, and Type C access areas with average sizes of 75 acres, 40 acres, and 10 acres, respectively, would be used for both fish and wildlife and recreation. Type D with an average size of 2 acres would be for fish and wildlife only. Types A, B, and C access areas

would have facilities for boating, camping, swimming, fishing, limited hunting, picnicking, sightseeing, parking, water supply, sanitation, and access to these facilities. Type D access areas would have facilities for parking and access to the water for fishing and hunting.

A total of 89 access areas would be developed by 2000. In addition to these access sites, high density and general recreation areas will provide numerous access points to the coast. No attempt has been made to locate the proposed access areas precisely. They may be located at or near highway crossings or other suitable sites where they best suit the desires of the local landowners and sportsmen and where construction work and land acquisition could be held to a minimum. The anticipated use of the sites to be developed by 2000 would be as follows:

Data

State	Type of area	Number of areas	Annual user-days	
			Recreation	Fish and wildlife*
Georgia portion	A	0	0	0
	B	2	120,000	4,000
	C	2	80,000	4,000
	D	41	0	82,000
Subtotal		45	200,000	90,000
South Carolina portion	A	0	0	0
	B	2	120,000	4,000
	C	3	120,000	6,000
	D	39	0	78,000
Subtotal		44	240,000	88,000
Total		89	440,000	178,000

* These user-days for fish and wildlife are not additive to the user-days shown in the single-purpose wildlife and sport fisheries program.

Benefits

Annual Equivalent Primary Tangible ($1,000)

	Georgia	South Carolina	Total
Recreation	359	438	797
Fish and wildlife	45	44	89
Total	404	482	886

Impacts

The access areas provide a wide distribution of facilities, at low cost, to make the streams, lakes, small reservoirs, and coastal areas available to people all over the basin. The use of private land along water bodies is becoming more and more restricted. While the restrictions are usually justifiable, they limit the use of the water bodies of the basin and make fishing and other water-based activities more and more difficult for the public. A main objective of the access areas is to keep the water bodies available for public use and, at the same time, protect the rights of private property holders.

The access sites will provide convenient points to reach the streams, small reservoirs, lakes, and seacoast for fish and wildlife management, stream gaging and sampling, and other purposes outside the fields of recreation and fishing.

Costs

	Georgia	South Carolina	Total
Investment			
Early action	$703,000	$911,000	$1,614,000
Total	1,631,000	1,809,000	3,440,000
Annual Equivalent			
Investment	58,900	65,400	124,300
Operation, maintenance, and replacements	78,500	89,700	168,200
Total	137,400	155,100	292,500

Allocation of Costs

Investment			
Recreation	972,700	1,169,800	2,150,500
Fish and wildlife	658,300	639,200	1,289,500
Total	1,631,000	1,809,000	3,440,000
Total Annual Equivalent			
Recreation	93,500	111,300	204,800
Fish and wildlife	43,900	43,800	87,700
Total	137,400	155,100	292,500
Annual Equivalent Operation, Maintenance, and Replacements*			
Recreation	57,400	69,500	126,900
Fish and wildlife	21,100	20,200	41,300
Total	78,500	89,700	168,200

* Operation, maintenance, and replacements costs at year 2000 are assumed to be equal to the annual equivalent operation, maintenance, and replacements costs.

UPSTREAM WATERSHED PROJECTS

Location

While no specific locations are selected for final development, watershed areas in the basin were analyzed as typical projects.

Plan and Data

Multiple-purpose flood prevention and drainage projects are proposed for development between 1960 and 2000 on tributary streams draining some 2.5 million acres. The structural works of improvement would protect and provide for the improvement of agricultural lands and other areas. In addition, many of the desired land-use changes would be made possible by more effectively utilizing, protecting, and developing the land and water resources of the basin.

Changes in the criteria for project selection, evaluation, installation and cost sharing due to legislative changes which cannot be predicted; increased local interest; or other factors such as changes in the amount of watershed technical assistance would substantially change the estimate and result in a different rate of watershed project installations. The possibility of changes in the watershed program is recognized. Appropriate recognition of actual developments and resulting modifications can be accomplished as a part of keeping the plan up to date.

Upstream watershed projects would provide watershed protection, flood prevention, and water resources development for other purposes in the upstream areas. The structural works of improvement included would result in reducing the average annual floodwater and sediment damages occurring under existing conditions on a substantial area of flood plains in the small-stream watersheds. Flood protection in these areas would enable landowners to convert some low value production and use areas because of the existing flood hazards to highly productive areas. Many opportunities exist in the proposed reservoirs in the upstream watersheds for recreation and fish and wildlife developments. To the extent the reservoirs are made available to and managed for public use, they will provide substantial portions of the projected needs for recreation and fish and wildlife as well as other purposes.

Benefits

Annual Equivalent Primary Tangible ($1,000)

	Georgia	South Carolina	Total
Flood prevention	2,057	932	2,989
Drainage	73	....	73
Total	2,130	932	3,062

Impacts

Corrective measures to prevent soil erosion together with utilization of sediment storage capacities provided in upstream structures will reduce sediment storage requirements in downstream reservoirs.

Costs ($1,000)

	Georgia	South Carolina	Total
Investment			
Early action	18,880	9,720	28,600
Total	32,690	11,610	44,300
Annual Equivalent			
Investment	1,181	420	1,601
Operation, maintenance, and replacements	420	162	582
Total	1,601	582	2,183

Allocation of Costs ($1,000)

Investment			
Flood prevention	31,810	11,610	43,420
Drainage	880	....	880
Total	32,690	11,610	44,300
Total Annual Equivalent			
Flood prevention	1,564	582	2,146
Drainage	37	....	37
Total	1,601	582	2,183
Annual Equivalent Operation, Maintenance, and Replacements*			
Flood prevention	410	162	572
Drainage	10	....	10
Total	420	162	582

* Annual equivalent operation, maintenance, and replacements costs are the same as the operation, maintenance, and replacements costs at the year 2000.

WATER SUPPLIES

Location

Water supply programs would be basinwide.

Plan

The programs for domestic, municipal, and industrial uses of water include the development or improvement of water supplies, treatment facilities, and distribution systems as described in Part Two, Section II. Water available by 2000 under these programs would serve domestic needs for 15 million gallons per day, municipal needs for 261 million gallons per day, and industrial needs for 306 million gallons per day.

Data

	Number*
Domestic supplies	
New drilled wells	10,000
Wells to be improved	18,000
Pressure systems to be added	11,000
Wells to be rehabilitated during study period	33,000
Municipal supplies	
Municipalities	97
Systems to be improved, enlarged, or treatment facilities added	63
Source improvement	(40)
Water treatment	(63)
Elevated storage tanks	37
Distribution systems or extensions required	74

* Number of systems or number of proposed improvements to meet projected needs to year 2000.

Twenty-four or more new or enlarged industrial water supplies would be provided by 2000 to meet projected needs.

Benefits

Annual Equivalent Primary Tangible

Benefits from providing a water supply are limited to the cost of obtaining from the cheapest and most likely alternative supply that is adequate in quantity and quality. In the Savannah basin the alternative is either surface or ground water and both generally are available. Usually ground water is the most practical source in the Coastal Plain.

Impacts

The availability of good quality water determines to a considerable extent the degree of community and industrial development. Industry is attracted to areas where, in addition to other considerations, high-quality water is available in sufficient volumes to meet its requirements. Savannah basin has adequate water for expansion.

A properly designed and operated water supply protects the health of the community, strengthens its fire defenses, and contributes to recreational activities.

Costs ($1,000)

	Georgia	South Carolina	North Carolina	Total
Investment				
Early action	31,790	18,960	500	51,250
Total program				
Domestic	12,600	10,300	500	23,400
Municipal	64,850	23,630	....	88,480
Industrial	10,170	50	....	10,220
Total	87,620	33,980	500	122,100
Annual Equivalent				
Investment				
Domestic	379	309	14	702
Municipal	1,339	529	....	1,868
Industrial	241	1	....	242
Subtotal	1,959	839	14	2,812
Operation, maintenance, and replacements				
Domestic	91	74	3	168
Municipal	3,706	1,334	....	5,040
Industrial	948	1	....	949
Subtotal	4,745	1,409	3	6,157
Total				
Domestic	470	383	17	870
Municipal	5,045	1,863	....	6,908
Industrial	1,189	2	....	1,191
Total	6,704	2,248	17	8,969
Operation, Maintenance, and Replacements at Year 2000				
Domestic	220	180	8	408
Municipal	7,340	2,286	....	9,626
Industrial	1,210	6	....	1,216
Total	8,770	2,472	8	11,250

Allocation of Costs

All costs are allocated to water supplies.

NAVIGATION

Location

This portion of the navigation plan includes the programs for port improvements at Savannah and improvements to the Atlantic Intracoastal Waterway in or near the Savannah basin. The Lower Savannah project is discussed separately and the costs and benefits relating to the navigation development between Savannah and Augusta are excluded here.

Plan and Data

Harbor improvements to permit up to 36-foot draft navigation with 40-foot depth across the ocean bar would include deepening or widening existing channels, increasing the size of existing turning facilities and providing at least one additional turning area, additional anchorage areas, and additional deep-draft berthing facilities.

Waterborne commerce in 1960 and future commerce expected to move through Savannah Harbor is estimated as follows:

Year	Waterborne commerce (tons)		
	Petroleum	Other	Total
1960	2,320,000	2,005,000	4,325,000
1975	3,070,000	3,665,000	6,735,000
2000	6,770,000	4,970,000	11,740,000

By the year 2000, the commercial traffic on the Atlantic Intracoastal Waterway is expected to reach 4,683,000 tons, an increase of more than four times the 1959 tonnage. Widening the 90-foot cut channel reaches to 150 feet would be provided. Total cost of this improvement for 9¼ miles total, of which 3¾ miles are in the basin, and 5½ miles are outside the basin, is estimated at $730,900. These improvements outside the basin are not included in other basin plans. Total annual equivalent costs are estimated at $44,500.

Benefits

Annual Equivalent Primary Tangible

Total average annual equivalent benefits, including revenues from increased commerce, revenue from berths and facilities, and other increased activities for improvements of the Port of Savannah and the Atlantic Intracoastal Waterway, are $11,780,000.

Impacts

The economic impacts of navigation stem from the primary benefits of savings in transportation costs to: (1) Existing traffic not now using the waterway, and (2) potential traffic expected to develop because of the waterway. In the case of harbor improvements, the benefits stem from: (1) Elimination of lost time, (2) elimination of ship damage, and (3) protection from storms. All of these benefits may give rise to economic development or economic impacts.

Industries that utilize or produce agricultural products, steel or iron, coal, petroleum, chemicals, pulp and paper, building materials, transportation equipment, and farm machinery are the big users of navigable waterways. These industries have been responsible for billions of dollars of industrial development on navigable waterways since World War II. Notable examples are the industrial growth in Memphis, Tennessee; Evansville, Indiana; Houston, Texas; and in the Baton Rouge-New Orleans area. The Houston Ship Canal, connecting a land-locked city with the Gulf of Mexico, has had a multimillion dollar industrial development along its 52-mile length. A similar expansion of the petrochemical industries on the Gulf Intracoastal Waterway is evidence of the attraction of navigable waterways to industrial development. A currently flourishing development is the large industrial complex along the lower Hiwassee River near Chattanooga, Tennessee. The Savannah River, when similarly developed, could easily emulate development on the Hiwassee.

Costs ($1,000)*

Investment

Total	32,380

Annual Equivalent

Investment	1,460
Operation, maintenance, and replacements	7,320
Total	8,780

* The costs involve improvements in both Georgia and South Carolina.

Allocation of Costs

All costs are allocated to navigation.

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RECLAMATION, IRRIGATION, AND DRAINAGE

Location

The reclamation, irrigation, and drainage programs would be carried out on irrigable areas of the basin used for cropland, and on wetland areas of the basin used for cropland and pastureland. Drainage of woodland is discussed under Forest Conservation and Utilization.

Plan and Data

The reclamation, irrigation, and drainage programs summarized in this Section are not included elsewhere in this Appendix. Drainage in upstream areas is included in the upstream watershed projects.

The features of the irrigation program include individual sprinkler systems on an individual farm basis to irrigate an estimated 13,600 additional acres of cropland. Irrigation of home gardens, nurseries, lawns, and nonagricultural areas would be in addition to the cropland acres. In the Coastal Plain about 77 percent of the water supply requirements will be provided by farm ponds, 11 percent from individual wells, and 12 percent from streams. In the Blue Ridge and Piedmont provinces, farm ponds and streams are sources of irrigation water. Crops to be irrigated include tobacco, cotton, truck crops, corn, and speciality crops. The irrigated acres would require a high level of conservation treatment for protection and efficient use.

Irrigation included in the plan was established on the basis that incremental returns to the farmer, based on long-term projected prices, would at least equal the incremental operation, maintenance, and replacements costs without consideration of secondary effects or intangibles. This general guide was considered acceptable for reconnaissance studies although it was realized that followup individual irrigation development would be subject to standard and more detailed evaluations.

The features of the drainage program include onfarm open ditch drainage systems on an estimated 28,000 additional acres of cropland and pastureland. Crops to be grown on drained land include tobacco, corn, cotton, peanuts, truck and other speciality crops, and pasture.

Individual farmers are expected to install the irrigation and drainage systems with technical and financial assistance provided by private concerns and State and Federal programs.

Benefits

Annual Returns to Farmers ($1,000)

	North Carolina	South Carolina	Georgia	Total
Irrigation	2	269	317	588
Drainage	2	127	155	284
Total	4	396	472	872

Impacts

Irrigation would provide insurance against drought conditions and assist in prompt germination and continuous plant growth of new seedlings. Irrigation and drainage would both permit improved management and better use of land in accordance with its capability.

Costs (exclusive of technical assistance) ($1,000)

	North Carolina	South Carolina	Georgia	Total
Investment				
Early action				
Irrigation	3	360	482	845
Drainage	1	64	89	154
Total	4	424	571	999
Total				
Irrigation	8	889	1,048	1,945
Drainage	3	185	229	417
Total	11	1,074	1,277	2,362
Annual Equivalent				
Irrigation				
Investment	1	32	38	70
OM&R[2]	2	198	234	434
Total	2	230	272	504
Drainage				
Investment	1	7	8	15
OM&R[2]	1	13	16	29
Total	1	20	24	44

NOTES: [1] Less than $500.
[2] Annual equivalent operation, maintenance, and replacements costs are assumed to be equal to the operation, maintenance, and replacements costs at year 2000.

Allocation of Costs

All costs are allocated to irrigation and drainage as shown.

SOIL CONSERVATION AND UTILIZATION

Location

The soil conservation and utilization program would be carried out on cropland, pastureland, and rangeland throughout the basin.

Plan

Features of soil conservation and utilization plan for the basin include:

(1) The treatment of about 890,000 acres of cropland, pastureland, and rangeland by the installation of annual and enduring soil conservation measures and practices, which would consist of establishment or reestablishment of vegetative cover, improvement of vegetative cover, erosion control practices, management of grazing, and protection from fire.

(2) The installation of about 16,000 farm ponds from 1960 to the year 2000 to provide livestock water, irrigation water supplies, some of the small impoundment fishing, and some unclassified recreation use.

(3) The conversion of about 136,000 acres of woodland, pastureland, and other lands to cropland, and 191,000 acres of cropland, woodland, and other lands to pastureland.

Land owners and operators will install the above measures on an individual farm basis and in upstream watershed projects with technical and financial assistance from State and Federal programs.

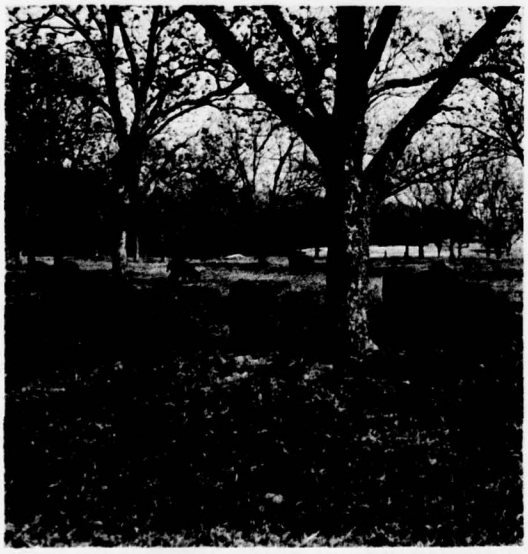

Figure 4.39 *Good Soil Conservation Measures Permit Intensive Land Utilization.*

Pressure is being applied to present land uses in the basin by expanding nonagricultural uses such as urban and industrial areas and highways. It is estimated that some 328,000 acres now used for food and fiber production will be diverted by year 2000 to such nonagricultural uses, including new large water impoundments. The erosion control and water management problems on the nonagricultural lands will require similar treatment measures as for cropland and pastureland and will be applied by private individuals, industries, and local and State entities. At the time these areas are changed into nonagricultural use, the specific problems and solutions will need to be determined and means established to carry out the control measures.

Data

Land Use — 2000

	Acres (1,000)
Cropland and pastureland	1,815
Woodland	3,925
Other	650
Total	6,390

Benefits

Annual Returns to Farmers ($1,000)

	North Carolina	South Carolina	Georgia	Total
Total	17	1,114	2,017	3,148

Impacts

Installation of soil conservation measures and practices on the areas of cropland, pastureland, and rangeland needing conservation treatment is a basic principle in protecting the soil resources and in providing sustained agricultural production in the basin and Nation. The application of these practices and measures would contribute to extending the life of floodwater retarding structures, major reservoirs, and drainage ditches by reducing sediment. Improving water quality would reduce the cost of treatment for municipal and industrial use and enhance the value of reservoirs for fish and wildlife.

Additional economic impacts of soil conservation measures and practices are discussed as part of the agriculture program in Section III, Part Four, Impacts of the Plan.

Costs (exclusive of technical assistance) ($1,000)

	North Carolina	South Carolina	Georgia	Total
Investment				
Early action	50	3,450	5,450	8,950
Total	131	8,619	13,620	22,370
Annual Equivalent				
Investment	5	312	492	809
Operation, maintenance, and replacements*	10	594	1,177	1,781
Total	15	906	1,669	2,590

* Annual equivalent operation, maintenance, and replacements costs are the same as the operation, maintenance, and replacements costs at year 2000.

Allocation of Costs

All costs are allocated to soil conservation and utilization.

FOREST CONSERVATION AND UTILIZATION

Location

The forest conservation and utilization program would be carried out on the woodland areas throughout the basin including 397,000 acres in national forest and 289,000 acres in other Federal lands.

Plan

The forestry program would include items such as: (1) Technical assistance for managing and harvesting timber and for applying other recommended measures; (2) commercial and noncommercial thinnings to help bring stands to operable conditions; (3) tree planting and site preparation for natural regeneration and seeding; (4) detecting and controlling insect and disease infestations; (5) water management by drainage and flood control; (6) forest fire protection by providing needed additional facilities such as towers and tractors and by increasing air observation and the number of personnel assigned to detection and suppression activities; (7) fencing overgrazed woodland areas to control grazing and prevent damage to tree seedlings by livestock; (8) road building for management and protection activities; (9) additional education and information; and (10) intensified forest research.

Data

Item	Unit	Georgia	South Carolina	North Carolina	Total
Fire protection (new)	acre	10,000	....	....	10,000
Fencing for woodland grazing control	mile	600	600	....	1,200
Erosion control tree planting	acre	135,000	135,000	5,000	275,000
Woodland drainage and water control	acre	104,000	50,000	....	154,000
Shelterbelts	acre	900	1,200	....	2,100
Timber-stand improvement (commercial and noncommercial)	acre	2,139,000	1,673,000	78,000	3,890,000
Other tree planting and site preparation for natural regeneration	acre	1,535,000	1,178,000	27,000	2,740,000
Annual Production—2000					
Timber cut	cu. ft.	143,000,000	99,000,000	10,000,000	252,000,000
Gum-naval stores	barrel	14,000	.....	.....	14,000

Benefits

Annual Equivalent Primary Tangible ($1,000)

Georgia	2,821
South Carolina	2,016
North Carolina	202
Total	5,039

Impacts

Economic impacts of the forest conservation and utilization program are discussed in Section III, Part Four, Impacts of the Plan.

Costs ($1,000)

	Georgia	South Carolina	North Carolina	Total
Investment				
Early action				
Forest fire protection	20	....	....	20
Fencing for woodland grazing control	180	180	....	360
Erosion control tree planting	3,370	3,380	130	6,880
Water control and forest roads	18,640	8,250	1,290	28,180
Shelterbelts	10	20	....	30
Timber-stand improvement (commercial and noncommercial)	1,630	1,270	60	2,960
Other tree planting and site preparation for natural regeneration	7,710	6,030	280	14,020
Total	31,560	19,130	1,760	52,450
Total program				
Forest fire protection	20	....	....	20
Fencing for woodland grazing control	180	180	....	360
Erosion control tree planting	3,370	3,380	130	6,880
Water control and forest roads	19,410	8,630	1,290	29,330
Shelterbelts	10	20	....	30
Timber-stand improvement (commercial and noncommercial)	7,480	5,850	270	13,600
Other tree planting and site preparation for natural regeneration	23,440	18,000	420	41,860
Total	53,910	36,060	2,110	92,080
Annual Equivalent				
Investment	1,301	872	51	2,224
Operation, maintenance, and replacements	631	522	61	1,214
Total	1,932	1,394	112	3,438
Annual Operation, Maintenance, and Replacements at Year 2000	827	700	80	1,607

Allocation of Costs

All costs are allocated to forest conservation and utilization.

FISH AND WILDLIFE

Location

The single-purpose fish and wildlife programs would be basinwide. Fish and wildlife facilities included in multiple-purpose projects are described as part of specific projects.

Plan

Sport fisheries programs and projects, as proposed, are designed to meet the need for 4,795,000 user-days of sport fishing by 2000. Selection of projects to meet these needs has been guided by recognition of the desirability of a balanced distribution of fishing pressure by types of fishing water—streams, large impoundments, small impoundments and salt waters; geographical location; resource potentials; and costs of development.

Wildlife programs and projects are designed to meet a total demand of 1,429,000 user-days

of hunting by 2000. Selection of projects to meet these needs have been guided by trends in hunting by type, resource potentials, and feasibility of development.

The features of the wildlife program include: (1) Habitat improvement on State-owned lands now administered for wildlife purposes; (2) further development of habitat within the national forests in Georgia, South Carolina, and North Carolina, the military areas in Georgia, the Savannah defense area, and the Savannah National Wildlife Refuge in South Carolina; (3) establishment and development of five additional wildlife management areas in the Piedmont and Coastal Plain provinces of Georgia; (4) establishment and development of two new wildlife management areas in the Piedmont and Coastal Plain provinces of South Carolina; (5) private development of about 4,000 new acres of small impoundments in the coastal marshes of inland bottom lands for waterfowl purposes; (6) full development of the wildlife plan and development of the Highlands project as described in the specific projects; (7) extensive management of wildlife habitat throughout the basin by interested landowners in cooperation with State and Federal conservation agencies; and (8) the expansion of current activities in research, planning, education and information, and management and enforcement. The benefits and costs of the Highlands project mentioned in item (6) have been included in the specific project descriptions.

The features of the sport fisheries program are: (1) Improvement of the Savannah River for sport fishing by abatement of pollution in the vicinity of Augusta and Savannah, Georgia, which would be provided by the pollution abatement program; (2) renovation and more intensive management of the existing and prospective large and small impoundments; (3) development of seven new large impoundments in the Piedmont and Coastal Plain provinces in conjunction with other functions; (4) private development of small impoundments in the tidal marshes in South Carolina and Georgia, totaling 2,000 acres; (5) full development of the fishery potential of the mountain streams and lakes in the Blue Ridge province in conjunction with the potential Highlands project; (6) expansion of services and facilities for coastal fishermen, including installation of additional fishing piers and artificial reefs; (7) expansion of existing hatcheries to meet the needs for stocking and renovation of large and small impoundments and cold water streams; and (8) the expansion of current activities in research, planning, education and information, and management and enforcement.

The commercial fisheries improvement would consist of: (1) Expansion of existing operations; (2) rehabilitation of oyster producing reefs;

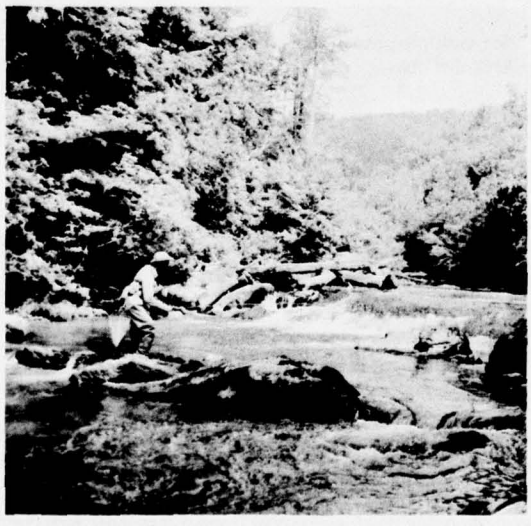

Figure 4.40 *Mountain Streams in the Basin Provide Good Trout Fishing.*

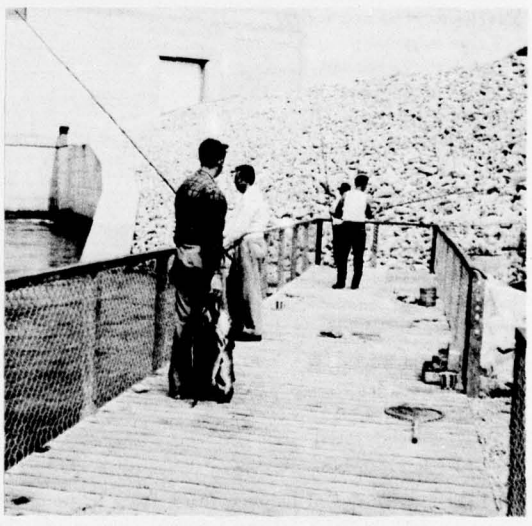

Figure 4.41 *Fisherman with Catch Below Clark Hill Dam on Savannah River.*

(3) cultivation of shrimp, pompano, and other high quality seafoods under controlled conditions; and (4) acceleration and expansion of existing facilities and activities with a view toward more efficient harvests, better methods of handling and processing the catch, new sources of supply, sound regulations and enforcement, and increasing demand for domestic products. With these programs in effect, and considering advantages of other improvements in equipment and technology, it is anticipated that the total production of seafoods will be about 6,600,000 pounds annually by 2000, an increase of about 3,450,000 pounds over the 1959 harvest.

Data

	Unit	Georgia	South Carolina	North Carolina	Total
Wildlife					
Improvement of existing facilities					
State-owned lands	acre	0	16,000	0	16,000
National forest lands	acre	[1]33,000	[1]112,000	0	[1]145,000
Military and defense areas	acre	56,000	201,000	0	257,000
Savannah National Wildlife Refuge	acre	0	13,000	0	13,000
Reservoir lands	acre	[2]84,000	[2]77,000	0	161,000
Development of new facilities					
Wynn Mountain	acre	18,000	0	0	18,000
Broad Mountain	acre	25,000	0	0	25,000
Fishing Creek	acre	25,000	0	0	25,000
Williams Creek	acre	20,000	0	0	20,000
Rocky River	acre	0	10,000	0	10,000
Hampton	acre	0	10,000	0	10,000
Tidal impoundments	acre	2,000	2,000	0	4,000
Extensive habitat improvement			Basinwide		
Supporting programs			Basinwide		
Fresh-Water Sport Fisheries					
Improvement of streams		See multiple-purpose reservoir projects			
Cold water		See Highlands project			
Warm water		See Pollution Abatement and Public Health			
Improvement of lakes					
Large impoundments	acre	69,000	64,000	0	133,000
Small impoundments	acre	17,000	7,000	0	24,000
Development of new waters					
Large impoundments	acre	See multiple-purpose reservoirs			
Small impoundments	acre	Included above			
Tidal impoundments	acre	2,000	2,000	0	4,000
Separate facilities					
Water access	site	35	42	0	77
Salt-Water Sport Fisheries					
Facilities					
Fishing reefs[3]	reef	10	10	0	13
Fishing piers	pier	1	0	0	1
Water access	site	10	2	0	12
Supporting programs			Coastwide		
Commercial Fisheries					
Food fishes	pound				3,360,000
Seafood culture					
Oysters (175 acres)	pound				60,000
Shrimp (38 acres)	pound				30,000

NOTES: [1] Exclusive of national forest lands in proposed Highlands project.
[2] Includes all Federally owned lands above the normal operating level of Hartwell and Clark Hill Reservoir projects.
[3] These are submerged reefs 3 to 4 feet high and in water with depths varying from 20 to 60 feet.

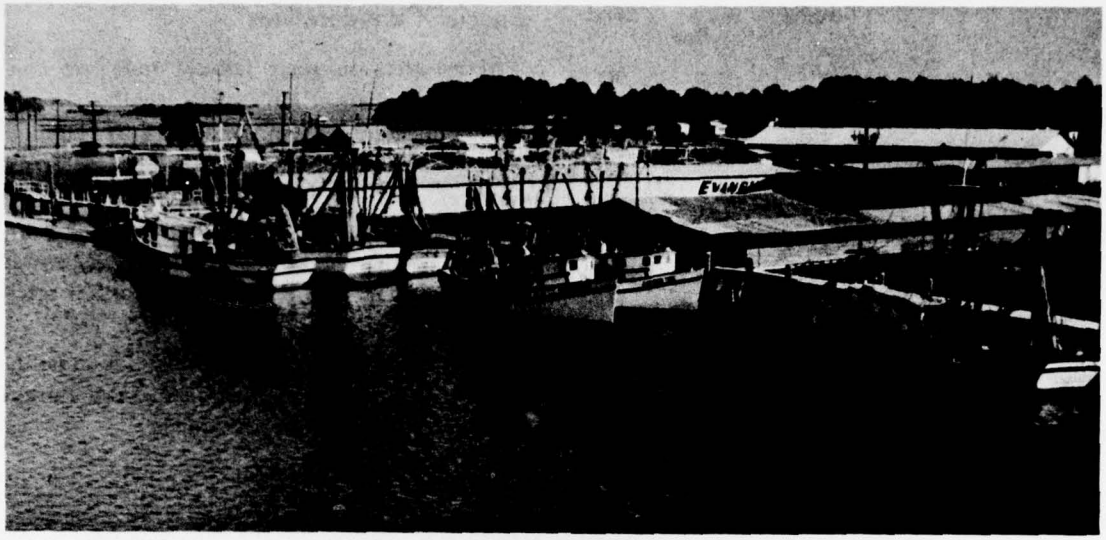

Figure 4.42 *Commercial Fishing Boats, Thunderbolt, Georgia — The Annual Basin Catch by 2000 Is Anticipated to be 6,600,000 Pounds.*

By the year 2000, the total estimated increase in annual user-days of hunting and sport fishing associated with the above program features are as follows:

Item	User-days annually			
	Georgia	South Carolina	North Carolina	Total
Hunting	394,000	276,000		670,000
Sport fishing, fresh-water	2,013,000	678,000	0	*2,691,000
Sport fishing, salt-water	137,000	44,000	0	*181,000
Total	2,544,000	998,000		3,542,000

* Includes user-days of fishing shown for water-access areas. Benefits and costs of water-access areas are not included in the following.

Benefits

Annual Equivalent Primary Tangible ($1,000)

	Georgia	South Carolina	Total
Wildlife	835	532	1,367
Sport fisheries	2,107	809	2,916
Commercial fisheries	264	88	352
Total	3,206	1,429	4,635

Impacts

Many of the benefits from sport fisheries and wildlife programs would be intangible. Preservation of areas in their natural state and increased esthetic values are difficult to assess in monetary terms. The basin has many areas that support a variety and abundance of fish and wildlife. See Section III of this Part for further discussion.

Costs ($1,000)

	Georgia	South Carolina	Total
Investment			
Early action			
Wildlife	113	565	678
Sport fisheries	289	82	371
Commercial fisheries	18	18	36
Total	420	665	1,085
Total			
Wildlife	138	1,190	1,328
Sport fisheries	587	125	712
Commercial fisheries	30	30	60
Total	755	1,345	2,100
Annual Equivalent			
Investment			
Wildlife	4	28	32
Sport fisheries	6	1	7
Commercial fisheries	1	1	2
Total	11	30	41
Operation, maintenance, and replacements			
Wildlife	392	523	915
Sport fisheries	1,196	459	1,655
Commercial fisheries	223	74	297
Total	1,811	1,056	2,867

	Georgia	South Carolina	Total
Total			
Wildlife	396	551	947
Sport fisheries	1,202	460	1,662
Commercial fisheries	224	75	299
Total	1,822	1,086	2,908
Operation, Maintenance, and Replacements at Year 2000			
Wildlife	603	819	1,422
Sport fisheries	1,870	700	2,570
Commercial fisheries	398	132	530
Total	2,871	1,651	4,522

Allocation of Costs

All costs are allocated to wildlife, sport fisheries, and commercial fisheries as shown.

Special Considerations

Many areas in their natural state are controlled by owners of large tracts who have manifested much interest in preserving the land in its natural state. Full utilization of these areas, however, will require that provisions be made to assure public use and ultimate development by local, State, or Federal conservation agencies with a view to maintaining their natural attributes.

Many oysterbed areas now closed due to pollution could be restored when adequate pollution abatement programs are installed.

RECREATION

Location

The recreation program is interwoven in the comprehensive plan of development. It is a major purpose in all of the specific projects involving the storage and regulation of water. The recreation programs in the water-access areas and in the specific multiple-purpose projects have already been described and summarized in the discussion of the Highlands, Horsepasture, Jocassee, Newry-Old Pickens, Chattooga, Tallow Hill, Anthony Shoals, Trotters Shoals, and Lower Savannah.

Plan

The programs, costs, and benefits of all phases of the recreation program, except for the specific projects as listed above, are in this Section of the Report.

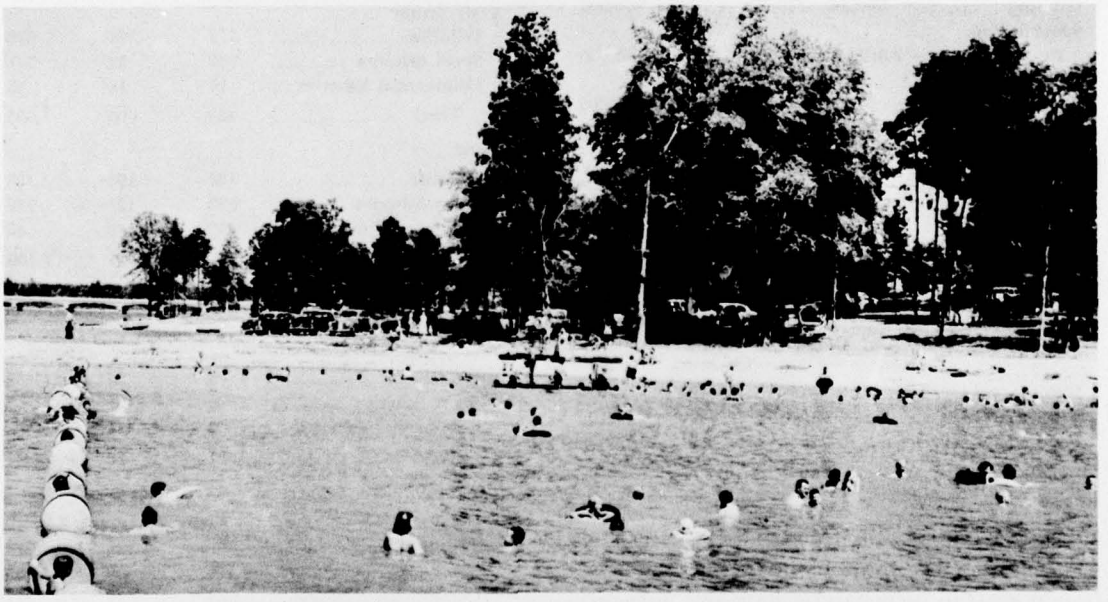

Figure 4.43 *Facilities at Clark Hill Reservoir Accommodate Many Recreationists.*

The high-density recreation area on Tybee Island, Savannah Beach, Georgia, constitutes the one area in the Savannah basin which is intensively developed for recreation use. The availability of salt-water surf bathing is one of the chief recreation assets of Savannah Beach. Future development should keep abreast of the projected population increase. Facilities would be expanded to accommodate 4.5 million user-days by 2000. Additional land and improved access roads, parking, water supply, and sanitary provisions, along with facilities for picnicking and swimming, would be provided.

Two existing general outdoor recreation areas and six new areas in counties not adjacent to major rivers would provide opportunity for future recreation use. The new areas are not specifically located but would best be in areas where opportunity is not now provided. The areas and information listed below are illustrative of what is considered to be reasonable for such development.

Victoria Bryant State Park, near Royston, Georgia, is a 45-acre recreation area. Facilities would be provided to accommodate 100,000 user-days by 2000. Camping, picnicking, and cultural pursuits would be the major activities participated in by the recreationists.

New Savannah Bluff Lock and Dam provides a 48-acre recreation area on the Savannah River about 8 miles south of Augusta, Georgia. Facilities would be provided at this popular picnicking area for 400,000 user-days in 2000.

The six general recreation areas not adjacent to major rivers and lakes would be developed in Warren, Banks, Franklin, and Stephens Counties in Georgia, and Abbeville and Anderson Counties in South Carolina. Facilities would be provided for 900,000 user-days by the year 2000. Location and design details would be determined by local conditions.

There are six natural environment recreation areas with large acreages that are owned and administered by public agencies in the Savannah basin. These areas are: (1) The Chattooga Ranger District of the Chattahoochee National Forest in northeast Georgia; (2) the Long Cane Ranger District of the Sumter National Forest in west-central South Carolina; (3) the Savannah National Wildlife Refuge on the Savannah River, about 10 miles north of Savannah; (4) Tybee National Wildlife Refuge south of Savannah in South Carolina; (5) Clark Hill Reservoir; and (6) Hartwell Reservoir. These areas, for which further development appear to be warranted, are discussed and summarized below. Costs and benefits are illustrative of what is considered to be reasonable for development of the natural environment recreation areas.

The Chattooga Ranger District, near Toccoa, Georgia, is part of the Chattahoochee National Forest. It encompasses 121,200 acres and provided over 100,000 user-days in 1960. Additional facilities are needed in the national forest for camping, hiking, picnicking, swimming, sightseeing, and cultural activities to provide opportunity for 500,000 user-days by the year 2000. Toccoa Falls, although not in the national forest, are representative of natural features which attract people to this area.

The Long Cane Ranger District of the Sumter National Forest includes 111,900 acres of forest land on the South Carolina side of the Savannah River. About 35,000 user-days were accounted for at two recreation areas within the forest in 1959. Additional facilities are needed for camping, picnicking, swimming, and cultural activities to provide for 300,000 user-days by the year 2000.

Savannah National Wildlife Refuge and Tybee National Wildlife Refuge are primarily administered for the preservation and enhancement of fish and wildlife. Extensive developments for recreation would not be beneficial on these 12,800 acres. However, some development for bird watchers would give opportunity to people who pursue these activities. Facilities would be provided for about 25,000 user-days annually by the year 2000.

The multiple-purpose Clark Hill Reservoir is administered by the Corps of Engineers. This large manmade lake has become one of the major recreation resources in the basin. It has facilities for 3.5 million user-days. Additional facilities would be developed for high-density use, general outdoor recreation, and dispersed activities such as boating, so that 5 million user-days could be accommodated annually by the year 2000.

Hartwell Reservoir, administered by the Corps of Engineers primarily for flood control, navigation, hydroelectric power, and recreation, has a present capacity for about 1.5 million user-days. Additional facilities would be developed to provide for 4 million user-days by 2000. Many areas would be developed for high-density use,

as well as for general outdoor recreation use, to accommodate greater opportunity for outdoor recreation.

There are many developed historic and cultural areas in the basin and numerous other undeveloped historic, archeologic, and cultural sites. Additional facilities are proposed for three of the major existing areas, for four undeveloped historic sites, and two undeveloped archeological sites. These sites are illustrative, and costs and benefits are given only to show the magnitude of the areas involved. Subsequent studies may identify similar areas which could be developed.

Alexander H. Stephens Memorial State Park in Crawfordville, Georgia, is a 1,175-acre area with facilities for picnicking, group camping, and a museum. Additional facilities would accommodate 225,000 user-days by the year 2000.

Fort Pulaski National Monument on the Savannah River, about 10 miles south of Savannah, would be developed to provide for 400,000 user-days for 2000.

Nancy Hart State Park near Elberton, Georgia, is the home of the famous Revolutionary War heroine. Facilities would be provided to accommodate 10,000 user-days by the year 2000.

Two archeological sites have been identified as worthy of preservation and interpretation. Estatoe on the Tugaloo River 2 miles above Panthers Bridge, Stephens County, Georgia, and the Keowee site on Keowee River below Nimmons Bridge, Oconee County, South Carolina, are sites of major Cherokee towns. Facilities for these two sites would provide 100,000 user-days of recreation by the year 2000.

Four historic sites have been identified as worthy of development, if accompanied by interpretive programs. Burt Mansion, Abbeville, South Carolina, is the site of the last Confederate cabinet meeting. Hopewell, 21.3 miles south of Walhalla, South Carolina, is the site where an

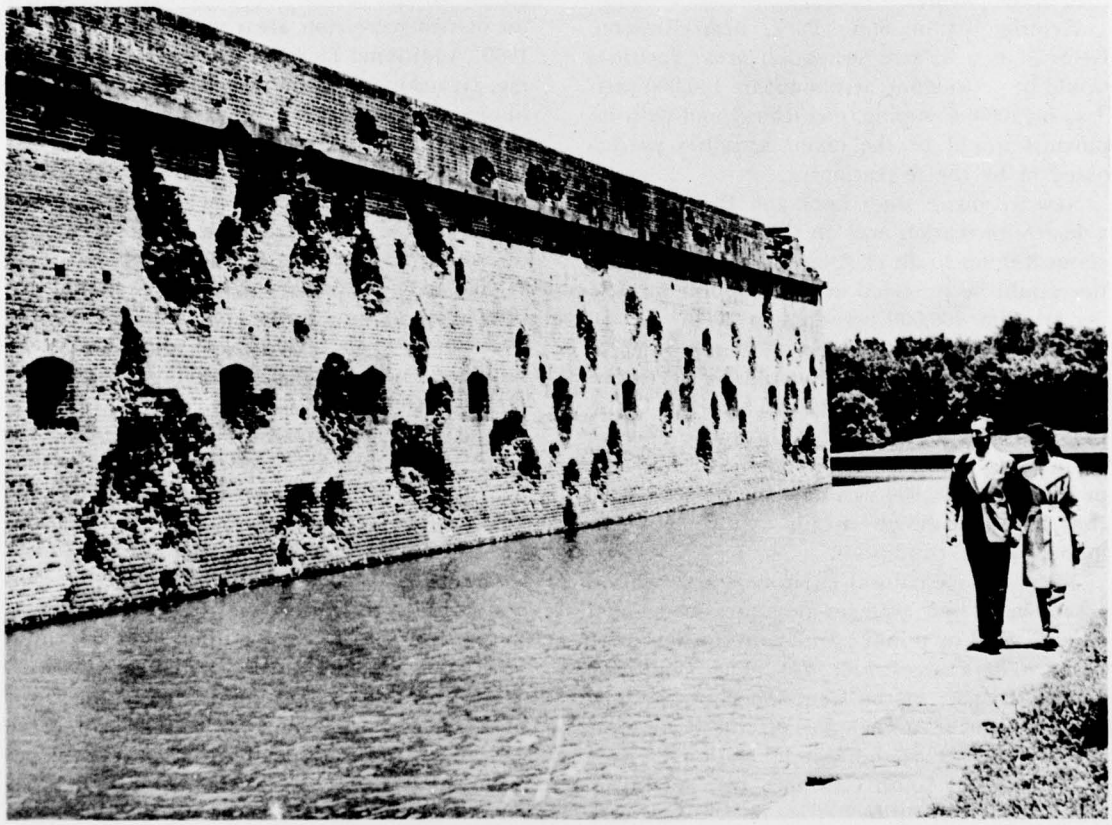

Figure 4.44 *Additional Development at Fort Pulaski National Monument Will Help Meet Recreation Needs.*

Indian treaty was negotiated with the Cherokees in 1795. Old Stone Church, at Clemson, South Carolina, is a well-preserved structure associated with General Andrew Pickens. Long Cave Massacre Site, near Troy, South Carolina, is the site where 23 settlers were massacred in 1760. Facilities would be developed to accommodate 150,000 user-days by 2000.

Data

The proposed level of development at single-purpose recreation areas included in the plan would provide an opportunity for the following estimated use of facilities:

	User-days annually (1,000)		
	1960 Base	By 1975	By 2000
Existing Developments			
Savannah Beach	1,000	1,350	4,500
Victoria Bryant State Park	40	60	100
New Savannah Bluff Lock and Dam	150	200	300
Chattooga Ranger District (USNF) [1]	170	200	500
Long Cane Division (USNF)[1]	50	100	300
Savannah and Tybee National Wildlife Refuges	4	4	25
Clark Hill Reservoir[2]	3,500	4,300	5,000
Hartwell Reservoir[2]	1,500	1,600	4,000
Fort Pulaski National Monument	150	300	400
Alexander H. Stephens State Park	55	100	225
Nancy Hart State Park	1	1	10
Subtotal	6,620	8,215	15,360
New Developments			
Historic sites	—	75	150
Archeological sites	—	50	100
Six county areas	—	460	900
Subtotal	—	585	1,150
Total	6,620	8,800	16,510

NOTES: [1] U. S. National Forest.
[2] These areas include public areas leased for recreation from the U. S. Corps of Engineers.

Benefits

Annual Equivalent Primary Tangible ($1,000)

	Georgia	South Carolina	Total*
Expansion of existing facilities	6,502	4,607	6,702
New developments	871	1,001	1,001
Total	7,373	5,608	7,703

Impacts

Impacts of the single-purpose recreation program are discussed in Sections II and III, Part Four.

Costs ($1,000)

	Georgia	South Carolina	Total*
Investment			
Early action			
Existing areas	6,046	3,960	6,520
New areas	2,971	3,650	3,650
Total	9,017	7,610	10,170
Total program			
Existing	26,720	13,310	27,910
New	3,710	4,620	4,620
Total	30,430	17,930	32,530
Annual Equivalent			
Investment	703	487	769
Operation, maintenance, and replacements	1,111	785	1,202
Total	1,814	1,272	1,971
Operation, Maintenance, and Replacements at Year 2000	2,123	1,264	2,259

* State totals are nonadditive. Entire benefits and costs attributable to developments located on State boundaries are included in summaries for both States involved.

Allocation of Costs

All costs are allocated to recreation.

POLLUTION ABATEMENT

Location

The pollution abatement program would be basinwide. A portion of the total program is included in project facilities.

Plan

In addition to the Savannah Pollution Abatement project and the low-flow augmentation provided by the water-storage projects, pro-

grams for pollution abatement consist of new and extended sewerage systems and new or enlarged municipal and industrial waste-treatment facilities.

Data

Projected pollution abatement needs from 1960 to year 2000 are as follows:

Feature	Number*
Total municipal sewerage systems	94
New collection systems	13
Primary plants	15
Secondary plants	53
Primary treatment plants to be converted to secondary plants	8
Sewer extensions	80

* Number of improvements included in plan to meet projected needs to year 2000.

Benefits

Annual Equivalent Primary Tangible

The pollution abatement program is justified primarily on intangibles. Benefits were not evaluated in monetary terms; however, in each situation the most economical proposal that would satisfactorily meet the needs was selected.

Impacts

Although not readily expressed in monetary terms, pollution abatement will also be valuable in protecting health and esthetic values in the basin. See Section III, Part Four, for further discussion.

Costs ($1,000)

	Georgia	South Carolina	Total
Investments (new systems or expansion of sewerage facilities)			
Early action			
Municipal	10,420	15,850	26,270
Industrial	3,220	8,120	11,340
Total	13,640	23,970	37,610
Total			
Municipal	36,180	24,470	60,650
Industrial	14,830	8,200	23,030
Total	51,010	32,670	83,680
Annual Equivalent			
Investment			
Municipal	716	632	1,348
Industrial	204	245	449
Subtotal	920	877	1,797
Operation, maintenance, and replacements			
Municipal	209	175	384
Industrial	237	145	382
Subtotal	446	320	766
Total			
Municipal	925	807	1,732
Industrial	441	390	831
Total	1,366	1,197	2,563
Operation, Maintenance, and Replacements at Year 2000			
Municipal	422	275	697
Industrial	483	192	675
Total	905	467	1,372

Allocation of Costs

All costs are allocated to pollution abatement.

PUBLIC HEALTH

Location

Public health programs are basinwide.

Plan

Programs include measures for vector control, solid-waste collection and disposal, and air pollution and radiation monitoring. For vector control and radiation monitoring, the plan assumes a continuation and expansion of existing programs. The small investment costs involved are reflected in the annual equivalent costs. Costs for sanitary landfill are treated in the same manner, with investment in the land and equipment required for disposal and landfill operations accounted for only in annual equivalent costs.

Data

Solid-waste disposal	
Incinerators	1
Number of sanitary landfill operations	72
Annual operations	
Vector control	Basinwide
Air pollution and radiation monitoring	Basinwide

Benefits

Annual Equivalent Primary Tangible

Benefits from the public health programs are not expressed in monetary terms. These items are justified on the basis of intangibles.

Impacts

Vector control will not only guard against the spread of vector-borne diseases but, as in the case of mosquitoes and other swarming and biting insects, it will reduce the psychological and physiological discomforts caused by these pests. Insect pest control deserves high priority in recreation planning. The measures for solid-waste disposal will also have effects far beyond these important public health aspects. By helping to prevent haphazard or uncontrolled waste dumping and burning, these measures would add to well-being and help retain the desirability of the basin. In addition, the land area created by the fill generally has a value in excess of that of the original land involved.

Costs ($1,000)

	Georgia	South Carolina	Total
Investment*			
Early action	---	460	460
Total program	---	460	460
Annual Equivalent			
Investment*	---	12	12
Operation, maintenance, and replacements			
Solid-waste disposal	722	582	1,304
Vector control	145	127	272
Air pollution and radiation monitoring	10	10	20
Total	877	731	1,608
Operation, Maintenance, and Replacements at Year 2000			
Solid-waste disposal	722	655	1,387
Vector control	145	127	272
Air pollution and radiation monitoring	10	10	20
Total	877	802	1,679

*Except for the incinerator cost, investment costs for public health features are assumed to be part of the annual costs. Amounts shown for annual costs are those considered necessary to carry out effective basinwide programs.

Allocation of Costs

All costs are allocated to public health.

SECTION VI – OTHER PROJECTS CONSIDERED

The studies leading to the comprehensive plan for the basin involved consideration of numerous projects not included in the plan and various alternative locations and sites for the projects included in the plan.

Many studies of alternative sites have been made over the years. The report on the Savannah River published in 1944 as House Document 657, 78th Congress, is the basic document on which 11 projects were approved by the Flood Control Act of 1944. Those 11 units included Clark Hill and Hartwell projects already constructed, and War Woman, Sand Bottom, Rogues Ford, Camp Creek, Newry-Old Pickens, Middleton Shoals, Goat Island, Tallow Hill, and Anthony Shoals projects. Twenty-six alternative sites were studied from which the 11 sites were selected. Those selected were found to be economically justified on the basis of benefits and costs estimated at that time.

Since 1944, studies have been made of Goat Island-Carter Island and Trotters Shoals as alternative sites to the approved Goat Island-Middleton Shoals development between Clark Hill and Hartwell projects on the Savannah River. Recent studies show that Trotters Shoals would be better justified than the Goat Island-Carter Island combination and that the Goat Island-Carter Island combination would be better justified than the approved Goat Island-Middleton Shoals plan. Accordingly, the Trotters Shoals site has been included in the plan.

Additional units and alternatives have been studied as a basis for this Report, both on the tributaries above the approved projects and on Brier Creek and Savannah River below the ap-

proved projects. The more significant alternative units studied and the reasons for their exclusion from the plan of development are summarized in the following tabulation. More discussion on alternatives is contained in Appendix 12, Planning.

Name of project not included in plan	Key number on Figure 4.45	Approximate location	Description	Purpose*	Reason for not including in plan
Brier Creek	18	On Brier Creek upstream from U. S. Highway No. 1 crossing, Ga.	Dam and reservoir. Surface area — 4,600 acres; 29,000 acre-ft. storage for flood control	F&W,FC,R	Needs better satisfied by existing streams
Long Cane	15	On Long Cane Creek near Greenwood, S.C.	Dam and reservoir	R,F&W	Needs better satisfied by existing streams
Toxaway	4	On Toxaway River in South Carolina	Dam, reservoir, and powerplant. Reservoir area — 1,650 acres	F&W,R,P	Jocassee reservoir better alternative
Upper Whitewater	2	Above Whitewater Falls in Jackson and Transylvania Counties, N.C.	Dam and reservoir. Powerplant would be located at Jocassee reservoir	P,R,F&W	Not economically justified
Lower Whitewater	5	Oconee County, S.C. Above Lower Whitewater Falls	Dam and reservoir. Powerplant would be located at Lower Whitewater Falls reservoir	P,R,F&W	Purposes other than power served in Highlands project
Chattooga #1	3	Macon and Jackson Counties, N.C.	Dam and reservoir. Powerplant would be located at either War Woman or Chattooga #2 reservoir	P,R,F&W	Purposes other than power served in Highlands project
Chattooga #2	7	Oconee County, S.C., and Rabun County, Ga.	Dam and reservoir. Powerplant would be located at War Woman reservoir	R,P,F&W	Purposes other than power served in Highlands project
Navigation from Savannah River to (1) Tennessee; (2) Chattahoochee; and (3) Coosa Rivers			Numerous locks, high lifts, and existing streams, rivers, and lakes	N	Not economically justified

* FC — Flood control; N — Navigation; P — Hydroelectric power; F&W — Fish and wildlife; R — Recreation.

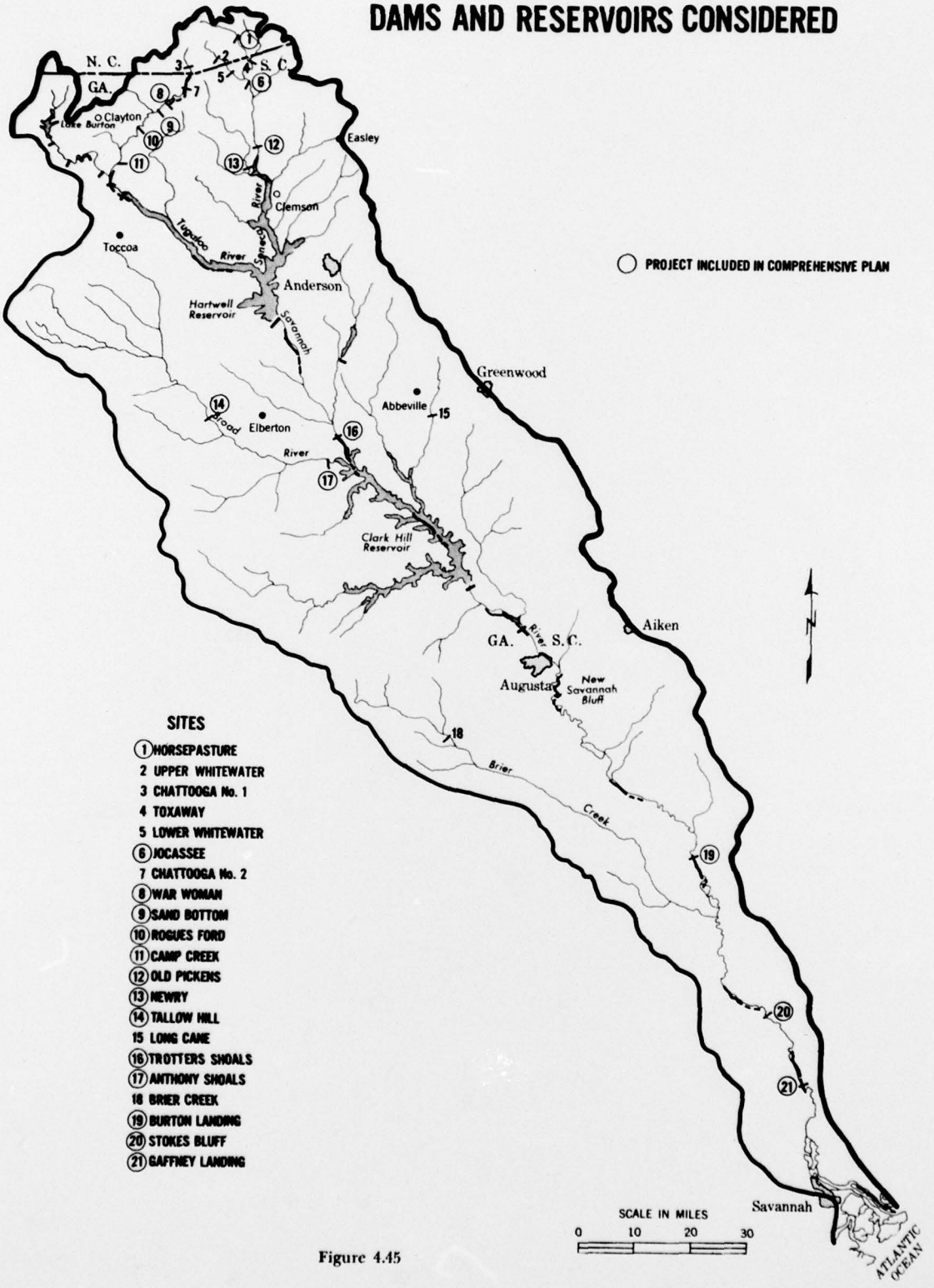
DAMS AND RESERVOIRS CONSIDERED
PROJECT INCLUDED IN COMPREHENSIVE PLAN
N. C.
S. C.
GA.
Clayton
Lake Burton
Easley
Clemson
Toccoa
Tugaloo River
Seneca River
Anderson
Hartwell Reservoir
Savannah River
Greenwood
Abbeville
Elberton
Broad River
Clark Hill Reservoir
Aiken
Augusta
New Savannah Bluff
Brier Creek
Savannah
ATLANTIC OCEAN
SCALE IN MILES
0 10 20 30
SITES
1 HORSEPASTURE
2 UPPER WHITEWATER
3 CHATTOOGA No. 1
4 TOXAWAY
5 LOWER WHITEWATER
6 JOCASSEE
7 CHATTOOGA No. 2
8 WAR WOMAN
9 SAND BOTTOM
10 ROGUES FORD
11 CAMP CREEK
12 OLD PICKENS
13 NEWRY
14 TALLOW HILL
15 LONG CANE
16 TROTTERS SHOALS
17 ANTHONY SHOALS
18 BRIER CREEK
19 BURTON LANDING
20 STOKES BLUFF
21 GAFFNEY LANDING

Figure 4.45

PART FIVE – CONCLUSIONS

DISCUSSION

The future development in the Savannah River basin is closely related to its location, climate, and natural resources which offer unusual opportunities and challenges for land and water resource development. In the broad highlands of the Blue Ridge province the rainfall is high and the runoff from the steep rugged slopes is great. The Piedmont province with lower elevations and rolling terrain provides a number of excellent sites for reservoirs, creating possibilities for hydroelectric power, recreation, fish and wildlife, and other developments. In addition to large reservoir sites there are numerous locations where small to medium sized reservoirs may serve multiple-use needs. In the Coastal Plain the Savannah River has been made navigable from Savannah to Augusta and further improvements are possible for navigation, power, recreation, fish and wildlife, and abatement of pollution problems that have followed the growth of industry in the valley. Extending from the highlands to the seashore, the location and character of resources in the Savannah basin are such that the use and management of land and water in one part often have important consequences for other parts of the basin. Thus, the full potentials of the basin will be realized only through development of carefully integrated plans for use and management of land and water resources.

The land and water resource potentials of the basin have been recognized and significant progress has been made in their development. In the Piedmont, two large reservoirs, Clark Hill and Hartwell, and ten smaller hydroelectric projects have been completed. Clark Hill and Hartwell were planned to serve power, flood control, and navigation needs. Recreation and fish and wildlife have become important purposes. Existing facilities in the Lower Savannah basin include the Port of Savannah, the Atlantic Intracoastal Waterway, and the navigation improvements on the Savannah River to Augusta. In addition to these improvements a very active small watershed program is underway principally in the Piedmont province, but extending into the Blue Ridge and Coastal Plain provinces. This program serves a wide range of conservation purposes and will help to increase agricultural output and efficiency.

These projects and programs and others have set the stage for important agricultural and industrial developments, but there is urgent need for additional development. The present population is expected to double and the per capita income to more than double by the year 2000. These projections reflect not only the potentialities of this basin for social and economic expansion but also the opportunities and necessity for such expansion. Needed future development, including the best use of present programs and projects for land and water resources development, can be achieved through comprehensive planning as indicated in this Report. Prompt action is needed as over one-half of the counties in the Savannah basin have been classified under the area redevelopment program as economically depressed and in need of assistance through area development efforts. Average per capita income is lower in the Savannah basin than the average for the Southeast River Basins study area and the United States. Out-migration has been commonplace. There are many untrained workers particularly in the Coastal Plain area where about one-half of the population is Negro.

In reviewing the specific conclusions of the plan, it is essential to keep in mind that each part of the plan has been shaped by its relation to other parts and that the overall objective of the plan is to attain the maximum contribution from the land and water resources to the present and future development of the area, region, and the Nation.

CONCLUSIONS

(1) The development of the land and water resources of the Savannah basin to meet the needs to the year 2000 can be accomplished by coordinated non-Federal and Federal endeavor. Opportunities for expanding development to meet much greater needs will exist far beyond the year 2000.

(2) At the present time, an equivalent of about 4 percent of the gross personal income of the Savannah basin is being used for land and water resource developments within the basin. This rate of expenditure will need to be slightly increased to meet the needs during the first 15 years, but it can be slightly decreased to meet the average needs for the 40-year period from 1960 to 2000.

(3) Development of the plan can be scheduled to meet needs of the basin as they grow from year to year. The more favorable projects, compatible with development of all the resources for future needs, have been scheduled first in the plan. For the Savannah basin, this includes: The Highlands and Horsepasture projects in the Blue Ridge province for recreation, fish and wildlife, and power; the Trotters Shoals project in the Piedmont province for power, recreation, and fish and wildlife; and the Lower Savannah and Savannah Pollution Abatement projects for navigation, power, recreation, fish and wildlife, and pollution abatement in the Coastal Plain province. Development of small watersheds, water-access areas, and about 40 percent of all single-purpose programs can be initiated between 1960 and 1975, along with the larger projects, to meet the immediate needs in the basin.

(4) Lands in project reservoir sites generally are isolated and only partially developed for agricultural use. No towns or cities are located in them and few road relocations will be required. The lands in project reservoir sites should be reserved for development as soon as feasibility studies are completed so that future developments in the specific areas can be kept at a minimum and costly later relocations can be avoided.

(5) Ground and surface waters developed or proposed for development in the comprehensive plan are generally of good quality and sufficient in quantity for all foreseeable uses. Concentrated pumping from ground waters near the coast, if restricted within reasonable limits, will not cause serious salt-water intrusion.

(6) Improvement of waterways and related facilities at the Port of Savannah, on the Atlantic Intracoastal Waterway, and from Savannah to Augusta can be scheduled and accomplished to meet the estimated increases in waterway traffic. Further development of the waterway from Savannah to Augusta is included in the Lower Savannah project for 12-foot navigation which will aid the promotion of additional industrial expansion. During the followup feasibility studies other navigation depths and lock widths should also be considered. Navigation on the Savannah upstream from Augusta would be extremely costly due to topography and existing structures and, accordingly, has not been included in the plan.

(7) Hydroelectric power development included in the 12-reservoir projects of the plan would meet only a portion of the estimated needs to the year 2000 for electric capacity and energy. The remaining needs can be supplied by thermal plants in the basin or in nearby areas. Some of the future capacity requirements probably can be met by pump storage which is made possible by the fact that the larger reservoirs in the plan would join one another.

(8) Industrial development and utilization are key factors in supporting the projected income growth in the basin and will be supported by power, navigation, and development of other land and water resources embodied in the plan. This basin provides attractive areas for new industrial enterprises. Coordinated and integrated development and operation of the entire plan of development is necessary to best support related activities which generally are needed throughout the basin.

(9) Facilities for treating all liquid wastes prior to discharge and programs to prevent overloading of receiving streams are proposed in the plan to protect stream water quality for reuse and to maintain public health standards. Public health and water supply programs in the plan coordinated with pollution abatement are necessary not only to meet existing needs but

to establish a firm basis for future expansion of related resource developments.

(10) Additional hydrologic, topographic, and economic data and analyses are needed for many planning purposes throughout the basin. These data are needed before projects and programs in the plan are studied in greater detail. Hydrologic data at the Horsepasture site, in particular, is needed at an early date.

(11) To be effective, the plan, as a joint local, State, and Federal effort, must be implemented in the form of actual projects and programs. The rights and major responsibilities of the States and local interests in the development of the land and water resources are recognized. A major portion of the new resource development programs and facilities is to be initiated and maintained by non-Federal entities. In most instances, more detailed analyses and evaluations will be necessary before programs and projects are started. Because the plan is based on long-range assumptions and projections, it will need frequent reviews and periodic revisions to insure that it is properly responsive to changing times and conditions.

(12) As population continues to increase throughout the Nation, more people will be looking for a pleasant place to work, live, and eventually retire. Great opportunity presents itself in the Savannah basin for providing pleasant living conditions, adequate services, and attractive recreation, fishing, and hunting areas from the mountains to the coast.

PART SIX – LOCAL, STATE, AND FEDERAL PARTICIPATION AND ASSISTANCE

Acknowledgments

The U. S. Study Commission, Southeast River Basins, gratefully acknowledges the assistance and cooperation of the following:

Alabama

Department of Agriculture; Auburn University; Department of Conservation; State Docks Department; Extension Service; Division of Forestry; Geological Survey; Department of Public Health; Highway Department; State Planning and Industrial Development Board; Department of Labor; Pilotage Commission; Public Service Commission; River Development Board; Soil Conservation Committee; Soil Conservation Districts; and Water Improvement Commission.

Florida

Department of Agriculture; Board of Conservation; Development Commission; Extension Service; Florida State University; University of Florida; Forest Service; Game and Fresh Water Fish Commission; State Board of Health; Industrial Commission; Inland Navigation District; Board of State Parks and Historical Monuments; Railroad and Public Utilities Commission; Road Department; Soil Conservation Board; Soil Conservation Districts; and Suwannee River Water Conservation Authority.

Georgia

Department of Agriculture; Bainbridge Port Authority; Brunswick Port Authority; Extension Service; Foresty Commission; Game and Fish Commission; University of Georgia; Georgia Institute of Technology; Georgia State College; Georgia Southern College; Department of Public Health; Highway Department; Department of Industry and Trade; Jekyll Island State Park Authority; Department of Labor; Department of Mines, Mining, and Geology; Department of State Parks; Georgia Ports Authority; Public Service Commission; Savannah District Authority; Soil and Water Conservation Committee; Soil and Water Conservation Districts; Tidewater Commission; Waterways Commission; Water Quality Council; and Water Resources Commission.

North Carolina

Extension Service; State Board of Conservation and Development; Highway Department; North Carolina State College; Western North Carolina Regional Planning Commission; Soil Conservation Committee; Department of Water Resources; Soil Conservation Districts; and Wildlife Resources Commission.

South Carolina

Department of Agriculture; Clemson College; Development Board; Extension Service; Foresty Commission; State Board of Health; Department of Labor; Congaree Navigational Study Committee; Parks Commission; Ports Authority; Public Service Authority; Public Service Commission; Soil Conservation Committee; Committee for Water Development; Soil Conservation Districts; Water Pollution Control Authority; and Wildlife Resources Department.

General

Altamaha Development Association; Middle Chattahoochee Development Association; Upper Chattahoochee Development Association; Choctawhatchee-Pea Development Association; Council of State Governments; Southern Regional Education Board; Southeastern Power Committee of Electric Membership Cooperatives of Nine Southeastern States; and Three Rivers Development Association.

Federal

U. S. Department of Agriculture—Agricultural Marketing Service, Agricultural Research Service, Agricultural Stabilization and Conservation Service, Economic Research Service, Farmers Home Administration, Forest Service, and Soil Conservation Service; U. S. Department of the Army—Beach Erosion Board, Board of Engineers for Rivers and Harbors, Corps of Engineers, and Military Posts; Atomic Energy Commission;

Atlanta Federal Reserve Bank; U. S. Civil Service Commission; U. S. Department of Commerce – Area Redevelopment Administration, Business and Defense Services Administration, Bureau of the Census, Office of Business Economics, Bureau of Public Roads, Small Business Administration, and Weather Bureau; Federal Power Commission; General Services Administration; U. S. Department of Health, Education, and Welfare–Public Health Service; Housing and Home Finance Agency; U. S. Department of the Interior–Bureau of Commercial Fisheries, Geological Survey, Bureau of Mines, National Park Service, Bureau of Reclamation, Bureau of Outdoor Recreation, Southeastern Power Administration, and Bureau of Sport Fisheries and Wildlife; U. S. Department of Labor–Bureau of Labor Statistics; U. S. Department of the Navy –Sixth Marine Corps Reserve and Recruitment District; Executive Office of the President–Bureau of the Budget, and Public Works Planning; Outdoor Recreation Resources Review Commission; Advisory Commission on Intergovernmental Relations; Select Committee on National Water Resources, U. S. Senate, 86th Congress; Smithsonian Institution; U. S. Study Commission–Texas; and Tennessee Valley Authority.

In addition, the Commission gratefully acknowledges assistance received from numerous county and municipal governments, planning commissions, development commissions, chambers of commerce, corporations, trade associations, interested individuals, press, radio, television, and professional societies.

Public Hearings and Presentations

A series of public hearings were held early in the investigation to secure the views and desires of various interests, organizations, and individuals. These hearings were held at Tallahassee, Florida, on November 16, 1959; at Dothan, Alabama, on November 17, 1959; at Macon, Georgia, on November 18, 1959; and at Anderson, South Carolina, on November 19, 1959.

During the latter stage of the studies, a series of public presentations were held to acquaint the public with the proposed plan of the Commission for development of the land and water resources of the Southeast River Basins; to inform Federal, State, local, and private interests of their responsibility in implementing the developments proposed; and to solicit views and opinions on the proposals under active consideration. These presentations were held as follows:

Place	Date
Statesboro, Georgia	March 20, 1962
Waycross, Georgia	March 23, 1962
Tallahassee, Florida	May 15, 1962
White Springs, Florida	May 17, 1962
Valdosta, Georgia	May 18, 1962
Geneva, Alabama	June 19, 1962
Pensacola, Florida	June 20, 1962
Savannah, Georgia	July 16, 1962
Clemson, South Carolina	July 17, 1962
Atlanta, Georgia	August 13, 1962
Columbus, Georgia	August 14, 1962
Albany, Georgia	August 14, 1962
Baxley, Georgia	August 15, 1962
Macon, Georgia	August 16, 1962
Athens, Georgia	August 17, 1962

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