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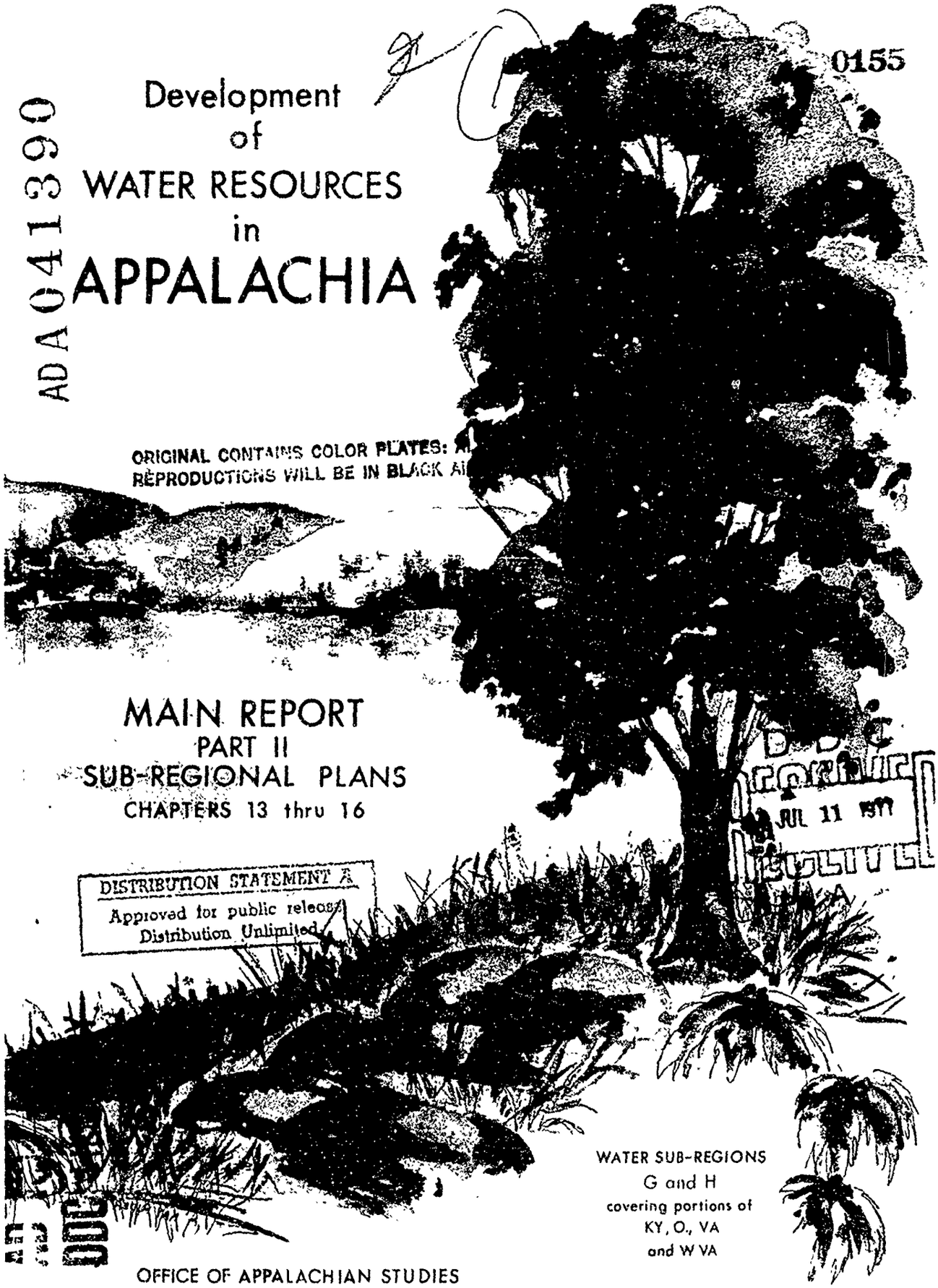

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PART II
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CHAPTERS 13 thru 16

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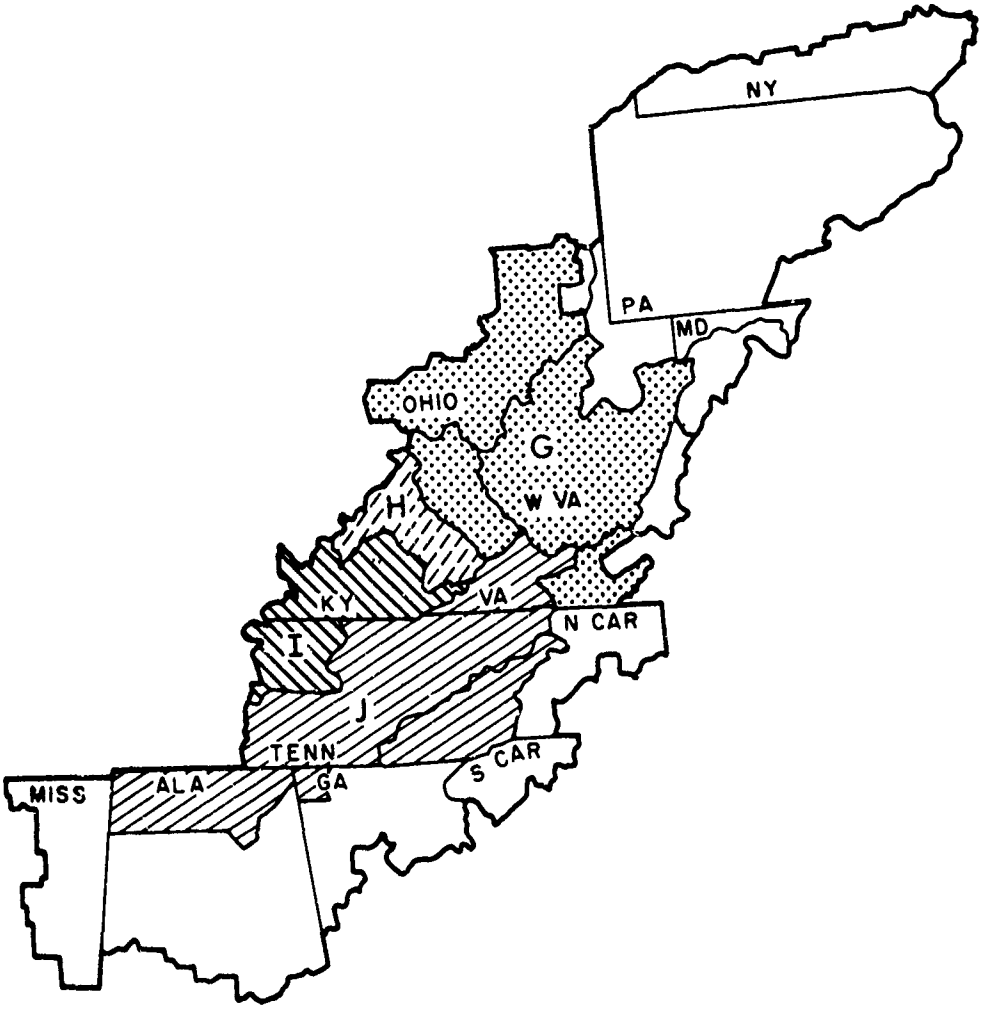
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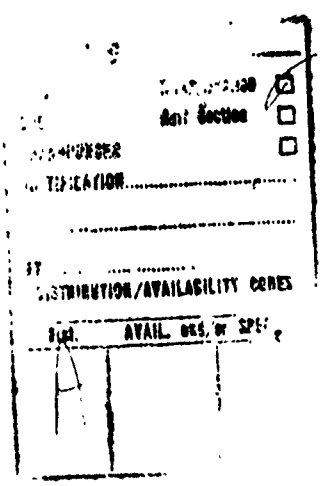
This volume ~~(Number 3)~~ is one of three that comprise Part II, "Sub-Regional Plans," to the Main Report for Development of Water Resources in Appalachia. The volume contains the last eight chapters of the 20 chapters that make up Part II. Chapters 13 and 14 present information on Sub-Region "G" in southeastern Ohio, West Virginia and eastern Kentucky. Chapters 15 and 16 cover Sub-Region "H" in central southeastern Kentucky. Chapters 17 and 18, Sub-Region "I" cover the remainder of southeastern Kentucky and a portion of northcentral Tennessee. Chapters 19 and 20 present information on Sub-Region "J" in eastern Tennessee, western Virginia, western North Carolina, northern Alabama and three counties in northwestern Georgia.

The first chapter of each pair presents physical and economic conditions in the sub-region today as well as estimates of the potential for future development and the role water may play. The second chapter contains a definition of the water related needs and the evolution of a water resources plan of development to meet those needs. The plan presented generally contains both structural and non-structural elements as well as future studies that will be required after anticipated growth trends begin to be realized.

The Summary Report (Part I, Volume 1) should be consulted for recommendations made concerning specific elements in the water resources plan presented in the even numbered chapters in this volume. A volume index for the Main Report and its nine supporting Appendices is included on the next two pages for your convenience.



JOHN C. H. LEE, JR.
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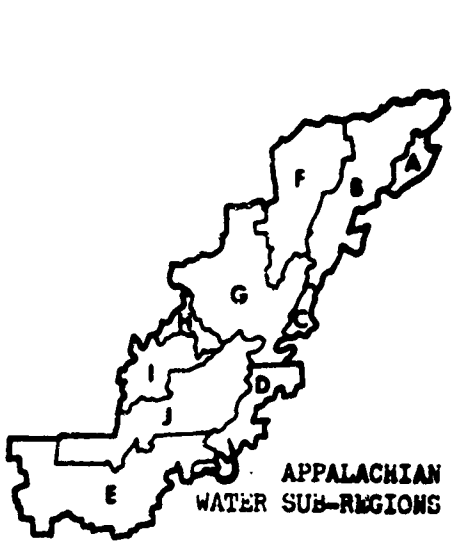

APPALACHIAN WATER SUB-REGIONS

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2	I	-	Key Map Folio (By States)
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REPORT
For
DEVELOPMENT FOR WATER
RESOURCES IN APPALACHIA

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18	C	The Incidence and Formation of Mine Drainage Pollution
19	D	Water Supply and Water Pollution Control
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PREFACE

RELATION OF PART II (VOLUMES 3, 4 and 5) TO OTHER REPORT COMPONENTS

The principal planning and economic aspects of this study are found in the first four parts of the Main Report and throughout a number of appendices. Part I, "Summary Report," presents the overall development plan of the Appalachian Region as a whole and outlines the specific courses of action required to attain it. Part II (this Part) provides a detailed analysis, in two chapters per water sub-region, of the facts and their weighting that led to development of the plan.

Part III, "Project Analyses," presents detailed information on each recommended project concerning hydrologic, hydraulic, structural characteristics and costs as well as benefits, cost allocations and apportionment.

Specific methodology for measuring the impact of public water resource investments is contained in Part IV, "Planning Concepts and Methods." In Part IV some of the methods and techniques used in plan development are discussed in terms of the research undertaken by the Office of Appalachian Studies to assist in better analysis of the effects of public investment in water resources.

In summary, Part II furnishes the basic economic and physical data used in the planning process and tells how they are combined to arrive at the basis for planning decisions. In this Part the physical characteristics (in terms of engineering concepts) and the economic conditions of the sub-regions are reviewed and estimates made of the potentials for development and the role water may hold. This process leads to a statement of the needs which spring from development of the regional potential, and which the sub-regional plan may fulfill.

SOURCES OF DATA

Sources of data are mentioned throughout the report but it is appropriate to mention several principal sources here. The state development plans in many instances proved the best source of data on current state economic objectives for each region and sub-region. The Appalachian Regional Commission has summarized these plans. Their summary, State and Regional Development Plans in Appalachia, 1968 (December 1967), serves as a guide to the State reports but is not a substitute for them. The Appalachian Data Book, June 1967, also by the Appalachian Regional Commission, is a convenient source for basic economic and social data organized for the 63 State Planning Sub-Regions. The Appalachian Industry Location Studies Program, which was undertaken by Fantus Area

Research for the Appalachian Regional Commission, has furnished much information on twenty-five industries expected to have a significant potential for growth in the region and for which often multiple location opportunities are present. The Preliminary Analysis for Economic Development Plan produced by Litton Industries for the Commission also was used as a source material.

The planning process, as carried out by the action offices, produced the physical data and a wealth of economic data which, together with the field surveys undertaken directly by the Office of Appalachian Studies, became a basic source for this Part.

(2)

~~REPORT FOR~~ DEVELOPMENT

OF

WATER RESOURCES IN APPALACHIA.

Main Report.

Part II. Volume 5a.

~~PART II~~ - SUB-REGIONAL PLANS.

VOLUME 5 Chapters 13 thru 16.

CHAPTERS:

(11) Nov 69

13 and 14 - SUB-REGION "G" - OHIO, WEST VIRGINIA AND KENTUCKY

15 and 16 - SUB-REGION "H" - KENTUCKY

17 and 18 - SUB-REGION "I" - KENTUCKY AND TENNESSEE

19 and 20 - SUB-REGION "J" - VIRGINIA, NORTH CAROLINA, TENNESSEE, GEORGIA, AND ALABAMA

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APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 13 - WATER SUB-REGION G TODAY

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CHAPTER 13 - WATER SUB-REGION G TODAY

SECTION I - THE REGION TODAY

1. POLITICAL

There are 81 counties in Sub-region G of which 26 are in Ohio, 34 are in West Virginia, 8 in Virginia, and 13 in Kentucky (See Figure 13-1). The two largest cities, which are substantially larger than any others, are Charleston and Huntington, West Virginia, with 1966 populations of 96,000 and 90,000 respectively; the sub-region is essentially the same as the Appalachian portion of the U.S. Army Engineer's Huntington, West Virginia District. Since the sub-region is large and served by several major river systems, it has been divided into five water areas designated G-1 through G-5, and into 15 state planning sub-regions, for analysis of the economic and water resource problems and possible solutions. The water areas and state planning sub-regions are shown in Figure 13-15, and their general relationships to other planning areas are discussed in Paragraph 4 on Page 13-57.

A number of special political entities have been organized which have water resource development as a major objective. The Ohio River Valley Water Sanitation Commission (ORSANCO), an eight-state compact agency, is actively engaged in coordinating and supplementing efforts in abating and preventing pollution of the member states' rivers. States common to ORSANCO and Sub-region G are Kentucky, Ohio, Virginia and West Virginia.

The Ohio Revised Code permits groups of citizens or political subdivisions to create conservancy districts for the purposes of water management. Many of the districts or subdistricts have been created to administer Public Law 566 projects, making the typical district a small one. The Muskingum, and Hocking Conservancy Districts are larger districts, and include much of the Appalachian area in Ohio. The Scioto Conservancy District is now inactive.

The United States Department of Agriculture administers most of its resource-oriented programs and services through memoranda of understanding with state, county, and other legal subdivisions. Technical and financial assistance is also provided through the many state and county agencies and local rural cooperatives having responsibilities in the use, development, and conservation of natural resources. State forestry agencies, in cooperation with the U.S. Forest Service, provide private landowners with technical and professional assistance in the protection, management, and marketing of forest resources.

Of particular significance are the many special purpose and public service districts organized under state law as legal entities of the

state. Included in that group are the soil conservation districts, the watershed districts, and the drainage districts. These districts, locally organized and managed for the purpose of providing leadership and coordinating the efforts of all state and federal conservation districts, include all the agricultural and rural land of the region.

2. PHYSICAL

Topography

Water Area G-1 consists of the southern portion of the Muskingum River Basin, most of the Hocking River Basin, and all of the Shade and Little Muskingum River Basins. Most of the topography is moderately rugged. The major part of the level land is confined to the flood plains.

The dominant natural feature of Water Area G-2 is the Ohio River, which has one-fourth of its 981-mile length in the area. The terrain varies from broad expanses of relatively level land in the western portion to the moderately rugged hills in the east and south. Major streams include the lower reaches of the Kanawha, Guyandotte, Big Sandy, and Scioto Rivers. Many minor tributaries of the Ohio River (White Oak Creek, Ohio Brush Creek, Little Scioto River, Symmes Creek, Raccoon Creek, Twelvepole Creek, Little Sandy River, Tygarts Creek) also drain the area.

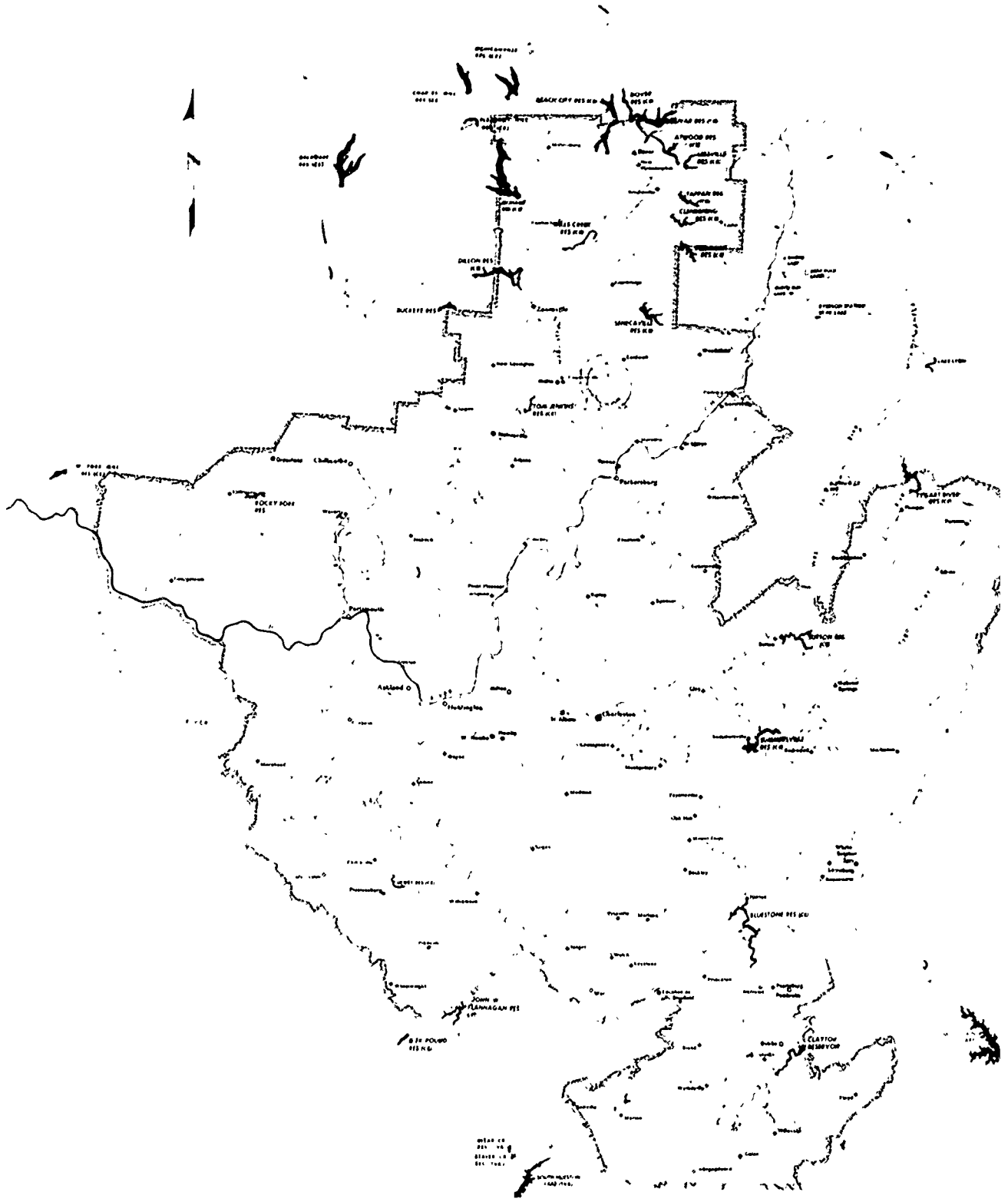
Water Area G-3 is located entirely in western West Virginia. Six of the 11 counties in the area are either bisected by, or adjacent to, a major river. The terrain is moderately rugged except for the broad flood plains of the Kanawha and Ohio Rivers. The Ohio, Kanawha Little Kanawha, Middle Island Creek, and many minor Ohio tributaries drain the region.

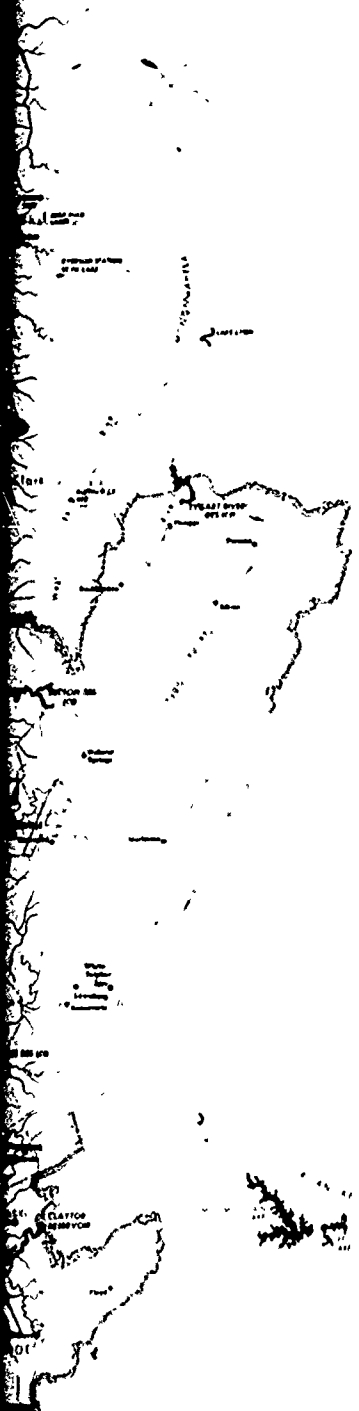
Water Area G-4 is quite rugged. Level land is confined mostly to very narrow stream valleys. The region is drained by the headwaters of the Guyandotte, Big Sandy and Licking Rivers.

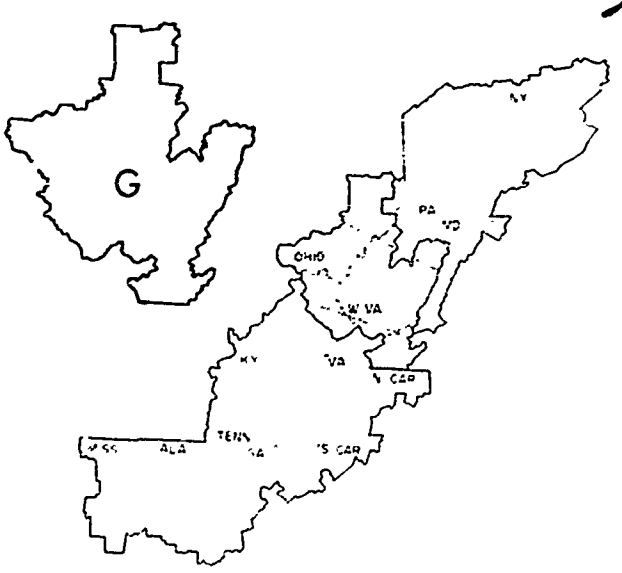
The northern portion of Water Area G-5 is drained by tributaries of the Monongahela River, and the southern portion is drained by tributaries of the Kanawha River, the most prominent are the Gauley, Greenbrier and New Rivers. This particular section is in general extremely rugged and mountainous and contains a sizable amount of relatively moderate terrain and fertile agricultural area in the Greenbrier sub-basin.

Geology

Sub-region G has varying characteristics both topographically and in its physiographical divisions. Portions of five physiographic provinces are contained within the sub-region (See Figure 13-2 on Page 13-5).







VICINITY MAP

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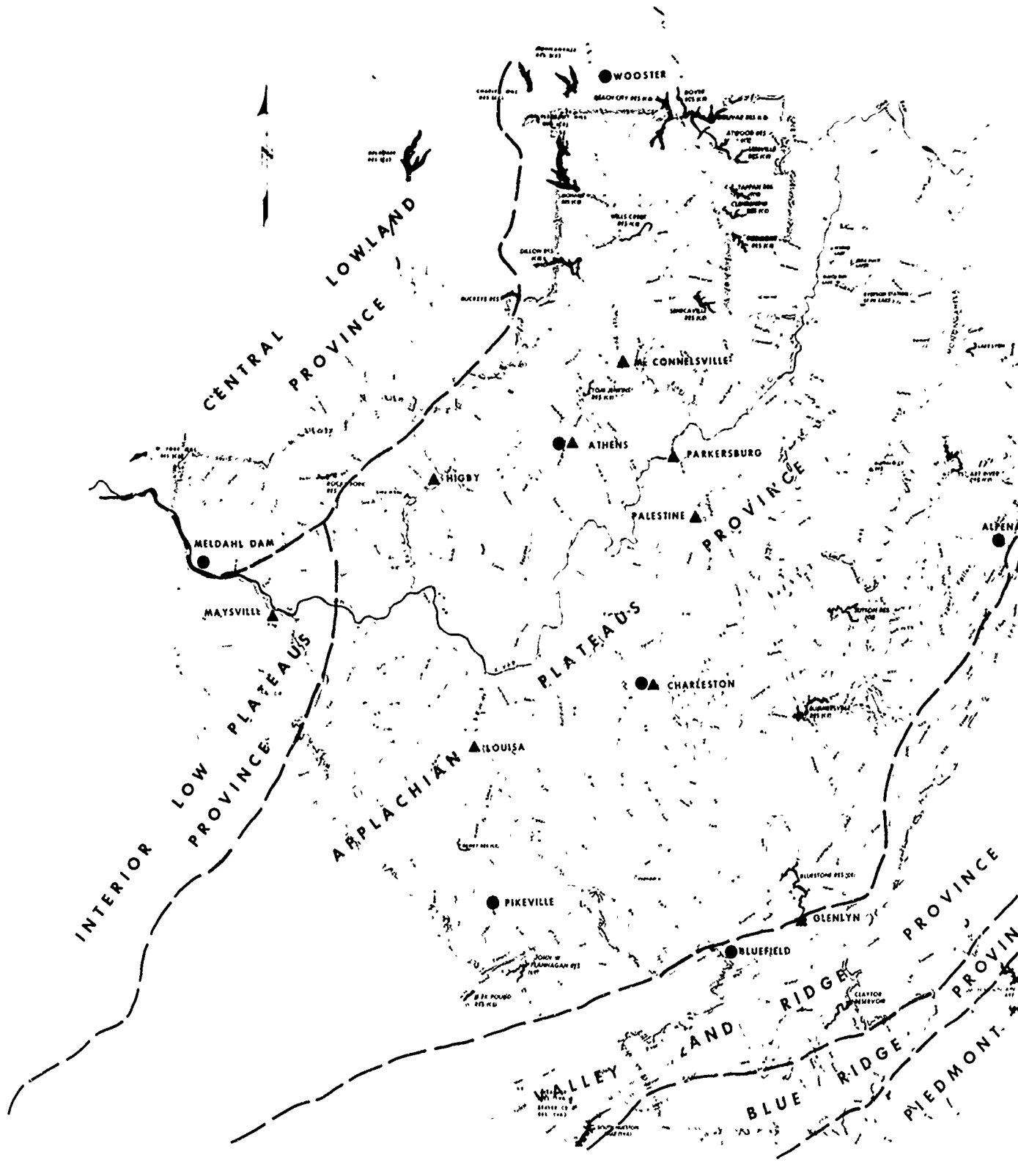
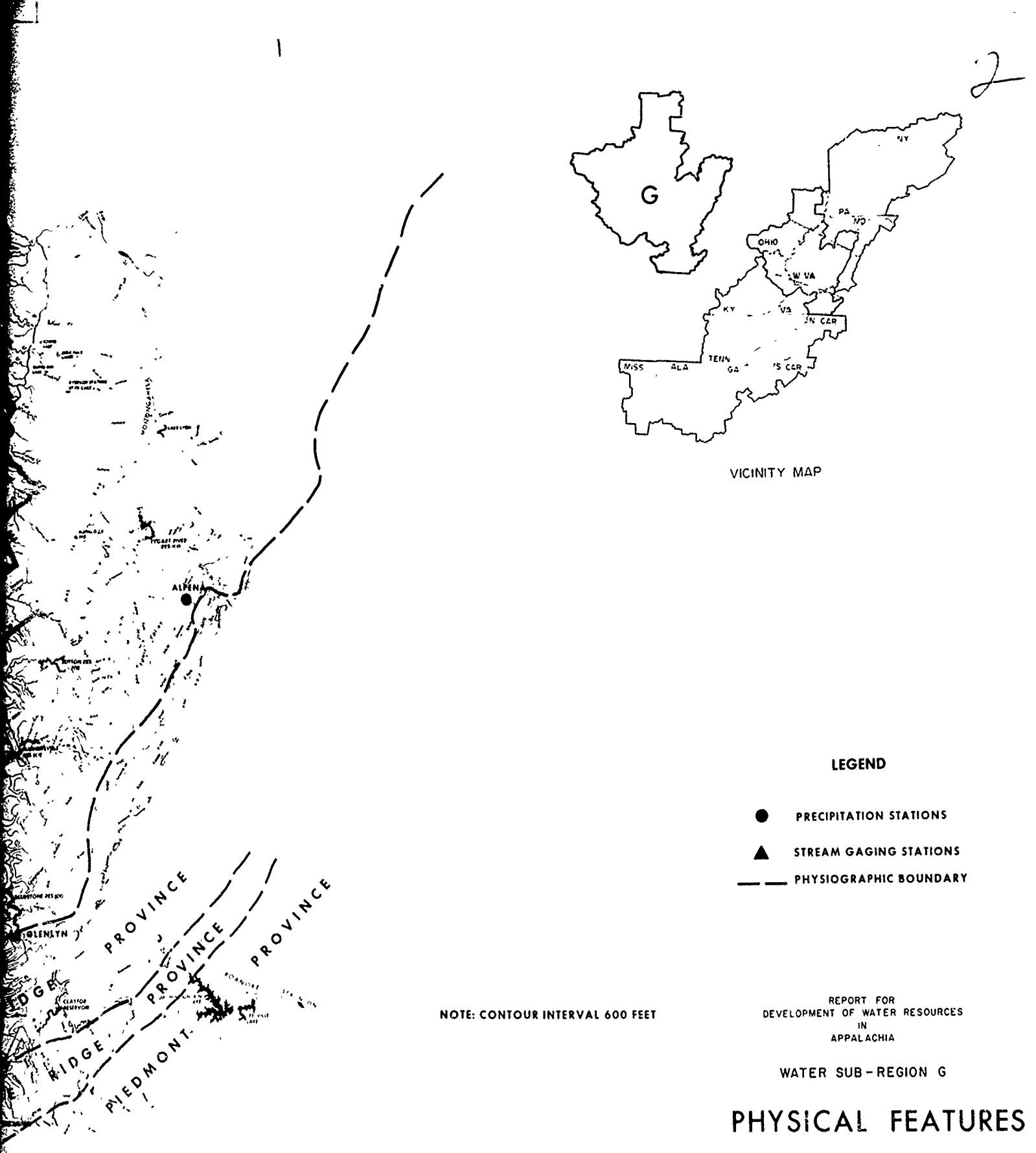
WATER SUB-REGION G

LOCATION MAP

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-3 **FIGURE 13-1**


WOOSTER
CENTRAL LOWLAND PROVINCE
MT CONNELSVILLE
ATHENS
PARKERSBURG
HIGBY
PALESTINE
MELDAHL DAM
MAYSVILLE
INTERIOR LOW PLATEAUS PROVINCE
APPALACHIAN PLATEAUS PROVINCE
CHARLESTON
LOUISA
PIKEVILLE
GLENLYN
BLUEFIELD
VALLEY AND RIDGE PROVINCE
BLUE RIDGE PROVINCE
PIEDMONT



VICINITY MAP

LEGEND

- ● PRECIPITATION STATIONS
- ▲ STREAM GAGING STATIONS
- — — PHYSIOGRAPHIC BOUNDARY

NOTE: CONTOUR INTERVAL 600 FEET

REPORT FOR
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WATER SUB-REGION G

PHYSICAL FEATURES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-5 **FIGURE 13-2**

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The characteristics of these provinces vary from the young glacial plain of the Central Lowland Province in the northwest to subdued mountains of disordered crystalline rocks of the Blue Ridge Province in the southeast.

The central and major portions of the sub-region lie within the Kanawha Section of the Appalachian Plateaus Physiographic Province. This section is characterized as a mature plateau, highly dissected by streams, and with moderate to strong relief. The topography varies in accordance with the physiography.

To the northwest, in the glacial plains, only occasional hummocky deposits and entrenched streams interrupt the nearly level plain.

To the northeast, influenced by glacial deposits, the topography is rugged. Deeply dissected by streams, the area consists of hills and valleys. Broad floodplains are common along the major stream channels in the valleys.

To the southeast the relief becomes greater, and the floodplains less prominent. Folded sedimentary rock and older crystalline rock form the mountainous topography of the extreme southeastern portion. Streams in this section flow in deep, steep-walled valleys accentuating the extremes in topography and relief.

Drainage Pattern

Sub-region G is located entirely within the Ohio River Basin. The major northern tributaries are divided by the Appalachian boundary, resulting in the upstream drainage areas being outside and the downstream portions within Sub-region G. Approximately one-fourth of the Little Miami, one-third of the Scioto, three-fourths of the Hocking, and one-half of the Muskingum Basins are included in the sub-region. To the south, all of the Guyandot Basin; most of the Kanawha Basin; about three-fourths of the Big Sandy and Little Kanawha Basins; and approximately one-fourth (upstream part) of the Licking and Monongahela Basins are contained in the sub-region. Many smaller streams are direct tributaries to the Ohio River. Table 13-1 below includes the drainage areas of the major tributaries affecting Sub-region G.

TABLE 13-1

DRAINAGE AREAS, WATER SUB-REGION G

River System	Drainage Areas (Square Miles) Tributary Total	In Appalachia	In Sub-region G
Little Miami River	1,755	500	500
Scioto River	6,510	2,160	2,160
Hocking River	1,200	910	910
Muskingum River	8,040	4,510	4,400
Licking River	3,670	1,940	910
Big Sandy River	4,290	4,290	3,310
Guyandot River	1,670	1,670	1,670
Kanawha River	12,300	12,110	11,340
Little Kanawha River	2,320	2,320	1,780
Monongahela River	7,400	7,400	2,060

Hydrology and Climatology

Sub-region G lies beyond the immediate climatic effect of the Atlantic Ocean; therefore, its climate is more of the continental type. The most important aspect of the continental type climate is the marked temperature contrast between summer and winter. The sub-region is affected by prevailing westerly winds which are frequently interrupted by northward and southward surges of relatively warm and cold air, respectively. These atmospheric movements are accompanied by the passage of high and low-pressure areas near the average path of the extra-tropical cyclones which move in a general easterly direction across the United States in the colder half of the year. In the warm half-year, the region is affected by showers and thunderstorms that occur in the broad current of air that tends to sweep northeastward from the Gulf of Mexico. Summer is marked by hot and showery weather, with much cooler temperatures in the mountains, which are subjected to more frequent thunderstorms. Thunderstorms occur on an average of 40 to 50 days per year, occurring more frequently in June and July. Violent local winds, accompanying thunderstorms, are experienced about every year; however, tornadoes are rare. Warm-season thunderstorms often yield intense local rainfall and cause flooding of farm lands in the plateau regions and property damage along narrow valleys in the mountainous regions. Winter climate throughout the sub-region is moderately severe with frequent alternations of fair and stormy weather. The southern and southeastern part of the sub-region has been subjected to extremely heavy rainfall occurring when dissipated hurricanes pass through the area. More frequent and severe is the damage from intense large-area storms that originate from exceptionally strong specimens of the ordinary low pressure areas during the colder half of the year. Frozen soils or saturation from previous rain or snow and successive storm waves from a more or less stationary cold front contribute to optimum conditions for the occurrence of cold season floods.

Maximum, minimum, and average monthly temperatures for Pikeville, Kentucky and Zanesville, Ohio, are representative of this sub-region.

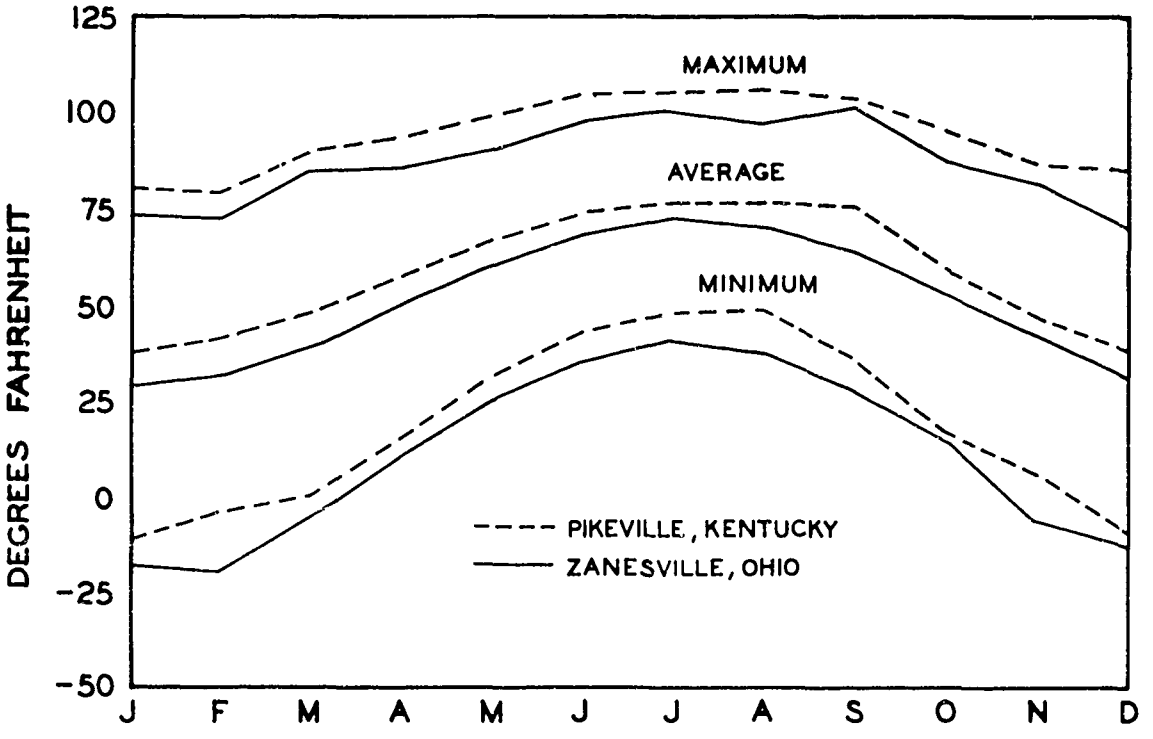


Figure 13-3 Maximum, Minimum and Average Monthly Temperatures for Pikeville, Kentucky and Zanesville, Ohio.

Most of the sub-region has average annual precipitation of 40 to 48 inches, which is considerably above the average of 29 inches for the coterminous United States. The precipitation averages vary from about 36 inches a year in north central Ohio to about 60 inches in east central West Virginia and eastern Kentucky. Average annual snowfall is 14 inches at Pikeville, Kentucky and 24 inches at Ohio Agricultural Research and Development Center, Wooster, Ohio, just north of the sub-region. Typical station records are shown in Figure 13-4. Station locations are shown in Figure 13-2 on Page 13-5.

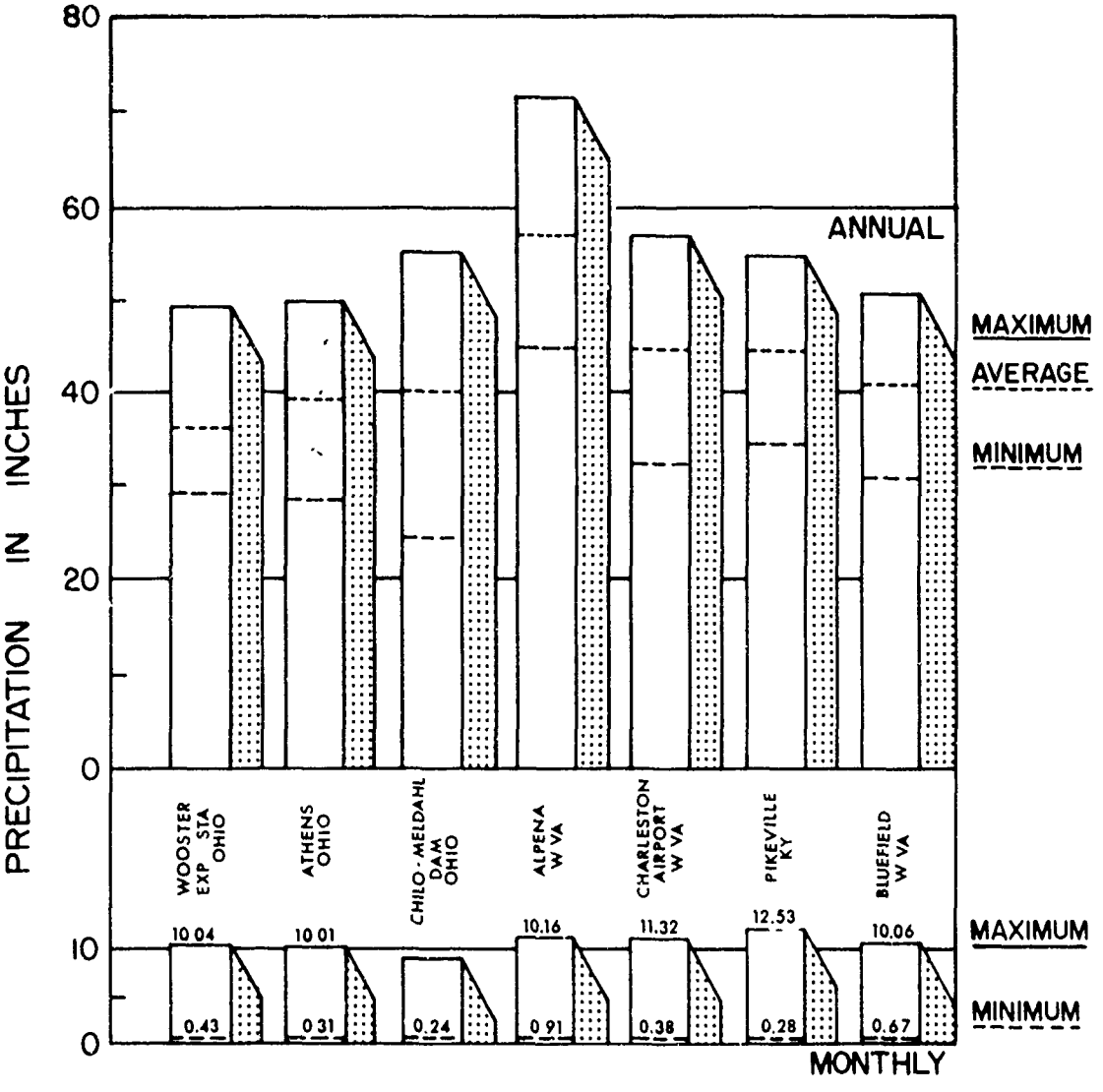


Figure 13-4 Precipitation Data for Selected Stations in Water Sub-region G. (U.S. Weather Bureau)

Average annual runoff over the sub-region is about 18 inches; it varies widely from year to year. One distinct area of high runoff is the mountainous portion of the Gauley River area in the Kanawha River Basin where the average annual runoff exceeds 30 inches. Geology and topography exert strong influences on the variability of daily stream flows in the sub-region. Stream flow data are shown in Table 13-2 for selected streams and stations.

TABLE 13-2
STREAM FLOW DATA

Stream and Station	Period of Record	Drainage Area sq. mi.	Aver. Annual		Annual Runoff Max. of Record		Annual Runoff Min. of Record		Average Runoff Million Gallons Per Day (mgd)
			cfs	Inch	Year	Inch	Year	Inch	
KENTUCKY									
Ohio River Maysville, Ky.	1939-67	70,130	91,000	17.62	1950	25.69	1941	10.31	58,970
Big Sandy River Louisa	1938-67	3,892	4,180	14.59	1950	23.53	1941	5.26	2,710
OHIO									
Scioto River Higby	1930-67	5,131	4,300	11.38	1950	18.72	1954	3.84	2,790
Hocking River Athens	1915-67	944	970	13.96	1920	22.13	1953	6.83	630
Muskingum River McConnelsville	1921-67	7,411	7,150	13.10	1937	20.58	1934	3.67	4,630
VIRGINIA									
New River (Kanawha) Glenlyn	1929-67	3,768	5,000	18.00	1949	26.26	1930	9.78	3,240
WEST VIRGINIA									
Kanawha River Charleston	1939-67	10,419	14,200	18.70	1940	23.96	1957	14.94	9,300
Little Kanawha Rvr. Palestine	1939-67	1,515	2,065	18.81	1967	32.21	1947	9.72	1,350
Ohio River Parkersburg, W.Va	1940-67	35,600	48,400	18.90	1943	26.85	1955	13.05	32,100

Droughts of long duration have occurred in Sub-region G. Regional long-duration droughts occurred in 1932 through 1934 and 1952 through 1954. There was a long period of drought (1964-67) in parts of eastern Kentucky, southeastern Ohio and northwestern West Virginia. Short term droughts have occurred at least one year in three since 1930.

Ground water may be obtained from wells in the consolidated rocks in all counties. (Ground water discharge at about 90 percent stream flow duration is between 0 and 50,000 gallons per day per square mile.) The yield is quite low and unit cost of delivered water would be relatively high in many areas. In other areas, yields are adequate and ground water would be the logical source to develop. (See Appendix H for a detailed report.)

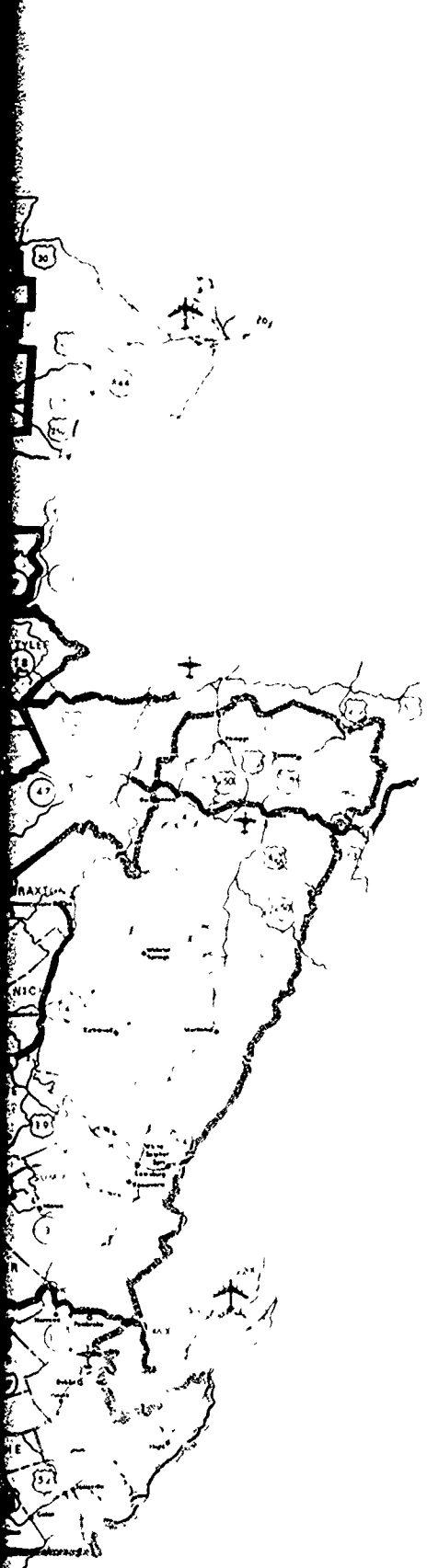
Transportation Facilities

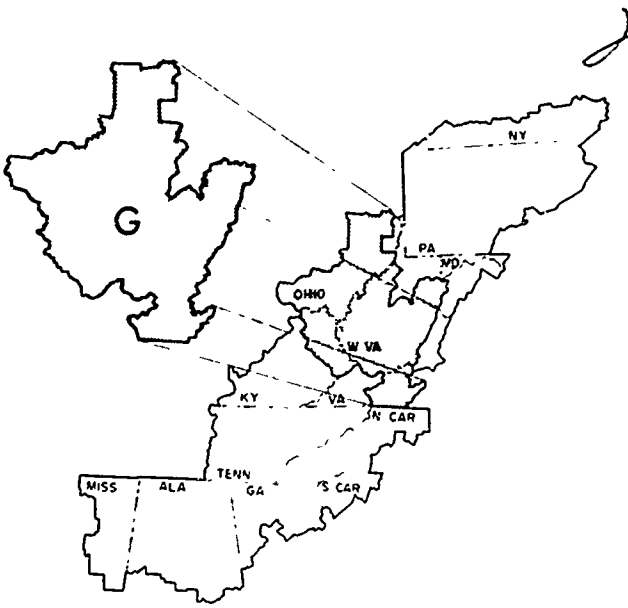
Principal transportation facilities in the sub-region include highways and airports (See Figure 13-5); and railroads and river navigation (See Figure 13-6). An extensive network of Federal, State and local highways comprises the highway transportation system. Because of the rugged topography throughout most of the area, many of the roads are narrow and crooked and tend to restrict traffic movement. Better quality roads exist in that part of Ohio where the terrain is less hilly, and in the wide river valleys. Several interstate routes, when completed through Sub-region G, will provide excellent highway facilities between principal cities within and beyond the area. Interstate 70 crosses the Ohio area from Columbus in the west to Pittsburgh in the east. Interstate 64 connects the Kentucky and West Virginia area, with Lexington and Louisville to the west and Richmond, Virginia to the east. Interstate 81 crosses the Virginia portion in a southwest-northeast direction. Interstate 79 extends from Charleston, West Virginia to Lake Erie. Interstate 77 is a North-South route that passes through the Ohio, West Virginia, and Virginia portions of the sub-region.

A number of the Appalachian Corridors will supplement the Interstate system. Corridors D and H, with connecting links of Interstate 79 and 66, will link Cincinnati to Washington, D.C. Corridors I, Q, and R will cross the southern portion of the sub-region between Winchester, Kentucky, and Christansburg, Virginia. North-South highways include Corridors C and B between Columbus, Ohio and Ashville, North Carolina; Corridor G from Charleston, West Virginia to Pikeville, Kentucky; and Corridor L between Sutton and Beckley, West Virginia.

Commercial air service is available at Zanesville and Portsmouth, Ohio; Huntington, Charleston, Parkersburg, Elkins, Beckley, and Bluefield, West Virginia; and at Pulaski, Virginia. Huntington and Charleston have jet service. The other airports accommodate only propellor-driven and turbo-prop planes. The carriers operating in the area furnish connections to major airports surrounding the sub-region. Additional

N





VICINITY MAP

LEGEND

- Interstate Highway
- Federal Highway
- State Highway
- Appalachian Corridor
- Includes Jet Service
- Scheduled Prop Service

10 5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

HIGHWAYS & AIRPORTS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-13 **FIGURE 13-5**

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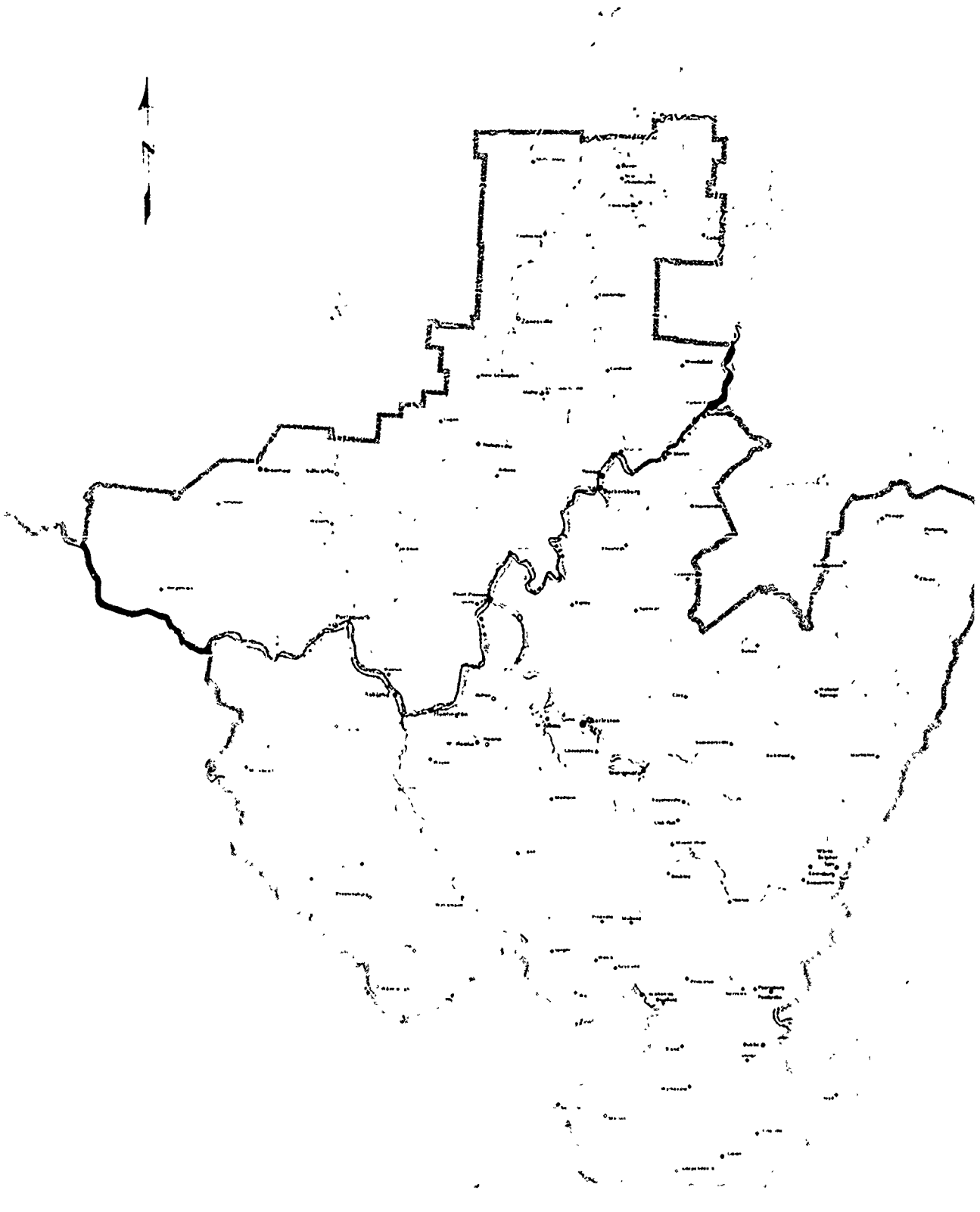

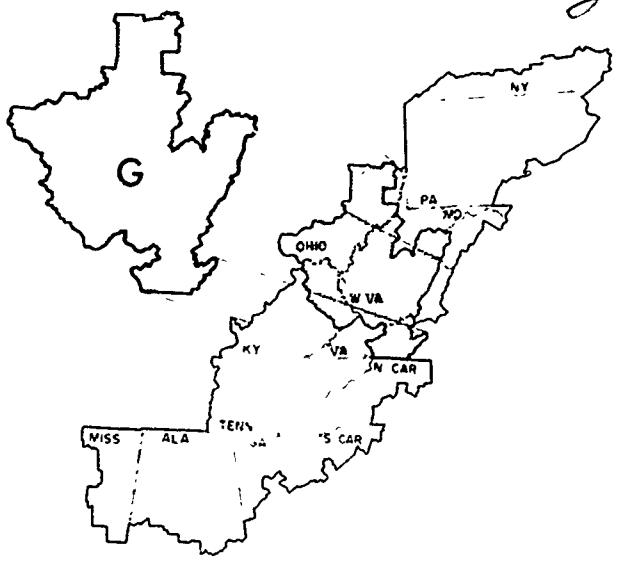

VICINITY MAP

EXISTING NAVIGABLE WATERWAYS

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

RAILROADS & NAVIGATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-15 FIGURE 13-6

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general aviation airports with improved facilities for private, business, and charter service include four in Ohio, two in Kentucky, and three in West Virginia. Several general aviation airports with lesser facilities exist throughout the area.

Sub-region G is so situated with respect to the rail transportational structure of the United States that it is traversed by four of the six major east-west rail lines linking the Atlantic seaboard with the interior, and by two major north-south lines which follow a single corridor. The east-west routes include the Penn Central's New York-Pittsburgh-St. Louis line, which passes through Coshocton, Ohio; the Baltimore and Ohio Railroad's Baltimore-Cincinnati-St. Louis line, which passes through Parkersburg, West Virginia, and Athens and Chillicothe, Ohio; the Chesapeake and Ohio Railway's Newport News-Cincinnati-Chicago line, which passes through Charleston, and Huntington, West Virginia, and Ashland, Kentucky; and the Norfolk and Western Railway's Norfolk-Roanoke-Cincinnati line, which passes through Bluefield and Williamson, West Virginia, and Ironton and Portsmouth, Ohio. A fifth east-west route is the Norfolk and Western's Roanoke-Bristol line, which passes through Pulaski and Wytheville, Virginia. The two north-south lines are the routes of the Norfolk and Western Railway and the Chesapeake and Ohio Railway which pass through Portsmouth and Chillicothe, Ohio. In addition, many branches and main lines of lesser importance serve various parts of Sub-region G.

Commercial navigation on the Muskingum River in Ohio was discontinued in 1953, but the system has been rehabilitated for pleasure boating. The navigation system on the Big Sandy River was abandoned in 1952. One dam is currently used by local interests for recreation and water supply. Navigation on the Little Kanawha River was discontinued in 1951. Two dams have been rebuilt to provide local water supplies.

River navigation systems afford a means of low-cost shipment of bulk cargo into and out of the area. Access is provided to the entire Mississippi River system and the Gulf Intracoastal Waterway. The original Ohio River navigation project was completed in 1929 and provided channel depths of nine feet or greater throughout the 981-mile length from Pittsburgh, Pennsylvania, to Cairo, Illinois. A modernization and replacement program is underway that will ultimately result in a new lock and dam system comprising only 19 structures. A 344-mile reach of the Ohio River, which will include seven of the modern high-lift dams, is located within, or borders, the sub-region. Total shipping has increased from about 20 million tons, in 1929, to over 103 million tons in 1965.

The Kanawha River navigation project was constructed between 1931 and 1937, and provides a channel with minimum depth of nine feet for a distance of 91 miles in central West Virginia. The system consists of three locks and dams on the Kanawha River in conjunction with the

Gallipolis locks and dam project on the Ohio River. Shipping volume amounted to over 13 million tons in 1965.

3. RESOURCES DEVELOPMENT

Human

The first population movement into Water Sub-region G followed the path pioneered by Daniel Boone and his contemporaries along the Wilderness Road and into the Blue Grass Region of Kentucky. Additional movements resulted in settlers migrating down the tributaries of the major streams that drain the area. By the middle of the Revolutionary War, the area, while not densely populated, had attracted many pioneers.

The early settlers in the sub-region were from England or its possessions with a few French Huguenots and Germans interspersed among them.

The second movement began after the Revolutionary War, and resulted in organized settlement of the lands north of the Ohio River. Settlers moved down the river to the growing communities of Pittsburgh, Wheeling, Marietta, and Cincinnati. Practically all the area's movement of goods and people was along the navigable waterways.

A constant stream of immigrants, primarily from western Europe swelled the population of the growing communities. The expansion continued, until the 1920's. Small population increases during World War II were offset by increased out-migration during the 1950's.

The 1960 population of the sub-region was 2,676,000; the estimated 1966 population was 2,673,000, a decrease of about 0.1 percent. In 1960 the population of the sub-region was about one-third urban and two-thirds rural, with most of the rural population being non-farm in character. That was almost directly inverse to the national picture as shown in Figure 13-7. Areas of the sub-region are near the industrial areas of Western Pennsylvania - panhandle of West Virginia and Cincinnati, Ohio, which are almost entirely urban. There are no urban areas of 2,500 or more population in twenty-five of the counties. Those entirely rural counties include almost half the sub-region area and have only about one-tenth of the population. The only intensely urban county in the sub-region is Kanawha County, West Virginia, in which only 0.8 percent of the people are engaged in commercial farming.

In 1960 there were about 75 towns in the sub-region with 2,500 or more inhabitants. There were 35 in Ohio, 30 in West Virginia and 5 each in Virginia and Kentucky. Fifteen of the cities (9 in Ohio, 5 in West Virginia and 1 in Kentucky) had over 10,000 people. Four cities (2 in Ohio, 1 in West Virginia and 1 in Kentucky) had over 25,000 people; Charleston and Huntington, West Virginia each had over 80,000 people.

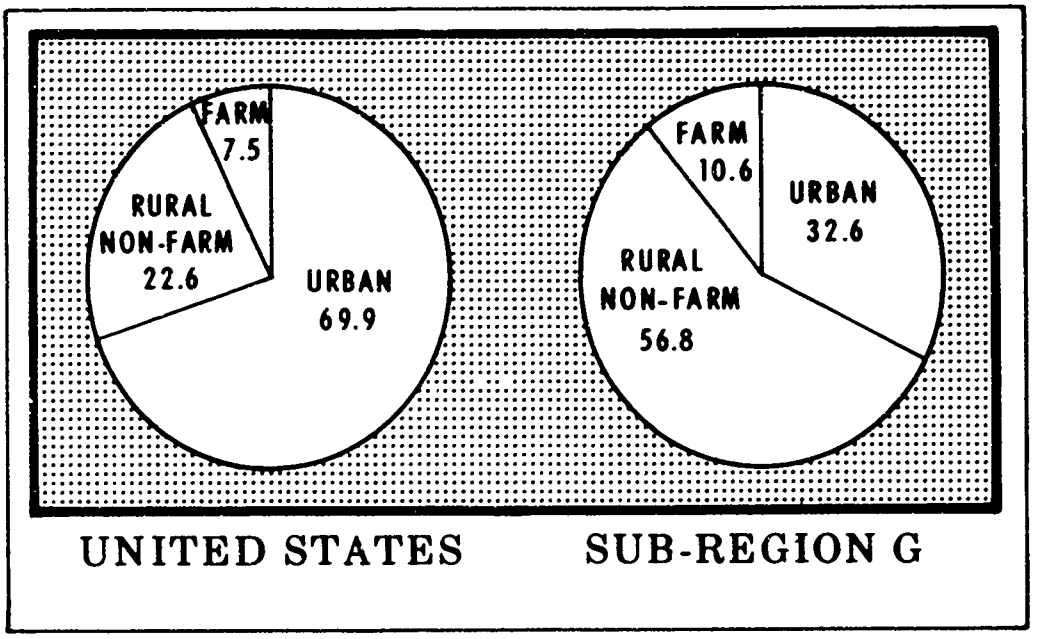


Figure 13-7 Percentage of Urban, Rural Non-farm and Farm Population in Water Sub-region G compared to the United States, 1960.

Figure 13-8 shows the population of that portion of West Virginia, Ohio, Kentucky and Virginia within Sub-region G, broken down by age groups and by sex. There are proportionally about 10 percent more people under age twenty in the sub-region than in the whole of the nation. There are about 8 percent fewer people age 20-64 and 2 percent fewer over age 64 than that of a representative national group. The comparative total number of males and females is about the same as the nation.

Educational levels in the 81 county area are compared to national averages in Figure 13-9.

The sub-region is generally representative of the portions of each of the four states with education attainment levels uniformly below national averages. The greatest needs are for increased high school or technical school vocational training. All states are expanding such programs. It appears, also, that there is a need for more trained professionals to assist in industrial expansion of the area. Increased numbers of two-year colleges are needed througout the sub-region.

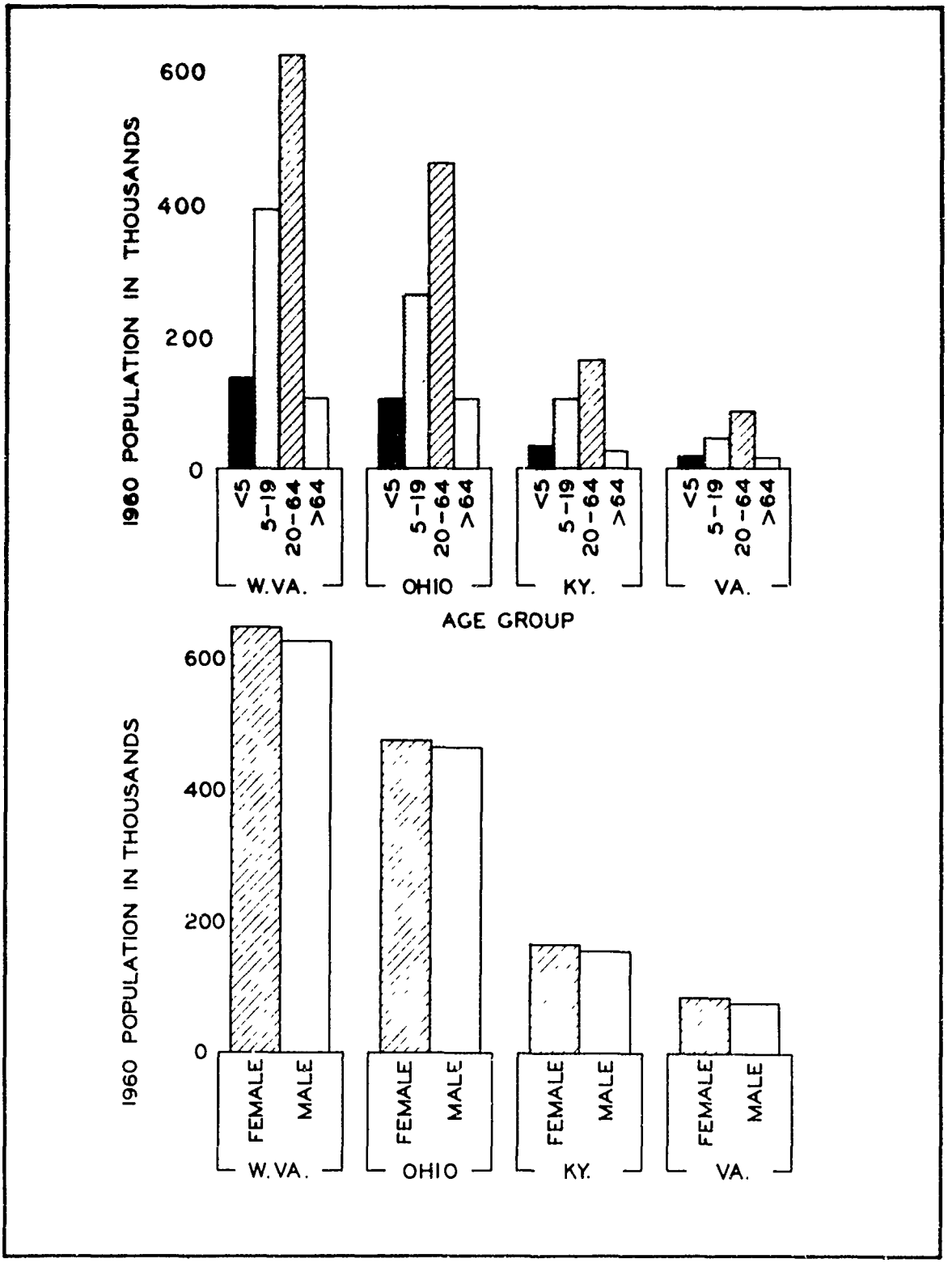


FIGURE 13-8 POPULATION DISTRIBUTION BY AGE GROUP AND BY SEX, 1960.

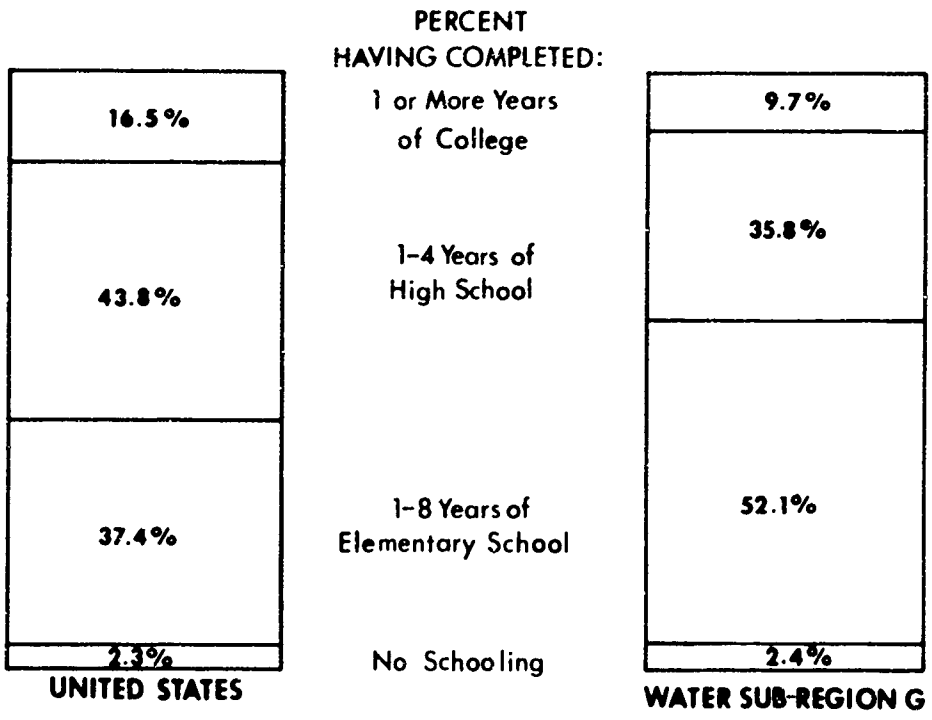


Figure 13-9 Educational Attainment in Water Sub-region G compared to the United States.

Institutions of higher learning are distributed throughout the sub-region and their locations, by counties, are shown on Figure 13-10. A number of hospitals offer advanced medical training. Vocational schools provide a level of education to prepare para-professional people to support and work with professional and skilled people. Extension centers are located in other communities and additional programs are established often in conjunction with the high schools. Additional vocational facilities are being installed and planned in all four states in the sub-region. Educational television is being implemented in eastern Kentucky and is being considered in other areas.

College enrollment in the sub-region is about 30,000 and expanding rapidly. Technical schools beyond high school level are training or retraining more people every year.

Minerals

Historic Development

Of all minerals in Water Sub-region G, coal ranks most significant in terms of the total value of mineral production. Early in the 20th Century, the expanding national economy required ever larger amounts of energy to run its factories. Railroads were pushed into the mountains of Water Sub-region G, and soon the mining of coal became the major activity of the areas. The use of coal as a primary source of engergy brought tremendous growth in mining employment.

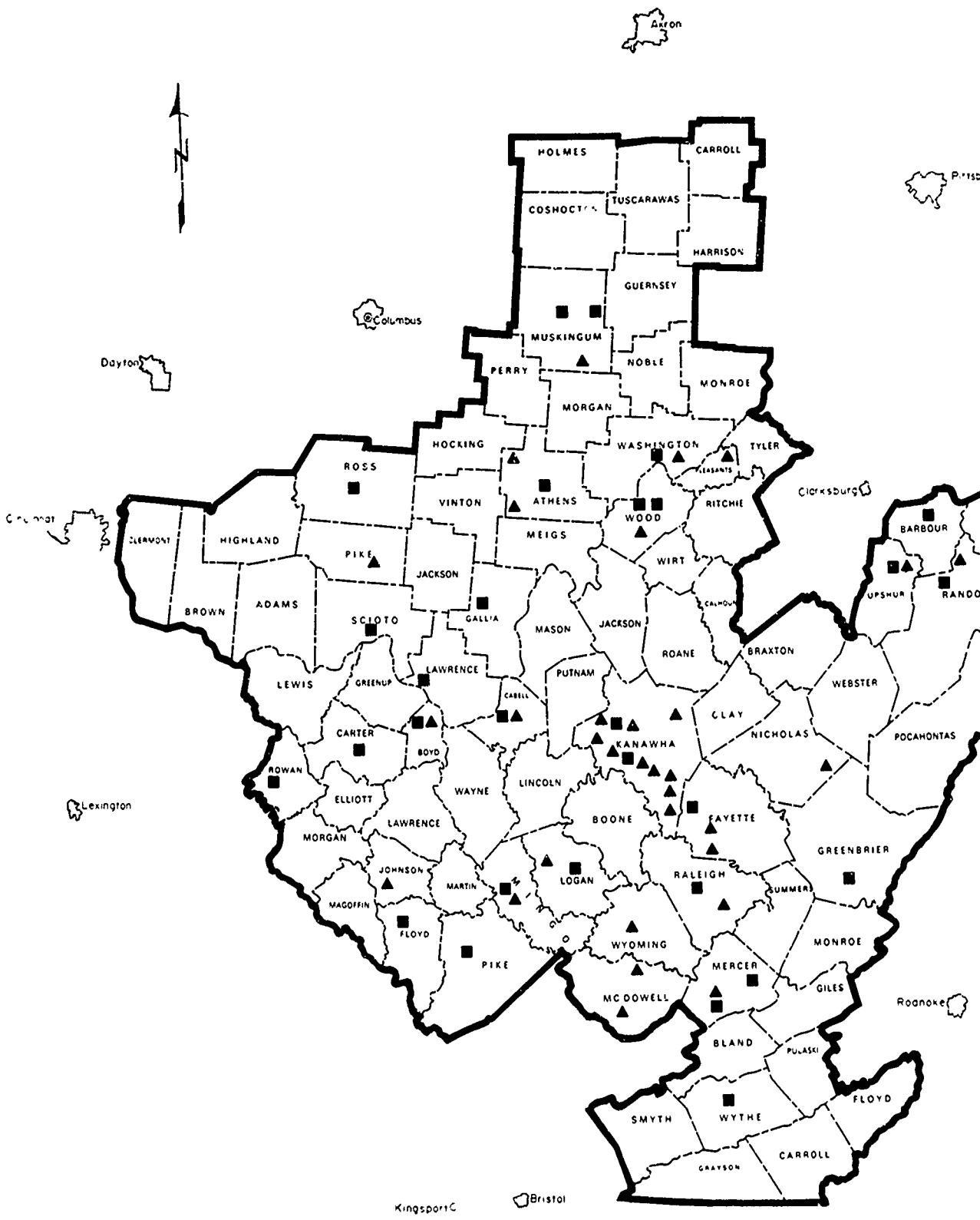
By the end of World War II, inroads from competing forms of energy decreased the traditional markets for coal. The transition from coal fired steam to diesel electric locomotives reflected a wide range of improvements in the cost structure of railroads. Energy costs were only one factor. Other influences on operating efficiency (principally reduced maintenance costs) dominated the decision.

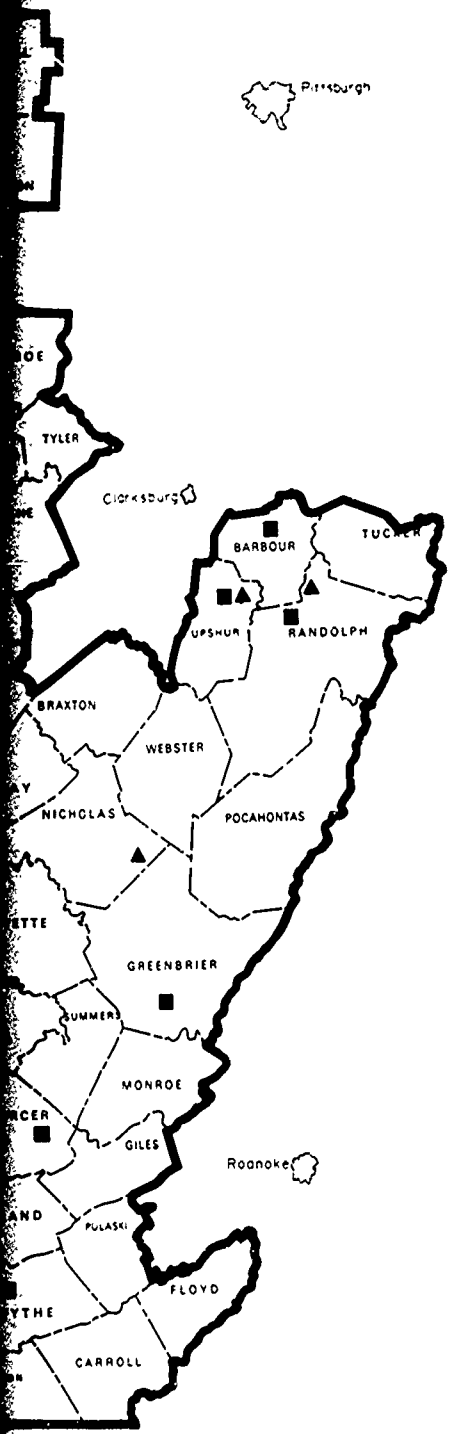
The effects of technological improvements in coal mining acted both to improve the competitive position of coal as a source of energy and to sharply reduce the number of employees required to meet the demand for coal.

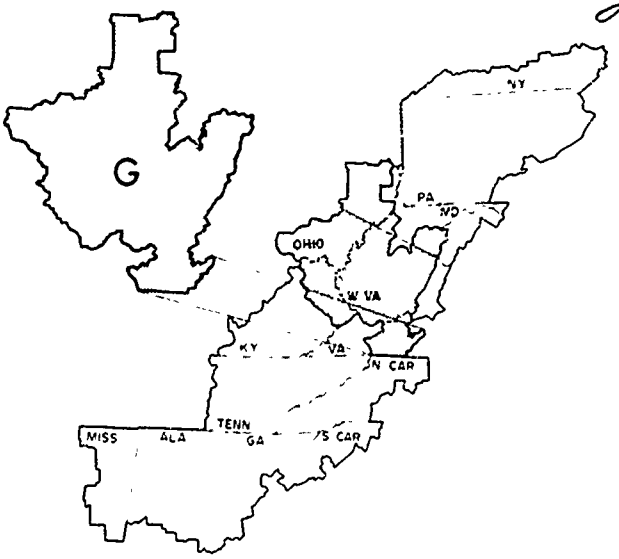
The resultant income and employment declines were very harmful to the sub-region.

Present

Abundant deposits of bituminous coal, limestone, clay and shale, salines, sand and gravel, natural gas and oil are found in Sub-region G. Production and value of minerals exceeded those of all other sub-regions during the period 1961 through 1965. The coal resources of the sub-region are probably greater than those in any other comparable-sized area in the world. The percentage of bituminous coal and lignite exported overseas is double the National average. (14 percent of the total production.) Production and value of natural gas and natural gas liquids of the sub-region are 50 percent and 80 percent of that of the Appalachian Region, respectively. The reserves of limestone and dolomite are virtually inexhaustible. Stone production is widespread; sand and gravel, clay and shale, cement, lime and gypsum production rank in descending order after stone. There are sufficient reserves of saline and iron oxide pigments for the markets served. The Bureau of Mines of the U.S. Department of the Interior presents more detailed information on minerals in Appendix I of this Report.


Akron
HOLMES
CARROLL
COSHOCTON
TUSCARAWAS
HARRISON
GUERNSEY
Columbus
MUSKINGUM
Dayton
PERRY
NOBLE
MONROE
MORGAN
HOCKING
WASHINGTON
TYLER
ROSS
PLEASANTS
VINTON
ATHENS
WOOD
RITCHIE
Clarksburg
Cincinnati
CLERMONT
HIGHLAND
PIKE
MEIGS
WIRT
BARBOUR
JACKSON
BROWN
ADAMS
SCIOTO
GALLIA
MASON
JACKSON
ROANE
BRAXTON
LAWRENCE
PUTNAM
LEWIS
GREENUP
CABELL
WEBSTER
CLAY
CARTER
BOYD
KANAWHA
NICHOLAS
POCAHONTAS
ROWAN
WAYNE
LINCOLN
Lexington
ELLIOTT
BOONE
FAYETTE
LAWRENCE
MORGAN
GREENBRIER
JOHNSON
MARTIN
LOGAN
RALEIGH
SUMMERS
MAGOFFIN
FLOYD
WYOMING
MONROE
PIKE
MERCER
GILES
MC DOWELL
Roanoke
BLAND
PULASKI
FLOYD
SMYTH
WYTHE
CARROLL
GRAYSON
Kingsport
Bristol





VICINITY MAP

LEGEND

▲ TECHICNAL OR VOCATIONAL SCHOOLS

■ SENIOR AND JUNIOR COLLEGES

10 5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

HIGHER EDUCATION FACILITIES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-13-23 **FIGURE 13-10**

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Lands

The total area of the sub-region is 23.9 million acres (37,421 sq. mi.). Of that area, 12,752 sq. mi. (34.1 percent) are in Ohio; 4,705 sq. mi. (12.6 percent) in Kentucky; 3,274 sq. mi. (8.7 percent) in Virginia; and 16,690 sq. mi. (44.6 percent) in West Virginia. The total land area is 23.9 million acres; of that, 3.6 million acres are in cropland; 4.1 million acres are in pasture; 12.9 million acres in state and private forest and woodlands; 1.1 million acres in National Forest lands; and 1.4 million acres of other lands. The 0.8 million acres of non-agricultural lands include other Federal lands, urban and built-up areas, water areas less than 40 acres, and streams less than one-eighth mile in width.

The present forest soil cover (three-fifths of the total area) serves reasonably well to hold the soil in place. However, past mismanagement, land clearing, heavy livestock grazing, poor timber cutting practices and forest fires have caused the destruction of much of the surface mulch and surface soil organic matter. The result is that about one-half of the forest land is in poor hydrologic cover condition with limited capacity to retard runoff and store moisture. About 90 percent of the forest land areas have a high to medium potential for hydrologic cover improvement if properly managed and protected from fires.

An increase in forest land of about 835,000 acres over 1958 acreages is projected by 1975. It is expected that most of the increase will come from conversions of lands from crop and pasture production.

The total agricultural land in the sub-region is expected to decrease by approximately 326,000 acres by 1975 through shifts to urban development, highway extensions and reservoir development. As of July 1, 1967, approximately 57 percent of the sub-region had been surveyed and mapped and classified into the eight broad-land capability classes by USDA Soils Scientists. About one-fourth of the area is suitable for cropping; Capability Classes I, II, and III (See Figure 13-11). The remainder is suited for grass, trees and shrubs which can be used for pasture, wood products or wildlife purposes. (Soil Capability Classes are discussed in USDA's Appendix A.)

Sub-region G has large areas of spoil piles left by deep and surface mining of coal. This is a principal factor in the tremendous erosion and sedimentation problem of the area; a deterrent to production on 87 percent of the land. The redevelopment of these lands is a critical need for the sub-region.

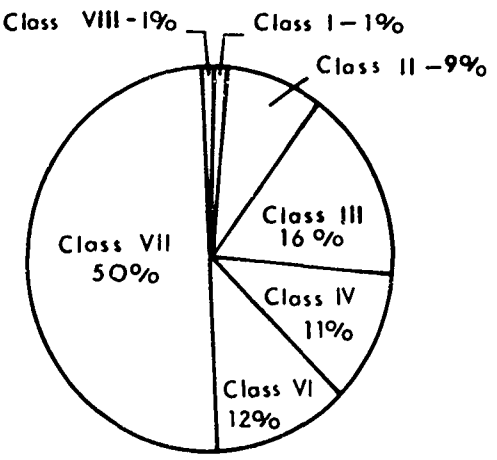


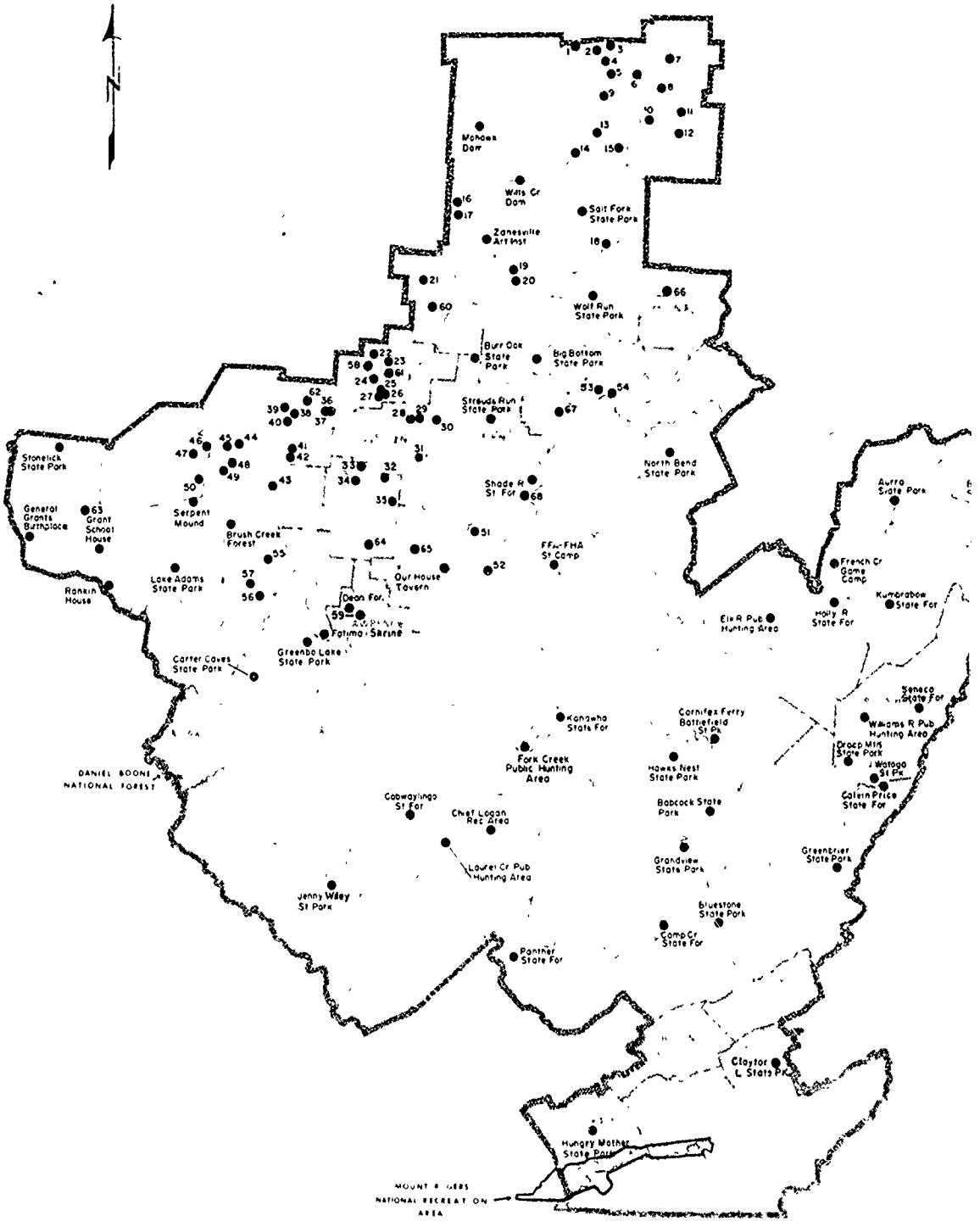
Figure 13-11 Percent of Inventory Acreage by USDA Land Capability Classes, Water Sub-region G.

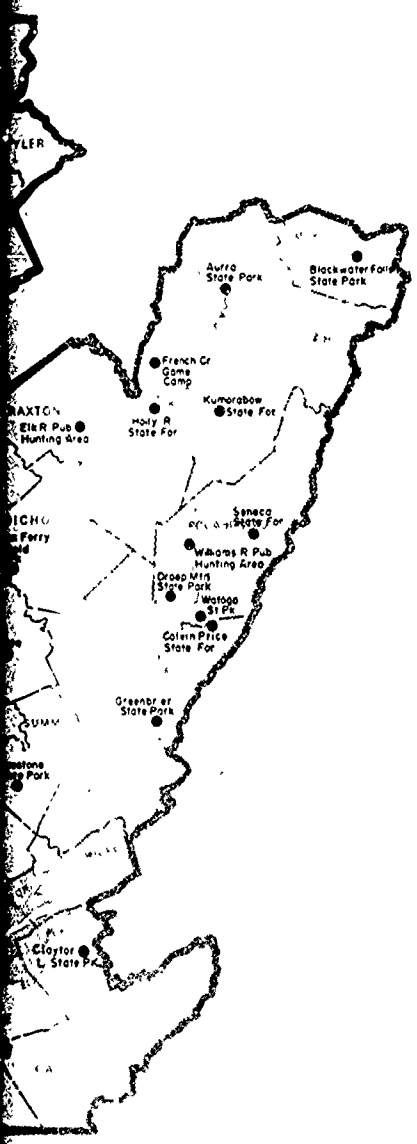
Environmental Aspects

Sub-region G is an area rich and varied in its scenic and aesthetic features. The terrain varies from the nearly level glacial plain of southern Ohio with its beautiful green cover of corn and other crops in the spring and summer, to the stark beauty of the rugged mountains of southern West Virginia, as they grade from a blaze of autumn foliage into the winter season. From the demonstrated beauty of conservation farming, the terrain changes to the rolling areas of the Appalachian Plateaus; those areas lie on each side of the scenic Ohio River. The hills are covered by bluegrass and woods, and broad flood plains lie along the streams. There are those who claim that the addition of wild flowers and flowering shrubs in spring results in scenic values unsurpassed anywhere in the world. Toward the southeast, the terrain becomes steeper, the timber cover more dense, and the valleys narrower. That area, with its forests and mountain streams, is a favorite of the city-tied tourists of the eastern seaboard.

A wide variety of trees and shrubs, including evergreen and deciduous species, grow in the area. The colorful mountain displays include rhododendrons, mountain laurels, bright azaleas and redbud trees. The scenic values are especially high along the mountain streams and on the banks of the man-made lakes and ponds which dot the area.

The principal outdoor recreation activities in the sub-region are hunting, fishing, hiking and nature studies, horseback riding, boating, swimming, canoeing, camping, picnicking, sight-seeing, driving, snow skiing, and water skiing.


N
Mohawk Dam
Wills Cr Dam
Salt Fork State Park
Zanesville Art Inst
Wolf Run State Park
Burr Oak State Park
Big Bottom State Park
Strouds Run State Park
North Bend State Park
Shade R St For
FFw-FHA St Camp
Our House Tavern
Dean For
Fatima Shrine
Greenbo Lake State Park
Carter Caves State Park
Lake Adams State Park
Rankin House
Brush Creek Forest
Serpent Mound
Grant School House
General Grants Birthplace
Stonelick State Park
DANIEL BOONE NATIONAL FOREST
Kanawha State For
Fork Creek Public Hunting Area
Gabwaylingo St For
Chief Logan Rec Area
Laurel Cr Pub Hunting Area
Jenny Wiley St Park
Panther State For
Cornfex Ferry Battlefield St Pk
Hawks Nest State Park
Babcock State Park
Grandview State Park
Bluestone State Park
Camp Cr State For
Greenbrier State Park
Seneca State For
Williams R Pub Hunting Area
Droop Mtn State Park
J Wotaga St Pk
Calvin Price State For
Aurra State Park
French Cr Game Camp
Kumbrabow State For
Holly R State For
Elk R Pub Hunting Area
Claytor L State Pk
Hungry Mother State Park
MOUNT ROGERS NATIONAL RECREATION AREA



1 Beech City Dam
2 Ft Laurens State Mem
3 Bolivar Dam
4 Zoar Village Mem
5 Dover Dam
6 Atwood Dam
7 McCook House State Mem
8 FFA Muskingum Camp
9 Schoenbrunn State Mem.
10 Tappan Dam
11 General Custer Mem.
12 Snow Bowl Ski Area
13 Gnadenhutten Mon.
14 Cy Young Mem
15 Devils Den
16 Boughman
17 Dillon Res State Park
18 Senecaville Dam
19 Blue Rock State Park
20 Blue Rock State Forest
21 General Sheridans Home
22 Cantwell Cliffs
23 Lake Logan State Park
24 Conkles Hollow
25 Old Mans Cave
26 Cedar Falls
27 Ash Cave
28 Lake Hope State Park
29 Zaleski State Forest
30 Waterloo Forest
31 Racoon Forest
32 Lake Alma State Park
33 Richland Furnace Forest
34 Leo Petroglyph
35 Buckeye Furnace Mem
36 Tar Hollow State Forest
37 Tar Hollow State Park
38 Mt Logan
39 Mound City
40 Adena State Mem
41 Scioto Trail Forest
42 Scioto Trail State Park
43 L White State Park
44 Seip Mound
45 First Dental School Museum
46 Seven Caves
47 Rocky Fork State Park
48 Pike Lake State Park
49 Pike State Forest
50 Fort Hill State Memorial
51 Clifton McClintic Wildlife Station
52 Chief Cornstalk Public Hunting Area
53 Steamboat W P Snyder Jr
54 Campus Martius Museum
55 Tremper Mound
56 Shawnee State Forest
57 Roosevelt-Shawnee State Park
58 Rock House Park
59 Vesuvius Recreation Area
60 Clouse Lake
61 Hocking State Forest
62 Rose Lo Lake
63 Lake Grant
64 Jackson Lake
65 Tycoon Lake
66 Monroe Lake
67 Vote Lake
68 Forked Run State Park

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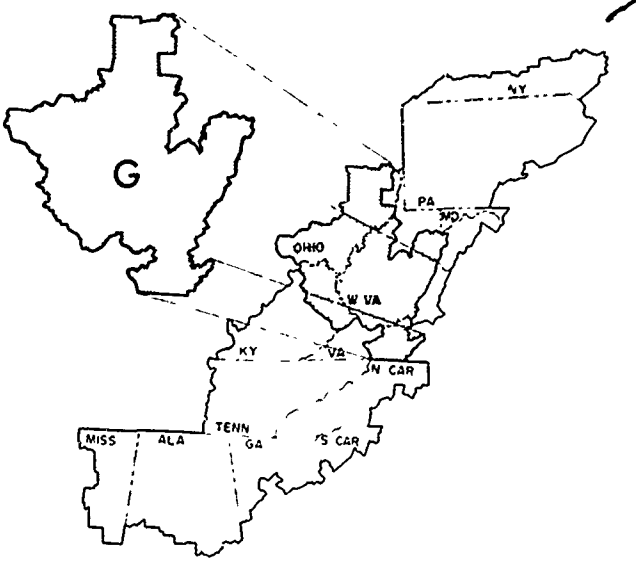
SCALE IN MILES



VICINITY MAP

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

SCENIC & HISTORICAL SITES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-27 **FIGURE 13-12**

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There are many recreation and fishing and hunting developments in the public forests. In 1966, the recreation use of the 35 small camp and picnic sites in the Daniel Boone and Jefferson National Forest alone was 78,000 visitor days. The Wayne National Forest in Ohio's recreation use was 138,700 man-days in 1964. Much use was also made of the Monongahela National Forest and state forests and parks. The total number of recreation visits to National Forests during 1966 was about 1,657,000; and about 6,922,000 to State Forests.

Most of the mountain streams in Water Sub-region G are stocked with trout from state and Federal hatcheries. All four states have game and regulated hunting to the point that there are now large supplies of deer, turkey, squirrel and quail. In addition, there are 24,266 farm ponds with water surface of 14,940 acres; some of which are used as income-producing recreational enterprises.

Places of special visitor interest in the sub-region include Carter Caves and Jenny Wiley State Parks in Kentucky; Mound City Group National Monument, and Burr Oak State Park in Ohio; Hungry Mother State Park in Virginia; and Bluestone, Watoga, and Holly River State Parks in West Virginia (See Figure 13-12).

The U.S. Department of Agriculture's Upstream Watershed Projects authorized for operations as of July 1, 1967, include additional storage and developments for recreation. These developments provide 577 acres of water surface with adjacent land area which will accommodate 238,988 recreation days. The U.S. Forest Service has constructed and developed five lakes totalling 496 surface acres for public fishing and recreation in the Monongahela, Wayne, and Jefferson National Forests.

Corps of Engineers reservoir projects within the sub-region have 20,580 surface acres of water available to recreationists. Fourteen projects now in the Construction, and Advanced Planning Categories, in addition to the eighteen now in operation, will result in a total of over 26,000 acres. The entire length of the Ohio River in the sub-region is in slack-water navigation pools and over 90 miles of the Kanawha River is navigable. There are many recreation developments and opportunities along those streams.

There are two private power installations with a surface area of about 4,540 acres available for recreation, and others are planned.

The State of Ohio alone has reservoir areas with a total surface of over 10,000 acres with developments for recreation. The states have recreation facilities in cooperation with Federal Agencies at many water management projects. In addition, there are many municipal and county recreational areas.

Water Resources Development - Federal

Corps of Engineers

Reservoir Projects. The Muskingum River Reservoir System in the Huntington District consists of 15 reservoirs located on tributaries of the Muskingum River as follows:

Reservoir	Stream	Nearest Town
Atwood	Indian Fork	New Cumberland
Beach City	Sugar Creek	Beach City
Bolivar	Sandy Creek	Bolivar
Charles Mill*/	Black Fork	Mifflin
Clendening	Brush Fork	Tippecanoe
Dillon	Licking River	Zanesville
Dover	Tuscarawas River	Dover
Leesville	McGuire Creek	Leesville
Mohawk	Walhonding River	Nellie
Mohicanville*/	Lake Fork	Mohicanville
Piedmont	Stillwater Creek	Piedmont
Pleasant Hill*/	Clear Fork	Perrysville
Senecaville	Seneca Fork	Senecaville
Tappan	Little Stillwater Creek	Tappan
Wills Creek	Wills Creek	Conesville

The Muskingum River Reservoir System controls the runoff from a drainage area of 5,015 square miles. Construction of the original 14 dams was completed in 1938. Dillon Dam was completed in 1961. Fourteen of the dams are of earth fill construction while Dover Dam is a concrete gravity structure. Each dam has an uncontrolled spillway. Minimum pools provided at 11 of the projects have a combined area of 17,710 acres. In addition to the minimum pools, a total storage capacity of 1,588,800 acre-feet is provided by the system for the temporary storage of flood flows. When full, the reservoirs would have a total water surface area of 87,900 acres.

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*/ Not in Appalachia.

The reservoirs are operated as units of a coordinated reservoir system for flood protection in the Tuscarawas, Walhonding, Muskingum, and Licking River valleys. The coordinated system of reservoirs is also operated to reduce floods on the Ohio River and to contribute to the reduction of floods on the lower Mississippi River.

The Muskingum Watershed Conservancy District has developed the original 14 reservoir areas for recreational activities and beneficial uses of agricultural lands, forests, and fish and wildlife resources. Administration and operation of all the Dillon reservoir lands, except those required for operating purposes, including four recreation sites developed by the Corps of Engineers, have been transferred to the Ohio Department of Natural Resources. Public attendance at the reservoirs during 1965 totaled over five million visitors.

Burr Oak Reservoir impounded by Tom Jenkins Dam is located in Athens and Morgan Counties in the Hocking River Basin, on the East Branch of Sunday Creek, and controls the runoff from a drainage area of 33 square miles. The reservoir is operated as a unit of a coordinated system for flood protection in the Sunday Creek, Hocking, and Ohio River valleys. The project includes storage that is being utilized for water supply in the Sunday Creek valley, a feature for which the State of Ohio contributed the cost or its equivalent in reservoir lands. The Ohio Department of Natural Resources also operates the reservoir area for recreational activities and beneficial uses of agricultural lands, forests, and fish and wildlife resources.

Dewey Reservoir is located on Johns Creek in the Big Sandy River Basin, near Paintsville and Prestonburg, Kentucky, and controls runoff from a drainage area of 207 square miles. During the summer and fall seasons, a pool about 18.5 miles long with a surface area of 1,100 acres is maintained. During the winter and spring seasons, when floods are most likely, the pool is lowered; capacity available for flood storage varies from 76,100 acre-feet during the summer months to 81,000 acre-feet during the winter flood season. In addition to its function of providing flood control in the Big Sandy River Basin, it is a unit in the coordinated system of reservoirs designed to reduce floods on the Ohio and lower Mississippi Rivers.

To the extent consistent with flood control purposes, the reservoir area is operated by the Kentucky Department of Conservation for recreational acitivities and beneficial uses of lands and forests. The Kentucky Department of Fish and Wildlife Resources is developing the fish and game resources of the area. The Huntington District of the Corps of Engineers grants leases in certain reservoir areas for camp sites and group camp use. Public attendance at the reservoir during 1961 was approximately 365,000 visitors. The dam and appurtenances were completed in July 1949.

The Bluestone Reservoir, a unit in the comprehensive flood control plan for the New, Kanawha and Ohio River Basins, is located in Summers, Mercer and Monroe Counties, West Virginia, and Giles County, Virginia. It is formed by a concrete gravity dam on New River near Hinton, West Virginia, and controls runoff from a drainage area of 4,565 square miles. Penstocks are incorporated in the dam for possible future installation of hydrcelectric power; however, installation of power facilities has been deferred until additional flood control storage is provided in the Basin by the construction of other reservoirs.

The West Virginia Department of Natural Resources manages recreational activities and beneficial uses of forests as well as fish and wildlife resources. The Corps of Engineers grants leases in certain reservoir areas for camp sites and group camp use.

The Summersville project is located in the Kanawha River Basin, on Gauley River near Summersville in Nicholas County, West Virginia, and controls a drainage area of 803 square miles. The project is operated so as to provide water for low flow augmentation during the summer season.

The project is operated as a unit of a coordinated reservoir system for flood protection in the Gauley, Kanawha and Ohio River valleys. Additional benefits accrue as a result of water quality, primarily along the Kanawha River in the highly industrialized areas above and below Charleston, West Virginia, with lesser water quality benefits along the Ohio River. Recreation facilities and fish and wildlife areas will be operated by the Corps of Engineers, West Virginia Department of Natural Resources and the City of Summersville.

The Sutton Reservoir is a multiple purpose project with storage for flood control and water quality control. It is located on Elk River in Braxton and Webster Counties, West Virginia, and controls the runoff from a drainage area of 537 square miles. The reservoir is operated so as to provide storage for water quality control during summer months.

The project is operated as a unit in the comprehensive plan for flood control and other purposes in the Ohio River Basin. It relieves flood hazards along the Elk River, operates in conjunction with the Bluestone and Summersville Reservoirs in providing flood protection for the Kanawha Valley, and reduces flood flows along the Ohio River. To the extent consistent with flood control purposes, the Corps of Engineers is developing nine recreation and access sites. A large area south of the reservoir is owned by the West Virginia Department of Natural Resources and is used as a public hunting area.

The Tygart Reservoir, which has storage for flood control and navigation, is located in the Monongahela River Basin, on Tygart River, in

Taylor and Barbour Counties, West Virginia. It controls the runoff from a tributary drainage area of 1,184 square miles. The dam is located about two miles upstream from Grafton in Taylor County. Two penstocks are contained in the dam for possible future generation of hydroelectric power.

The reservoir is operated effectively for the purpose of assuring adequate navigation water supply in the Monongahela River, and as a unit of a coordinated reservoir system for flood protection in the Tygart, Monongahela and Ohio River Valleys. Important secondary functions resulting from operation of the reservoir include improvement of domestic and industrial water supplies, reduction in damages caused by acid mine wastes, and reduction in the intensity of organic pollution. Pertinent data on Corps of Engineer reservoirs are included in Table 13-3 (Page 13-47) and their locations are shown in Figure 13-13.

Major Reservoir Projects expected to be completed by 1980 (see Figure 13-13) are as follows:

Project	Location	Purposes
Salt Creek	Scioto River Basin, Ohio	FC, R
Paint Creek	Scioto River Basin, Ohio	FC, WS, WQ, R
East Fork	Little Miami River Basin, Ohio	FC, WS, WQ, R
Grayson	Little Sandy River Basin, Kentucky	FC, WQ, R
Cave Run	Licking River Basin, Kentucky	FC, WQ, R
Kehoe	Tygarts Creek Basin, Kentucky	FC, WQ, R
East Lynn	Twelvepole Creek Basin, W. Va.	FC, R
Beech Fork	Twelvepole Creek Basin, W. Va.	FC, R
Fishtrap	Big Sandy River Basin, Kentucky	FC, WQ, R
Yatesville	Big Sandy River Basin, Kentucky	FC, WQ, R
Paintsville	Big Sandy River Basin, Kentucky	FC, WQ, R
R. D. Bailey	Guyandot River Basin, W. Virginia	FC, WQ, R
Burnsville	Little Kanawha River Basin, W. Va.	FC, WQ, R
Rowlesburg	Monongahela River Basin, W. Va.	FC, WQ, P, R
West Fork	Little Kanawha River Basin, W. Va.	FC, WQ, R
Royalton	Licking River Basin, Kentucky	FC, WS, WQ, R

Completed Local Protection Projects in the sub-region include the following:

Project	Location	Purposes
Roseville, Ohio	Moxahala Creek	FC
Portsmouth, Ohio	Ohio River	FC
Ironton, Ohio	Ohio River	FC
Russell, Kentucky	Ohio River	FC
Ashland, Kentucky	Ohio River	FC
Catlettsburg, Kentucky	Ohio River	FC
Ceredo-Kenova, W. Va.	Ohio River	FC
Huntington, W. Va.	Ohio River	FC
Barboursville, W. Va.	Guyandot River	Bank Protection

Project	Location	Purposes
Gallipolis, Ohio	Ohio River	Bank Protection
Point Pleasant, W. Va.	Ohio River	FC
Parkersburg, W. Va.	Ohio River	FC
Williamson, W. Va.	Tug Fork, Big Sandy River	FC
East Rainelle, W. Va.	Meadow River	FC
Princeton, W. Va.	Brush Creek	FC
Galax, Virginia	Chestnut Creek	FC

Local Protection Projects expected to be completed by 1980 (see Figure 13-13) are as follows:

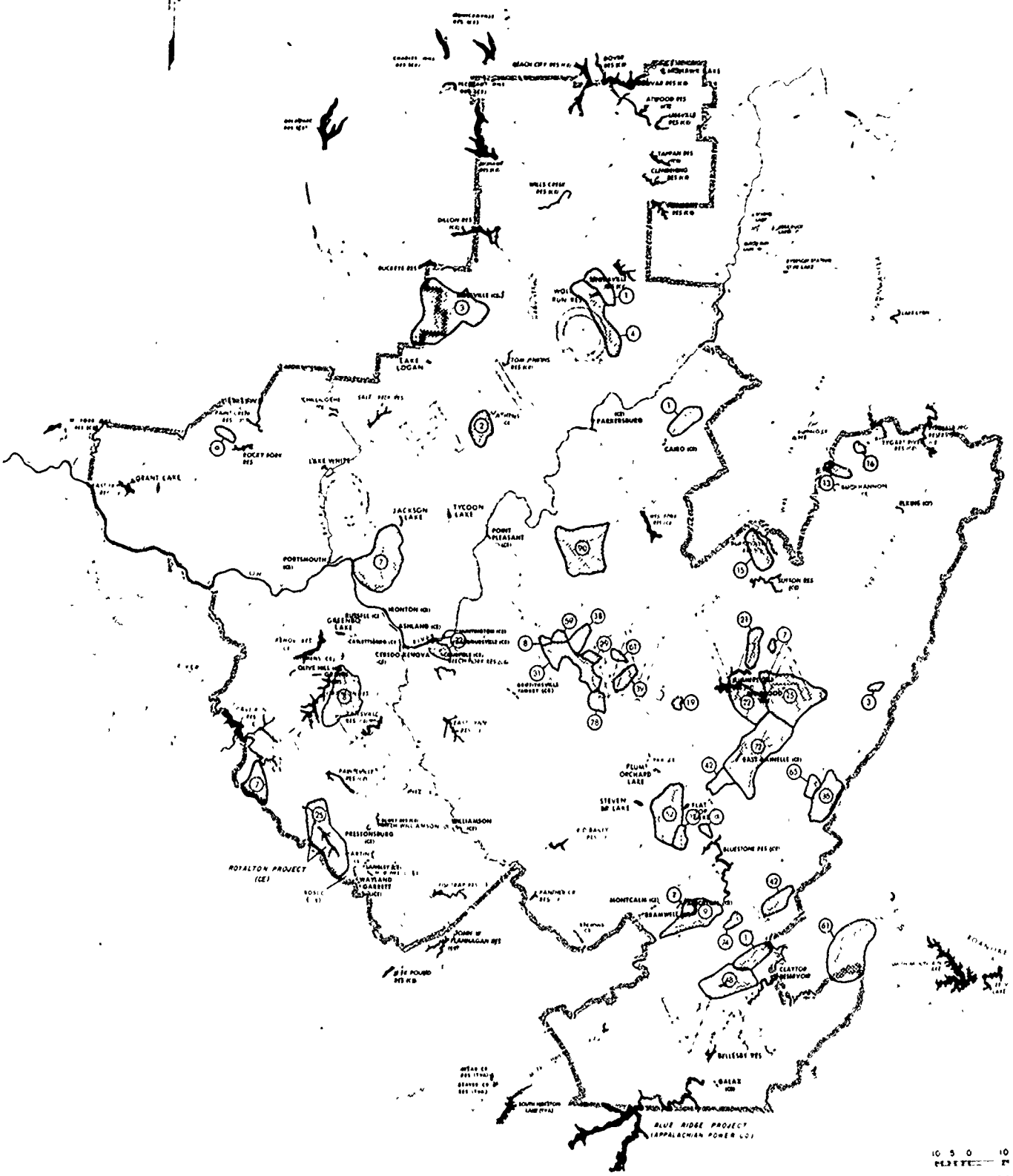
Project	Location	Purposes
Athens, Ohio	Hocking River	FC
Martin, Kentucky	Beaver Creek	FC
Buckhannon, W. Va.	Buckhannon River	FC
Chillicothe, Ohio	Scioto River	FC

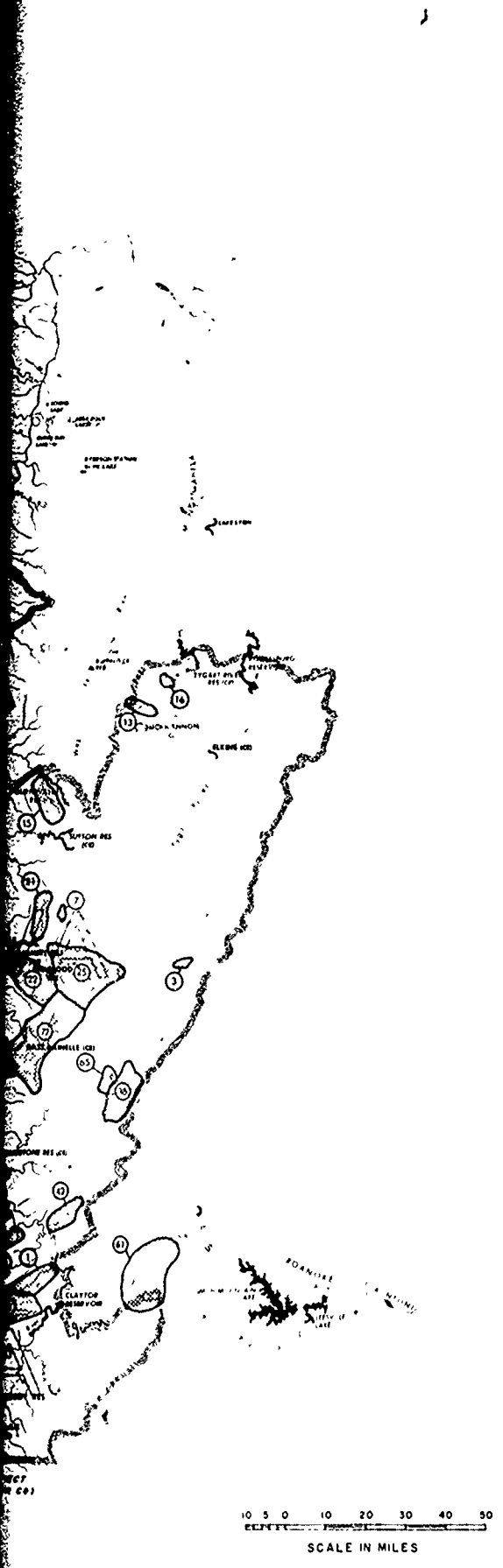
Completed Channel Improvement Projects are as follows:

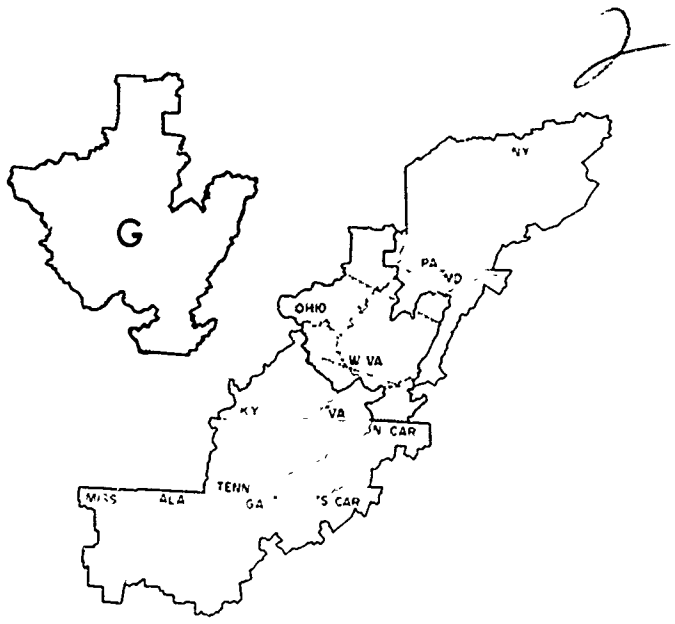
Project	Location	Purposes
Hitchens, Kentucky	Little Fork, Little Sandy Rvr.	FC
Olive Hill, Kentucky	Tygarts Creek	FC
Grahn, Kentucky	Sinking Creek	FC
Huntington, W. Va.	Fourpole Creek	FC
Griffithsville-Yawkey, W. Virginia	Middle Fork, Mud River	FC
Cairo, W. Virginia	North Fork, Hughes River	FC
Prestonsburg, Kentucky	Levisa Fork, Big Sandy River	FC
Langley, Kentucky	Right Fork, Beaver Creek	FC
Wayland-Garrett, Ky.	Right Fork, Beaver Creek	FC
Bramwell, W. Virginia	Bluestone River	FC
Montcalm, W. Virginia	Bluestone River	FC
Richwood, W. Virginia	Cherry River	FC
Elkins, W. Virginia	Tygart River	FC

Channel Improvement Projects expected to be completed by 1980 (see Figure 13-13) are as follows:

Project	Location	Purposes
McDowell & Drift, Ky.	Left Fork, Beaver Creek	FC
Chillicothe, Ohio	Paint Creek	FC
Inez, Kentucky	Rockcastle Creek	FC
South Williamson, Ky.	Tug Fork	FC
Bosco, Kentucky	Right Fork, Beaver Creek	FC
Berwind, W. Virginia	Dry Fork	FC
Pax, West Virginia	Paint Creek	FC


LAKE LOGAN
LAKE WHITE
GRANT LAKE
JACKSON LAKE
TYCOON LAKE
POINT PLEASANT
PORTSMOUTH
MONTON
GLENVILLE
CEDARVILLE
OLIVE HILL
WILLIAMSON
PRESTONSBURG
ROYALTON PROJECT
(CE)
PAINTSVILLE
FLOYD
PARKERSBURG
CAIRO
SUTTON
STEVENSON LAKE
PLUMP ORCHARD LAKE
BLUESTONE
MONTCALM
BEAMSVILLE
CLAYTOR
BELLEMEADE
BLUE RIDGE PROJECT
(APPALACHIAN POWER CO.)
SCA





VICINITY MAP

	COMPLETED	EXPECTED TO BE COMPLETED BY 1980
UPSTREAM WATERSHEDS	③	⑦
MAJOR RESERVOIRS		
CHANNEL IMPROVEMENTS	-------	-------
LEVEE OR WALL	——	——

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-35 FIGURE 13-13

Local Protection Projects. The Roseville Local Protection Project is located on Moxahala Creek at and below the village of Roseville, Ohio, in Muskingum and Perry Counties. It comprises 1.4 miles of channel rectification, 1.0 mile of earth levee, one pump station, and bridge alterations. The project would protect the village of Roseville from a flood with peak discharge 33 percent greater than the maximum flood of record (June 1950).

The Portsmouth-New Boston Local Protection Project is located along the Ohio and Scioto Rivers at Portsmouth and New Boston, Ohio, in Scioto County. It comprises 4.0 miles of earth levees, 4.1 miles of concrete walls, 12 pump stations, and 16 openings and two ramps for traffic. The project affords protection against a flood equal to that in 1937. Protection is even greater considering reductions in river stages by the Ohio River Reservoir System.

The Ironton Local Protection Project is located along the Ohio River at Ironton, Ohio, in Lawrence County. It comprises 5.8 miles of earth levees, 1.0 mile of concrete walls, 19 traffic openings, ten pump stations, and a 2300-foot diversion channel. The project would protect Ironton from a flood equal to that in 1937, and from floods of greater magnitude considering the Ohio River Reservoir System.

The Russell Local Protection Project is located along the Ohio River at Russell, Kentucky in Greenup County. It consists of 1450 feet of earth levee, two traffic ramps, and one pump station. The project affords partial protection from Ohio River backwater. Major flood stages will be reduced by the Ohio River system of Reservoirs.

The Ashland Local Protection Project is located along the Ohio River at Ashland, Kentucky in Boyd County. The protection works consist of 0.1 mile of earth levees, 2.6 miles of concrete walls, six pump stations, and 17 traffic openings. The project affords protection against floods equal to that in 1937, with even greater protection considering the Ohio River system of Reservoirs.

The Catlettsburg Local Protection Project is located at the confluence of the Ohio and Big Sandy Rivers, in Catlettsburg, Kentucky in Boyd County. The project includes 1.2 miles of earth levee, 0.7 mile of concrete wall, four pump stations, and seven openings and a ramp for traffic. The project provides protection against floods equal to that of 1937. River stages also would be reduced by the Ohio River Reservoir System.

The Ceredo-Kenova Local Protection Project is located at the confluence of the Ohio and Big Sandy Rivers in Wayne County, West Virginia. The protection works include 2.6 miles of earth levee, 1.6 miles of concrete wall, six pump stations, and 27 openings and two ramps for traffic. The works protect the communities against floods equal to that of 1937, and are supplemented by the Ohio River Reservoir System.

The Huntington Local Protection Project is located along the Ohio and Guyandot Rivers at Huntington, West Virginia, in Cabell and Wayne Counties. Principal elements of the protective works are 7.0 miles of concrete walls, 4.5 miles of earth levees, 17 pump stations, and 45 gated traffic openings. The project provides protection against floods equal to that of 1937, and is supplemented by the Ohio River Reservoir System.

The Barboursville Project is for repair and restoration of the bank of the Guyandot River in the vicinity of Barboursville, West Virginia in Cabell County.

The Gallipolis Project protects a 300-foot length of caving bank along the Ohio River at Gallipolis, Ohio in Gallia County. The project consists of compacted pervious fill, gravel fill, and dumped rock.

The Point Pleasant Local Protection Project is located at the confluence of the Ohio and Kanawha Rivers at Point Pleasant, West Virginia in Mason County. It comprises a system of works including 1.4 miles of concrete wall, 0.9 mile of earth levee, 15 gate openings and one ramp for traffic, three pump stations, and 2400 feet of diversion channel. The works afford protection against a flood stage equal to that of 1937, and are supplemented by the Ohio River Reservoir System.

The Parkersburg Local Protection Project is located at the confluence of the Ohio and Little Kanawha Rivers, at Parkersburg, West Virginia, in Wood County. The system includes 2.0 miles of concrete wall, 1.8 miles of earth levee, 14 gated traffic openings, six pump stations, and 1900 feet of diversion channel. The protection provided is for floods equal in stage to that of 1913, and is supplemented by the Ohio River Reservoir System.

The Williamson, West Virginia Local Protection Project is located along Tug Fork of the Big Sandy River in Mingo County. The works consist of 2315 feet of concrete wall, one pump station and 16 gate openings for traffic. Protection is provided against a flood stage equal to that of January 1957.

The East Rainelle, West Virginia Local Protection Project is located on Meadow River and Sewell and Boggs Creeks in Fayette and Greenbrier Counties. The project consists of 4.2 miles of channel improvement and modification to bridges, sewage, and drainage facilities. The project provides nearly complete protection from floods equal to the March 1934 stage.

The Princeton, West Virginia Local Protection Project is located on Brush Creek in Mercer County. Principal features of the protection works are 3.9 miles of channel improvement, construction of bridges, and 0.3 mile of railroad relocation. The project provides virtually complete protection from floods having 20 percent greater discharge than the flood of June 1924.

The Galax, Virginia Local Protection Project is located on Chestnut Creek in Carroll and Grayson Counties. The project includes 13,700 feet of improved channel, bridge relocation and extension and drainage modification. Complete protection is provided against minor and moderate floods, and a dependable degree of protection is provided against extreme flash floods.

Small Flood Control and Snagging and Clearing Projects. The Hitchens, Kentucky Project consists of 4.8 miles of snagging and clearing on Little Fork of Little Sandy River in Carter County.

The Olive Hill, Kentucky Project consists of 1.7 miles of channel improvement on Tygarts Creek in Carter County.

The Grahn, Kentucky Project includes 0.9 mile of channel improvement on Little Sinking Creek, 0.4 mile of channel clearing on tributaries and bridge construction and alterations. The project is located in Carter County.

The Huntington, West Virginia Project on Fourpole Creek involves 2.6 miles of clearing, snagging, and straightening the channel and reconstruction of two bridges, and alteration of utility lines. The project is located in Cabell County.

The Griffithsville-Yawkey, West Virginia Project on Middle Fork of Mud River consists of 18,900 feet of channel improvement. The project is located in Lincoln County.

The Cairo, West Virginia Project on North Fork of Hughes River, consists of 2.6 miles of channel snagging and clearing in Ritchie County.

The Prestonburg, Kentucky Project utilizes a portion of a road fill, 265 feet of earth levee, and a pump station for protection against backwater of Levisa Fork of Big Sandy River. The project is located in Floyd County.

The Langley, Kentucky Project is located on Right Fork of Beaver Creek in Floyd County. The project consists of 2.1 miles of channel snagging and clearing.

The Wayland-Garrett, Kentucky Project is located on Right Fork of Beaver Creek in Floyd County. The project consists of 6.8 miles of channel snagging and clearing.

The Bramwell, West Virginia Project on Bluestone River in Mercer County consists of 2.7 miles of channel snagging, clearing, and straightening.

The Montcalm, West Virginia Project is located on Bluestone River in Mercer County and consists of 3.0 miles of channel snagging and clearing.

The Richwood, West Virginia Project is located on Cherry River in Nicholas County. The project includes channel improvement through Richwood and Fenwick.

Completed and functioning river navigation systems include the following:

Project	Location	Purpose
Ohio River	Ohio, Ky., W.Va.-350 miles in S.R.-G	N
Kanawha River	W. Virginia (all) 191 miles in S.R.-G	N

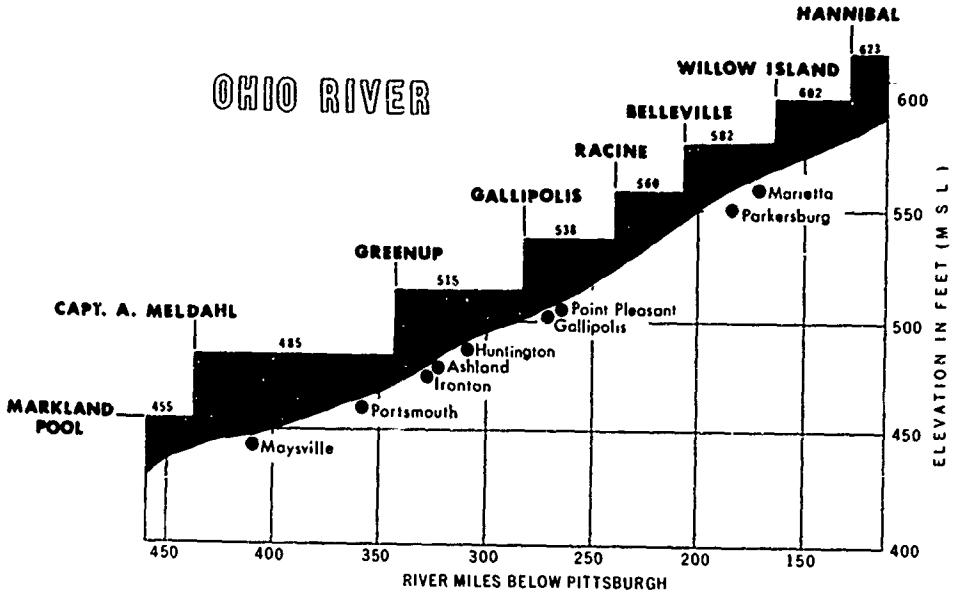
The Ohio River Navigation System is being modernized as shown in Figure 13-14.

Navigation Projects. As now planned, the modernized Ohio River Navigation Project will consist of 19 high-lift dams and dual lock chambers. The main lock chamber will be 110 feet wide and 1200 feet long, with an auxiliary chamber 110 feet by 600 feet. Seven of the structures will be located on the 350-mile reach of the Ohio River within or adjacent to the sub-region. Projects in operation include Capt. Anthony Meldahl, Greenup, and Gallipolis Locks and Dams. The Gallipolis Project was the most modern prior to the modernization program now under way. The lock chambers are 110 feet by 600 feet and and 110 feet by 360 feet. A replacement structure with lock chambers compatible with the other modern structures is being considered. Projects under construction include Racine, Belleville, Willow Island, and Hannibal Locks and Dams. The channel will continue to have a minimum navigable depth of 9 feet, with provisions incorporated in the new structures to permit increasing the depth of the navigable channel should it be warranted in the future.

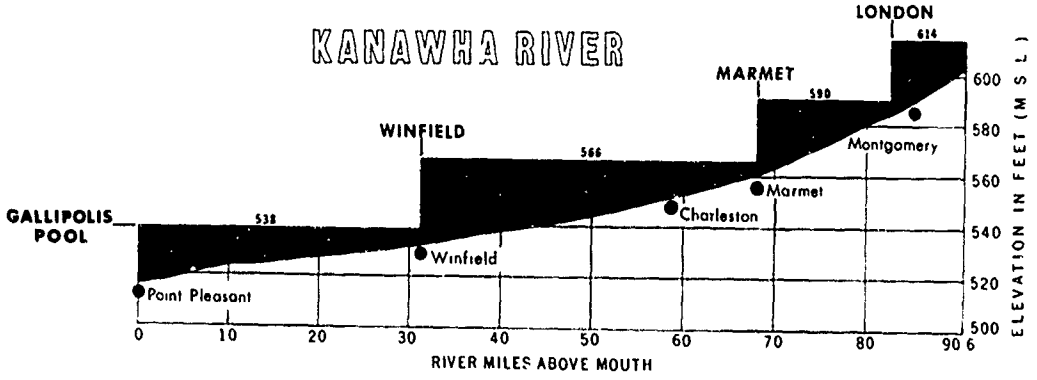
The Kanawha River Navigation Project (see Figure 13-14) consists of the Winfield, Marmet, and London Locks and Dams in conjunction with the Gallipolis Locks and Dam on the Ohio River. A channel with minimum navigable depth of 9 feet extends 91 miles upstream from the confluence with the Ohio River. Twin lock chambers at each of the Kanawha structures are 56 feet wide by 360 feet long. Hydroelectric power plants are incorporated in each of the 3 structures on the Kanawha River. A general plan for modernization of the Kanawha River System is underway.

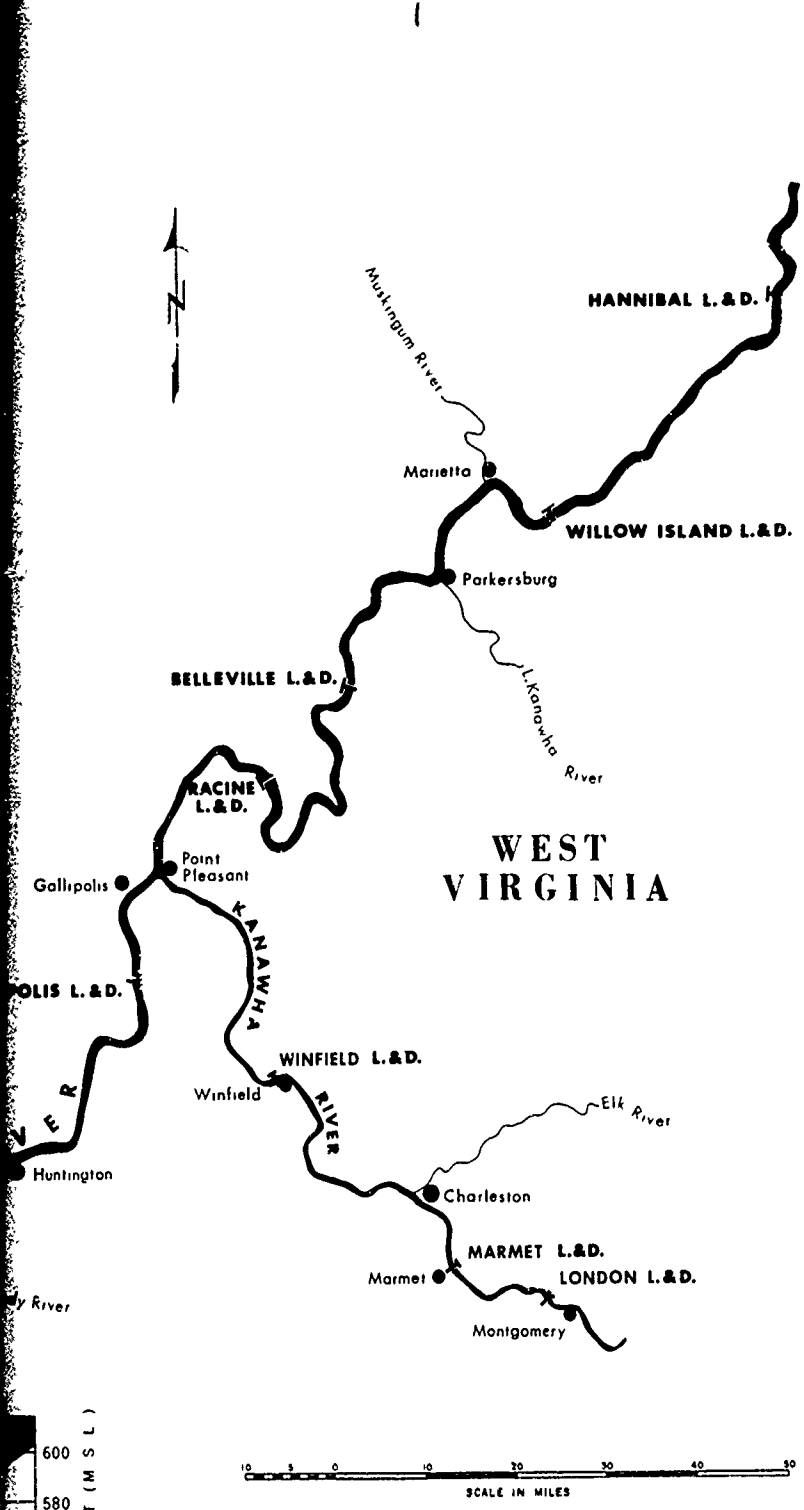
The Muskingum River Navigation Project ceased to be used for commercial navigation in 1953. Subsequently, the system has been rehabilitated by the State of Ohio for use by pleasure boaters. The navigable channel extends from the confluence with the Ohio River to just downstream of Dresdon, Ohio.

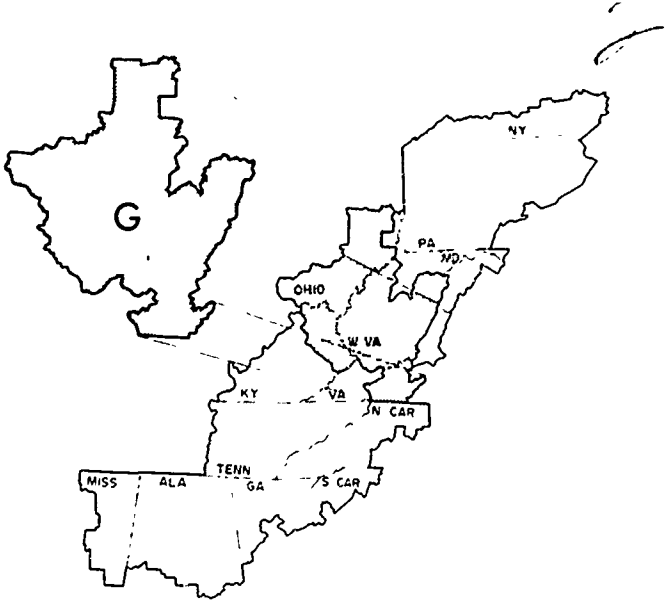
The lower 3 miles of the Little Kanawha River and the lower 4 miles of the Big Sandy River are navigable.


OHIO RIVER
HANNIBAL
623
WILLOW ISLAND
602
BELLEVILLE
582
RACINE
560
GALLIPOLIS
538
GREENUP
515
CAPT. A. MELDAHL
485
MARKLAND POOL
455
Marietta
Parkersburg
Point Pleasant
Gallipolis
Huntington
Ashland
Ironton
Portsmouth
Maysville
600
550
500
450
400
ELEVATION IN FEET (M S L)
450
400
350
300
250
200
150
RIVER MILES BELOW PITTSBURGH

Scioto River
OHIO
CAPT. A. MELDAHL L.&D.
Maysville
OHIO
Portsmouth
GREENUP L.&D.
Ironton
Ashland
RIVER
Huntington
KENTUCKY
Big Sandy River
RACINE L.&D.
Point Pleasant
Gallipolis
KANAWHA
GALLIPOLIS L.&D.
WIN
Winfield


KANAWHA RIVER
LONDON
614
MARMET
590
WINFIELD
566
GALLIPOLIS POOL
538
Montgomery
Marmet
Charleston
Winfield
Point Pleasant
600
580
560
540
520
500
ELEVATION IN FEET (M S L)
0
10
20
30
40
50
60
70
80
90 6
RIVER MILES ABOVE MOUTH





LEGEND

- EXISTING STRUCTURE AND POOL
- REPLACEMENT STRUCTURE BEING BUILT; NEW POOL BEING PROVIDED[1]
- EXISTING PROJECT UNDER STUDY FOR REPLACEMENT[1]

[1] EXPECTED TO BE COMPLETED BY 1980

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

NAVIGATION PLAN & PROFILES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-41 FIGURE 13-14

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U.S. Department of Agriculture

Four upstream watershed projects (PL 83-566) have been completed in the sub-region.

Map Ref. Number Figure 13-13	Watershed	Location	Purpose
1	Back Creek	Kanawha Rv. Basn.(U.New)-Virginia	FC
1	Bondo Creek	Little Kanawha Rv. Basn.-West Virginia	FC,FWL
2	Daves Fork & Christians Fork	Kanawha R. Basn.(U.New)-West Virginia	FC
3	Marlin Run	Kanawha Rv. Basn.(U.New)-West Virginia	FC

The watersheds have a combined drainage area of 57.8 square miles. Five multipurpose floodwater retarding structures were installed with an aggregate drainage area of 4.1 square miles. Channel improvements totaled 18.1 miles. The reservoirs have a total of 69 acre-feet of storage for sediment, 860 acre-feet for flood prevention and 147 147 acre-feet of storage for Fish and Wildlife.

The cost of structural measures was $685,400 and the cost of accelerated land treatment measures was 420,700 dollars. The flood plain area benefited by the programs totalled 1,335 acres. Estimated damage reduction attributable to the projects is $67,261 annually; the total annual benefits are 68,564 dollars.

Pilot watershed projects, Clear Creek and Hocking River, have also been completed in the Ohio portion of the sub-region.

Thirteen additional upstream watershed projects have been approved for construction.

Map Ref. Number Figure 13-13	Watershed	Location	Purpose
1	Buffalo Creek	Muskingum Rv. Basn.-Ohio	FC, WS
2	Margaret Creek	Hocking Rv. Basn.-Ohio	FC, WS, R
3	Rush Creek	Hocking Rv. Basn.-Ohio	FC, WS, R
4	West Fork	Duck Creek-Ohio	FC, WS, R
7	Big Ditch Run	Kanawha Rv. Basn.-W.Va.	FC, R
8	Blakes & Armours Creeks	Kanawha Rv. Basn.-W.Va.	FC, R
9	Brush Creek	Kanawha Rv. Basn.-W.Va.	FC, WS, R
13	Pecks Run	Monongahela Rv. Basn.-W.Va.	FC

Map Ref. Number (cont'd) Figure 13-13	Watershed	Location	Purpose
15	Saltlick Cr.	Little Kanawha Rv. Basn.- West Virginia	FC
16	Shooks Run	Monongahela Rv. Basn.-W.Va.	FC
29*	Elk-Two Mile Creek	Kanawha Rv. Basn.-W.Va.	FC
38*	Kanawha-Two Mile	Kanawha Rv. Basn.-W.Va.	FC, R
61	South Fork	Roanoke Rv. Basn.-Va.	FC

* Authorized after 1 July 1967.

The total drainage area of the watersheds is 744.3 square miles. Seventy-two single purpose and multipurpose floodwater retarding structures will control the runoff from 310.7 square miles. The reservoirs formed will contain storage for 14,352 acre-feet of sediment; 45,593 acre-feet of floodwater; 4,426 acre-feet of Municipal and Industrial Water Supply and 8,393 acre-feet of water for recreation. There will be 83.8 miles of channel improvements for flood control.

It is estimated that the total installation costs of the 72 dams and 83.8 miles of improved channels will be 20,583,900 dollars. The accelerated land treatment measures will cost an estimated 2,844,200 dollars. The benefited floodplain area of 21,828 acres and the surrounding region which are now damaged $653,471 each year will be benefited $1,355,817 a year. The benefits will include $524,894 damage reduction; the remaining benefits are through storage of water for municipal and industrial and recreation uses, more intensive and changed land use, redevelopment and secondary benefits.

An additional twenty-five upstream watershed projects have been investigated or approved for planning and are expected to be physically completed by 1980. Their locations are shown in Figure 13-13.

The land treatment programs of the U.S. Department of Agriculture are contributing to improved water quality in the sub-region through the reduction of sediment. The Soil Conservation Service is working with 56,197 landowners and operators in the 50 organized Soil and Water Conservation Districts in the application of land treatment measures. The area covered includes all of the agricultural and rural land. Basic conservation plans are being carried out on about 5,653,000 acres; to date about 3,634,800 acres, or about 15 percent of the sub-region lands have been treated adequately with conservation measures.

The U.S. Department of Agriculture's Farmers Home Administration has received applications for water and sewer comprehensive planning grants from 40 counties. In addition, applications have been received for loans and grants for improving, enlarging, or constructing sewer systems, waste treatment plants, or storm drains from 172 communities, associations, public service districts, and towns.

The U.S. Forest Service is cooperating with state forestry agencies in the protection and management of over 14,075,000 acres (59 percent of the sub-region) of privately-owned forest and woodland. Assistance to local organizations and individuals in planning and installing forestry measures for watershed protection and flood prevention is provided by State Foresters in cooperation with the Forest Service. These cooperative programs also provide forest fire protection, insect and disease control, technical assistance to improve the management of forests and the operations of small forest products processors, and to produce and distribute forest planting stock. The Forest Service also administers 1,132,200 acres of land in the Wayne, Daniel Boone, Jefferson and Monongahela National Forests in the sub-region (See Figure 13-12). These lands are managed under the multiple use concept for the production of high quality water, timber, fish and wildlife, and recreation.

Water Resource Development - Non-Federal

State

All four states partially in the sub-region are active in water resource management and development. Water impoundments with over 200 acres surface area are itemized in Table 13-3 and are shown on Figure 13-13 on Page 13-35.

The state government of Kentucky has centered efforts on cooperation with the U.S. Army Engineer major downstream reservoirs and with USDA Soil Conservation Service upstream floodwater retarding structure systems (locally sponsored). The state has provided small recreation lakes along interstate and state highways by sharing in costs of fill and drop spillways with the construction agencies. Similar lakes have been formed by damming of small creeks on state park lands. The largest of those in Sub-region G is Greenbo Lake on a tributary of the Little Sandy River with 225 acres surface. State agencies are cooperating in ground water studies (U.S. Geological Survey), water quality control efforts (FWPCA, ORSANCO and U.S. Army Corps of Engineers) and flood plain information studies (USGS and Corps of Engineers).

The Ohio State government was an innovater in the provision for local flood control conservancy districts. The Miami River Conservancy District, formed two years after the disastrous 1913 floods, has been used as a model for such districts throughout the world. The Muskingum Conservancy District area is partially in Water Area G-1. The dams built in cooperation with the U.S. Corps of Engineers have been described under Federal developments and detailed in Table 13-3.

The voters approved $100 million in bonds for the financing of water and recreation-oriented projects in 1965. The six-year program is well underway - it will be discussed further in Chapter 14. Major Ohio State reservoirs are detailed in Table 13-3.

An inventory of Ohio waters is made annually. The State Division of Water has, since 1965, made studies and has recommended management programs and projects for all the surface and ground water of Sub-region G except for the already intensely managed Muskingum River Basin. A study is now in progress there - (completed 1969).

Ohio State officials are cooperating with Federal agencies, regional and local organizations in water pollution control (ORSANCO, FWPCA and Corps of Engineers), flood plain information (USGS and Corps), and ground water studies (USGS). Both State and local sponsors work directly with USDA Soil Conservation Service and the Corps of Engineers on flood control and watershed protection projects.

The Virginia Division of Water Resources has developed a management plan for the New River - the Virginia part of Water Area G-5. State recommendations are reflected in Chapter 14.

There are no major state built dams in Water Area G-5. The State has fostered development by local and private groups for recreation and power pollution.

Virginia Water Control Board and Department of Health are cooperating with ORSANCO, FWPCA and U.S. Corps of Engineers in efforts to control water pollution.

The State of West Virginia has been especially active in water management for recreation. State programs, such as pollution control (from mine acids) are coordinated by the Department of Natural Resources with developing fisheries in state streams. The Division of Game and Fish manages lakes and hunting areas throughout the West Virginia part of the sub-region. Plum Orchard Lake, with 2020 acres surface, is shown in Table 13-3.

The State has actively supported multiple purpose water resource projects of the U.S. Army Corps of Engineers and U.S. Department of Agriculture in cooperation with other agencies.

TABLE 13-3
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "G"

ITEM	UNITS	Corps of Engineers							
		Atwood Reservoir	Beach City	Bolivar	Clendening	Dillon	Dover	Leesville	Mohawk
LOCATION:									
River Basin	--	Muskingum	Muskingum	Muskingum	Muskingum	Muskingum	Muskingum	Muskingum	Muskingum
Stream	--	Tuscarawas R.	Tuscarawas R.	Sandy Creek	Still Water Cr.	Licking R.	Tuscarawas R.	Tuscarawas R.	Walhonding R.
River Mile	miles	188.4	179.8	183.4	184.4	89.3	173.6	196.4	129.8
County	--	Carroll-Tuscarawas	Stark-Tuscarawas	Stark-Tuscarawas	Harrison	Muskingum	Tuscarawas	Carroll	Coshocton
State	--	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio
STATUS:	--	Operating	Operating	Operating	Operating	Operating	Operating	Operating	Operating
Authorized Purposes	--	FC, R	FC, R	FC	FC,R	FC, R	FC	FC, R	FC
Completion Date	--	1936	1936	1937	1936	1961	1938	1937	1937
Drainage Area	square miles	70	300	502	70	748	1,397	48	1,501
ELEVATION:	feet/msl						(Net) 777		(Net) 817
Power Pool	--	--	--	--	--	--	--	--	--
Flood Control Pool		941.0	976.5	962.0	910.5	790.0	916.0	977.5	890.0
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	--
Recreation Pool		928.0	948.0	--	898.0	--	--	963.0	--
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		--	--	895.0	--	734.0	874.0	--	799.2
STORAGE CAPACITY:	acre feet								
Power		--	--	--	--	--	--	--	--
Flood Control		26,100	70,000	149,600	27,500	260,900	202,000	17,900	285,000
Navigation		--	--	--	--	--	--	--	--
Water Quality		--	--	--	--	--	--	--	--
Recreation		23,600	1,700	--	26,500	--	--	19,500	--
Water Supply		--	--	--	--	--	--	--	--
Conservation		--	--	--	--	13,100	1,000	--	--
TOTAL		49,700	71,700	149,600	54,000	274,000	203,000	37,400	285,000
SURFACE AREA:	acres								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		2,460	6,150	6,500	2,620	10,280	10,100	1,470	7,950
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	--
Recreation Pool		1,540	420	--	1,800	--	--	1,000	--
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		--	--	--	--	1,560	350	--	--
POWER INSTALLATION:									
Capacity	1000 kw	--	--	--	--	--	--	--	--
Units	number	--	--	--	--	--	--	--	--
Yield (or Releases)1/									
Navigation	cfs	--	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--	--
Recreation (F. WL)	cfs2/	1.5	Inflow	Inflow	1.5	50	Inflow	1.5	Inflow
Water Supply	MGD	--	--	--	--	--	--	--	--

TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "G"

ITEM	UNITS	Corps of Engineers							
		Piedmont	Senecaville	Tappan	Wills Creek	Burr Oak (Tom Jenkins)	Dewey Reservoir	Bluestone Lake	Summersville Lake
LOCATION:									
River Basin	--	Muskingum	Muskingum	Muskingum	Muskingum	Hocking	Big Sandy	Kanawha	Kanawha
Stream	--	Tuscarawas R.	Wills Creek	Tuscarawas R.	Wills Creek	Sunday Creek	Levisa Fork	New River	Gauley River
River Mile	miles	198.0	188.0	174.0	108.2	57.5	84.8	161.8	131.5
County	--	Harrison	Guernsey-Noble	Harrison	Coshocton-Muskingum	Athens	Floyd	Summers	Nicholas
State	--	Ohio	Ohio	Ohio	Ohio	Ohio	Kentucky	W.Virginia	W.Virginia
STATUS:	--	Operating	Operating	Operating	Operating	Operating	Operating	Operating	Operating
Authorized Purpose	--	FC, R	FC, R	FC, R	FC, R	FC, WS, R	FC, R	FC, R	FC, WQ
Completion Date	--	1937	1937	1936	1937	1951	1951	1952	1967
Drainage Area	square miles	84	121	71	844	33	207	4,565	803
ELEVATION:	feet/msl				(Net) 723				
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		924.6	842.2	909.0	779.0	740.0	686.0	1520.0	1710.0
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	1650.0
Recreation Pool		913.0	832.2	899.3	742.0	710.0	650.0	1409.0	--
Water Supply Pool		--	--	--	--	721.0	--	--	--
Conservation Pool		--	--	--	--	--	645.0	1406.0	1520.0
STORAGE CAPACITY:	acre feet								
Power		--	--	--	--	--	--	--	--
Flood Control		32,200	45,000	26,500	190,000	17,600	76,100	594,500	227,400
Navigation		--	--	--	--	--	--	--	--
Water Quality		--	--	--	--	--	--	--	163,400
Recreation		34,500	43,500	35,100	6,000	3,500	4,900	5,600	--
Water Supply		--	--	--	--	5,800	--	--	--
Conservation		--	--	--	--	--	12,300	30,900	23,000
TOTAL		66,700	88,500	61,600	196,000	26,900	93,300	631,000	413,800
SURFACE AREA:	acres								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		3,270	5,170	3,100	11,450	1,192	3,340	9,180	4,920
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	2,723
Recreation Pool		2,310	3,550	2,350	900	394	1,100	1,970	--
Water Supply Pool		--	--	--	--	664	--	--	--
Conservation Pool		--	--	--	--	--	800	1,800	407
POWER INSTALLATION:									
Capacity	1000 kw	--	--	--	--	--	--	Authorized	--
Units	number	--	--	--	--	--	--	--	--
Yield (or Releases)1/									
Navigation	cfs	--	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--	75
Recreation (F & WL)	cfs2/	1.5	2.5	2.0	Inflow		10	610	1,000(Max)+Inflow
Water Supply	MGD	--	--	--	--	5	--	--	--

TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "C"

		Corps of Engineers							
ITEM	UNITS	Sutton Lake	Tygart Lake	Paint Creek Reservoir	Salt Creek Reservoir	East Fork Reservoir	Grayson Reservoir	Cave Run Reservoir	Fishtrap Reservoir
LOCATION:									
River Basin	--	Kanawha	Monongahela	Scioto	Scioto	Little Miami	Little Sandy	Licking	Big Sandy
Stream	--	Elk River	Tygart River	Paint Creek	Salt Creek	East Fork	Little Sandy	Licking	Levisa Fork
River Mile	miles	158.9	(Tyg.) 22.7	(Paint) 36.8	(Salt) 10.8	(E. Fork) 21.0	51.2	173.6	(LF) 103.3
County	--	Braxton	Taylor	Ross-Highland	Ross	Clermont	Carter	Bath	Pike
State	--	W. Virginia	W. Virginia	Ohio	Ohio	Ohio	Kentucky	Kentucky	Kentucky
STATUS:	--	Operating	Operating	AE & D	Construction	AE & D	Construction	Construction	Construction
Authorized Purpose	--	FC, WQ	FC, N	FC, WS, WQ, R	FC, R	FC, WQ, R	FC, WQ, R	FC, WQ, R	FC, WQ, R
Completion Date	--	1961	1938	--	--	--	--	--	--
Drainage Area	square miles	537	1,184	573	285	342	196	826	395
ELEVATION:	feet/msl								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		1000.0	1167.0	845.0	659.0	795.0	681.0	765.0	825.0
Navigation Pool		--	1094.0	--	--	--	--	--	--
Water Quality Pool		925.0	--	798.0	--	733.0	645.0	730.0	757.0
Recreation Pool		--	--	--	625.0	--	--	--	--
Water Supply Pool		--	--	787.5	--	729.0	--	--	--
Conservation Pool		850.0	1010.0	786.0	620.0	683.0	634.0	720.0	725.0
STORAGE CAPACITY:	acre feet								
Power		--	--	--	--	--	--	--	--
Flood Control		201,100	178,100	124,820	88,835	202,200	89,590	419,800	126,640
Navigation		--	--	--	--	--	--	--	--
Water Quality		60,100	--	10,240	--	8,400	(max)13,950	(max)47,000	27,190
Recreation		--	--	--	5,172	--	--	--	--
Water Supply		--	--	1,040	--	65,200	--	--	--
Conservation		4,100	9,700	8,900	6,290	19,000	15,450	147,306	10,530
TOTAL		265,300	187,800	145,000	100,297	294,800	118,990	614,100	164,360
SURFACE AREA:	acres								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		3,875	3,430	4,760	3,969	4,600	3,620	14,870	2,631
Navigation Pool		--	1,740	--	--	--	--	--	--
Water Quality Pool		1,520	--	1,190	--	2,160	1,500	(max)8,270	1,131
Recreation Pool		--	--	--	1,233	--	--	--	--
Water Supply Pool		--	--	--	--	2,050	--	--	--
Conservation Pool		270	620	890	933	820	1,050	6,790	569
POWER INSTALLATION:									
Capacity	1000 kw	--	Future	--	--	--	--	--	--
Units	number	--	--	--	--	--	--	--	--
Yield (or Releases)1/			350						
Navigation	cfs	--	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--	--
Recreation (F & WL)	cfs2/	400(Max)+Inflow		10	20S/10W	82	--	50	75S/10W
Water Supply	MGD	--	--	--	--	37	--	--	--

TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "G"

		Corps of Engineers						
ITEM	UNITS	Paintsville Reservoir	Yatesville Reservoir	Kehoe Lake	Beech Fork Lake	East Lynn Lake	R.D. Bailey Lake	Leading Creek Lake
LOCATION:								
River Basin	--	Big Sandy	Big Sandy	Ohio	Ohio	Ohio	Guyandot	Little Kanawha
Stream	--	Paint Creek	Blaine Creek	Tygart Creek	Twelvepole Creek	Twelvepole Creek	Guyandot	Leading Creek
River Mile	miles	(PC) 7.8	--	(TC) 48.5	(BF) 3.7	(TP) 42.0	112.0	--
County	--	Johnson-Morgan	Lawrence	Greenup-Carter	Wayne	Wayne	Wyoming	Gilmer
State	--	Kentucky	Kentucky	Kentucky	West Virginia	West Virginia	West Virginia	West Virginia
STATUS:	--	AE & D	AE & D	Authorized	Construction	Construction	Construction	Authorized
Authorized Purpose	--	FC, WQ, R	FC, WQ, R	FC, WQ, R	FC, FWL	FC, R	FC, WQ, R	FC, WQ, R
Completion Date	--	--	--	--	--	--	--	--
Drainage Area	square miles	92	208	127	78	133.0	540.0	--
ELEVATION:	feet/msl							
Power Pool		--	--	--	--	--	--	--
Flood Control Pool		733.0	646.0	700.0	614.5	701.0	1155.0	--
Navigation Pool		--	--	--	--	--	--	--
Water Quality Pool		696.0	612.0	653.0	--	--	1035.0	--
Recreation Pool		--	617.0	655.0	592.0	662.0	--	--
Water Supply Pool		--	--	--	--	--	--	--
Conservation Pool		650.0	609.0	636.0	583.5	656.0	1012.0	--
STORAGE CAPACITY:	acre feet							
Power		--	--	--	--	--	--	--
Flood Control		49,000	(s)77,600	(s)63,600	(s)28,360	(s)15,310	(s)169,500	52,600
Navigation		--	--	--	--	--	--	--
Water Quality		22,900	(max)10,100	8,600	--	--	12,200	--
Recreation		--	--	2,000	4,980	5,405	--	--
Water Supply		--	--	--	--	--	--	22,800
Conservation		4,500	12,100	4,800	4,200	11,705	22,000	2,000
TOTAL		76,400	99,800	79,000	37,540	82,500	203,700	76,400
SURFACE AREA:	acres							
Power Pool		--	--	--	--	--	--	--
Flood Control Pool		1,890	4,200	1,980	1,830	2,351	2,850	--
Navigation Pool		--	--	--	--	--	--	--
Water Quality Pool		840	1,100	780	--	--	630	--
Recreation Pool		--	1,375	825	720	1,005	--	--
Water Supply Pool		--	--	--	--	--	--	--
Conservation Pool		240	950	400	450	823	440	--
POWER INSTALLATION:								
Capacity	1000 kw	--	--	--	--	--	--	--
Units	number	--	--	--	--	--	--	--
Yield (or Releases)1/								
Navigation	cfs	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--
Recreation (F & WL)	cfs2/	10	10	10	--	10	45	--
Water Supply	MGD	--	--	--	5	--	--	--

TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "C"

		Corps of Engineers				Kentucky	Ohio		
ITEM	UNITS	West Fork Lake	Burnsville Lake	Rowlesburg Lake	Panther Creek Lake	Greenbo Lake	Grant Lake	Rocky Fork Reservoir	Lake White
LOCATION:									
River Basin	--	Little Kanawha	Little Kanawha	Monongahela	Big Sandy	Little Sandy	Ohio	Scioto	Scioto
Stream	--	West Fork	Little Kanawha	Cheat River	Tug Fork	Greenbo Creek	Whiteoak Cr.	Rocky Fork Cr.	Pee Dee Creek
River Mile	miles	2.0	123.7	129+	(PC) 6.1	--	--	--	--
County	--	Wirt	Braxton	Preston-Tucker	McDowell	Greenup	Brown	Highland	Pike
State	--	West Virginia	West Virginia	West Virginia	West Virginia	Kentucky	Ohio	Ohio	Ohio
STATUS:	--	Authorized	Construction	Authorized	Authorized	Operating	Operating	Operating	Operating
Authorized Purpose	--	FC, WQ, R	FC, WQ, R	FC, WQ	FC, WQ, R	R	R	R	R
Completion Date	--	--	--	--	--	1955	1948	1953	1935
Drainage Area	square miles	237.5	1o5.4	936.0	23.6	--	25.5	115.0	37.4
ELEVATION:	feet/msl								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		--	825.0	1632.0	1312.0	--	--	--	--
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	788.0	1601.0	1266.0	--	--	--	--
Recreation Pool		--	--	--	1271.0	--	906.0	880.0	567.0
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		--	775.0	1420.0	1218.0	--	--	--	--
STORAGE CAPACITY:	acre feet								
Power		--	--	--	--	--	--	--	--
Flood Control		63,200	(s)54,276	250,800	(s)9,320	--	--	--	--
Navigation		--	--	--	--	--	--	--	--
Water Quality		--	10,138	571,500	5,100	--	--	--	--
Recreation		--	--	--	760	2,000	1,190	34,100	3,734
Water Supply		33,200	--	--	--	--	--	--	--
Conservation		2,000	4,077	9,400	1,700	--	--	--	--
TOTAL		98,400	68,491	831,700	16,880	2,000	1,190	34,100	3,734
SURFACE AREA:	acres								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		--	1,965	9,140	288	--	--	--	--
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	980	5,800+	144	225	--	--	--
Recreation Pool		1,775	--	--	155	--	221	2,020	337
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		575	544	550	60	--	--	--	--
POWER INSTALLATION:									
Capacity	1000 kw	--	--	--	--	--	--	--	--
Units	number	--	--	--	--	--	--	--	--
Yield (or Releases)1/									
Navigation	cfs	--	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--	--
Recreation (F & WL)	cfs2/	--	20	1,400 +Inflow	5W/10S	--	--	--	--
Water Supply	MGD	--	57 (max)	--	--	--	--	--	--

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TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "G"

		Ohio							West Virginia
ITEM	UNITS	Jackson Lake	Tycoon Lake	Lake Logan	Buckeye Lake	Mohawk Lake	Salt Fork Reservoir	Wolf Run Reservoir	Plum Orchard Lake
LOCATION:									
River Basin	--	Ohio	Ohio	Hocking	Muskingum	Muskingum	Muskingum	Ohio	Kanawha
Stream	--	Symmes Cr.	Racoon Cr.	Hocking Rvr. Trib.	Jonathan Creek	Middle Run	Wills Creek	Duck Creek	Plum Orchard Cr.
River Mile	miles	--	--	--	--	--	--	--	--
County	--	Jackson	Gallia	Hocking	Fairfield-Perry	Carroll	Guernsy	Noble	Fayette
State	--	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio	West Virginia
STATUS:	--	Operating	Operating	Operating	Operating	Operating	Construction	Op (USDA)	Operating
Authorized Purpose	--	R	R	R	R	R	FC, WS, R	FC, WS, R	R
Completion Date	--	1940	1961	1954	1832	1963	--	1966	--
Drainage Area	square miles	19.0	1.4	14.8	49.2	6.1	160.0	5.6	4.1
ELEVATION:	feet/msl								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		--	--	--	--	--	--	--	--
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	--
Recreation Pool		700.0	616.0	--	--	1,030	900	--	--
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		--	--	--	--	--	--	--	--
STORAGE CAPACITY:	acre feet								
Power		--	--	--	--	--	--	--	--
Flood Control		--	--	--	--	--	29,400	--	--
Navigation		--	--	--	--	--	--	--	--
Water Quality		--	--	--	--	--	--	--	--
Recreation		1,700	2,000	3,000	19,940	5,000+	42,100	2,000	2,000
Water Supply		--	--	--	--	--	--	--	--
Conservation		--	--	--	--	--	--	--	--
TOTAL		1,700	2,000	3,000	19,940	5,000+	71,500	2,000	2,000
SURFACE AREA:	acres								
Power Pool		--	--	--	--	--	--	--	--
Flood Control Pool		--	--	--	--	--	6,900	--	--
Navigation Pool		--	--	--	--	--	--	--	--
Water Quality Pool		--	--	--	--	--	--	--	--
Recreation		243	204	340	2,853	500	3,000	220	202
Water Supply Pool		--	--	--	--	--	--	--	--
Conservation Pool		--	--	--	--	--	--	--	--
POWER INSTALLATION:									
Capacity	1000 kw	--	--	--	--	--	--	--	--
Units	number	--	--	--	--	--	--	--	--
Yield (or Releases)1/									
Navigation	cfs	--	--	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	--	--	--	--
Recreation (F & WL)	cfs2/	--	--	--	--	--	--	--	--
Water Supply	MGD	--	--	--	--	--	--	--	--

TABLE 13-3 (cont'd)
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION "G"

		Private Developments		Appalachian Power Co. - Private			
ITEM	UNITS	Steven Branch Lake	Flat Top Lake	Byllesby Reservoir	Claytor Lake	Blue Ridge (Upper) Res.	Blue Ridge (Lower) Res.
LOCATION:							
River Basin	--	Kanawha	Kanawha	Kanawha	Kanawha	Kanawha	Kanawha
Stream	--	Coal River	New River	New River	New River	New River	New River
River Mile	miles	--	--	--	--	344	315
County	--	Raleigh	Raleigh	Carroll	Pulaski	Grayson(Dam)	Grayson(Dam)
State	--	West Virginia	West Virginia	Virginia	Virginia	Virginia, N.C.	Virginia, N.C.
STATUS:	--	Operating	Operating	Operating	Operating	License Approval Pending	
Authorized Purpose	--	R	R	P	P	P, WQ, R	P, WQ, R, FC
Completion Date	--	--	--	--	--	Expected by 1980	
Drainage Area	square miles	3.8	6.6	1,310.0	2,302.0	758	1,111
ELEVATION:	feet/msl						
Power Pool		--	--	--	--	2,652	2,434.4
Flood Control Pool		--	--	--	--	--	2,446
Navigation Pool		--	--	--	--	--	--
Water Quality Pool		--	--	--	--	2,652	2,434.4
Recreation Pool		--	--	--	--	2,652	2,434.4
Water Supply Pool		--	--	--	--	--	--
Conservation Pool		--	--	--	--	2,640	2,390
STORAGE CAPACITY:	acre feet						
Power		--	--	3,540	232,000	290,000 3/	466,000 3/
Flood Control		--	--	--	--	--	160,000
Navigation		--	--	--	--	--	--
Water Quality		--	--	--	--	290,000 3/	466,000 3/
Recreation		8,000	2,200	--	--	--	--
Water Supply		--	--	--	--	--	--
Conservation		--	--	--	--	1,720,000	625,000
TOTAL		8,000	2,200	3,540	232,000	2,010,000	1,251,000
SURFACE AREA:	acre						
Power Pool		--	--	335	4,540	26,000	12,800
Flood Control Pool		--	--	--	--	--	14,400
Navigation Pool		--	--	--	--	--	--
Water Quality Pool		--	--	--	--	26,000	12,800
Recreation Pool		303	225	--	--	26,000	12,800
Water Supply Pool		--	--	--	--	--	--
Conservation Pool		--	--	--	--	22,700	8,400
POWER INSTALLATION:							
Capacity	1000 kw	--	--	22	75	1,600	200
Units	number	--	--	--	--	8	2
Yield (or Releases) 1/							
Navigation	cfs	--	--	--	--	--	--
Water Quality	cfs	--	--	--	--	260-4,000 4/	260-4,000 4/
Recreation (F & WL)	cfs 2/	--	--	--	--	--	--
Water Supply	MGD	--	--	--	--	--	--

1/ May be in combination. 2/ Minimum release during "drouth" condition. 3/ Joint-use. 4/ System release.

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Local

Local governments sponsor, support and share in the costs of local protection projects, flood control structures and upstream watershed projects authorized under Federal law. In addition, city and county governments have invested heavily in recreation and water supply impoundments.

Water Sub-region G's cities with a population in excess of 10,000 and their source of municipal supply are shown below.

City	Population	Supply Source
Ashland, Kentucky	31,000	Ohio River
Athens, Ohio	16,500	Wells along Hocking Rv.
Chillicothe, Ohio	25,000	Wells
Coshocton, Ohio	13,100	Wells along Walhonding
Dover, Ohio	11,300	Wells
Ironton, Ohio	15,800	Ohio River
Marietta, Ohio	16,900	Wells along Muskingum Rv.
New Philadelphia, Ohio	14,300	Wells
Portsmouth, Ohio	31,500	Ohio River
Zanesville, Ohio	38,000	Wells along Muskingum Rv.
Beckley, W. Va.	22,500	Glade Creek Reservoir
Bluefield, W. Va.	22,000	Springs
Charleston, W. Va.	96,000	Elk and Kanawha Rivers
Huntington, W. Va.	90,000	Ohio River
Parkersburg, W. Va.	46,000	Wells along Ohio River

Private

There are hundreds of recreation and training developments in the sub-region; especially in the steeper areas of southeastern Ohio and in the mountainous sections of Kentucky, Virginia and West Virginia. Such developments are sponsored by Boy and Girl Scouts, benevolent organizations and other similar groups. In addition, there are "private club" hunting, fishing and recreation developments. The two largest lakes so sponsored are the Steven Branch and Flat Top Lakes in West Virginia (See Table 13-3 on Page 13-53). White Sulphur Springs Resort in West Virginia is the best known commercial facility in the sub-region.

The Appalachian Power Company has two relatively large operating hydropower plants on New River in Virginia, at Byllesby and Claytor, and has an application pending for construction of a major power project at the site of the U.S. Army Corps of Engineers authorized Moores Ferry Project. (APC's Blue Ridge Site.) (See Table 13-3 on Page 13-53 and Figure 13-13 on Page 13-35).

4. INTRODUCTION

Planning Devices

To analyze an area as large as Appalachia required that it be divided into sub-regions, reflecting physical and economic differences, and state planning administration. Types of sub-regions which have been delineated include: (1) water sub-regions and water areas, related to drainage patterns and other physical aspects; (2) economic sub-regions; and (3) state planning sub-regions.

Appalachia has been divided into 10 water sub-regions, "A" through "J", the boundaries corresponding as nearly as feasible to the areas of responsibility of participating Corps of Engineer Districts and the Tennessee Valley Authority. In drawing the boundaries, adjustments were made to correspond so far as possible with the limits of the state planning sub-regions established by the Appalachian states.

Water Sub-region G corresponds generally with the Huntington District, Corps of Engineers. Figure 13-15 shows the several sub-regions utilized in analysis of Water Sub-region G.

The water sub-regions were divided into water areas to allow for a more detailed analysis. Water Sub-region G contains 5 water areas, G-1 through G-5. G-1 contains 15 southeastern Ohio counties, forming the northern portion of Sub-region G. G-2 includes 11 southern Ohio counties, 4 western West Virginia counties, and 7 eastern Kentucky counties. G-3, comprising 11 counties, occupies a belt in western West Virginia. G-4 is composed of 6 eastern Kentucky counties and 4 southern West Virginia counties. G-5 contains 15 eastern and southeastern West Virginia counties and 8 southwestern Virginia counties.

The Office of Business Economics, U.S. Department of Commerce, has regionalized Appalachian counties into a series of 27 economic sub-regions focused on trade centers. Projections made on the basis of OBE economic sub-regions have been adapted to the 10 water sub-regions and to the water areas and, on a very limited basis, to the 63 state planning sub-regions. (See Appendix E).

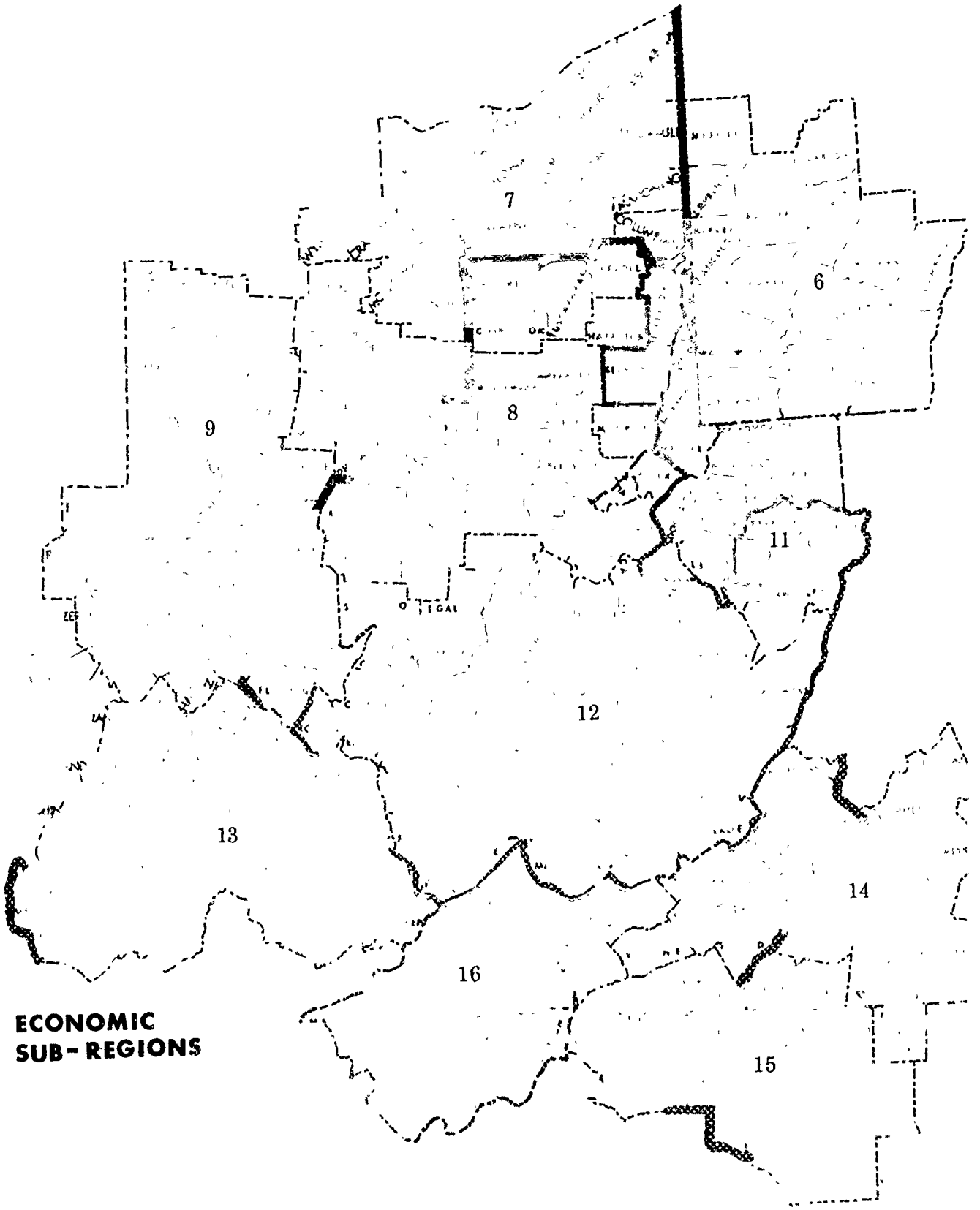
Within Water Sub-region G, portions of ten OBE economic sub-regions are represented. (See Figure 13-15). Monroe and Harrison Counties in Ohio and Pleasants and Tyler Counties in West Virginia are within OBE Sub-region 6. The four northernmost Ohio counties of Water Sub-region G are in OBE Sub-region 7. Twelve Ohio counties and three West Virginia counties of Water Sub-region G are within OBE Sub-region 8. Four Appalachian Counties in southwest Ohio and Lewis County, Kentucky are in OBE Sub-region 9. Four

east-central West Virginia Counties of Water Sub-region G are in OBE Sub-region 11. All of OBE Sub-region 12 (25 West Virginia Counties, 4 Ohio and 10 Kentucky), except Gilmer County, West Virginia, is within Water Sub-region G. Magoffin and Morgan Counties, Kentucky, fall within OBE Sub-region 13. Four Virginia Counties of Water Sub-region G are within OBE Sub-region 14. Carroll and Grayson Counties, Virginia, are within OBE Sub-region 15. Bland and Symth Counties, Virginia, are within OBE Sub-region 16.

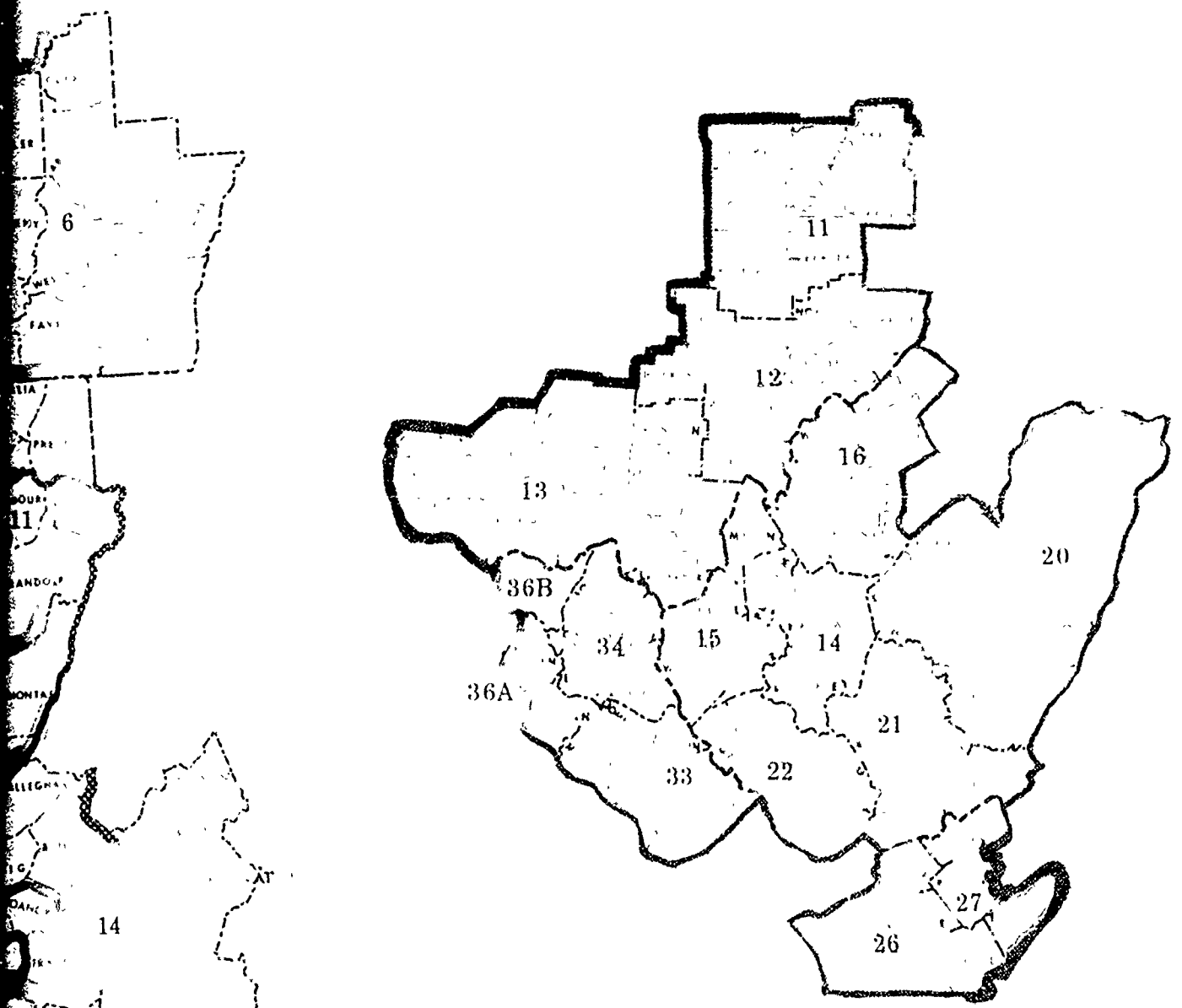
Sixty-three state planning sub-regions were established to meet the requirements for regional economic development analysis and to provide a framework for local development programs under the Appalachian Regional Development Act of 1965. Characteristics relating to social, political, economic, and physical conditions were considered in delineating the planning areas, particular attention being given to the historic pattern of economic activity and to indicators of potential economic expansion. The sub-regions selected for the writing of this report were determined as nearly as possible according to state planning areas, modified in some instances in relation to drainage area boundaries. All of eleven state planning sub-regions, and parts of four others, are within Water Sub-region G. Two counties in Ohio where the planning area and drainage basin boundaries are not compatible are Jefferson (State Planning Sub-region 11) and Belmont (State Planning Sub-region 12). The two counties are along the state border and have more linkages with an adjacent area; they were accordingly included in Water Sub-region F. Another area where planning area and drainage basin boundaries do not correspond is in eastern Kentucky. When the Kentucky planning areas were reformulated in 1967, Areas 36A and 36B were divided by the sub-regional boundary which had been established according to the original planning areas. State Planning Sub-region 36A contains Rowan and Morgan Counties in Water Sub-region G. State Planning Sub-region 36B is comprised of Lewis County in Water Sub-region G and Fleming County in Water Sub-region H. (See Figure 13-15).

Within each of the state planning sub-regions, the States, as part of their Appalachian development plans, have designated one or more areas of significant potential for future growth (growth areas). Such areas have been defined by the Appalachian Regional Commission as follows:

> "an area consisting of an urban center or centers and their hinterland where the state had determined significant future growth is likely or can be induced.
>
> By a center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide a

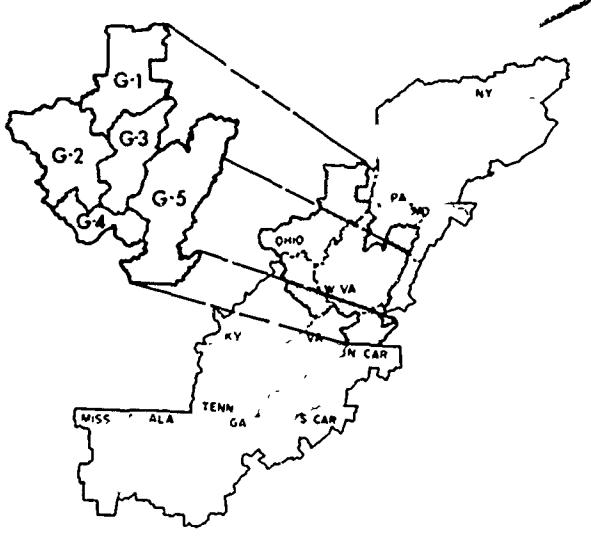


ECONOMIC SUB-REGIONS



STATE PLANNING SUB-REGIONS

3



VICINITY MAP

APPALACHIAN REGIONAL BOUNDARY

WATER SUB-REGION G BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-13-57 **FIGURE 13-15**

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range of cultural, social, employment, trade and service functions for itself and its associated rural hinterland. Though a center may not be fully developed to provide all these functions, it should provide, or potentially provide, some elements of each and presently provide a sufficient range and magnitude of these functions to be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland."

The following table shows the relationship between the state planning sub-regions, the water areas, and the growth centers for Water Sub-region G:

TABLE 13-4
RELATIONSHIP BETWEEN STATE PLANNING SUB-REGIONS, WATER AREAS, AND GROWTH CENTERS IN WATER SUB-REGION G

State Planning Sub-region No.	Name	Water Areas	State	Growth Centers
11	Tuscarawas	G-1	Ohio	(1) New Philadelphia, Zanesville, Cambridge, Coshocton (Primary)
12	Central Ohio Valley	G-1	Ohio	(1) Athens-Marietta, Malta-McConnelsville (Primary)
13	Lower Ohio Valley	G-2	Ohio	(1) Chillicothe-Portsmouth-Ironton (Primary); (2) Hillsboro-Greenfield (Secondary); (3) Jackson (Primary); (4) Gallipolis (Secondary); (5) Greater Cincinnati (Clermont County-Primary)
14	Kanawha Valley	G-3	W.Va.	(1) Greater Charleston (Primary)
15	Lower Ohio Valley	G-2	W.Va.	(1) Greater Huntington (Primary) (2) Milton (Secondary) (3) Hamlin-W. Hamlin (Secondary)
16	Middle Ohio Valley	G-3	W.Va.	(1) Parkersburg (Primary); (2) Spencer (Secondary); (3) Grantsville (Secondary); (4) Harrisville (Secondary)

TABLE 13-4
RELATIONSHIP BETWEEN STATE PLANNING SUB-REGIONS,
WATER AREAS, AND GROWTH CENTERS IN WATER SUB-REGION G
(Cont'd)

State Planning Sub-region No.	Name	Water Areas	State	Growth Centers
20	Appalachian Highlands	G-5	W.Va.	(1) Elkins-Buckhannon-Philippi (Primary); (2) Lewisburg-Ronceverte-White Sulphur Springs (Primary); (3) Sutton-Gassaway (Secondary); (4) Marlinton (Secondary); (5) Summersville-Richwood (Secondary)
21	Southern Coalfields	G-5	W.Va.	(1) Bluefield-Princeton (Primary); (2) Beckley (Primary); (3) Montgomery (Secondary); (4) Hinton (Secondary); (5) Oak Hill-Mt. Hope (Secondary)
22	Central Appalachia	G-4	W.Va.	(1) Williamson (Primary); (2) Logan (Primary); (3) Welch (Primary); (4) Pineville-Mullins (Secondary)
26	Great Valley and Blue Ridge	G-5	W.Va.	(1) Galax-Hillsville (Primary); (2) Marion-Wytheville (Primary)
27	Greater Roanoke	G-5	Va.	(1) Pulaski-Narrows (Primary)
33	Big Sandy	G-4	Ky.	(1) Pikeville-Prestonburg-Paintsville (Primary)
34	Fivco	G-2	Ky.	(1) Huntington-Ashland (Primary) (2) Grayson (Secondary)
36A & 36B	Gateway-Buffalo Trace	G-2	Ky.	(1) Midland (Primary); (2) Morehead (Primary)

Economic Characteristics

Total employment in Water Sub-region G in 1960 was 768,600, down 9 percent from the 1950 level of 845,000 workers. The employment of the nation between 1950 and 1960 increased by 5.7 percent. Even though total employment in the sub-region declined, primarily because of

percent declines of 57, 56, and 17 percent in agriculture, mining, and transportation, respectively, some industries experienced significant increases. Most prominent of Sub-region G's employment gains was a 24 percent increase in manufacturing employment, a gain that surpassed the nation's increase of 20 percent. Construction employment in the sub-region increased 1.6 percent. All other industries that gained in employment had increases that were less in percentage terms than those for the nation. Service employment gained 22 percent compared with 34 percent, for the nation. Wholesale and retail trade gained 5 percent, compared with 11 percent for the nation. Government employment increased 17 percent compared with 27 percent for the nation. See Tables 13-5 and 13-6 for related data.

Sub-region G's employment is dominated by the large proportion of the total which is concentrated in manufacturing (26 percent in 1960), practically identical with the nation's share. Within the manufacturing industries, large employment gains were posted by chemicals, machinery, food, and printing. However, the sub-region has more of its work force (8 percent) employed in mining than has the nation (0.9 percent), and less in services, 18 percent compared with 20 percent. If the sub-region is to participate adequately in the nation's growth, it will have to expand its manufacturing and service industries so that jobs will be available to the younger people as well as offering alternatives to those who will continue to lose jobs in agriculture and mining, as technology reduces present employment opportunities.

Agriculture, which made up only 7 percent of the sub-region's 1960 total employment and 2 percent of its 1966 income, accounts for a very significant portion of total land use in the sub-region, though the number of acres in farms, as well as the number of farms, has been decreasing. The inherent handicaps of rugged terrain keep agriculture at a disadvantage as compared with the nation's better farming areas. Figure 13-16 presents the value of all farm products sold in Water Sub-region G for Census of agriculture years, 1949 and 1964.

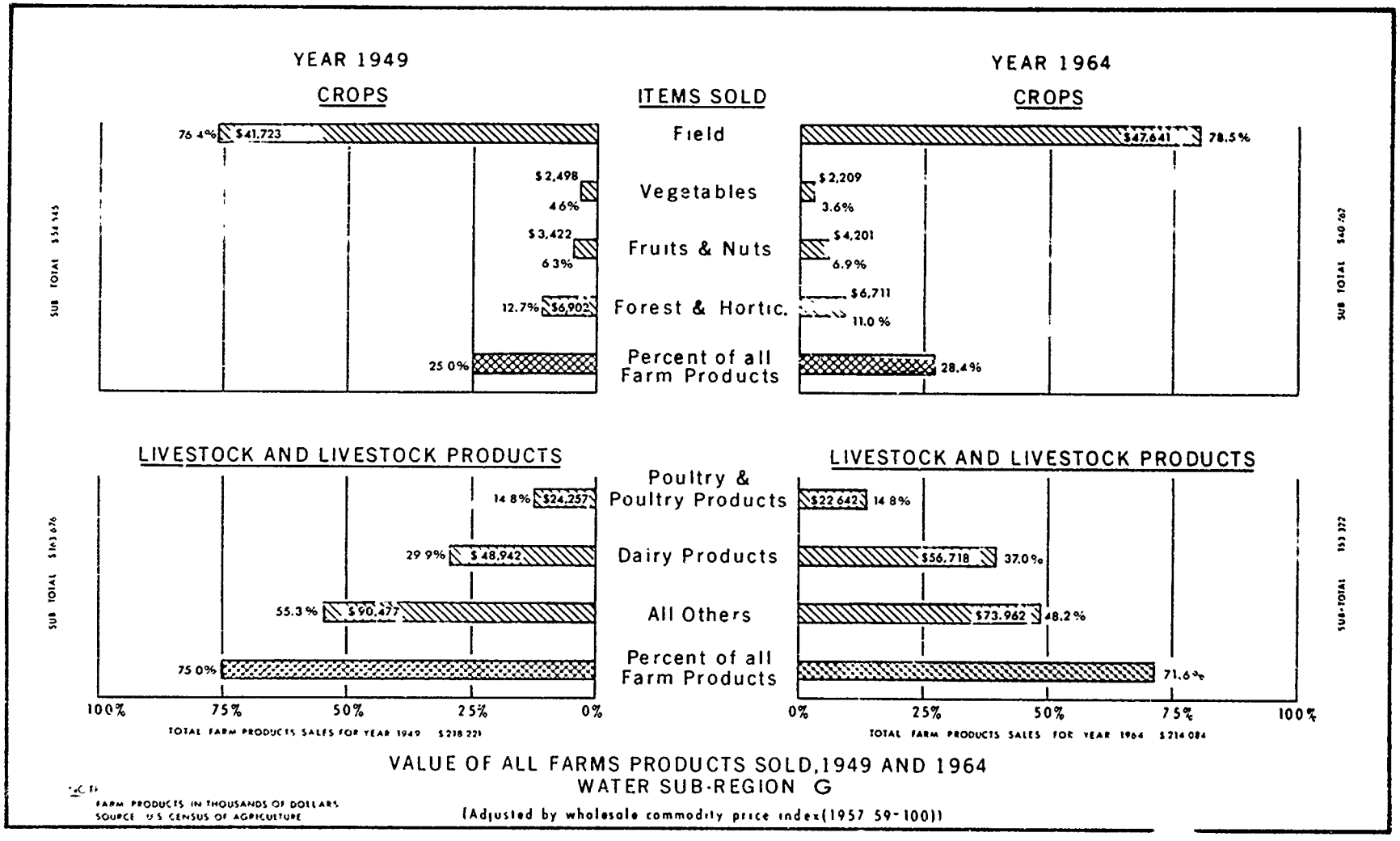
Over half of the sub-region's 239 million acres of land are in forest cover of which 99 percent is classified as commercial (See Appendix A, particularly Table I, VIII, IX and X for more details). In 1962 the Sub-region had 13,090 million cubic feet of merchantable timber. Hardwood growing stock comprises 12,313 million cubic feet and softwood 777. Hardwood sawtimber accounts for 34,715 million board feet and softwoods 2,323. About 38 percent of the commercial forest area is less than 70 percent stocked with growing stock trees. (See Appendix A, Tables VII - XI). The net annual cut from growing stock is 138 million cubic feet. In 1962, the volume of timber products output was 89 million cubic feet of sawlogs, veneer logs, and miscellaneous products; 23 million cubic feet of pulpwood and 18 million cubic feet of fuel wood. The total estimated value of the output was $41 million.

TABLE 13-5
EMPLOYMENT BY SECTORS FOR 1950 and 1960
UNITED STATES

	1950	1960	Absolute Change
TOTAL ALL SECTORS	57,474,700	66,372,600	3,270,900
PRIMARY ACTIVITIES	7,973,400	5,003,900	-2,969,500
Agriculture	6,917,700	4,256,700	-2,661,000
Forestry & Fisheries	125,000	93,200	- 31,800
Mining	930,700	654,000	- 276,700
SECONDARY ACTIVITIES	18,058,100	21,329,000	3,270,900
Contract Construction	3,457,200	3,815,900	358,700
Food & Kindred Products	1,414,000	1,822,500	408,500
Textile Mill Products	1,240,300	954,000	- 286,300
Apparel	1,063,900	1,159,200	95,300
Lumber, Wood Products, Furniture	1,190,200	1,067,300	- 122,900
Printing & Publishing	855,300	1,141,200	285,900
Chemicals & Allied Products	659,300	864,500	205,200
Electrical & Other Machinery	2,084,300	3,055,400	971,100
Motor Vehicles & Equipment	869,400	841,900	- 27,500
Other Transportation Equipt.	482,800	976,800	494,000
Other & Miscellaneous	4,741,400	5,630,300	888,900
TERTIARY ACTIVITIES	30,600,700	37,431,600	6,830,900
Transportation & Communications	3,664,000	3,559,500	- 104,500
Utilities & Sanitary Serv.	785,200	898,600	113,400
Wholesale Trade	1,981,800	2,213,000	231,200
Retail Trade	8,602,800	9,579,700	976,900
Finance, Ins. & Real Estate	1,920,700	2,694,600	773,900
Personal Services	4,814,400	5,469,200	654,800
Professional Services	4,797,200	7,577,800	2,780,600
Recreational Services	494,700	502,900	8,200
Public Administration	2,514,400	3,202,900	688,500
Armed Forces	1,025,500	1,733,400	707,900
NOT REPORTED	842,500	2,608,100	1,765,600

TABLE 13-6
EMPLOYMENT BY SECTORS FOR 1950 and 1960
WATER SUB-REGION G

	1950	1960	Absolute Change
TOTAL ALL SECTORS	844,964	768,645	- 76,319
PRIMARY ACTIVITIES	276,091	119,449	-156,642
Agriculture	130,306	54,266	- 76,040
Forestry & Fisheries	610	806	196
Mining	145,175	64,377	- 80,798
SECONDARY ACTIVITIES	205,612	244,675	39,063
Contract Construction	44,896	45,608	712
Food & Kindred Products	9,519	12,846	3,327
Textile Mill Products	7,508	7,446	- 62
Apparel	5,110	7,776	2,666
Lumber, Wood Products, Furniture	21,531	17,921	- 3,610
Printing & Publishing	6,190	9,273	3,083
Chemicals & Allied Products	25,179	33,715	8,536
Electrical & Other Machinery	10,590	18,623	8,033
Motor Vehicles & Equipment	2,106	4,288	2,182
Other Transportation Equipt.	674	2,809	2,135
Other & Miscellaneous	72,309	84,370	12,061
TERTIARY ACTIVITIES	349,389	380,481	31,092
Transportation & Communications	56,339	46,820	- 9,519
Utilities & Sanitary Service	13,619	14,146	527
Wholesale Trade	18,529	18,124	- 405
Retail Trade	108,872	115,291	6,419
Finance, Ins. & Real Estate	12,399	16,690	4,291
Personal Services	53,149	51,869	- 1,280
Professional Services	58,602	86,260	27,658
Recreational Services	4,878	4,315	- 563
Public Administration	22,194	25,859	3,665
Armed Forces	808	1,107	299
NOT REPORTED	13,872	24,040	10,168



VALUE OF ALL FARMS PRODUCTS SOLD, 1949 AND 1964
WATER SUB-REGION G

FARM PRODUCTS IN THOUSANDS OF DOLLARS
SOURCE U S CENSUS OF AGRICULTURE

(Adjusted by wholesale commodity price index(1957-59=100))

FIGURE 13-16

The labor force for Sub-region G declined slightly between 1950 and 1960, while the nation's increased. Labor force as a percent of total population for Sub-region G and the nation differed significantly in 1960 (31 percent compared with 39 percent), and indicated widespread unemployment. Unemployment in the sub-region is still significant, especially in areas south of the Ohio River. (See Figure 13-17 on Page 13-67.) When the number of people who are capable of working but who are not included in the labor force are tallied, the number of jobless becomes highly significant.

The distribution of the labor force by sex in 1960 in the sub-region (73 percent male and 27 percent female), differs somewhat from the nation's distribution of 68 percent male and 32 percent female. This disparity is emphasized by the rapid increase in female participation in the country generally.

White collar workers in the sub-region, as a percent of employed workers, fall short of the proportion in the United States. The contrast may be indicative of lack of managerial talent in the sub-region.

Disparities in the distribution of Sub-region G's labor force by age relative to the nation's reflect the tremendous population migration that resulted from lack of employment opportunities. Males in the 24-44 age bracket departed, taking their families, which lowered the percent of people who enter the labor force. Large portions of the older segment of the population remained. It is also significant that large numbers of workers are approaching retirement age (especially miners and farmers) and this in all probability will further decimate the labor force.

The relative economic well-being of the various parts of Sub-region G is evident from a comparison of median family incomes in the various counties with the national figure (4,660 in 1959). Only 9 counties in the sub-region had median family incomes of $5,000 and more. These included 5 counties in Ohio (Clermont near Cincinnati; Tuscarawas and Carroll near Canton; Ross, containing Chillicothe; and Muskingum, containing Zanesville); 3 counties in West Virginia (Kanawha, containing Charleston; Cabell, containing most of Huntington; and Wood, containing Parkersburg); and 1 in Kentucky (Boyd, containing Ashland).

Counties in the intermediate income range ($4,000 to $4,999) also show a close correlation with urban and industrial centers and, in several instances in southern West Virginia, with areas of intensive coal production. The counties of lower rank (under $4,000) are generally in the more remote sections, where industrial development is at a minimum.

Proprietor's income, property income, trade income, and services income have maintained fairly constant percentages of total personal income from 1929 to 1966. The most significant decreases occurred in the farming and mining sectors. Transportation income has also decreased between 1929 and 1966.

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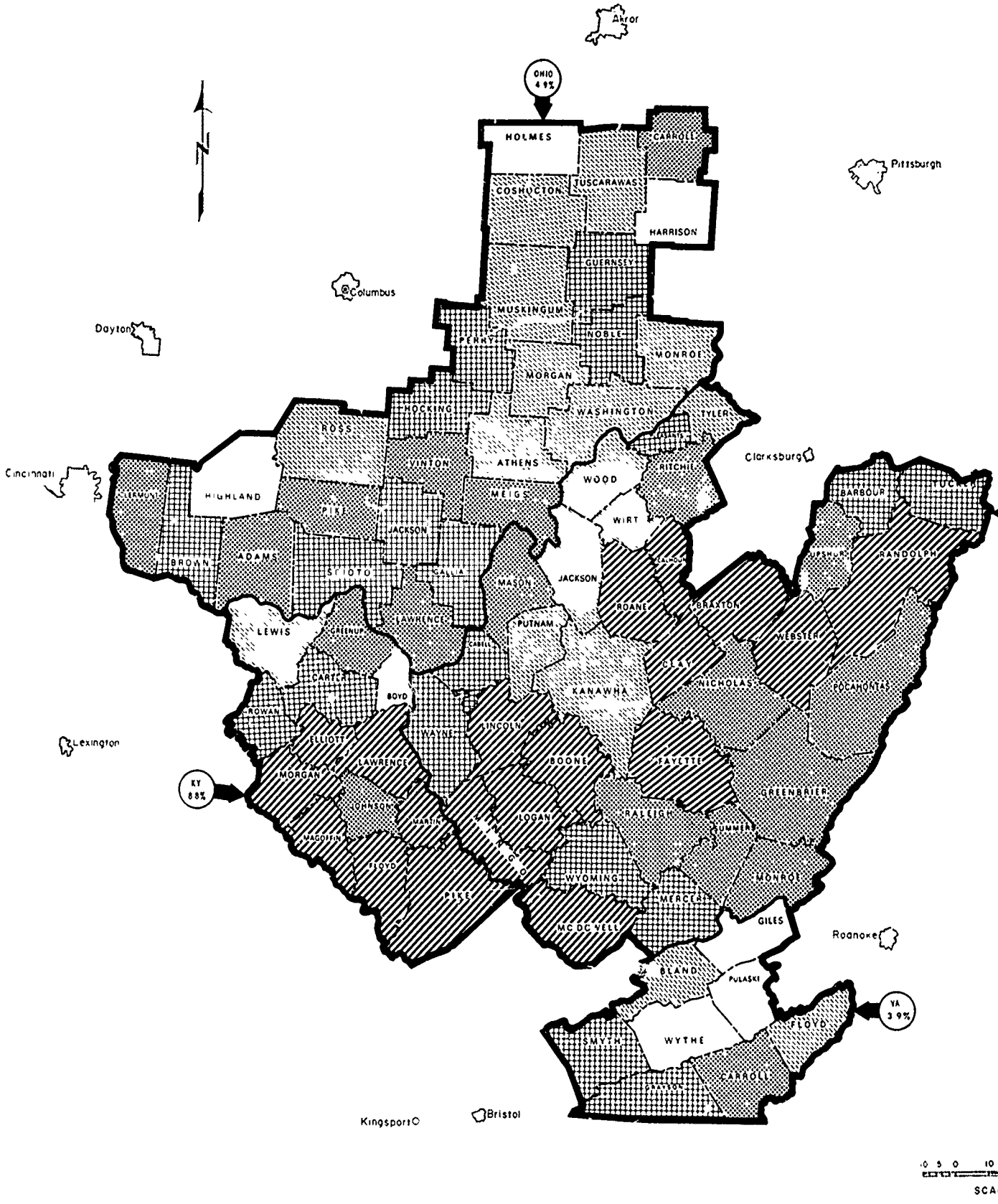
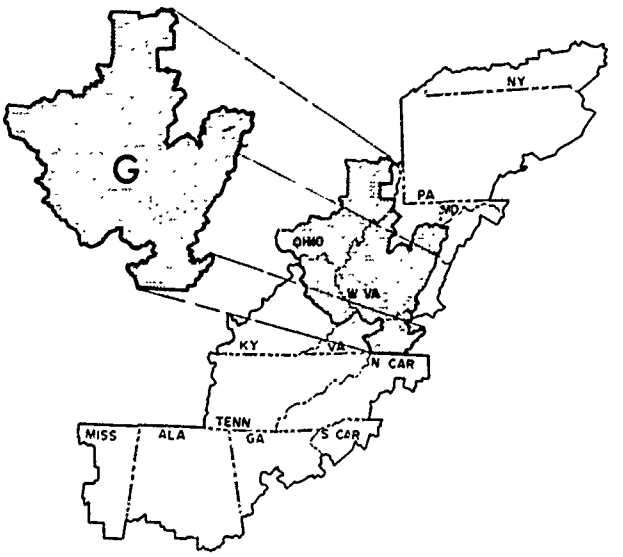
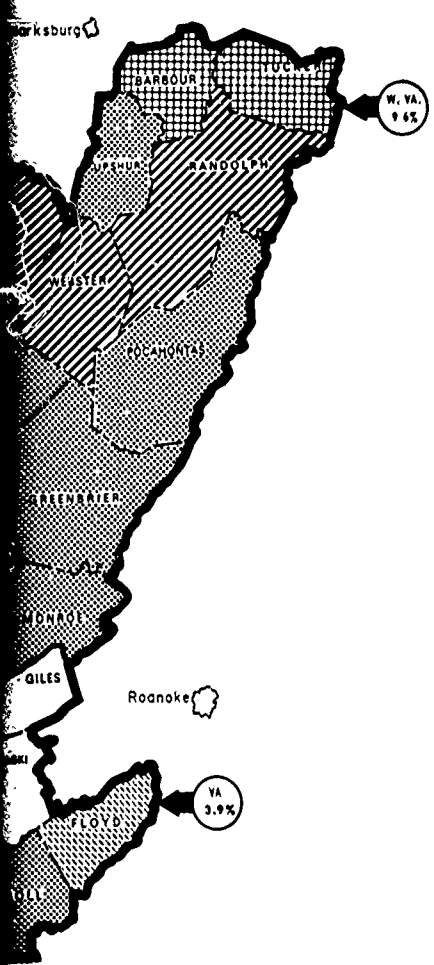




VICINITY MAP

Pittsburgh



10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

- COUNTIES HAVING LESS THAN 3.0%
- COUNTIES HAVING 3.0%–4.9%
- COUNTIES HAVING 5.0%–6.9%
- COUNTIES HAVING 7.0%–9.9%
- COUNTIES HAVING 10.0%–24.9%
- W.VA 9.6% — PERCENT OF UNEMPLOYMENT BY PORTION OF STATE SHOWN

NOTE: VALUES SHOWN ARE PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-13-67 **FIGURE 13-17**

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The most significant increase in income has been shown by transfer payments (social security payments, relief payments, veterans programs, etc.). Government as a source of income also has shown a substantial increase, reflecting a growing population and a need for more services (schools, roads, etc.) that are not provided by the private sector of the economy. Manufacturing increased its contribution to income from 14.9 percent in 1929 to 29.8 percent in 1962. Figure 13-18 (Page 13-70) shows the distribution of family income for the United States and Sub-region G. Sources of income by sectors are shown in Figure 13-19 (Page 13-71).

Per capita income for Sub-region G amounted to $1,404 (1954 dollars) in 1962. This was 77 percent of the per capita income of $1,822 for the entire Appalachian Region and 66 percent of the per capita income of $2,114 for the nation. The sub-region's per capita income has, in general, improved in recent years, reflecting the tremendous increase in the nation's economic growth, as well as continuing out-migration from the sub-region.

The quality of Sub-region G's housing is far below national norms. The median value of owner occupied housing units in 1960 for the nation was 11,900 dollars. In the sub-region, values ranged from below $5,000 in one water area to $7,700 in another. In the sub-region, houses having sound plumbing accounted for 45 percent of all units, compared with 74 percent for the country. The low quality of housing decreases valuable tax revenues, in addition to contributing to poor health and depression among the populace.

Coal is a major export from the area. This goes to users along the eastern seaboard and in the Middle West, and is transshipped on the Great Lakes and to overseas destinations. Chemicals and primary metals are other major exports shipped to other sub-regions and to non-Appalachian markets.

Capital Availability

Capital funds flow from a number of public and private sources. Money markets in the metropolitan areas close to Sub-region G (for example: Lexington, Cincinnati, Columbus, Cleveland, Pittsburgh, and Roanoke) and within the region (Huntington and Charleston) provide sources of funds for a wide array of industrial and commercial endeavors. Capital is also provided by large corporations for their own needs. Several firms in the sub-region have contributed monies for civic improvements. Public funds come from programs of Federal, state, and local governments. The Appalachian Regional Commission is furnishing additional developmental capital for public facilities such as water and sewer systems, hospitals, libraries and schools. Bank deposits per capita, by counties, are shown in Figure 13-20 on Page 13-73). There are significant

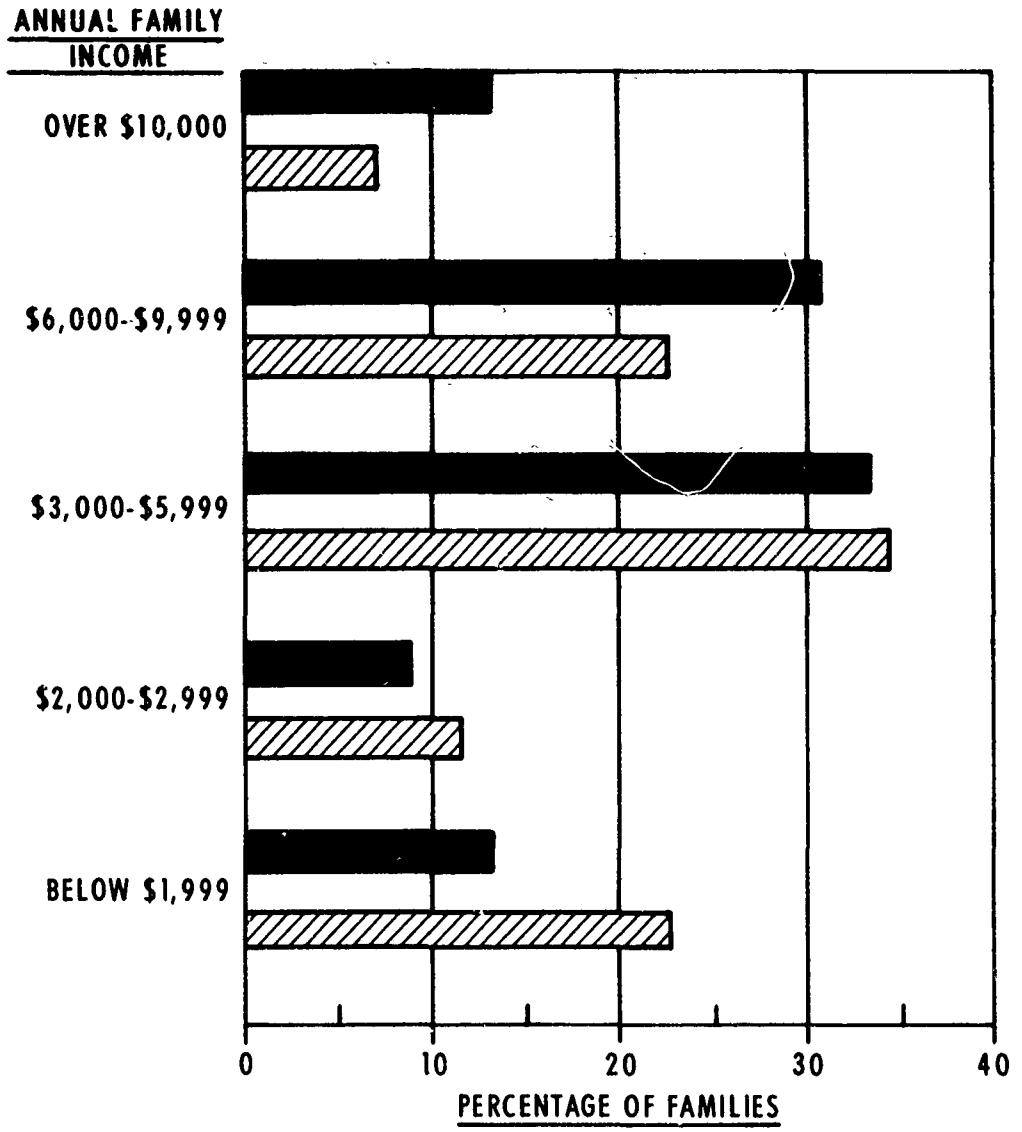


FIGURE 13—18 DISTRIBUTION OF FAMILY INCOME, WATER SUB-REGION G VS THE U.S.

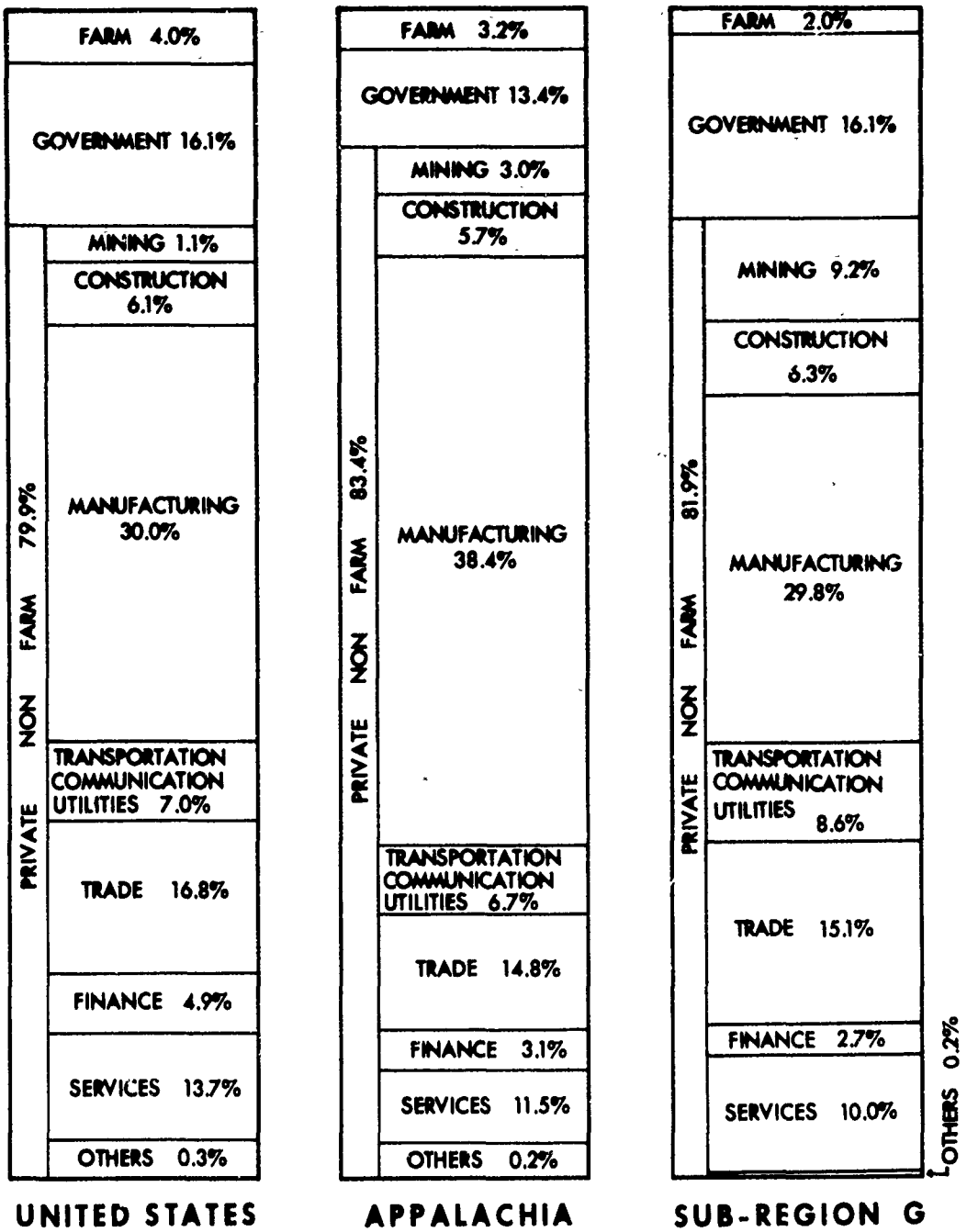


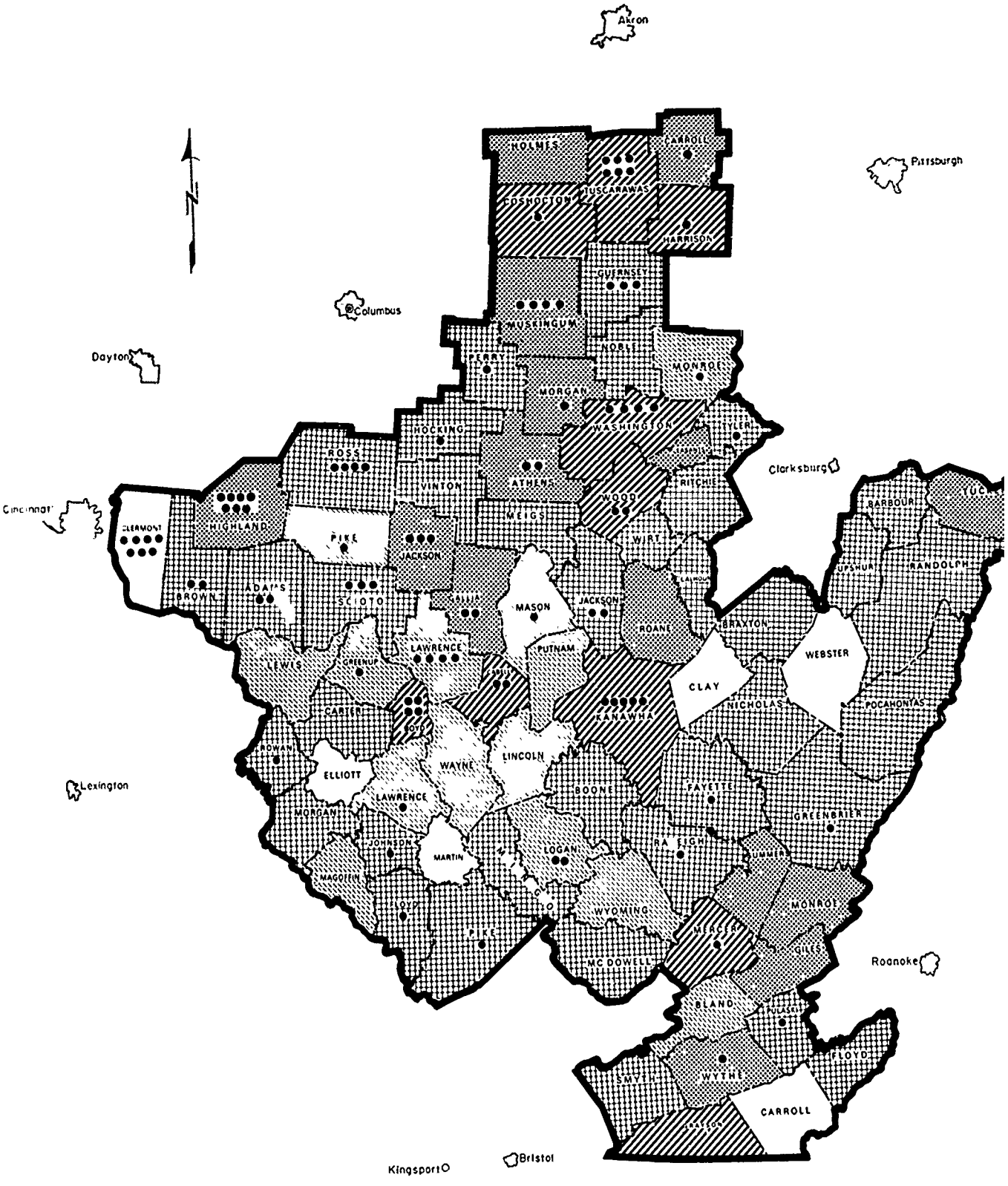
FIGURE 13–19 SOURCES OF INCOME, 1966.

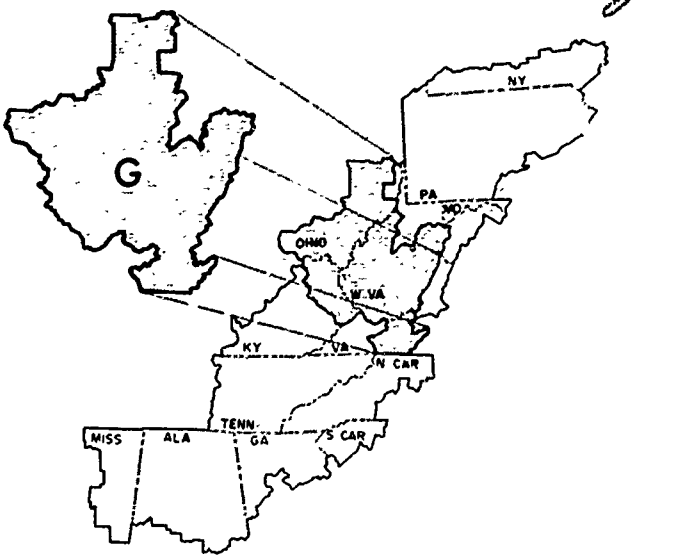
Federal land holdings in the Sub-region. National Forests account for 1,132,200 acres all available for public recreation use. About 332,000 acres of forest land are in public holdings. Thus, about 1,464,200 acres or 6 percent of the total land area is in public ownership. To help sustain the local tax base, it is the policy of the Federal Government that maintains and manages the forest land to return about 25 percent of all revenues to the counties concerned.

Local Attitudes

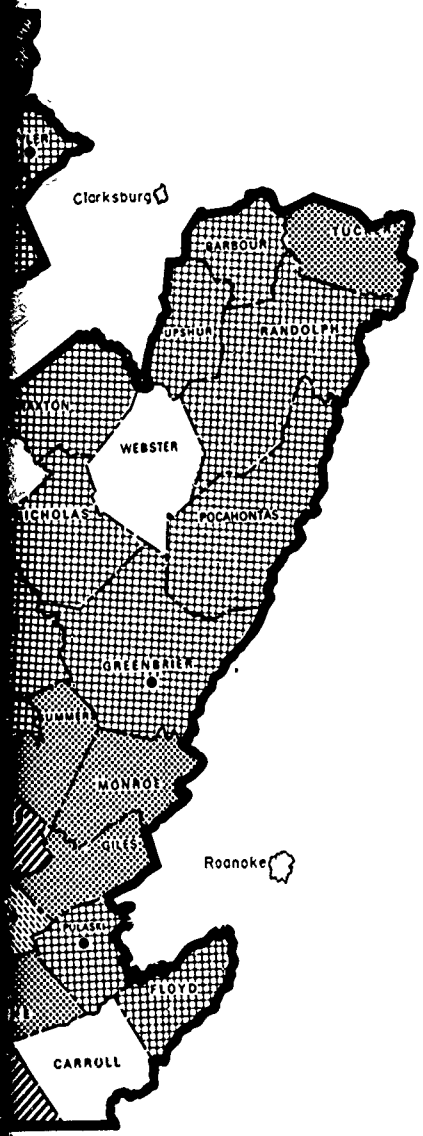
A positive attitude is evolving toward economic growth within the water sub-region, though the change is slow, notwithstanding special outside stimuli. Great contrast exists among local groups in their attitude toward economic development or other social changes. Attitudes vary from active solicitation of new employers in parts of Ohio and West Virginia to relative indifference to commercial expansion, as in various rugged areas of West Virginia and Kentucky. State and private agencies, while supporting development in some localities, are in opposition to commercial development in other areas because of past exploitation. In some counties, an adequate tax base exists, but due to public apathy and failure to use available revenue sources properly, provision of public services is severely handicapped. It is not at all uncommon for bond issues for public improvements to be defeated in areas of relatively high per capita income.

The willingness of the people to work and to produce, along with increased local and state cooperation in economic development projects, may contribute to raising economic standards.


Akron
Pittsburgh
Columbus
Dayton
Cincinnati
Clarksburg
Lexington
Roanoke
Kingsport
Bristol
HOLMES
CARROLL
TUSCARAWAS
COSHOCTON
HARRISON
GUERNSEY
MUSKINGUM
NOBLE
MONROE
PERRY
MORGAN
WASHINGTON
TYLER
HOCKING
ROSS
VINTON
ATHENS
RITCHIE
WOOD
MEIGS
HIGHLAND
CLERMONT
PIKE
JACKSON
WIRT
BROWN
ADAMS
SCIOTO
GALLIA
MASON
JACKSON
ROANE
BARBOUR
UPSHUR
RANDOLPH
LAWRENCE
PUTNAM
GREENUP
LEWIS
CLAY
WEBSTER
NICHOLAS
POCAHONTAS
CARTER
KANAWHA
BOYD
ROWAN
ELLIOTT
WAYNE
LINCOLN
BOONE
FAYETTE
GREENBRIER
LAWRENCE
MORGAN
JOHNSON
MARTIN
LOGAN
RALEIGH
MAGOFFIN
WYOMING
MONROE
PIKE
MERCER
GILES
MC DOWELL
BLAND
FLOYD
WYTHE
SMYTH
CARROLL
GRAYSON



VICINITY MAP



LEGEND

BANK DEPOSITS PER CAPITA

- LESS THAN $300
- $300–$499
- $500–$799
- $800–$999
- $1,000–$1,499
- SAVINGS & LOAN ASSOCIATION

10 5 0 10 20 30 40 50

SCALE IN MILES

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-13-73 FIGURE 13-20

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5. WATER AREAS

Water Sub-region G discussions are presented by water areas. The water areas, as previously noted, have been determined so far as possible to be compatible with state planning areas and drainage basins. The several state planning areas which are not compatible have been discussed in Paragraph 4 above. (See Figure 13-15 for county composition and relation to other planning sub-regions.)

Water Area G-1

Economic indicators show that Water Area G-1 is the most highly developed portion of Water Sub-region G. Seven of the fifteen counties, Athens, Washington, Muskingum, Coshocton, Tuscarawas, Guernsey, and Morgan, have strong growth potentials, the potential for Coshocton and Morgan Counties being of a secondary order.

The water area contains the southern portion of the Muskingum River Basin, most of the Hocking River Basin, and all of the Shade River and Little Muskingum River basins, as well as numerous minor tributaries of the Ohio River. The topography is generally rolling and most of the developable land is in terraces along the rivers and creeks.

Once dominated by marginal agriculture, mining, and other extractive industries, Water Area G-1 has become an industrial-commercial region since World War II. The region is mainly oriented around the growth centers of Zanesville, Cambridge, New Philadelphia, and Logan-Athens-Marietta, and the south end of the Steubenville-Wheeling corridor.

Population increased in Water Area G-1 by 1.8 percent during the 1950-65 period. The water area has consistently maintained a lower population:worker ratio than Water Sub-region G; so that the water area maintained a higher labor participation ratio which is a favorable indicator of a community's welfare. The reasons for the area's fairly stable population:worker ratio over the past two decades are twofold: (a) alternative employment opportunities were forthcoming to such an extent that the trend in declining agriculture and mining employment was offset by gains in other industries; and (b) employment levels continued to show steady gains relative to Water Sub-region G, preventing large out-migration. Actually, Water Area G-1 experienced net in-migration in contrast with most of Water Sub-region G.

Historical employment data for Water Area G-1 show highly favorable trends when compared with the water sub-region While total employment in Water Sub-region G increased between 1940 and 1950 by about 12 percent and decreased between 1950 and 1960 by about 8 percent, employment in Water Area G-1 increased between 1940 and 1950 by 12 percent and decreased between 1950 and 1960 by only 0.1 percent. Employment between 1950 and 1966 increased by 4.4 percent.

Median family income in 1960 and income distribution for Water Area G-1 show not only higher family income relative to Water Sub-region G, but also a more equitable income distribution. Additionally, the proportion of the population receiving public assistance equals the U.S. figure of 4 percent, which is lower than the Water Sub-region G average of 6.7 percent.

Water Area G-1 has a greater proportion of sound housing units and a higher housing equipment index than does Water Sub-region G. The median value of housing is also significantly higher than for Water Sub-region G.

Median school years completed in the water area is greater than for Water Sub-region G by nearly a full year. The percentage of persons completing less than five years of schooling is lower relative to comparable figures for the water sub-region and the nation. The proportion of the population completing high school or more is less for Water Area G-1 than for the U.S., yet above the norm for the water sub-region.

Poor access handicaps portions of the water area, but this situation is improving. Interstate Highway 77, running north-south, has improved access to the metropolitan areas to the north of Water Area G-1 (Canton, Akron, and Cleveland) and to the Charleston area to the south. Interstate Highways 70 and 77, which intersect at Cambridge, strengthen the linkage with Columbus to the west and the industrial areas along the Ohio River to the east. Appalachian Corridor D, east-west, will cross the southern portion of Water Area G-1.

Mining activities have created environmental problems in lagging portions of Water Area G-1. Vocational training is necessary to equip farm youth for urban employment, and to retrain miners and others whose skills are outdated.

Flooding of the Hocking River has created serious problems for some industrial plants because of poor locational adjustments. Use of flood proofing techniques and adoption of better evacuation methods will reduce institutional flood damages. Flood damages along the Ohio River and in the Muskingum Basin have been greatly reduced, but residual damages continue to occur in some areas. The quality of the Tuscarawas River water is poor due to brines. In some streams, acid mine wastes cause significant problems.

State Planning Sub-region 11 (Tuscarawas, Ohio)

State Planning Sub-region 11 contains eight counties, all but one, Jefferson, being in Water Area G-1. Four, Muskingum, Tuscarawas, Guernsey, and Coshocton, are considered to be growth counties.

Figure 13-21 shows the 1966 population and employment for State Planning Sub-region 11 and Water Area G-1, compared with Water Sub-region C. It also shows the urban rural population distribution for State Planning Sub-region 11, Water Area G-1 and Water Sub-region G.

Dover-New Philadelphia-Cambridge-Zanesville. Geographically, the Dover-New Philadelphia-Cambridge-Zanesville area possesses many conditions favoring economic development. Historically, it has been predominantly rural in outlook and pursuits, with much of its population engaged in agriculture, but the proximity to the manufacturing-oriented economy of northeastern Ohio and the resulting exposure to organizational and technological innovations have blurred the traditional agrarian economy. New manufacturing plants have been established, construction activity is being intensified, and service industries are growing. In addition, transportation needs have led to the building of roads.

The populations of the 3 counties represented by these growth centers have varied growth histories (See Table 13-7). Guernsey County had only minute population changes during the decade ending in 1960; Cambridge, the only community classed as urban, has also shown a static population. Tuscarawas County's population showed a 9 percent gain during the decade, and Dover-New Philadelphia, the county's largest urban center, continues to grow, its 1967 population being up 7 percent from 1960. Muskingum County's 1960 population represented a 6 percent gain over 1950. Zanesville, the county's only urban community, had a 1960 population of 39,000 a 10-year loss of 4 percent. The Dover-New Philadelphia-Cambridge-Zanesville growth area as a whole is expected to post population gains in coming years.

TABLE 13-7
POPULATION OF MUSKINGUM, GUERNSEY, AND TUSCARAWAS COUNTIES, OHIO
1950-1965

County	Years			Percent Change
	1950	1960	1965	1950-65
Muskingum	74,535	79,159	80,725	8.3
Guernsey	38,452	38,579	38,645	0.3
Tuscarawas	70,320	76,789	79,037	12.4
TOTAL	183,307	194,527	198,407	8.2
Ohio Appalachia	1,035,058	1,119,555	1,154,159	11.5
Percent of Ohio Appalachia	17.7	17.4	17.2	

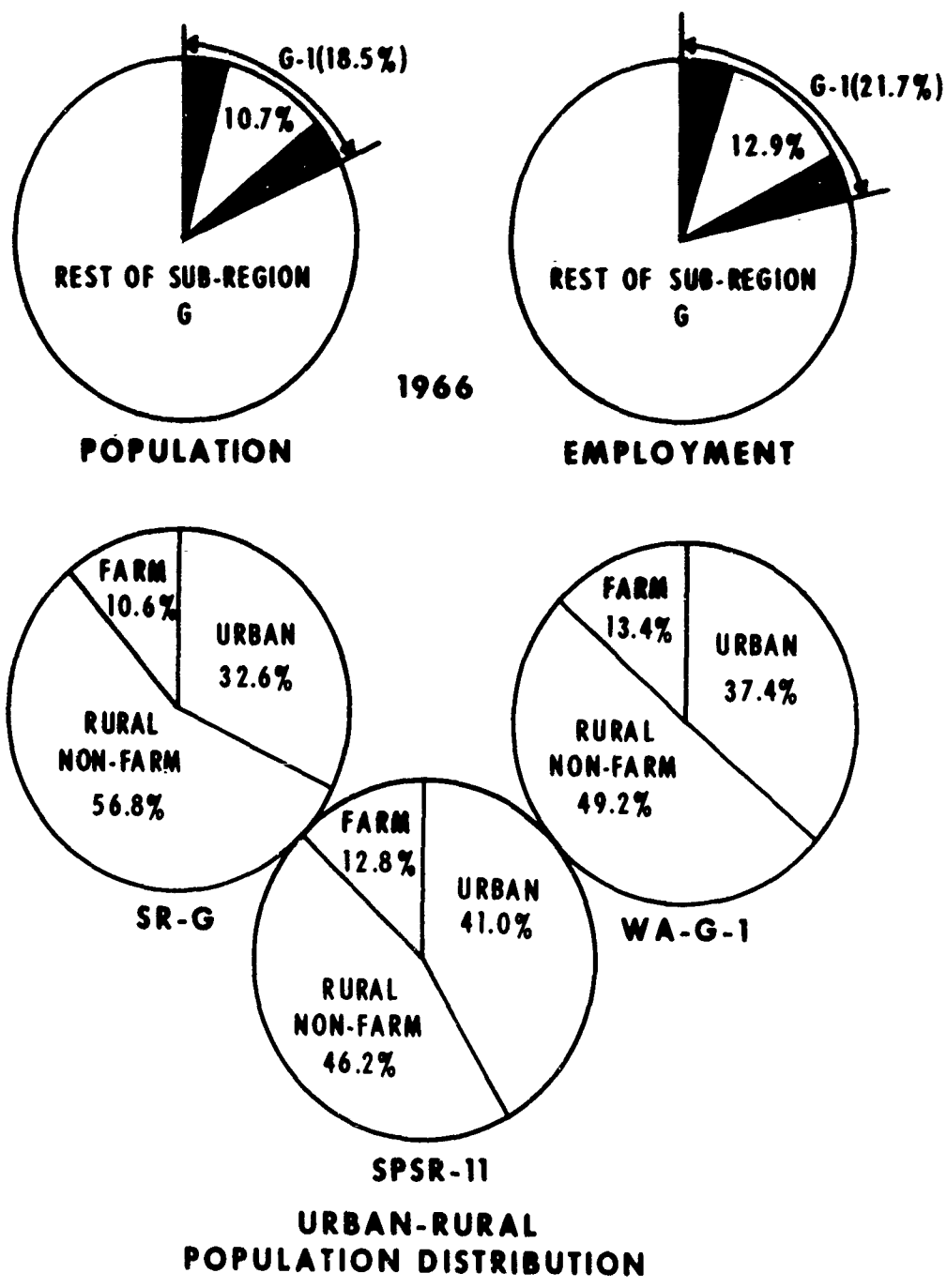


Figure 13-21 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 11 Compared to Water Area G-1 and Sub-region G.

Between 1960 and 1965, total employment for the three-county area increased from 40,235 to 41,801 workers. This growth was shared by all industries except mining, trade, and utilities, which decreased. The relative position of the industries was not altered substantially between 1950 and 1965. The only significant shifts occurred in mining which dropped from 3.4 percent of total employment to 2.6 percent, and construction which rose from 4.6 percent to 5.4 percent.

A common denominator of the counties has been the high unemployment rate in February of each year, with a low rate in October. Ohio Appalachian investments are aimed, in part, at attacking these irregularities by seeking to minimize seasonal unemployment as well as hard-core idleness.

The principal natural resources of the area are bituminous coal, clays, shales, gas and oil, limestone, sandstone, and sand and gravel. Guernsey ranks fourth among Ohio counties in estimated reserves of recoverable coal, and Tuscarawas is the State's foremost clay-producing county. The area has passed its period of peak production in gas and oil.

The existing and planned highway network is one of the most valuable assets. The area will be served by two interstate highways. Interstate 70 will replace U.S. 40 and connect Zanesville and Cambridge with Wheeling and the Pennsylvania Turnpike to the east and with Columbus to the west. Interstate 77 will replace U.S. 21 and connect Dover-New Philadelphia and Cambridge with Cleveland, Akron, and Canton to the north and with Marietta and points south. Major portions of these two highways are constructed. In addition to the two interstate routes, the area contains U.S. Highways 250, 36, and 22 and fifteen state highways.

Allegheny Airlines operates from Zanesville Municipal Airport, and flights of United, Eastern, and Allegheny Airlines are available at Akron-Canton Airport, 35 miles north of New Philadelphia. There are several private airfields in the area.

Three railroads, the Baltimore and Ohio, the Penn Central, and the Norfolk and Western, serve the area.

Lack of new industry and losses in existing industries have added to the problems in the area. In 1967, about 80 percent of the unemployed workers were under 45 years of age. Many of the available workers possessed skills that were either obsolete or not in demand. It is anticipated that the vocational-technical center at Zanesville will help correct this imbalance. Needed also is the uplifting of the school standards throughout the area. The raising of such standards will better equip those who enter the center in Zanesville.

Coshocton. Coshocton, a Primary Growth Center, is located 70 miles northeast of Columbus and 100 miles south of Cleveland. The city of Coshocton, the principal center and the county seat, is located where the Walhonding and Tuscarawas Rivers join to form the Muskingum River. Coshocton County has shown little net change in population since the turn of the century. The 1960 population of 32,224 was up but 3 percent over 1950 and 10 percent over 1900. The July 1967 estimate was 33,174, up 3 percent from 1960. Forty-one percent of the 1960 population, represented by the city of Coshocton, was urban. The city's 1960 population was 13,106, a 12 percent gain over 1950; the 1967 estimate was 14,530, a gain of 11 percent over 1960.

The labor force of Coshocton County in 1960 was 12,088 (72 percent male), with 5.9 percent unemployed. Recent estimates by the state (May 1968) indicate a labor force of 13,000 with 3.1 percent unemployed. Thirty-eight percent of the employed persons residing in the county in 1960 were engaged in manufacturing. Personal and business services represented 15 percent, wholesale and retail trade 14 percent, and agriculture 11 percent of the total. Though manufacturing employment increased 16 percent between 1950 and 1960, total employment declined 3 percent. Loss in agricultural employment (889) exceeded the gain in manufacturing (588). The loss in agriculture was 41 percent.

Mineral production resources of Coshocton County includes coal, clay, oil and gas, commercial sand and gravel, and dimension sandstone. Large coal deposits exist in the county. Almost 90 percent of the coal now being mined is produced by stripping. Farms comprise 65 percent of the land area. The major sources of farm income are livestock and dairy products.

Coshocton is well situated in terms of transportation. U.S. Highway 36 and State Highways 76 and 541 intersect at Coshocton. The county is served by the New York-Pittsburgh-St. Louis main line of Penn Central Railroad, which provides passenger service at Coshocton; by the Cleveland-Zanesville line of Norfolk and Western; and by a Penn Central branch reaching into the north part of the county. A small airport is situated in West Lafayette.

Major needs in Coshocton are for expansion of the water and sewage treatment plants. Its waste treatment facility presently is operating at a near 100 percent capacity. Annexation of the village of Roscoe, natural population growth, and expansion of industry and commerce will increase the need for this enlargement. A vocational-technical education program should be instituted to supply commercial and industrial needs. Finally, a complete site survey should be made for the city and county, to determine future locations for industry, housing, highways, and agriculture.

The tabulations in Tables 13-8 and 13-9 present the most recent census data for Ohio State Planning Sub-region 11.

TABLE 13-8
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
OHIO STATE PLANNING SUB-REGION 11 1/

	1950	1960	Absolute Change
TOTAL ALL SECTORS	132,202	129,669	- 2,533
PRIMARY ACTIVITIES	24,998	14,162	-10,836
Agriculture	15,842	9,305	- 6,537
Forestry & Fisheries	31	28	- 3
Mining	9,125	4,829	- 4,296
SECONDARY ACTIVITIES	50,471	53,827	3,356
Contract Construction	6,161	6,761	600
Food & Kindred Products	1,944	2,225	281
Textile Mill Products	176	91	- 85
Apparel	401	727	326
Lumber, Wood Products, Furniture	1,057	873	- 184
Printing & Publishing	1,244	1,573	329
Chemicals & Allied Products	465	603	138
Electrical & Other Machinery	4,431	7,032	2,601
Motor Vehicles & Equipment	275	641	366
Other Transportation Equipt.	48	124	76
Other & Miscellaneous	34,269	33,177	- 1,092
TERTIARY ACTIVITIES	54,844	58,076	3,232
Transportation & Communications	7,813	6,707	- 1,106
Utilities & Sanitary Service	2,306	2,330	24
Wholesale Trade	2,860	2,702	- 158
Retail Trade	18,794	19,648	854
Finance, Ins. & Real Estate	2,192	2,814	622
Personal Services	8,135	7,203	- 932
Professional Services	8,791	12,632	3,841
Recreational Services	861	717	- 144
Public Administration	3,003	3,222	219
Armed Forces	89	101	12
NOT REPORTED	1,889	3,604	1,715

1/ Data includes Jefferson County which is in Water Sub-region F.

TABLE 13-9
SOCIO-ECONOMIC CHARACTERISTICS
OHIO STATE PLANNING SUB-REGION 11 1/
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966	
Total	392,000
Absolute Change 1960-1966	5,600
Percent Change 1960-1966	1.45

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	386,395	190,646	195,749	38,896	174,673	172,916
Percent Distribution	100.00	49.34	50.66	10.04	45.21	44.75
Percent Change 1950-1960	5.06	4.01	6.10	-44.83	27.21	7.77

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	12,93/	8,467	39,033	29,750	9,186	99,373
Percent Distribution	13.02	8.52	39.28	29.94	9.24	100.00
Percent Change 1950-1960	-50.73	-60.86	11.71	461.85	456.73	5.24

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	218,080	92,869	102,327	20,053
Percent Distribution	100.00	42.58	46.92	9.20
Percent Change 1950-1960	2.25	-14.55	27.79	13.29

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	129,568	8,992	93,615	6,329	35,953	2,663
Percent Distribution	93.51	6.49	93.67	6.33	93.10	6.90
Percent Change 1950-1960	-1.93	65.45	-7.70	46.23	17.16	140.56

RATE OF UNEMPLOYMENT, 1962-65

1962	5.7
1963	5.4
1964	4.8
1965	4.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	138,661	134,468	100,041	32,724	38,620	101,744
Percent Distribution	50.77	49.23	75.35	24.65	27.51	72.49
Percent Change 1950-1960	0.74	-0.80	-5.47	11.11	21.40	-4.10

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	130.1	5.0	4.0
Tot. Employment	124.9	6.0	5.8
Unemployment	5.2	-1.9	-26.8

1/ Data includes Jefferson County which is in Water Sub-region F.

State Planning Sub-region 12 (Central Ohio Valley, Ohio)

State Planning Sub-region 12 contains nine counties, eight of which are within Water Area G-1. Belmont County, although a part of the state planning sub-region, is not a part of Water Area G-1; it is in Water Sub-region F, discussed in Chapters 11 and 12. Belmont County has considerable influence on the other counties of State Planning Sub-region 12 as it has a large population (80,000) and is industrialized, but much of the economic activity of the county is closely related to developments in the Wheeling, West Virginia area. Seventy-two percent of the planning area population is in Water Area G-1.

State Planning Sub-region 12 contains the Primary Growth Center, Logan-Athens-Marietta, in Hocking, Athens, and Washington Counties, (Logan is Secondary when considered alone), and the secondary growth area, Malta-McConnelsville, in Morgan County. Most of the urban growth from 1950 to 1960 occurred in Marietta and Athens and their vicinities.

Employment in State Planning Sub-region 12 declined 0.2 percent in the period 1950-60, less than the changes in State Planning Sub-region 11 and Water Area G-1. Agriculture and mining employment decreased between 1950 and 1960 by about 60 percent. In both state planning sub-regions, increases in manufacturing and service employment offset about half of the declines in agriculture and mining.

Figure 13-22 shows the population and employment for State Planning Sub-region 12 and Water Area G-1 compared with Water Sub-region G. It also shows urban-rural population distribution for State Planning Sub-region 12, Water Area G-1 and Water Sub-region G.

Logan-Athens-Marietta. This east-west corridor contains Logan, Athens, and Marietta, the county seats of Hocking, Athens, and Washington Counties, respectively. Physically, the area is a part of the unglaciated region characteristic of southeast Ohio, where hills and valleys are forest covered. The Hocking River flows through Logan and Athens Counties on its way to the Ohio River. Marietta, in Washington County, is at the confluence of the Muskingum and Ohio Rivers. Agriculture played an important part in this area's development, but topography has limited the degree of mechanization and consolidation of farms. The rolling land between Athens and Marietta is utilized for pasturelands, horticulture, and timber production.

The area made significant population gains between 1950 and 1965, increasing 12.5 percent. Hocking and Athens Counties had population increases of 5 and 4 percent respectively in the 15-year span from 1950 to 1965. Washington County, however, largely because of the location of new firms in adjacent Wood County, West Virginia, and on the Ohio and Muskingum Rivers in Ohio, gained 25 percent. (See Table 13-10.)

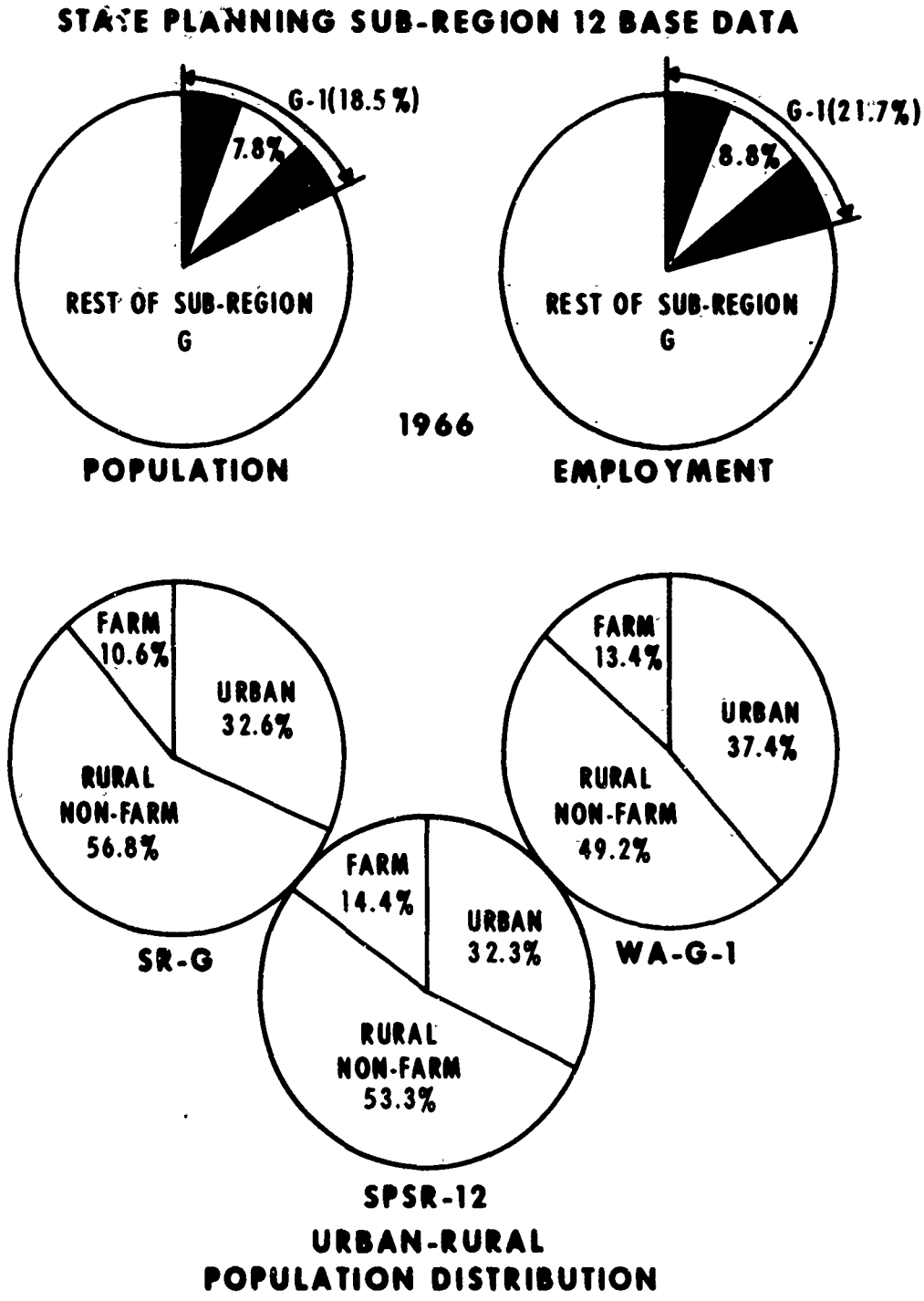


Figure 13-22 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 12 Compared to Water Area G-1 and Sub-region G.

TABLE 13-10
POPULATION OF HOCKING, ATHENS, AND WASHINGTON COUNTIES, OHIO
1950-1965

County	Years			Percent Change
	1950	1960	1965	1950-65
Hocking	19,520	20,168	20,513	5.1
Athens	45,839	46,998	47,655	4.0
Washington	44,407	51,689	55,296	24.5
TOTAL	109,766	118,855	123,464	12.5
Total Ohio Appalachia	1,035,058	1,119,555	1,154,159	11.5
Percent of Ohio Appalachia	10.6	10.7	10.7	

One of the most striking changes that has occurred has been the assimulation of local people into the work force. During the fifteen-year span (1950-65), employment rose 20.6 percent.

As in Appalachia generally, there was a large decrease in employment in mining. In 1950, the area had 1,988 mine workers, 12.5 percent of the working force; fifteen years later, the figure had declined to 2.3 percent.

Manufacturing is the dominant employer. This industry was responsible for 33.2 percent of those employed in 1950, but by 1965 it had increased to 45.8 percent. Large gains in Washington County are mainly responsible for the increasing share of manufacturing.

The emphasis on manufacturing may lead to problems in other parts of the economy. The service and trade industries were relatively constant during the fifteen-year period.

Athens County's employment structure is influenced by the presence of Ohio University and, as a result, that county has a service-oriented economy, even though new manufacturing plants have located there in recent years.

One of the problems of the area is the out-migration of young workers. Openings that exist call for skilled workers such as machinists, draftsmen, management trainees for finance institutions, and teachers. More than two-thirds of the females seeking employment are under thirty-five years of age. They seek clerical and sales jobs and service occupations.

Women having such skills as registered and licensed practical nurses, clerks, stenographers, secretaries, and teachers are needed. The Vocational School and Technical Center in Nelsonville will help meet the needs of the growth area.

Traversing the area are three U.S. Highways: 21, 33, and 50, with sections of 33 and 50 being converted from two to four lanes. U.S. 33 connects Logan with Athens and opens an area to the south as far as Pomeroy in Meigs County. U.S. 50 extends from Athens eastward, then northeasterly into Washington County, linking with a connector to Marietta; west from Athens it runs to the southwestern corner of the county. The east-west Appalachian Developmental Highway Corridor D will connect the West Virginia industrial area at Parkersburg with the market of Cincinnati in southwest Ohio via Athens.

The Chesapeake and Ohio Railway connects Athens and Logan with Columbus; and Athens, and Marietta are on the Baltimore-Cincinnati-St. Louis main line of the Baltimore and Ohio Railroad. A line of the Penn Central Railroad which reaches into the West Virginia coalfields passes north-south through Athens.

Allegheny and Piedmont airlines provide services at Wood County Airport (Parkersburg, W. Va.), 6 miles south of Marietta. A private airport serves Athens.

Frequent flooding has been a problem in Athens and in rural bottomlands in the three counties. Heavy property damages are caused to grounds and buildings of Ohio University, to railroads, to highways, and to businesses. Programs are needed to stem the flooding of Hocking River. Land conservation plans for good quality and safe water for domestic, industrial, and commercial uses are also needed. Remaining industrial sites should be preserved for future use.

Malta-McConnelsville. A Secondary Growth Center near the center of Morgan County is made up of the twin villages of Malta and McConnelsville, the latter being the county seat. They lie on opposite sides of the Muskingum River, which flows through Morgan and Washington Counties and enters the Ohio River at Marietta.

The county's 1960 population of 12,700 declined 0.7 percent from 1950. By census definition, there is no urban population. Morgan County had a 2.3 percent unemployment rate in June 1967. Of the employed labor force, more than 50 percent is classified in lumber and wood products, and furniture and fixtures. Nearly all of the employment is in industries in the growth center and immediate vicinity. Most of the unemployed workers are unskilled or semi-skilled. When skills of unemployed workers are compared with job demands, a gap appears which cannot be bridged by the existing educational and training programs. Positions are available for medical

and related technical personnel, pharmacists, guidance counselors, and other services. The demand for industrial workers is low.

The Malta-McConnelsville Center is slowly moving away from an agricultural economy. Changes in local attitudes and investment patterns are needed to accelerate growth. The recent approval and funding of a sewage system, combined with other advantages the area offers, may well give an impetus to economic growth.

The tabulations in Tables 13-11 and 13-12 present the most recent census data for Ohio State Planning 12.

TABLE 13-11
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
OHIO STATE PLANNING SUB-REGION 12 1/

	1950	1960	Absolute Change
TOTAL ALL SECTORS	93,315	89,757	- 3,558
PRIMARY ACTIVITIES	29,230	12,522	- 16,708
Agriculture	17,466	7,200	- 10,266
Forestry & Fisheries	86	189	103
Mining	11,678	5,133	- 6,545
SECONDARY ACTIVITIES	23,107	29,927	6,820
Contract Construction	5,235	6,131	896
Food & Kindred Products	1,385	1,693	308
Textile Mill Products	191	83	- 108
Apparel	443	525	82
Lumber, Wood Products, Furniture	1,959	1,351	- 608
Printing & Publishing	1,195	1,690	495
Chemicals & Allied Products	958	1,115	157
Electrical & Other Machinery	1,190	3,186	1,996
Motor Vehicles & Equipment	86	412	326
Other Transportation Equipt.	39	174	135
Other & Miscellaneous	10,426	13,567	3,141
TERTIARY ACTIVITIES	39,600	44,858	5,258
Transportation & Communications	4,990	4,075	- 915
Utilities & Sanitary Service	2,163	2,201	38
Wholesale Trade	1,958	1,855	103
Retail Trade	13,218	14,108	890
Finance, Ins. & Real Estate	1,448	1,921	473
Personal Services	5,795	5,537	- 258
Professional Services	6,930	11,588	4,658
Recreational Services	592	533	- 59
Public Administration	2,422	2,998	576
Armed Forces	84	42	- 42
NOT REPORTED	1,378	2,450	11,072

1/ Date includes Belmont County which is in Water Sub-region F.

TABLE 13-12
SOCIO-ECONOMIC CHARACTERISTICS
OHIO STATE PLANNING SUB-REGION 12 1/
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966	
Total	290,700
Absolute Change 1960-1966	-1,000
Percent Change 1960-1966	-0.34

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	291,739	144,798	146,941	34,767	148,079	108,893
Percent Distribution	100.00	49.63	50.37	11.92	50.76	37.32
Percent Change 1950-1960	0.71	-0.29	1.72	-54.44	28.97	10.47

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	14,011	8,483	29,039	17,698	5,095	74,326
Percent Distribution	18.85	11.41	39.07	23.81	6.85	100.00
Percent Change 1950-1960	-52.28	-52.92	48.65	578.08	756.30	1.94

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	163,668	73,984	71,521	15,834
Percent Distribution	100.00	45.20	43.70	9.67
Percent Change 1950-1960	-2.71	-18.79	26.11	13.51

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	89,715	8,087	64,402	6,433	25,313	1,654
Percent Distribution	91.73	8.27	90.92	9.08	93.87	6.13
Percent Change 1950-1960	-3.77	.18	-11.67	59.39	24.58	131.01

RATE OF UNEMPLOYMENT, 1962-65

1962	8.4
1963	7.9
1964	6.7
1965	6.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	97,844	112,798	70,877	32,509	26,967	80,289
Percent Distribution	46.45	53.55	68.56	31.44	25.14	74.86
Percent Change 1950-1960	-0.23	-4.50	-7.97	6.23	28.09	-8.25

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	91.2	1.0	1.1
Tot. Employment	85.7	3.1	3.8
Unemployment	5.5	-2.1	-27.6

1/ Data includes Belmont County which is in Water Sub-region F.

Water Area G-2

Water Area G-2 includes 11 southern Ohio counties, four western West Virginia counties, and seven eastern Kentucky counties. The water area takes in State Planning Sub-regions 13, 15, and 34 and parts of 36A and 36B.

The terrain of Water Area G-2 varies from broad expanses of relatively level land in the western portion to moderately rugged hills in the east and south. The most prominent natural feature is the valley of the Ohio River. Other tributaries include the Kanawha, Guyandotte, Big Sandy and Scioto rivers. Minor tributaries of the Ohio: White Oak Creek, Ohio Brush Creek, Little Scioto River, Symmes Creek, Raccoon Creek, Twelvepole Creek, Little Sandy River, and Tygarts Creek also drain the area.

Water Area G-2 contains the Huntington-Ashland-Ironton metropolitan area, one of the two Standard Metropolitan Statistical Areas (SMSA) in Water Sub-region G. The water area is also influenced by the Cincinnati metropolitan area. The primary growth centers in Water Area G-2, Chillicothe-Portsmouth-Ironton in Ohio and the Tri-State growth center, SMSA, (Huntington-Ashland-Ironton), depend upon manufacturing as the major source of employment and income. The Huntington-Ashland-Ironton center is also a wholesale and service center to the coal-producing regions to the south. The Ohio Secondary Growth Centers: Hillsboro, Greenfield, Jackson, and Gallipolis are in Water Area G-2. The portions of Water Area G-2 outside growth centers include excellent farmland along the Ohio River floodplain and marginal farmland in the hilly regions.

Populations and employment trends in Water Area G-2 have shown significant improvement when compared to Water Sub-region G during the past two decades. In the period 1940-60, population increased over 10 percent to a 1960 total of 791,000 persons. Total employment for the same period increased nearly 14 percent. The population:worker ratio decreased from a high of 4.02 in 1940, to 3.75 in 1960. This figure is above that for Water Sub-region G. Employment increased 10 percent between 1950 and 1960, because of rapid gains in manufacturing and services that more than offset declines in agriculture and mining. Between 1960 and 1965, employment continued to increase at a greater rate than population, which resulted in improved polulation:worker balance, and a greatly decreased rate of unemployment.

The present transportation system needs improvement, especially in the West Virginia and Kentucky portions. Construction of highways along Appalachian Corridors B, R, D, and I, and completion of Interstate Highway 64, will result in improved regional access. Extensive work on secondary and local access roads also is needed. There are good industrial sites in the water area, but there is a scarcity of organizations

to acquire and develop them. Additional flood control and floodplain management will enhance the existing industrial sites, some of the best in the Appalachian Region, and permit greater opportunity for development in the valleys of the hilly region.

Public services in the small communities and growth centers need improvement. Water supply may become a critical factor in the latter part of the century where ground water supplies are limited, especially in the western Ohio portion of the water area.

State Planning Sub-region 13 (Lower Ohio Valley, Ohio)

Historical data on population and employment, and other economic indicators, present a mixed economic picture for State Planning Sub-region 13. Population increased 17 percent between 1950 and 1960, and nearly 7 percent between 1950 and 1965.

Clermont County, adjacent to Hamilton County, which contains Cincinnati, greatly affected the area figures. In the two periods 1950-60 and 1960-65, Clermont County showed net increases of 66.2 percent and 19.1 percent, respectively, reflecting its growth as a residential area for the Cincinnati metropolitan area.

The employment base in State Planning Sub-region 13 shifted significantly in the period 1950-60: agricultural and mining employment declined significantly. There were employment gains in manufacturing, services, and trade. In manufacturing, food and kindred products, chemicals, and electrical and other machinery all increased. Retail (but not wholesale) trade, finance, entertainment, and medical and other professional services grew in importance.

The population:worker ratio in State Planning Sub-region 13 was about 4.0 for 1965. The unemployment rate in this area is still much higher compared to State Planning Sub-regions 11 and 12 in Ohio (Water Area G-1), as well as the other state planning sub-regions in Water Area G-2. The unemployment rate is also above that of Water Sub-region G levels.

Figure 13-23 shows population and employment for Water Sub-region G, for Water Area G-2, and for State Planning Sub-region 13. It also shows the rural and urban population distribution for Water Sub-region G, Water Area G-2 and State Planning Sub-region 13.

Chillicothe-Portsmouth-Ironton. The growth center includes parts of four contiguous counties: Ross, Pike, Scioto, and Lawrence. It runs from the north boundary of Ross County through Portsmouth on the Ohio River and up the Ohio to Ironton. Three of the four counties are bisected by the meandering Scioto River; the fourth, Lawrence, has

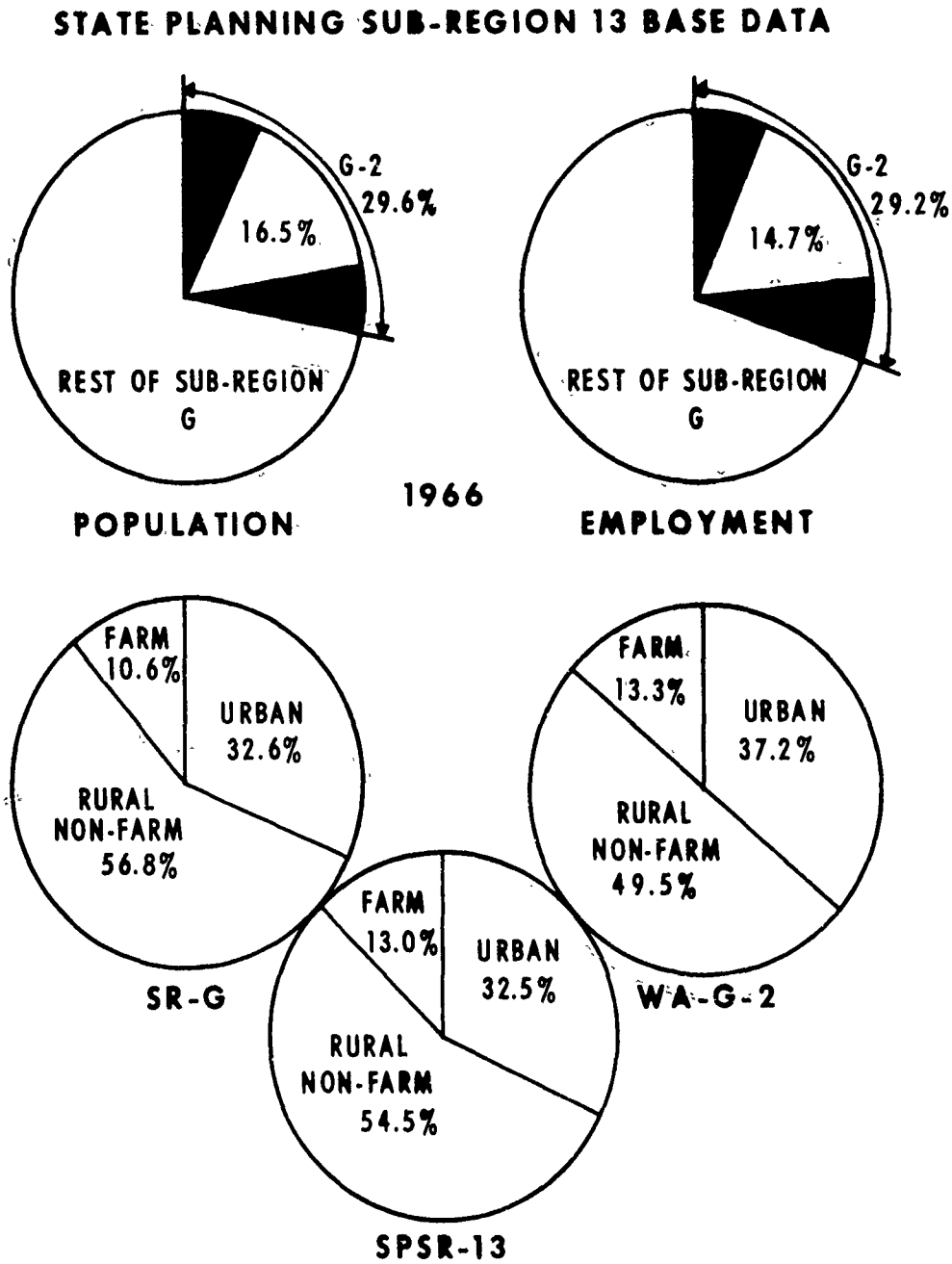


Figure 13-23 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 13 Compared to Water Area G-2 and Sub-region G.

the Ohio River for its southern boundary. The extreme northern portion of the area is covered by glacial drift, which contain excellent supplies of ground water. Southward and eastward, the topography is hilly and tree-covered, except for low ground along the major streams, and relict valleys of certain streams of glacial and pre-glacial origin. Part of the area is in the Wayne National Forest. Limestones and shales used in the manufacture of cement are available in some areas, but, in general, the mineral wealth is by no means so important as in the coal-bearing sections of the sub-region. Excellent water supplies are available from aquifers along the Scioto and Ohio Rivers, as well as from the streams themselves.

The area had significant population gains between 1950 and 1965, and these gains will probably continue. (See Table 13-13 below.) Of the four counties, Pike had the greatest relative growth in the 1950-65 period, and it is expected to have the greatest growth in the future. Completion of Appalachian Corridors "C" and "D," which intersect in Pike County will undoubtedly be an important factor in future growth. Lawrence County had the second highest relative gain of the four counties. This growth occurred outside its main city, Ironton, which declined in population from 16,333 to about 15,700 between 1950 and 1965.

TABLE 13-13
POPULATION OF CHILLICOTHE-PORTSMOUTH-IRONTON PRIMARY GROWTH AREA
1950-1965

County	Years			Percent Change
	1950	1960	1965	1950-65
Ross	54,424	61,215	64,513	18.5
Pike	14,607	19,380	21,433	46.7
Scioto	82,910	84,216	84,902	2.4
Lawrence	49,115	55,438	58,104	18.3
TOTAL	201,056	220,249	228,952	13.9
Total Ohio Appalachia	1,035,058	1,119,555	1,154,159	11.5
Percent of Ohio Appalachia	19.4	19.7	19.8	

Total employment in the counties comprising the growth center increased between 1950 and 1960 and decreased between 1960 and 1965. Primarily responsible for the decrease were mining and (more important) manufacturing. Most of the decrease was in Lawrence and Scioto counties where a loss of more than 27 percent took place during the fifteen-year period. Losses in manufacturing were accompanied by losses in the transportation, trade, and service industries. Ross County was the only one of the four in which there was substantial and consistent gains in all of its industries with the exception of mining.

Thus far, the area has been able to absorb the influx of new residents that has been occurring since World War II. The location of several new plants in the area, plus the expansion of present facilities, indicate that the area will continue to grow and attract migrants. However, the phasing out of the Atomic Energy Commission plant in Pike County and a reduction of workers in the chemical industry recently have contributed to high rates of unemployment. Community amenities have not, however, kept pace with the growth experienced in the last 25 years.

Down the length of the growth area is a four-lane highway system, U.S. Route 23 through Ross, Pike and Scioto Counties connecting with U.S. Route 52 at Portsmouth, which continues eastward through southern Lawrence County. These routes have become a part of the Appalachian developmental highway system as Corridors "C" and "B," respectively. Corridor "D," from the outerbelt of Cincinnati to Belpre on the Ohio River near Parkersburg, West Virginia, on the eastern border of Ohio, will bisect the growth corridor in Pike County. Land acquisition, design and construction have started on Corridor "D," with completion date scheduled for 1971. Development of these routes will open the area to a flow of economic activity not othewise obtainable. Completion of four-lane east-west U.S. Route 50 and northwest-southeast U.S. Route 35, which cross the corridor in Ross County, may contribute to future development of that area.

Four rail lines serve the major growth cities. The Baltimore and Ohio's Washington-Cincinnati-St. Louis main line crosses the area at Chillicothe. The Chesapeake and Ohio, and Norfolk and Western Railways, entering the region at Portsmouth and South Point respectively, parallel the Scioto River. The Detroit, Toledo and Ironton Railroad extends northward from Ironton through Chillicothe. Along the southern boundary of the corridor flows the Ohio River, one of the great inland channels for bulk movement of fossil fuels and freight. There is one private airport that provides charter passenger and freight service. Municipal airports are at nearby Columbus, Ohio, and the Tri-State Airport at Huntington, West Virginia.

Community facilities are better than in most areas of the Appalachian Region. Water supply, power, and fuel are available to any industrial user in the southern portion. There is land that could be developed for industrial use to meet future growth.

One of the major problems is the shortage of skilled labor. Ohio's first vocational school was established in Pike County and, although small, its high quality is recognized. The atomic materials plant is being phased out and there will be need to train workers for new jobs if they are to remain in the area.

Hillsboro-Greenfield. Within the past 15 years, the economy of Highland County has changed from one based primarily on agriculture to one with a growing and diversified manufacturing base, supplemented by crop and livestock production. In 1950, the county population numbered 28,168 people. By 1960, it had reached 29,716, an increase of 1,528, or 5.4 percent. Five years later, the population had risen to 30,280, an increase of 1.9 percent. A large share of the increase was in Hillsboro and Greenfield.

Paint Creek Reservoir, currently under construction by the Corps of Engineers in northeastern Highland County, provides for fish and wildlife conservation, flood control, and general recreation. It is currently being proposed that storage be included for purposes of water quality control, and for water supply for Greenfield. The potential reservoir projects on Whiteoak Creek, Brush Creek, and East Fork of Little Miami River would further contribute to satisfying needs for outdoor recreation facilities. These projects would also satisfy needs in surrounding areas, both in and out of the Appalachian Region.

Jackson. Jackson County, situated in southeastern Ohio, between the Ohio and Scioto Rivers, is almost surrounded by Wayne National Forest, part of which lies within its borders.

The 1960 population, about equally divided between urban and rural, was 29,373, a gain of 5.7 percent increase over 1950. Jackson, the county seat, with a 1960 population of 6,980, gained 7.3 percent, while Wellston, the only other city, with 5,728, gained 0.7 percent.

Employment in the county increased 6 percent during the decade, largely as a result of gains in manufacturing, services, and trade, which offset declines in agriculture and mining. A total of 8,426 persons was employed in 1960, of whom 33 percent were in white-collar occupations. Manufacturing is the largest employer, accounting, in 1960, for about 30 percent of the working population. The civilian labor force of Jackson County in 1960 was 9,170, of whom more than 25 percent were female. The unemployment rate was 8.1 percent.

The county's location and ample labor supply are attractive to light industry, and a number of sites are available for development. Vocational-technical training is needed, local access roads require improvement, and housing needs to be improved. Construction of Appalachia Highway "D" will stimulate trade with other areas. Outdoor recreational facilities are available at Jackson Lake, located in the southern part of the county near Oak Hill.

Gallipolis. Gallipolis, the urban center in Gallia County, has increased moderately in population from 7,851 in 1950 to 11,526 by 1965. Basic employment in the center is in the wholesale and retail trade sectors. Gallipolis accounts for nearly half of the county's population, thus has a fairly large labor force in the hinterlands. With careful planning for growth in manufacturing and services, the urban center area has the potential for substantial growth.

Clermont County, a Primary Growth Center. Clermont County is in the Cincinnati Standard Metropolitan Statistical Area. It, and Brown County, adjoining it to the east, are often referred to as satellite communities, furnishing bedrooms and recreation areas for industrial Cincinnati.

Clermont County has grown phenomenally in the past few years. The county population increased from 80,530 in 1960 to 104,858 in 1967, an increase of 30.2 percent, and almost twice the rate of gain in any other county in Water Sub-region G. This rapid growth generated some problems. Since 1966, new plants which will employ about 600 people have located there. Other plants and industries have expanded. Grant Park, a "new town" is now (1969) being built. It will, with full development, have 100,000 people; will contain a 1,200-acre industrial park, an airport with an aircraft-support training school, and access by rail and Appalachian Highway Corridor "D" (now in place) to a second industrial park of 700 acres. The county has considerable upland areas potentially suitable for industrial development. Interstate 275 will loop through the county, U.S. Highway 52 and Ohio Highway 125 will be four-laned by 1970.

The Corps of Engineers East Fork Dam on the Little Miami River near Batavia, the county seat, is scheduled to be begun in 1969. The development will include storage for water supply, water quality control, and flood control, and a 16,000-acre state park.

Table 13-14 shows employment by major categories for Ohio State Planning Sub-region 13 for 1950 and 1960. Table 13-15 provides a variety of socio-economic data for the planning sub-region for 1950-1965.

TABLE 13-14
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
OHIO STATE PLANNING SUB-REGION 13

	1950	1960	Absolute Change
TOTAL ALL SECTORS	120,101	134,625	14,524
PRIMARY ACTIVITIES	28,136	14,607	- 13,529
Agriculture	25,793	13,164	- 12,629
Forestry & Fisheries	144	140	- 4
Mining	2,199	1,303	- 896
SECONDARY ACTIVITIES	36,817	51,388	14,571
Contract Construction	6,713	8,845	2,132
Food & Kindred Products	1,930	3,101	1,171
Textile Mill Products	581	319	- 262
Apparel	1,030	1,037	7
Lumber, Wood Products, Furniture	2,193	2,307	114
Printing & Publishing	1,003	1,969	966
Chemicals & Allied Products	1,105	4,435	3,330
Electrical & Other Machinery	1,916	5,098	3,182
Motor Vehicles & Equipment	942	2,182	1,240
Other Transportation Equipt.	121	1,406	1,285
Other & Miscellaneous	19,283	220,689	1,406
TERTIARY ACTIVITIES	53,070	64,330	11,260
Transportation & Communications	9,459	8,354	- 1,105
Utilities & Sanitary Service	1,255	1,888	633
Wholesale Trade	2,694	2,750	56
Retail Trade	17,086	20,629	3,543
Finance, Ins. & Real Estate	1,957	3,129	1,172
Personal Services	7,631	8,544	913
Professional Services	8,818	13,785	4,967
Recreational Services	689	707	18
Public Administration	3,368	4,319	951
Armed Forces	113	225	112
NOT REPORTED	2,078	4,300	2,222

TABLE 13-15
SOCIO-ECONOMIC CHARACTERISTICS
OHIO STATE PLANNING SUB-REGION 13
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1966	
Total	474,800
Absolute Change 1960-1966	33,400
Percent Change 1960-1966	7.57

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	441,406	220,463	220,943	57,484	240,325	143,597
Percent Distribution	100.00	49.95	50.05	13.02	54.45	32.83
Percent Change 1950-1960	16.90	16.07	17.75	-49.44	61.19	25.10

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	20,879	11,086	39,877	29,761	8,748	110,351
Percent Distribution	18.92	10.05	36.14	26.97	7.93	100.00
Percent Change 1950-1960	-46.81	-44.78	50.68	850.83	850.87	17.57

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	235,740	114,655	96,165	21,719
Percent Distribution	100.00	48.64	40.79	9.21
Percent Change 1950-1960	12.98	-5.69	47.03	39.81

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	134,400	10,885	97,348	8,784	37,052	2,101
Percent Distribution	92.51	7.49	91.72	8.28	94.63	5.37
Percent Change 1950-1960	12.01	56.96	4.11	52.98	39.89	76.11

RATE OF UNEMPLOYMENT, 1962-65

1962	9.6
1963	9.1
1964	8.4
1965	7.1

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	145,510	158,016	106,357	43,410	39,153	114,606
Percent Distribution	47.94	52.06	71.01	28.99	25.46	74.54
Percent Change 1950-1960	14.54	9.32	7.06	18.34	41.34	6.25

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	118.9	-3.8	- 3.1
Tot. Employment	110.5	-0.4	- 0.4
Unemployment	8.4	-3.4	-28.8

State Planning Sub-region 15 (Lower Ohio Valley, W. Va.)

State Planning Sub-region 15 is made up of four southwestern West Virginia counties, Wayne, Cabell, Lincoln, and Mason, whose economic and cultural interests center at Huntington (1960 population, 83,627), the state's second largest city. Cabell and Wayne counties had, in 1965, 76.7 percent of the total population of the Huntington-Ashland Standard Metropolitan Statistical Area, which includes also Boyd County, Kentucky, and Lawrence County, Ohio. Subcenters include Point Pleasant, Mason, and New Haven in the north, and Kenova, Barboursville, Milton, Wayne, Hamlin, and West Hamlin in the central and southern portions of the area. The valley of the Ohio River contains most of the area's industry and people.

The population of State Planning Sub-region 15 decreased 0.4 percent in the period 1950-60, and increased 0.1 percent in the period 1960-66.

The rate of unemployment in 1965 (8.1 percent) was slightly higher for Water Area G-2 as a whole, and substantially greater than the average for the country.

Only Lincoln and Mason counties have significant employment in agriculture (25 percent and 18 percent, respectively, for 1965), and in both counties the number of farms in operation and agricultural employment have decreased steadily. The level-of-living index for farm families in State Planning Sub-region 15 is low compared to the national average.

Manufacturing employment has remained fairly stable. The most important industries, from the point of view of employment, are stone, clay, and glass; primary metals and metals processing. Also important are chemicals and allied products; transportation equipment; lumber and wood products; and apparel and related industries.

From the point of view of employment, mining is of secondary importance in the area and, as a result of technological innovations, is tending to become increasingly less important. Coal is the principal mineral and resource, and it is produced in every county. In 1965, Lincoln County led in mining and employment. Oil and gas are also produced, but neither is of great importance either in employment or value.

Family income and per capita disposable income data show great differences among the four counties. The more industrialized counties, Cabell, Wayne, and Mason, show the higher income levels and the least industrialized county, Lincoln, shows the lowest level. No county in the region measures up, however, to the median family income (1966 data) for the country.

The state planning sub-region is well served by navigable waterways, the Ohio and the Kanawha, and most sections also benefit from excellent rail transportation. The main line of the Chesapeake and Ohio Railway extends east-west through Huntington, and a branch extends southward through Lincoln County. The Baltimore and Ohio operates an important banch along the Ohio River. A Penn Central line follows the Kanawha River through Mason County, crossing the Ohio River at Point Pleasant. The Norfolk and Western Railway main line follows the west boundary of Wayne County, crossing the Ohio River at Kenova.

The region is relatively well served by highways, including the east-west Interstate Route 64, connecting the Huntington area with the industrial area around Charleston.

A commercial airport at Huntington, the Tri-State, is served by three commercial airlines. A new jet airport proposed for a site in Putnam County, about thirty-five miles east of Huntington. would be an asset to the entire area.

Certain parts of the area, especially large portions of Lincoln and Wayne counties, have failed to share adequately in overall development. Employment has declined, largely as a result of technological advancement. Farming, which used to provide a livelihood, however inadequate, to many residents of the region, is becoming increasingly marginal, and many have abandoned agriculture entirely, some of these swelling further the ranks of the unemployed and lengthening the lists of welfare recipients.

The Huntington and the Point Pleasant-Mason vicinities have significant growth potential, with excellent transportation facilities. Good industrial sites presently exist, but they are irregularly distributed. Steps must be taken for their protection and development.

Figure 13-24 shows population, employment, and urban-rural population distribution for Water Sub-region G, Water Area G-2, and State Planning Sub-region 15.

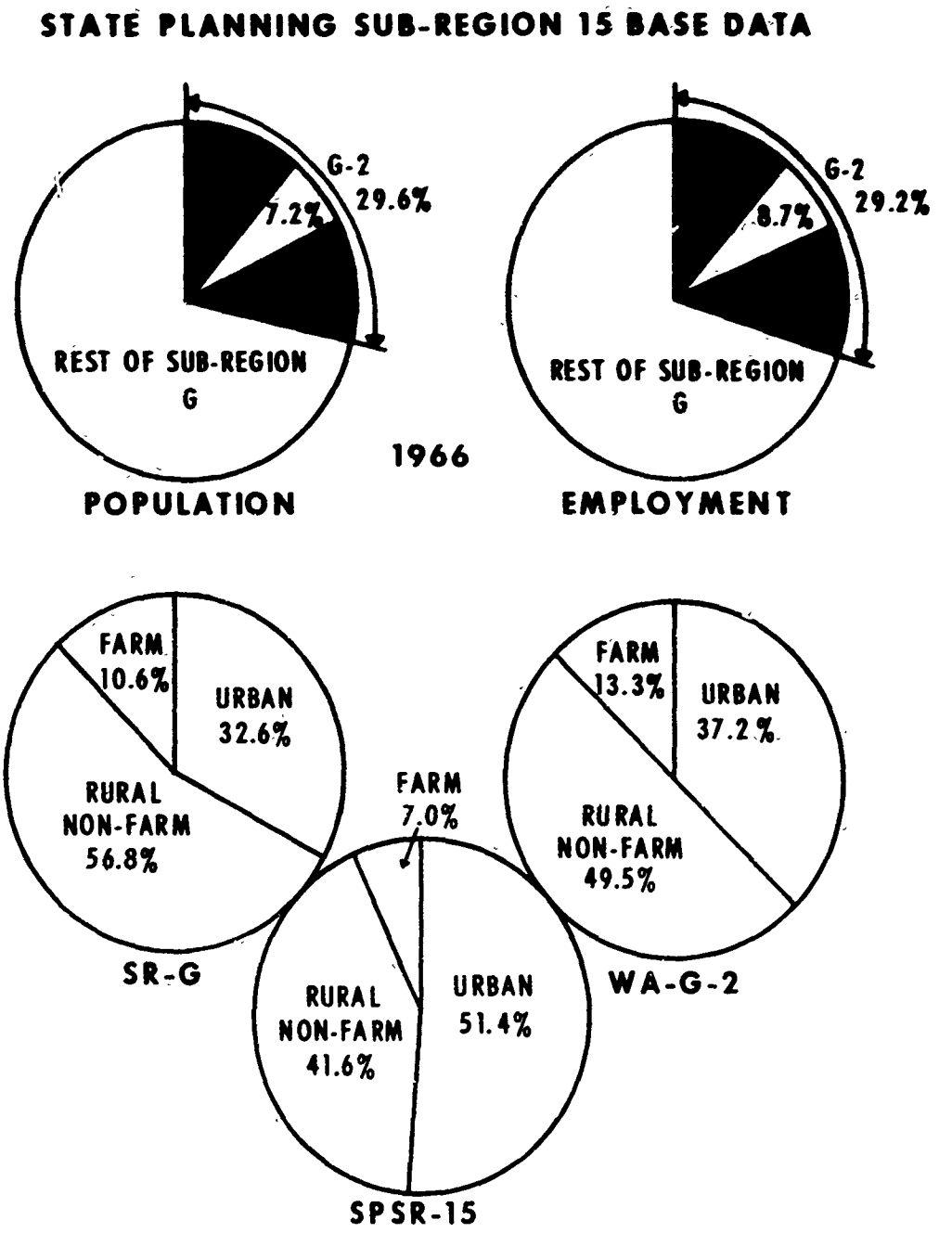


Figure 13-24 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 15 Compared to Water Area G-2 and Sub-region G.

Huntington. The city is a trade center of importance; has a diversified economy; and is a focus of a new east-west interstate and a north-south development highway.

The manufacture of producers' durables dominates manufacturing employment, accounting for 58 percent of the total in 1960. The leading industry in the manufacture of durable goods, with respect to employment, is primary metals, with 2,360 employees in 1960. Second highest 1960 employment was in "other durable goods" (mainly stone, clay, and glass products), employing 1,620 in 1960. The third largest employment is in transportation equipment, employing 530 in 1960. The leading employer in the manufacture of non-durable goods in 1960 was the food and kindred products industry, employing 840. The chemical industry employed 760 in 1960.

Declines in some economic sectors point to weaknesses in the structures of the Greater Huntington Area. Detailed study to identify the reasons for such a decline is required. Many workers live outside Cabell County. Improvement of feeder roads and additional bridges are a necessity. Completion of a bridge and one in the planning stage across the Ohio River will foster residential expansion in the neighboring Ohio area. This will cause the available land in Lawrence County to be more rapidly developed. Outdoor recreation facilities will be partially satisfied by reservoir projects (East Lynn and Bear Fork) in the construction and planning stages.

The real test of the growth potential of the region, however, seems to rest in the region's ability to draw the population from the hinterlands and thus strengthen its labor force. However, in so doing, it will be necessary to provide them with improved housing and an improved living environment if they are to become full participants in the region's prosperity. Such proposals as the midway jet airport are also of great developmental importance.

Milton and Hamlin-West Hamlin. The Milton Secondary Growth Center has excellent transportation facilities, as well as developable land for industrial and other purposes. The Hamlin-West Hamlin leaders are faced with an opposite situation, and development efforts must focus on its potential as a service center for the Lincoln County hinterland. There is a pressing need for a variety of social investments, such as improved educational facilities, because the Hamlin-West Hamlin vicinity is the logical service center.

Table 13-16 shows employment by major categories for West Virginia State Planning Sub-region 15 for 1950 and 1960. Table 13-17 provides a variety of socio-economic data for the planning sub-region for 1950-1965.

TABLE 13-16
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 15

	1950	1960	Absolute Change
TOTAL ALL SECTORS	61,602	57,887	-3715
PRIMARY ACTIVITIES	9,405	3,231	-6174
Agriculture	6,600	1,972	-4628
Forestry & Fisheries	32	-	- 32
Mining	2,773	1,259	-1514
SECONDARY ACTIVITIES	17,886	18,425	539
Contract Construction	4,266	3,968	- 298
Food & Kindred Products	875	1,130	255
Textile Mill Products	57	31	- 26
Apparel	1,379	1,042	- 337
Lumber, Wood Products, Furniture	1,767	935	- 832
Printing & Publishing	494	698	204
Chemicals & Allied Products	1,091	1,327	236
Electrical & Other Machinery	961	643	- 318
Motor Vehicles & Equipment	636	667	31
Other Transportation Equipt.	426	926	500
Other & Miscellaneous	5,934	7,058	1124
TERTIARY ACTIVITIES	33,614	33,839	225
Transportation & Communications	7,171	5,862	-1309
Utilities & Sanitary Service	1,345	1,170	- 174
Wholesale Trade	2,319	2,221	- 98
Retail Trade	8,958	9,004	46
Finance, Ins. & Real Estate	1,316	1,803	487
Personal Services	4,366	4,081	- 285
Professional Services	5,492	7,228	1736
Recreational Services	387	381	- 6
Public Administration	2,163	2,009	- 154
Armed Forces	97	80	- 17
NOT REPORTED	697	2,392	1695

TABLE 13-17
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 15
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	193,100
Absolute Change 1960-1965	1,200
Percent Change 1960-1965	0.63

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	191,905	93,685	98,220	13,423	79,953	98,529
Percent Distribution	100.00	48.82	51.18	6.99	41.66	51.35
Percent Change 1950-1960	-0.43	-1.63	0.74	-72.30	70.79	1.09

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	10,076	4,981	16,544	12,033	4,726	48,360
Percent Distribution	20.84	10.30	34.21	24.88	9.77	100.00
Percent Change 1950-1960	-42.75	-50.97	13.59	359.27	440.11	1.77

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	105,248	52,652	36,727	13,659
Percent Distribution	100.00	50.03	34.90	12.98
Percent Change 1950-1960	3.18	-5.38	20.83	13.73

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	57,807	5,256	40,252	3,950	17,555	1,306
Percent Distribution	91.67	8.33	91.05	8.95	93.08	6.92
Percent Change 1950-1960	-6.01	59.08	-12.83	47.33	14.51	109.63

RATE OF UNEMPLOYMENT, 1962-65

1962	13.2
1963	11.3
1964	9.5
1965	8.1

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	63,143	73,257	44,274	21,040	18,869	52,217
Percent Distribution	46.29	53.71	67.79	32.21	26.54	73.46
Percent Change 1950-1960	-2.72	0.45	-9.55	15.70	18.23	-4.61

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	%
Tot. Work Force	70.1	2.1	3.1
Tot. Employment	64.5	5.5	9.3
Unemployment	5.6	-3.4	-37.8

State Planning Sub-region 34 (Fivco, Ky.)

State Planning Sub-region 34 contains five counties in Eastern Kentucky: Boyd, Carter, Elliott, Greenup, and Lawrence. Lawrence County is in Water Area G-4. About 4.5 percent of the population and 4.3 percent of the employment of G-2 are in State Planning Sub-region 34. The area is bordered on the east by the Big Sandy River and on the north by the Ohio River, and contains most of the Tygarts Creek and Little Sandy River drainage basins, as well as minor Ohio River tributaries. Boyd County, containing Ashland, is a part of the Huntington-Ashland Standard Metropolitan Statistical Area.

State Planning Sub-region 34 gained 3.3 percent in population over the 1950-66 period. Out-migration at differing rates characterized all of the counties during the whole span, but the rates declined in the latter part of the period.

The population:worker ratio in the planning sub-region remained above that for Water Area G-2 for the period 1950-65, increasing during the fifteen-year period. In 1960, the ratio (3.6) was higher than that for either Water Area G-2 or for Water Sub-region G.

The employment base of the state planning sub-region is centered in Boyd County (Ashland). Primary metals accounted in 1960 for over 70 percent of manufacturing employment; railroads and railway express for over 58 percent of transportation employment; and medical services for 50 percent of total service employment.

Although the area has grown rapidly in manufacturing and services during the 1950-65 period, this growth has not compensated for the decline in agriculture. Large decreases in railway employment (linked to declines in coal mining) centered in Boyd County, also contributed to the decline in total employment of over 1,450 persons.

The Ohio River navigation system is a valuable shipping route for the area's minerals. Major improvements are expected in road transportation. The completion of Interstate 64, extending east-west, will link the Charleston, Huntington-Ashland, and Lexington Standard Metropolitan Statistical Areas. The reconstruction of U.S. 23 will provide needed links between Portsmouth, Ohio and Ashland, Kentucky. Appalachian Corridor "B," now being planned, passing through Greenup and Boyd counties, will complete the needed road system. Major recreation activities are not contemplated, although the completed Grayson Reservoir will provide an effective drawing attraction, as will the construction of the authorized Kehoe and Yatesville reservoirs.

Figure 13-25 shows population, employment, and urban-rural population distribution for Water Sub-region G, Water Area G-2, and State Planning Sub-region 34.

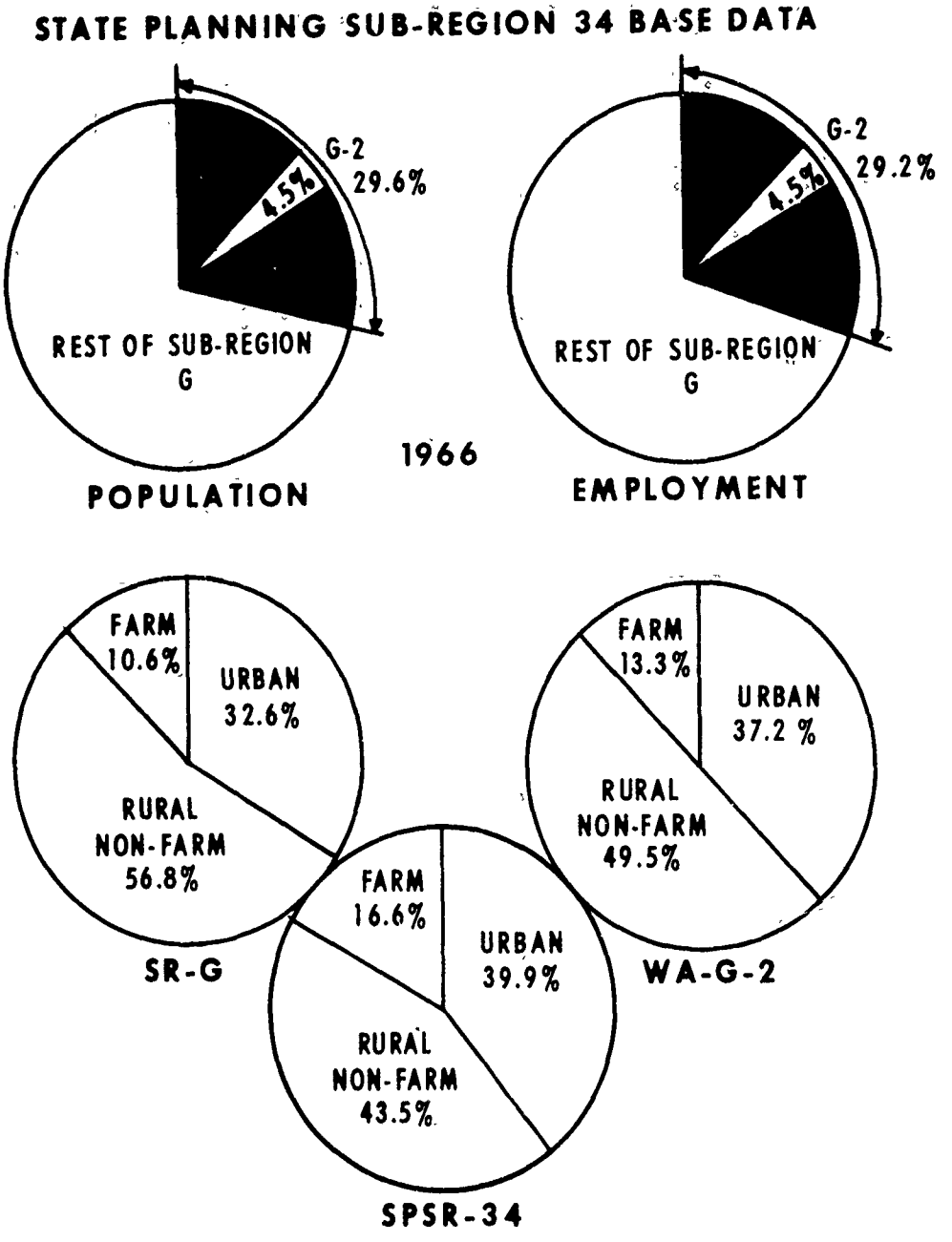


Figure 13-25 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 34 Compared to Water Area G-2 and Sub-region G.

Ashland. Boyd County, which contains the City of Ashland, is situated at the junction of the Ohio and Big Sandy Rivers in northeastern Kentucky. The county has shown increases in population for each decade since 1900. The smallest percentage increase occurred between 1950 and 1960, when it gained 4.4 percent. The 1960 population, 76 percent urban, was 52,163. Ashland had a population of 31,283 in 1960.

The primary metals industry is the largest source of employment in Boyd County. This accounted for 19 percent of total employment in 1960 and 58 percent of manufacturing employment. The manufacture of nondurable goods, predominantly petroleum refining, is the second largest source of employment and in 1960 accounted for 60 percent of the 1,890 persons employed in the nondurable goods sector. Practically every sector of the economy has registered gains. Total employment, sparked by a 24 percent increase in manufacturing employment, increased 7 percent between 1950 and 1960. The gain in manufacturing more than offsets the long-term loses in agriculture and mining.

Table 13-18 shows employment by major categories for Kentucky State Planning Sub-region 34 for 1950 and 1960. Table 13-19 provides a variety of socio-economic data for the planning sub-region for 1950-1965.

State Planning Sub-region 36 (Gateway-Buffalo Trace, Ky.)

Since designating the boundaries of Water Sub-region G, the Commonwealth of Kentucky has rearranged the boundaries of its state planning sub-regions. With this rearrangement, three counties of State Planning Sub-regions 36A and 36B are in Water Sub-region G and the remainder are in Water Sub-region H. The State Planning Sub-regions are more closely associated with Water Sub-region H than G; therefore, they are discussed in Chapter 15 (Water Sub-region H Today).

For mathematical continuity, Figure 13-26 as presented here shows population and employment for the portions of State Planning Sub-regions 36A and 36B which are in Water Area G-2 and Water Sub-region G.

TABLE 13-18
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 34

	1950	1960	Absolute Change
TOTAL ALL SECTORS	34,638	33,176	- 1,462
PRIMARY ACTIVITIES	8,847	3,480	- 5,367
Agriculture	7,521	2,926	- 4,595
Forestry & Fisheries	7	37	30
Mining	1,319	517	- 802
SECONDARY ACTIVITIES	9,093	12,424	3,331
Contract Construction	1,841	2,324	483
Food & Kindred Products	215	333	118
Textile Mill Products	21	27	6
Apparel	157	561	404
Lumber, Wood Products, Furniture	474	695	221
Printing & Publishing	141	311	170
Chemicals & Allied Products	400	549	149
Electrical & Other Machinery	158	204	46
Motor Vehicles & Equipment	42	48	6
Other Transportation Equipt.	8	24	16
Other & Miscellaneous	5,636	7,348	1,712
TERTIARY ACTIVITIES	15,963	16,526	563
Transportation & Communications	4,885	3,563	- 1,322
Utilities & Sanitary Service	486	546	60
Wholesale Trade	701	513	- 188
Retail Trade	4,098	4,442	344
Finance, Ins. & Real Estate	504	764	260
Personal Services	2,036	2,489	453
Professional Services	2,130	3,023	893
Recreational Services	194	147	- 47
Public Administration	897	999	102
Armed Forces	32	40	8
NOT REPORTED	735	746	11

TABLE 13-19
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 34
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	123,500
Absolute Change 1960-1965	2,800
Percent Change 1960-1965	2.3

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	120,682	59,919	60,763	20,087	52,504	48,091
Percent Distribution	100.00	49.65	50.35	16.64	43.51	39.85
Percent Change 1950-1960	1.50	0.22	2.79	-48.17	41.34	11.85

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	7,546	3,403	10,794	6,211	1,902	29,856
Percent Distribution	25.27	11.40	36.15	20.80	6.37	100.00
Percent Change 1950-1960	-38.58	-43.33	34.42	488.72	513.55	3.59

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	62,272	34,906	20,511	5,855
Percent Distribution	100.00	56.05	32.94	9.40
Percent Change 1950-1960	3.81	-9.55	42.88	21.73

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	33,136	3,301	24,809	2,750	8,327	551
Percent Distribution	90.94	9.06	90.02	9.98	93.79	6.21
Percent Change 1950-1960	-4.25	71.12	-12.99	66.77	36.69	96.79

RATE OF UNEMPLOYMENT, 1962-65

1962	11.8
1963	9.1
1964	7.4
1965	5.9

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

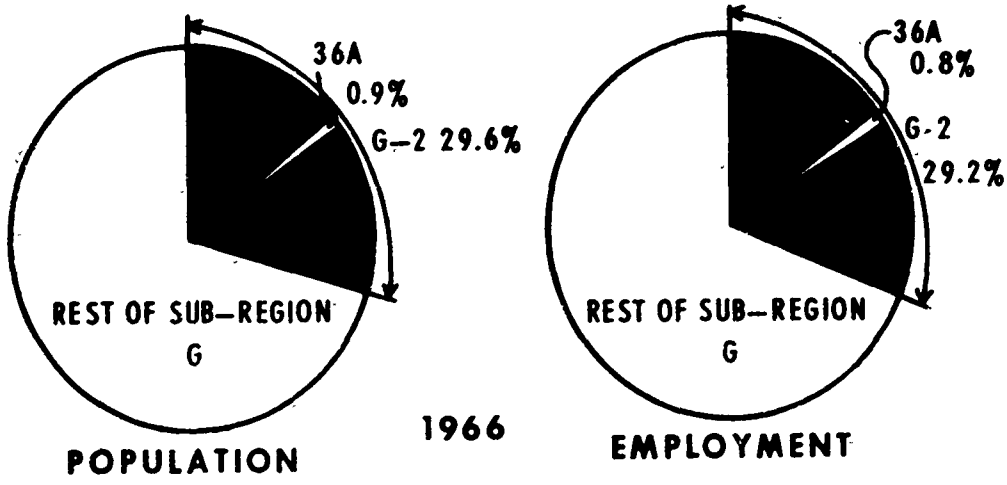
	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	36,477	46,197	27,599	13,098	8,878	
Percent Distribution	44.12	55.88	67.82	32.19	21.15	
Percent Change 1950-1960	-0.25	2.98	-8.60	22.34	39.26	

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	34.1	0.2	0.6
Tot. Employment	32.1	2.2	7.4
Unemployment	2.0	-2.0	-50.0

STATE PLANNING SUB-REGION 36A(PART) BASE DATA



STATE PLANNING SUB REGION 36B(PART) BASE DATA

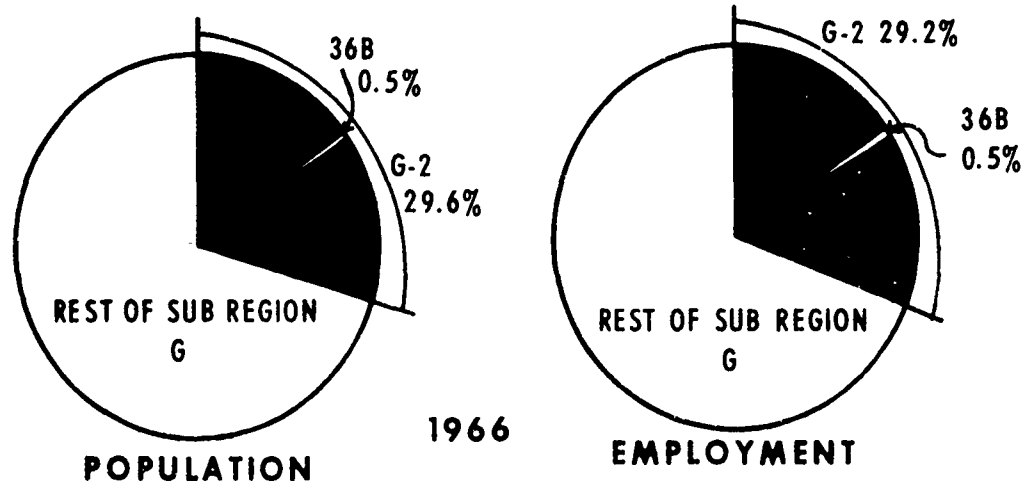


Figure 13-26 Population and Employment: State Planning Sub-regions 36A (Part) and 36B (Part) Compared to Water Area G-2 and Sub-region G.

Water Area G-3

Water Area G-3 lies entirely within the western portion of West Virginia. It consists of State Planning Sub-region 14, containing Putnam, Kanawha, and Boone counties, and State Planning Sub-region 16, containing Tyler, Pleasants, Wood, Jackson, Roane, Calhoun, Wirt, and Ritchie counties. Major concentrations of population and economic activity are in Kanawha County, which contains the Charleston metropolitan area, and Wood County, where the county seat, Parkersburg, is an important trading and manufacturing center.

Population trends in Water Area G-3, over the past twenty years, have been similar to those in Water Sub-region G as a whole, though the area offers greatly different employment opportunities. Population increased by 15,962, or 4 percent, during the period 1950-65. This exceeded the rate of increase for Water Sub-region G.

Of the 1960 population of 458,208 for Water Area G-3, 52 percent was classified as urban, 43 percent as rural nonfarm, and 5 percent as rural farm population.

Employment trends in Water Area G-3 since World War II have compared favorably with those in Water Sub-region G. The decline in employment in the period 1950-60 was less than that for the other water areas in the sub-region. As a result, the population:worker ratio is one of the lowest in Water Sub-region G. (See Table 13-20.) Only Water Area G-1 has a lower population:worker ratio. This ratio has consistently remained lower than that of Sub-region G since the end of World War II. Estimates for 1965 indicate a substantial decrease in the population:worker ratio to approximately 2.9. Despite overall growth in population and employment, G-3 is subject to a high rate of out-migration.

TABLE 13-20
POPULATION GAIN AND POPULATION-WORKER RATIO,
WATER SUB-REGION G AND WATER AREA G-3

	Percent Gain	
POPULATION	1940-50	1950-60
G	4.2	2.7
G-3	10.5	4.4

POPULATION:WORKER RATIO	1940	1950	1960
United States	2.91	2.63	2.66
G	3.77	3.29	3.48
G-3	3.48	3.04	3.19

Increases in employment in manufacturing, trade, and service have served to offset in part declines in agricultural and mining employment during the same period. The two fastest growing employment groups, manufacturing and services, were responsible for nearly 50 percent of total employment in 1960. Thus, employment opportunities alternative to agriculture and mining have been made available. Total employment for 1965 in Water Area G-3 increased by 8,302, or 5.8 percent, over 1950.

Median income levels for Water Area G-3 are higher than for Water Sub-region G. The distribution of income is, however, similar to that for the water sub-region. Data on education and housing are very similar to those for the sub-region.

State Planning Sub-region 14 (Kanawha Valley, W. Va.)

State Planning Sub-region 14, containing three West Virginia counties, is the largest center of economic activity in Water Area G-3, and in West Virginia. It is economically dominated by heavy manufacturing. The chemical industry employed 62 percent of all manufacturing workers in 1960.

Socio-economic characteristics of the state planning sub-region are shown in Figure 13-27 and Tables 13-21 and 13-22.

The area is of generally rugged terrain, with limited areas of rolling land in the western portion, and level bottomlands along the Kanawha River and principal tributaries. The Kanawha, which enters the region near Montgomery, at the east, and flows northwestward for more than 30 miles to Mason County, and thence to the Ohio River, has been the dominant influence in the development of the area's economy from earliest days.

Water resources have been a prime factor in making the Kanawha Valley a major chemical center, but in the process water quality has been seriously impaired. A three-phased program is now underway to "clean up" the stream. This is now in the latter stages of Phase II. Progress in the program can be measured in terms of wastes no longer discharged to the river. This includes hundreds of tons per year of fly ash and other solids. It can be seen also in the recreational aspect of fishing. Ten years ago, certain stretches of the river were so polluted with wastes from industries and municipalities that it could not support any type of game fish.

Nine municipalities with a combined population of more than 120,000 are concentrated on the Kanawha in the Charleston area. All have waste treatment plants, but several of these are not sufficiently efficient to meet water quality standards set by the state. Because of financing problems facing the municipalities and the state, a lag has developed in the construction of secondary facilities.

Figure 13-27 shows population, employment, and urban-rural population distribution for Water Sub-region G, Water Area G-3, and State Planning Sub-region 14.

Charleston Growth Center. Charleston, the capital of West Virginia and the seat of Kanawha County, is located at the junction of the Elk and Kanawha Rivers. Cities in Kanawha County with over 5,000 population are Charleston, South Charleston, St. Albans and Dunbar.

From 1930 to 1960, Kanawha County grew in population faster than the nation. Average annual growth for the 35-year period has been 1.60 percent per year, compared with the nation's average annual gain of 1.25 percent. A different picture is seen in the more recent population trend. While the nation's population increased 10.1 percent from 1960 to mid-1966, Kanawha County's population decreased 5.2 percent, even more than the state's loss of 2.8 percent.

The labor force of Kanawha County gained 0.9 percent from 1960 to 1965, increasing from 93,200 to 94,000 workers. The rate of unemployment dropped from a maximum of 10 percent in 1950 to 6.2 percent in 1965.

Employment in Kanawha County decreased following 1960, but non-manufacturing employment increased enough to bring about a slight gain in overall employment.

Employment in the chemical industry, Kanawha County's major employer, has dropped since 1950, though the county is still the state's dominant chemical-manufacturing area. In 1958, the county accounted for 58 percent of state chemical employment; in 1963, for 53 percent. In 1947, Kanawha County was the source of 72 percent of the state's value added by manufacturing; by 1963, the figure had dropped to 64 percent.

The concentration of chemical manufacturing in Kanawha County has made the area's per capita income one of the highest in Water Sub-region G. Total value added by manufacturing increased 61 percent between 1958 and 1963.

The county is served by Chesapeake and Ohio, Penn Central, and Baltimore and Ohio railroads. Barge transportation is available on the canalized Kanawha River to the vicinity of Deepwater, ninety-one miles above the mouth of the stream. The Kanawha County Airport is served by Allegheny, American, Eastern, Piedmont, and United Airlines.

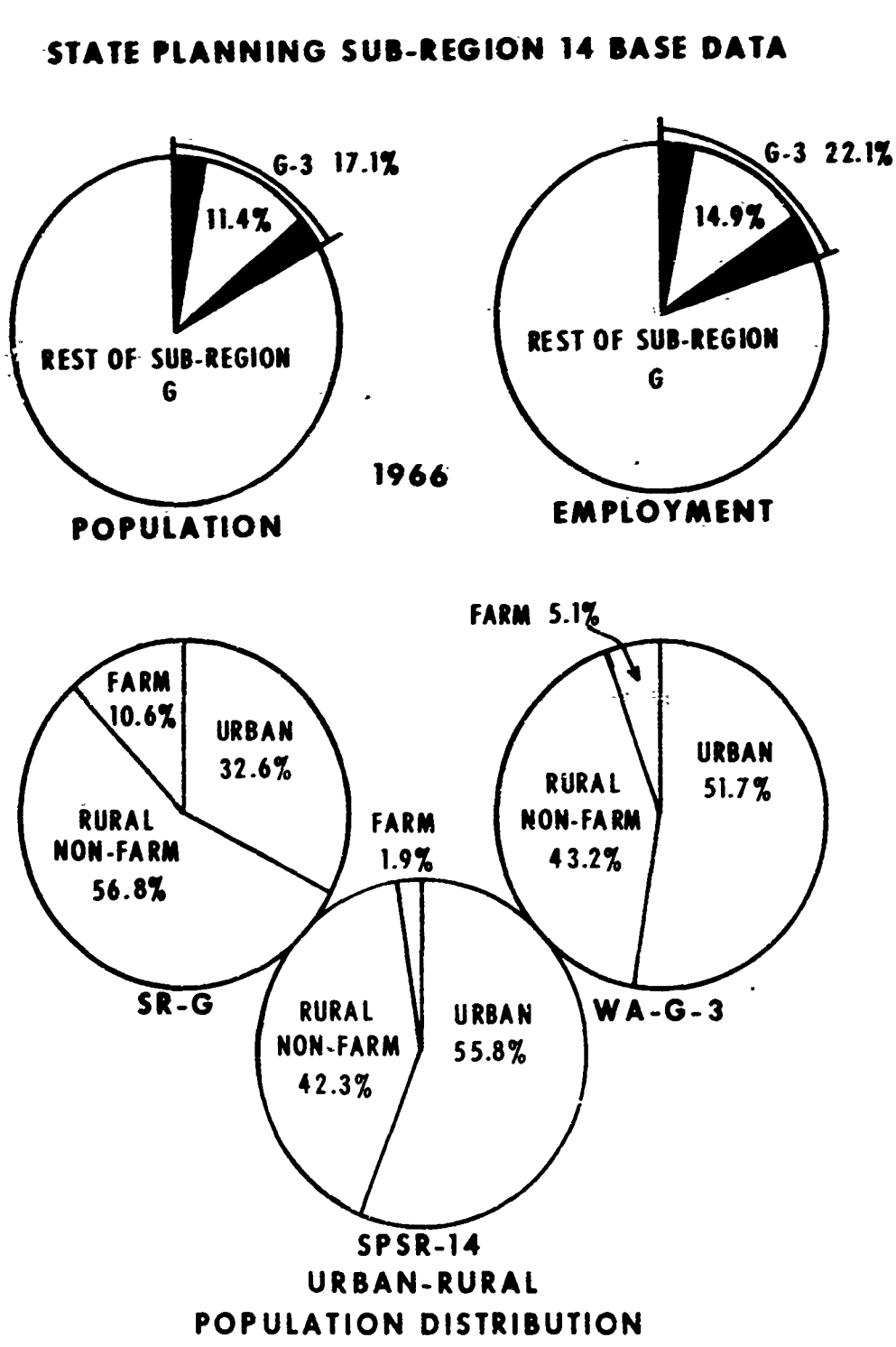


Figure 13-27 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 14 Compared to Water Area G-3 and Sub-region G.

TABLE 13-21
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 14

	1950	1960	Absolute Change
TOTAL ALL SECTORS	97,201	96,066	-1135
PRIMARY ACTIVITIES	17,246	7,325	-9921
Agriculture	2,849	1,015	-1834
Forestry & Fisheries	16	20	4
Mining	14,381	6,290	-8091
SECONDARY ACTIVITIES	30,049	30,978	929
Contract Construction	6,200	5,174	-1026
Food & Kindred Products	1,185	1,531	346
Textile Mill Products	966	28	- 938
Apparel	45	58	13
Lumber, Wood Products, Furniture	587	403	- 184
Printing & Publishing	999	1,267	268
Chemicals & Allied Products	13,975	16,286	2411
Electrical & Other Machinery	787	979	192
Motor Vehicles & Equipment	65	115	50
Other Transportation Equipt.	12	69	57
Other & Miscellaneous	5,228	5,068	- 160
TERTIARY ACTIVITIES	48,545	53,085	4540
Transportation & Communications	5,868	6,040	172
Utilities & Sanitary Service	2,508	2,775	267
Wholesale Trade	3,410	3,527	117
Retail Trade	15,121	14,927	- 194
Finance, Ins. & Real Estate	2,264	2,809	545
Personal Services	7,435	7,036	- 399
Professional Services	7,425	10,595	3170
Recreational Services	644	647	3
Public Administration	3,680	4,398	718
Armed Forces	190	331	141
NOT REPORTED	1,361	4,678	3317

TABLE 13-22
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 14
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	300,100
Absolute Change 1960-1965	-5,200
Percent Change 1960-1965	- 1.73

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	305,250	149,164	156,086	5,725	129,198	170,327
Percent Distribution	100.00	48.87	51.13	1.88	42.33	55.79
Percent Change 1950-1960	3.89	2.02	5.74	-76.85	-2.26	24.41

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	11,947	6,305	23,719	24,989	9,980	76,940
Percent Distribution	15.53	8.19	30.83	32.48	12.97	100.00
Percent Change 1950-1960	-31.75	-57.76	-18.65	315.10	543.87	5.75

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	161,343	73,463	61,319	23,849
Percent Distribution	100.00	45.53	38.01	14.78
Percent Change 1950-1960	6.40	-6.38	25.56	25.65

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	95,735	6,697	68,270	5,423	27,465	1,274
Percent Distribution	93.46	6.54	92.64	7.36	95.57	4.43
Percent Change 1950-1960	-1.32	37.86	-7.65	37.19	18.99	40.77

RATE OF UNEMPLOYMENT, 1962-65

1962	8.4
1963	8.3
1964	7.7
1965	6.6

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	102,763	106,489	74,008	26,388	28,755	80,101
Percent Distribution	49.11	50.89	73.72	26.28	26.42	73.58
Percent Change 1950-1960	0.69	3.14	-5.19	14.70	19.83	-0.18

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	105.7	-0.4	- 0.4
Tot. Employment	98.8	1.6	1.6
Unemployment	6.9	-2.0	-22.5

The county is served by U.S. Highway 21, 35, 60 and 119 and the three state highways. The West Virginia Turnpike links Charleston with Princeton in southern West Virginia. Kanawha County will be one of the few areas in the nation where three Interstate highways converge. I-77 is a north-south route, I-64 an east-west route, and I-79 extends northeastward from Charleston. Appalachian Corridor G will originate in Charleston, extending southwestward.

There are several industrial sites in valley areas in Kanawha County, and near by, but in general industrial land is in limited supply. With carefully planned and controlled land use, Kanawha County has a potential for future economic expansion, but several deficiencies handicap its growth. As an example, impaired water quality inhibits industrial location. Regulation of stream flows could aid in solving this problem. The area also has an unbalanced economy, dominated by chemical manufacturing. Diversification should be sought after.

Table 13-21 shows employment by major categories for West Virginia State Planning Sub-region 14, for 1950 and 1960. Table 13-22 provides a variety of socio-economic data for the planning sub-region for 1950-1965.

State Planning Sub-region 16 (Middle Ohio Valley, W. Va.)

State Planning Sub-region 16 is composed of the eight northwestern West Virginia counties of Calhoun, Jackson, Pleasants, Ritchie, Roane, Tyler, Wirt, and Wood. The dominant influence in the development of the area has been the Ohio River, which separates the region from Ohio, and borders four of the eight counties. Parkersburg, located at the confluence of the Little Kanawha and Ohio rivers, has in recent years become the focal point of a remarkable industrial growth, which has spread in a linear pattern all along the Ohio Valley, extending beyond State Planning Sub-region 16 boundaries.

The area topography is generally rugged except for the bottomlands along the Ohio River in Jackson, Wood, Pleasants, and Tyler counties and principal tributaries, and limited areas of rolling land, oriented in particular with respect to the Little Kanawha.

In 1960 Parkersburg accounted for 51 percent of the population and 56 percent of the employment in State Planning Sub-region 16. The planning area accounted for 33 percent of the population and 33 percent of the employment in Water Area G-3.

Population and employment trends for State Planning Sub-region 16 during the period 1950-65 compared favorably with those of Water Sub-region G. The planning sub-region is one of the few portions of West Virginia to have appreciable growth over the past fifteen years. Population increased 5 percent between 1950 and 1960, though only 1 percent between 1960 and 1965. The rate of change varied greatly among the eight counties. For the period 1950-65, population increased in only three counties (Wood, Jackson, and Pleasants). Population declined in the remaining five counties.

According to the 1960 census, 44 percent of the population was urban, 45 percent rural nonfarm and 11 percent rural farm.

The dominant industries are manufacturing, trade, and services. Over the period 1950-65, gains in manufacturing and service employment offset the decline in agricultural employment. The 1962-65 gain of 7.4 percent in total employment was considerably greater than the 4.8 percent increase in the work force. Unemployment dropped to 6.0 percent in 1965 from 8.3 percent in 1962. Population:worker ratios indicate the area's growth to be a continuing one. In 1950, this ratio was about 3.08; in 1960, 3.06. The ratio is currently estimated to be 2.87, one of the lowest in the water sub-region. The population:worker ratio in State Planning Sub-region 16 has consistently been below that for Water Sub-region G. G's ratio in 1965 was 3.48.

Water resources are of major importance to local industries. There is a heavy demand for quality water, especially from the Little Kanawha River. Although most of the industrial plants have waste abatement programs, further work and investment will be needed if the quality of the water supply is to be maintained. Cities must also improve their waste disposal facilities. Two possible impoundments in the Little Kanawha River Basin are being studied.

The major growth resources are situated along the Ohio River. In addition to the availability of low cost river transportation, industry is attracted by the improved highway system and the possibility of developing additional industrial sites.

Spencer is an important service and marketing center for the southern hinterlands and should continue to develop as an employment center. The Grantsville area performs a similar role for the eastern hinterlands. Pennsboro, located on Appalachian Highway Corridor "D" is an important center, but it has not developed as a major service center because of ready access to Parkersburg.

One of the major constraints on the development potential is the overall lack of adequate vocational education facilities. This is particularly true in the eastern portions of the area from which the Parkersburg-Ohio River Growth Center attracts much of its labor force. Improved vocational education facilities appear desirable for the extreme northern and southern portions of the area also. The higher education facilities of the region are somewhat limited, but have been improved significantly in recent years and further efforts should be made in this direction.

This planning sub-region needs a well conceived and properly carried out housing program, so that healthy communities can be developed while at the same time allowing for industrial expansion. Without a housing plan, the area is likely to develop as a "hodge-podge" of conflicting land uses, with the resulting loss of sites needed by industry. Efforts should be made, also, to insure that the development of West Virginia 2 as an expressway along the Ohio River is in conformity with the best interest of the sub-region so that land development possibilities will be enhanced.

Figure 13-28 shows population, employment, and urban-rural population distribution for Water Sub-region G, Water Area G-3, and State Planning Sub-region 16.

Parkersburg Growth Center. Parkersburg, in Wood County, is located in western West Virginia, on the Ohio River. The county population increased 22 percent between 1960 and 1965. Growth is occurring in Parkersburg and Vienna. Wood County and neighboring Washington County in Ohio are expected to qualify as a Standard Metropolitan Statistical Area by 1970.

The labor force of Wood County increased 13.5 percent between 1950 and 1960. Employment increased 16.4 percent during the 1950-60 decade, dominated by gains in manufacturing. Manufacturing employment is almost equally divided between durable and nondurable goods, the 1960 percentages being 47.5 and 52.5 percent, respectively.

Chemical production, responsible for the employment of 3,560 in 1960, is the largest single source of manufacturing jobs. Other important manufacturing industries are primary and fabricated metals, with 2,230 employees (1960) and nondurable goods, primarily stone, clay, and glass products, with 2,110 employees. The nonmanufacturing groups which provide large numbers of jobs are wholesale and retail trade, employing 5,200; and services, 4,800 workers.

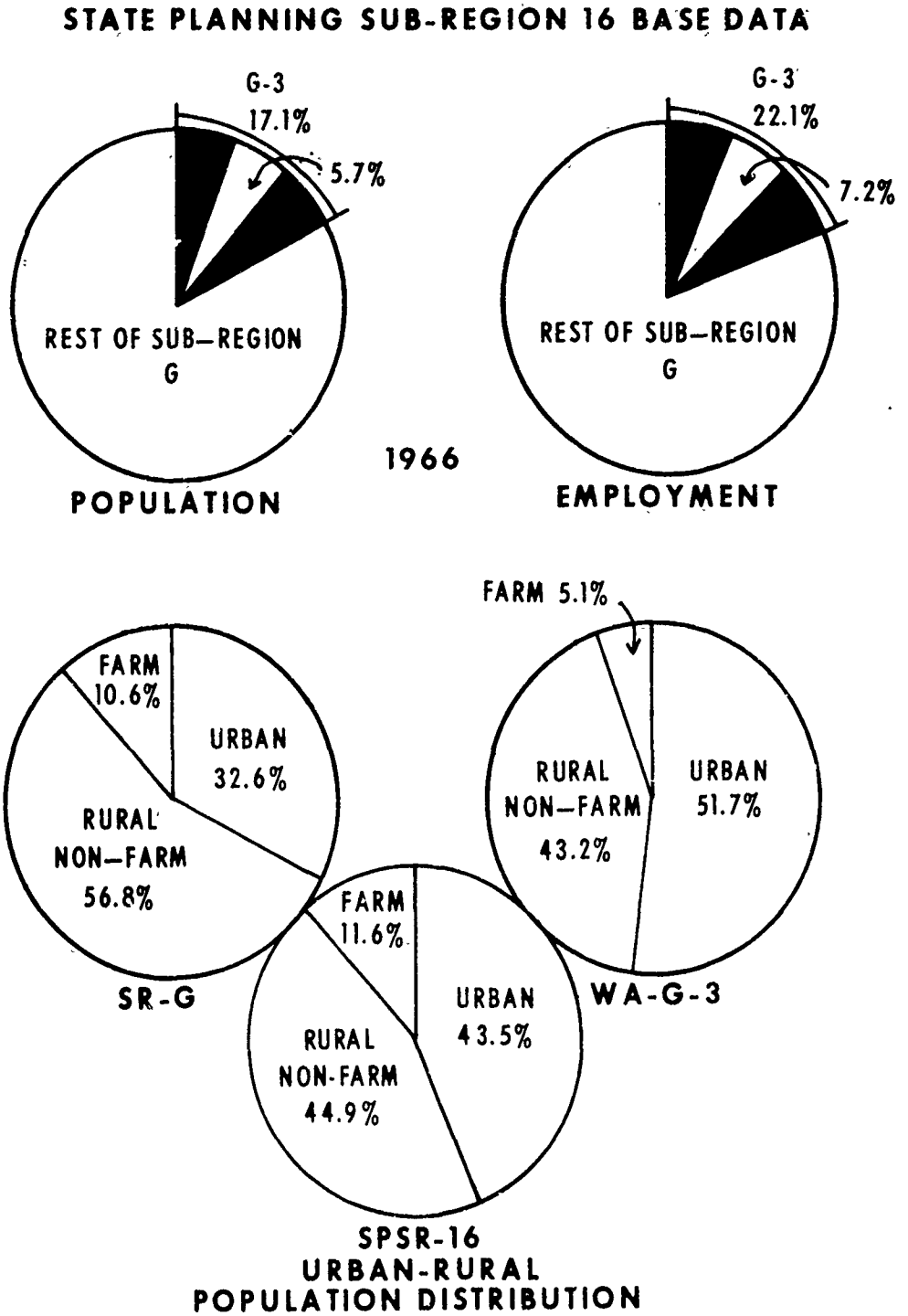


Figure 13-28 Population, Employment, and Urban-Rural Population Distribution of State Planning Sub-region 16 Compared to Water Area G-3 and Sub-region G.

The county is serviced by the Baltimore and Ohio Railroad mainline, which provides both passenger as well as freight service. Air, water, truck, and bus services also are available. Appalachian Highway Corridor "D" and Interstate 77 will converge in the county. U.S. Highways 50 and 21 traverse the county, as well as West Virginia Highways 2, 14 and 47.

Numerous grade schools and three high schools are located in the county, with a new high school being completed. Instruction is also provided by Ohio Valley College, a branch of West Virginia University, and several commercial colleges.

Table 13-23 shows employment by major categories for West Virginia State Planning Sub-region 16, for 1950 and 1960. Table 13-24 provides a variety of socio-economic data for the planning sub-region for 1950-1965.

TABLE 13-23
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 16

	1950	1960	Absolute Change
TOTAL ALL SECTORS	47,197	47,653	456
PRIMARY ACTIVITIES	12,552	4,697	-7885
Agriculture	10,634	3,276	-7358
Forestry & Fisheries	8	25	17
Mining	1,910	1,396	- 514
SECONDARY ACTIVITIES	14,018	19,381	5363
Contract Construction	3,155	3,524	369
Food & Kindred Products	619	745	126
Textile Mill Products	528	334	- 194
Apparel	180	439	259
Lumber, Wood Products, Furniture	718	622	- 96
Printing & Publishing	399	525	126
Chemicals & Allied Products	2,963	4,759	1796
Electrical & Other Machinery	548	408	- 140
Motor Vehicles & Equipment	15	42	27
Other Transportation Equipt.	17	12	- 5
Other & Miscellaneous	4,876	7,971	3095
TERTIARY ACTIVITIES	19,631	22,406	2775
Transportation & Communications	2,193	1,951	- 242
Utilities & Sanitary Service	885	978	93
Wholesale Trade	1,141	968	- 173
Retail Trade	6,357	7,214	857
Finance, Ins. & Real Estate	811	1,117	306
Personal Services	2,967	3,140	173
Professional Services	3,502	4,794	1292
Recreational Services	292	227	- 65
Public Administration	1,443	1,976	533
Armed Forces	40	41	1
NOT REPORTED	996	1,169	173

TABLE 13-24
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 16
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	154,400
Absolute Change 1960-1965	1,400
Percent Change 1960-1965	0.92

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	152,958	74,968	77,990	17,769	68,625	66,564
Percent Distribution	100.00	49.01	50.99	11.62	44.87	43.51
Percent Change 1950-1960	5.44	4.73	6.13	-66.71	63.79	33.68

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	8,190	3,954	13,817	10,192	3,044	39,197
Percent Distribution	20.89	10.09	35.25	26.00	7.77	100.00
Percent Change 1950-1960	-46.22	-47.52	40.99	732.00	680.51	10.91

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	84,415	44,962	29,703	8,819
Percent Distribution	100.00	53.26	35.19	10.45
Percent Change 1950-1960	4.97	-11.79	43.29	35.68

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	47,612	3,507	33,950	2,775	13,662	732
Percent Distribution	93.14	6.86	92.44	7.56	94.91	5.09
Percent Change 1950-1960	0.96	31.59	-7.72	32.02	31.78	30.02

RATE OF UNEMPLOYMENT, 1962-65

1962	8.3
1963	7.2
1964	6.1
1965	6.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	51,160	56,224	36,766	14,939	14,394	41,285
Percent Distribution	47.64	52.36	71.11	28.89	25.85	74.15
Percent Change 1950-1960	2.60	2.03	-5.56	22.89	31.67	-3.87

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	57.3	2.6	4.8
Tot. Employment	53.9	3.7	7.4
Unemployment	3.4	-1.1	-24.5

Water Area G-4

Water Area G-4 contains State Planning Sub-regions 22, in West Virginia, and 33 in Kentucky, totaling nine counties, plus Lawrence County, Kentucky in State Planning Sub-region 34, which has been discussed with Water Area G-2 above.

The nine-county area, which is included in the Appalachian Regional Commission's Central Appalachian Study, is characterized by large declines in employment opportunities and in population with high rates of out-migration. The area is quite rugged, and level land is at a premium. Such land is generally confined to narrow stream valleys. The water area conforms closely to the upper drainage basins of the Guyandotte, Big Sandy, and Licking rivers.

The population of Water Area G-4 increased during the decade 1940-50, but it declined by over 19 percent between 1950 and 1960, and has continued to decline. The population of Water Area G-4 is basically rural nonfarm; this accounts for 85.3 percent of the total, with only 10.6 percent classed as urban and 4.1 percent as rural farm.

In the period 1940-50, employment increased at a greater rate than population, but in the fifties employment declined at a greater rate than population. The trend is continuing; in the period 1960-66, employment decreased by over 11 percent, and population by about 5 percent.

Agricultural employment in the period 1940-60 has greatly declined, absolutely and relatively. Mining employment has decreased greatly, but still accounted in 1960 for 40 percent of total employment. The area's historical growth and later instability was linked to conditions in coal mining. Manufacturing employment has not increased by any appreciable amount, and hence has not acted to offset the declines in agriculture and mining.

Of the five water areas in Sub-region G, Water Area G-4 has the greatest proportion of families earning less than $3,000, more than 43 percent. Median family income is below the national norm by over $2,600, and below the Sub-region G median by $800. Thus, it is not surprising that nearly 12 percent of the population in Water Area G-4 were public assistance recipients in 1960, compared to 6.7 percent for Water Sub-region G and 4.0 percent for the United States.

Water Area G-4 had in 1960 a median level of school years completed more than two years under the U.S. average, and a larger proportion having less than five years of schooling. There was, for the water area in 1960, a lower proportion of those finishing high school or more (16.8 percent), compared with either Water Sub-region G (26.0 percent), or the nation (41.4 percent).

The economy is based almost entirely on coal. Until its eventual depletion, coal will continue to be the major source of income and employment, but the nature of the employment structure will change. Skilled technicians rather than low-skilled miners will be required. Investment is needed in education and training programs to adapt the labor force to the new technological conditions of coal mining employment and to hold and attract the area's youth for work in the mines.

State Planning Sub-region 22 (Central Appalachia, W. Va.)

In State Planning Sub-region 22, composed of Mingo, McDowell, Wyoming, and Logan counties, there is no center where economic activity is concentrated. The population is widely distributed outside the cities. Only 12.6 percent of the population was urban in 1960, compared with 38.2 percent for West Virginia. This is not to imply that the state planning sub-region had relatively low population density. Population per square mile for the U.S., West Virginia and State Planning Sub-region 22 in 1960 is as follows:

	Population Per Square Mile
United States	50.5
West Virginia	77.3
State Planning Sub-region 22	108.0

The major cities of the state planning sub-region and their 1960 population, and the percentage change between 1950 and 1960 are shown below.

City	1960	Percent Change, 1950-60
Logan	4,185	- 17.6
War	3,006	- 24.7
Welch	5,315	- 19.5
Williamson	6,746	- 21.8

The population of the area decreased 29 percent between 1950 and 1965.

The decline in total employment from 1950 to 1960 was 28,231, of which mining accounted for 87 percent. The unemployment rate in 1960 was 11.1 percent. During the 1960-65 period, McDowell County lost 12,253 jobs; Logan 8,567; Mingo 4,530 and Wyoming 2,781 jobs. The alternatives open to the displaced miners have been out-migration or welfare.

Much of the coal, including certain high-volatile seams, as well as the low volatile seams found in the eastern part of the area, is

in great demand for metallurgical purposes. Large new mines are currently under construction or have been announced for construction to meet growing demands. The modernized coal industry may supply a base for a reorganized economy; an economy based on skilled labor, and the increased services which more highly skilled and better paid labor will demand.

The area is also heavily forested, but poor forest management has resulted in deterioration of the growing stock, and forest fires have seriously damaged or destroyed many stands. The area does, however, have a good potential for exploitation of its wood resources. The furniture industries of North Carolina and Virginia are close enough to provide ready markets for much wood. To the extent that income and employment grow in the state planning sub-region and new housing is constructed, an improved local market will also be developed for the wood industries.

The limited number of developable plant sites in State Planning Sub-region 22 poses a major deterrent to industrial growth. Most of the level land is already being utilized, for housing, highways, railroads, stores, schools, mine operations, government facilities, cemeteries, and other conflicting uses. Much land is concentrated in the ownership of holding companies, many of which are organized as subsidiaries of coal mining companies or railroads. The larger part of the land is underdeveloped, and of that which is developed, almost half is utilized for mining.

Much of the land has a slope greater than 15 percent, which seriously limits the development potential. An associated problem is the frequent flooding of much of the narrow valley bottoms.

There are few restrictions on land use and none of the counties of the state planning sub-region have countywide zoning. Of the industries which have been proposed for the area, most have extensive land-use requirements, and consequently, would present problems in finding suitable sites. In a survey conducted by the U.S. Army Corps of Engineers, less than 300 acres of developable sites was identified. As observed in a report prepared by Battelle Memorial Institute, this is in competition with a site of 1,350 acres on the Ohio River at Haverhill, between Ironton and Portsmouth, a short distance from the study area.

The Chesapeake and Ohio and Norfolk and Western railways have built main and branch lines into almost every part of the area to open up its vast coal resources and to facilitate the transport of the coal to inland markets and to ports on the eastern seaboard and the Great Lakes. With respect to road and highway development, the region has not fared nearly so well. The high cost of road construction and maintenance in areas of rugged terrain has limited the

effectiveness of highways expenditures. This situation will be remedied in some measure through the building of the Appalachian Corridor "G" highway, scheduled for construction through Logan and Mingo Counties. A small airport is scheduled for construction at Williamson.

A wide range of community improvement programs is needed to upgrade the quality of the living environment throughout the area. These improvements are especially needed at Welch, Williamson, Logan, and Pineville-Mullens.

The educational programs must be strengthened if the area is to train its young people adequately to enter the higher skilled labor force. The area's strong vocational training program should be constantly upgraded and efforts should be made to tie these efforts closely to labor force needs.

The town areas are badly in need of waste treatment facilities. McDowell County, with a population of 71,359 people, has treatment provided for less than 2 percent. Because of the "coal camp" type villages prevalent in the area, the problem of waste treatment is difficult. Local public service districts, with county support, may be needed to cope with the domestic waste problem.

The waste abatement drive for the coal preparation plants, which started in 1953, has proven very successful. (Prior to 1953, the coal industry was exempt from water pollution laws.) Streams that were laden with thousands of tons of coal waste solids in 1953 are now recovering and sport fishing is once again possible.

For the protection of areas subjected to flooding, flood control dams and floodplain planning projects take a high priority. Strip mining sediments in the streams contribute to higher stages. R. D. Bailey Lake, on Guyandotte River, near Pineville, is being built, and the Panther Creek Lake (on a tributary of Tug Fork of the Big Sandy) is authorized. These multipurpose facilities will add, among other things, to the recreation potential in a section of the state which is definitely in need of increased recreational opportunities.

The utility system of the area is not highly developed and few communities have substantial surpluses of water. (Natural gas is produced in the area, and a surplus is transmitted to other areas.) Electrical service is quite highly developed in the study area, and most sites are served with, or could easily be served with, electricity.

Selected socio-economic indicators for State Planning Sub-region 22 are shown in Figure 13-29 and Tables 13-25 and 13-26.

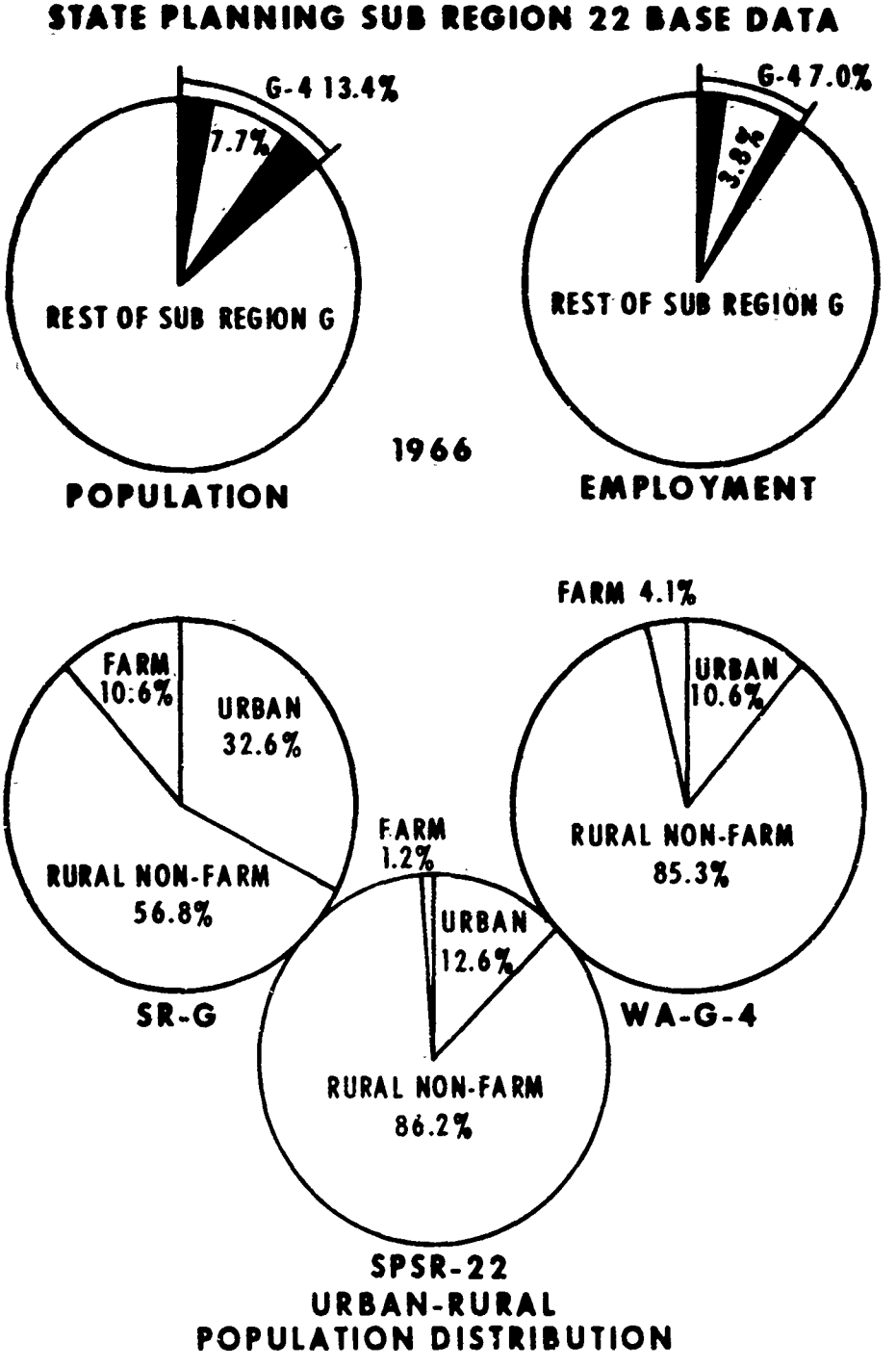


Figure 13-29 Population Employment and Urban-Rural Population Distribution of State Planning Sub-region 22 Compared to Water Area G-4 and Sub-region G.

TABLE 13-25
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 22

	1950	1960	Absolute Change
TOTAL ALL SECTORS	72,356	44,130	-28,226
PRIMARY ACTIVITIES	45,069	19,233	-25,836
Agriculture	1,424	202	- 1,222
Forestry & Fisheries	22	21	- 1
Mining	43,623	19,010	-24,613
SECONDARY ACTIVITIES	4,078	3,371	- 707
Contract Construction	1,628	1,221	- 407
Food & Kindred Products	428	493	65
Textile Mill Products	2	-	- 2
Apparel	5	11	+ 6
Lumber, Wood Products, Furniture	1,468	704	- 764
Printing & Publishing	203	355	152
Chemicals & Allied Products	13	12	- 1
Electrical & Other Machinery	169	345	176
Motor Vehicles & Equipment	6	16	10
Other Transportation Equipt.	1	11	10
Other & Miscellaneous	155	203	48
TERTIARY ACTIVITIES	22,237	22,528	291
Transportation & Communications	3,743	2,509	- 1,234
Utilities & Sanitary Service	740	717	- 23
Wholesale Trade	751	850	99
Retail Trade	7,748	6,619	- 1,129
Finance, Ins. & Real Estate	495	614	119
Personal Services	3,379	2,401	- 978
Professional Services	3,838	5,317	1,479
Recreational Services	422	220	- 202
Public Administration	1,080	1,215	135
Armed Forces	41	66	25
NOT REPORTED	972	998	26

TABLE 13-26
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 22
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	191,100
Absolute Change 1960-1965	-16,400
Percent Change 1960-1965	- 7.9%

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	207,507	103,397	104,110	2,561	178,766	26,180
Percent Distribution	100.00	49.83	50.17	1.23	86.15	12.62
Percent Change 1950-1960	-20.56	-23.15	-17.82	-90.68	-6.07	-39.73

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	13,910	4,733	15,762	10,047	2,706	46,258
Percent Distribution	28.12	10.23	34.07	21.72	5.85	100.00
Percent Change 1950-1960	-18.41	-73.29	-3.60	222.02	270.68	-19.90

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	96,368	57,423	28,531	6,516
Percent Distribution	100.00	59.59	29.61	6.76
Percent Change 1950-1960	-17.82	-22.09	-3.05	-6.85

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	44,084	5,486	34,035	4,844	10,029	642
Percent Distribution	88.93	11.07	87.54	12.46	93.98	6.02
Percent Change 1950-1960	-39.07	64.30	-45.37	71.41	0.20	25.13

RATE OF UNEMPLOYMENT, 1962-65

1962	18.9
1963	16.9
1964	15.2
1965	13.3

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	49,616	81,163	38,937	25,432	10,679	55,731
Percent Distribution	37.94	62.06	60.49	39.51	16.08	83.92
Percent Change 1950-1960	-34.45	-11.27	-40.25	18.00	1.44	-20.30

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	%
Tot. Work Force	46.6	-2.9	- 5.9
Tot. Employment	40.4	0.2	0.5
Unemployment	6.2	-3.2	-34.1

State Planning Sub-region 33 (Big Sandy, Ky.)

State Planning Sub-region 33 contains four distinctly different subareas within its five counties. The portion along the southwest bank of Tug Fork of Big Sandy in Pike and Floyd Counties is extremely rugged, with level land limited to narrow stream bottoms. Economically, this part of the Big Sandy area is closely linked to adjoining population centers in West Virginia. A secod very rugged subarea, with a severely limited amount of level land, is the coal mining section of southern Floyd County which lies along the left and right forks of Beaver Creek and along Mud Creek. Aside from the old, but well-maintained mining town of Wheelwright, the urban areas are generally dilapidated. Much of the subarea is mined-out, and the work force economically stranded. A third subarea, at the headwaters of Licking River, includes most of what comparatively little agricultural activity occurs in the planning sub-region. It also includes Salyersville, a latent urban service area, the development of which depends on increased economic activity along the Kentucky Mountain Parkway, local initiative in industrial development, and the construction of the proposed Royalton Reservoir. Salyersville may become a growth center tied closely to Paintsville, Prestonsburg, and Pikeville. The fourth subarea includes the three growing urban centers, just mentioned, lying along Levisa Fork of Big Sandy River in Floyd and Johnson Counties.

The population data for State Planning Sub-region 33 shows a heavy out-migration, especially of persons in the 15 to 40-year age group. In 1960, the area had a population of 151,011 people of which 95.7 percent were in nonagricultural employment. There was a ratio of 5.2 persons to each employed person. Comparison of this ratio to the statewide ratio of 4.0 and the Water Area G-4 ratio of 4.9, indicates underemployment, attributable to lack of alternatives to work in mining. The state planning sub-region had 5.7 percent of the total population and only 3.8 percent of the employed people in Water Sub-region G in 1960. Between 1950 and 1960, the rural farm population decreased 84 percent; the urban population decreased 8 percent; and rural nonfarm increased 33 percent. Several counties have no areas classed as urban. Graphic representations of the relative position of the state planning sub-region in Water Sub-region G and Water Area G-4 are shown in Figure 13-30.

Although the planning area has declined in population since 1950 (22.2 percent, down to 143,200 in 1966) total nonfarm employment, manufacturing employment, and total manufacturing wages have increased recently.

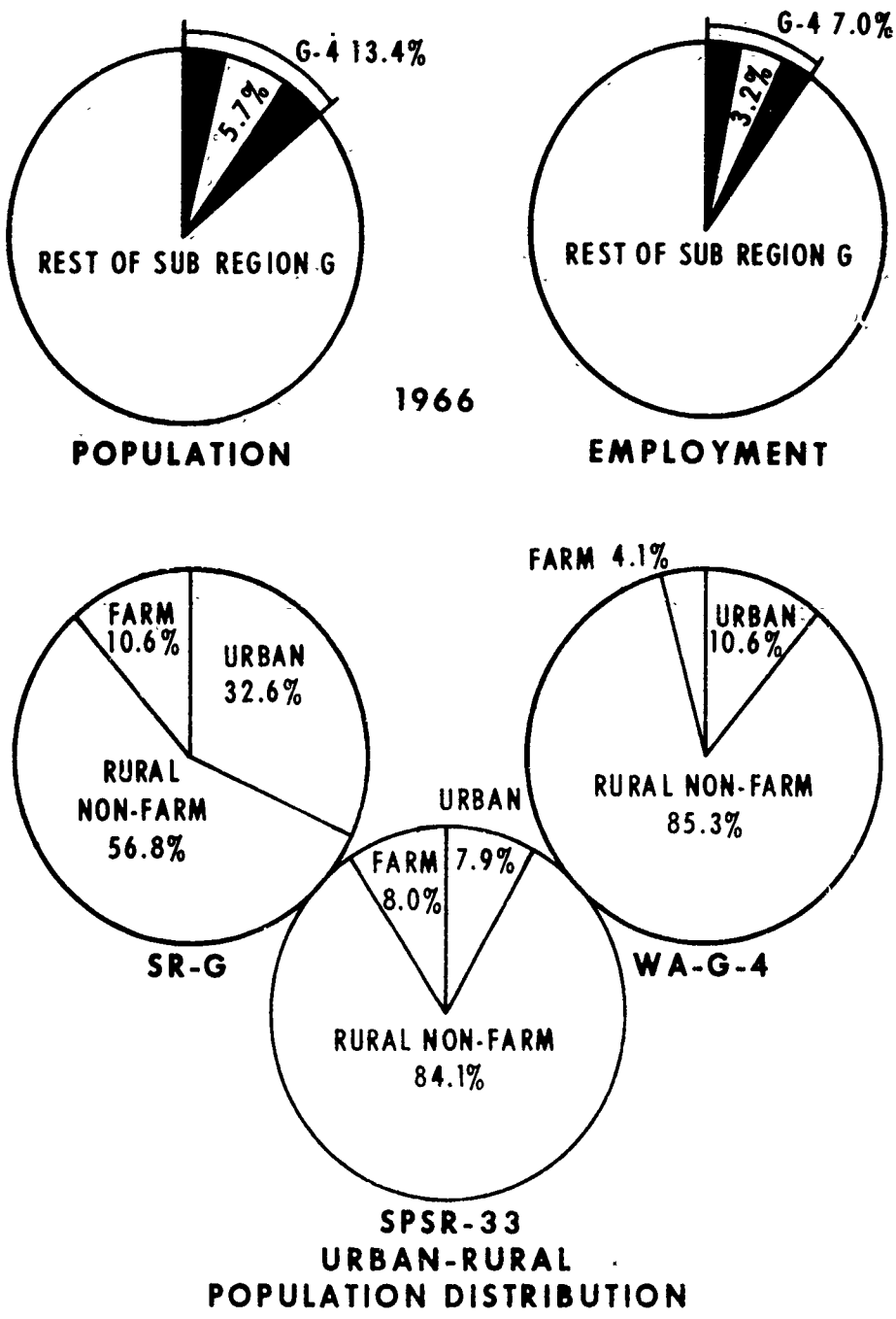


Figure 13-30 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 33 Compared to Water Area G-4 and Sub-region G.

A 1966 survey of the labor force conducted for the Kentucky Department of Commerce indicated a recruitable labor force of 16,700 to 17,700 persons. Area high schools graduated 1,923 students in 1964. This indicates a labor supply adequate to man substantial manufacturing development.

The coal industry is the major employer (9,932 people out of 28,798 employed in 1960) and a major source of personal income ($10.5 million in the fourth quarter of 1965 out of $16.8 million industrial wages paid to area employees covered under the unemployment insurance program). Other area firms manufacture shoes and lumber products; process food and petroleum products.

Families with annual incomes greater than $7,000 increased from 645 in 1950 to 3,106 in 1960, with over half located in Pike County. Families with annual incomes less than $3,000 declined from 30,535 to 18,840 over the same decade. This was still 56 percent of all families in 1960. The increases in manufacturing wages noted in Table 13-27 indicate substantial progress since 1960.

TABLE 13-27
EMPLOYMENT AND WAGES
STATE PLANNING SUB-REGION 33

	1960	1963	1965
Total Nonfarm Employment	13,227	14,597	13,884
Manufacturing Employment	477	604	723
Manufacturing Wages (4th Quarter)	$320,404	$483,094	$604,616

Present and expected land use in the state planning sub-region is shown below in Table 13-28. Forest and woodland occupy 78 percent of the total land area, most of the forest land being on very rough land. Cropland plus pasture and range occupy another 11 percent.

TABLE 13-28
EXPECTED CHANGES IN LAND USE--1958 TO 1975
STATE PLANNING SUB-REGION 33

Land Use	Acres (000's) 1958	1975	Percent Change
Cropland	64.7	67.8	4.9
Pasture-Range	69.5	106.7	53.5
Forest-Woodland	993.6	1052.6	6.1
Other Land	124.5	24.2	80.6

Most of the timber is hardwood. Surveys by the U.S. Forest Service indicate more timber can be harvested. However, the area's existing sawmills are small and crude, and utilized only the better quality sawtimber. Over the years, this situation has resulted in a scarcity of sawtimber but an abundance of poletimber.

The sub-region is becoming more accessible to the industrial centers in the surrounding regions. The Mountain Parkway, which connects the Prestonsburg-Paintsville area to central Kentucky, has been completed. Appalachian Corridor "B" will traverse the area in a north-south direction, connecting Portsmouth and Columbus, Ohio, with Asheville, N.C. Appalachian Corridor "G" will connect Pikeville with Charleston, W. Va., and Corridor "Q" will extend from a point near Pikeville to Interstate 81 near Roanoke, Va.

A complete access road system is needed for development of land for industrial and residential use. A bridge across Levisa Fork to connect an industrial site with Corridor "B" has been funded under the Appalachian Regional Development Act.

The sub-region is served by a good rail system (freight), designed to transport coal for U.S. and foreign consumption. Lines in or near the area belong to the Louisville and Nashville and Chesapeake and Ohio railroads. They provide connection with the Ohio River navigation system as well as to all major rail lines.

There is no commercial air transportation in the area. The nearest airports providing scheduled airline service are located at Huntington, West Virginia, and Lexington, Kentucky. Small airports offering service for light planes exist at Prestonsburg and Pikeville, and a small mountaintop airport is under construction at Pikeville.

In State Planning Sub-region 33, 12,959 dwellings out of a total of 40,429 were sound structures with plumbing in 1960. Nearly 40 percent of all dwellings were built prior to 1930. A potential market for housing exists when gaged in terms of the number of old and substandard structures and the recent increase in manufacturing wages and family income. Major deterrents to the development of an active housing industry in the area include: (1) lack of locally available long-term financing; (2) lack of skilled construction workers; and (3) the scarcity and high cost of level land.

Concerning education levels of residents of the state planning sub-region, teachers' salaries and teacher training show the region to be below state and national averages. The percent of ninth grade entrants completing high school is nearly equal to the state

average. The average education level is 8.0 years of formal education completed. Several new facilities have been constructed, but serious deficiencies remain in the public school facilities in all counties. The major new facilities include additions to the elementary schools at Prestonsburg and McDowell, new high schools for Pikeville and Johnson Counties, two new elementary schools in Pike County, and a new elementary school in Magoffin County.

The development of manpower resources to support industrial expansion is being increasingly well accomplished. Vocational training needs are served by the Mayo Area Vocational-Technical School in Paintsville, with extension centers at Belfry, Garth, Inez, and Millard. In 1964-65, 2,092 students from the area were enrolled at institutions of higher education; this included 920 enrolled at the two colleges in the area (Pikeville College and Prestonsburg Community College).

The sub-region has a potential for diversifying and expanding its employment base and developing a range of urban services. However, the realization of this potential depends on vigorous efforts to develop the bottomlands along Levisa Fork, which are becoming increasingly protected from flooding. Equally vigorous efforts are necessary to link the central urban service subarea with the other three subareas, to achieve for them a viable economic and social base by overcoming the severe restrictions imposed on them by terrain or flooding. Municipalities throughout the area must improve their water supply and waste disposal systems.

Socio-economic data for the planning sub-region are shown in Tables 13-29 and 13-30.

TABLE 13-29
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 33

	1950	1960	Absolute Change
TOTAL ALL SECTORS	44,544	28,821	- 15,723
PRIMARY ACTIVITIES	28,142	11,191	- 16,951
Agriculture	7,962	1,215	- 6,747
Forestry & Fisheries	21	44	23
Mining	20,159	9,932	- 10,227
SECONDARY ACTIVITIES	2,918	3,018	100
Contract Construction	1,499	1,487	- 12
Food & Kindred Products	241	291	50
Textile Mill Products	1	0	- 1
Apparel	4	4	0
Lumber, Wood Products, Furniture	804	657	- 147
Printing & Publishing	84	82	- 2
Chemicals & Allied Products	20	46	26
Electrical & Other Machinery	69	103	34
Motor Vehicles & Equipment	39	102	63
Other Transportation Equipt.	2	4	2
Other & Miscellaneous	155	242	87
TERTIARY ACTIVITIES	12,726	13,967	1,041
Transportation & Communications	1,899	1,287	- 612
Utilities & Sanitary Service	689	874	185
Wholesale Trade	625	628	3
Retail Trade	4,133	4,170	37
Finance, Ins. & Real Estate	323	416	93
Personal Services	2,103	1,824	- 279
Professional Services	1,912	3,478	1,566
Recreational Services	184	119	- 65
Public Administration	828	948	120
Armed Forces	30	23	- 7
NOT REPORTED	758	845	87

TABLE 13-30
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 33
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	145,200
Absolute Change 1960-1965	-5,800
Percent Change 1960-1965	- 3.9

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	151,011	75,358	75,653	12,131	126,968	11,912
Percent Distribution	100.00	49.90	50.10	8.03	84.08	7.89
Percent Change 1950-1960	-17.94	-19.30	-16.53	-83.98	33.31	-8.71

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	14,159	4,681	10,084	3,785	1,111	33,820
Percent Distribution	41.87	13.84	29.82	11.19	3.29	100.00
Percent Change 1950-1960	-32.24	-51.44	66.68	440.71	264.26	-11.84

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	69,310	48,407	13,802	4,460
Percent Distribution	100.00	69.84	19.91	6.43
Percent Change 1950-1960	-7.27	-13.64	25.47	13.92

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	28,798	4,650	22,658	4,324	6,140	326
Percent Distribution	86.10	13.90	83.97	16.03	94.96	5.04
Percent Change 1950-1960	-35.31	120.27	-41.95	132.22	12.00	30.92

RATE OF UNEMPLOYMENT, 1962-65

1962	16.8
1963	14.9
1964	13.8
1965	14.7

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	33,471	63,514	27,005	20,952	6,466	42,562
Percent Distribution	34.51	65.49	56.31	43.69	13.19	86.81
Percent Change 1950-1960	-28.26	-5.07	-34.01	25.22	12.77	-15.17

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng.1962-65 No.	Chng.1962-65 %
Tot.Work Force	29.2	0.7	2.5
Tot.Employment	24.9	1.2	5.1
Unemployment	4.3	-0.5	-10.4

Water Area G-5

Water Area G-5 is composed of State Planning Sub-regions 20 and 21 in West Virginia, and 26 and 27 in Virginia.

Much of the water area is located in rugged terrain, and in much of it coal mining has been the principal industry. It includes expanses of spectacular mountain scenery and secluded wilderness areas; and it is the location of one of the county's best known resort hotels.

Three clusters of growth centers account for most of the economic activity in the water area. The northernmost cluster is focused around the West Virginia communities of Philippi, Buckhannon, and Elkins in State Planning Sub-region 20. The transportation network of the northern cluster is improving and development of industrial sites has improved the economic base. Deficiencies still remain, however, in urban service and education.

The central cluster, including the West Virginia communities of Beckley, Ronceverte, Princeton, and Bluefield, includes parts of the southern coalfields and Monongahela National Forest. Recreation potential of the area has been handicapped by poor highway access, but the Appalachian and Interstate highway systems and several scenic parkways under consideration will aid in exploiting this potential. Location of an aviation plant and the recent upsurge in demand for coal will contribute to the area's future economy. Investments in education, industrial site development, housing, and health are required, however, for expansion.

The southern portion of Water Area G-5 has a cluster of growth centers which includes Pearisburg-Narrows; Marion-Wytheville; Hillsville-Galax, and Pulaski-Parrott, Virginia. Population declines have been arrested, and investments in highways, health, education, and industrial site development are planned which will enable this portion of Water Area G-5 to offset losses in agricultural and mining employment.

Population and employment changes in Water Area G-5 are similar to those for Water Area G-4, in that decreases in agricultural and mining employment were not offset by gains in other industries. This behavior has resulted in high unemployment rates and high rates of out-migration. In the decade of the 1940's, population and employment in Water Area G-5 did not increase as greatly as in Water Sub-region G; and in the '50's declined at a higher rate. Although employment increased 15.9 percent and population 3.8 percent in the 1940-50 period, the trends were reversed in the period 1950 to 1960.

During the latter period, employment losses of 20.8 percent exceeded the decline in population of 13.5 percent, so that the population: worker ratio increased from 3.35 in 1950 to 3.67 in 1960. This ratio is, moreover, above the 3.48 of Water Sub-region G (See Table 13-31). Estimates for 1965 indicate the ratio has increased to approximately 4.0. This increase portends continued unemployment and out-migration.

TABLE 13-31
POPULATION AND EMPLOYMENT
WATER SUB-REGION G AND WATER AREA G-5

	Percent Change	
POPULATION	1940-50	1950-60
Sub-region G	4.2	2.7
Area G-5	3.8	-13.5
EMPLOYMENT		
Sub-region G	19.1	- 6.9
Area G-5	15.9	-20.8

	Ratio		
POPULATION:WORKER RATIO	1940	1950	1960
United States	2.91	2.63	2.66
Sub-region G	3.77	3.29	3.48
Area G-5	3.74	3.35	3.67

Growth in other employment groups has offset part of the loss in mining and agriculture. Employment changes in six major categories in Water Area G-5 are shown in Table 13-32. Major employment losses over the twenty-year period 1940 to 1960 were in agriculture and mining, with transportation gaining in the first decade and losing in the second decade. These losses greatly exceeded the employment gains in manufacturing, trade, and services. Total employment declined 19.7 percent in the Fifties.

Employment shares of the six largest employment categories in Water Area G-5 are shown below for purposes of comparison. In 1940, agriculture and mining employment accounted for nearly 50 percent of total employment. In 1960, only 21.1 percent of total employment was in these groups, mostly mining. Gains in employment shares were registered in every other category. Thus, as in other water areas, except Water Area G-4, the period 1950-60 is marked by; a broader employment base, despite overall declines in agriculture and mining; and the emergence of manufacturing and services as major employment groups (See Table 13-32).

TABLE 13-32
EMPLOYMENT CHANGES
WATER AREA G-5

	Percent Change	
	1940-50	1950-60
Agriculture	-23.7	-58.3
Mining	14.2	-59.8
Manufacturing	26.0	31.3
Transportation	25.7	-22.7
Trade	37.3	5.8
Services	8.8	16.6
Total	15.8	-19.7

EMPLOYMENT SHARES
WATER AREA G-5

	Percent of Total		
	1940	1950	1950
Agriculture	25.2	16.6	8.8
Mining	23.6	23.8	12.3
Manufacturing	13.3	15.6	24.0
Transportation	6.5	7.6	7.5
Trade	9.5	13.2	17.9
Services	14.9	14.2	21.3
Not in Above	7.0	9.0	8.2
Total	100.0	100.0	100.0

State Planning Sub-region 20 (Appalachian Highlands, W. Va.)

State Planning Sub-region 20 contains ten counties in eastern West Virginia. The region is referred to by the state of West Virginia as the Southern Appalachian Highland Area. It is considered to have excellent development potential in the recreation and natural resource fields.

The topography ranges from hilly to mountainous. The little level land found in the region is located in the valleys of the major streams and in plateau areas atop the higher mountains. The mountainous area serves as the point of origin of several of the state's most important streams, among them the Greenbrier, Cheat, Elk, Tygart, and Little Kanawha rivers. The rugged terrain, the vast wilderness areas, the relatively unspoiled beauty of its streams and forests, and, most important, its proximity to population centers to the north, east, and west combine to make the region a vast recreation area of great actual importance and even greater potential.

In 1960, State Planning Sub-region 20 contained a population of 178,674, a decline of 15.1 percent from 1950. All counties lost population. The 1966 estimate indicates a further decline of 3.3 percent between 1960 and 1966. The only county that did not decrease was Upshur, which had a net increase of 545, or 3 percent.

Only four counties of the ten in the sub-region (Greenbrier, Nicholas, Randolph, and Upshur) had urban population in 1960. About 62 percent of the population over 25 have completed one to eight years of elementary school; 27 percent have completed high school; and 9 percent one or more years of college.

The total work force of State Planning Sub-region 20 in 1965 was 48,800, of whom 43,500 were classed as employed. Mining was the major source of employment in the sub-region in 1960, with a total of 7,619 employees. Agriculture employed 3,920 and lumber, wood products, and furniture followed with 3,550 employees.

State Planning Sub-region 20 is one of the more depressed areas of the Appalachian region. The unemployment rate in 1962 was 15.3 percent, but it had declined to 10.8 by 1965. Both Webster and Clay Counties had rates of nearly 20 percent in 1965. The two counties with the lowest rates, Nicholas and Barbour, with 7.8 percent and 6.3 percent, had the highest out-migration rates.

Thirty-eight percent of the families in the state planning sub-region had incomes of less than $3,000 in 1960. In 1966, West Virginia reported that the per capita income in six of the counties was more than $1,000 less than the national figure of 2,367 dollars.

Forest resources provide a base for a wood products industry. Coal and stone are the principal minerals. Agriculture is important to the area, especially livestock, poultry, and dairy products. Greenbrier, Pocahontas, Randolph, Barbour, and Upshur are the leading counties in agricultural production.

One of the major impediments to economic growth has been the lack of adequate transportation. This will be significantly improved by the Interstate and Appalachian highway developments. Corridor "H" will link the Elkins, Buckhannon and Philippi area in the northern part of the region with Interstate 79 in the west and Interstates 81 and 66 in the east. In the south, Interstate 64 will traverse the Lewisburg-Ronceverte-White Sulphur Springs section and tie this area with the eastern seaboard.

The Sutton-Gassaway Center will be bisected by the north-south Interstate 79 and will thus have ready access both to Charleston and to northern West Virginia. Appalachian Corridor "L" will tie the Summersville area to both I-79 and I-64, as well as providing better access to area hinterlands.

These tremendous improvements in the region's access, along with a supply of potential industrial sites and other developable land, especially uplands, provides the region with important development potential. The region has an ample labor supply which, if it can be mobilized and trained, will be a major factor in attracting industry. To mobilize and train this potential labor force, the cities and towns must be upgraded with technical education facilities to meet the needs of potential industry. The southern part of the area is also in need of additional higher education facilities.

In planning, emphasis should be given to preserving major wilderness and scenic areas. Recreational and service developments should be clustered in or near the growth areas wherever possible to assure the greatest benefits. Opportunity for development based on a recreation base is especially great in Summersville-Richwood (Summersville Lake) and Marlinton (Greenbrier River).

Selected socio-economic indicators for State Planning Subregion 20 are shown in Figure 13-31 and Tables 13-33 and 13-34.

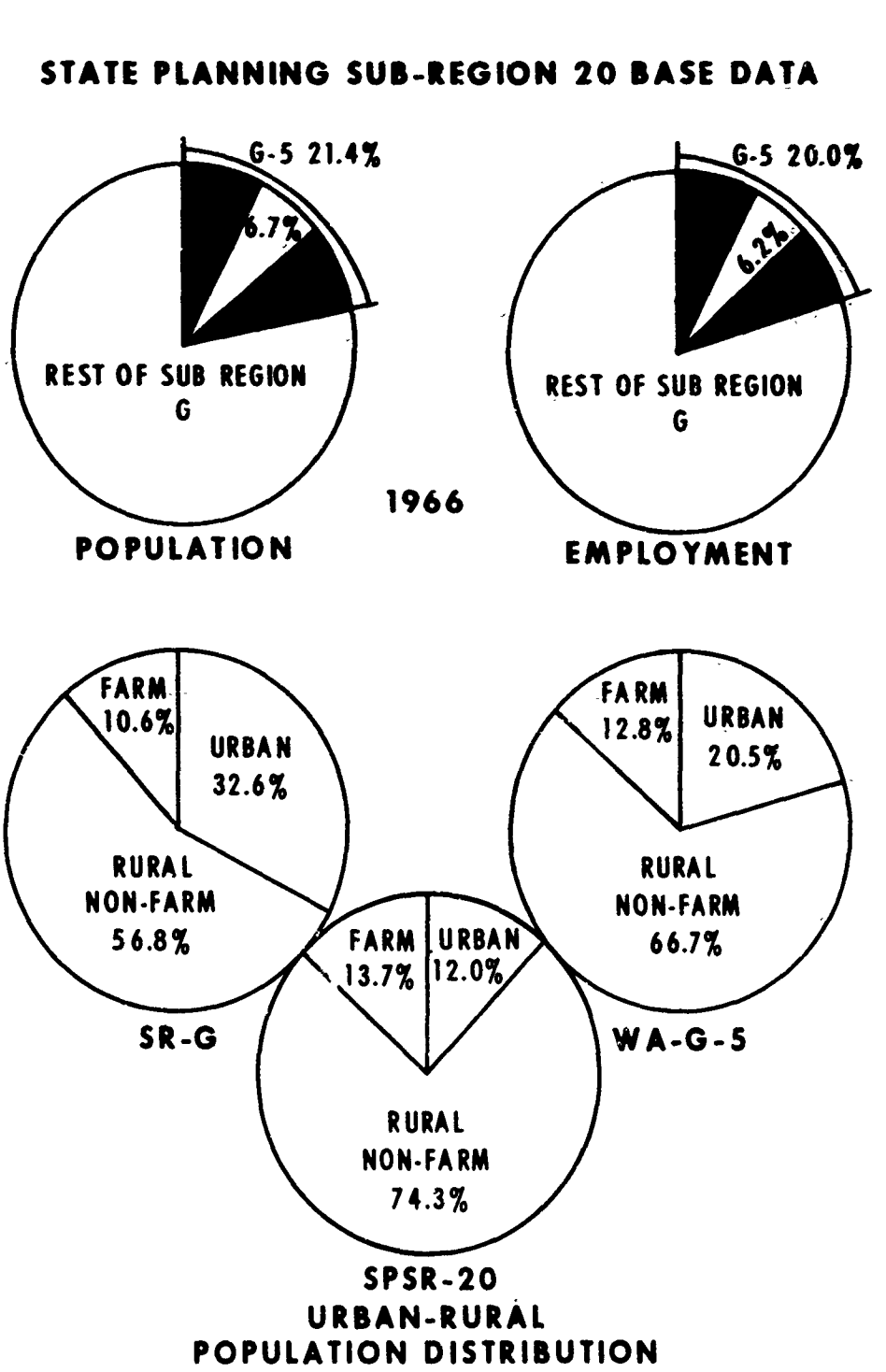


Figure 13-31 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 20 Compared to Water Area G-5 and Sub-region G.

TABLE 13-33
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 20

	1950	1960	Absolute Change
TOTAL ALL SECTORS	59,311	45,679	-13,632
PRIMARY ACTIVITIES	25,873	11,751	-14,122
Agriculture	11,599	3,920	- 7,679
Forestry & Fisheries	144	212	68
Mining	14,130	7,619	- 6,511
SECONDARY ACTIVITIES	9,807	9,540	- 267
Contract Construction	3,052	2,742	- 310
Food & Kindred Products	323	495	172
Textile Mill Products	213	306	93
Apparel	188	323	135
Lumber, Wood Products, Furniture	4,214	3,550	- 664
Printing & Publishing	213	317	104
Chemicals & Allied Products	115	204	89
Electrical & Other Machinery	125	169	44
Motor Vehicles & Equipment	9	42	33
Other Transportation Equipt.	4	24	20
Other & Miscellaneous	1,351	1,368	17
TERTIARY ACTIVITIES	22,228	23,180	952
Transportation & Communications	3,325	2,663	- 662
Utilities & Sanitary Service	726	619	- 107
Wholesale Trade	722	720	- 2
Retail Trade	6,227	7,071	844
Finance, Ins. & Real Estate	488	623	135
Personal Services	4,274	3,769	- 505
Professional Services	4,457	5,599	1,142
Recreational Services	385	300	- 85
Public Administration	1,596	1,780	184
Armed Forces	28	36	8
NOT REPORTED	1,403	1,208	- 195

TABLE 13-34
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 20
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	175,400
Absolute Change 1960-1965	-3,300
Percent Change 1960-1965	- 1.85

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	178,674	89,157	89,517	24,391	132,804	21,479
Percent Distribution	100.00	49.90	50.10	13.65	74.33	12.02
Percent Change 1950-1960	-15.14	-16.77	-13.45	-70.48	-29.83	-16.20

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	14,291	6,293	14,956	5,789	1,757	43,086
Percent Distribution	33.17	14.61	34.71	13.44	4.08	100.00
Percent Change 1950-1960	-38.61	-43.96	53.32	332.01	237.88	-10.43

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	93,369	57,525	25,182	8,658
Percent Distribution	100.00	61.61	26.97	9.27
Percent Change 1950-1960	-10.44	-17.91	20.11	-4.28

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	45,643	4,809	33,911	4,298	11,732	511
Percent Distribution	90.47	9.53	88.75	11.25	95.83	4.17
Percent Change 1950-1960	-23.01	73.42	-31.55	78.86	20.45	38.11

RATE OF UNEMPLOYMENT, 1962-65

1962	15.3
1963	12.8
1964	12.2
1965	10.8

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	50,488	73,327	38,241	22,929	12,247	50,398
Percent Distribution	40.78	59.22	62.52	37.48	19.55	80.45
Percent Change 1950-1960	-18.68	-9.58	-26.42	10.64	21.10	-16.52

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	48.8	-2.7	- 5.3
Tot. Employment	43.5	-0.2	- 0.5
Unemployment	5.3	-2.5	-32.1

State Planning Sub-region 21 (Southern Coalfields, W. Va.)

Composed of the five West Virginia counties of Fayette, Mercer, Monroe, Raleigh, and Summers, State Planning Sub-region 21 has the characteristics which are generally associated with "Central Appalachia," including, among others: high levels of unemployment; concentration of workers in industries whose total employment is declining nationally; low levels of personal and family income; low labor force participation rates (particularly among women); and relative insularity and inaccessibility. The five-county area is in the southeastern part of the state.

The topography is rugged, and the little level, developable land is in upland areas. Elevations range up to more than 4,000 feet, and a considerable portion of the region has slopes of between 25 and 40 percent. The New River and the Bluestone River are the dominant water courses in the region, and a large flood control-recreation reservoir exists at the junction of the two rivers. The reservoir is principally in Summers County, but it also influences the neighboring counties of Mercer and Monroe in West Virginia and Giles in Virginia. The New River valley from Hinton northwest to the confluence of the New and Gauley Rivers is the route of the Chesapeake and Ohio Railway main line, linking the industrial centers of Charleston and Huntington-Ashland with major population centers of the eastern seaboard.

The 1966 population of the state planning sub-region was 219,405, a decrease of more than 23 percent from 1950. The population of every county in the area has been decreasing steadily and rather substantially for several years. For the region as a whole, the population loss between 1950 and 1960 was 17.9 percent. The losses ranged from a low of 9.1 percent for Mercer County to a high of 25.1 percent for Fayette County. Estimates for 1966 show that the region is continuing to lose population. The estimated loss for the region over the six-year period from 1960 to 1966 was 6.6 percent.

In 1960, 68.6 percent of the population was classed as rural nonfarm. Only Mercer County, with 40.5 percent of its population classed as urban, came remotely near the national figure for urban population (69.6 percent), while Monroe County had no urban population. In 1960, rural farm population represented a significant percentage of total population in only two counties: Monroe (36.7 percent) and Summers (13.6 percent). The total state planning sub-region population was 5.3 percent rural farm and 26.1 percent urban.

The major urban centers are Bluefield-Princeton, in Mercer County, Beckley, in Raleigh County, and Montgomery, in Fayette County. There are excellent developmental centers at Hinton, in Summers County and at Oak Hill-Mount Hope in Fayette County. All of the centers have ready access to Charleston.

Coal is the dominant natural resource, and coal mining is the primary industry. With the sustained demand for coal, it appears coal mining will long continue to be dominant.

Employment was distributed in 1965 as follows: mining, 12.7 percent; manufacturing, 12.0 percent; wholesale and retail trade, 18.7 percent; services, 11.1 percent; and government, 13.3 percent.

Mining has been particularly important in Fayette and Raleigh counties. Manufacturing is of less importance as an employer in State Planning Sub-region 21 than it is in the state or in the nation as a whole, but it is increasing.

Of the five counties, Raleigh, Fayette, and Mercer Counties have the greatest employment in manufacturing. Value added by manufacturing totaled 22.5 million dollars in the area in 1963, an increase of 18.4 percent over 1960 levels.

Rates of unemployment vary significantly from county to county. In every county, the rate is higher than that for the state, and much higher than that prevailing in the nation. The state planning sub-region rate in 1965 was 11.8 percent. Fayette County had the lowest rate, 8.3 percent.

Agriculture is of little importance as an employment source for the area as a whole, but it is of importance in Summers and Monroe counties. Between 1954 and 1959, the number of farms declined about 30 percent in every county of the region except Monroe, where the decline was about 20 percent. Between 1959 and 1964, the number continued to decline, averaging 20 percent for the sub-region as a whole. Total farm acreage declined 16 percent between 1959 and 1964.

About 41 percent of the families in the state planning sub-region had incomes of less than $3,000 in 1960. The more highly industrialized counties of Fayette, Raleigh and Mercer have higher levels of family income.

Rail transportation facilities for the area are good. The main line of the Chesapeake and Ohio Railway passes through the area, serving the area between Hinton and Fayetteville. Bluefield and Princeton are served by the Norfolk and Western Railway.

Princeton and Beckley are connected with Charleston by the West Virginia Turnpike. U.S. 52 connects the same area with Huntington and Cincinnati. U.S. 21, 60, and 19 traverse the region, the first two going northwest and the latter northeast. Commercial airports are located at Beckley and Bluefield.

Poor conservation practices have seriously damaged the natural resources. The mining and forest industries, as well as the state and local governments, have a great rehabilitation task before them.

Selected socio-economic indicators for State Planning Subregion 21 are shown in Figure 13-32 and Tables 13-35 and 13-36.

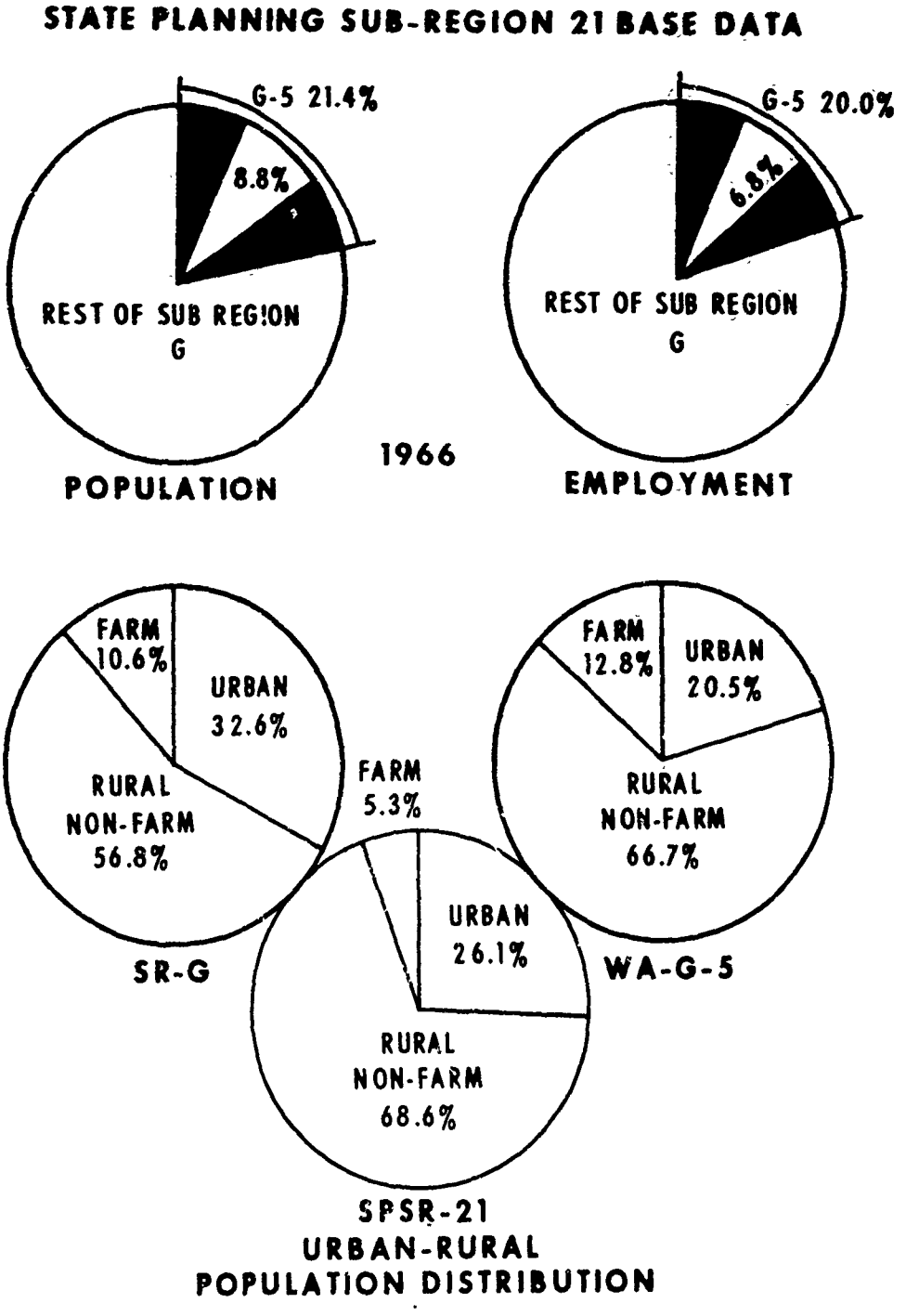


Figure 13-32 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 21 Compared to Water Area G-5 and Sub-region G.

TABLE 13-35
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
WEST VIRGINIA STATE PLANNING SUB-REGION 21

	1950	1960	Absolute Change
TOTAL ALL SECTORS	82,840	58,374	-24,466
PRIMARY ACTIVITIES	36,502	12,155	-24,347
Agriculture	5,837	1,967	- 3,870
Forestry & Fisheries	30	20	- 10
Mining	30,635	10,168	-20,467
SECONDARY ACTIVITIES	10,422	10,179	- 243
Contract Construction	3,717	2,566	- 1,151
Food & Kindred Products	838	1,035	197
Textile Mill Products	370	655	285
Apparel	294	496	202
Lumber, Wood Products, Furniture	1,757	1,451	- 306
Printing & Publishing	493	674	181
Chemicals & Allied Products	711	266	- 445
Electrical & Other Machinery	453	1,157	704
Motor Vehicles & Equipment	12	44	32
Other Transportation Equipt.	4	15	11
Other & Miscellaneous	1,773	1,820	47
TERTIARY ACTIVITIES	34,559	34,288	- 271
Transportation & Communications	6,813	4,861	- 1,952
Utilities & Sanitary Service	1,184	930	- 254
Wholesale Trade	1,763	1,791	28
Retail Trade	10,386	9,784	- 602
Finance, Ins. & Real Estate	1,184	1,294	110
Personal Services	5,083	4,901	- 182
Professional Services	5,923	8,385	2,462
Recreational Services	468	343	- 125
Public Administration	1,699	1,903	204
Armed Forces	56	96	40
NOT REPORTED	1,357	1,752	395

TABLE 13-36
SOCIO-ECONOMIC CHARACTERISTICS
WEST VIRGINIA STATE PLANNING SUB-REGION 21
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	223,500	Number	234,987	114,434	120,553	12,439	161,103	61,445
Absolute Change 1960-1965	-11,500	Percent Distribution	100.00	48.70	51.30	5.29	68.56	26.15
Percent Change 1960-1965	- 4.89	Percent Change 1950-1960	-17.85	-20.41	-15.26	-76.29	-1.35	12.55

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	16,172	7,333	19,764	10,795	3,197	57,261
Percent Distribution	28.24	12.81	34.52	18.85	5.58	100.00
Percent Change 1950-1960	-23.36	-61.69	5.07	247.67	236.53	-12.59

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	124,911	67,932	39,306	6,634
Percent Distribution	100.00	54.38	31.47	5.31
Percent Change 1950-1960	-11.28	-18.67	4.91	7.09

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	58,278	7,793	41,107	6,675	17,171	1,118
Percent Distribution	88.21	11.79	86.03	13.97	93.89	6.11
Percent Change 1950-1960	-29.60	66.09	-39.46	72.44	15.41	36.18

RATE OF UNEMPLOYMENT, 1962-65

1962	17.0
1963	10.7
1964	11.5
1965	9.7

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	66,167	95,859	47,874	29,458	18,293	66,401
Percent Distribution	40.84	59.16	61.91	38.09	21.60	78.40
Percent Change 1950-1960	-24.41	-10.88	-33.35	13.49	16.51	-18.63

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	59.8	-3.4	- 5.4
Tot. Employment	54.0	1.5	2.9
Unemployment	5.8	-4.9	-45.8

State Planning Sub-region 26 (Great Valley and Blue Ridge, Va.)

State Planning Sub-region 26 is composed of Bland, Carroll, Grayson, Smyth, and Wythe Counties, Va. Bland, Smyth and Wythe Counties are in the Valley and Ridge Physiographic Province, between Roanoke and Bristol. Carroll and Grayson Counties, with the city of Galax, are in the Blue Ridge Province, and are oriented toward Winston-Salem, N. C. Wythe County is oriented toward Roanoke, Va.; Smyth County toward Bristol, Tenn.; and Bland County toward Bluefield, W. Va.

Population growth of the area between 1960 and 1965 partially offset high out-migration rates, reversing the trends of the 1950's. The 1966 estimated population (108,300) represented a 3.3 percent increase over the 1960 total of 104,800 people. Population in State Planning Sub-region 26 is now well over half rural nonfarm. This category increased 50 percent from 1950 to 1960, while a loss of similar size was recorded in rural farm population. About 20 percent of the population was urban in 1960.

Agriculture and mining remain as principal sources of employment, despite an absolute decline of over 5,500 jobs from 1950 to 1960. Agriculture was the largest single employment category in 1960 (5,431 persons). Manufacturing employment increased, largely as a result of growth in apparel and textiles. Retail trade (27 percent) and professional services (50 percent) also showed heavy growth.

The unemployment rate has remained fairly constant in recent years. The 1966 unemployment rate of 4.6 percent is a decrease from the 1962 figure of 5.2 percent, and represents a sharp drop from the 1964 peak of 6.0 percent.

Although more than 44 percent of the families in State Planning Sub-region 26 were in the below $3,000 annual family income category in 1960, sizable increases over 1950 family income levels were reported for the middle income groups. About 40 percent earned between $3,000 and $5,000, an increase of 158 percent over 1950.

Industrial growth will remain concentrated in valley lands of the state planning sub-region. Marion, with a 1960 population of 8,385, Wytheville with 5,634, and Galax with 5,254 are the largest urban centers and the foci for the area's industrial activities.

The Marion and Wytheville Centers benefit from access afforded by Interstate Highway 81, the major Roanoke-Bristol highway link, which passes just outside each city's corporation limits. Wytheville is skirted, too, by Interstate 77, which will connect Charleston, W.Va., and Winston-Salem, N.C. Carroll, Wythe, and Bland Counties will also be traversed by Interstate 77, which should also give an impetus to economic growth, especially at Galax. Grayson County is traversed east-west by U.S. 58.

Construction of a planned hydroelectric power project on New River near Galax will also provide flood control, water quality control, and recreational opportunities. The New River, which drains all of the area except Smyth County and a small part of Bland County is a primary resource of the area. Yields of groundwater up to 400 gallons a minute are obtainable from wells in the river bottom alluvium.

Selected socio-economic indicators for State Planning Subregion 26 are shown in Figure 13-33 and Tables 13-37 and 13-38.

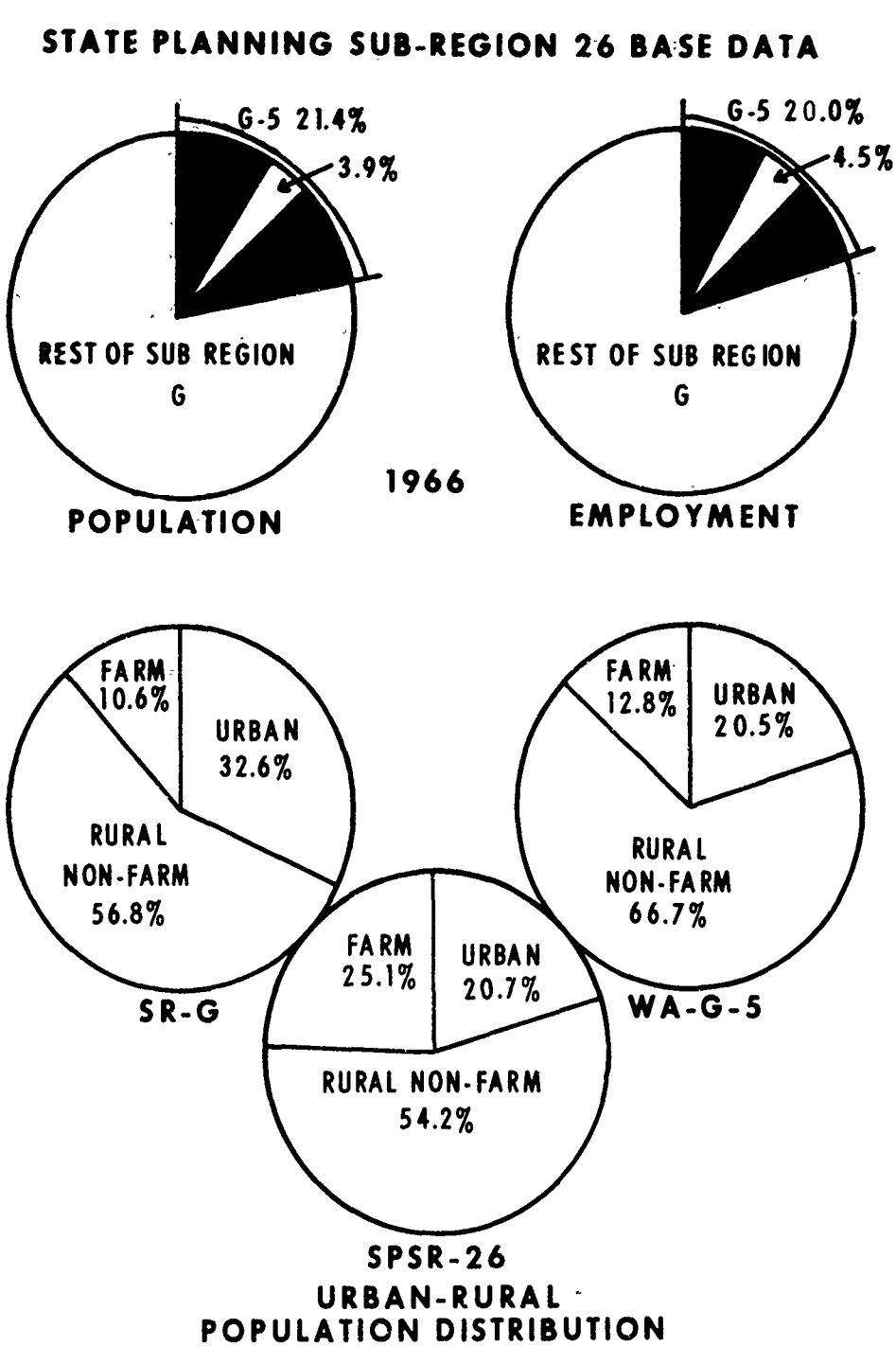


Figure 13-33 Population, Employment and Urban-Rural Population Distribtuion of State Planning Sub-region 26 Compared to Water Area G-5 and Sub-region G.

TABLE 13-37
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
VIRGINIA STATE PLANNING SUB-REGION 26

	1950	1960	Absolute Change
TOTAL ALL SECTORS	33,827	34,151	324
PRIMARY ACTIVITIES	11,727	6,185	- 5,542
Agriculture	10,557	5,431	- 5,126
Forestry & Fisheries	58	35	- 23
Mining	1,112	719	- 393
SECONDARY ACTIVITIES	11,192	14,727	3,535
Contract Construction	2,109	1,927	- 182
Food & Kindred Products	261	460	199
Textile Mill Products	3,250	4,130	880
Apparel	1,034	1,964	930
Lumber, Wood Products, Furniture	2,833	2,774	- 59
Printing & Publishing	83	113	30
Chemicals & Allied Products	1,084	1,499	415
Electrical & Other Machinery	64	112	48
Motor Vehicles & Equipment	6	8	2
Other Transportation Equipt.	0	8	8
Other & Miscellaneous	468	1,732	1,264
TERTIARY ACTIVITIES	10,159	12,504	2,345
Transportation & Communications	1,123	1,129	6
Utilities & Sanitary Service	234	159	- 75
Wholesale Trade	433	522	89
Retail Trade	3,366	4,219	853
Finance, Ins. & Real Estate	268	394	126
Personal Services	1,969	2,296	327
Professional Services	1,893	2,844	951
Recreational Services	166	122	- 44
Public Administration	688	784	96
Armed Forces	19	35	16
NOT REPORTED	749	735	- 14

TABLE 13-38
SOCIO-ECONOMIC CHARACTERISTICS
VIRGINIA STATE PLANNING SUB-REGION 26
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	108,000
Absolute Change 1960-1965	3,200
Percent Change 1960-1965	3.00

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	104,845	51,673	53,172	26,297	56,838	21,710
Percent Distribution	100.00	49.29	50.71	25.08	54.21	20.71
Percent Change 1950-1960	-2.94	-3.78	-2.12	-47.91	51.66	8.21

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	7,234	4,271	10,202	3,364	840	25,911
Percent Distribution	27.92	16.48	39.37	12.98	3.24	100.00
Percent Change 1950-1960	-49.34	-9.99	158.28	673.33	166.67	4.14

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	57,231	35,110	15,379	4,863
Percent Distribution	100.00	61.35	26.87	8.50
Percent Change 1950-1960	5.17	-4.80	59.37	20.97

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	32,898	1,995	22,625	1,443	10,273	552
Percent Distribution	94.29	5.71	94.00	6.00	94.90	5.10
Percent Change 1950-1960	-2.69	42.60	-16.14	37.82	50.41	56.82

RATE OF UNEMPLOYMENT, 1962-65

1962	5.7
1963	5.9
1964	5.9
1965	4.5

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	36,390	38,435	25,561	10,897	10,829	27,538
Percent Distribution	48.63	51.37	70.11	29.89	28.22	71.78
Percent Change 1950-1960	3.19	-2.75	-8.84	24.01	50.72	-10.40

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	35.3	0.3	0.9
Tot. Employment	33.7	0.7	2.1
Unemployment	1.6	-0.4	-20.0

State Planning Sub-region 27 (Greater Roanoke, Va.)

State Planning Sub-region 27 oriented with respect to the Standard Metropolitan Statistical Area contains Floyd, Giles and Pulaski Counties, Virginia. Economic development has progressed to different degrees in the several counties, chiefly because of physiographic differences. Floyd County is situated in the Blue Ridge Physiographic Province and the other two counties are in the Valley and Ridge Province. Growth has occurred in the main valley areas. Other areas remain little developed, because of the topography and because of poor access.

Population losses that occurred in the 1950's have since been partially regained, by reason of a reduction in the rate of out-migration. A net out-migration rate of 20 percent resulted in a population decline of about 3,100 from 58,065 in 1950 to 54,939 in 1960. From 1960 to 1966, area population was estimated to have increased to 56,410 persons. The majority of migrants were younger educated people, seeking better employment opportunities in Roanoke and other cities. Between 1960 and 1966, Pulaski County population increased to 28,524 (+1,266), Giles County increased to 17,490 (+271), and Floyd County, down to 10,396, lost 66.

The major portion of the recorded population loss was from farms; rural farm population dropped more than 50 percent from 1950 to 1960. Gains were reported in the rural nonfarm (22.5 percent) and urban (10.7 percent) groups. In 1960, almost 25 percent of area residents were urban, while fewer than 20 percent were farmers.

The economy of State Planning Sub-region 27 no longer is agriculturally oriented. There were great losses (2,200) in agricultural employment between 1950 and 1960. Chemical and allied products plants were the dominant employment group in 1960, with 2,822 workers. Growth occurred among apparel and textile mill operations. The retail trade and professional service categories also increased. Total employment decreased from 18,869 in 1950 to 18,317 in 1960. The 1966 employment was 19,416, and the upward trend is continuing. Industrial employment is centered at Pulaski and in the vicinity of Radford, which is not included in Appalachia. The development that has occurred in Floyd is relatively minor. Urban services necessary for advanced industrial growth are available only in the Pulaski and Radford vicinities.

Unemployment rates, which have been above state and national averages, show marked fluctuations. The 1960 rate, 7.4 percent, was reduced to 2.6 percent in 1966, after reaching a peak in 1964. Increases in total employment were greater than increases in the work force. Pulaski County employment in 1966 was 10,569, and increasing; Giles County employment was 6,460 and fairly stable; Floyd County, with no urban centers, had 2,387 employed and the force was decreasing.

Income levels remain below national averages, but positive gains are recorded for the relative distribution of families in income categories. Thirty-six percent of area families earned below $3,000 in 1960, but this was a 40 percent reduction from the 1950 number. The largest income group, from $3,000-$5,999, increased by over 40 percent in the same period.

There have also been relative gains in education levels. The number of persons over 25 who have attended high school increased from 1950 to 1960 by almost 50 percent. Nevertheless, more than half have not attended high school.

New River follows a northwesterly course through Giles County. A large plant of the Celanese Fibers Company, a subsidiary of Celanese Corporation of America, is located on the river between Pearisburg and Narrows. This accounts for the greater share of employment in Giles County. Limestone quarry operations constitute much of the remaining industrial employment. The Appalachian Power Company operates one of its steam-electric generating plants on the New River at Glen Lyn.

The New River Basin, with its clean water, offers excellent possibilities as an interstate recreation area. Increased highway and airport development, coordinated with long-range planning efforts, could establish many employment opportunities within the basin area.

Pulaski-Narrows Center. The Commonwealth of Virginia has designated the Pulaski-Narrows area, consisting of Giles and Pulaski Counties in the Appalachian Region, plus the independent city of Radford and most of Montgomery County, which are outside Appalachia, as a growth area. Its population increased at an average annual rate of 0.2 percent in the 1950's, and this is projected to accelerate to about 2.5 percent annually from 1965 to 1970. Its growth center extends from Pulaski through Dublin, Radford, and Christiansburg along Interstate Highway 81, and through Blacksburg, Pembroke, Pearisburg and Narrows along Appalachian Development Highway Corridor Q.

There are three State-supported institutions of higher education in the growth center: (1) the State's land-grant university, with graduate programs leading to master's degree in 53 disciplines and to the doctor of philosophy degree in 26; (2) a women's college, with graduate programs leading to the master's degree in 10 disciplines and (3) a community college with 2-year programs in the arts and sciences and various technical specialities, including an accredited school of practical nursing.

The Virginia state investment plan shows that about 15 industrial sites are available in the growth center, varying in size from 20 to 1,800 acres. The New River Valley Industrial Commission, established in 1962, serves Giles, Montgomery and Pulaski Counties and the independent city of Radford. It has successfully promoted industrial development (total employment in the growth area increased at an average of 4.2 percent annually from 1960 to 1966) and is currently considering the employment of a full-time research staff to undertake comprehensive development planning on a continuing basis. Problems receiving initial emphasis include the provision of more and better housing and attraction of additional labor supplies from nearby mountain areas. As in many areas of Appalachia, the lack of adequate housing serves as a deterrent to the attraction of additional needed manpower to this growth area.

Selected socio-economic indicators for State Planning Sub-region 27 are shown in Figure 13-34 and Tables 13-39 and 13-40.

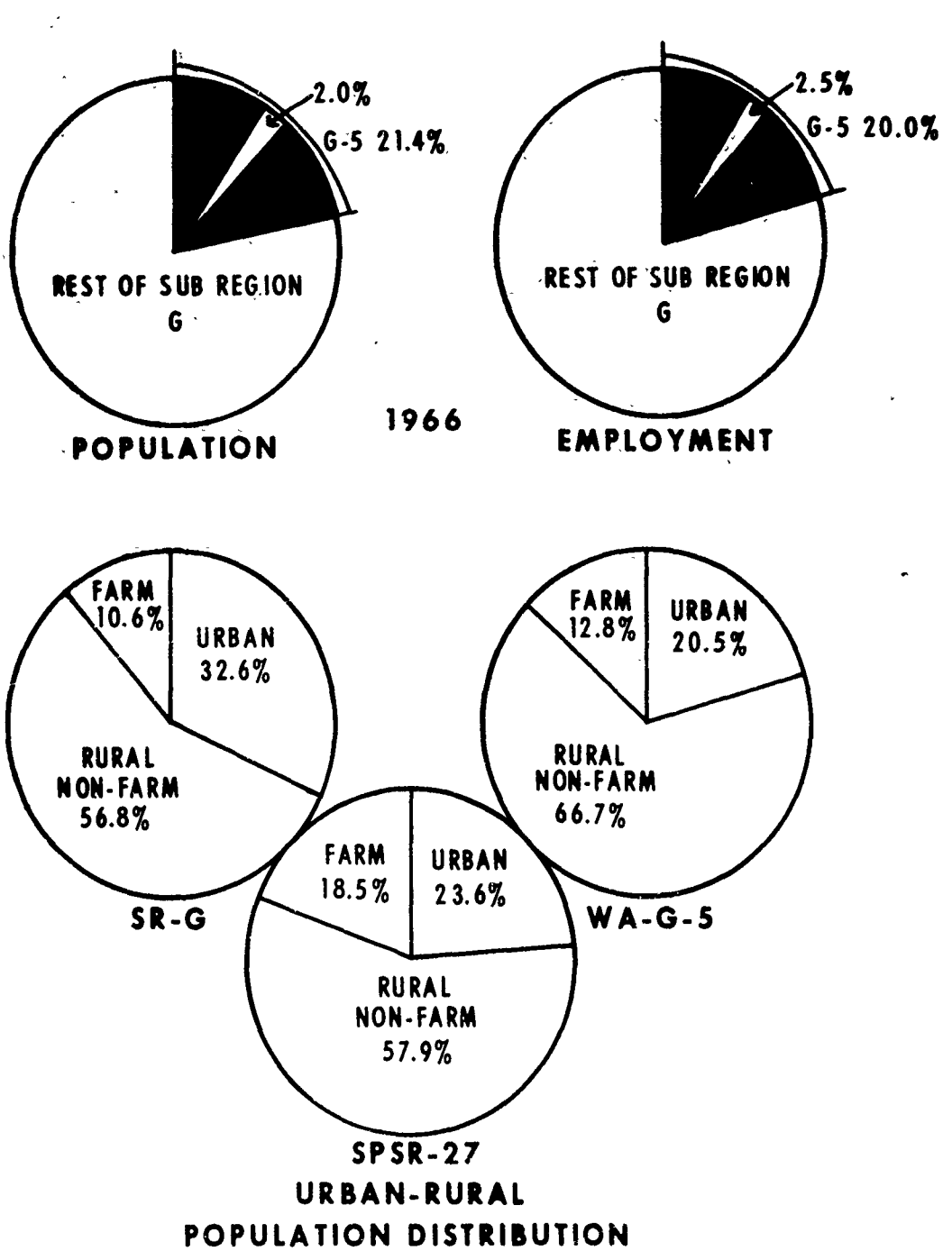


Figure 13-34 Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 27 Compared to Water Area G-5 and Sub-region G.

TABLE 13-39
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
VIRGINIA STATE PLANNING SUB-REGION 27

	1950	1960	Absolute Change
TOTAL ALL SECTORS	18,869	18,317	- 552
PRIMARY ACTIVITIES	4,399	1,925	- 2,474
Agriculture	4,027	1,836	- 2,191
Forestry & Fisheries	8	16	8
Mining	364	73	291
SECONDARY ACTIVITIES	7,632	8,999	- 1,367
Contract Construction	1,365	1,260	- 105
Food & Kindred Products	132	208	76
Textile Mill Products	1,213	1,419	206
Apparel	226	917	691
Lumber, Wood Products, Furniture	1,507	1,336	- 171
Printing & Publishing	88	149	61
Chemicals & Allied Products	2,439	2,822	383
Electrical & Other Machinery	148	67	- 81
Motor Vehicles & Equipment	2	0	- 2
Other Transportation Equipt.	1	4	3
Other & Miscellaneous	511	817	306
TERTIARY ACTIVITIES	6,555	7,129	574
Transportation & Communications	871	697	- 174
Utilities & Sanitary Service	351	251	- 100
Wholesale Trade	219	203	- 16
Retail Trade	2,020	2,274	254
Finance, Ins. & Real Estate	222	326	104
Personal Services	1,249	1,279	30
Professional Services	1,026	1,490	464
Recreational Services	80	132	52
Public Administration	506	460	- 46
Armed Forces	11	17	6
NOT REPORTED	283	264	- 19

TABLE 13-40
SOCIO-ECONOMIC CHARACTERISTICS
VIRGINIA STATE PLANNING SUB-REGION 27
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	57,100
Absolute Change 1960-1965	2,200
Percent Change 1960-1965	4.00

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	54,939	27,109	27,830	10,171	31,791	12,977
Percent Distribution	100.00	49.34	50.66	18.51	57.87	23.62
Percent Change 1950-1960	-5.38	-6.27	-4.51	-50.13	22.52	10.71

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	3,286	1,738	5,489	2,523	727	13,763
Percent Distribution	23.88	12.63	39.88	18.33	5.28	100.00
Percent Change 1950-1960	-44.87	-40.17	42.57	491.65	438.52	-0.09

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	29,573	16,211	9,511	2,972
Percent Distribution	100.00	54.82	32.16	10.05
Percent Change 1950-1960	.64	-12.44	46.55	12.58

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	18,300	1,468	12,582	1,095	5,718	373
Percent Distribution	92.57	7.43	91.99	8.01	43.88	6.12
Percent Change 1950-1960	2.96	46.65	-13.39	53.15	31.78	30.42

RATE OF UNEMPLOYMENT, 1962-65

1962	2.8
1963	3.9
1964	3.7
1965	2.6

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	19,785	19,098	13,690	5,243	6,095	13,855
Percent Distribution	50.88	49.12	72.31	27.69	30.55	67.45
Percent Change 1950-1960	-.43	-3.40	-10.45	24.92	31.58	-11.04

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	19.5	1.4	7.7
Tot. Employment	19.0	1.4	8.0
Unemployment	0.5	0.0	0.0

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 14 - SHAPING THE PLAN FOR SUB-REGION G

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CHAPTER 14 - SHAPING THE PLAN FOR SUB-REGION G

SECTION I - FUTURE GROWTH PATTERN

1. WATER SUB-REGION

The Office of Business Economics, U.S. Department of Commerce, prepared projections of the future levels of employment (by sector) and population for economic Sub-region 6, 7, 8, 9, 11, 12, 13, 14, 15, and 16. Only part of each is within Water Sub-region G. (See delineation shown in Figure 13-15 on Page 13-53). A more detailed presentation of the data is in Appendix E. These projections combined into Water Areas G-1 through G-5 are shown in the following tabulation:

	Years			
	1960	1980	2000	2020
G-1:				
Population	495,069	623,000	793,000	1,009,000
Employment	160,138	209,000	281,000	368,000
G-2 (+ Lawrence Co., Ky.):				
Population	790,987	1,012,000	1,269,000	1,611,000
Employment	235,316	277,000	362,000	466,000
G-3				
Population	458,208	594,000	761,000	937,000
Employment	143,719	190,000	253,000	320,000
G-4 (- Lawrence Co., Ky.):				
Population	358,518	310,000	316,000	329,000
Employment	72,951	65,000	69,000	75,000
G-5:				
Population	573,445	606,000	700,000	839,000
Employment	156,521	182,000	224,000	278,000
G-Total:				
Population	2,676,227	3,145,000	3,839,000	4,725,000
Employment	768,645	923,000	1,189,000	1,507,000

Development benchmarks for Water Sub-region G which reflect a growth rate higher than the OBE projected rate have been established. These developmental benchmark objectives are the result of an analysis of the growth potential of the Water Sub-region, and were prepared to reflect the contribution that the Water Sub-region can make to the overall objectives of the Appalachian program. The water resources program for the Water Sub-region is being planned and analyzed within the objectives set in the developmental benchmarks.

Parts of the sub-region may not reach the population and employment objectives by 1980, or even by 2020, unless special programs are implemented to reverse the deeply established out-migration trend. The Upper Licking River (Salyersville, Ky.) Report outlines such economic development program. (See Part III, Chapter 1 for summary).

Developmental benchmark growth objectives are as follows:

	Years		
	1980	2000	2020
G-1:			
Population	623,000	923,000	1,159,000
Employment	218,000	343,000	437,000
G-2 (+):			
Population	1,010,000	1,287,000	1,912,000
Employment	290,000	504,000	735,000
G-3			
Population	594,000	820,000	1,203,000
Employment	200,000	320,000	448,000
G-4 (-):			
Population	365,000	414,000	471,000
Employment	105,000	152,000	179,000
G-5:			
Population	606,000	750,000	946,000
Employment	190,000	290,000	336,000
G-Total:			
Population	3,198,000	4,194,000	5,691,000
Employment	1,003,000	1,609,000	2,135,000

OBE and benchmark projections are presented graphically in Figure 14-1, and 14-1a.

2. STATE PLANNING SUB-REGIONS

Water Sub-region G is also divided into State Planning Sub-regions 11 (part), 12 (part), 13, 14, 15, 16, 20, 21, 22, 26, 27, 33, 34, 36A (part), and 36B (part). This sub-regionalization was prepared by the states involved. (See Figure 13-15, Page 13-57).

3. GROWTH AREAS IN WATER SUB-REGION G

For purposes of water resource program formulation the growth areas listed in Chapter 13 were aligned as shown in Figure 14-2, Page 14-5.

Growth Area No. 1, all in Ohio, includes Coshocton, Tuscarawas, Muskingum, Guernsey, and Morgan Counties. Studies evolve around the

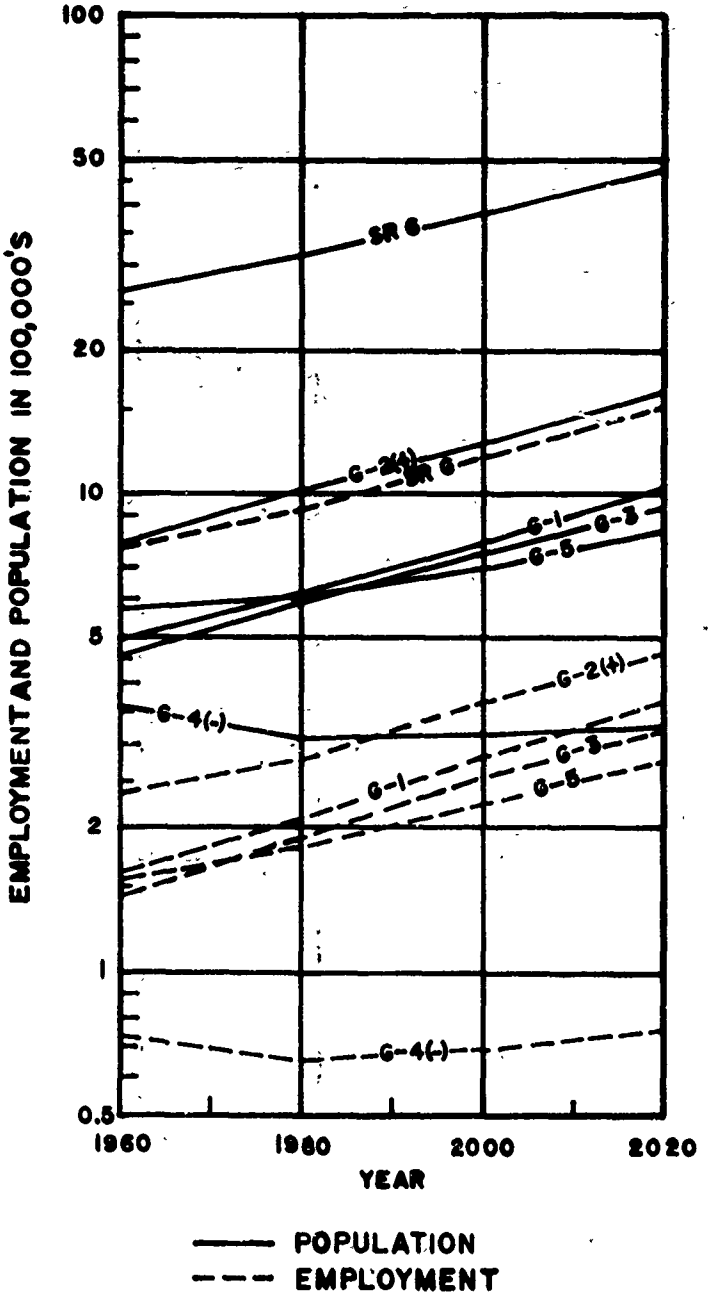


FIGURE 14-1 OFFICE OF BUSINESS ECONOMICS PROJECTIONS

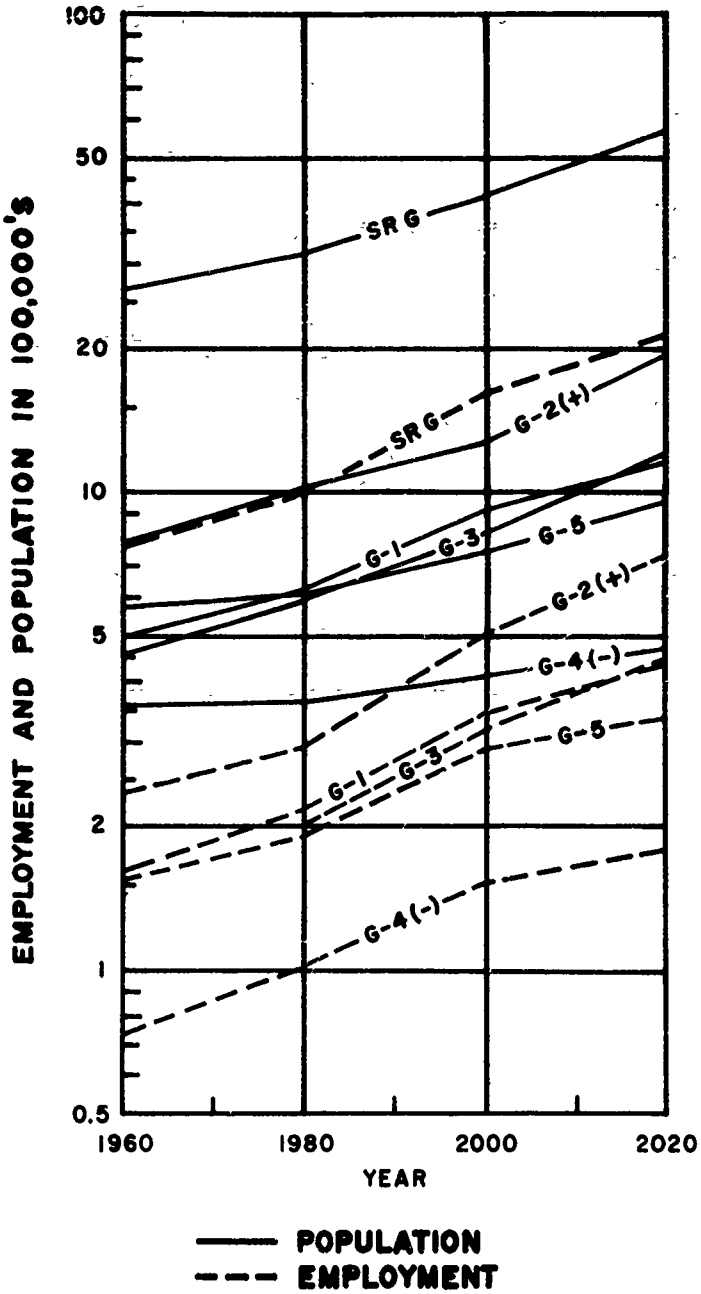
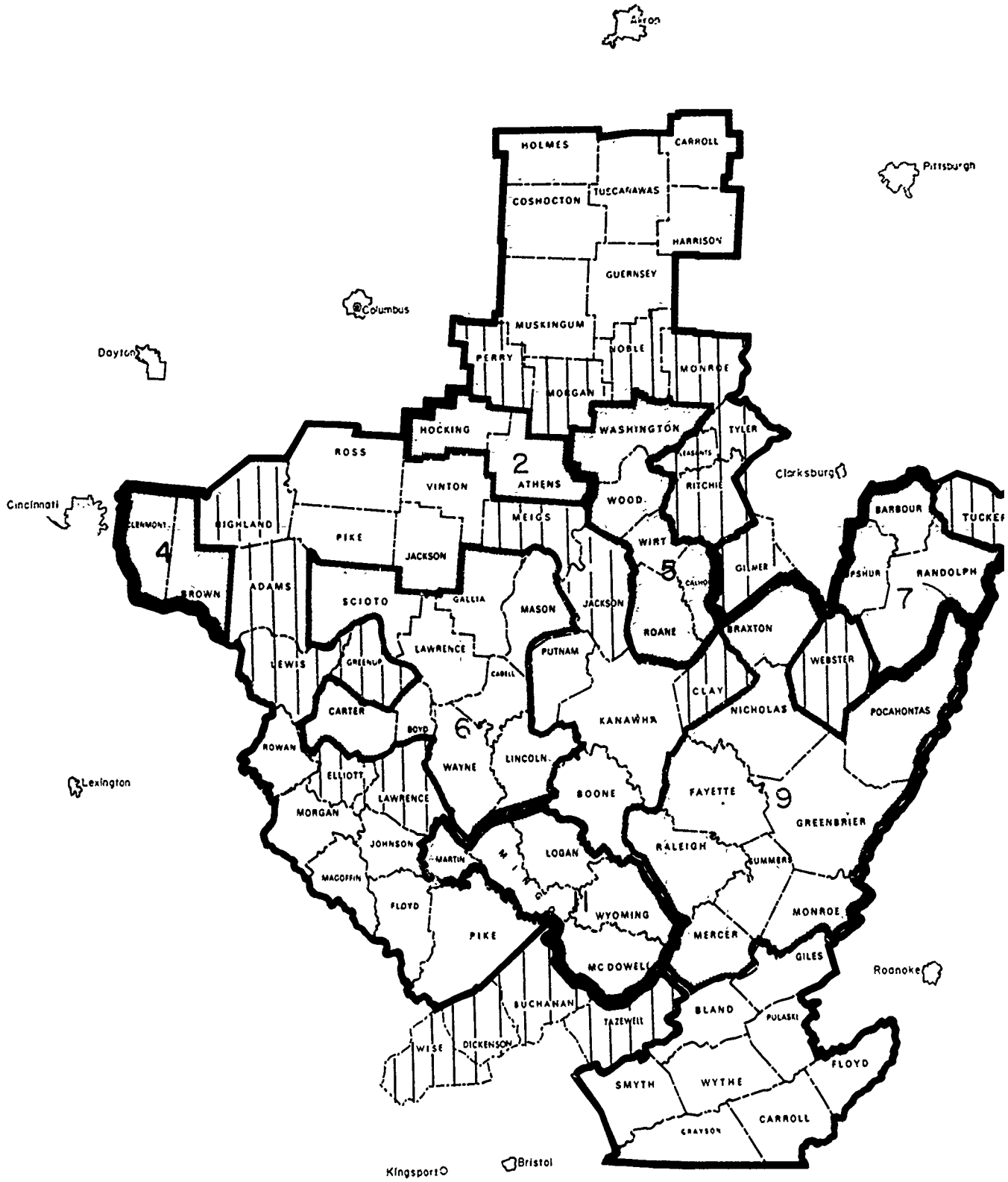
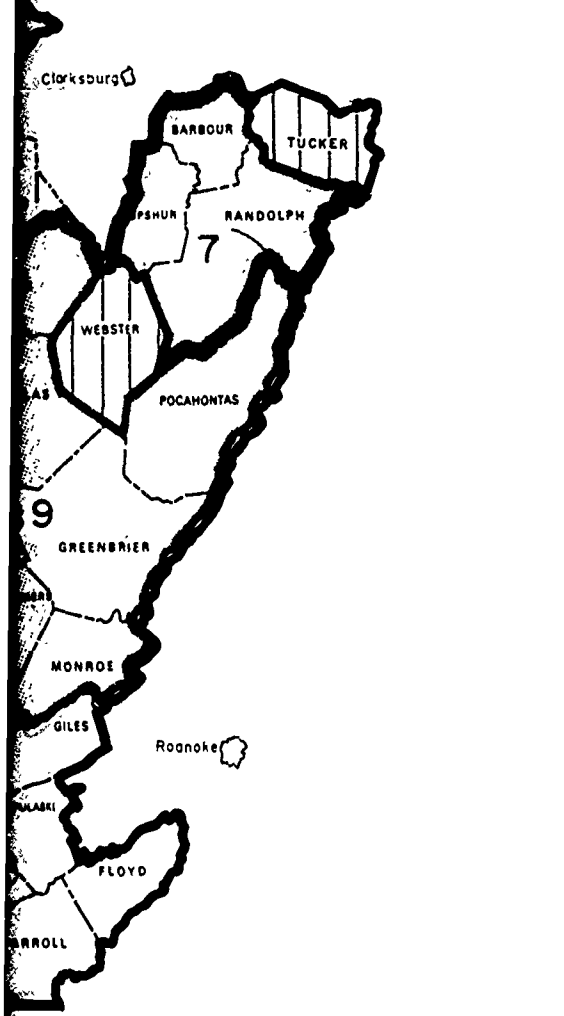
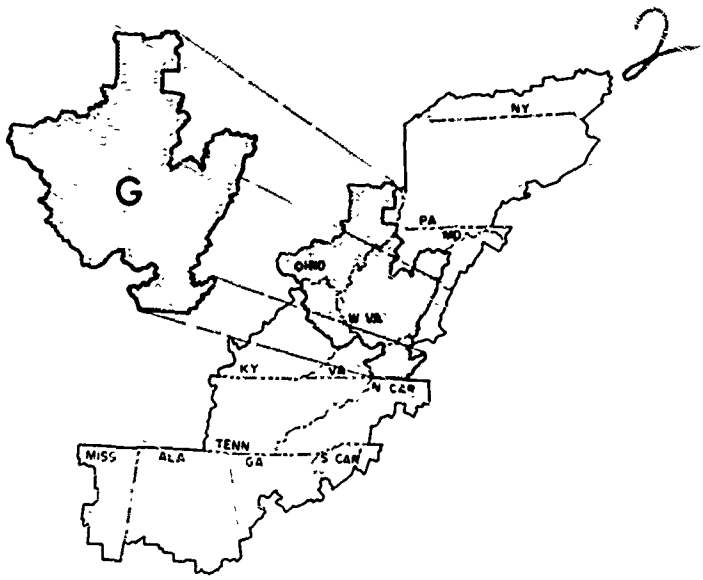


FIGURE 14-1a BENCHMARK PROJECTIONS


Akron
Pittsburgh
Columbus
Dayton
Cincinnati
Clarksburg
Lexington
Kingsport
Bristol
Roanoke
HOLMES
CARROLL
COSHOCTON
TUSCARAWAS
HARRISON
GUERNSEY
MUSKINGUM
PERRY
NOBLE
MONROE
MORGAN
WASHINGTON
TYLER
HOCKING
ROSS
VINTON
ATHENS
2
WOOD
RITCHIE
PLEASANTS
BARBOUR
TUCKER
HIGHLAND
PIKE
JACKSON
MEIGS
WIRT
4
5
GILMER
RANDOLPH
7
BROWN
ADAMS
SCIOTO
GALLIA
MASON
JACKSON
ROANE
BRAXTON
LEWIS
GREENUP
LAWRENCE
CABELL
PUTNAM
WEBSTER
CLAY
NICHOLAS
POCAHONTAS
CARTER
BOYD
6
KANAWHA
ROWAN
WAYNE
LINCOLN
ELLIOTT
LAWRENCE
BOONE
FAYETTE
9
GREENBRIER
MORGAN
JOHNSON
MARTIN
LOGAN
RALEIGH
SUMMERS
MAGOFFIN
FLOYD
1
WYOMING
MONROE
PIKE
MERCER
GILES
MC DOWELL
BUCHANAN
TAZEWELL
BLAND
PULASKI
WISE
DICKENSON
SMYTH
WYTHE
FLOYD
CARROLL
GRAYSON





VICINITY MAP

LEGEND

WATER SUB-REGION G BOUNDARY

7 GROWTH AREA NUMBER

BRAXTON COUNTY IN GROWTH AREA

CLAY COUNTY ASSOCIATED WITH GROWTH AREA

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION G

GROWTH AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 1966

II-14-5 FIGURE 14-2

New Philadelphia (Dover), Cambridge, Zanesville and Coshocton Primary Growth centers and the Secondary Growth Center of Malta-McConnelsville (Morgan Co.). The Growth Area is called "the Muskingum River in Appalachia" and analyses were made of tributary streams in Holmes, Carroll, Harrison, Perry, and Noble Counties. Washington County was studied with other Ohio River counties in Growth Area No. 5.

Growth Area No. 2, the Hocking River in Appalachia, has the Logan-Athens, Primary Growth Center in Hocking and Athens Counties (Logan, when considered alone, is a Secondary Center). Tributary drainage areas in Perry and Morgan Counties were included in solution studies. All the area is in Ohio.

Growth Area No. 3, Scioto River in Appalachia, includes the Ohio Counties of Ross, Pike, Highland and Jackson. Vinton County tributaries are part of the study area. Chillicothe is the Primary Growth Center and Jackson and Hillsboro-Greenfield (Highland County) Secondary Growth Centers. Scioto and Lawrence Counties, Ohio, are in Growth Area No. 6.

Growth Area No. 4 covers Brown and Clermont Counties, Ohio, which are satellite (secondary) to the Cincinnati, Ohio Standard Metropolitan Statistical Area (SMSA). Tributary streams are in Highland County.

Growth Area No. 5, Upper Ohio River in Water Sub-region G, includes Wood, Wirt, Calhoun and Roane Counties in West Virginia and Washington County, Ohio. The Primary Growth Centers are Parkersburg, W. Va. and Marietta, Ohio. Secondary Growth Centers in No. 5 are Spencer and Grantsville, in West Virginia. The Little Kanawha and Little Muskingum River and Duck Creek are principal direct Ohio River tributaries in No. 5. Tributaries in Jackson, Tyler, Pleasants and Ritchie Counties, West Virginia, and in Meigs and Monroe Counties, Ohio, were included in the study.

Growth Area No. 6, Lower Ohio River Mainstream in Water Sub-region G, covers Scioto, Lawrence and Gallia Counties, Ohio and Mason, Cabell, Lincoln and Wayne Counties, West Virginia, plus Boyd and Carter Counties in Kentucky. No. 6 contains the Huntington-Ashland SMSA, with Primary Growth Centers at Huntington, W. Va.; Ashland, Ky,; Portsmouth and Ironton, Ohio; and Point Pleasant, W. Va. The Secondary Growth Centers are Gallipolis, Ohio, and Milton and Hamlin-West Hamlin, W. Va. Studies of water needs and ways of satisfying them covered Elliott, Lawrence, Lewis and Greenup Counties, Kentucky and Adams County, Ohio. Lucasville, Ohio will become a key element in the Portsmouth Primary Center in Growth Area 6. Ohio River mainstream flood damages along Growth Area No. 4 were tabulated in No. 6.

Growth Area No. 7, Monongahela River in Water Sub-region G, includes only part of the Monongahela River Basin in the water sub-region. The area includes Barbour, Randolph, and Upshur Counties, West Virginia. The cities of Elkins, Buckhannon, and Philippi are primary growth centers.

Water needs in total were also considered for Tucker County, but studies of flood damage and how to alleviate them were made for the Growth Area (Tygart River) only, because total river basin analyses are contained in the Water Sub-region F reports (Chapters 11 and 12).

Growth Area Nos. 8 through 10 are within the Kanawha River Basin. Growth Area No. 8, the Upper New River in Virginia, covers Grayson, Carroll (+ independent Galax City), Smyth, Wythe, Pulaski and Giles Counties. Needs within the designated Primary Growth Centers of Galax-Hillsville, Marion-Wytheville and Pulaski-Parrott and the secondary growth center of Pearisburg-Narrows were studied. Symth County (Marion) is in the Tennessee River Basin. New River tributaries in Bland and Floyd Counties were included in the analyses.

Growth Area No. 9, Kanawha River tributaries, contains Pocahontas, Monroe, Greenbrier, Nicholas, Braxton, Fayette, Raleigh, Mercer and Summers Counties, W. Va. Tributary areas in Clay and Webster Counties, W. Va. and Tazewell County, Va. were studied for needs satisfaction. The Primary Growth Centers are Lewisburg-Ronceverte-White Sulphur Springs, Bluefield (Va. and W. Va.) - Princeton, Beckley and Montgomery. Secondary Growth Centers in No. 9 are Marlinton, Summersville-Richwood, Sutton-Gassoway, Hinton and Oak Hill-Mt. Hope.

Growth Area No. 10, Charleston, is made up of Kanawha and Putnam Counties in West Virginia. Coal River in Boone and Raleigh Counties has an impact on the area. Charleston SMSA is, of course, the Primary Growth Center.

Growth Area No. 11, Big Sandy River - Guyandotte River, has Mingo, McDowell, Wyoming and Logan Counties, West Virginia and Martin County and South Williamson (city) in Kentucky. The Primary Growth Centers are Williamson-So. Williamson, Welch and Logan. The Pineville-Mullens area is secondary. All cities above are in W. Va. except South Williamson.

Growth Area No. 12, Big Sandy River - Upper Licking River is all in Kentucky. Floyd, Pike, Magoffin, Johnson and Rowan Counties are included; Morgan County areas were studied for water needs satisfaction. The Primary Growth Centers of Pikeville-Prestonburg-Paintsville, Salyersville and Morehead - Midland are in No. 12. Morehead is now considered Secondary, but it will become part of a Primary Center with Midland (New Town) development. Its relation to the overall plan of development is contained in Chapter 16 of Part III.

Growth Areas 11 and 12 are studied together in Sections III and IV of this chapter in formulating a plan to meet common needs. Big Sandy River tributaries in Virginia were included in evaluations.

The relative priority of needs and ways of satisfying them among the Growth Areas is established in Section II and IV of this chapter.

4. DEVELOPMENTAL CONSTRAINTS

The economy of the industrial valleys of Sub-region G is closely related to expansion in the national economy. But in many of the industrialized areas economic growth is severely constrained by lack of suitable terrain. There are also severe water quality problems in some of the industrialized valleys. The hinterlands suffer from lack of social capital and general preparation for manufacturing or industrial employment.

The banks, savings and loan associations, and individuals located in the sub-region have significant assets. Lack of venture capital in the area appears to be related more to lending policy and lack of confidence in the area than to a shortage of funds. Local development groups have been involved more with attempting to attract outside firms than with aiding local industry. Risk capital is always difficult to obtain and especially so in economically depressed areas. Federal investment could contribute to the area, but unless the private sector responds in a meaningful way, the Federal investment will be ineffective.

Rail facilities in the sub-region are generally adequate in serving the industrial needs of the region. Extension of rail service to some potential plant sites along the Ohio River would enhance the value of sites. Airports to serve large commercial jet planes are needed. Planned highway improvements in the Ohio portion of the sub-region will have a significant impact upon the economy. In the more rugged portions of southern West Virginia and eastern Kentucky, highway construction, though needed, uses up scarce developable land. Even though airports and highways will stimulate the area economically, construction of limited-access freeways and first-class airports, by themselves, will not solve the socio-economic problems in the region.

Vocational education and stronger academic curriculums in high schools would equip the sub-region's people for effective performance in jobs in and out of the area and enable them to compete in the nation's universities and colleges. An inadequate tax base inhibits educational investment in some areas. Provision of health facilities in the sub-region is somewhat related to the population dispersion. Improvement of service and access roads will allow more effective use of medical facilities by the dispersed rural population who have the greatest need for medical treatment. Lack of water distribution and sanitary systems in the rural areas has lead to the spread of disease and water contamination.

A scarce resource in the sub-region is land suitable for industrial development. Potential sites are disappearing due to

improper zoning and residential encroachment. Consideration should be given to protection of potential sites for eventual industrial use by restrictive zoning or by ownership or control by agencies or interests concerned with promoting industrial development in the region.

Any large concentration of economic activity generates water resource problems. Many of the problems that will emerge in the decades ahead can be solved efficiently by wise and prudent management rather than resorting to structural solutions. Improvements in waste treatment technology may very well reduce the need for large volumes of water to be used for quality purposes. If demands for water storage for quality control decrease stored water can be reallocated to other uses.

Flood plain management, involving such techniques as zoning and floodproofing of structures, must be given consideration as alternatives to structural means of flood control. The residual damage and future damages can be decreased through proper management. The scarcity of land for industrial uses where there are adequate supplies of water and where water transportation facilities are available could seriously dampen economic growth.

When comparisons are made between the identified problems and the solutions in the plan for water resource development, it becomes apparent that a tremendous gap remains between existing and projected water oriented problems and the means for solving them. It should be recognized that in the case of flood control, damages have been substantially reduced in many areas of concentrated development where structural measures are most effective. With the degree of protection now provided for the Ohio River and major tributaries, each added increment of flood protection is more difficult to justify economically. The future development will include projects controlling smaller drainage areas, local flood protection projects, and flood plain management. Even with the recreation facilities included in the Appalachian Development Plan and those to be developed at potential projects in current and proposed studies, the gap between opportunity and demand will continue to widen. Assuming that improvements in municipal and industrial waste treatment techniques will be sufficient to handle the increase in waste loadings anticipated in the future, the major needs for storage capacity for water quality control will be largely satisfied by projects existing, proposed, or expected to result from current studies. Local problems will continue to exist in certain areas because of population concentration, industrial development, and mining operations. Although water supplies are generally adequate throughout the sub-region, problems will continue to exist in certain

areas (W. Va. and Ky.), because of inadequate distribution systems. Because of the abundance of annual rainfall (runoff), additional sources of water supply can be developed throughout much of the sub-region as needs arise. Dependable sources consist of streams with adequate base flow; ground water where quantity is sufficient and cost is reasonable; and surface storage, either in multiple-purpose reservoirs, upstream watershed structures, or single-purpose water-supply reservoirs.

The opportunities foregone in Sub-region G since World War II are staggering. Incomes unearned and resources unemployed are social costs that have created an impact on the area that will be difficult to negate. The failure to provide water quality in the Kanawha River, for example, could cost the region one of the world's largest concentrations of chemical manufacturing. Loss of tax revenues, wages, rents, interest, and profit. could handicap future generations and create a tremendous relief problem for the nation. Failing to provide opportunity for outdoor recreation could create social problems rather than to relieve the increased stress of urban living. New jobs are necessary so that an expanding labor force will have employment. Sites that are not subject to flooding are an integral part of any future employment.

Water resources development by itself is not always the single factor that is preventing opportunities from materializing in many areas of Water Sub-region G. Other investments are required and in some areas are more urgently needed than water resources investment. Failure to provide social overhead capital and lack of private investment in the sub-region will discourage future economic growth. Improvement in any one of the lagging parameters of economic development can be expected to act as a stimulus to all other parameters.

5. PATTERN OF GROWTH ANTICIPATED

The greatest assets of the sub-region are the relatively underdeveloped industrial sites along the Ohio River. Land adjacent to the river, in conjunction with competitive electric power generated using the large quantities of coal mined in the sub-region will contribute substantially to Sub-region G's future economic growth. Industries having high capital investment per employee will contribute to the economic improvement of growth centers along the Ohio River. The Parkersburg-Marietta area will probably have the largest rate of growth. Smaller centers, particularly the Pt. Pleasant-Gallipolis Center, will also expand at rates far exceeding those of the present. The Huntington-Ashland SMSA and communities downriver to Cincinnati will continue to expand but at lesser rates than the areas upriver. Flood damages in major population centers have been greatly reduced by local protection projects; nevertheless, reservoirs proposed in this plan will provide additional protection and enhance the value of available sites. Water supply will be no major problem for the Ohio

River Growth Areas 5 and 6. If water quality is raised to levels now proposed by the Ohio River Valley Water Sanitation Commission (ORSANCO) States, industrial development to benchmark levels will not result in lower dissolved oxygen levels in the river. Open water recreation is available on the river.

The economies of the growth areas in Ohio will be dominated by manufacturing composed of many small and medium-sized plants primarily engaged in fabrication and assembly; except for the great increase in paper production forecast for Chillicothe. The economy in the northwestern portion of the sub-region will be supplemented by agricultural production. Ohio Growth Areas 1-6 will benefit from an influx of visitors from the more populous portions of Ohio, to take advantage of the recreation opportunities in the hills of southern Ohio. The Logan and Whiteoak Reservoirs will contribute substantially to the recreational development of the area.

The pattern of growth anticipated for the growth areas south of the Ohio River will contrast greatly with the Ohio main stem and southern Ohio Growth Areas. Few new industries are expected to be located in the Kanawha Valley, but present industry will continue to expand. Elimination of the water quality problem in the Kanawha River is essential if the region is to continue to participate in the nation's growth.

The coal producing areas of the sub-region will continue to provide fuel for a substantial part of the nation's energy requirements. (In 1964, four counties in southern West Virginia: Logan, McDowell, Mingo, and Wyoming - produced almost 11 percent of the nation's bituminous coal.) However, the extraction of coal provides very little income, other than wages, to the region from which it is mined. Most of the wealth associated with coal comes from its combination with other resources. Little opportunity exists for such combinations in the coal belt of Sub-region G.

There is opportunity to further improve the coal-producing portions of Sub-region G through better utilization of the coal. Such an achievement will require substantial alteration in the present pattern of resource production and consumption. Change is not expected in the near future.

Much attention of resource analysts has been directed toward the potential wealth contained in the Appalachian forests in Sub-region G. Additional income and employment from timber resources could be obtained by the location of furniture, and pulp and paper mills in the sub-region.

The recreation industry provides another possible source of employment. However, in many instances, this employment is seasonal in nature and tends to provide little in the way of year-round employment. In addition, the investment in recreational facilities is very high and the employment generated by such an investment is relatively low in terms of employees per dollar unit of investment. Recreation by itself is hardly a cure for the area's ills, but supplemented by a strong manufacturing base, recreation can make a substantial contribution to the sub-region's product.

Manufacturing in the areas south of the Ohio River, excepting the Kanawha Valley, will be largely confined to the Big Sandy River Valley and Growth Area No. 7 in West Virginia. Fabricating and processing industries in the Elkins-Buckhannon-Philippi Growth Center may be established in the decades ahead. Within the Big Sandy River Valley area, a few capital intensive firms will be located.

6. ADDITIONAL CENTERS HAVING POTENTIAL FOR GROWTH

Potential development centers exist in Sub-region G along the Ohio River. Many of the smaller river communities could develop into expanding economies if industry locates near them. No other potential centers are foreseen; practically every community in the sub-region was selected by the states as a growth area.

SECTION II - WATER RELATED NEEDS

7. INTRODUCTION

The analysis of water needs in the context of the developmental objectives of PL 89-4 is based on several considerations. These include:

a. Immediate needs;

b. The needs that result from the continued development of the sub-region and contiguous areas, with a normal water development program: and

c. The needs that will result from accelerated development to an economy utilizing full capacity of the area to supply industrial sites, labor, developmental capital, and other resources.

The latter aspect has been incorporated into the setting of the benchmarks for population, employment, and income.

Definition of the developmental impediments associated with water resource management has evolved from the socio-economic analysis of the region and the overlay of the benchmark projections. The procedure used included spatially locating the benchmark projections on the sub-region by disaggregating the projections from larger to smaller areas. Error limits increase, of course, as the process narrows the projections to smaller areas. This is an inherent risk associated with long-range planning, but the analysis can be improved by building greater flexibility into project recommendations and by hedging future needs by staged construction.

Water resources planning is dominated by the hydrologic delimitation of space. The regions delimited for economic analysis were overlain on watersheds for the derivation of water needs. Benchmark projections were allocated (by the disaggregation procedures) to state planning sub-regions, thence to river basins. If the analysis indicates a set of water problems or water related impediments to the attainment of regional potential, these problems or impediments become the needs against which water management proposals would be designed.

8. WATER RESOURCE NEEDS IN THE SUB-REGION

The Problems in General

The primary relevant water and related resource needs of the sub-region are flood control, land conservation, sediment reduction, water

supply, maintenance of stream quality, power, and recreation. Needs related to irrigation and drainage are expected to be adequately considered in planning other water-management projects, and so should not inhibit economic growth and development of the sub-region. The term "needs" is used here in a specialized sense. It refers to projected demands less the supply that will be available by virtue of present development plus additional installations expected through 1980. Estimates were made for the sub-region as a whole to establish a frame of reference, and estimated needs, insofar as they can be localized, are indicated for each growth center.

Flood Control

Compared with similar-sized areas elsewhere in Appalachia, Sub-region G appears more subject to flood damage. At present (1968) values, total annual flood damages affecting growth areas in the sub-region are estimated at $24,617,000 (including $60,000 in the Tennessee River Basin); addition of damages in unevaluated stream reaches would raise this to about 27,000,000 dollars. Rural damages ($12,046,000 per year) are about 47 percent of the total; urban and structural damages, including railroads, bridges, etc., account for the other 53 percent. Projects of all programs that are scheduled to be constructed prior to 1980 will reduce damages by 3,815,000 dollars. Projects in the Water Resource Study Plan would further reduce damages by $1,894,000 a year. Estimates of damages by growth areas are presented in Table 14-1. Works recommended for future study in this plan and Water Sub-region F and H plans, along with adequate flood plain management practices to minimize flood damages, could result in a reduction of damages to well below $10,000,000 a year.

Most of the growth centers in the sub-region are located in flood plain lands and are, or have been, damaged by floods. Future economic developments will result in increased pressure for further urban development of the flood plain. An estimate of urban land requirements by growth areas is given in Table 14-2 on Page 14-20.

The U.S. Department of Agriculture's 1967 Conservation Needs Inventory for Watersheds shows that floodwater and sediment damages, occurring in upstream areas and requiring project action, total an estimated $12,608,000 annually. Thirteen percent ($1,608,900) occurs in urban areas.

Watershed Land Management

The problems and needs with respect to proper watershed land management are those associated with needed changes in present land use and the application of needed conservation treatment for its proper use.

TABLE 14-1
FLOOD CONTROL NEEDS AND RESIDUAL DAMAGES BY RIVER BASIN
AND GROWTH AREA IN WATER SUB-REGION G ($1,000) a/

Item	Estimated Annual Damages-1968			Reduction by Projects to be in Place by 1980	Residual Needs	Reduction by Alternatives Studied for AWRS	Residual Damages	Programmed by 1980 d/	Additional Projects (WRS) by 1980 d/
	Upstream b/	Downstream c/	Total						
Growth Area 1 - Ohio - G-1									
Muskingum River in Appalachia	870	565	1,435	27	1,408	131	1,277	USDA Buffalo Cr (26) e/	USDA Mohahala-Jonathan Cr (78)
								CE Utica Res (1) Upstream	USDA Wakatomika Cr (53)
New Philadelphia	-	20	20	-	20	-	20		
Cambridge	-	4	4	-	4	-	4		
Zanesville	-	55	55	-	55	-	55		
Coshocton County		-							
Malta-McConnelsville		-							
Growth Area 2 - Ohio - G-1									
Hocking River in Appalachia	350	612	962	520	442	153	289	USDA Margaret Cr (18)	USDA Federal Valley Cr (51)
								USDA Rush Cr (117)	CE Logan Res (102)
								CE 4 LPP (385)	
Logan	-	165	165	41	124	39	85	CE Rockbridge LPP (2)	CE Logan Res (Logan) (39)
								CE Logan LPP (39)	
Athens	-	447	447	344	103	48	55	CE Nelsonville LPP (28)	CE Logan Res (Athens) (48)
								CE Athens LPP (316)	
Other	350	-	350	135	215	51	164	USDA Margaret Cr (18)	USDA Federal Valley (51)
								USDA Rush Cr (117)	
Growth Area 3 - Ohio - G-2									
Scioto River in Appalachia (less Scioto County)	380	489	869	240 e/	629	70	559		USDA L. Salt Cr (70)
Chillicothe (city only)	-	300 e/	300	240 e/	60	-	60 e/	CE Chillicothe LPP	
Jackson County	101	2	103	-	103	70	33		USDA L. Salt Cr
Hillsboro-Greenfield	25	-	25	-	25		25		
Growth Area 4 - Ohio - G-2									
Little Miami River in Appalachia	210	273	483	226	257	1	256	CE E. Fk. Res (226)	USDA O'Bannon Cr (1)
White Oak Cr and Other River Tribs.	90	-	90	-	90	32	58		USDA Upper Whiteoak Cr (32)
									CE Whiteoak Res (167 Ohio R)
Clermont County									
Brown County									
Main Stream Ohio River	(See Growth Area No. 6)								CE Whiteoak Res (167)
Growth Area 5 - West Virginia & Ohio - G-1 and G-3									
Upper Ohio River in WSR-G +	2,184	1,900	4,084	1,242	2,842	384	2,458		
Parkersburg, W. Va.	219	515	734	-	734	208	526		USDA Pond Run (208) f/
Marietta, Ohio	201	248	449	71	378	27	351	USDA W. Fk. Duck (71)	USDA Wolf Cr (27)
Spencer, W. Va.	780	137	917	187	930	-	730	USDA Saltlick Cr (31)	
Grantsville, W. Va.								CE Burnsville Lake (77)	
								West Fork (5)	
								Leading Creek (74)	
Ohio River Mainstream c/	984	1,000	1,984	984 g/	1,000	149 g/	851	USDA Mill Creek (88)	Logan Res (51)
								Burnsville Lake (172)	Upper Middle I. Creek (98)
								West Fork (474)	
								Leading Creek (250)	

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TABLE 14-1 (CONT'D)
FLOOD CONTROL NEEDS AND RESIDUAL DAMAGES BY RIVER BASIN
AND GROWTH AREA IN WATER SUB-REGION G ($1,000) a/

Item	Estimated Annual Damages - 1968			Reduction by Projects to be in Place by 1980	Residual Needs	Reduction by Alternatives Studied for AWRS	Residual Damages	Programmed by 1980 d/	Additional Projects (WRS) by 1980 d/
	Upstream b/	Downstream c/	Total						
Growth Area 6 - Ohio - W Va. - Kentucky - G-2									
Lower Ohio River	927	4,893	5,820	183 e/	5,637	216 e/	5,421 e/	USDA Pine Cr (73) USDA L. Fk. Little Sandy (47)	USDA L Scioto R. (24) USDA E. Fk. Little Sandy (25)
Huntington, W Va.	280	625	905	-	905	-	905	USDA Fourpole Cr (47)	
Ashland Ky	-	127	127	-	127	-	127		
Gallipolis, Ohio									
Portsmouth, Ohio	177	1,298	1,475	73	1,402	24	1,378	USDA Pine Creek (73)	USDA L. Scioto R. (24)
Ironton, Ohio	-	1,045	1,045	-	1,045	-	1,045		
Point Pleasant, W. Va.	-	180	180	-	180	-	180		
Milton, W. Va.	-	20	20	-	20	-	20		
Hamlin - W Hamlin, W. Va.	-	30	30	-	30	-	30		
Ohio River Mainstream	470	1,568	2,038	110 c/	1,928	192 c/	1,736	CE Panther Creek Res (16)	USDA E. Fk. Little Sandy (25) CE Whiteoak Res (167)
Growth Area 7 - W. Virginia - G-5									
Monongahela River	180	80	260	87	173	69	104	USDA Shooks Run (2) USDA Pecks Run (15)	USDA French Cr (5) USDA Upper Buckhannon (64)
Elkins	78	3	81	-	81	-	81		
Buckhannon	102	77	179	87	92	69	23	CE Buckhannon LPP (70)	USDA French Cr (5) USDA Up. Buckhannon (64)
Philippi	Included in Buckhannon Reach								

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TABLE II-1 (Cont'd)
FLOOD CONTROL NEEDS AND RESIDUAL DAMAGES BY RIVER BASIN
AND GROWTH AREA IN WATER SUB-REGION G ($1,000)a/

ITEM	Estimated Annual Damages - 1968 Upstream b/	Downstream c/	Total	Reduction by Projects to be in Place by 1980	Residual Needs	Reduction Alternatives Studied for AWRS	Residual Damages	Programmed by 1980 d/	Additional Projects (WRS) by 1980 d/
Growth Area 8 - Virginia - G-5									
Tennessee River	60	-	60	-	60	34	26		
Marion - (P)	60	-	60	-	60	34	26		USDA Holston River (34)
New River (Kanawha) in Va.	513	62	575	11	564	59	505		
Wytheville (P)	47	-	47	-	47	-	47		
Galax-Hillsville (P)	111	10	121	-	121	-	121		
Pulaski-Parrott (P)	160	22	182	-	182	59	123		USDA Peak Cr. (59)
Pearisburg-Narrows (S)	95	30	125	11	114	-	114	USDA Mill Cr. (11)	
In North Carolina	100	-	100	-	100	-	100	Est. only	
Growth Area 9 - W. Va. - G-5	1,840 b/	655	2,495	526	1,969	131	1,838		
Kanawha River Tribs.									
Marlinton (S) (Greenbrier)	95	434	529	-	529	-	529		1/
Lewisburg-Ronceverte White Sulphur Springs (P) (Greenbrier R.)	233	145	378	72	306	8	298	USDA Howard Cr. (72)	USDA Gypsy Hill (8)
Summersville-Richwood (S) (Gauley R.)	412	23	435	64	371	120	251	USDA Big Ditch Run (24) USDA Grassy Cr. (15) USDA Beaver Cr. (25)	USDA Upper Meadow R. (100) USDA Cherry R. (20)
Sutton-Gassaway (S) (Elk R.)	137	30	167	-	167	-	167	-	
Bluefield-Princeton Bluefield, Va. (P) (Bluestone River)	523 b/	22	545	215	330	-	330	USDA (R.C. & D.) Jumping Br. (2) USDA Upper Bluestone R. (143)	
Beckley (P)	150	-	150	74	76	-	76	USDA Brush Cr. (70) USDA Piney Cr. (74)	
Hinton (S)	100	-	100	25	75	3	72	USDA Meadow Cr. (25)	USDA Glade Cr. Upper (3)
Oak Hill-Mt. Hope (S)	120	-	120	74	46	-	46	USDA Dunloup Cr. (74)	
Montgomery (S)	70	1	71	2	69	-	69	USDA Ansted Cr. (2)	
Growth Area 10 - W. Va. - G-3									
Lower Kanawha River Charleston (P)	1,450	1,841	3,291	206	3,085	70	3,015	USDA Elk-Two Mile Cr. (82) USDA Blakes & Armour Cr. (20) USDA Rocky Fork (19) USDA Kanawha-Two Mile (15) USDA Georges Cr. (24) USDA Wertz Hollow (16) USDA Lick Br. (30)	USDA Quick Br. (18) USDA Slaughter Cr. (21) USDA Kellys Cr. (31)
Total Growth Areas 8, 9, and 10 (less Tenn. R.)	3,803 b/	2,558	6,361	743	5,618	260	5,358		
Growth Areas 8, 9, and 10 - not in Growth Centers	-	1,440							
Tenn. River in Growth Area 8	60	-	60	-	60	34	26		

TABLE 14-1 (Cont'd)
FLOOD CONTROL NEEDS AND RESIDUAL DAMAGES BY RIVER BASIN
AND GROWTH AREA IN WATER SUB-REGION G ($1,000)a/

Item	Estimated Annual Damages - 1968			Reduction Projects to be in Place by 1980	Residual Needs	Reduction Alternatives Studied for AWRS	Residual Damages	Programmed by 1980 d/	Additional Projects (WRS) by 1980 d/
	Upstream b/	Downstream c/	Total						
Growth Area 11 - W. Virginia - Ky - G-5									
Guyandotte River -	1,247	63 i/	1,310	-	1,310	20	1,290		USDA Big Creek (20)
B. Sandy in Appalachia	1,230 k/	613 j/	1,843	76	1,767	64	1,703	CE Panther Creek Lake (76)	
Williamson, W. Va. - S. Williamson, Ky. (P) j/	128	387	515	58	457	64	393	CE Panther Creek Lake (58)	USDA Mate Creek (64) f/
Welch, W. Va.		38	38		38		38		
Pineville - Mullens, W. Virginia		46	46		46		46		
Logan, W. Virginia		10	10	-	10	-	10		
Growth Area 12 - Kentucky - G-2 & G-4									
Big Sandy -	375	422	797	-	797	-	797		
Licking River	140	103	243	4	239	196	43	USDA Grassy Creek (4)	CE Royalton Res + LPP (146) USDA Upper Licking River (26)
Pikeville	-	4	4	-	4	-	4		
Prestonsburg	-	21	21	-	21	-	21		USDA Triplett Creek (24)
Paintsville (P)	-	23 m/	23	-	23	-	23		
Salyersville (P)	80	103	183	-	183	172	11		CE Royalton Res + LPP + USDA Upper Licking R. (172)
Midland - Morehead (P) (in G)	43	-	43	-	43	24	19		USDA Tripplett Creek (24)
	12,046	12,571	24,617	3,348	21,269	1,630	19,639		

a/ Damages shown are stream reach damages with a 1968 price base.
b/ Downstream damages along Ohio River are separated for cities within flood walls - other damages are included in Reach data.
c/ Tributary damages (including Ohio R. Trib.) generally shown in reaches along mainstem.
d/ Order of construction may be changed.
e/ Five major reservoirs upstream and two in Appalachia assumed in place.
f/ May be in operation by 1980.
g/ By projects within WSR-G only - damage reduction from Rowlesburg Lake, Stonewall Jackson Lake in place by 1980 and St. Petersburg Reservoir ($1,000,000) in WRS plan not included because reach distribution has not been determined.
h/ Includes Bluestone River in WSR-J.
i/ Greenbrier Reservoir (system of two) studied but not accepted by the Coordinating Committee (Kanawha Type II).
j/ Downstream from R.D. Bailey Res. $11,000/year remains. (R.D. Bailey to be in place before 1980.)
k/ Includes damages in Virginia.
l/ Lower Knox (Creek) Reservoir was studied and found infeasible by present criteria (see sections III and IV this chapter and chapter 13 part II)
m/ With Paintsville Reservoir assumed in place. (Scheduled for completion prior to 1980.)

*/ Data shown inclosed by parenthes.s are the average annual flood reductions that would be provided by that project.

TABLE 14-2
URBAN LAND REQUIREMENTS BY RIVER BASIN AND GROWTH AREA IN
WATER SUB-REGION C

ITEM	TOTAL 2020 URBAN LAND NEEDS [a] Total Acres	Flood Plain Acres	INDUSTRIAL NEEDS Undeveloped Total 2020 Acres	Available [b] 1965 Acres	Remaining 2020 Acres	AREA PROTECTED TO 100 YEAR RECURRENCE INTERVAL Logan Res.	Whiteoak Res.	Greenbrier Res.	Royalton Res.
OHIO - Water Area G-1									
Muskingum River Basin									
Growth Area 1	24,200	[b] 4,000	6,500	[d] 4,279					
New Philadelphia (P)	7,400		1,380	1,060	320				
Cambridge (P)	2,600		520	825	0				
Zanesville (P)	8,600		2,300	1,005	1,295				
Coshocton Co. (P)	3,500		1,050	515	535				
Malta-McConnelsville (S)	1,500		650	340	310				
Other	600		600	525	75				
Hocking River Basin						2,900			
Growth Area 2	7,900	2,900	2,360	[g] 663	1,707	(partial)			
Logan -	1,000	1,000	1,000	243	767				
Athens (P)	6,200	1,300	1,350	420	930				
Other	700	600	0	0	0				
OHIO - Water Area G-2									
Scioto River Basin									
Growth Area 3	20,400	[c] 1,000	3,570	[f] 10,180	0				
Chillicothe (P)	11,000		2,020	5,585	0				
Jackson (P)	2,800		600	917	0				
Hillsboro-Greenfield (S)	5,200		600	768	0				
Other	1,400		350	2,910	0				
Little Miami-Whiteoak Creek & other Ohio River Tributaries									
Growth Area 4	15,800	[c] 0	2,250	[f] 3,815	0		0		
Clermont Co.	12,200	0	1,600	1,295	305				
(+ Brown Co.)(P)	3,600	0	650	2,520	0				
OHIO - WEST VIRGINIA - Water Areas G-1 & G-2									
Ohio River Upper Main Stem									
Growth Area 5	26,200	13,000	4,940	[d] 1,964					
Parkersburg, W. Va. (P)	16,700		2,090	1,135	955				
Marietta, O. (P)	7,600		2,000	775	1,225				
Spencer, W. Va. (S)	400		400	0	400				
Grantsville, W. Va. (S)	200		200	0	200				
Other	1,300		250	54	196				
OHIO - WEST VIRGINIA - KENTUCKY Water Area G-2									
Growth Area 6	43,800	20,000	10,000	[d] 13,426	0				
Huntington, W. Va.-	13,600		200	977	0				
Ashland, Ky. (SMSA)	8,300		2,550	[g] 1,797	750				
Gallipolis, O. (S)	2,100		200	1,665	0				
Portsmouth -	4,500		800	3,615	0				
Ironton, O. (P)	6,500		1,180	280	0				
Point Pleasant, W. Va. (P)	5,100		3,900	3,930	0				
Milton, W. Va. (S)	800		200	200	0				
Hamlin-W. Hamlin, W. Va. (S)	1,200		70	65	0				
Other	1,700		900	897	0				
WEST VIRGINIA - Water Area G-5									
Tygart River (Monongahela R. Basin)									
Growth Area 7	4,500	450	1,200	[b] 1,754					
Elkins	1,700		600	877	0				
Buckhannon	1,600		400	505	0				
Philippi	1,000		100	228	0				
Other	200		100	144	0				

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TABLE 14-Z (cont'd)
URBAN LAND REQUIREMENTS BY RIVER BASIN AND GROWTH AREA IN
WATER SUB-REGION G

ITEM	TOTAL 2020 URBAN LAND NEEDS [a] Total Acres	Flood Plain Acres	INDUSTRIAL NEEDS Undeveloped Total 2020 Acres	Available 1965 Acres	Remaining 2020 Acres	AREA PROTECTED TO 100 YEAR RECURRENCE INTERVAL Logan Reg.	Whiteoak Reg.	Greenbrier Res.	Royalton Res.
VIRGINIA - Water Area G-5									
New River Basin									
Growth Area 8	22,500	[c] 1,650	4,600	[f] 1,750					
Galax-Hillsville (P)	5,100		1,300	78	1,222				
Marion-Wytheville (P)	4,900		1,100	1,105	0				
Pulaski-Parrott (P)	6,400		900	420	480				
Pearisburg-Narrows (S)	4,900		700	147	553				
Other	1,200		600	-	600				
WEST VIRGINIA - Water Area G-5									
New River Basin (Kanawha)									
Growth Area 9	3,300	[c] 1,760	1,950	[f] 1,874	-			[f]	
Lewisburg-Ronceverte-White Sulphur Springs (P)	[b] 700		600	524	0				
Marlinton (S)	[b] 300		200	527	0				
Summersville-Richwood (S)	400		200	205	0				
Sutton-Cassoway (S)	200		100	36	64				
Bluefield-Princeton (P)	400		200	52	148				
Beckley (P)	300		100	92	0				
Hinton (S)	300		200	343	0				
Oak Hill-Mt. Hope (S)	200		100	65	35				
Montgomery (P)	300		50	30	20				
Other	200		200	-	200				
Kanawha River Basin									
Growth Area 10	31,400	3,000	7,940	[d] 2,663	5,277				
Charleston (P)									
WEST VIRGINIA - KENTUCKY - Water Area G-4									
Big Sandy & Guyandotte R. Basins									
Growth Area 11	10,900	[f] 2,000	2,000	253					
Williamson, W. Va. - S. Williamson	3,900		800	97	703				
Welch, W. Va. (P)	200		200	9	191				
Pineville-Mullens, W. Va. (S)	3,500		500	80	420				
Logan, W. Va. (P)	3,300		500	67	433				
KENTUCKY - Water Areas G-2 & G-4									
Big Sandy & Licking River Basins									
Growth Area 12	12,100	5,320	1,600	[d] 1,713	-				
Pikeville-Prestonburg-Paintsville	4,500	800	800	457	343				
Salyersville (P)	[k] 2,700	[k] 2,700	200	919	0				1,80
Midland (P)	[k] 5,100	[k] 1,820	600	337	263				
Morehead (S)									
Total 12 Growth Areas	223,000	55,080	48,910	44,325					
Total Needs Outside Growth Areas	19,000	-	3,090	9,158					
Total W.S.R.-G Needs	242,000	55,080	52,000	53,483					

[a] Needs for total urban area needed over 1960 land use - city listed plus suburbs.
[b] Includes both upland and bottomland sites.
[c] Developable uplands available.
[d] All bottomland.
[e] 45% bottomland.
[f] Less than 10% bottomland.
[g] Includes Boyd and Greenup Counties, Ky.
[h] 25% bottomland.
[i] Over 90% bottomland.
[j] Computed level land needs not available.
[k] Areas specified in Chapter 16, Part III, "Midland Local Protection Project", q.v., partly in Bath County, Ky.
[l] Greenbrier Reservoir (system of two) studied but not accepted by the Coordinating Committee (Kanawha Type II).

The principal conservation problems for cropland are erosion and excess water. An estimated 1,847,100 acres need conservation treatment to maintain production and the soil resources.

Pastureland conservation treatment is needed on 2,448,900 acres. An estimated 721,400 acres need establishment or re-establishment of vegetative cover, 1,474,000 acres need improvement of existing vegetative cover and 553,600 acres need protection from over-grazing, erosion or encroachment of undesirable plants.

Some of the conservation treatment needs for forest and woodland include 1,210,500 acres of tree planting, 6,986,500 acres of hydrologic stand improvement, 3,974,300 acres of protection from overcutting and damage from logging, 1,548,400 acres of protection from over-grazing, and 333,100 acres of erosion control.

Other conservation needs by 1980 include converting about 397,400 acres of cropland to less intensive use, such as pasture, woodland, wildlife and others. By 1980, 326,300 acres of agricultural land will be needed for non-agricultural uses. As suggested by USDA in Appendix A, to attain satisfactory watershed management on forest lands presently in public ownership, small private inholdings should be acquired by state, Federal, or other governmental units where development and management will not otherwise be accomplished.

It is expected that by 1980 the following land use acreage will be needed to support planned and expected development:

Land Use	Land Use 1958	Land Use by 1980
Cropland	3,556,300	3,150,200
Pasture	4,083,700	3,668,200
Forest and Woodland:		
State and Private	12,879,200	13,279,600
National Forests	1,132,200	1,566,900
Other Land	1,437,000	1,097,200
Nonagricultural	862,700	1,189,000
Total	23,951,100	23,951,100

The demand for land for industrial, commercial, and urban residential site development in the sub-region is projected to be about 238,000 acres by 2020. The estimates are based on population and employment projections (Benchmarks, see Section I this chapter and Appendix E) and allow 24 workers per acre for manufacturing, 10 per acre for transportation, 30 per acre for trades, and 150 per acre for services. Residential land needs are based on 15 persons per acre. Analysis indicates

sufficient land of suitable gradient and location will be available for industrial development only. However, those lands are not well distributed within areas of projected need. It is obvious that new residents of the sub-region will have to live on small tracts, or multiple family dwellings, or in upland areas such as the flat ridge areas above the Greenbrier River.

Water Supply

Current and projected water supply estimates for Sub-region G are given on Table 14-3. Water supply "needs" (the increment of "demand" over the available 1980 supply) are given in Table 14-3 and portrayed graphically in Figure 14-3.

Table 14-3 shows that the estimated daily demand for domestic water in 1960 was about 200 mgd, and the total manufacturing intake was about 1,550 mgd. In the year 2020, it is estimated that total daily demands for water supply in Sub-region G will be about 8,795 mgd. The annual runoff of the area is on the order of 60,000 mgd. Estimated water supply needs in Tables 14-10, 14-11, and subsequent tables vary from those

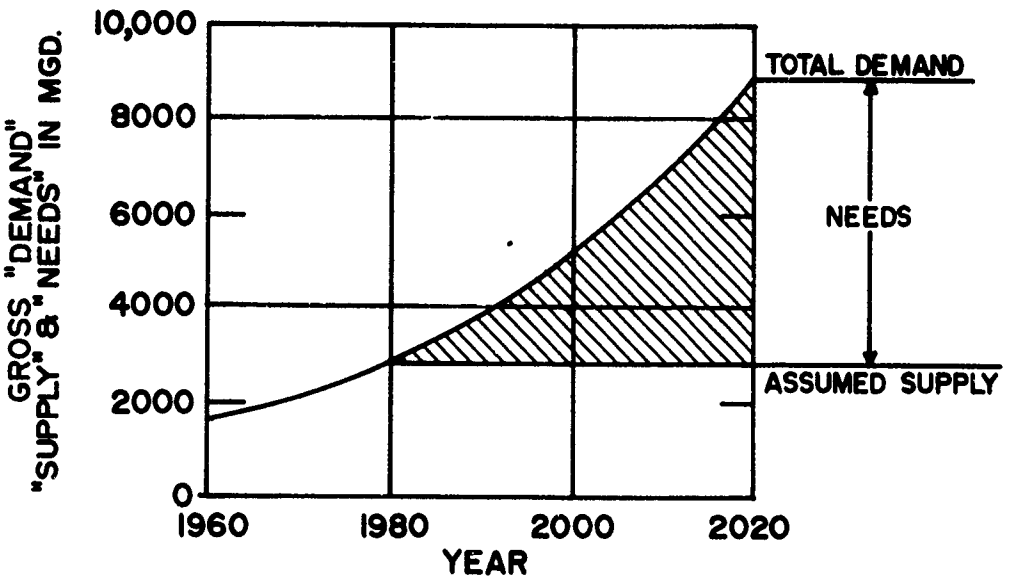

FIG. 14-3 "WATER SUPPLY","DEMAND" AND "NEEDS"
SUB-REGION G

TABLE 14-3
ESTIMATED GROSS WATER DEMANDS AND NEEDS
FOR SUB-REGION G (IN MGD)[a]

YEAR	GROSS MANUFACTURING DEMAND			DOMESTIC[b]			TOTAL URBAN DEMAND	NEEDS[c]	RURAL USE[d]
	SURFACE	GROUND	TOTAL	SURFACE	GROUND	TOTAL			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1960	1,490	60	1,550	163	37	200	1,750	0	60
1980	2,360	90	2,450	240	50	290	2,740	0	66
2000	4,590	170	4,760	350	60	410	5,170	2,430	71
2020	7,920	310	8,230	480	85	565	8,795	6,055	78

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a/ SOURCE: Appendix D by FWPCA and reports by Kentucky, Ohio, Virginia and West Virginia. The distribution between ground and surface water sources is also based on State and Federal Surveys and projections.

b/ Per capita consumption estimated at 85 gallons in 1960
100 gallons in 1980
107 gallons in 2000
115 gallons in 2020, based on Southeast River Basin Report.

c/ Increment between 1980 demand which is assumed to be "supply" and gross needs.

d/ Includes irrigation, livestock and household uses.

estimated by the Federal Water Pollution Control Administration in Appendix D. The procedures outlined in Appendix D were followed exactly; however, more recent estimates, especially those in Virginia, were used when they were based on projections from actual field studies. An example of the estimates derived for this report follows:

TABLE 14-4
WATER NEEDS GROWTH AREA 6

	Municipal Use			Manufacturing Use (Self Supplied)			Total
Year	Pop.a/	Gallons Per Capita Per Day b/	Use (MGD)	Manuf. Employment c/	Water Use Per Employee GPD	Use (MGD)	Municipal & Manuf. Use (MGD)
1960	430,700	90	39	37,700	8,250	311	350
1980	478,500	100	48	47,200	11,900	560	608
2000	611,500	107	66	64,800	17,500	1,134	1,200
2020	865,900	115	100	99,000	23,200	2,300	2,400

a/ Huntington-Ashland SMSA, actual and projected totals.
b/ From Appendix D values (exclusive of industrial uses).
c/ Employment adjusted to reflect the percentage of employment.

It should be recognized that the procedures outlined in Appendix D, are a general and broad scope approach which should not be used when a more exact definition of potential development based on detailed studies is available. More detailed studies are being undertaken in the Kanawha Comprehensive Study and in the future may be undertaken in other areas. The results of this study may lead to different estimates for water supply in various areas.

The 1967 Conservation Needs Inventory (USDA) indicates over a third of all watersheds in Sub-region G contain or lie above areas with municipal and industrial water supply needs. The 35 upstream watersheds investigated revealed municipal and industrial water supply needs in the following:

Location No.	Watershed and River Basin	State	Needs Location
9	Federal Valley (Hocking)	Ohio	Amesville, Ohio
12	Moxahala-Jonathan Creek (Muskingum)	Ohio	Roseville, Ohio
16	Wolf Creek (Muskingum)	Ohio	Pennsville-Chesterhill Area
76	Headwaters Holston River (Tenn)	Virginia	Saltville, Va.
83	Mate Creek (Tug Fk-B. Sandy)	W. Va.	Matewan
42	Little Stony Creek (Kan.)	Virginia	Giles County
74	Mill Creek (Kan.)	Virginia	Town of Narrows
48	Peak Creek (Kan.)	Virginia	Town of Pulaski
19	Ansted Creek (Kan.)	W. Va.	Ansted (future)
21*	Beaver Creek (Kan.)	W. Va.	Downstream
25	Cherry River (Kan.)	W. Va.	Richwood Area
36*	Howard Creek (Kan.)	W. Va.	White Sulphur Springs (suppl.)
39	Kelly's Creek (Kan.)	W. Va.	Community of Mammoth (future)
90	Mill Creek (Ohio)	W. Va.	Ripley
52*	Piney Creek (Kan.)	W. Va.	Beckley Area
65	Gypsy Hill (Kan.)	W. Va.	Ronceverte Area (future)
61	Quick Branch - Slack (Kan.)	W. Va.	Town of Quick
6*	Upper Bluestone River (Kan.)	Virginia	Bluefield Area

* Water Quality.

The aggregate demand values presented in Table 14-3 appear to be adequate indicators of the magnitude of water needs. However, for more detailed analysis, another approach was adopted to reflect the spatial distribution and availability of ground and surface water supplies. For this analysis the estimate of gross water needs by growth centers over time was related to the supply of potable water which could reasonably be expected to be available to each growth center by 1980. This analysis required a judgment of both quality and quantity availability. Both factors were introduced as constraints on available supply. Then the differences between gross needs and available supplies were calculated to indicate the magnitude of additional water supply sources which should be developed to meet the regional development objectives.

Table 14-5 presents the estimated gross demands for water by growth centers as of 1980, 2000, and 2020. The increment between gross demand in 2020 and dependable supply expected to be available in 1980 is referred to as unmet needs in Table 14-6 (Page 14-30), and the subject for planning studies outlined later.

TABLE 14-5
ESTIMATED GROSS NEEDS FOR WATER SUPPLY IN MGD
GROWTH CENTERS IN WATER SUB-REGION G

ITEM	1980	2000	2020
OHIO - Water Area G-1			
Muskingum River Basin			
Growth Area 1	111	244	413
New Philadelphia-Cambridge-Zanesville (P)			
Coshocton Co. (P)			
Malta-McConnellsville (S)			
Hocking River Basin			
Growth Area 2	29	62	118
Logan-Athens (P)			
OHIO - Water Area G-2			
Scioto River Basin			
Growth Area 3	131	230	517
Chillicothe (P)			
Jackson (P)			
Hillsboro-Greenfield (S)			
Little Miami-Whiteoak Creek & Other Ohio River Tributaries			
Growth Area 4	30	58	94
Clermont Co. (+ Brown Co.)			
OHIO - WEST VIRGINIA - Water Areas G-1 and G-3			
Ohio River Upper Main Stem			
Growth Area 5	91	402	700
Parkersburg, W. Va. (P)			
Marietta, O. (P)			
Spencer, W. Va. (S)			
Granville, W. Va. (S)			

TABLE 14-5 (Cont'd.)
ESTIMATED GROSS NEEDS FOR WATER SUPPLY IN MGD
GROWTH CENTERS IN WATER SUB-REGION G

ITEM	1980	2000	2020
OHIO - WEST VIRGINIA - KENTUCKY - Water Area G-2			
Ohio River Lower Main Stem			
Growth Area 6	608	1,200	2,400
Huntington, W. Va. - Ashland, Ky. (SMSA)			
Gallipolis, O. (S)			
Portsmouth-Ironton, O (P)			
Point Pleasant, W. Va. (P)			
Milton, W. Va. (S)			
Hamlin - W. Hamlin, W. Va. (S)			
WEST VIRGINIA - Water Area G-5			
Tygart River (Monongahela R. Basin)			
Growth Area 7	11	17	45
Elkins-Buckhannon-Phillippi			
VIRGINIA - Water Area G-5			
New River Basin			
Growth Area 8	170	276	436
Galax-Hillsville (P)			
Marion-Wytheville (P)			
Pulaski-Parrott (P)			
Pearisburg-Narrows (S)			
WEST VIRGINIA - Water Area G-5			
New River Basin (Kanawha)			
Growth Area 9	109	143	218
Lewisburg-Ronceverte-White			
Sulphur Springs (P)			
Marlinton (S)			
Summerville-Richwood (S)			
Sutton-Gassaway (S)			
Bluefield-Princeton (P)			
Beckley (P)			
Hinton (S)			
Oak Hill-Mt. Hope (S)			
Montgomery (P)			
Kanawha River Basin			
Growth Area 10	1,300	2,256	3,360
Charleston (P)			

TABLE 14-5 (Cont'd.)
ESTIMATED GROSS NEEDS FOR WATER SUPPLY IN MGD
GROWTH CENTERS IN WATER SUB-REGION G

ITEM	1980	2000	2020
WEST VIRGINIA - KENTUCKY			
Big Sandy & Guyandotte R. Basins - Water Area G-4			
Growth Area 11	57	108	179
Williamson, W. Va. - S. Williamson, Ky. (P)			
Welch, W. Va. (P)			
Pineville-Mullins, W. Va. (S)			
Logan, W. Va. (P)			
KENTUCKY - Water Areas G-2 & G-4			
Big Sandy & Licking River Basins			
Growth Area 12	43	70	108
Pikeville-Prestonsburg-Paintsville (P)			
Salyersville (P)			
Midlands (P)			
Morehead (S)			

TABLE 14-6
WATER SUPPLY NEEDS, AVAILABLE SUPPLY AND UNMET NEEDS
WATER SUB-REGION G

ITEM	GROSS DEMAND (2020) MGD	DEPENDABLE SUPPLY-MGD (By 1980)	UNMET NEEDS
Growth Area 1	413	150	263
2	118	93	25
3	517	250	267
4	94	40	54
5	700	91	609 1/
6	2,400	608	1,792 1/
7	45	11	34
8	436	170	266
9	218	109	109
10	3,360	850	2,490
11	179	57	122
12	108	43	65

1/ All industrial water supply needs can be met by Ohio River water after Pittsburgh Area & Kanawha R. Basin quality needs are satisfied.

Maintenance of Stream Quality

The establishment and maintenance of stream classification standards is primarily a state function, but a Federal interest is exerted through the Federal Water Pollution Control Administration (FWPCA) of the Department of Interior. All water resource planning must be concerned with maintaining water quality. In recent years State requirements for waste treatment have induced a large investment in treatment facilities. Heavy investments in such facilities are expected to continue; but even so, it is expected that additional water will have to be provided in certain streams to prevent nuisances arising during periods of low flow. (Especially true at Chillicothe, Ohio - after 1984 - and Charleston, West Virginia - beginning now.)

Projected stream waste loadings for Sub-region G are given in Appendix D of this report, as determined by the FWPCA. The Appendix shows that untreated waste loadings, expressed in millions of population-equivalents were 11.3 in 1960 and will be 21.4, 36.5, and 51.1 in 1980, 2000, and 2020, respectively. These figures refer to loadings before treatment, and are specific indicators of the investment required in new treatment facilities. While the Appendix does not pinpoint specific problem areas, certain problem areas have been studied separately in some detail by the FWPCA.*/

Many programs of the U.S. Department of Agriculture play an important role in the maintenance of stream quality. Particularly important are those programs concerned with development of upstream watersheds, the proper use of all land, and its treatment and management to control erosion and reduce sediment. There are five principal programs:

a. Upstream Watershed Program (PL-566).

b. Technical assistance by the Soil Conservation Service to individual landowner, operator, or user in determining proper land use and planning, and installing the needed conservation practices and measures and technical assistance on forest land by State Foresters in cooperation with U.S. Forest Service.

* Appendix D, Water Supply and Water Pollution Control, Federal Water Pollution Control Administration.

All needs for water quality control have been converted from flow requirements at selected stations to storage requirements in acre-feet by estimating deficiencies from a mass curve, and assuming that the storage would be located above the point of need and in an impoundment which would have adequate inflows to refill annually.

c. Cost sharing by the Agricultural Stabilization and Conservation Service with landowners and operators for carrying out needed conservation practices and measures, under either ACP or Section 203, PL 89-4.

d. Water development and soil conservation loans by the Farmers Home Administration to landowners and operators in putting into effect basic soil and water conservation plans.

e. Multiple Use Management on National Forests - emphasis is needed on proper land use and those conservation measures and practices to stabilize eroding gullies, channels, roadbanks, ditches, strip-mine spoil, and new residential, industrial, and highway construction, and to improve all vegetative cover. These programs can help provide water quality management in the sub-region. Table 14-9 (Page 14-96), compares water quality needs, alternatives and needs satisfaction by growth areas.

Pollution from Acid Mine Drainage

The tributary waters of every major stream in Water Sub-region G are affected adversely by acid mine drainage. It is not within the scope of this report to present solutions - because programs for control of such pollution are now being evolved; however, the extent of damage will be noted for each area in Paragraph 9. Salt in stream waters is a major pollutant in some river basins. (See Appendix C.)

Power

A discussion concerning electric power needs, probable future installation of generation capacity, and cooling water needs for the Appalachian Region, on a regional basis, is contained in Chapter 4 of Part I. Anyone seeking detailed information can find it in Appendix B to this report, "Power Supply and Requirements."

Recreation

A huge deficit in unsatisfied demand for outdoor recreation opportunities is expected by the year 1980 in Sub-region G. The "demand" is estimated to be 37,900,000 recreation days (1980) which would require about 283,000 acres of water to meet the needs for boating, swimming, camping, picnicking, hunting and fishing. The Appendices prepared by the Bureau of Outdoor Recreation and the Fish and Wildlife Service present a detailed discussion and additional projections to the year 2020. (See Appendices F and G).

Information from these appendices has been summarized and graphically shown in Figure 14-4. Note that all activities have been reduced to a common measure - man-days annually. Again, the Figure shows "needs," as previously defined, and as explained in the footnotes. A separate chart is shown for the water using portion of outdoor recreation needs. Since the emphasis in this report is on water resources, it is necessary to recognize that certain activities require a rather definite water surface area, while others are less directly related to water surface. A summary of water using recreation needs and means for their satisfaction considered in this report is presented in Table 14-10 (Page 14-97). Needs are the increment between demand in 1980 and 2020. Needs by Water Sub-region and Growth Area are discussed in Paragraph 9.

Development of additional public and private outdoor recreation facilities can be accelerated through various programs of the U.S. Department of Agriculture. Increased technical and financial assistance to landowners, operators, small rural and urban groups, and others cooperating with soil conservation districts can accelerate land use conversion to, and development of, recreation areas.

It should be noted that the provision of recreational opportunities is the responsibility of many entities - Federal, state, municipal, county, and private.

Other and Summary

There are bank stabilization problems along some streams in the surface coal mining areas (Coal River, e.g.).

The demand for inland navigation routes is generally being satisfied by the Ohio River system of locks and dams, and the three locks on the Kanawha River. The slackwater reaches of the Big Sandy, Little Kanawha and Muskingum Rivers along the Ohio River are used by commercial freighters (tugs and barges).

Insect and vector control are necessary public health measures in conjunction with the construction of water resource projects, and the necessary measures are generally made an integral part of project operations. With increased demand for, and availability of, recreational areas, a great deal of effort will have to go into controlling terrestrial arthropods and rodents in such areas.

Water resource related needs are shown for each growth area in Table 14-11 and subsequent tables. The footnotes explain the underlying assumptions. The needs are those of growth areas and not restricted to growth centers.

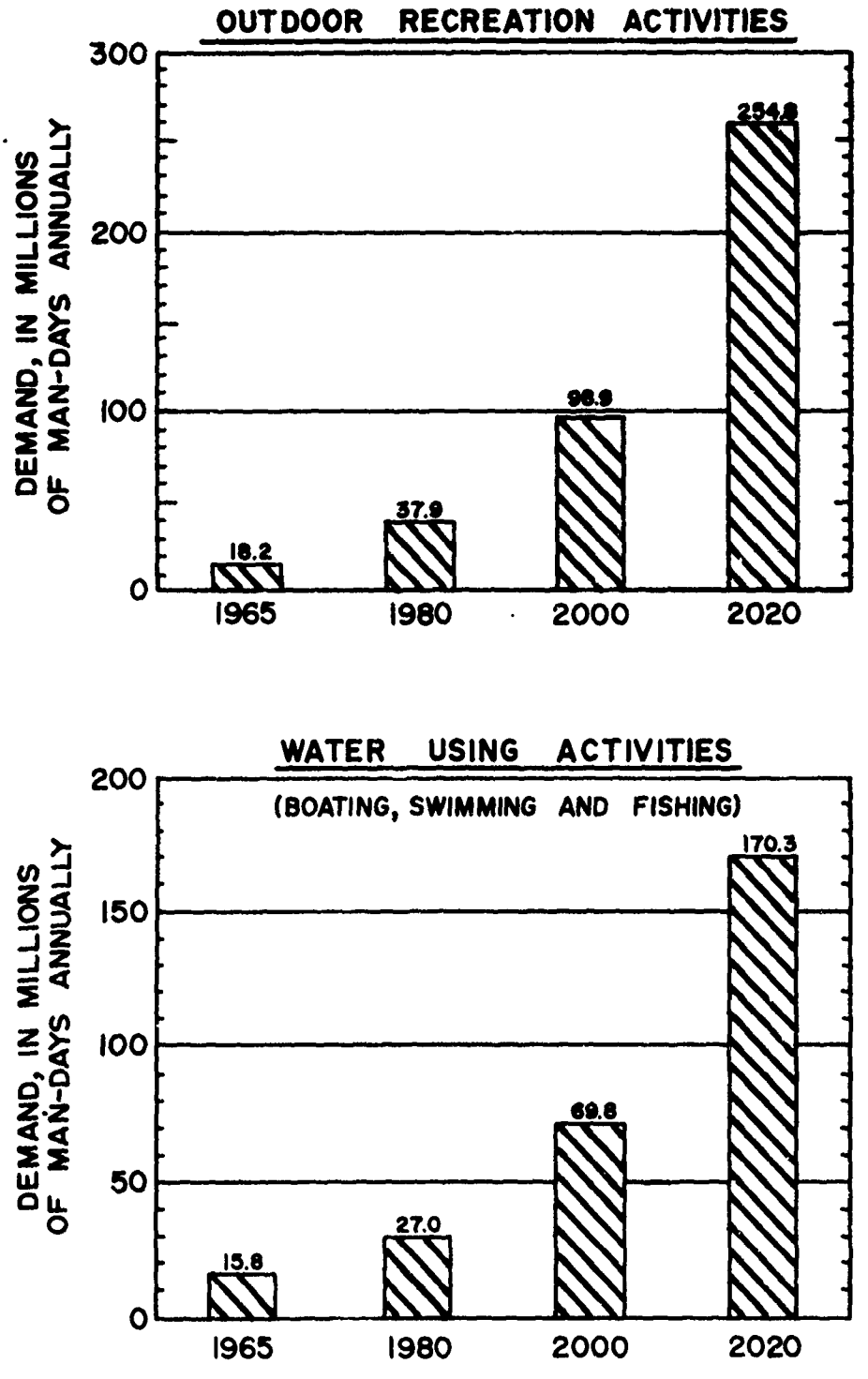


Figure 14-4 Projected Demand for Water-Using & Outdoor Recreation Opportunities in Water Sub-Region G.

9. WATER RESOURCE NEEDS BY WATER AREAS

The water needs previously discussed for Sub-region G were disaggregated to Water Areas. The State Planning Sub-regions do not follow river basin divisions. However, the data has been disaggregated to represent only those parts of State Planning Sub-regions within Water Areas. The Water Area boundaries generally follow river basin divisions; therefore, the pattern of data presentation covers river basin areas very well.

Water Area G-1

Water Area G-1 (15 southeastern Ohio counties) contains 4,410 square miles of the lower reaches of the Muskingum River Basin; 910 square miles of the Hocking Basin; all of the Shade (221 square miles) and Little Muskingum Rivers (315 square miles); about 148 square miles in Leading Creek Watershed; Duck Creek, with 288 square miles; Sunfish Creek, with 114 square miles; Little Hocking's 142 square miles; and large areas of small Ohio River Tributaries plus upland areas of Raccoon Creek and Scioto River (122 square miles) drainage areas.

The Water Area includes State Planning Sub-regions 11 and 12 except for Jefferson County in 11 and Belmont County in 12, which are discussed with Water Sub-region F. Figure 14-5 indicates the magnitude of population and employment implied by the developmental benchmark objectives.

Water Area G-1 contains the Primary Growth Centers of New Philadelphia, Zanesville, Cambridge, Athens and Coshocton, and Malta-McConnelsville Secondary Growth Center.

Employment for Water Area G-1 in 2020, projected in the developmental benchmarks, will be nearly three times the 1960 employment. To meet the demand for land additional industrial and commercial sites will need to be developed. Land to meet housing and commercial needs for the population, projected to more than double by 2020, must also be developed. The greater portion of the unidentified future needs in Water Area G-1 are expected to be associated with the two primary growth areas.

A large share of the unsatisfied demand for outdoor recreation in the Sub-region will be in Water Area G-1. Even with the recreational development associated with the Muskingum Reservoirs, the needs in Water Area G-1 are great because of the population density within the zone of influence. Fishing needs in Water Area G-1 were estimated in excess of 700,000 man-days in 1964. This unfulfilled need is expected to double by the year 2000 and continue to increase thereafter. Hunting needs are expected to exceed 400,000 man-days by 2020. The projected needs for water based recreation is 34,000,000 man-days by 2020.

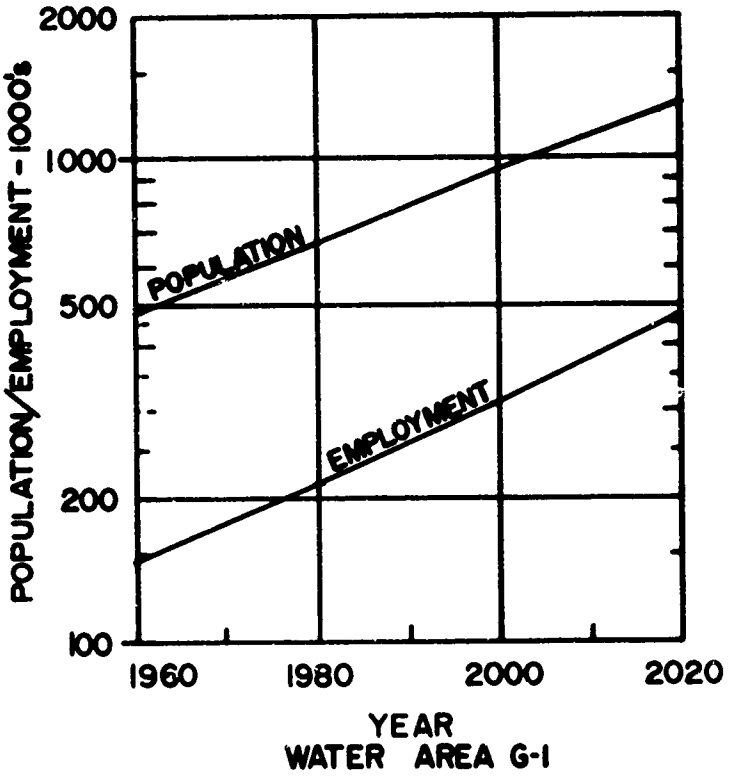


Figure 14-5. Population/Employment, Actual and Projected, Water Area G-1.

Water supply needs as determined by Federal Water Pollution Control Administration follow:

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-1

Year	Million Gallons per Day
1960	80
1980	200
2000	420
2020	710

There are potential water quality problems in Water Area G-1. The discharge of chlorides from industrial processes adversely affects the entire length of the Tuscarawas and Muskingum Rivers. Untreated waste loadings for Water Area G-1, as determined by the Federal Water Pollution Control Administration are shown in the following tabulation.

UNTREATED WASTE LOADINGS ACCRUING FROM
BENCHMARK GOALS IN WATER AREA G-1

Year	Population Equivalents (Thousands)
1960	490
1980	810
2000	1,400
2020	2,250

Growth Area Number 1

Growth Area Number 1 includes most of the Muskingum River Basin in Appalachia. New Philadelphia, Cambridge, Zanesville and Coshocton are the Primary Growth Centers. Malta-McConnelsville in Morgan County is the Secondary Growth Center. Tuscarawas, Guernsey, Muskingum, Coshocton, and Morgan Counties are included in Growth Area No. 1. Needs in Harrison, Carroll, Holmes and in parts of Perry and Noble Counties were considered in the evaluations. Washington County, with its principal City of Marietta, is included in Growth Area No. 5.

The Muskingum River Conservancy District was organized after the terrible floods of 1913. By 1938, the Conservancy District and the Corps of Engineers had built a system of flood control structures which they felt were adequate for the entire basin. More recently, the Corps of Engineers has supplemented the system in the lower reaches with Dillon Reservoir on the Licking River, which was completed in 1961.

Storms in recent years, especially one below Senacaville Reservoir above Cambridge, have resulted in reconsideration of the flood needs of the basin. The Division of Water of the Ohio Department of Natural Resources has recently published the findings of one such study. The Huntington District of the Corps of Engineers is conducting more exhaustive studies, in cooperation with other agencies, as to the total needs of the basin. Upstream and mainstream flood control needs, storage of water for quality improvement, water supply sources, and special studies concerned with treatment of stream waters for hardness and salt content are some of the needs being analyzed.

Many streams in the Muskingum River Basin are affected by coal mine drainage. Moxahala Creek and tributaries have the most serious acid mine drainage problem. Other polluted streams are tributary to the Tuscarawas and Walhonding Rivers and Wills Creek in Coshocton, Tuscarawas and Muskingum Counties.

The increased area of land needed for growth at New Philadelphia will be 7,400 acres by 2020. Industrial development will require 1,380 additional acres. New Philadelphia, which is on the Tuscarawas River, will need approximately 80 mgd of new water supply. In addition, flood control measures to remove or decrease the present $20,000 annual damage will be required. There is a major pollution problem caused by industrial wastes. Cambridge, on Wills Creek, has a pollution problem also. Water supplies which will increase by 2020 will be satisfied from Salt Fork Reservoir. There is damage from local tributary flooding and from Wills Creek (a total of $4,000 average annually) which should be removed. Residential areas in Cambridge will increase by 2,600 acres by 2020 (520 acres industrial). Zanesville, on the main stem of the Muskingum, has major flood damages ($55,000 average annually) in spite of the protection from the recently completed Dillon Reservoir. In addition, an increase of 142 mgd of municipal and industrial water will have to be made available by 2020 if growth is to reach projected levels. Areas totalling 8,600 acres (2,300 acres industrial) will need to be developed for the orderly expansion of Zanesville.

Coshocton will need an increase in municipal water supply of 31 mgd by 2020 and 3,500 acres (1,050 acres industrial) of new lands developed. The Malta-McConnelsville water supply for municipal and industrial uses will have to be increased 10 mgd between 1980 and 2020. Lands needed for expansion total 1,500 acres, of which 650 acres will be for industrial growth.

Growth Area Number 2

Growth Area Number 2, Hocking River in Appalachia, includes Athens and Hocking Counties with Logan-Athens their primary growth center. Tributary flows from Perry and Morgan Counties were considered in the analyses. Past efforts to control flooding in the Hocking River Basin have resulted in alleviation of flooding in certain areas but have provided little protection along the main stem where the greatest and most recurring damages are experienced. The Tom Jenkins Reservoir on the East Branch of Sunday Creek, completed by the Corps of Engineers in 1951, controls about 33 square miles of drainage area and provides the town of Glouster and rural communities in the Sunday Creek Valley with a substantial degree of protection. It provides only minor flood reductions along the Hocking River. The Upper Hocking Upstream Watershed Project of the United States Department of Agriculture, a "Pilot Watershed", includes nine flood water retarding structures and some channel improvements which substantially alleviate flooding in the basin at, and upstream from Lancaster, Ohio. The Soil

Conservation Service has claimed no flood control benefits along the river below Lancaster in its economic evaluation of the watershed plan. The USDA also has watershed projects for Rush Creek and Margaret Creek Basins approved for construction. Local interests also have submitted an application for assistance under Public Law 566 for the drainage area of the Hocking River above the mouth of Rush Creek. The study area, designated as the North Hocking Watershed, would incorporate the completed Upper Hocking projects. Major flood damages occur in the Federal Valley Creek area and, to a lesser extent, along Sunday Creek. The present annual upstream damages of $350,000 will be decreased to $215,000 by the Rush Creek and Margaret Creek programs (by 1980).

Practically all present flood damages to improvements along the Hocking River, which now average $516,000 annually, are confined to the 55-mile stretch of the main stem between Guysville and Rockbridge. Approximately 72 percent of the damages to improvements occur at Athens with the smaller cities of Logan and Nelsonville sustaining 13 and 8 percent, respectively. The remaining 7 percent is distributed throughout the rural reaches. These rural reaches also sustain the majority of crop damages within the basin, which averages about $96,000 annually.

The flood problem at Athens is particularly acute. The wide and relatively flat flood plain, crossed by several highways and railroads, would normally be conducive to extensive urban development; however, most of the development at Athens lies on the moderate to steep slopes surrounding the relatively undeveloped bottom land. Because of the scarcity of suitable building sites in the flood-free sections of Athens, a large number of residences and commercial, industrial and institutional establishments encroach upon the flood plain of the river. About one-third of the area at Athens inundated by the flood of March 1964 has been developed in this manner. This recent flood on the Hocking River inundated approximately 1,300 acres within the area immediately adjacent to the city of Athens. Very recently, in May 1968, the Hocking River had its severest recorded flood which reached a crest stage of 24.63 feet at Athens. The March 1907 flood, the greatest known flood, reached a height of 27.4 feet, or about 3.2 feet higher than the 1964 flood and about 2.8 feet higher than the 1968 flood. It flooded about 40 percent of the area presently within the corporate limits of Athens. Seven lives were lost and a number of the inhabitants lost their homes. Substantial damages have occurred during several other floods in this century, including the floods of March 1913, January 1937, March 1945 and March 1963, which reached stages of 24.2 feet, 23.4 feet, 23.7 feet and 23.1 feet, respectively, on the Athens gage.

The expansion of facilities to accommodate the rapidly increasing enrollment of Ohio University has been seriously hampered in the past few years. The unavailability of flood-free land has forced the University to develop well into the flood plain. Their most recently constructed facilities are subject to some flooding on the average of about once every 15 years. Most of the land available for future construction is subject to flooding more frequently than once in ten years.

The local protection project for Athens, authorized by Congress in 1965, will consist of channel straightening and widening throughout the city, and will prevent about 86.0 percent of the total average annual damages at Athens, currently estimated to be $368,800 (on a July 1968 level of development). Similar improvements are planned at Logan, Nelsonville and Rockbridge. Total remaining damages to existing development throughout the Hocking River Valley after 1980 will average $520,000 a year after construction of the four local protection projects and the two watershed systems. There will still be major flood control needs from Logan down, on the main stem and on the tributary streams noted above. The uncontrolled flows from the Hocking River add significantly to the flood heights along the Ohio River.

Additional flows of 15 cfs will be needed for waste dilution at Athens. Coal reserves are present in three quarters of the basin. In 1965, 1,600,000 tons were produced. Surface recoverable coal reserve is estimated at over one billion tons, representing a substantial potential for continued and expanded coal production. The FWPCA estimates that an acid load of 200 tons per day is discharged into the basin's streams and that the load will increase to 990 tons per day by the year 2020 unless corrective measures are taken. However, the FWPCA also estimates that acid mine drainage loads can be reduced 80 percent through regulatory control measures for active operations and a physical abatement program for inactive operations. If this magnitude of reduction is achieved, it is expected that the basin's streams will be able to assimilate the residual loads without any significant quality disturbance.

Most of the river's major tributaries, especially Sunday, Monday and Federal Creeks and the upper reaches of Rush Creek, are heavily polluted with acid mine drainage. These streams also carry high concentrations of sulfates, metals and hardness. Outflow from these streams into the mainstem of the Hocking River is insufficiently diluted to provide an acceptable quality. The only major tributary of the Hocking River with acceptable quality is Clear Creek which has a maximum hardness during extremely low flow conditions of 150 milligrams per liter (mg/l) in contrast to the maximum hardness of 700 mg/l in the Hocking River at Athens.

Hardness and high iron content exist in most of the surface waters of the basin including the main stem of the Hocking River. These undesirable qualities in combination with the severe and widespread acid mine drainage in certain areas necessitate extremely expensive water treatment for municipal and/or industrial use. Well fields have been established as the primary water source along the main stem of the Hocking River. The existing ground water suppy is of fairly good quality; however, they have a high degree of hardness and iron content requiring comparatively high treatment costs. Since the development of water supply in the Tom Jenkins Reservoir, no communities in the immediate area of that reservoir have chronic water supply deficiencies. Lancaster's present underground source has a hardness which has been steadily increasing and currently is in excess of 400 mg/l. The present low quality of the Hocking River water at Lancaster (above Appalachia) precludes economical direct withdrawal from the river. Solutions to the Lancaster water supply deficiency (24 mgd) are key elements in any plan.

The people at Logan will need 1,000 additional developed acres, all for industrial expansion between now and 2020. The Athens city area will need to be increased by 6,200 acres, including 1,350 acres for industrial expansion. Slightly over one-fourth of the needed industrial areas are identified on Figure 14-10 Section III. Local leaders will have to be "growth conscious" if the area is to expand as forecast.

Water Area G-2

Water Area G-2 (eleven counties in southern Ohio plus four western West Virginia and seven eastern Kentucky counties) contains 2,033 square miles of the lower Scioto River Basin and about 550 square miles of the Little Miami River in Ohio. In addition, it contains most of Raccoon Creek (about 575 square miles) and all of Symmes Creek (356 square miles), Pine Creek (185 square miles), Little Scioto River (233 square miles), Ohio Brush Creek (435 square miles), and Whiteoak Creek (234 square miles). There are over 1,000 square miles of lesser tributary areas in Ohio. In Kentucky, the Water Area includes about 600 square miles of the Licking River; about 400 square miles of Big Sandy Basin; and all of the Little Sandy River Basin (721 square miles); Kinniconick Creek (235 square miles), and Tygart Creek Basins (339 square miles). The West Virginia portion of Water Area G-2 includes about 100 square miles of the Big Sandy River Basin; 700 square miles of the Guyandotte Basin; most of Twelvepole Creek Watershed (400 square miles); about 150 square miles of the Kanawha River Basin and over 500 square miles drained by small, direct Ohio River tributaries.

The Water Area contains State Planning Sub-regions 13 in Ohio, 15 in West Virginia and 36A (part), 36B (part) and 34 in Kentucky. Figure 14-6 indicates the magnitude of population and employment implied by the developmental benchmark objectives.

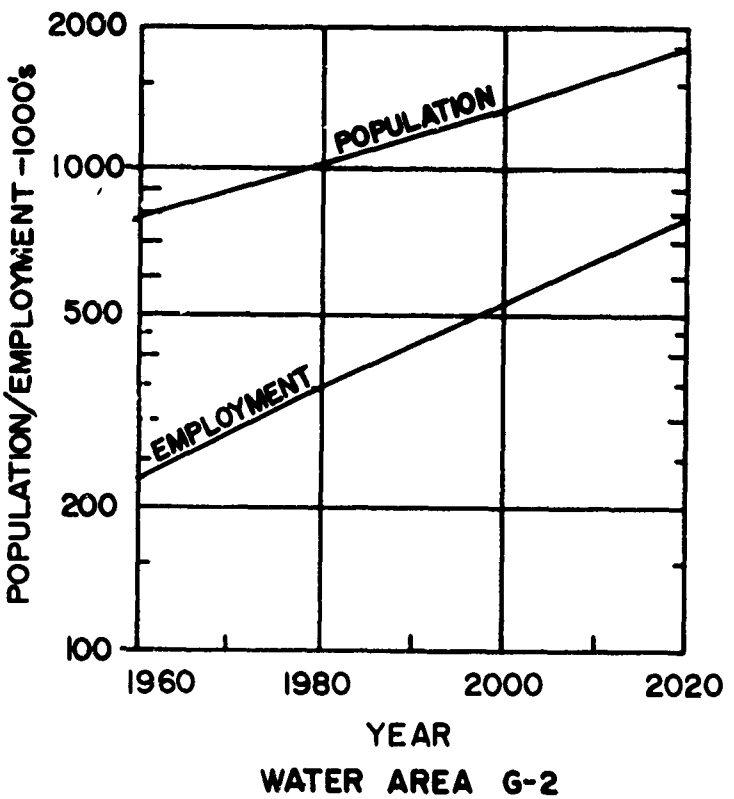


Figure 14-6. Population/Employment, Actual and Projected, Water Area G-2.

Water Area G-2 contains the Chillicothe-Portsmouth-Ironton Primary Growth Centers and the Hillsboro-Greenfield, Gallipolis and Clermont County Secondary Growth Centers, all in Ohio. The Chillicothe-Portsmouth-Ironton center extends downstream along the Scioto River to the Ohio River. The Water area also contains part of the Huntington-Ashland SMSA and the Morehead Secondary Growth Center and will include part of the Midland Primary Growth Center, a "newtown" proposal.

Water supply needs, and waste loadings for Water Area G-2 are shown below.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-2

Year	Million Gallons per Day
1960	460
1980	800
2000	1,550
2020	3,100

UNTREATED WASTE LOADINGS ACCRUING FROM BENCHMARK
GOALS IN WATER AREA G-2

Year	Population Equivalents (Thousands)
1960	1,200
1980	2,500
2000	5,300
2020	13,300

Employment in Water Area G-2 in 1960 was greater than in the other water areas and is projected to nearly triple, under developmental benchmarks, by 2020. Additional lands must be developed to meet the demand for the new and expanding enterprises supporting this employment. With population projected to increase to about two and one-half times the 1980 population by 2020, additional lands must be developed to provide the necessary housing and associated needs. It is anticipated that the greater portion of the unidentified future needs will be related to the two primary growth centers.

The metropolitan areas of Cincinnati, Dayton, Springfield, and Columbus, Ohio lie just beyond G-2 and contribute heavily to demand for outdoor recreational opportunities. Water oriented facilities are limited in quantity in the area. Fishing needs in G-2 in 1964 were estimated to be well over 800,000 man-days. This need is expected to

lessen somewhat in the near future, but to be over 1,800,000 by 2020. Hunting needs are expected to increase to over 1,200,000 by 2020. Total water related recreation needs (over 1980 supply) will be about 40,000,000 man-days by 2020.

Growth Area Number 3

The Scioto River basin is the principal drainage system of central Ohio and contains all or parts of 29 counties. The watershed is in the form of a rectangle about 50 miles wide and 135 miles long which drains 6,510 square miles (2,033 square miles in Appalachia). The Appalachian part of the basin includes the lower 80 miles of the mainstem along with the lower tributaries. Salt Creek and Paint Creek are major tributaries which flow southwest and almost due east, respectively, to join the Scioto River in the lower portion of the basin.

The evaluation of needs includes those in Vinton County, as well as those in the growth area counties of Ross, Highland, Pike and Jackson.

Chillicothe, the primary growth center, is located on the Scioto River about 65 miles above the mouth. Other towns and villages along the lower main stem include Piketon in Pike County, and Portsmouth, which is located at the mouth of Scioto River on the Ohio River, in Growth Area 6.

The City of Chillicothe is located in the east central part of Ross County, along the right descending bank of the Scioto River, 69 miles above the mouth. Chillicothe is the County Seat of Ross County and has an excellent balance between industry within the city and agricultural activity in the surrounding area. Paint Creek, a major tributary of Scioto River, flows along the southern edge of the city. Two railroads, U.S. Highways Nos. 23, 35, and 50, and State Routes Nos. 104, 207, and 772, serve the city.

The record flood of March 1913 inundated seventy-five percent of the city and caused damages in excess of one million dollars. Eighteen lives were lost at Chillicothe as a direct result of this flood. It is estimated that damages in excess of $30,000,000 would result from recurrence of a flood equivalent in height to that of March 1913. The January 1959 flood waters, which did not approach the stage or discharge of the 1913 flood, caused damages estimated to be in excess of 2,800,000 dollars. A low section of a natural barrier between the Scioto River and a large sand and gravel operation on the northeast side of the city washed out, diverting part of the stream flow overland through the east side residential section. Damages on the east side of

Chillicothe in January 1959 resulted from the flooding of 779 houses, three small manufacturing plants, two schools, and seven churches. Considerable damage was caused to the property of three utility companies and to streets and sewers.

Approximately eighty to eighty-five percent of the flooded area along the Scioto River and its principal tributaries is devoted to agriculture. Rural improvements are generally located on the first terrace or on even higher ground and are subject to flooding only from major floods. However, many highway and railway structures, fences, outbuildings and other rural improvements are within the reach of frequent floods and suffer major damage. Crop losses are significant throughout the entire length of the stream.

The farm lands flooded represent some of the most highly productive land in the Scioto Valley. Principal crops include corn, wheat, oats, soybeans and hay. Crops common to the "Scioto Marsh" area above Kenton are onions, hybrid seed corn, potatoes and a variety of truck farm vegetables. An estimate of the proportion of bottom land devoted to various crops is contained in Appendix A.

Local interests have constructed levees along various reaches of the Scioto River and some of the major tributaries to protect the rural areas. However, very little maintenance has been performed on these levees and they are generally in a state of disrepair. These levees offer little protection from major floods, and would require complete replacement if substantial protection were to be provided.

Total average annual flood damages in the Scioto Basin in Growth Area 3 are 869,000 dollars. That estimate is based on the premise that five major reservoirs, upstream reservoirs and Paint Creek and Salt Creek Reservoirs are complete. (Scioto County is in Growth Area 6). The major damage center is Chillicothe, in central Ross County. That Primary Growth Center, which is expected to continue dominating the area economically, has annual damages which average 300,000 dollars. Installation of the authorized local protection project will prevent $240,000 in damages. Flood damages in Jackson average about $2,000 a year. The remaining $587,000 average annual damages occur as $380,000 in upstream areas and $187,000 along downstream reaches.

All of the above damages are remaining needs with Paint Creek Reservoir, Salt Creek Reservoir and Clear Creek (of Rocky Fork) Watershed Program in place (1980). They were computed assuming the planned Corps of Engineers five-dam system upstream (Delaware, Big Darby, Millcreek, Alum Creek and Deer Creek Reservoirs) to be in place. There are other major storage sites available above Chillicothe.

If the area is to grow to national levels by the year 2020, Chillicothe water supplies will have to be increased 240 mgd: Jackson needs a 7 mgd increase and the Hillsboro-Greenfield supply should be increased 10 mgd. All of those increases are needed, in addition to expected expansion by 1980, to bring the water supply total capacity to 517 mgd.

Water storage for maintenance of stream quality is the key to economic growth in the area. It has been estimated that there could be over 25,000 people employed in paper manufacturing in Chillicothe by 2020. Such manufacturing activity would greatly increase water needs. If stream low flow could be intercepted in its entirety, there would still be net needs of over 250 mgd in 2020 to meet the 800+ cfs requirement. In addition, the dilution storage needs above Chillicothe would be over 500,000 acre-feet. It appears that tertiary treatment of waste will be necessary if the expansion is to take place. If water dilution needs at Columbus (780 cfs) are met by upstream storage and the stream water were to recover its DO (dissolved oxygen) above Chillicothe, the benchmark goals might be met with only secondary waste treatment. There are water quality needs in Highland County at Hillsboro, on Rocky Fork, and Greenfield, in the Paint Creek Basin (6,000 AF-Q).

There are no major mine drainage pollution problems in the streams of the lower Scioto River.

The Chillicothe urban area will be increased by 11,000 acres by 2020, if benchmark objectives are realized. Of that area 2,020 acres will be developed for industrial uses. Jackson will expand by 2,800 acres (600 acres industrial) and Hillsboro-Greenfield will expand 5,200 acres in area (600 industrial).

Growth Area Number 4

The streams which influence Growth Area 4 are Whiteoak Creek in Brown County, Ohio and the East Fork of the Little Miami River in Clermont County.

Whiteoak Creek Basin rises in Highland County, Ohio, and flows in a southerly direction for approximately 62 miles to its confluence with the Ohio River near Higginsport, Ohio, 424.0 river miles below Pittsburgh, Pennsylvania, and approximately 46 miles upstream from Cincinnati, Ohio. Whiteoak Creek watershed lies adjacent to Ohio Brush Creek Basin on the east and Little Miami River Basin on the west.

Whiteoak Creek Basin has a drainage area of 234 square miles and is roughly fan-shaped. The drainage basin is approximately 30

miles in length; averages 12 miles in width in the northern portion; and necks down to approximately 4 miles in width in the southern part.

About 60 percent of the Whiteoak Creek Basin has inadequate ground water supply; generally, yields are less than 5 gallons per minute (gpm). Generally, water wells must be supplemented by cisterns to provide an adequate domestic water supply. The northwestern portion of the basin has slightly more abundant ground water and wells can produce yields of 5 to 25 gpm.

The larger upstream communities in the basin utilize water supply from Whiteoak Creek or its tributaries in conjunction with offstream storage reservoirs. The streams in the Whiteoak Basin, as in neighboring basins, carry away the municipal and industrial wastes. Georgetown and Mt. Orab are the only communities in the basin having municipal sewage treatment plants. The impervious Illinoian soil found in the basin makes home sewage disposal systems extremely difficult to construct properly. As the area develops it will become imperative for all communities and built-up areas to provide adequate treatment for their waste in order to maintain adequate water quality in Whiteoak Creek.

Due to the characteristics of the stream banks and the general topography of the area, flood damages to improvements in the Whiteoak Creek Basin are very minor. Most towns in the basin, though located near the streams, occupy fairly high ground. Agricultural damages occur primarily in the headwater areas.

Water resources development is important to the economic development of Brown County. Brown County is rural in nature. Eighty-nine percent of its 1966 population of 27,000 was classified as rural. The county's population, even though it has increased in recent years, has not kept pace with national population growth. The area has a small surplus of labor caused by underemployment in agriculture and low participation rates, especially for females. About 2,100 persons were employed in agriculture in 1960. The largest source of employment, other than agriculture, is manufacturing which had slightly less than 2,100 employees in 1960. Significant numbers of workers commute to the Cincinnati area. In 1962, the county's per capita income (1954 dollars) was $1,380, which is considerably less than the state and national figures. Value added by manufacturing has decreased in recent years.

The existing pattern of slow growth with income and employment well below the state average, will probably continue unless efforts are made to stimulate economic growth. Increased growth could not be accommodated with the limited water supply sources now developed.

Ground water supplies are so limited that further significant development of sub-surface sources would be extremely difficult. Although the industrial base is small and opportunities for local employment are limited, there is a large amount of relatively flat land available for industry and commerce and an excellent transportation network. The prime industrial sites (which may be pre-empted for non-industrial purposes unless protective measures are taken) are presently undeveloped farm lands lying between the Norfolk and Western Railway and State Route 32, and between the railroad and the proposed Appalachian Corridor D highway. Consideration of these and all other factors contributing to economic growth potential clearly pointed to the lack of adequate water supplies as the primary physical restraint, if not the only restraint, to economic growth. That restraint to growth in Brown County reveals the direct role water resources development can play in economic development. In Brown County, economic growth would not be dependent on other phases of water resources development although development of water oriented recreation facilities and provision of stream flow augmentation for water quality control would enhance environmental quality, thereby indirectly influencing economic growth.

The projected water needs for economic development within the Whiteoak Creek Basin are reduction of the $49,000 average annual upstream flood damages; the storage of water supply sufficient to yield 7.9 mgd by 2020; and storage of water to assure 7 cfs minimum stream flow at Georgetown by 2020 and 14.3 cfs by 2075.

Waters of the East Fork of the Little Miami River have a major part in economic development of Clermont County.

The Little Miami River rises in Clark County, not far from South Charleston. The main stem passes through Clark, Greene, Warren, and Hamilton Counties. The Little Miami has three principal tributaries: Caesar Creek, Todd Fork, and East Fork. East Fork has a basin area of 500.7 square miles; it drains portions of Clinton, Warren, Highland, Brown, and Clermont Counties.

During the recent past the expansion of the Cincinnati Metropolitan Area has been the dominant economic mover in the area. The opening of such new centers as Grants Park and the building of trade schools, along with the desire of people to flee the inner city are causing the acceleration of growth in Clermont County (a secondary growth area).

The Little Miami River flows through the suburbs of Cincinnati and could create a health hazard if allowed to become degraded during normal periods of low flow. There are also recreation, esthetic, and fish and wildlife benefits that could be derived from stream flow regulation of the Little Miami River. High water quality must be maintained.

Ground water is generally in short supply in the East Fork Basin. Drilled wells usually yield less than 5 gpm. Surface water is available in fairly large quantities in the area; however, in order to make the supply dependable, provision for storage must be made. There will be a tremendous future need for water supply in the area.

The total average annual flood damages within the East Fork of Little Miami River are 483,000 dollars. The downstream damages are $273,000 a year and the upstream damages are 210,000 dollars. The critical damage centers are Batavia and Milford. There is a need for storage water quality control at Milford and on down through the Cincinnati area. About 40 mgd of increased water supply will be needed for growth by 2020 (in addition to Brown County needs and those to be satisfied by East Fork Reservoir).

The construction and operation of the East Fork Dam and Reservoir above Batavia will provide a water supply of 25 mgd. There will be sufficient storage of water to keep the stream flow above 150 cfs, as recommended by FWPCA for 2060. An ultimate annual capacity of 2,659,000 recreation visitor days is provided. The only remaining major water needs in the basin after 1980 will be control of flooding in the upstream tributaries and more water based recreation developments. The O'Bannon Creek Watershed is a possible recreation area. Cincinnati will still need increased water supply.

There are needs for increasing urban areas by 12,200 acres (1,600 acres industrial) in Clermont County, and 3,600 acres (650 acres industrial) in Brown County.

Water Area G-3

Water Area G-3 (11 West Virginia counties) lies along the Kanawha and Ohio Rivers. The area includes aobut 1,900 square miles of the Kanawha Basin, 1780 square miles (77 percent) of the Little Kanawha Basin and about 750 square miles of direct Ohio River tributaries (and flood plain). The principal direct tributaries included are Middle Island Creek in Tyler County and Mill Creek in Jackson County.

The water Area includes State Planning Sub-regions 14 and 16. Figure 14-7 indicates the magnitude of population and employment implied by the developmental benchmark objectives.

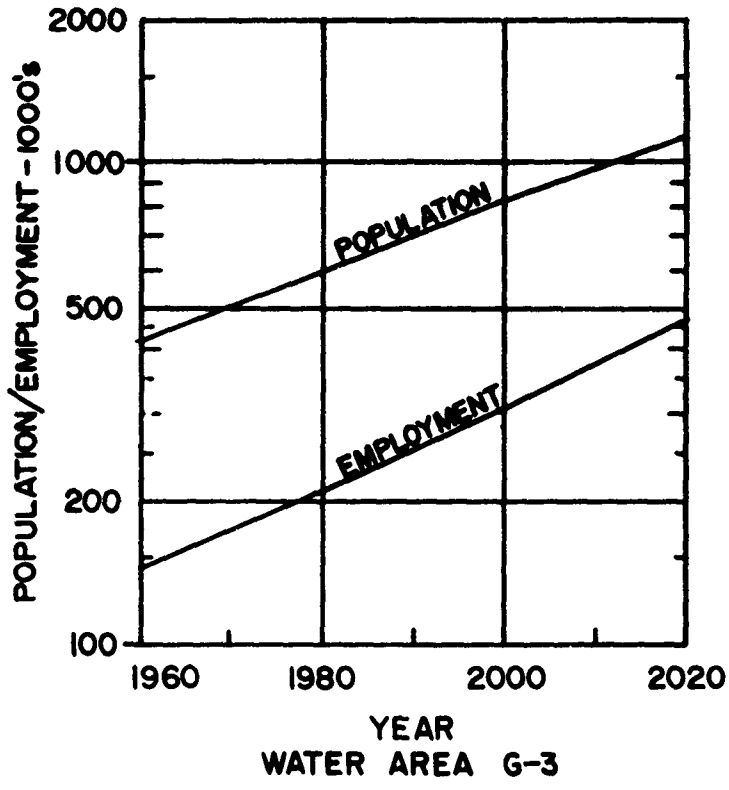


Figure 14-7. Population/Employment, Actual and Projected, Water Area G-3.

Water supply needs and untreated waste loadings are shown below.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-3

Year	Million Gallons per Day
1960	1,050
1980	1,400
2000	2,600
2020	4,400

UNTREATED WASTE LOADINGS ACCRUING FROM
BENCHMARK GOALS IN WATER AREA G-3

Year	Population Equivalents (Thousands)
1960	9,200
1980	17,300
2000	28,600
2020	33,100

Employment in the area is projected to have the greatest increase of the five water areas. Based on the developmental benchmarks, the 2020 employment would be more than three times the 1980 employment. In the same time frame, population is projected to increase more than two and one-half times. Additional land must be developed to allow this growth to take place. In the Kanawha Valley, where developable lands are in limited supply, land use should be planned for optimum development. It is anticipated that most of the unidentified future needs will occur in the vicinity of the two primary growth areas.

Much of the generated demand for additional outdoor recreational opportunities will come from this area. With the absence of impoundments, the natural streams provide the major source of water oriented recreation. Fishing needs for Water Area G-3 were estimated to exceed 800,000 in 1964 and are projected to more than double by 2020. Hunting needs are expected to reach 1,300,000 by 2020. The total needs (2020-1980) will be about 41,000,000 man-days.

Most of Growth Area 5 and all of Growth Area 10 are in Water Sub-region G-3.

Growth Area Number 5

The Upper Ohio River main stem in Water Sub-region G has primary growth centers at Parkersburg, West Virginia and Marietta, Ohio, and secondary growth centers at Spencer and Grantsville, West Virginia. Annual flood damages along the entire reach average $4,084,000 per year. The downstream or main stem damages are $515,000 in the Parkersburg area: $248,000 ($110,000 in Marietta) in the Marietta reach, and $1,000,000 additional along the river.

The principal tributary stream in the Upper Ohio River Mainstem Water Sub-region G area is the Little Kanawha River. About 440 square miles of the basin is within Water Sub-region F; the total basin is discussed here, however.

The Little Kanawha River rises in the extreme southern portion of Upshur County, and flows in a generally northwestern direction a distance of approximately 167 miles to join the Ohio River at Parkersburg. It lies wholly within the State of West Virginia and extends in a northwesterly direction from its headwaters in central West Virginia to Parkersburg, West Virginia, on the Ohio River. The Little Kanawha drainage area includes all of Calhoun, Gilmer, Ritchie, and Wirt Counties, the greater part of Braxton, Roane and Wood Counties. The drainage area is roughly diamond-shaped, its greatest length, from north-northeast to southwest.

Parkersburg is at the mouth of the stream; there are no other large towns in the Little Kanawha River Basin. The principal economic

pursuits of the Basin are gas and oil production, agriculture, coal mining, manufacturing and lumbering.

Wood County, in which Parkersburg is located, is by far the most populous of the basin counties and the greater portion of its area and population are contained in the Little Kanawha Watershed.

The damages at Parkersburg result from local runoff and Ohio River flows in areas not protected by the local protection projects. Pond Run floodwaters cause average annual damages of 219,000 dollars. Downstream damages in the Little Kanawha Basin average $137,000 (above Parkersburg) annually. Upstream damages average $780,000 per year.

There is need for water quality improvement in the lower reaches of the Little Kanawha River. The needs of Grantsville (56,000 AF) could be met by the authorized West Fork and Leading Creek Lakes. Spencer will need dilution water (4,000 AF). Spencer and Grantsville will need more municipal water (4 mgd total) if they are to grow. Major future water supply needs (481 mgd) and water quality needs (6,000 mgd) at Parkersburg can be met from Ohio River flows after 1980 if the West Virginia Water Quality Standards are met.

Bond Creek Watershed Project (USDA) and Cairo LPP are functioning now. By 1980 Saltlick Creek Watershed Project will be in place. Burnsville, West Fork and Leading Creek Lakes (CE), will be complete by 1980. These projects will provide flood control, water quality control, and recreational development. There will still be need for flood control works ($730,000 annual flood damages), primarily on headwater and tributary streams.

The Little Muskingum River drains 315 square miles in Washington and Monroe Counties, Ohio. The watershed lies almost entirely within the Wayne National Forest and has excellent recreation development opportunities.

Duck Creek, with its two major tributaries - East Fork and West Fork, drains 288 square miles of Guernsey, Monroe, Noble and Washington Counties, Ohio.

Major flood damages, which occur in the West Fork and in the east edge of Marietta will be mitigated by 1980 by the planned upstream measures.

Middle Island Creek in Tyler and Pleasants Counties, West Virginia is outside the Growth Area. There are both upstream and downstream flood control needs within the basin.

The lower end of the Muskingum Basin (Water Area G-1) is included in Growth Area 5 because of the intimate relationship of the economy of Marietta and other river towns. Major flood control and

water supply needs (124 mgd) must be met for economic growth. Upstream damages in Wolf Creek (231 square miles) are a deterrent to growth at Beverly which is a satellite community to Marietta.

Tributary damages along the north bank of the Ohio River near Marietta average $201,000 per year. That total includes $79,000 in the West Fork Duck Creek Watershed, $46,500 in Wolf Creek, as well as those damages in the East Fork of Duck Creek and along the Little Muskingum River. The $984,000 damages in other small tributaries along the Ohio River include over $100,000 in the Mill Creek (upper) Watershed (W. Va.). The Mill Creek Watershed project will be complete by 1980.

Action is needed in tributary streams above Marietta, and there is a need for an increase in recreation facilities in the area. Some local protection measures are needed at Belpre and Marietta. Major impoundments in the Hocking or Muskingum River Basins would result in reductions in flood stage along the Ohio River.

The water supply needs at Marietta (124 mgd) can be met from Ohio River waters if present ORSANCO goals are met; however, alternate short term supplies may be needed.

The waters of the Shade River (221 square miles) and Leading Creek (151 square miles) in Meigs and Athens Counties, Ohio intermittently carry acid mine drainage into the Ohio River. There is pollution from acid mine drainage within the Little Muskingum River Basin. The effects of local flooding within the watersheds does not seem to extend to the river.

The Ohio River will continue to serve as a major source of water-oriented recreation if quality standards are reached and maintained. Considerable additional recreational opportunity will be provided by completion of authorized reservoirs in the basin.

There will be an additional need of 26,200 acres in Growth Area 5 for urban expansion. It is estimated that Parkersburg, West Virginia, will expand by 16,700 acres; 2,090 acres for industrial expansion is included in the total. Marietta, Ohio will expand by 7,600 acres (2,000 acres industrial). Spencer and Grantsville, West Virginia will expand by 400 acres and 200 acres, respectively. All of the listed areas are predicated on expansion to reach national economic levels by 2020.

NOTE: Growth Area 10 (Kanawha River) in Water Area G-3 will be discussed in proper sequence with the entire Kanawha River system. The principal needs include a mitigation of major flood damages at Charleston, West Virginia and extensive water quality control measures above Charleston.

Growth Area Number 6

Growth Area 6, Lower Ohio River Mainstream in Water Sub-region G, is a seven-county area entirely within Water Area G-2. Developmental needs relate to Lawrence County, Kentucky in G-4 as well as those in Elliott, Greenup and Lewis Counties, Kentucky and in Adams County, Ohio, within G-4, but outside the growth area. The growth area is discussed after Growth Area 5 to provide hydrologic continuity. The growth area includes the mainstem of the Ohio River from Racine Lock to the west boundary of Clermont County.

A discussion of the water and related needs of the lower 150 square miles of the Kanawha Basin will follow in the Growth Area 10 narrative.

Point Pleasant, West Virginia, a primary growth center, is at the confluence of the Kanawha and Ohio Rivers. Point Pleasant is protected by a floodwall from floodwaters of the two rivers. The city lies along the pool of the Gallipolis Lock on the Ohio River and below the Winfield Lock on the Kanawha River. There is a residual annual flood damage of $180,000 (1965). A need for 16 mgd of new industrial water and 5 mgd of new municipal water after 1980 will be satisfied from Ohio River waters. Major flood damages occur at unprotected Gallipolis, Ohio. New water supply of 11 mgd and dilution water at Gallipolis will come from the Ohio River.

The Guyandotte River tributary, Mud River, is in Growth Area 6. The Guyandotte mainstem was studied with Growth Area 11. The Mud River, with a drainage area of 358 square miles, rises in Boone County, West Virginia. It flows northward in the Hamlin area, in Lincoln County. Annual flood damages at Hamlin total about 30,000 dollars. There will be a need for additional water supply of about 0.5 mgd for both Hamlin and West Hamlin after 1980. Farther on Guyandotte River mainstem north, the stream passes through Milton, another secondary growth center. Average annual flood damages there are an estimated $20,000; new water sources with a 2 mgd yield is needed for future growth. Annual upstream flood damges (Lincoln County) average about 230,000 dollars. The Mud River flows west from Milton to its junction with the Guyandotte River at River Mile 7.2 at Barboursville, within the Huntington-Ashland SMSA. Bank erosion at Barboursville has been stabilized by a Corps project.

Huntington, West Virginia, lies at the juncture of the Guyandotte and Ohio River (RM 304.6). The City of Huntington, which is between the Greenup and Gallipolis Locks on the Ohio River, is protected by an LPP and extensive flood control works in the Ohio Basin. The residual annual flood damages are $342,000 in the city. The Huntington Reach of the Ohio River has additional average annual damages of 283,000 dollars. Average annual damages along the small tributaries around Huntington total about 50,000 dollars.

The upstream damages along Raccoon and Indian Guyan Creeks in Ohio are minor. However, Raccoon Creek is contaminated by acid mine drainage.

Fourpole Creek now has an LPP (CE) in place and flooding will be mitigated by a complete upstream watershed program (USDA) by 1980.

Twelvepole Creek (440 square miles) is located in Cabell, Wayne, Mingo and Lincoln Counties, West Virginia. There are no growth areas in the basin; however, the lower end is within the Huntington-Ashland SMSA. All major mainstem flood damages will be removed by the Beech Fork and East Lynn Reservoirs. Upstream damages will still be high on small tributaries.

There will be no water needs along the lower Big Sandy River (less than $11,000 average annual flood damages) after Yatesville and Paintsville Reservoirs are completed.

The Little Sandy River (721 square miles) lies in Greenup, Boyd, Carter, Lawrence, Elliott and Rowan Counties, Kentucky. The basin has a rectangular shape 17 miles by 42 miles. The major tributaries are East Fork and Little Fork.

There are two projects, Grayson Reservoir (CE), now completed and Little Fork of Little Sandy Watershed project (USDA), which will be in place by 1980. Grahn and Hitchens LPP's are completed. There will be further need for protection in the East Fork area. Greenbo Lake (Kentucky) is in place. The watershed lies within the Huntington-Ashland SMSA.

The Tygarts Creek Basin lies in Carter and Greenup Counties, Kentucky. It is 42 miles by 8 miles and has a drainage area of 339 square miles. The lower reaches lie outside the growth area. Olive Hill LPP is completed; Kehoe Reservoir is expected to be completed by 1980. There is a remaining upstream flood problem on Buffalo Creek and above Kehoe Reservoir.

Kinniconick Creek (outside Growth Area 6 but in SMSA area of influence) is located in Lewis County, Kentucky. It drains 253 square miles. There is a need for flood protection within the watershed (agricultural) and there is a site for flood storage to reduce Ohio River flood damages.

Symmes Creek (356 square miles) is located in Lawrence, Gallia and Jackson Counties, Ohio. Damages within the basin are moderate but sites for satisfying needs for Ohio River flood reduction, recreation facilities and flow augmentation are available. Acid mine drainage pollution is widespread in the basin.

In place by 1980 will be Kehoe Reservoir on Tygarts Creek, Grayson Reservoir, and Little Fork-Little Sandy Watershed (47,000 damage

reduction) will be in place in the Little Sandy River Basin. Additional upstream protection in East Fork Little Sandy Watershed would reduce damages $25,000 more to a net of about $150,000 a year. Tygarts Creek will have residual damages of $60,000 a year. East Lynn and Beechfork Lakes will be in place on Twelvepole Creek; the West Fork will be unprotected. Fourpole Creek will be protected by upstream watershed measures.

Upstream areas of Little Sandy River, Kinniconick, Eagle Creek, Symmes Creek, Indian Guyan Creek, Raccoon Creek, Leading Creek, Tygarts Creek, Twelvepole Creek, and other minor tributaries will have an average annual flood damage of $470,000 after 1980.

Ashland, Kentucky (SMSA) and Ironton, Ohio (primary) are both protected by Local Protection Projects; there is still extensive flood damage from Ohio River flows, and greater possible damage could result as these cities expand areally into uncompleted areas. The average annual flood damages remaining are: $1,045,000 at Ironton and $127,000 at Ashland. The demand for new water supplies of 1,520 mgd at Ashland and 225 mgd at Ironton can be satisfied from the Ohio River if ORSANCO goals for 1980 are met.

Pine Creek Watershed Project (USDA) near Portsmouth, Ohio, will be complete; it will reduce annual flood damages 73,000 dollars.

Watershed measures in the Little Scioto River (which would reduce flood damages by about $24,000 a year) are needed. Studies should continue at Lucasville, Ohio, (Project Scioto), on the Scioto River, with the goal of aiding local development plans. A Local Protection Project (Corps) along the Scioto and an Upstream Watershed Project for Miller Run, along with Appalachian Corridor B, should effectively remove constraints to economic growth at Lucasville.

Ohio River average annual mainstem flooding other than listed above totals $1,568,000 (1980). Total average annual flood damages in Growth Area 6 are $927,000 upstream and $4,893,000 downstream.

There will be an expansion of urban areas in Growth Area 6 by 43,800 acres by year 2020 if economic levels reach national standards. The major needs will be for new housing areas. Huntington, W. Va. will expand by 13,600 acres (200 acres industrial). Ashland, Kentucky will expand by 8,300 acres (2,550 acres industrial). Gallipolis, Ohio will need 2,100 acres (200 acres industrial). Portsmouth, Ohio will need 4,500 acres (800 acres industrial). Ironton, Ohio will need 6,500 acres (1,180 acres industrial). Milton, W. Va. will expand by 800 acres (200 industrial). Hamlin-W. Hamlin will need 1,200 acres (70 acres industrial). Other towns will need 1,700 acres (900 industrial).

Water Area G-5

Water Area G-5 discussion precedes that of G-4 because of its upstream position (Ohio River).

Water Area G-5 (fifteen counties in southeastern West Virginia and eight counties in southwestern Virginia) is drained to the northeast by the Monongahela River (2,060 square miles) and to the northwest by tributaries of the Kanawha River (about 9,300 square miles). The principal tributaries to the Kanawha River in the water area are the New, Greenbrier, Gauley and Elk Rivers. Small areas of the Guyandotte Basin (about 50 square miles); about 450 square miles of the Tennessee River Basin (Smyth County, Virginia) and the headwaters of the Pee Dee River are in the water area.

State Planning Sub-regions 20 and 21 in West Virginia, and 26 and 27 in Virginia are in G-5. Figure 14-8 shows the benchmark objectives for the area.

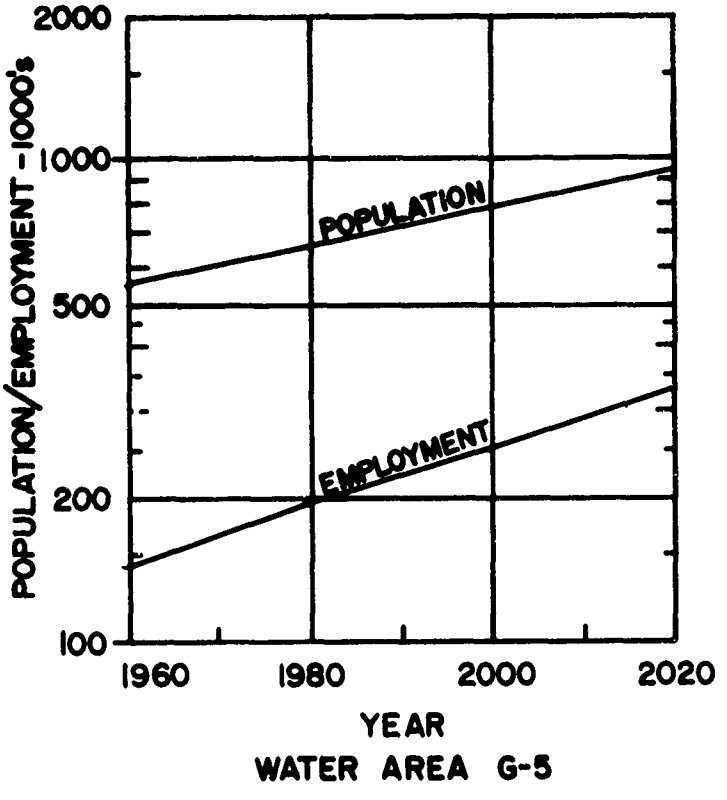


Figure 14-8. Population/Employment, Actual and Projected, Water Area G-5.

There are six areas classified as Primary Growth Centers; they are the Elkins-Buckhannon-Phillippi, Lewisburg-Ronceverte-White Sulphur Springs, Bluefield-Princeton, Beckley and Montgomery Growth Centers in West Virginia and the Pulaski-Parrott (near Radford) Growth Center in Virginia. The eight Secondary Growth Centers include the Sutton-Gassaway, Marlinton, Summersville-Richwood, Hinton and Oak Hill-Mt. Hope Growth Centers of West Virginia and the Galax-Hillsville, Marion-Wytheville and Pearisburg Narrows Growth Centers of Virginia.

Water supply needs and untreated waste loadings as projected by FWPCA in 1966 are shown below.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-5

Year	Million Gallons per Day
1960	100
1980	170
2000	200
2020	300

UNTREATED WASTE LOADINGS ACCURING FROM
BENCHMARK GOALS IN WATER AREA G-5

Year	Population Equivalents (1000's)
1960	300
1980	470
2000	700
2020	1,150

Water resources planning personnel of the Commonwealth of Virginia have made intensive studies of the industrial expansion that is anticipated by the industries of this growth area. This study indicated that the industries now expect their water needs to be much greater than was evident when the 1966 studies were made by FWPCA. The needs developed in this recent study are tabulated below.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-5

Year	Million Gallons per Day
1960	170
1980	290
2000	435
2020	690

A major share of the sub-region's tremendous demand for outdoor recreational opportunities will originate in this water area. The net amount of fishing needs for Water Area G-5, which were about 650,000 man-days in 1964, are expected to decline slightly by 1980, overall, but will amost double by 2020. Unfulfilled hunting needs are projected to be over 500,000 man-days by 2020. Total recreation needs by 2020 will be 21,000,000 man-days.

Most of this water area is within the Kanawha River Basin, for which a comprehensive study is to be completed in 1970. Water resource needs will be determined with greater specificity during the study.

Growth Area Number 7

Only the needs within the Elkins-Buckhannon-Philippi Primary Growth Center (Tygart River) were evaluated in detail. The total Monongahela River Basin discussion is in Chapter 12 of Part II.

The Tygart River rises on the Pocahontas-Randolph County line in northeastern West Virginia. The main stream flows northward to Elkins, county seat of Randolph County, and thence, northwest through Philippi, to the Tygart River Reservoir in northern Barbour County. The principal tributaries are Middle Fork and Buckhannon Rivers. Present average annual flood damages in the Tygart River Basin (W. Va.) are about $178,000 in upstream areas and $82,000 downstream (260,000 total). Major damage at Elkins has been mitigated by a Local Protection Project (CE). There are major upstream damages above Elkins and Buckhannon and on small direct tributaries. There are mainstream flood damages at Buckhannon and downstream through Philippi. Average annual flood damages will be decreased $70,000 by 1980 with the installation of the Buckhannon LPP (CE) and the Pecks Run and Shooks Run Upstream Watershed Programs (USDA) to $173,000 a year on the average.

There is a need for flow augmentation for water quality improvement at all three cities. Storage to increase low flow by 6 cfs at Elkins and Buckhannon (to 14 cfs) would also meet the requirements at Philippi (15 cfs total) through natural recovery of quality (oxygen) as the water flows northward. A storage of 2,000 acre-feet - 1,000 acre-feet above each city should satisfy the needs.

It is estimated that economic growth of the area can proceed to national levels if the municipal and industrial water supply of 11 mgd forecast for 1980 is further augmented by 29 mgd between 1980 and 2020. Elkins will need an increase of 13 mgd to support local industry and increased population. Buckhannon supply will need to be increased by 12 mgd and Philippi supply will need an increase of 4 mgd.

The urban area of Elkins will need 1,800 acres additional area; about 400 acres of that will be needed for industrial development. The Buckhannon and Philippi urban areas will need to be expanded by 1,700 acres (100 acres industrial) and 1,000 (100 acres industrial) acres, respectively. There is land adequate for industrial expansion, but residential areas must be very densely settled or located in the steep hill areas around the growth centers.

Growth Area Number 8

The area of the New River Basin considered is known as the Upper New River Basin which extends from the Bluestone Dam near Hinton, West Virginia, to the headwaters of its North and South Forks in northwestern North Carolina near Blowing Rock. (North Carolina is in Sub-regions D and J). New River flows from its headwaters in Watauga County through Ashe and Alleghany Counties in North Carolina to the confluence of its North and South Forks. From the North Carolina-Virginia boundary line it flows northeasterly to Radford and then northwesterly to Glen Lyn where it leaves Virginia and enters West Virginia. This reach of the river drains 4,634 square miles or approximately 38 percent of the Kanawha River Basin. It is bounded by the basins of the James and Roanoke Rivers to the east, the Big Sandy and Tennessee Rivers to the west and the Catawba and Yadkin Rivers to the south. The Kanawha River, into which it flows to the northwest, empties into the Ohio River at Point Pleasant, West Virginia.

Of the 4,634 square miles drainage area in the Upper New River Basin above Bluestone Dam, 770 square miles are in North Carolina, 3,070 in Virginia, and 794 in West Virginia. The length of the Upper New River Basin is 115 miles from Blowing Rock, North Carolina to Bluestone Dam near Hinton, West Virginia. The maximum width of the Basin is 70 miles in the area from Rural Retreat, Virginia, to the Floyd County-Franklin County (Virginia) line near the headwaters of Little River.

There are ten tributaries in the Upper New River Basin each having more than 100 square miles in drainage area and many others of forty or more square miles. They are Wolf Creek, Walker Creek, Reed Creek, Peak Creek, Cripple Creek, Big Reed Island Creek, Little River in Floyd County, Virginia, Little River in Grayson County, Virginia and Allegheny County, North Carolina, in Growth Area 8 and Bluestone River and Indian Creek in Growth Area 9. In general, these tributaries have steep, irregular profiles through narrow, winding valleys. There are many rapids and small waterfalls in the larger tributaries. Due to the nature of the underlying limestone, there is a great amount of seepage of water into the streambeds of several of the tributaries, some creeks sink completely during certain periods of the year.

The primary growth centers in the growth area are Hillsville-Galax; Marion-Wytheville on the Holston River (Tennessee River) and Reed Creek, respectively; and Pulaski-Parrott on the mainstem and Peak Creek, respectively. The Secondary Growth Area is Pearisburg-Narrows.

There is a water quality problem on Little Reed Island Creek below Hillsville. A minimum flow of 20 cfs (total) will have to be provided for to keep the stream pure. There is a water quality problem below Pulaski on Peak Creek. A minimum flow of 35 cfs (total) will be required to keep the stream pure. A water quality problem is expected to develop in the Pearisburg-Narrows reach which require supplemental flows to maintain 1,200 cfs minimum flows.

Hillsville and Galax will need an 81 mgd increased water supply after 1980. Marion and Wytheville will need improved water supply of 55 mgd and 30 mgd, respectively, to reach national growth levels.

The Pulaski-Parrott Primary Growth Center will need 60 mgd of new water supplies by 2020. The Pearisburg-Narrows Secondary Growth Center will need a 40 mgd increase in water supply.

The major mainstem flooding occurs in the reach between Claytor Dam and Bluestone Lake, with damages averaging about $62,000 annually. About half of the mainstem damages are in the Pearisburg-Narrows area. Total upstream damages are estimated to amount to about $513,000 per year with about $100,000 of that amount being in North Carolina.

Outside the growth area, needs have been identified for pollution control on the North Fork of Holston River above Saltville (15 cfs) and for flood control ($60,000 average annual damages) for the South Fork of Roanoke River.

The Appalachian Power Company has one major hydroelectric power facility (Claytor Lake) and two relatively small run-of-river power projects (Buck and Byllesby Plants) on New River. A small private hydroelectric power plant (Washington Mills) is in operation on New River at Fries, Virginia. Other facilities are also operating.

Urban centers in the growth area will expand 22,500 acres by 2020. The Galax-Hillsville Center will grow by 5,100 acres (1,300 acres industrial); the Marion-Wytheville Center will increase 4,900 acres (1,100 acres industrial) in area; the Pulaski-Parrott Center will need 6,400 acres (900 acres industrial); and Pearisburg-Narrows will expand 4,900 acres (700 acres industrial).

Growth Area Number 9

The Kanawha River tributaries growth area includes all of the New River tributaries from the Virginia-West Virginia State Line to

its confluence with the Gauley River to form the Kanawha River. The growth area actually includes about 10 miles of the Kanawha River mainstem.

A major upstream tributary is the Bluestone River, which empties into Bluestone Lake in its lower reaches. The Bluefield (Va. and W. Va.) - Princeton Primary Growth Center is in the Bluestone Basin. The present average annual flood damages in the Basin are 545,000 dollars. Most of that ($523,000) occurs in the Upper Bluestone River and along tributaries. Flood damages will be reduced about $215,000 average each year by 1980 with the installation of projects in Jumping Branch Watershed (RC&D - USDA), Upper Bluestone River Watershed, and Brush Creek Watershed. The present condition does not include damages being prevented by the completed Bramwell, Montcalm, and Princeton LPP's and Daves Fork-Christians Fork Upstream Watershed Project. There will be a need for 23 cfs minimum flow for quality control below Bluefield (Va. and W. Va.). The Bluefield-Princeton Growth Area will need about 30 mgd increase in municipal and industrial water supply after 1980. There will be a need for 400 acres of developable land in addition to the 1980 city need.

The Greenbrier River Basin includes the Marlinton Secondary Growth Center and the Lewisburg-Ronceverte-White Sulphur Springs Primary Growth Center. Both areas need water storage for quality control (15 cfs minimum flow at Marlinton and 5 cfs minimum flow on Howard Creek tributary below White Sulphur Springs). Marlinton will need increased water supply of about 6 mgd and the Primary Growth Center will need an increase of about 14 mgd if they are to reach national economic levels.

Marlinton will need to grow in area by 200 acres (all industrial) and the Primary Growth Center will need to grow by 700 acres (600 acres industrial) by 2020. There are large areas of relatively level uplands in the Basin which could be developed for urban use. Flood damages which affect the two growth centers are $328,000 each year from upstream flood waters and $579,000 each year from downstream flood waters. The only improvement for flood control complete within the Basin is the Marlin Run Watershed Project (USDA) near Marlinton. A planned upstream watershed project (Howard Creek) will reduce flood damages $72,000 a year. The Gypsy Hill Watershed Association has applied for planning and assistance. Extensive studies have been made of the Greenbrier River Basin by the Corps District in Huntington, W. Va. Several sites for large reservoirs are physically possible.

The Secondary Growth Center of Hinton lies just below the intersection of the Greenbrier and the New Rivers. There are no significant water restraints to the economic growth of Hinton. Some low-lying flood plains in and adjacent to Hinton are subject to flooding

from the uncontrolled flows of Greenbrier River and from operational releases from Bluestone Lake. The primary economic constraint is poor highway access. The 300 acres needed for expansion to national economic levels is available.

Beckley Primary Growth Center lies in upland areas of Piney Creek, a direct west tributary of the New River. Flood damages in the watershed average $152,000 a year. Piney Creek Upstream Watershed Project above Beckley will reduce flood damages by $74,000 by 1980. Water needs include 24 mgd increased water supply by 2020 and supplemental storage to keep Piney Creek low flows above 20 cfs.

The Oak Hill-Mount Hope Growth Center stretches from Dunloup Creek to Arbuckle Creek in the uplands of Fayette County. There is some pollution in the two creeks from mine drainage and city sewage effluents. At each creek, low flows should be maintained above 2 cfs. Damages of about $120,000 average each year occur in the growth area ($100,000 on Dunloup Creek). A USDA watershed project on Dunloup Creek will lower the damages about $74,000 ($26,000 remaining). Glade Creek, a direct New River tributary south of Beckley, will probably be protected by an upstream watershed program in the future. Oak Hill and Mount Hope combined will need 10 mgd increase in water supply after 1980. The two cities will grow by 200 acres (100 acres industrial) by 2020.

Summersville-Richwood Secondary Growth Center is along and above Summersville Lake in the Gauley River Basin. There is need for quality control water below Richwood on the Cherry River (8 cfs). The two cities will grow by 400 acres in reaching national economic levels; the 200 acres required for industrial development have been identified (Figure 14-13). The average annual upstream and tributary flood damages within the Gauley Basin are now about 435,000 dollars. Installation of the Big Ditch Run, Beaver Creek, and Grassy Creek Upstream Projects will decrease that figure by about 64,000 dollars. Project action is needed in the Upper Meadow River and Cherry River Watersheds. There are several major reservoir sites in the Basin suitable for the needed storage of water for flood control, locally and downstream, and water for quality control downstream.

Within Sutton-Gassaway Secondary Growth Center, on the Elk River just below Sutton Lake (CE - flood control and quality control), the primary need will be to provide increased water supply (+7 mgd after 1980) and a large sewage system as the recreation industry grows in the area. Lesser fluctuation of water levels in Sutton Lake would increase the desirability for recreation. That might be made possible through the redistribution of storage among upstream lakes on Buffalo Creek, Big Sandy Creek, and Birch River. Such lakes might provide increased quality storage for quality control water as well as for flood control or recreation.

There is a need for flood control in upstream areas where about $167,000 in damages occur each year on the average. Elk-Two Mile Creek Watershed (draining directly into Charleston and discussed in Growth Area 10) will be protected by upstream measures by 1980. Upstream damages could be mitigated by USDA Watershed Programs in Middle Creek, Upper Birch River, Laurel Creek, Slack Branch (Quick) G.A. 10) and Mill Creek (G.A. 10) Basins. The completion of Interstate Highway 79 and Appalachian Highway Corridor L through the growth area will guarantee good access. The 200 acres needed for 2020 level growth in the two cities will be available along Interstate Highway 79.

Growth Area Number 10

The Kanawha River is formed by the junction of the New and Gauley Rivers in southwest West Virginia and flows in a northwest direction 97 miles to its confluence with the Ohio River at Point Pleasant, West Virginia. Point Pleasant is in Growth Area 6, 266 miles below Pittsburgh, Pennsylvania. Within the Growth Area are the lower 26 miles of the Elk River, the Pocatalico River (359 square miles), and the Coal River (880 square miles).

The Charleston Primary Growth Center (SMSA) is the trade and manufacturing center for the area. An estimated 2,665,000 acre-feet of water storage above Charleston will be required to dilute and cool the 3,288 mgd of water expected to be discharged from municipal and industrial outlets by 2020. The proposed Blue Ridge Project (power, recreation, flood control, quality control) on the New River could furnish up to 650,000 acre-feet of water for quality control. The Center will need almost 2,500 mgd of new water supplies to support economic growth between 1980 and 2020. Solutions, or partial solutions, for the water quality and water supply problems in the growth center will control future economic progress.

There are now three major dams storing flood waters which protect Charleston from flooding by the Kanawha River and its tributaries. They are Bluestone Lake on the New River, Summersville Lake on the Gauley River and Sutton Lake on the Elk River. There are still average annual flood damages from south of Charleston to the Ohio River of over 1,500,000 dollars. The total annual flood damages in the area now (1968) total 3,291,000 dollars.

Installation and full functioning of 7 upstream watershed programs in the growth area, Blakes Creek-Armours Creek, Elk-Two Mile Creek, Rocky Fork, Kanawha-Two Mile Creek, Georges Creek, Wertz Hollow, and Lick Branch are estimated to lower annual upstream (tributary) flood damages an average of about 206,000 dollars. (Elk-Two Mile is a tributary of the Elk River which drains directly into urban Charleston). There is extensive flooding in Davis Creek, (about

$190,000 a year) and Finney Creek ($4,000 a year) Watersheds at Charleston which could be mitigated (to about $42,000 a year) by upstream watershed projects.

Damage from upstream and tributary flooding in the Pocatalico River Basin average over $260,000 a year. Major damage occurs in Rocky Fork and Upper Pocatalico River areas and along the mainstem.

The Coal River Basin today is an example of bad results from resource exploitation. The area is a challenge to resource managers and conservationists. Much of the alluvial valleys are filled with coal mining debris. Flood damages along the mainstem are estimated to average $92,000 a year; upstream damages exceed $250,000 average a year. Major upstream flood damages occur in Pond Fork and Spruce Fork of Little Coal River. There is a need for major reservoir sites and/or watershed projects on Marsh Fork and Clear Fork of the Big Coal River; however, possibility of their being economically feasible seems remote using present justification criteria. Indeed, any programs in the Coal River Basin would be very expensive. No water resource developments on Coal River are included in the tentative plan for the Kanawha River Basin; however, a special study is recommended. The recommendation is supported very strongly by the State of West Virginia.

Increasing recreation needs for the burgeoning area will have to be satisfied within the Kanawha Basin.

If the Charleston Growth Center were to become as concentrated as Cincinnati, Ohio, there would be a need for an increase in urban area of 31,400 acres by year 2020. The 7,940 acres needed for industrial expansion will cause local planners some concern. It is possible for many of the workers to live in the smaller satellite towns or on acreages in the hinterland, but level (or levelled) developable land is essential for industrial plants. Possibilities for solving the problem may lie in multi-story plants; expensive hillside (stair step) plant construction; the clearing of present residential areas for plant sites and relocation of people in satellite communities; or in yet untried or unheard of construction procedures or village concepts.

The completion of Interstate Highways 77 and 79 and Appalachian Highway Corridor G will make the Charleston access network almost complete. Rail access is now very good. Commercial aviation facilities are available. Updating the three Kanawha River navigation locks (CE) would complete the system.

Many of the needed projects in the Kanawha River Area (Growth Areas 8, 9, and 10) will be built (installed) only after major changes in project benefit analysis and criteria have been effected. If all possibilities were in place, flood control and water pollution control would be complete. A discussion of the Type II Comprehensive Basin study and "Appalachian" study efforts are discussed in Sections III and IV of this chapter.

Water Area G-4

Water Area G-4 (six eastern Kentucky counties and four southwestern West Virginia counties) contains the upper 300 square miles of the Licking River; about 2,900 square miles of the Big Sandy River Basin (2,000 square miles in Kentucky); and over 950 square miles of the Guyandotte River Basin.

State Planning Sub-region 22 in West Virginia, and 33 in Kentucky are in Water Area G-4. Figure 14-9 shows the benchmark objectives for the area.

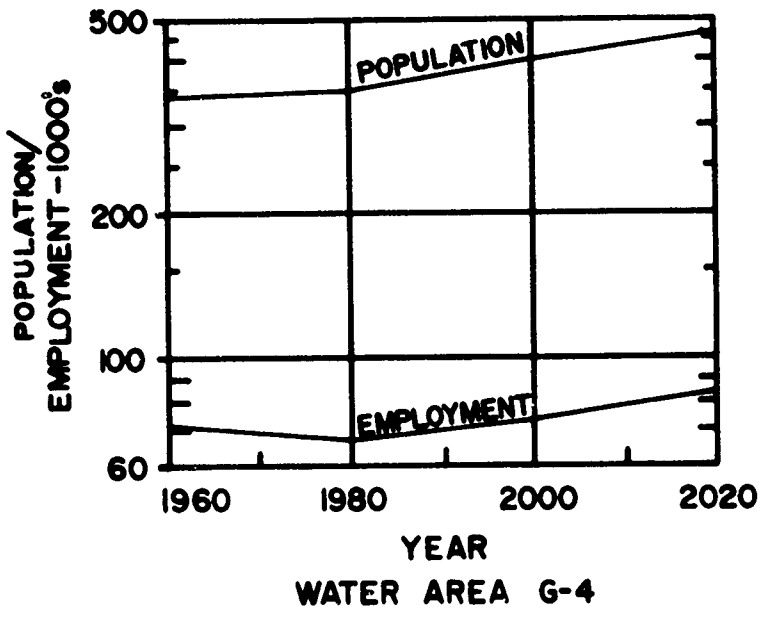


Figure 14-9. Population/Employment, Actual and Projected, Water Area G-4.

There are two Primary Growth Centers in Water Area G-4. They are the Pikeville-Prestonsburg-Paintsville and the Salyersville centers. The two are often considered as one growth area because of the U.S. Highway 460 linkage. The Secondary Growth Areas are the Williamson, Logan, Welch, and Pineville-Mullens areas.

Water supply needs and untreated waste loadings are shown below.

MUNICIPAL AND INDUSTRIAL WATER SUPPLY NEEDS
TO MEET BENCHMARK GOALS IN WATER AREA G-4

Year	Million Gallons per Day
1960	12
1980	100
2000	170
2020	260

UNTREATED WASTE LOADINGS ACCRUING FROM
BENCHMARK GOALS IN WATER AREA G-4

Year	Population Equivalents (1000's)
1960	70
1980	300
2000	480
2020	1,250

Employment is less in Water Area G-4 than in any of the five water areas. Based on developmental benchmarks, the 2020 employment would be somewhat more than double the 1960 employment. Population projections indicate only a modest increase over the 1960 population. Due to the rugged topography of this water area, developable land is quite limited. Use of land should be carefully programmed in order to reap the greatest benefit. Future water resource needs likely will be oriented around the five potential growth areas.

There will be demand for additional outdoor recreational opportunities in this area, but to a lesser degree than in the other four water areas. Fishing needs for Water Area G-4 which approached 400,000 man-days in 1964, are expected to be reduced to some extent by 1980, then increase to over 400,000 by 2020. Most hunting needs will be met, but there is a projected need of over 100,000 man-days by 2020. The total water related recreation needs of Water Area G-4 will increase by 7,300,000 man-days between 1980 and 2020.

Growth Area Numbers 11 and 12

The area includes parts of the major Ohio River tributaries, Guyandotte River, Big Sandy River (with its major tributaries of Tug Fork and Levisa Fork) and parts of the Licking River,

The Guyandotte Basin is located entirely in West Virginia. Its tributaries rise in the foothills of the Cumberland Mountains in Raleigh County. It is formed by the junction of Winding Gulf and Stonecoal Creeks and flows northwestward through Wyoming, Logan, Lincoln, and Cabell Counties to the Ohio River at Huntington, 304.6 miles below Pittsburgh, Pennsylvania.

The Guyandotte River, which lies entirely in West Virginia, contains the Growth Centers of Logan and Pineville-Mullens.

Average annual flood damages in the Guyandotte Basin were well over $400,000 along the main stem. Those damages will be reduced significantly by the installation of R. D. Bailey Dam. The annual flood damages within the Pineville-Mullens center above R. D. Bailey Lake is 46,000 dollars. The total upstream damage above R. D. Bailey Lake averages 1,218,000 dollars. Survey scope analyses of the Guyandotte Basin for possible control above the R. D. Bailey Lake and scheduled for completion in 1971. Logan, in Logan County, is situated about 30 miles downstream from the R. D. Bailey Dam. Local flood damage in Logan, with completion of the R. D. Bailey Lake, will be about $10,000 average a year. Local Protection Projects on Whitman Creek, Dingess Run, and Island Creek have been found infeasible in earlier economic analyses. Land and improvements in Big Creek, a small tributary along the Logan-Lincoln County Line, are damaged an estimated $29,000 by flood waters. A proposed upstream watershed project would eliminate $20,000 of those damages. There have been major water quality problems in the past caused primarily by local sewage effluents and by the location of more than 50 coal washeries in the basin. Wastes from the coal washers have been neutralized as required by West Virginia State Law. This study assumes the achievement of secondary treatment of all sewage wastes by 1980 in accordance with goals of the State and FWPCA.

The two growth centers will need a water supply totalling about 25 mgd capacity by 2020. These supplies can be obtained from stream flow and local small well systems.

If Logan, Pineville, and Mullens are to grow in accordance with Appalachian Regional Benchmarks, 3,300 acres (500 acres industral) will be needed by 2020 at Logan and 3,500 acres (500 acres industrial) at Pineville and Mullens. Alternatives to level land use are development of nearby level uplands, multi-story development of the limited lands available, or development of steeper valley areas.

The Big Sandy Basin, containing the drainage area of the Big Sandy River and its two major tributaries, Tug and Levisa Forks, lies within the States of Kentucky, West Virginia, and Virginia, and has a total drainage area of 4,290 square miles.

Growth Area 11 contains the Tug Fork of Big Sandy River. The Growth Centers of Welch and Williamson, West Virginia-South Williamson, Kentucky, are on the Tug Fork. Approximately $38,000 average damages per year are caused in Welch by flood waters. Some reduction could be effected by an upstream watershed project in Elkhorn Creek. Berwind, on the Dry Fork tributary, will have partial protection by a channel improvement project that will be completed prior to 1980-contingent upon necessary non-Federal cooperation.

There are major ($387,000 per year) damages within Williamson-South Williamson, and the neighboring Matewan community from Tug Fork flood waters. In addition, flood waters from Mate Creek result in $99,000 damage in the upstream areas. The authorized Panther Creek Reservoir will reduce the damages in the Matewan-Williamson area by about $58,000 per year. There will still be about $555,000 downstream and $1,212,000 upstream annual flood damages in the Basin. Alternates studied to reduce flood damages are the Lower Knox Creek Reservoir and Mate Creek Upstream Watershed. It is estimated that a Mate Creek Watershed Project, with channel improvement at Matewan, could reduce upstream flooding by $64,000 a year. Lower Knox Reservoir could reduce Tug Fork flooding by about $270,000 a year. If Lower Knox Dam were installed the flood wall in Williamson still would be inadequate to provide 100-year protection level required for industrial growth. A reanalysis of flood problems along Tug Fork is scheduled for completion in Fiscal Year 1971. Channel improvement at Inez on Rockcastle Creek and local protection for the Appalachian Regional Hospital at South Williamson are expected to be completed before 1980.

It has been estimated by FWPCA scientists that an assured flow of 70 cfs will be needed at the Kermit, West Virginia reference gage by 2020 for the assimilation of wastes in the stream. The need to be met from storage will be 43 cfs. Panther Creek Reservoir storage will provide 15 cfs; a reservoir at the Lower Knox site could provide the remaining 28 cfs. Major recreation developments are possible at the Lower Knox site and in Mate Creek Upstream Watershed.

The Lower Big Sandy River is protected by reservoirs on Levisa Fork (Dewey, Fishtrap, Flannagan, North Fork of Pound, Paintsville) and the Yatesville Reservoir on a direct tributary of the mainstem.

Williamson-South Williamson will grow by 3,900 acres and Welch will expand by 200 acres by 2020 if the Appalachian benchmark goals are accomplished. The needed 800 acres in Williamson and 200 acres in Welch for industrial expansion are not available. New development methods must be used if the towns are to expand.

In addition, there are Local Protection Projects at Wayland-Garrett, and Langley on Beaver Creek and Prestonsburg on Levisa Fork.

A local protection project at Martin, Kentucky and McDowell and Drift, Kentucky are expected to be completed by 1980.

The upstream flood damages in Levisa Fork average about $375,000 a year. The downstream damages average $422,000 a year. The three Primary Growth Centers, Pikeville, Prestonsburg, and Paintsville, will have no major water related needs except for flood protection after 1980. There will, of course, need to be continued expansion of water and sewage facilities to meet urban needs as the cities grow. The construction of the authorized Haysi Reservoir in Virginia would decrease flooding in all three cities. A system for flood plain management is critically needed in the growth centers, especially at Paintsville.

The area will be given good access by the construction of Appalachian Corridors B, F, G, Q, and R. However, under projected growth conditions, the three towns will need a 4,300 acre increase in urban lands. Industrial development to national levels can be obtained if 800 acres of new lands are developed. The proposed "Model City" Project for Pikeville could result in removal of residual flood damages; relocation of the collier rail switchyard; diversion of Levisa Fork, Appalachian Corridor and railroad around the city and the making available of 242 acres for urban expansion. All of these water-related improvements accompany expansion of educational and municipal facilities through Federal Grants-in-Aid. All three cities will probably continue to be trade centers while many of the "customers" and "workers" will continue to live in the hinterlands. Studies by the Huntington District, Corps of Engineers, indicate that industrial development along the mainstem of the Big Sandy River (downstream from the confluence of the Tug and Levisa) would proceed unchanged with or without channel improvement beyond the navigable pool of the Ohio River.

The Licking River rises in the Cumberland Mountains in eastern Kentucky and flows in a general northwesterly direction for a distance of about 320 miles to enter the Ohio River from the left bank opposite Cincinnati, Ohio, 511 miles above the mouth of the Ohio.

The Licking River in Growth Area 12 contains the Primary Growth Center of Salyersville in Magoffin County, Kentucky, and the Secondary Growth Center of Morehead in Rowan County. The flood damages in the Salyersville area average $80,000 a year in the upstream areas and $103,000 a year along the main stem. Plans have been developed for a complete economic growth package for the area. The package would include an upstream structure (Royalton Reservoir), channel improvements from the structure through Salyersville and an upstream watershed project covering the entire Basin. In addition, a complete area development plan has been prepared. The package would meet all developmental requirements for the entire trade territory of Salyersville. One thousand and eight hundred acres would be made available along the river for urban development. Recreation facilities with an ultimate capacity of over 274,000 visitor days would be provided. Salyersville

would be protected from flooding. Upstream flooding would be eliminated by the four flood water retarding structures. Water quality needs of 14.3 cfs minimum at Salyersville will be met. A water supply of 2.3 mgd would be provided Salyersville.

The Salyersville package was developed by the Federal and State Agencies cooperating in this report and undoubtedly will prove to be a benchmark in water resources development and management in the United States.

Grassy Creek Upstream Watershed Project in Morgan County will be in place by 1980. The community of Morehead is now considered a Secondary Growth Center. There is a plan for "New Town" development west of Morehead to be called Midland. With the development of Midland, Morehead will become part of a Primary Growth Center. The discussion of that plan is in Chapters 15 and 16, Water Sub-region H. The Morehead area is damaged about $43,000 average each year by flood waters in Triplett Creek Watershed. A complete watershed program of land treatment, detention reservoirs and channel improvements would decrease the damage ($24,000 average a year). Water supply and water quality needs for Morehead can be met from storage in Triplett Creek.

The urban lands needed at Salyersville were discussed above. The Morehead-Midland Center is projected to grow by about 5,100 acres. About 1,800 acres will be in the Licking River flood plain. At least 800 acres in Rowan County will be developed for industrial uses.

Partial River Basins - General

Growth Area 4 includes part of the Little Miami River Basin. Growth Area 7 includes tributaries of the Monongahela River. A small area of the upper end of the Yadkin River Basin in Carroll and Grayson Counties, Virginia, lies outside Growth Area 8. The Tennessee (Holston) River Basin in Bland and Smyth Counties, Virginia is in Growth Area 8. The upper reaches of the authorized Moores Ferry Reservoir (now Blue Ridge Project) would extend into North Carolina; needs in the Kanawha Basin above the projects were considered also in Growth Area 8. Big Sandy River Areas in Virginia were included in Growth Areas 11 and 12 analyses. Only part of the Licking River Basin lies in Growth Area 12.

10. INTER-BASIN AND INTERSTATE TRANSFER OF WATER

Suggestions have been made that transfer of water should be considered for Kanawha (Upper New) River and James River and between the Kanawha (Upper New) and Yadkin Rivers. The Kanawha-James Rivers suggestion relates to potential development of a connection that would permit water transportation whereas the Kanawha-Yadkin proposals pertain to pumped-storage hydroelectric power development. Neither proposal appears to be economically feasible on the basis of preliminary analysis and would involve interstate cooperation.

SECTION III - ALTERNATIVES FOR MEETING NEEDS

11. STRUCTURAL

Structural alternatives have been selected from an array of Federal, State and private water resource development opportunities. Alternatives considered include both structural and non-structural improvements as well as management considerations. Flood protection systems include levees, flood walls, channel improvements, reservoirs to retain and regulate excessive flood flows; and combinations of these measures. Alternatives for provision of water supply considered both surface and groundwater sources. Water quality improvements would be accomplished by dilution, by more advanced treatment of waste discharge or by combinations judged to be the most advantageous. The pertinent structural alternatives are discussed below.

Growth Area Number 1

There are four primary growth centers in the Basin. The primary areas include New Philadelphia-Dover, Cambridge, Zanesville and Coshocton. The secondary growth center is Malta-McConnellsville in Morgan County.

The comprehensive study of the Muskingum River Basin being conducted by the Corps of Engineers in cooperation with the State and other Federal Agencies is giving consideration to all phases of water management within the basin including non-structural techniques such as flood proofing and zoning. Reallocation of storage capacity in the existing reservoirs is being studied to assure optimum utilization in regulating excessive flows for alleviation of flooding as well as low-flow regulation in the interest of quality control. Water supply storage will be provided where the need justifies the inclusion and the necessary non-Federal interest is available.

Attention also is being given to the recreational development at the existing projects to determine whether additional facilities and/or expansion of existing development is needed to meet the need for regional recreational opportunity and to relieve presently overcrowded conditions. Additional projects are being considered where reallocation of storage and modification of existing facilities does not appear to be the best solution to existing and anticipated problems. Although many of the additional potential reservoirs are located on the tributaries outside the Appalachian area, most of the improved flow will provide beneficial effects in downstream areas within the Appalachian region. Included in the potential reservoir projects that may be developed in the future are the authorized Utica Reservoir in Licking River Basin (Ohio), the authorized Frazeysburg project, and several potential sites in the Nimishillen Creek Basin.

Alternatives studied for this report included studies by the USDA Soil Conservation Service and Forest Service of various upstream watersheds to determine project feasibility. Watershed studies in some detail to determine possible water management programs included Buffalo Creek (now authorized for construction), Moxahala-Jonathan Creeks and Wakatomika Creeks Watersheds. A field examination of Sugar Creek, above New Philadelphia, yielded information that may lead to a watershed project with flood prevention and recreation benefits.

Non-structural alternatives, such as advanced waste treatment, flood plain zoning, developing ground water supplies and industrial reuse of water, were investigated and included in the plans. Elements of programs, such as highway improvements and vocational education, which are directly related to economic growth were considered in the overall planning process.

Growth Area Number 2

Map studies were made of the entire Hocking basin by planners from the Huntington District, Corps of Engineers and the Ohio State Office of Soil Conservation Service (USDA).

Major reservoir locations studies included sites in the Rush Creek, Monday Creek, Sunday Creek, Federal Valley, and Clear Creek (authorized project - 1938 Flood Control Act) tributary streams. Reallocation of storage in Tom Jenkins Reservoir (Sunday Creek) was studied as well as revision of the authorized Athens Local Protection Project and of the plans for the recommended local protection projects (channel improvements) at Logan, Rockbridge and Nelsonville.

Possible USDA watershed programs, structural and land treatment measures, were evaluated for Clear Creek, Monday Creek, Sunday Creek, Federal Valley and lesser stream tributaries. Revision of plans for Rush Creek and Margaret Creek to satisfy needs based on an expanding economy was considered.

Logan Reservoir on Clear Creek, along with the four local protection projects, was selected for more detailed analyses by the Corps and Federal Valley was studied further by the SCS. Selection of these projects was based on available planning reservoirs; the possibility of removing constraints to economic growth; and the opportunities for multi-purpose water resource development. Purposes considered were storage for water supply, low flow augmentation, flood control and recreation.

Locational factors were very important in the overall (2020) plan. A study was made of the lands suitable for urban development. The local protection projects were important in these studies. Figure 14-10 shows potential industrial sites in Water Area G-1. Detailed maps and site tabulations are available in the Huntington District Office.

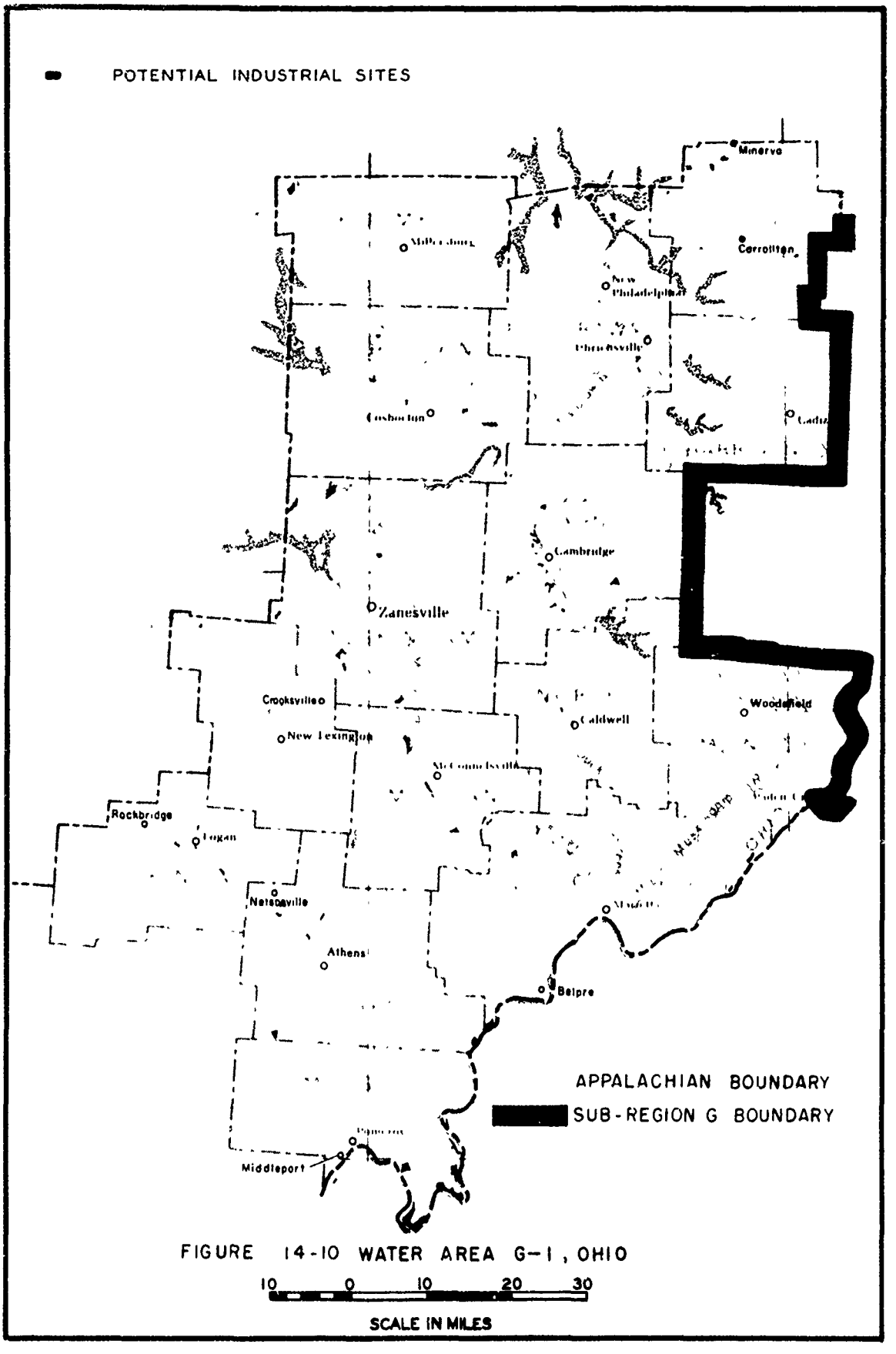


FIGURE 14-10 WATER AREA G-1, OHIO

Growth Area Number 3

Investigations of programs and projects to satisfy the development needs for the basin has as a first step consideration of the role of the seven (major) reservoirs (almost complete) and the authorized Chillicothe Local Protection Projects. A study to set up a regulation program for the system to satisfy the great needs for low flow augmentation for water quality control at Columbus and Chillicothe has been recommended in the Ohio River Basin Comprehensive Study report. Appalachian needs to be considered in the study (future) - include possible reallocation of conservation storage in Paint Creek and Salt Creek reservoirs to meet water supply needs at Hillsboro, Greenfield and Chillicothe.

Possible sources of water supply and dilution water and floodwater storage to mitigate problems for Jackson were sought in Little Salt Creek Watershed (USDA) and Ohio's Lake Jackson (W.S.). Possible reallocation of recreation storage in Lake White (Ohio) to low flow augmentation is needed in the future and reallocation of recreation storage in Rocky Fork Lake (Ohio) to Hillsboro for water supply were studied. Addition of flood storage to Rocky Fork Lake was considered.

Tributary upstream watersheds of the Scioto River, Point Creek and Salt Creek were studied by the USDA and the Ohio Division of Water for inclusion in the Plan.

A search was made for land sites developable for industry and housing to meet the urban expansion needs. Figure 14-11 shows potential industrial sites in Water Area G-2.

Non-structural alternatives; such as, flood plain zoning, tertiary or advanced waste treatment and industrial reuse of water were essential elements in developing the plan for the growth area.

Growth Area Number 4

The Clermont County-Brown County Secondary Growth Center lies along the Ohio River in the state of Ohio. The northern part of the area is drained by the East Fork of the Little Miami River. The comprehensive study was conducted in two parts; the Ohio River direct tributary area and the East Fork Basin.

The USDA made a reconnaissance study of possible upstream watershed programs in the small streams along the Ohio River. Streams studied were Bullskin Creek, Straight Creek, Eagle Creek and Whiteoak Creek. Whiteoak Creek appeared to provide the best opportunity for location of multi-purpose developments which would relate directly to economic growth. The Corps of Engineers studied several possible major reservoir locations and reached the same conclusions. A cooperative study was undertaken by representatives of all cooperating Federal and Ohio state offices.

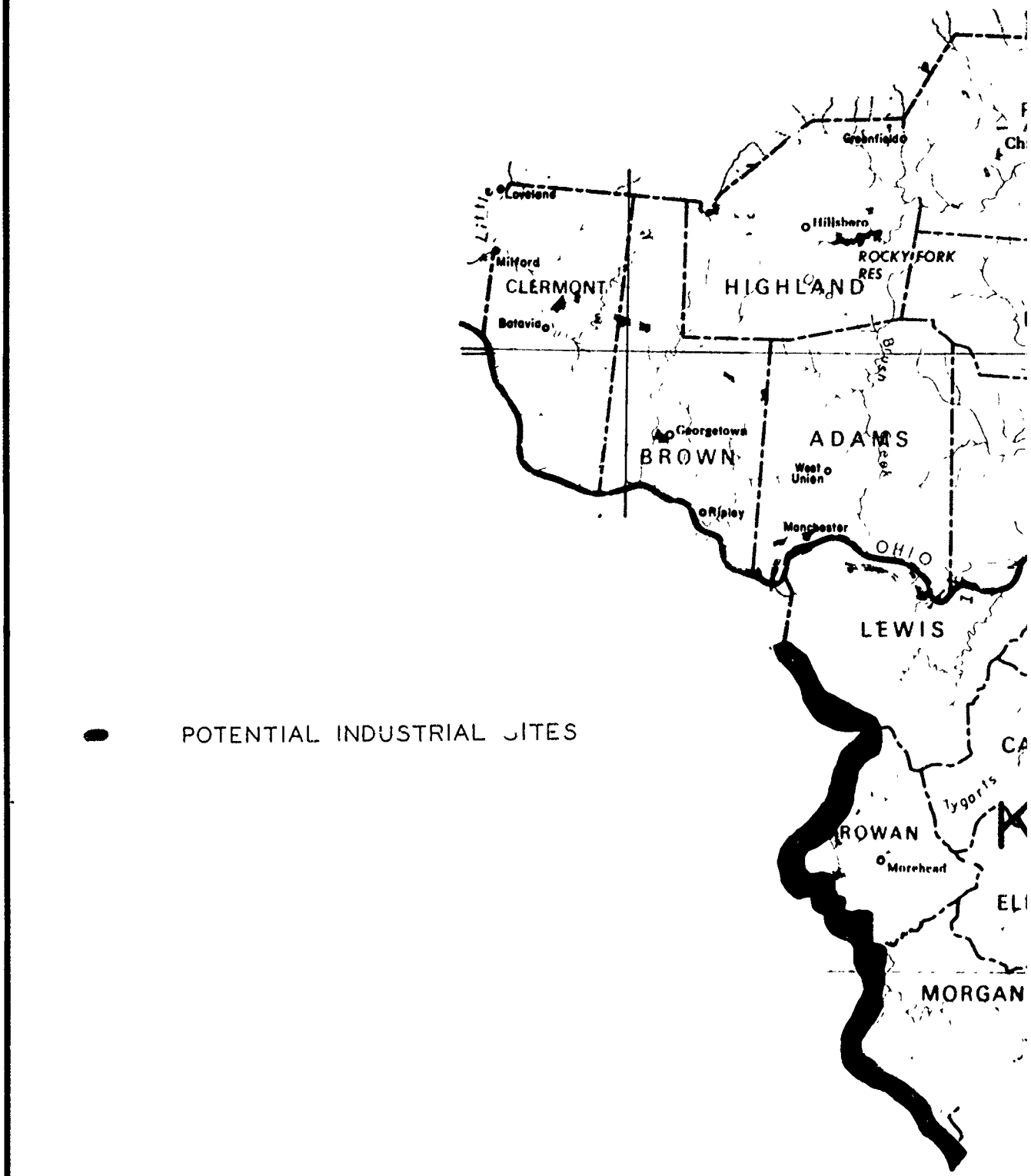
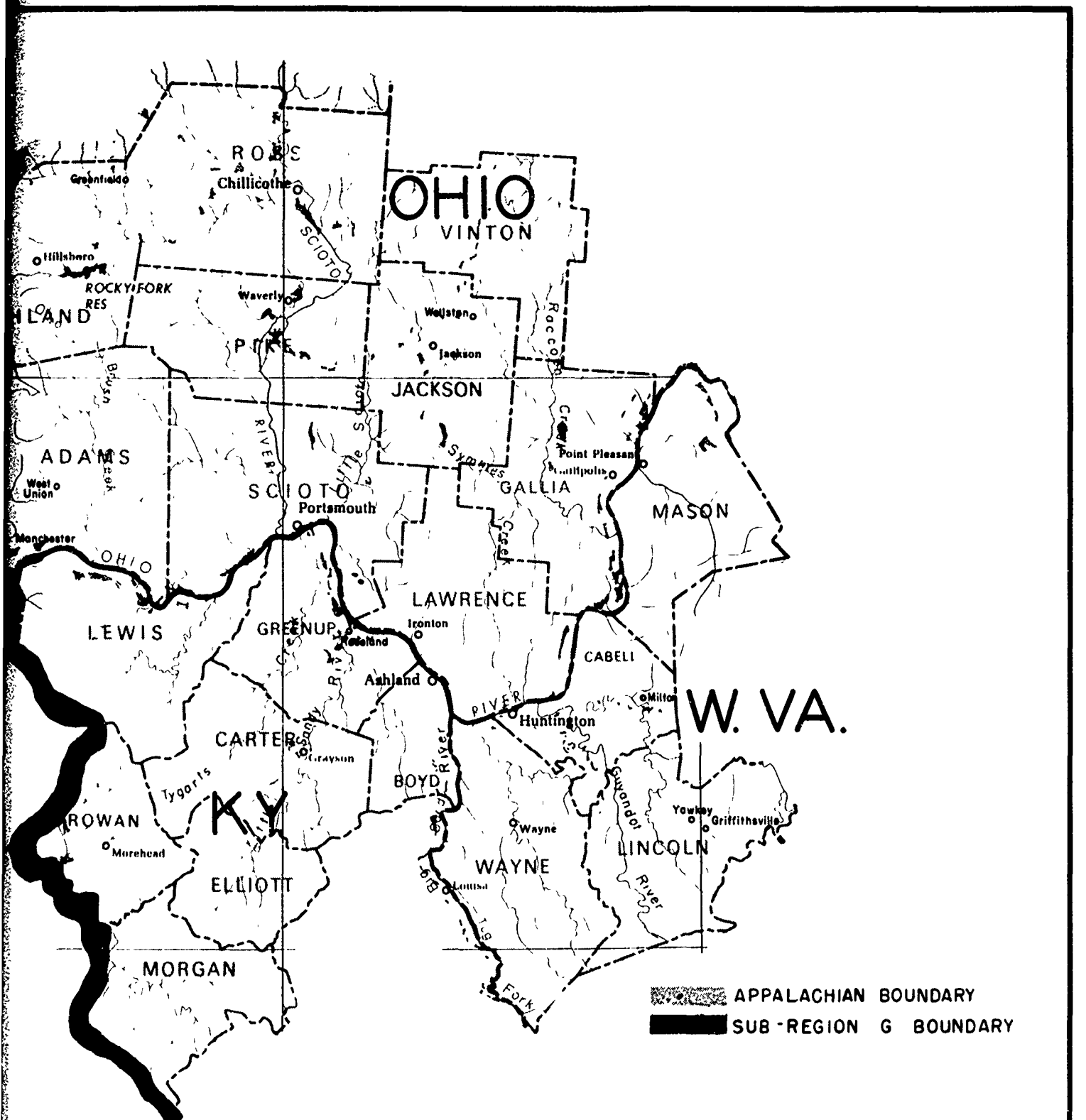


FIGURE 14-11 WATER AREA G-2, O



WATER AREA G–2, OHIO, KENTUCKY, W. VA.

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The East Fork (of Little Miami) Reservoir was scoped to provide flood protection and low flow regulation through 2060; so only upstream reconnaissance level studies were made. O'Bannon Creek (tributary to Little Miami River in northeast Clermont County), Stonelick Creek, Poplar Creek, Cloverlick Creek and Upper East Fork River were toured. There were sufficient resources to make detailed studies of O'Bannon Creek Watershed only; other areas will be studied in the future as funds are available.

The developable lands identified in the growth area total 3,815 acres. There are sufficient level uplands, however, as yet not listed, to meet any foreseeable expansion needs.

Growth Area Number 5

Removing economic growth constraints in the primary growth centers of Marietta, Ohio and Parkersburg, West Virginia was the first consideration. Next, was the same consideration of the Spencer and Grantsville, W. Va. secondary growth center's needs.

Flooding in the Marietta (Belpre) area is caused by flows from the Ohio River, the Muskingum River (Wolf Creek is the nearest large tributary), Duck Creek and indirectly by the Little Muskingum River. Reconnaissance studies were made of each to determine projects feasible for inclusion in the water plan. Principal cooperators in the studies were the Huntington Corps office staff, and U. S. Soil Conservation Service and U. S. Forest Service planners.

The entire Little Kanawha River Basin in West Virginia was studied for possible solutions (or mitigating measures) to growth constraints at Parkersburg, Spencer and Grantsville. USDA planners added Saltlick Creek Watershed to the already authorized Bonds Creek Watershed projects in their going programs. In addition field studies were made in Spring Creek Watershed above Spencer, and Stilwell Creek Watershed, direct tributary, in Wood County near Davisville. Pond Creek Watershed was evaluated for structural protection at Parkersburg. Construction schedules ("active") for West Fork and Leading Creek Lakes were recommended to remain unchanged by Huntington District (Corps) planners. Hughes River Lake was studied principally for Ohio River flood protection; for recreation development; and for low flow regulation along the lower reaches and the Ohio River.

Watershed studies were made of three watersheds and at upper and lower mainstem lake sites on the Middle Island Creek Basin.

The Little Muskingum River was studied for possible major flood control and recreation development. The remainder of Duck Creek Watershed was studied for structural possibilities for flood control and quality control. Upper Mill Creek Watershed was authorized for operations under P.L. 566-83 (USDA) authority. The Corps is now studying the possibility of a major reservoir in the Ripley area in that watershed; feasibility of such a project is doubtful. Raccoon Creek Watershed, in Ohio, has been studied by the Corps for possible developments with recreation, flood control and mine drainage pollution control elements. Conclusions cannot be reached until a clearcut policy on mine drainage pollution control benefit evaluation and cost allocation is developed.

The findings of the developable lands survey are in Table 14-2. The 13,426 acres of developable lands in Growth Area 5 are bottomlands along the Ohio River. Other areas, which are now unprotected, will be available as flood protection is provided. Many of the flood walls and levees will have to be extended at a later time. Figure 14-12 shows potential industrial sites.

Growth Area Number 6

Planning for economic growth through water resource developments in Growth Area 6 was tied to planning in every other growth area in Water Sub-region G because of its location below (downstream) from other areas.

The major area of concern was the avoidance of future growth constraints in the burgeoning Huntington-Ashland SMSA. All water management studies related directly to that area.

Sources of water for flow augmentation (quality control) and water supply (industrial and domestic) were studied first by planners. It is the opinion of the evaluating team that Ohio River water will be available to satisfy the developmental needs of growth centers along the river banks. There may be undesirable taste and odor problems; however, alternate groundwater supplies (for domestic use) would be much more expensive. Over 99 percent (1,789 mgd of the 1,792 mgd) new water supplies and all of the 17,000 mgd water for quality control will be Ohio River water. Ground water supplies for Hamlin-West Hamlin and Milton (inland) were investigated.

The installation of Corps dams and local protection projects within the Ohio River Basin have effected great reductions (80+%) in flood damages in the past. Projects to be in place by 1980 will reduce average annual damages in Growth Area 6 (study area) of at least $300,000. The mitigation of flood damages along the Ohio River is the goal of continuing studies and projects will be added to the water plan and Ohio River Type I plan as they are found feasible.

Ohio River tributary streams were investigated by the Corps for possible mainstem multi-purpose reservoirs for recreation, flood control

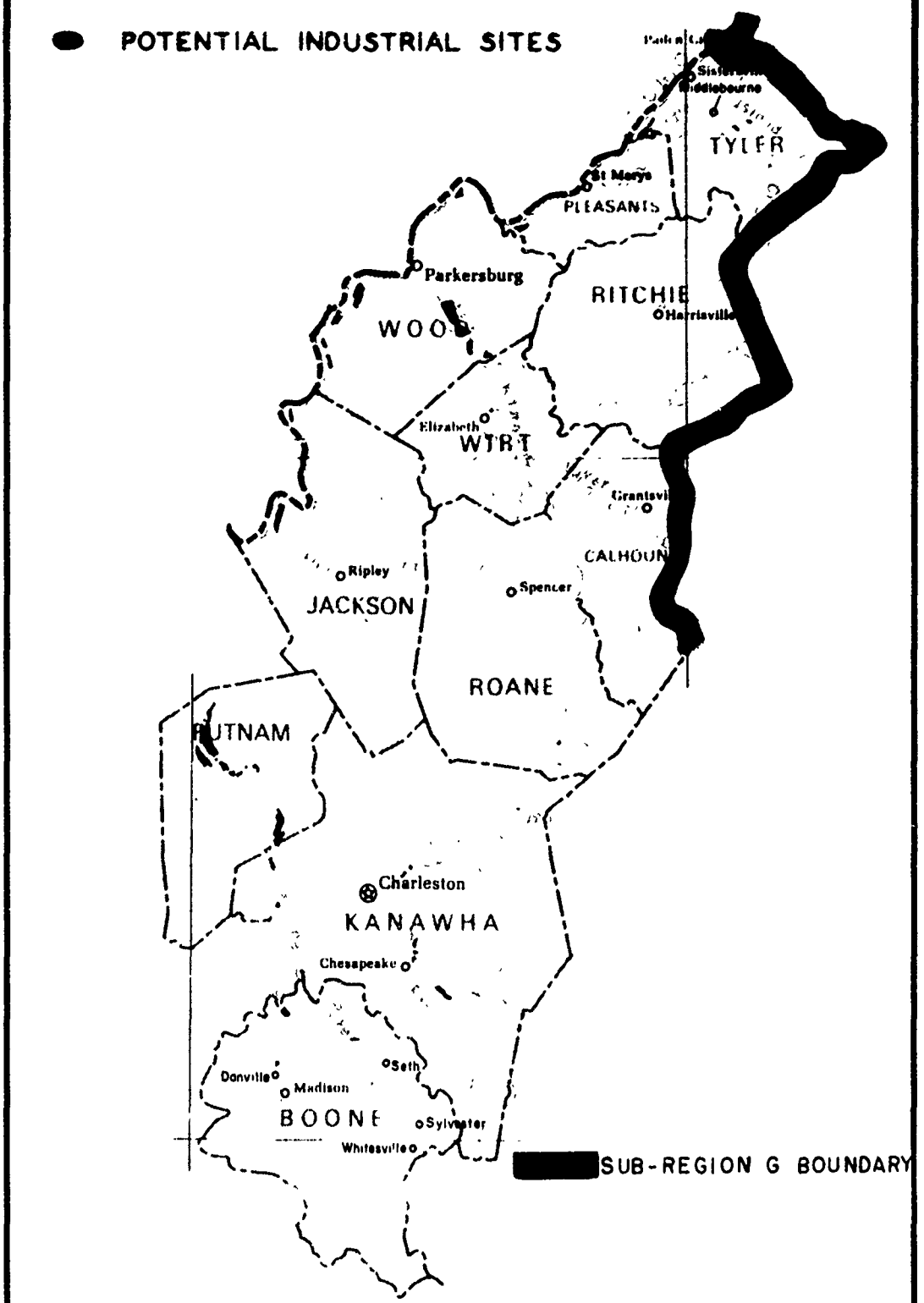


FIGURE 14-12 WATER AREA G-3, WEST VIRGINIA

and low flow augmentation. Streams investigated included Raccoon Creek (major-low flow augmentation), Symmes Creek (for recreation and low flow augmentation), Scioto Brush Creek and Ohio Brush Creek (for flood control - major) and Kinniconick Creek (major - flood control and recreation). Pertinent past studies were analyzed for possible developmental applications in the growth area.

U.S. Soil Conservation Service and Forest Service planners investigated the basins listed above cooperatively with the Corps. In addition the Little Scioto River, near Portsmouth; Storms Creek, through Ironton; upstream tributaries of Twelvepole Creek; Little Sandy River; Big Sandy River and Guyandotte River (Mud River) were investigated. Each watershed was evaluated for its feasibility based on P.L. 566-83 criteria and expansion effects within the growth area.

Studies for the Lucasville (Portsmouth Growth Center) development area have been requested by the State of Ohio.

Results of the developable lands survey are shown in Table 14-2. It appears that most critical need for developable lands will be at Ashland, Kentucky. Even allowing for expansion of industrial facilities as far west as Greenup County, at least 750 acres of additional industrial lands will be needed. (See Figure 14-11.) Portsmouth and Ironton, Ohio will expand toward each other.

Growth Area Number 7

The entire area above the Tygart River Reservoir was studied in the field by planners from the Pittsburgh Corps District and the Soil Conservation Service (USDA). The Cooperating agencies; including the Bureau of Sport Fisheries and Wildlife, U. S. Forest Service and interested West Virginia representatives shared in the planning process.

The SCS concentrated on watersheds that affected the growth centers directly. The only two areas that appeared to have sufficient rural flood damage and opportunity for an USDA upstream watershed program were above Buckhannon; they were the French Creek and Upper Buckhannon River watersheds. Each was studied at the level of a preliminary investigation.

Multi-purpose reservoir possibilities in the Upper Buckhannon River, on Middle Fork and upper mainstem of the Tygart River were considered. Teter Creek and Laural Creek sites were evaluated for downstream (outside Growth Area 7) flood control and low flow augmentation.

The results of the developable land identification are shown in Table 14-2. There are sufficient level bottomland and upland sites for industrial development in the growth areas. Figure 14-13 (Page 14-87) shows potential industrial sites.

Growth Area Numbers 8, 9 and 10

A Type II Comprehensive Study of the water and related land resources of the Kanawha River Basin has been underway for several years with the study scheduled for completion in late 1970. Study direction is provided by a coordinating committee composed of representatives of the States of West Virginia, Virginia, and North Carolina; the Federal Power Commission; the Departments of Agriculture, Interior, and Transportation; and the Corps of Engineers.

The Appalachian Water Resource Study was carried out concurrently with the Type II study.

Growth Area 8 studies included preliminary investigation of every upstream watershed in Virginia Sub-Region G by the Soil Conservation Service and Forest Service of the U. S. Department of Agriculture and the Virginia Division of Water Resources. The area in the Bluestone River tributary in Tazewell County is in Growth Area 9. Five watersheds were studied in detail in addition to the completed Back Creek Watershed Program; Little Stony Creek (a resource impact study and appraisal will be made by the U.S. Forest Service before authorization for planning is initiated), Peak Creek (at Pulaski) and Mill Creek (Wolf Creek tributary near Pearisburg) in the New River Basin; and Headwaters Holston River (Tennessee River), and Little River (Roanoke River).

Potential reservoir sites investigated by the Corps included those on Big Reed Island Creek, Reed Creek, Little River and Walker Creek. The Little River and Walker Creek sites were selected for detailed study. The authorized Moores Ferry Reservoir (currently designated Blue Ridge Project) was restudied by Corps of Engineers, Federal Power Commission, Virginia and the Appalachian Power Company for possible rescoping. In addition New River and South Fork New River reservoir sites in North Carolina were studied.

Growth Area 9 includes the Kanawha River Basin in West Virginia outside Kanawha, Putnam and Mason Counties. Those reaches are in Growth Area 10. The study of alternatives to meet water related needs was a complex one because of the large number of growth centers (16) considered. Analyses were concentrated in watersheds and tributary basins directly affecting each growth center.

Studies of sixteen possible reservoir locations were carried to the point of making preliminary cost estimates based on allocation of storage to meet needs. Primary needs were storage for low flow regulation (augmentation) for quality control, fishing and recreation; storage for recreation and for flood control. Six of the reservoir sites studied were in the Greenbrier Basin. They included an upper and lower mainstem location and sites on Anthony Creek, Knapp Creek, Deer Creek and East Fork tributaries. Sites analyzed in the Gauley River Basin included two mainstem locations and one on Williams River tributary; all were above Summersville Lake. Big Sandy Creek, Buffalo Creek and Birch River

reservoir sites were evaluated on Elk River tributaries below Sutton Lake and a possible Holly River site was studied above Sutton Lake. Bluestone River and Indiana Creek were studied along with possible reallocation of Bluestone Lake storage. Possible reallocation of storage in Sutton Lake and Summersville Lake, as well as that in Bluestone Lake, was a major consideration in the studies.

The Greenbrier River Sub-basin was selected by the Office of Appalachian Studies for detailed consideration in the water resources development program for Appalachia. Although it was recognized that the Comprehensive Basin Study had not progressed sufficiently to permit final selection of specific projects by the Coordinating Committee, it was thought that an interim sub-basin plan could be formulated for the Appalachian report that would be compatible with any plan that might evolve from the Comprehensive Basin Study. An interim sub-basin plan was formulated that consisted of two major reservoir projects (Site 40 on Anthony Creek and Site 87 on Greenbrier River above Marlinton) that could have been included in the Comprehensive Basin Plan since the two projects were responsive to local needs for water quality improvement, flood control, fish and wildlife enhancement, protected stream and recreational development, and also could provide a proportionate share of flow augmentation releases for downstream (Charleston area) needs.

Soil Conservation Service and Forest Service included land treatment needs and preliminary investigation of thirteen upstream watersheds. They included Howard Creek and Gypsy Hill watersheds in Greenbrier River Basin. Upper Meadow River, Big Ditch Run, Beaver Creek, Grassy Creek and Cherry River watersheds in the Gauley River Basin were investigated. Brush Creek and Upper Bluestone River watersheds and Jumping Branch Resource Conservation and Development Project in the Bluestone River Basin were studied. Direct tributary watersheds studied included Ansted Creek, Meadow Creek, Piney Creek (Beckley), and Glade Creek. Dunloup Creek (Mt. Hope) was added late in 1967.

Growth Area 10, with its Charleston SMSA, was the focal point of all planning within the Kanawha Basin.

Ten upstream watersheds were investigated in Growth Area 10 by the Soil Conservation Service and Forest Service. They were Quick Creek (Slack Branch), Blakes and Armours Creeks, Elk-Two Mile Creek, Rocky Fork (Pocatalico River), Kanawha-Two Mile Creek, Georges Creek, Wertz Hollow, Kellys Creek, Slaughter Creek and Lick Branch.

The Corps of Engineers made reconnaissance studies of four possible reservoir locations in the Coal River Basin and the Soil Conservation Service studied three possible watershed projects. Cooperative studies were also carried out in the Upper Pocatalico River Basin.

All of the studies within these three growth areas were keyed to the needs in the Charleston SMSA as well as to satisfaction of needs of closer growth centers.

A cut-off date of 1 October 1967 was set for evaluation of elements to be included in the water plan. At that time only the Greenbrier River plan and evaluation of watersheds listed by name above were in sufficient detail for project selection. The Type II Comprehensive Study has continued. Finney Branch, Rock Branch and Mill Creek (Elk) watersheds have been studied; and estimates of needs satisfaction capabilities of all the major reservoirs have been determined. More recent recommendations are discussed in Section IV.

A developable lands study was made of Water Area G-5; the findings are included in Table 14-2. There is a shortage of developable lands in all of the Kanawha Basin except for Growth Area 9. Both areas have sufficient level uplands for expansion. Figure 14-13 shows potential industrial sites in Water Area G-5.

Growth Area Numbers 11 and 12

The search for programs and projects to remove or alleviate water related constraints to economic growth in the two growth areas was made in each of the three river basins affecting it. The studies were made at the same time as the final evaluations by the Ohio River Basin Comprehensive Study group.

The Guyandotte River planning effort was concentrated on small tributaries and on the area above R. D. Bailey Lake. The remaining average annual mainstem damages below R. D. Bailey Lake are only $11,000 and that damage is pretty well concentrated in the Logan area. Several studies have been made of the Guyandotte River, Dingess Run, Rum Creek, and Island Creek around Logan. No program has been developed because of the low residual damages, and the railroad, highway and urban configuration. It is probable that flood control projects (e.g., LPP), as well as flood plain zoning, will be needed as Logan expands. Intensive studies are now underway in the upper reaches of the Guyandotte River. The Corps is studying nine potential major reservoir locations and the Soil Conservation Service is evaluating possible upstream watershed programs throughout the area. The coordinated plan will be completed in Fiscal Year 1971 and will consider local protection projects for Mullens and Welch. Most water related needs will be satisfied by the multi-purpose system.

Big Creek Watershed, north of Logan, was studied for possible water plan inclusion.

Tug Fork and Levisa Fork of the Big Sandy were studied for possible solutions to the flood control, water quality, water supply and recreation needs of the growth centers. A navigation feasibility study of Big Sandy River (lower) was made as a part of the studies for that stream.

The most intensive studies in the Tug Fork sub-basin were concerned with projects (systems) for flood protection for Williamson-West

Williamson-Matewan reach. Among the measures considered were (1) construction of reservoir projects on the mainstem or major tributaries upstream from the centers of major flood damage; (2) construction of retarding reservoirs in headwater areas or on minor tributaries; (3) construction of flood barriers including levees, floodwalls, or combinations thereof; (4) installation of control gates and pumping stations to permit utilization of highway and railroad embankments as levees; (5) channel improvement to reduce flood stages by increasing flow capacity; (6) diversion of flood flows; (7) permanent or emergency evacuation of the flood plain; (8) zoning to prevent encroachment on floodways and channels and to control the type of development on the flood plains; and (9) floodproofing of facilities required to be on the flood plain.

Reconnaissance level (preliminary investigation) studies were made of two sites on Knox Creek, by the Corps of Engineers, the Bureau of Outdoor Recreation, U.S. Fish and Wildlife Service. The Soil Conservation Service conducted similar studies of seven watersheds; they were five west (left) tributaries below Knox Creek, Mate Creek, and Tug Fork above Welch.

After screening studies were completed it appeared that the best early action flood control system for the primary growth center would include a multi-purpose reservoir in the lower reach of Knox Creek, the authorized Panther Creek Lake (CE), an Upstream Watershed Program (USDA) on Mate Creek (including channel improvement) and providing local protection in the Williamson-Matewan area. Detailed analyses were made of those projects. The authorized protection project for the Appalachian Regional Hospital at South Williamson was assumed to be in place since construction is scheduled in Fiscal Year 1970.

Watershed programs appeared to be feasible on Rockcastle Creek and on the more developed upper Tug Fork above Welch.

Soil Conservation Service planners found that there was little opportunity for project action (upstream watershed projects) to remove or alleviate the $375,000 average annual flood damages in the rural areas of Levisa Fork sub-basin because of the small area of flood plain. Nine upstream areas were investigated but only a part of Paint Creek near Paintsville had any impact on a growth center.

The Flood Control System, including: North Fork Pound and J. W. Flannagan on the Pound River in Virginia; Fishtrap Reservoir and Paintsville Reservoir in Kentucky; plus Yatesville Reservoir downstream in Growth Area 6 and four Local Protection Projects results in a very high level of protection for the basin as a whole. The only remaining unbuilt element of the originally planned system is Haysi Reservoir on upper Russell Fork in Virginia.

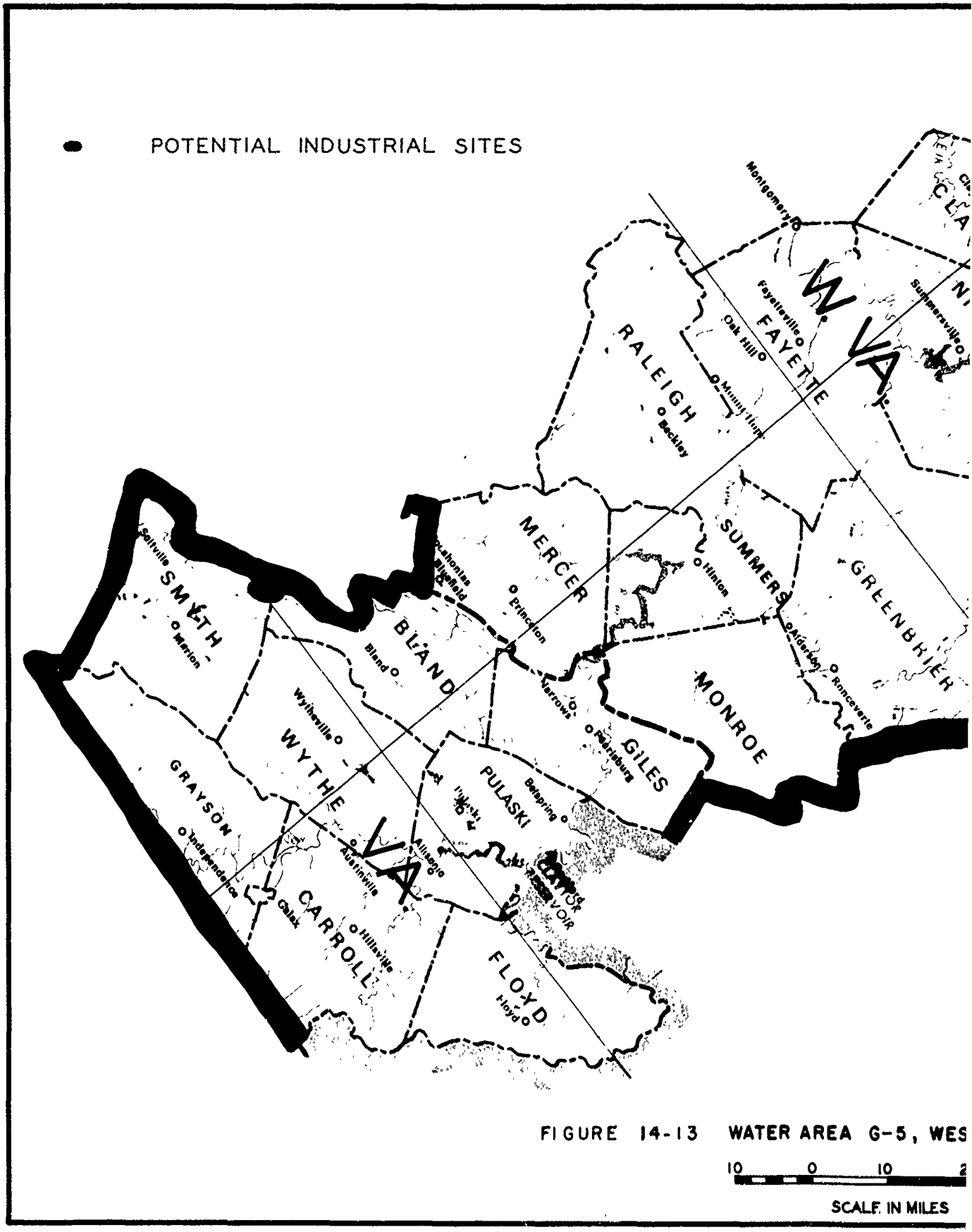
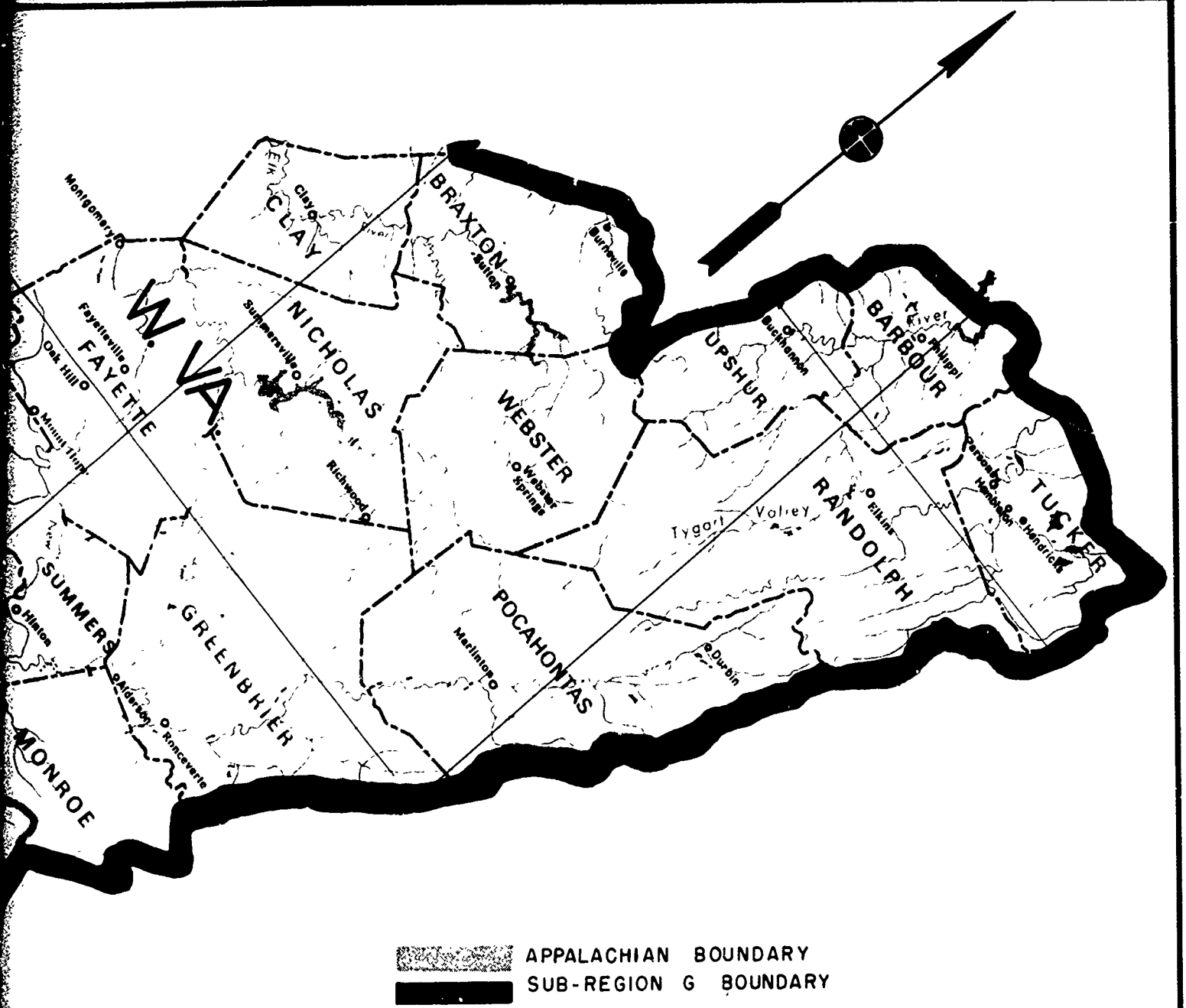


FIGURE 14-13 WATER AREA G-5, WES



APPALACHIAN BOUNDARY
SUB-REGION G BOUNDARY

13 WATER AREA G-5, WEST VIRGINIA, VIRGINIA

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Planning studies in the Upper Licking Basin were concentrated above the primary growth center of Salyersville. Early in the study that area was selected for a "Pilot" study to develop a system of water related structural measures and economic expansion programs that would fulfil the desires of the formulators of the Appalachian Regional Development Act. The study developed by the cooperating offices was completed in 1968 and an interim report forwarded to the appropriate Washington offices for action. It included a major reservoir (Royalton) with storage for water supply, low flow augmentation, recreation, fish and wildlife; three retarding structures (one with recreation, fish and wildlife storage); a Local Protection Project (CE) and an economic development plan for Salyersville.

Resource planners studied Triplett Creek Watershed at Morehead, in Rowan County, Kentucky, in unison with a possible "Newtown" development called "Midland" along the Licking River in Bath and Rowan Counties. The Midland project would be located below Cave Run Reservoir, adjacent to Interstate Highway 64. A complete discussion is in Chapter 16 of Part III. The Soil Conservation Service and U.S. Forest Service developed a program for Grassy Creek Watershed above Cave Run Reservoir during the study.

A study of developable lands in the growth areas yielded data listed in Table 14-2. There are not sufficient developable lands for areal growth as projected. Figure 14-14 shows potential industrial sites in Water Area G-4 (Figure 14-11 covers the Moorehead-Midland area).

Tables 14-7 through 14-10 contain data on the specific water related needs within the twelve growth areas and alternatives studied during the formulation of the Appalachian Water Resource Study Plan.

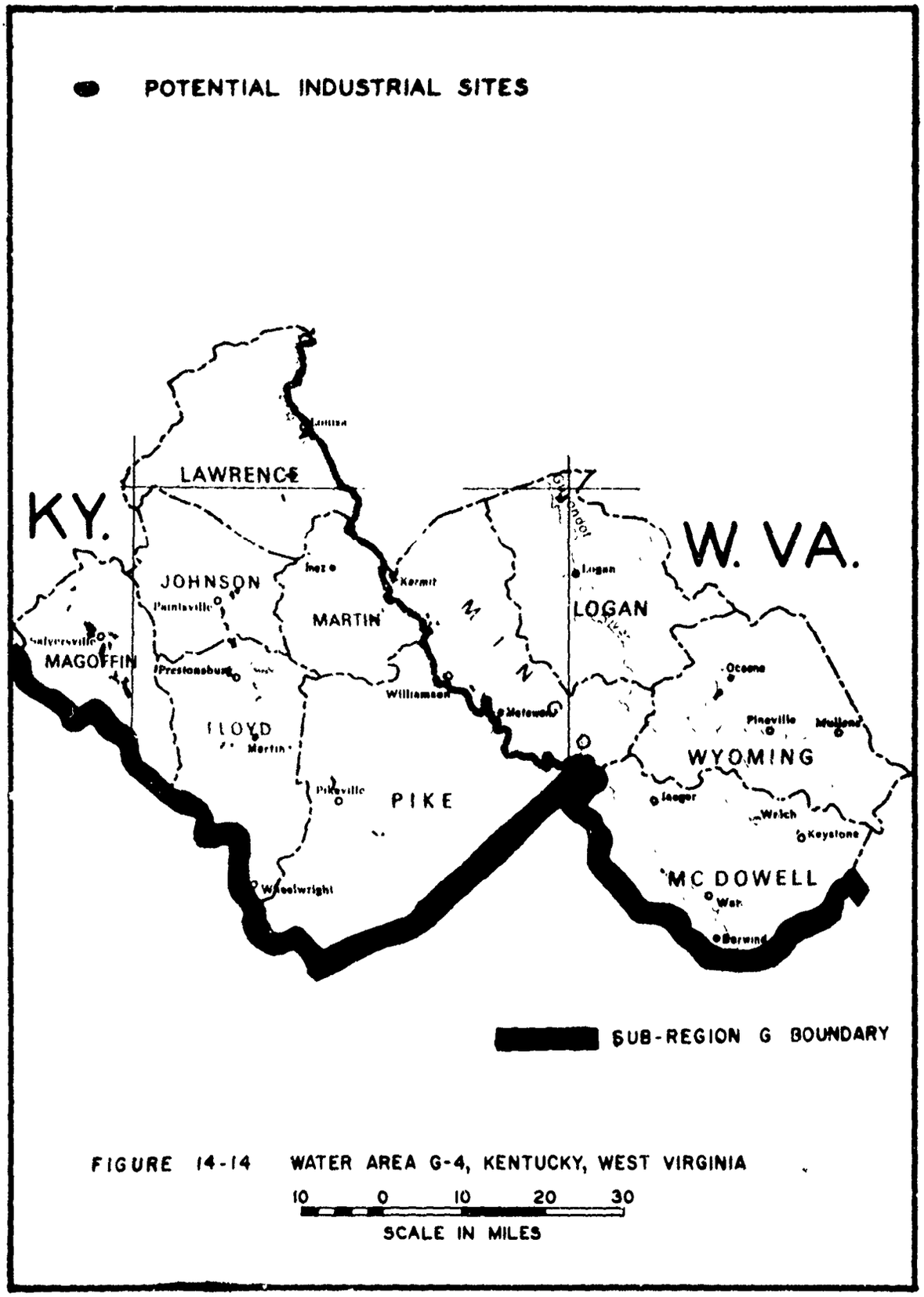

FIGURE 14-14 WATER AREA G-4, KENTUCKY, WEST VIRGINIA

TABLE 14-7
ALTERNATIVE SOURCES AND COSTS FOR WATER SUPPLY
WATER SUB-REGION G a/

Item	Alternative Costs for 1,000 Gal. dependable yield: Groundwater at Wellhead	Surface Storage at Site	Note
Muskingum River Basin Growth Area 1	$0.30	$0.012	Average costs for Logan Reservoir
Hocking Basin Growth Area 2	0.40	0.012	Average Costs for Logan Reservoir
Scioto River Basin Growth Area 3	0.50		
E. Fk. Miami and White Oak Creek Growth Area 4	0.79	0.036	Average Costs for White Oak Reservoir
Mainstem Ohio River Growth Areas 5 and 6	0.02		Not Competitive Ohio River Water is Available
Tygart River Basin (Monongahela) Growth Area 7	0.06		
Kanawha River Basin	0.04	0.05	Average Costs for Greenbrier River Reservoirs
Growth Areas 8, 9 & 10			
Big Sandy River Basin and Licking River Basin	0.07+	0.015	Average Costs for Royalton Reservoir
Growth Areas 11 & 12	0.06		

a/ Costs of groundwater at Wellhead (Appendix H) and surface water at source.

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TABLE 14-8
WATER SUPPLY NEEDS AND ALTERNATIVES
WATER SUB-REGION G

ITEM	UNMET NEEDS IN MGD 2020	ALTERNATIVE PROJECTS[b]	DEPENDABLE YIELD IN MGD Gross	DEPENDABLE YIELD IN MGD Net	REMAINING NEEDS
Growth Area No. 1					
Muskingum River Basin (Part)	263		2	2	261
New Philadelphia	80				80
Cambridge	-				-
Zanesville	142	Wakatomika Creek Watershed	1	1	140
		Moxahala-Jonathan Creek	1	1	-
Malta-McConnelsville	10				10
Coshocton	31				31
Growth Area No. 2					
Hocking River Basin	25				0
Logan	0				0
Athens	25	Federal Valley Watershed	1	1	24
		Logan Reservoir (For Lancaster)		24	
Growth Area No. 3					
Scioto River Basin (Part)	267				267
Chillicothe	240				240
Jackson	7	Little Salt Creek Watershed			7
Hillsboro-Greenfield	10				10
Growth Area No. 4					
Little Miami River-Whiteoak Basins					
Clermont County	54	Whiteoak Reservoir		17	37
		Upper Whiteoak Creek Watershed		-	
		O'Bannon Creek Watershed		-	
Growth Area No. 5					
Upper Ohio River - G	609	Ohio River (Pollution Control)	-	580[a]	28
Parkersburg, W. Va.	481	Pond Run Watershed	-	-	15
Marietta, Ohio	124	Wolf Creek Watershed	1	1	9
Spencer, W. Va.	2				2
Grantsville, W. Va.	2				2

TABLE 14-8 (Cont'd)
WATER SUPPLY NEEDS AND ALTERNATIVES
WATER SUB-REGION G

ITEM	UNMET NEEDS IN MGD 2020	ALTERNATIVE PROJECTS[b/]	DEPENDABLE YIELD IN MGD Gross	DEPENDABLE YIELD IN MGD Net	REMAINING NEEDS
Growth Area No. 6					
Lower Ohio River - G	1,792	Ohio River(Pollution Control)-		1,740[a/]	52
Huntington, W. Va. Ashland, Ky.	1,520	East Fork Little Sandy Wshd	-	-	26
Gallipolis	11				3
Portsmouth, Ohio	12	Little Scioto River Wshd	-	-	10
Ironton, Ohio	225				5
Point Pleasant, W.Va.	21				5
Milton, W. Va.	2				2
Hamlin-W.Hamlin, W.Va.	1				1
Growth Area No. 7					
Tygart River	29				29
Elkins	13				13
Buckhannon	12	French Creek Watershed	-	-	12
		Up. Buckhannon R. Wshd	-	-	
Phillippi	9				9
Growth Area No. 8					
New River Basin-Va.	266				266
Galax-Hillsville	81				81
Marion	55				55
Wytheville	30				30
Pulaski-Parrott	60				60
Pearisburg-Narrows	40				40
Growth Area No. 9					
Kanawha River Tribs.	109				109
Marlin	6	Gypsy Hill Wshd.		2	4
Lewisburg-Ronceverte-White Sulphur Springs	14				14
Summersville-Richwood	10	Cherry River Wshd		4	6
Sutton-Gassoway	7				7
Bluefield (Va. & W. Va.)-Princeton	30				30
Beckley	24				24
Hinton	2				2
Oak Hill-Mt. Hope	10				10
Montgomery	6				6
Growth Area No. 10					
Lower Kanawha River Charleston	2,490				2,490

TABLE 14-8 (cont'd)
WATER SUPPLY NEEDS AND ALTERNATIVES
WATER SUB-REGION G

ITEM	UNMET NEEDS IN MGD 2020	ALTERNATIVE PROJECTS[b]	DEPENDABLE YIELD IN MGD Gross	Net	REMAINING NEEDS
Growth Area 11 - 12 Guyandotte-Big Sandy-Licking Rivers					
Growth Area No. 11	122				
Pineville-Mullens	20		-	-	20
Logan	40	Big Creek	-	-	40
Welch	2		-	-	
Williamson-South Williamson	60	Mate Creek	2	1	59
Growth Area No. 12	65				62
Pikeville	20		-	-	20
Prestonsburg	15		-	-	15
Paintsville	6		-	-	6
Salyersville	3	Upper Licking River Wshd	-	-	
		Royalton Reservoir	3	3	0
Morehead-Midlands	21	Triplet Creek	-	-	21

a/ All industrial supply needs can be met if Quality of Ohio River Water meets ORSANCO and FWPCA standards by 1980.

b/ In USDA Upstream Watershed Projects only those sources which were specifically designated as municipal water supply (not including "Additional Beneficial Storage") for growth centers are listed above. Other sources considered in planning include:

Watershed and Growth Area	Dependable Yield (MGD) Gross
Moxahala-Jonathan Creek (GA-1)	29
Wakatomika Creek (GA-1)	24
Federal Valley (GA-2)	27
Little Salt Creek (GA-3)	12
O'Bannon Creek (GA-4)	0.4
Upper Whiteoak Creek (GA-4)	10
Wolf Creek (GA-5)	28
E. Fork Little Sandy River (GA-6)	34
L. Scioto River (GA-6)	1[illegible]
French Creek (GA-7)	20
Upper Buckhannon River (GA-7)	27
Big Creek (GA-11)	2
Triplett Creek (GA-12)	30

TABLE 14-9
WATER QUALITY NEEDS, ALTERNATIVES AND NEEDS SATISFIED
BY GROWTH AREAS IN WATER SUB-REGION G

Growth Area		MGD			ACRE FEET			
		Gross Dilution Needs a/	Satisfied from b/ Streamflow or Existing Resrs.	Net Dilution Needs c/	Net Dilution Needs	Logan Reservoir	Whiteoak Reservoir	Royalton Reservoir
		2020	1980	2020	2020			
Muskingum R.	1	905	655 d/	250	180,000			
Hocking R.	2	262	242.3		7,200	7,200		
Scioto R.	3	1,400 e/	710.	690	520,000 f/			
L. Miami-Whiteoak	4	80	55	25 g/	21,000		6,150	
Upper Ohio Tribs.	5	6,000	6,000 g/	60	280			
Lower Ohio Tribs.	6	16,800	16,800 g/	0	0			
Monongahela	7	20	10	10	2,000			
Kanawha								
Upper (Va.)	8	1,100	1,100	0	0			
Middle	9	700			30,000			
Lower	10	17,000	8,300	8,700 f/	2,015,000 h/			
Guyandotte	11	37	37	0	0			
Big Sandy (Tug Fork)		57	25	32	6,000			
Big Sandy (Lev. Fk.)	12	35	35	0	0			
Licking River		20	12	8	3,200			3,200

a/ Needs throughout Growth Area - not applicable at any one point.
b/ Includes recovery (reoxygenation) ability of streams.
c/ Average daily based on entire year.
d/ Muskingum River has generally high water quality. Storage is for tributary needs.
e/ Power production at Chillicothe, Ohio cannot expand as projected, unless tertiary waste treatment is effected. (If Quality needs are met at Columbus-Chillicothe needs may be satisfied-conclusion would require a detailed analysis.)
f/ Based on 1930-34 period at Chillicothe, Ohio (and Kanawha Falls, W. Va.)
g/ Ohio River water has high oxygen recovery capacity if Kanawha R. and Pittsburgh effluents are treated.
h/ Plan includes adequate treatment of wastes - advanced treatment of industrial wastes - (Data is after 650,000 acre feet is stored in Blue Ridge Project).

TABLE 14-10
WATER USING RECREATION NEEDS AND ALTERNATIVES
WATER SUB-REGION G

Item	Annual Recreation Days (1,000)
Recreation Needs	143,300 a/
Projects (Ultimate Use) b/	
Hipes (in Water Sub-region C)	925
Logan Reservoir (Hocking Basin)	2,764
Federal Valley Watershed - P.L. 566 (Hocking Basin)	110
Little Salt Creek Watershed (Scioto River)	51
Pine Creek Watershed (Ohio River)	--
Whiteoak Reservoir (Ohio River)	708
Upper Whiteoak Watershed (Ohio River)	87
Cherry River (Kanawha River)	--
Greenbrier Project (Kanawha) c/	
Little Scioto River (Ohio River)	114
O'Bannon Creek (L. Miami River)	35
Wolf Creek (Muskingum)	305
E. Fk. Little Sandy River	20
French Creek (Monongahela)	79
Upper Buckhannon R. (Monongahela)	53
Moxahala-Jonathan Creek (Muskingum)	192
Wakatomika Creek (Muskingum)	136
Mate Creek Watershed (Big Sandy Tug)	50
Big Creek (Guyandotte R.)	40
Triplett Creek (Licking-Ky)	20
Headwaters Holston River	200
Peak Creek Watershed (New)	229 e/
Gypsy Hill Watershed (Greenbrier)	6 f/
Upper Meadow R. Watershed	1,446 e/
Quick Branch Watershed	30
Slaughter Creek Watershed	2 f/
Kellys Creek Watershed	32 e/
Lower Knox Creek Reservoir (Big Sandy Basin) d/	
Royalton Reservoir (Licking River Basin)	250
Rockhouse Creek Reservoir (SCS, Upper Licking).	24
Upper Middle Island Creek	40

a/ The increment between 1980 and 2020 demand for water using activities (see figure 14-4).
b/ Estimated use includes picnicking, camping and other water-related activities.
c/ The Greenbrier system is being restudied. Will be in Type II Plan.
d/ Infeasible by existing criteria.
e/ Includes planned and incidental recreation.
f/ Includes incidental recreation (not planned).

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SECTION IV - EVOLUTION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN

12. SELECTION OF BEST SOLUTIONS

Water resource needs for the growth centers in Sub-region G have been described in Section II, and potential sources for satisfying those needs described in Section III. Certain assumptions have been made in order to facilitate selection of the best apparent plan for the provision of the needs. Those assumptions are: (1) development of presently authorized projects will continue; (2) water supply requirements sufficient to supply the 1980 needs will be provided or contracted for by states or municipalities prior to that time; and (3) minimum releases from all reservoirs will equal inflow.*/ Existing authorized and potential projects, whether developed by the Corps of Engineers, Department of Agriculture, state, city, or public utility, have been considered. Non-structural alternatives have also been given consideration in the derivation of this plan.

Muskingum River Basin

Growth Area 1 contains the Primary Growth Centers - New Philadelphia-Dover, Cambridge, Zanesville, and Coshocton. The Secondary Growth Center is Malta-McConnelsville.

The major water-related constraint to economic growth today is flow regulation. Storage capacity is needed to retain runoff during periods of high flow and for release to augment low flows in the interest of water quality control on the major tributaries.

The major constraint to economic growth - to national levels - after 1980 will be water supplies to support industrial growth. (Figure 14-15 presents a schematic of needs for Growth Area 1.)

The long-range plan of development presented in the following discussion and tabulations is not complete. The plan can be completed when the Muskingum River Basin Study is completed in 1971 and the findings are coordinated with the programs of the State of Ohio and Federal and local governmental units.

Basin Plan of Development

The recommended water and related resources development plan for the Muskingum River in Growth Area 1 includes the following elements:

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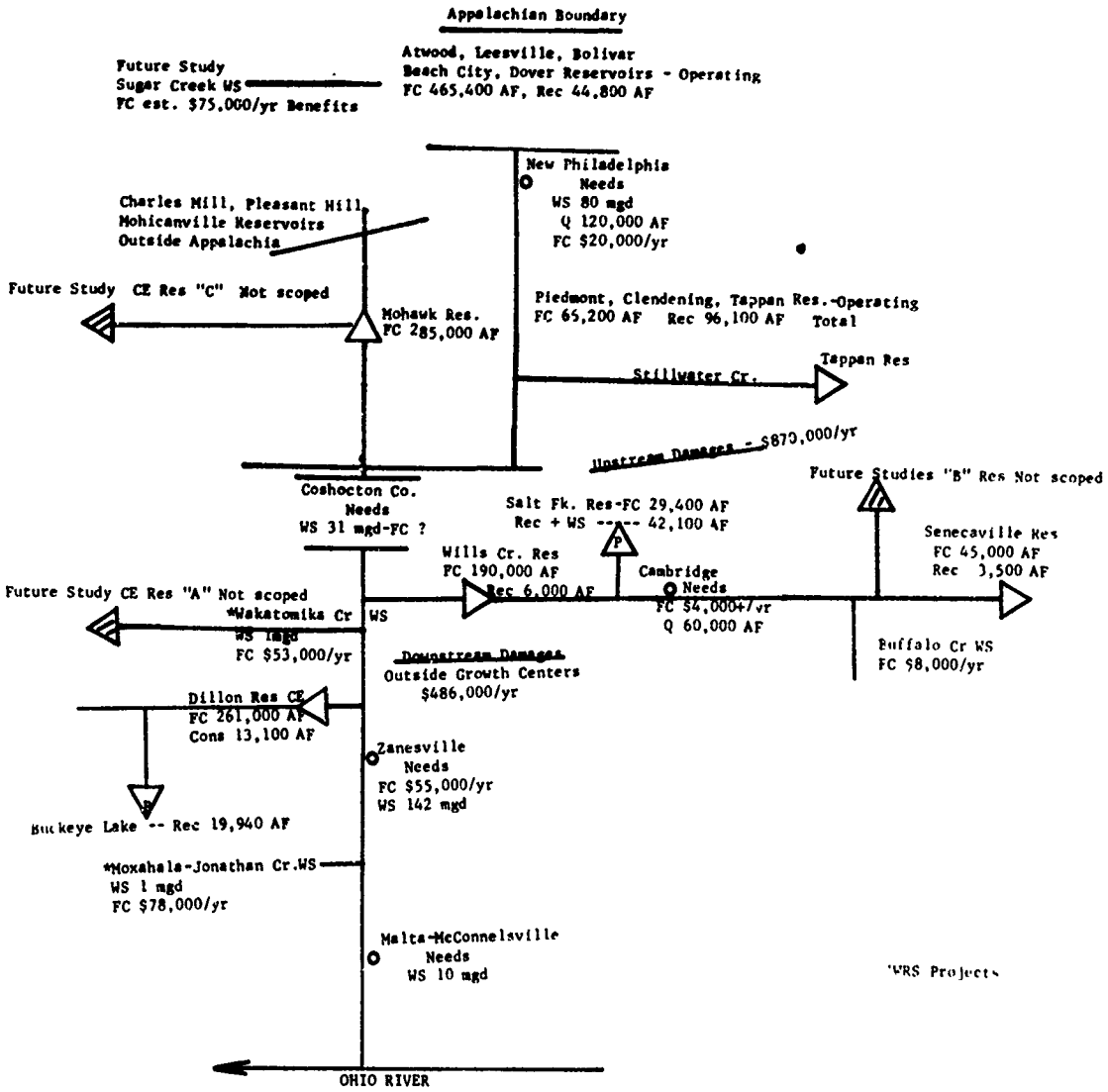
*/ To meet riparian obligations. For purposes of this Study we assumed that recorded minimum natural low flow would be available for use by all riparian owners.

FIGURE 14-15
NEEDS SCHEMATIC
GROWTH AREA NO. 1



Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S. - Interstate Highways No. 70 and 77
Ohio - Vocational Schools (2); One at Zanesville
Ohio - Expansion of Vocational Education at Ohio University - Athens
Local - Development plans for 5 growth centers
Local - Zanesville Airport (ARC grant)

Water Resources (See Figure 14-16)

Corps of Engineers

Dillon Reservoir
North Branch of Kokosing Reservoir (outside Appalachia)
Utica Reservoir (outside Appalachia)

Corps of Engineers and Muskingum Conservancy District

Atwood Reservoir
Beach City Reservoir
Bolivar Reservoir
Clendening Reservoir
Dover Reservoir
Leesville Reservoir
Mohawk Reservoir
Piedmont Reservoir
Senecaville Reservoir
Tappan Reservoir
Wills Creek Reservoir
Beneficial projects outside Appalachia (Charles Mill, Pleasant Hill and Mohicanville Reservoirs)

State of Ohio (Dept. of Natural Resources)

Salt Fork Reservoir
Friendship Park Recreation Complex in Jefferson County (Water Sub-region F)
Buckeye Lake - Recreation
Lake Mohawk - Recreation

USDA - SCS - Upstream Watershed Project

Buffalo Creek Map Location No. 1

Local Programs

Coshocton Flood Plain Information Studies (CE report)
Cambridge Flood Plain Information Studies (CE report)
New Philadelphia Flood Plain Information Studies (CE report)
Zanesville Flood Plain Information Studies (GS report)

Cooperative Federal State Programs

Comprehensive Study of Muskingum River Basin (1970)

For authorization:

USDA - SCS Watershed Projects

Moxahala-Jonathan Creeks	Map Location No. 12
Wakatomika Creek	Map Location No. 15

Future studies:

A Priority

Corps of Engineers

Reallocation (initial program) of existing storage

B Priority

Corps of Engineers

A, B and C Reservoirs from Muskingum River Basin Report and/or Zanesville LPP

USDA - SCS - Watershed Projects

Sugar Creek (below Beach City Res.-CE) Map Location No. a

The work plan of two watershed projects would benefit the growth centers around Zanesville and Malta-McConnelsville by decreasing discharges of sediment and mine pollutant (especially important in the future); by decreasing flood losses and access interruption in the hinterlands (more trade); and by flood protection to satellite communities.

Downstream flood damages in the basin have already been greatly reduced by the system of fifteen reservoirs. Local damages at Zanesville could be mitigated by a Local Protection Project or by additional

potential reservoirs (A) now being considered in the Comprehensive Basin Study. Reallocation of storage would also necessitate additional (B) reservoir(s) on Wills Creek. Reservoir (C) sites are also being studied in Holmes County above Coshocton.

Table 14-11 presents the effectiveness of alternatives considered in Growth Area 1. A map and schematic diagram of the various alternatives considered is shown in Figure 14-16.

TABLE 14-11
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 1
MUSKINGUM RIVER BASIN, SUB-REGION G
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. UPSTREAM WSHDS c/	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES CONTRI-BUTION	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
New Philadelphia	80	-			Industrial Reuse	Unknown		Groundwater	Limited	Unknown
Coshocton	31	-			Industrial Reuse	Unknown		Groundwater	Limited	Unknown
Zanesville	142	-	2 c/	140	Realloc. of Dillon Res. Storage	40+	100	Realloc. of Dillon Res. Storage	Limited 100	Unknown Unknown
								Groundwater Potential C.E. Reservoir(A) f/	Undeter-mined	
Water Quality	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
New Philadelphia	120,000	-		120,000	Reallocation of storage in existing reservoirs	80,000 d/	40,000			40,000
Cambridge	60,000	-		60,000	Reallocation of storage in Senecaville Res.	30,000+	30,000	Potential C.E. Res.(B) f/	30,000	0
Flood Control (residual damage)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
New Philadelphia	20	-		20	Sugar Creek Proj.	15	5			5
Cambridge	4	-		4			4			4
Zanesville	55	-		55		0	55	Zanesville LPP + F.P. Zoning + Potential C.E. Res.(C) & (A) f/	50	5
Other Downstream	486	1 b/		485			486	Potential C.E. Res.(C) & (A) f/	300+	186+
Upstream	870	8 b/	131	731	Sugar Creek Proj.	50+	684			684+
Flood Plain Area (Urban)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Growth Area #1	4,000	-	-	4,000						
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #1	22,000	-	328	21,672	Sugar Creek	100+	21,572	Potential C.E. Res.(A,B&C)	3,000+	18,600
Performance Index #1 e/										
Performance Index #2 e/										

a/ Needs presented are for total growth center.

b/ C.E. Utica Reservoir (1) upstream from Appalachia and USDA Buffalo Creek Watershed (8) in Wills Creek Basin.

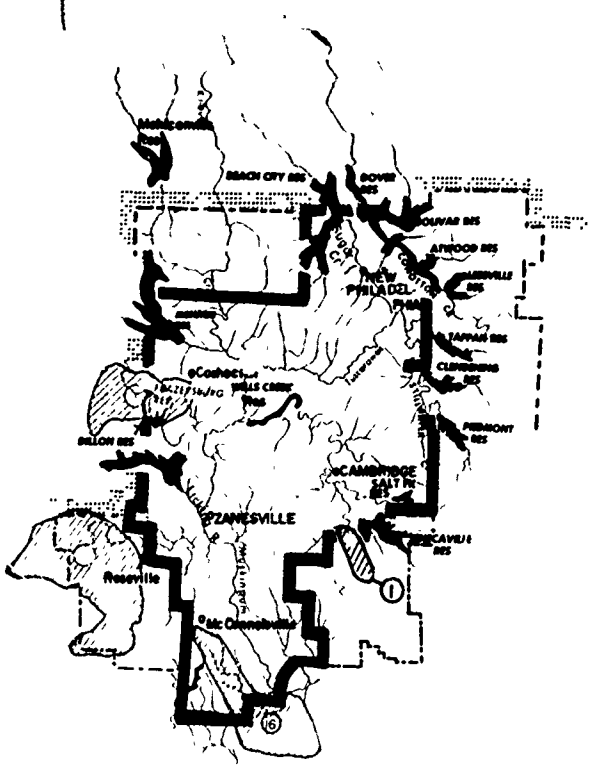
c/ Moxahala-Johnathan Creeks (1)c/, and Wakatomika Creek (1)c/ in W.R. S. Plan

d/ Effective values given - no structure is above the contamination area in lower Stillwater Creek.

e/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$

f/ Potential C.E. Reservoirs ( ) for Frazeysburg, ogg, Valley Run Reservoirs, etc., (B) for Upper Wills Creek (Leatherwood) Reservoir
Reservoir (B) will replace functions shifted from Senecaville Reservoir and/or store water for quality control;
(C) in Holmes County, above Coshocton, would have flood control, water quality and recreation storage.



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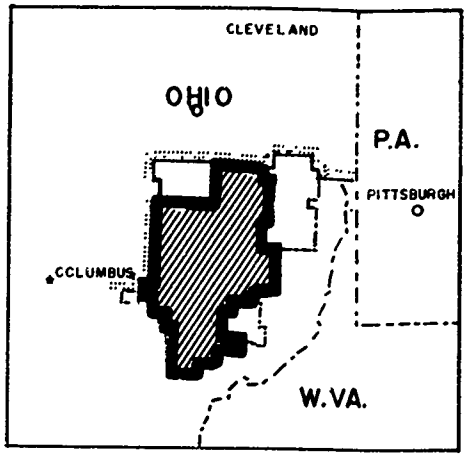


VICINITY MAP

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECT

LPP PROJECT

UPSTEAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

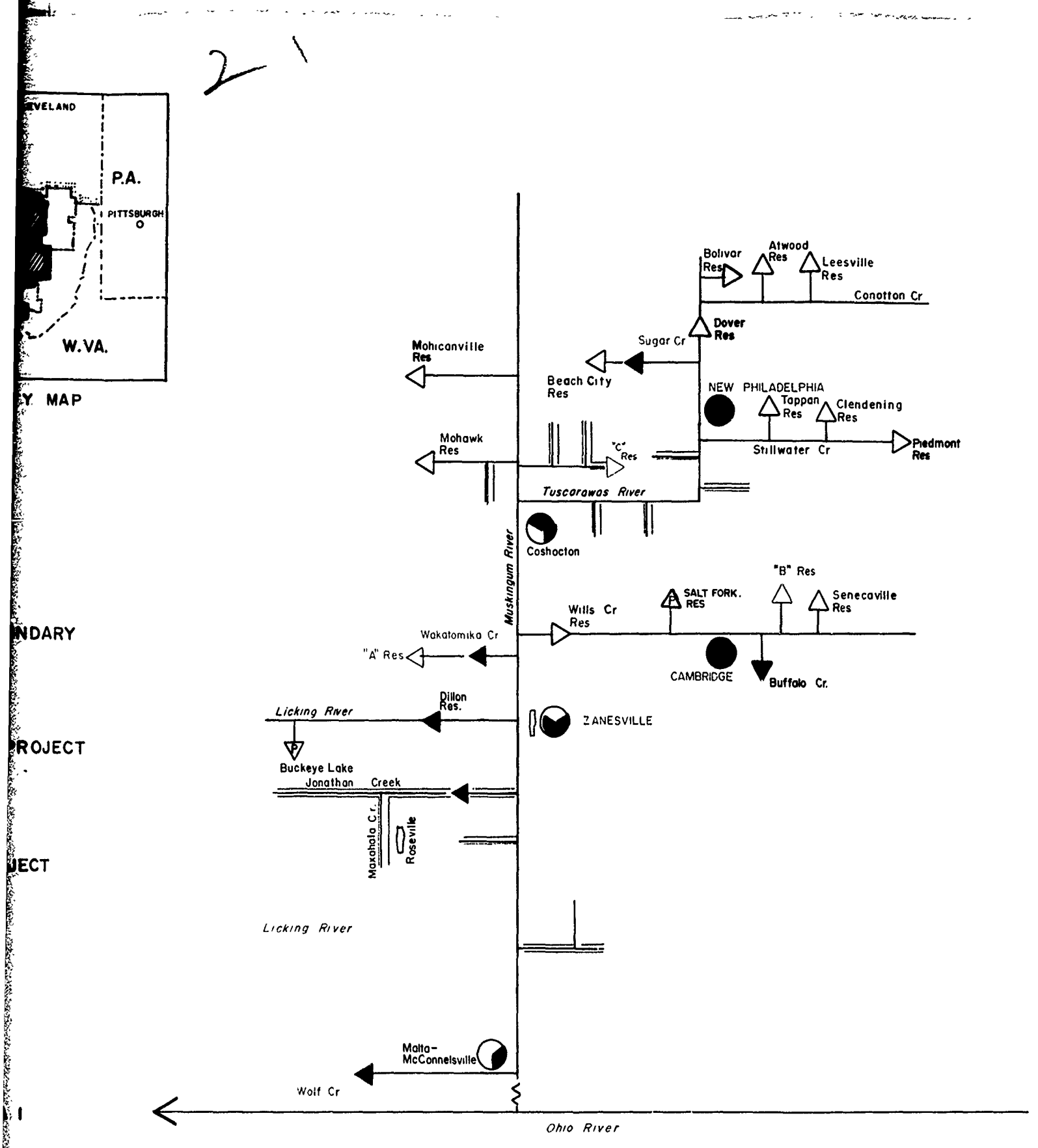
1 Buffalo Creek

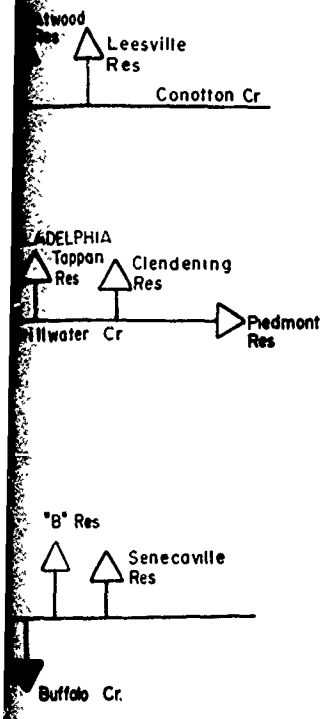
ALTERNATIVE AVAILABLE FOR PLANNING

12 Maxahala - Jonathan Creek
16 Wolf Cr

GROWTH AREA 1

LOCATION MAP


EVELAND
P.A.
PITTSBURGH
W.VA.
Bolivar Res
Atwood Res
Leesville Res
Conotton Cr
Dover Res
Sugar Cr
Mohicanville Res
Beach City Res
NEW PHILADELPHIA
Tappan Res
Clendening Res
Piedmont Res
Stillwater Cr
Mohawk Res
"C" Res
Tuscorawas River
Coshocton
Muskingum River
"B" Res
SALT FORK. RES
Senecaville Res
Wills Cr Res
Wakatomika Cr
"A" Res
CAMBRIDGE
Buffalo Cr.
Dillon Res.
Licking River
ZANESVILLE
Buckeye Lake
Jonathan Creek
Maxahala C.r.
Roseville
Licking River
Malta-McConnelsville
Wolf Cr
Ohio River



3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LPP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

GROWTH AREA I
OHIO

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

11-14-105 FIGURE 14-16

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Hocking River Basin

Growth Area 2 contains the Primary Growth Area - Logan-Athens.

The major constraint to economic growth today is flooding at Athens, Logan, and Nelsonville.

The major water related constraint to economic growth - to national levels - after 1980, will be water supplies to support industrial growth at Athens, Logan, Nelsonville, and other communities. (Figure 14-17 presents a schematic of needs for Growth Area 2.)

The selected Hocking River Basin water plan was developed based on the assumption that the proposed Logan, Rockbridge, Nelsonville and Athens (authorized) Local Protection Projects, consisting of channel improvements, will be in place by 1980.

A multiple purpose reservoir on Clear Creek was studied and, as requested by the Ohio Department of Natural Resources, special consideration was made of the need for and means of preserving environmental and ecological values that are peculiar to the watershed. A plan for a multi-purpose reservoir was developed which includes 7,200 acre-feet of storage for water quality control, 24 mgd of water supply (29,900 acre-feet), 35,900 acre-feet for flood control and a 5,000 acre-feet conservation pool. The water supply is for Lancaster, outside Appalachia. In addition, it is proposed that an annual recreational capacity of 2,764,000 man-days be provided. (See Part III, Chapter 15.)

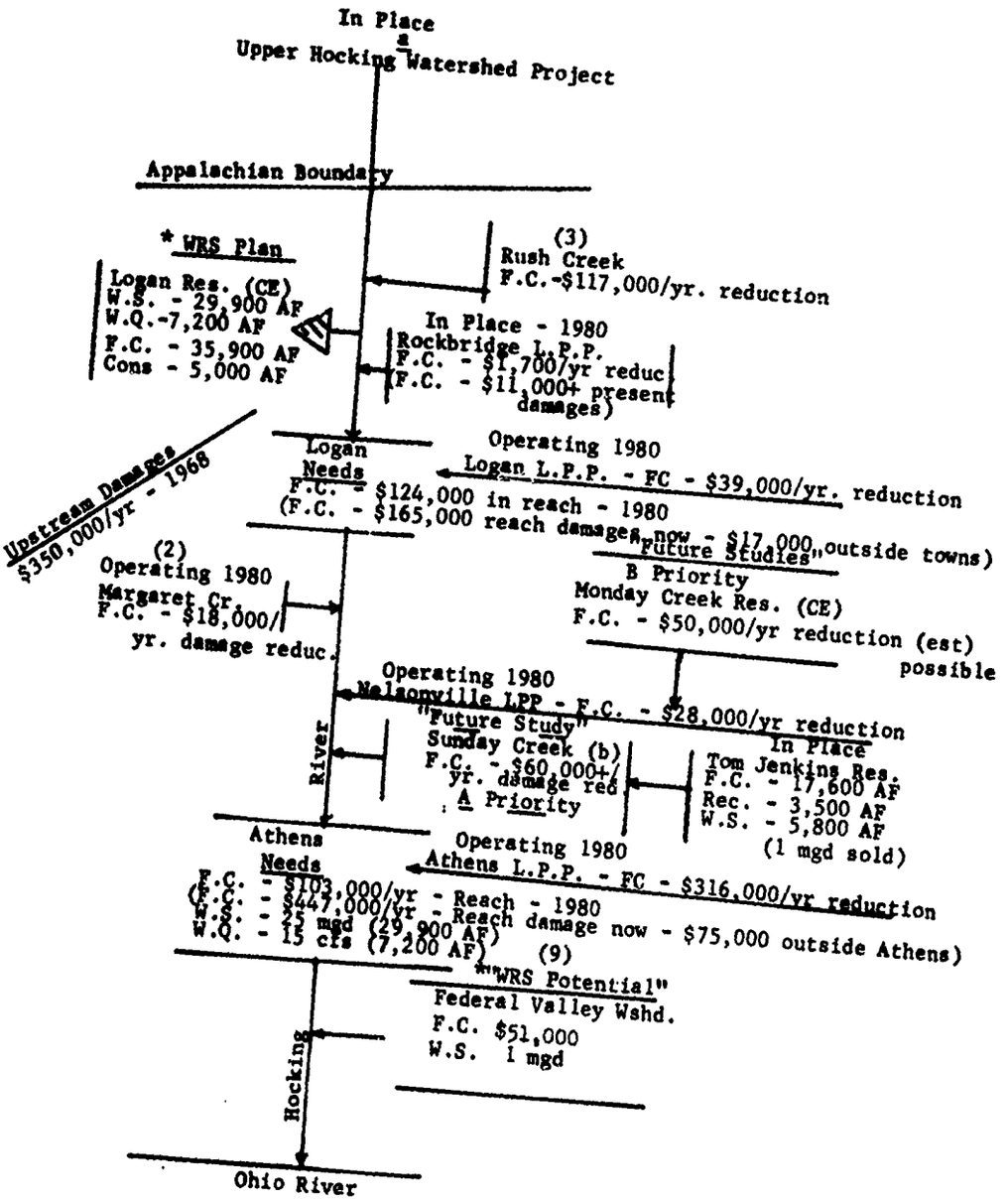
Upper Hocking Watershed Project is now operational. Margaret Creek and Rush Creek Watershed Projects (USDA) will be in place by 1980. The USDA Soil Conservation Service developed a Federal Valley Watershed Program which is feasible. In addition to flood prevention and sediment reduction, the project will supply 1 mgd of municipal water supply.

In the future it is expected that Athens will get water supply from groundwater and stream flow. A Sunday Creek Watershed Project would reduce the remaining $164,000 average annual upstream flood damages by about 60,000 dollars. The remaining damages are so distributed throughout the basin that future project action appears improbable. Reallocation of water supply in Tom Jenkins Reservoir may be necessary as water needs increase.

A multiple purpose reservoir, located in the Monday Creek basin could result in a higher level of flood control at Athens and could furnish needed water supply.

Control of pollution from acid mine drainage is the subject for continuing study and water related control measures cannot be determined now.

FIGURE 14-17
NEEDS SCHEMATIC
GROWTH AREA 2



* "W.R.S. Plan"

Basin Plan of Development

The recommended plan of development of water and related resources for the Hocking River in Growth Area 2 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S. (ARC) Appalachian Highway Corridor D
Ohio - Tri-County Vocational School and Technical Institute at Nelsonville
Ohio - Expansion of Vocational Education at Ohio University - Athens
Local - Development plans for 2 growth centers
Local - Athens Airport and Training Center (+ARC grant)

Water Resources (See Figure 14-18)

Corps of Engineers

Tom Jenkins Reservoir
Rockbridge Local Protection Project
Logan Local Protection Project
Nelsonville Local Protection Project
Athens Local Protection Project

USDA - SCS - Upstream Watershed Projects

Rush Creek	Map Location No. 3
Upper Hocking	Map Location No. a
Margaret Creek	Map Location No. 2

Local Programs

Athens Flood Plain Information Studies (CE report)
Logan Flood Plain Information Studies (CE report)
Nelsonville Flood Plain Information Studies (CE report)
Lake Logan - Recreation

For authorization:

Corps of Engineers

Logan Reservoir

USDA - SCS - Watershed Projects

Federal Valley	Map Location No. 9

Future studies:

A Priority

USDA - SCS - Watershed Projects

Sunday Creek

B Priority

Corps of Engineers

Monday Creek Reservoir
Reallocation of water in Tom Jenkins Reservoir

Table 14-12 presents the effectivess of alternatives considered in Growth Area 2. A map and schematic diagram of the various alternatives considered is shown in Figure 14-18.

TABLE 14-12
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 2
HOCKING RIVER BASIN, SUB-REGION G
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. Logan Res. (C.E.) a/	CONTRIB. OF ALTER. Fed.Valley Wshds b/	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES GROUP A CONTRI-BUTION	RECOMMENDED FUTURE STUDIES GROUP A UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP B (2nd priority)	RECOMMENDED FUTURE STUDIES GROUP B CONTRI-BUTION	RECOMMENDED FUTURE STUDIES GROUP B UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Athens	25	-	24c/	1	24	Groundwater & Streamflow	14	10	Monday Creek Res.	10	0
Water Quality	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
Athens	7.2	-	7.2	-	0		0	0	Realloc. of Tom Jenkins storage as needed - outside Basin also & Monday Creek Res.		0
Flood Control(resid.dam.)	($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Logan (Reach)	165	41 a/	39	-	85		-	85		-	85
Athens (Reach)	447	344 b/	48	-	55		-	55	Monday Creek Res.	60	15
Upstream	350	135 c/	-	51	164	Sunday Creek Wshd	60+	104		-	104
Flood Plain Area (Urban)	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Rockbridge	150	Partial	150	-	0		-	0		-	0
Logan	500	Partial	500	-	0		-	0		-	0
Nelsonville	350	Partial	350	-	0		-	0		-	0
Athens	1,300	Partial	1,300	-	0		-	0	Monday Creek Res.	-	0
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #2	6,000		1,131	110	4,759	Sunday Creek Wshd	250	4,539	Monday Creek Res.	1,000	3,559
Performance Index #1 d/			1.4								
Performance Index #2 d/			1.4								

a/ From Logan & Rockbridge LPP's.

b/ From Athens & Nelsonville LPP's.

c/ From Margaret Creek and Rush Creek Watersheds.

d/ Performance Index # 1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Projects Costs}}$

Performance Index # 2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$

e/ Water supply for Lancaster, Ohio outside Appalachia.

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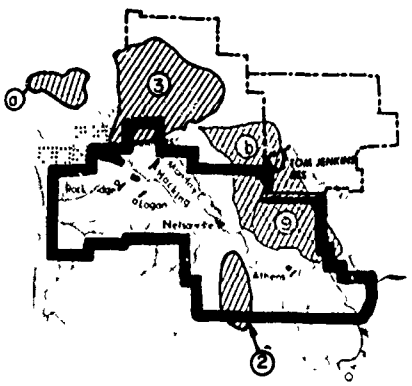

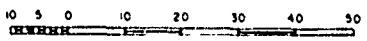

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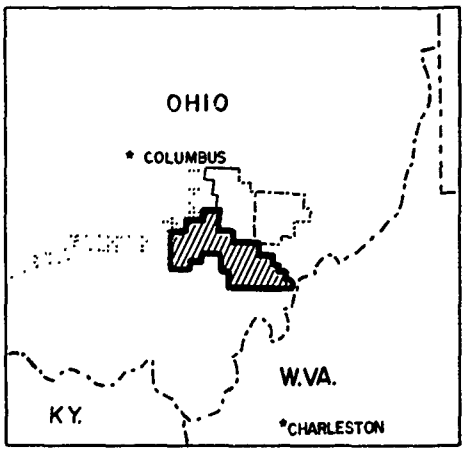


VICINITY MAP

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1930

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

LPP PROJECTS

PLANNING ALTERNATIVES

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

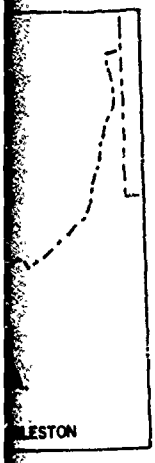
a Upper Hocking
2 Margaret Creek
3 Rush Creek

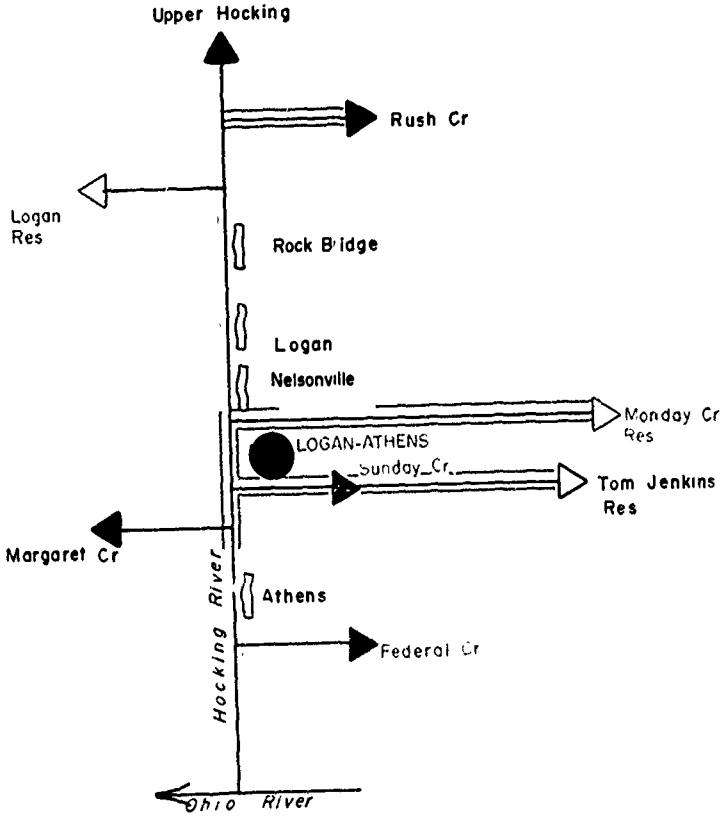
ALTERNATIVES AVAILABLE FOR PLANNING

1 Sunday Creek
9 Federal Creek

GROWTH AREA 2
OHIO

LOCATION MAP




Upper Hocking
Rush Cr
Logan Res
Rock Bridge
Logan
Nelsonville
Monday Cr Res
LOGAN-ATHENS
Sunday Cr.
Tom Jenkins Res
Margaret Cr
Athens
Federal Cr
Hocking River
Ohio River

3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT

Monday Cr Res

Tom Jenkins Res

OTHER

TOWN NAME - PRIMARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

GROWTH AREA 2
OHIO

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-113 FIGURE 14-18

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Scioto River Basin

Growth Area 3 contains the Primary Growth Area - Chillicothe and the Secondary Growth Areas of Hillsboro-Greenfield and Jackson County.

The major water-related constraint to economic growth today is water quality control.

The major constrant to economic growth - to national levels - after 1980 will be water quality control at Chillicothe. (Figure 14-19 presents a schematic of needs for Growth Area 3.)

Basin Plan of Development

The recommended plan of development of water and related resources for the Scioto River in Growth Area 3 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

- U.S. - (ARC) Demonstrative Health Area (Ohio)
- U.S. - (ARC) Appalachian Corridors, B, C, and D
- U.S. - Highway 35 (4-Lane - Limited Access)
- Ohio - Vocational School and Technical Institute at Lucasville - Scioto County
- Ohio - Expansion of Higher Education at Ohio University - Athens (nearby)
- Local - Development plans for 4 growth centers

Water Resources (See Figure 14-20)

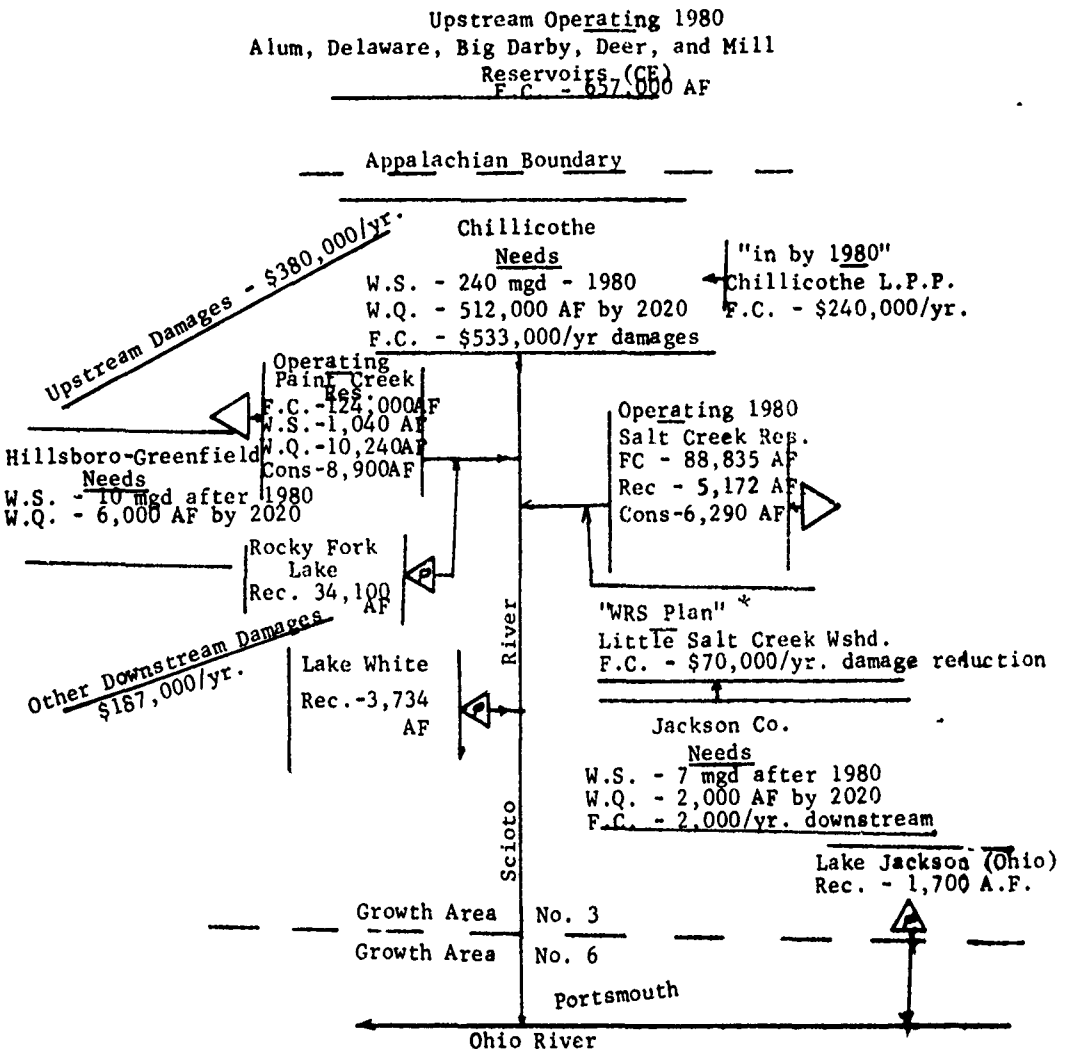
State of Ohio (and local)

- Lake White
- Rocky Fork Lake
- Lake Jackson

Corps of Engineers

- Salt Creek Reservoir
- Paint Creek Reservoir
- Chillicothe Local Protection Project (Scioto River and Paint Creek)
- Upstream reservoirs outside of Appalachia affecting streamflow within the area (Alum, Mill, Big Darby, Delaware, and Deer Creek)

FIGURE 14-19
NEEDS SCHEMATIC
GROWTH AREA 3



* "W.R.S. Plan"

USDA - SCS - Upstream Watershed Project

Clear Creek Map Location No. 2

Local Programs

Jackson Flood Plain Information Studies (USDA-SCS report)
Chillicothe Flood Plain Information Studies (CE and GS report)

For authorization:

USDA - SCS - Watershed Projects

Little Salt Creek Map Location No. 10

Future studies:

Corps of Engineers

Reallocation of water in existing reservoirs

Lands needed for industrial expansion (3,570 acres) were identified in the area study (See Figure 14-11 and Table 14-2). There are not sufficient developable lands in the floodplain to meet all urban needs, the lands identified being about 50 percent of that needed. However, there are more than enough suitable uplands available for residential purposes.

The Little Salt Creek Watershed Project will alleviate flood problems in Jackson County as planned; however, the plan should be revised to include water supply and quality control storage for Jackson (if USDA can share in quality storage). Channel improvement of Salt Creek will be considered for protection at Laurelville.

The critical unmet needs (assuming the great increase in water needs of an expanding paper industry - as projected in Appendix E - are realized) are and will continue to be water for industry and quality control at Chillicothe. Solution to those problems must be found in concordance with the same problems at Columbus.

The reallocation (redistribution) of waters in Rocky Fork Lake, Paint Creek Reservoir, Salt Creek Reservoir and use of Scioto River streamflows (as regulated by upstream reservoirs) could meet all needs in Growth Area 3 except, possibly those at Chillicothe. Industrial reuse should be a first step. New storage and reallocation of flood storage in Delaware, Big Darby, Alum, Mill Creek and Deer Reservoirs (CE) will be considered. Tertiary treatment of wastes seems to be a first step, economically, after 1980. Other possible reservoirs are discussed in the Ohio River Basin Comprehensive Survey Report; their inclusion in a future plan will come after the scheduled restudy of the Scioto Basin - with seven major structures and Chillicothe LPP in place.

Table 14-13 and Figure 14-20 present the plan.

TABLE 14-13
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 3
SCIOTO RIVER BASIN, SUB-REGION G
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. WSHD a/	UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP A (1st priority)	CONTRI-BUTION	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Chillicothe	240	-	-	240	Industrial Reuse	100	140	+ reuse of Dilution Water (Paint Cr + Salt Cr. Res. Cons. Pool)	120	0
Hillsboro-Greenfield	10	-	-	10	Rocky Fork Lake	4			20	
					Paint Cr. Res. Cons.	6	0		-	0
Jackson	7	-	-	7	L. Jackson & L. Salt Creek Plan	7	0		-	0
Water Quality	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
Chillicothe	512				Storage Upstream b/	300+	212-	+Tertiary Waste Treatment	170+	42-
Greenfield (+10 cfs)	3									
Hillsboro (+10 cfc)	3									
Jackson (+5 cfs)	2				Little Salt Creek	2	0		-	0
Flood Control (residual damage)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Chillicothe	300	240 c/	-	60		60	0		-	60
Jackson	2	-	2						-	2
Other Downstream	187	-	-	187		-	187		-	187
Upstream	380	-	68	312		-	312		-	312
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Chillicothe										
Recreation (Msn-days)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #3	41,000		51	40,949		-	40,949		-	40,949
Performance Index #1 d/										
Performance Index #2 d/										

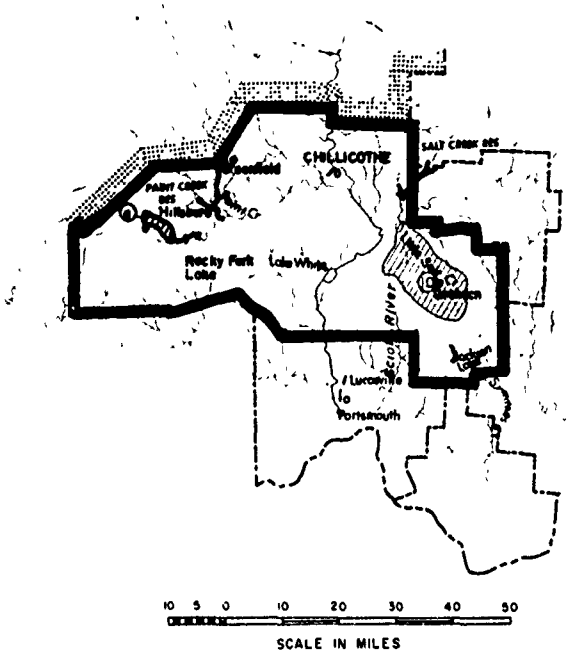
a/ Little Salt Creek Wshd

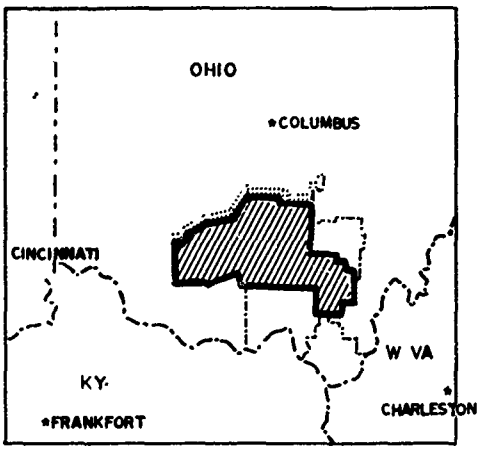
b/ If critical need is met at Columbus, reserated water may satisfy dilution needs at Chillicothe.

c/ Chillicothe Local Protection Project - 7 major reservoirs assumed to be in place.

d/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Reg. al Income Gains}}{\text{Total Costs}}$





VICINITY MAP

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVE

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

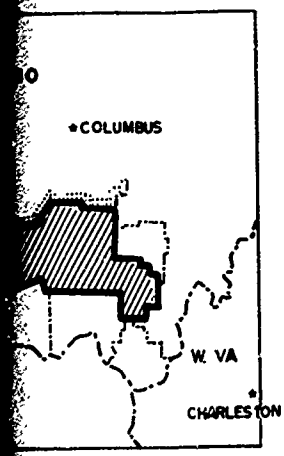
a Clear Cr

ALTERNATIVE AVAILABLE FOR PLANNING

10 Little Salt Cr

GROWTH AREA 3
OHIO

LOCATION MAP



MAP

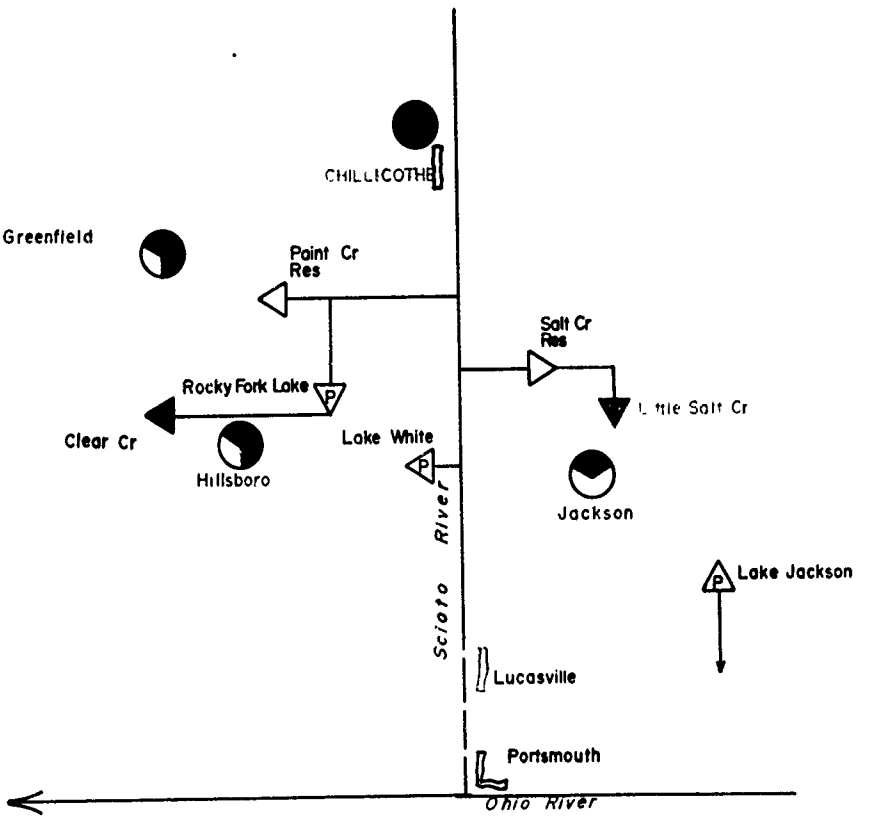
UNDARY

ROJECT

PROJECT

REA 3

N MAP



3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

Little Soak Cr

Lake Jackson

GROWTH AREA 3
OHIO

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-119 FIGURE 14-20

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Little Miami River Basin

Growth Area 4 contains the Secondary Growth Area of Clermont County.

The major water-related constraint to economic growth today is water supply.

The major constraint to economic growth - to national levels - after 1980 will be water supplies to support industrial growth. The economic growth will not be truly constrained by the water resource. (Figure 14-21 presents a schematic of needs for Growth Area 4.)

Basin Plan of Development

The recommended plan of development of water and related resources for the East Fork Little Miami River - Whiteoak Creek, plus other Ohio River tributaries in Growth Area 4, includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S. - (ARC) Appalachian Corridor D
U.S. - Interstate Highway No. 71
Ohio - Vocational School and Technical Institute - Grants Park
Ohio - Expansion of Vocational Education at University of Cincinnati (nearby)
Local - Development of plans for Clermont and Brown Counties

Water Resources (See Figure 14-22)

State of Ohio (and Local)

Grant Lake

Corps of Engineers

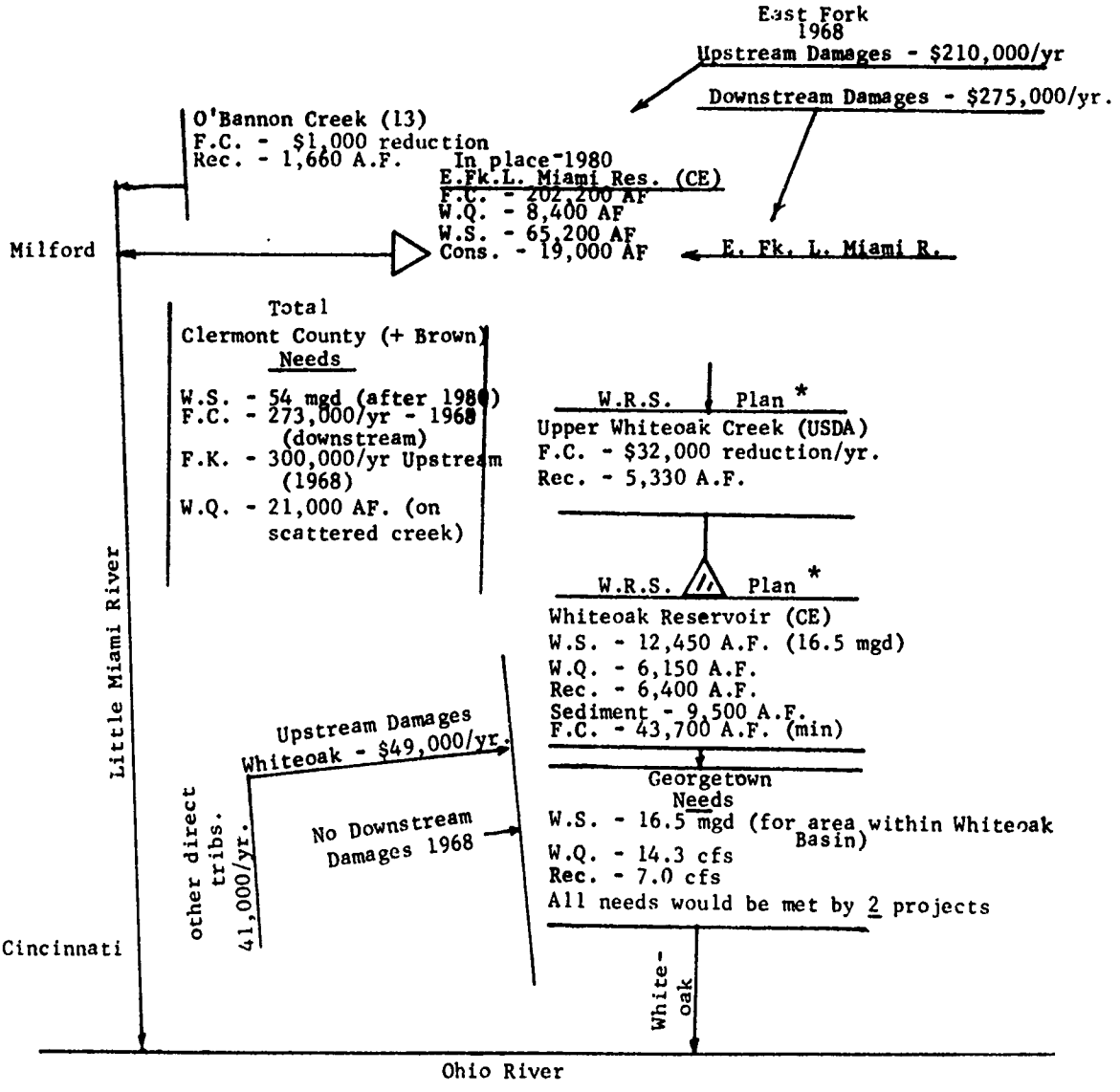
East Fork (Little Miami River) Reservoir
Meldahl Lock and Dam (Ohio River Navigation)

Local Programs

Milford Flood Plain Information Studies (CE report)
Cincinnati Flood Plain Information Studies (CE report)

For authorization:

FIGURE 14-21
NEEDS SCHEMATIC
GROWTH AREA 4



* W.R.S. Plan

Corps of Engineers

Whiteoak Reservoir

USDA - SCS - Water Projects

O'Bannon Creek	Map Location No. 13
Upper Whiteoak Creek	Map Location No. 14

Future studies:

Corps of Engineers

Reallocation of water in East Fork Reservoir (A Priority after 1980)

The Water Plan of Whiteoak Reservoir and two Upstream Watersheds, Upper Whiteoak Creek and O'Bannon Creek, in addition to the East Fork Reservoir (which will be operating by 1980), when implemented, will result in the removal of any foreseeable water constraint. There will be local distribution system problems as Greater Cincinnati "absorbs" Clermont County. The East Fork Basin has reservoir locations for storage of water for quality control at Cincinnati if needed later. East Fork Reservoir waters could be reallocated - water supply for new communities (37 mgd) - without decreasing flood protection downstream greatly.

The area will grow at least as fast as projected in Appendix E of this report.

Table 14-14 presents the effectiveness of alternatives considered in Growth Area 4. A map and schematic diagram of the various alternatives considered is shown in Figure 14-22.

TABLE 14-14
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 4
LITTLE MIAMI RIVER BASIN, SUB-REGION C
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. Whiteoak c/ Res. (CE)	Wshds b/	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES CONTRI-BUTION	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Georgetown (Whiteoak Basin)	17-	-	17-	-	0						
Outside Whiteoak Basin (E. Fk. Res. Furn 25 mgd before 1980)	37+	-	-	-	37+	Realloc. E. Fk. Res. Cincinnati W.S.	37	0			0
Water Quality (1980)	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
Georgetown	6,150	-	6,150	-	0			0	Q for Cincinnati		0
Flood Control (residual damage)	($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Georgetown	0	-	-	-	0		-			-	0
Other Downstream	273	226	-	-	47		-	47		-	47
Upstream	300	-	-	33	267		-	267	USDA Upstream Wshds	170	97
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Georgetown	0	-	-	-	0		-	0		-	0
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #4	12,000		708	122	11,170		-	11,170		300	10,870
Performance Index #1 d/			1.2								
Performance Index #2 d/			5.2								

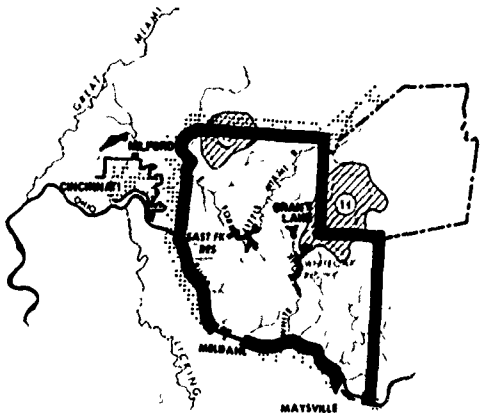
a/ East Fork Reservoir (C.E.)

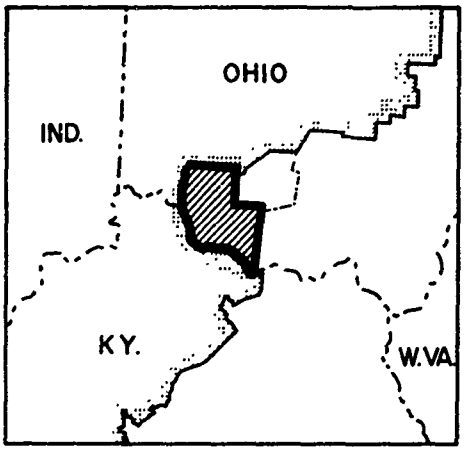
b/ Upper Whiteoak Creek and O'Bannon Creek

c/ Growth Area #6 tabulation contains Ohio River F.C. Benefits

d/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Projects Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$





VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY [illegible]

MAJOR RESERVOIRS

LOCK & DAM

LPP PROJECTS

PLANNING ALTERNATIVES

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

UPSTREAM WATERSHED PROJECT IDENTIFICATION

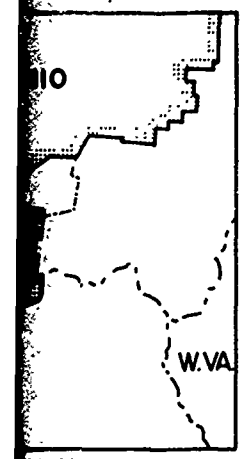
ALTERNATIVES AVAILABLE FOR PLANNING

3 O Bannon Creek

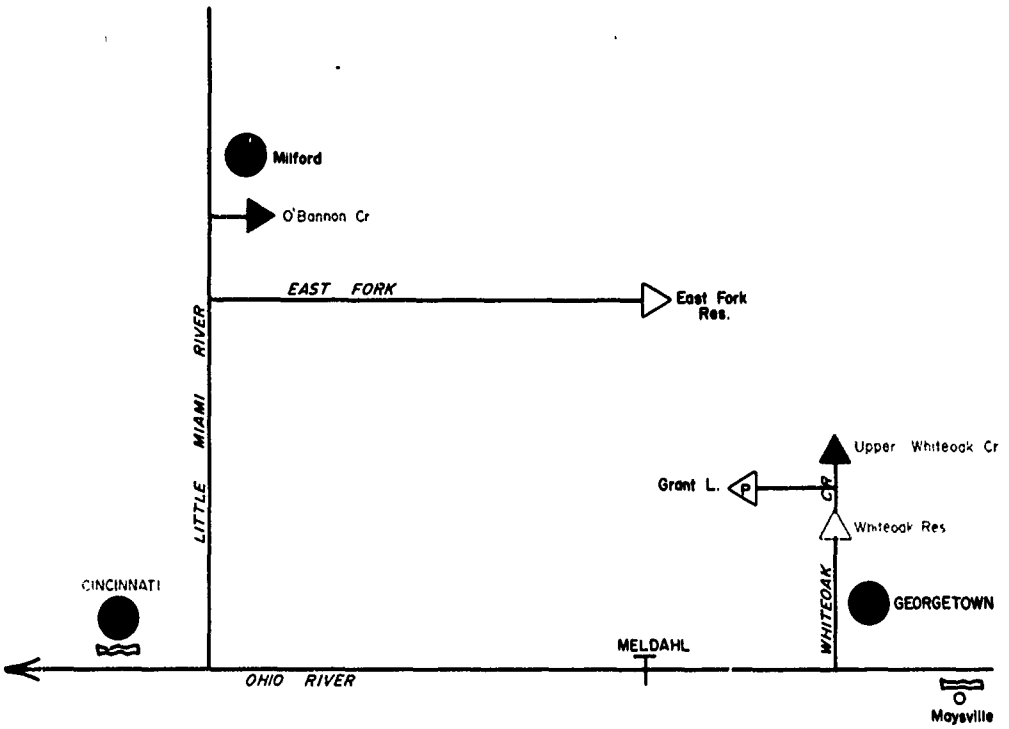
4 Upper Whiteoak Creek

GROWTH AREA 4
OHIO

LOCATION MAP



Y MAP



ARY

JECTS

EA 4

MAP

3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Whiteoak Cr

ook Res

GEORGETOWN

Maysville

GROWTH AREA 4
OHIO

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-125 FIGURE 14-22

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Upper Ohio River

Growth Area 5 contains the Primary Marietta, Ohio and Parkersburg, W. Virginia Growth Center on the Ohio River and the Secondary Growth Center of Spencer-Grantsville, West Virginia (Little Kanawha Basin).

The major water-related constraint to economic growth today is inadequate water and sewage distribution systems in the growth centers.

The major constraint to economic growth - to national levels - after 1980 will be flood control in the Growth Centers. Water for municipal use (industrial expansion) will be critical if Ohio River waters cannot be used. (Figure 14-23 presents a schematic of needs for Growth Area 5.)

Basin Plan of Development

The recommended plan of development of water and related resources for the Upper Ohio River in Growth Area 5 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S. - (ARC) Appalachian Corridor D
U.S. - Interstate Highway No. 77
W. Va. - Expansion of Vocational Education at Marshall University - Huntington, W. Va.
Local - Development plans for 4 growth centers

Water Resources (See Figure 14-24)

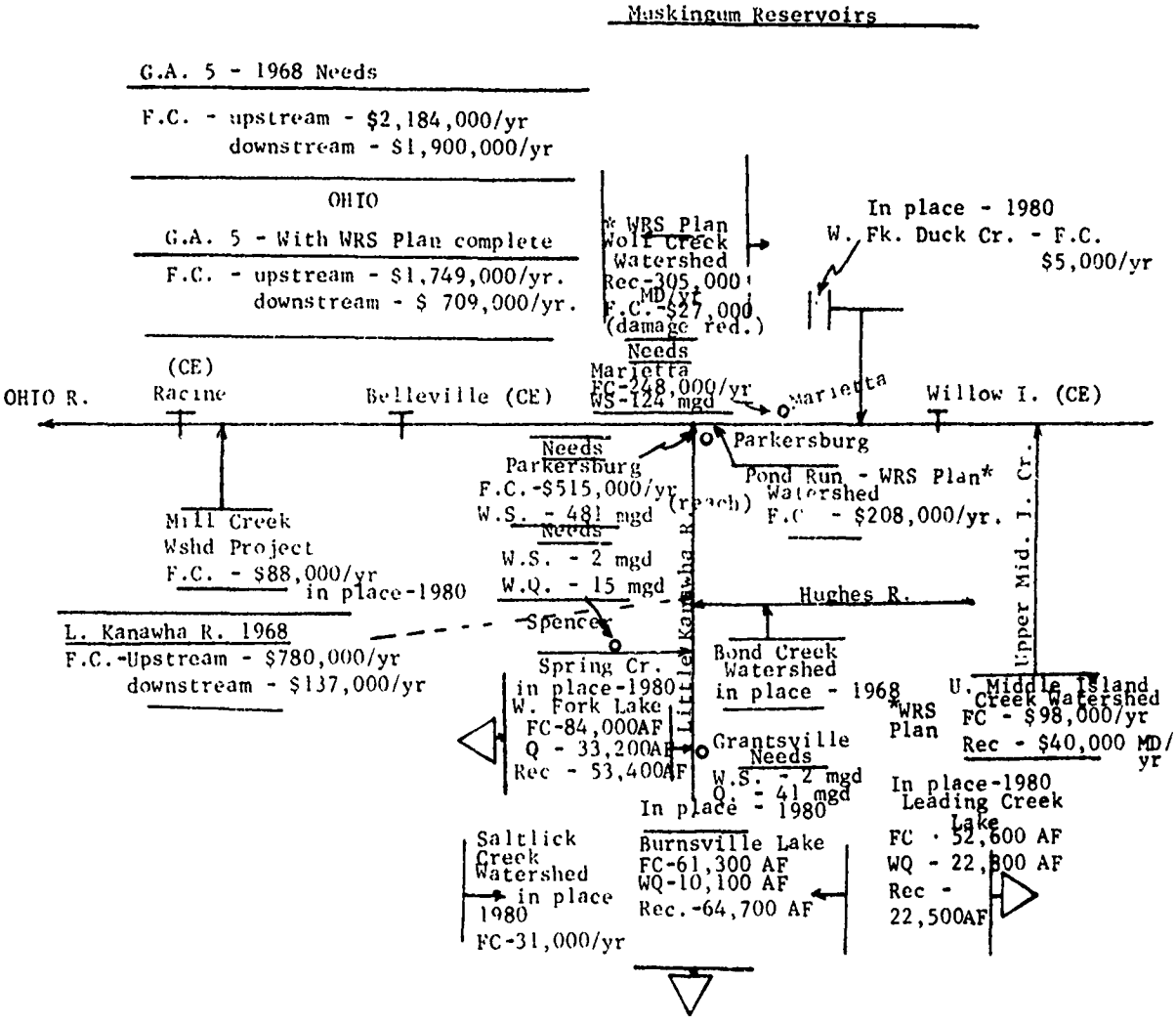
Corps of Engineers

Complete Reservoir Monitoring (Regulation) System
West Fork Lake (L. Kanawha River)
Leading Creek Lake (L. Kanawha River)
Burnsville Lake (L. Kanawha River)
Racine Lock and Dam (Ohio River Navigation)
Belleville Lock and Dam (Ohio River Navigation)
Willow Island Lock and Dam (Ohio River Navigation)
Hannibal Lock & Dam (Ohio River Navigation)
Parkersburg Local Protection Project
Cairo, W. Va. Local Protection Project

Ohio

Wolf Run Reservoir - Recreation - W. Fork Duck Creek

FIGURE 14-23
NEEDS SCHEMATIC
GROWTH AREA 5



Note: All water needs at Parkersburg and Marietta can be satisfied from the Ohio River - needs are shown to indicate distribution system requirements.

* WRS Plan

USDA - SCS - Upstream Watershed Projects

Bond Creek	Map Location No. 1 (L. Kan. R.)
W. Fork Duck Creek	Map Location No. 16 (Ohio)
Mill Creek (Upper)	Map Location No. 90 (W. Va.)
Saltlick Creek	Map Location No. 15 (L. Kan. R.)

Local Programs

Marietta, Ohio Flood Plain Information Studies (CE report)
Parkersburg, W. Va. Flood Plain Information Studies (CE report)
Spencer Flood Plain Information Studies (SCS report)

Cooperative - Federal - State

Central Ohio Survey

For authorization:

USDA - SCS - Watershed Projects

Wolf Creek	Map Location No. 16
Pond Run	Map Location No. a
Upper Middle Island Creek	Map Location No. 89

Future studies:

A Priority

Corps of Engineers

Marietta - Belpre Local Protection Project - restudy

USDA - SCS - Watershed Projects

Spring Creek Map Location No. 6

B Priority

Corps of Engineers

Middle Island Creek Lake
Hughes River Lake

USDA - FS - and State of Ohio

Little Muskingum River Reservoir (Recreation)

It is recommended that Reservoir Regulation (Monitoring) be planned and carried out to relate economic growth or potential at Ohio River growth centers for removal of flooding constraints by each of the elements in the Ohio River flood control system.

The Plan of Development, plus Spring Creek Watershed and Hughes River Lake projects in B (2000) future will satisfy the needs in the Little Kanawha River Basin. All water needs which could affect economic growth would be satisfied within the Basin. The West Fork and Leading Creek Lakes to be completed by 1980 are critical to the plan. The Hughes River and Middle Island Lakes (in Priority B) future studies, could add to recreation opportunities and, in a major way, to flood reductions on the Ohio River and for water quality control. Their impact on growth centers (expansion benefits) was not determined. Future studies may result in their being moved up in time.

The three upstream watershed (USDA) programs in the Water Plan, Upper Middle Island Creek, Wolf Creek (above Marietta) and Pond Run at Parkersburg would remove local constraints to growth by decreasing sediment yields, flood damages and by providing recreation opportunities. The Little Muskingum River Recreation Reservoir's place in the plan will be determined by future needs (1980). Federal cost-sharing is not available under present criteria because recreation development would be over 50 percent of the total costs.

The only other watershed directly influencing a growth center where structural measures seem practical is Upper Spring Creek, above Spencer, West Virginia. There is opportunity for flood reduction, local pollution control and water supply storage. It is included in future studies, Priority A. (See Ohio Basin Comprehensive Basin Study Report - Watershed 5-15.)

The control of pollution (and, to a lesser extent, flooding) in the Ohio River is and will continue to be the key to economic growth in the area.

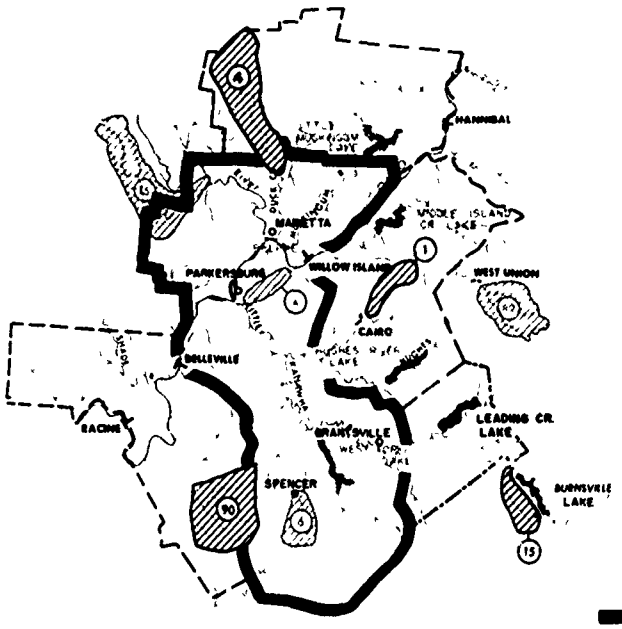
Table 14-15 presents the effectiveness of alternatives considered in Growth Area 5. A map and schematic diagram of the various alternatives considered is shown in Figure 14-24.

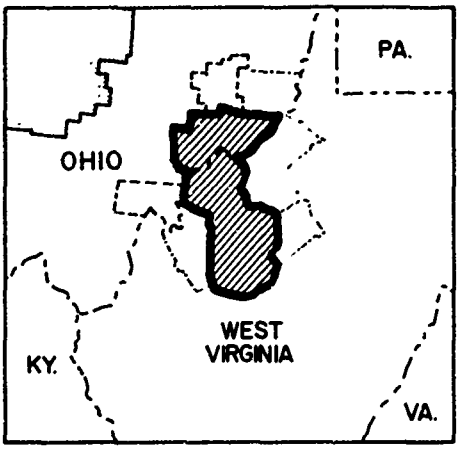
TABLE II-14-15
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 5
UPPER OHIO RIVER, SUB-REGION G
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. Logan Res. (C.E.) a/	USDA Wshds b/	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES CONTRI-BUTION	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Marietta	124	124 c/	-	1 d/	0			0	Ohio R. Alluvium (Alt.)	4	0
Parkersburg	481	481 c/	-	-	0	Ohio R. Alluvium (Alt)	10	0	Ohio R. Alluvium (Alt.)	5	0
Spencer-Grantsville	4	-	-	-	4	Ground Water + USDA Spring Creek Wshd	4	0		-	0
Water Quality	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
Parkersburg	6,000mgd	6,000mgd	-	-	0						
Spencer-Grantsville	60	56	-	-	4	USDA Spring Creek Wshd	4	4		-	0
Flood Control (residual damages)	($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Marietta - upstream	201	71 1/	-	27 d/	103		-	103		-	103
Marietta - downstream	248	- 1/	-	-	248	Belpre - Marietta LPP	95	153		-	153
Parkersburg - upstream	219	-	-	208 b/	11		-	11		-	11
Parkersburg - downstream	515	- j/	-	-	515		-	515		-	515
L. Kanawha R. Basin - upstream	780	82 f/ g/ i/	-	-	698	USDA Spring Creek Wshd	104	594	Hughes River Res.	50	564
L. Kanawha R. Basin - downstream	137	105 g/	-	-	32			32		-	32
Ohio R. Mainstem	1,000	896 g/ k/	51	-	53 j/			53	Middle Island Creek Lake Hughes River Lake	400 k/	0 k/
Ohio R. (direct tribs.)	984	88 h/	-	98 e/	798		-	798	Little Muskingum Res. Middle Island Creek Lake	130	668
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Marietta											
Parkersburg											
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #5	15,000	-	-	345 d/e/	14,655	Spring Creek	200	14,455	Middle Island Lake	2,500	12,455
Performance Index #1 m/											
Performance Index #2 m/											

a/ Logan Reservoir in Hocking River - Growth Area #2
b/ Pond Run,
c/ Use of Ohio River Water - will be usable for water supply by 1980 (reaeration between centers is assumed - source ORSANCO)
d/ Wolf Creek
e/ Upper Middle Island Creek
f/ Salt Lick Creek
g/ Burnsville, West Fork and Lesding Creek Lakes (CE)
h/ Mill Creek
i/ Bond Creek project - in place
j/ Upstream major Res. reduction not included
k/ Part in reach of Growth Area #6
l/ W. Fk. Duck Creek
m/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$





VICINITY MAP

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

LPP PROJECTS

PLANNING ALTERNATIVES

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

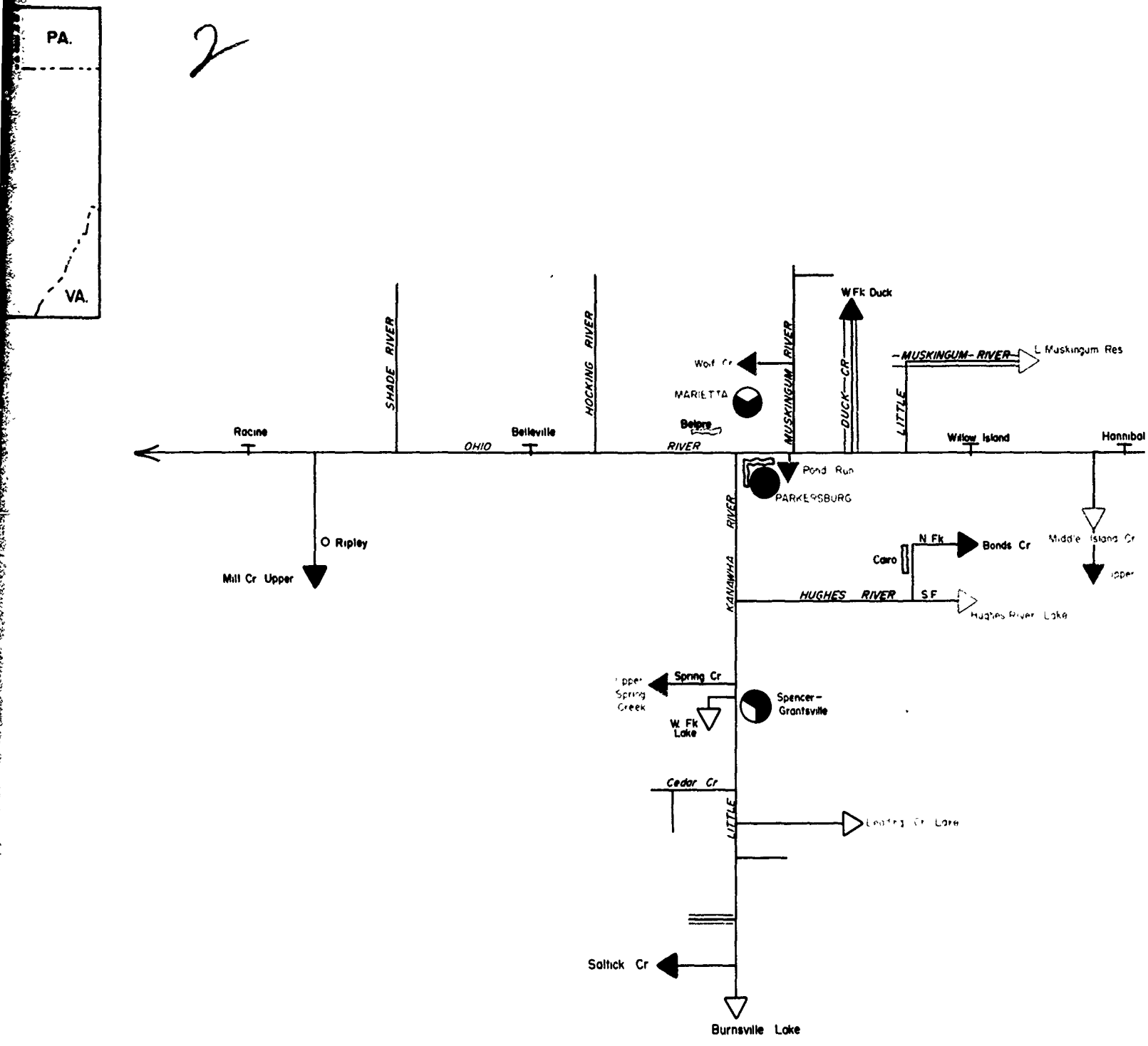
1 Bonds Creek
15 Saltlick Creek
4 W Fk Duck Creek
90 Mill Creek Upper

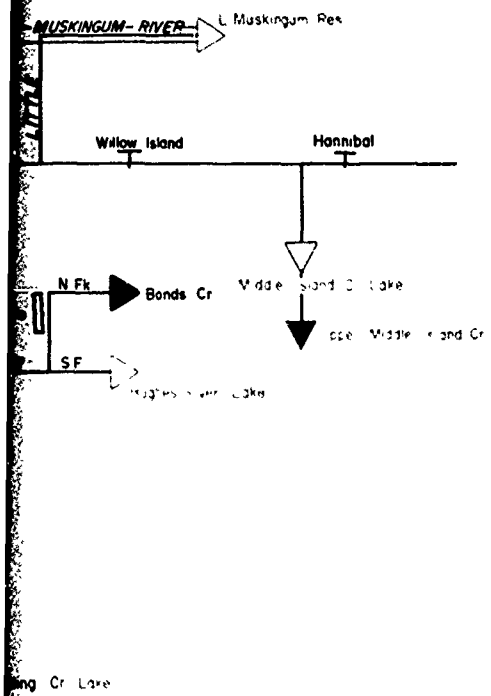
ALTERNATIVES AVAILABLE FOR PLANNING

A
6
16
80 Upper Middle Island Cr

GROWTH AREA 5
OHIO-WEST VIRGINIA

LOCATION MAP


PA.
VA.
SHADE RIVER
HOCKING RIVER
MUSKINGUM RIVER
DUCK CR
LITTLE
W Fk Duck
MUSKINGUM RIVER
L Muskingum Res
Wolf Cr
MARIETTA
Belpre
Racine
OHIO
Belleville
RIVER
Willow Island
Hannibal
Pond Run
PARKERSBURG
O Ripley
Mill Cr Upper
KANAWHA RIVER
N Fk
Bonds Cr
Caro
Middle Island Cr
HUGHES RIVER
S F
Hughes River Lake
Spring Cr
Upper Spring Creek
W Fk Lake
Spencer-Grantsville
Cedar Cr
LITTLE
Saltlick Cr
Burnsville Lake



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECTS

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

GROWTH AREA 5
OHIO-WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

FIGURE 14-24

II-14-133

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Lower Ohio River Mainstem

Growth Area 6 contains the Huntington-Ashland SMSA with the Primary Growth Areas of Point Pleasant, W. Va., Huntington, W. Va., Ashland, Ky., Portsmouth, Ohio, and Ironton, Ohio, and the Secondary Growth Areas of Gallipolis, Ohio, Milton, W. Va., and Hamlin-West Hamlin, W. Va. The order of discussion will be from upstream Ohio River down.

The rate of economic growth is above national averages.

The major water related constraint to economic growth - to national levels - after 1980 will be distribution systems for water supplies to support industrial growth - which will be tied closely to quality control of Ohio River waters. A secondary constraint will be lack of qualified technical people for industry. (Petroleum and metals.) (Figure 14-25 presents a schematic of needs for Growth Area 6.)

Planning in Growth Area 6 was related to that in all other areas of Sub-region G. It appears that the waters of the Ohio River will be available for industrial and domestic use, though there may be undesirable tastes and odors. Over 99 percent of the 2020 water supply needs will thus be satisfied. Groundwater supplies will be adequate at Hamlin-West Hamlin and Milton.

Staff limits precluded detailed analysis of all potential projects; however, studies are being continued within the "going programs" of the permanently established cooperating offices. It appears that a recreation lake is feasible (State of Ohio) in the Ohio Brush Creek Watershed. A project in Symmes Creek Basin for recreation and low flow augmentation (quality) appears feasible from reconnaissance level studies. Both projects should provide some flood control, but status is not definite. Those, and other, studies will be carried further in the proposed Central Ohio Survey.

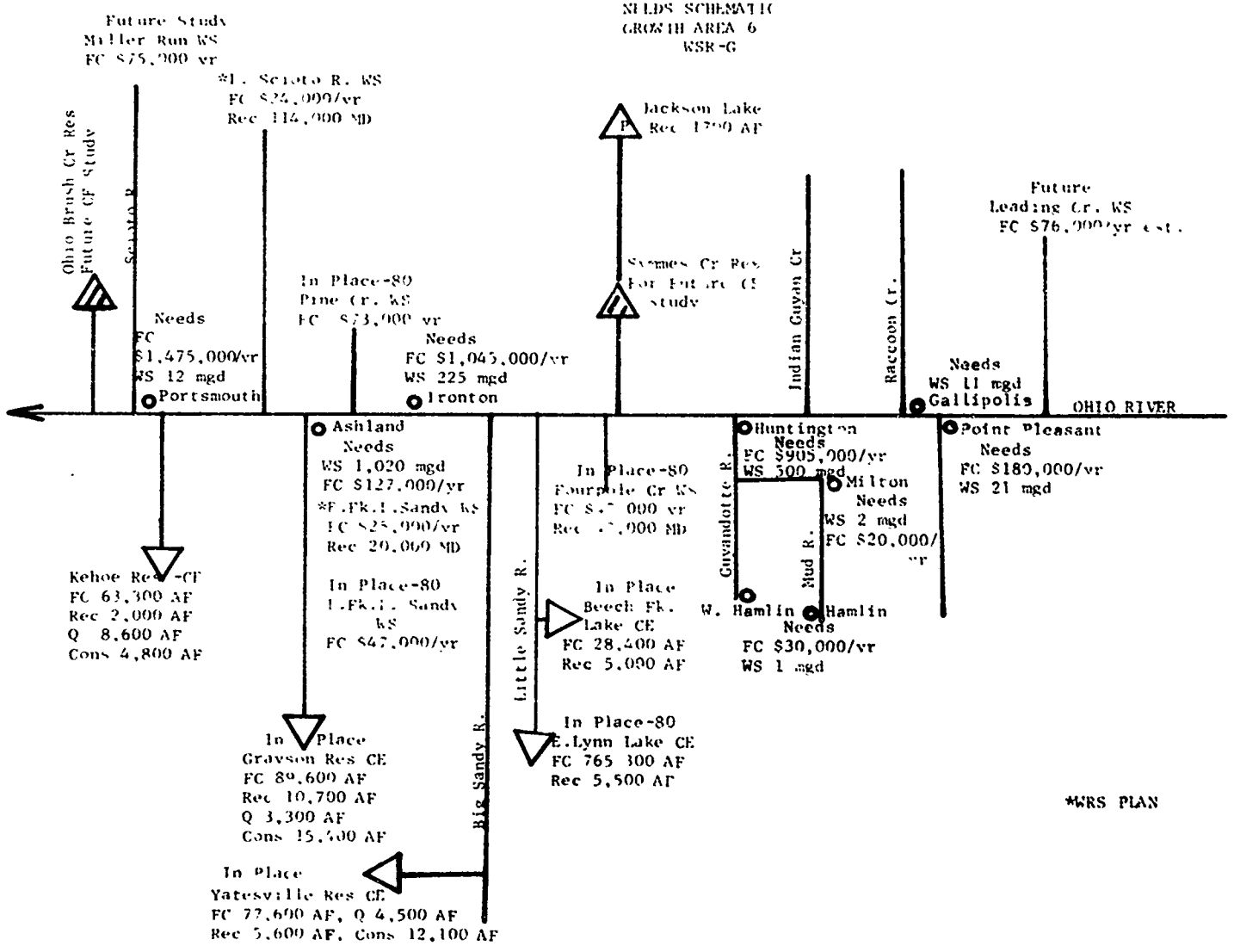
East Lynn, Beech Fork, Yatesville, Grayson and Kehoe Reservoirs and Fourpole, Little Fork Little Sandy and Pine Creek Watershed Projects of USDA will be in place by 1980. Two USDA watershed projects are proposed for the water plan. (Little Scioto River and East Fork Little Sandy), projects in upstream reaches will benefit Growth Area 6.

Long Range Basin Plan of Development

The recommended plan of development of water and related resources for the Lower Ohio River Mainstem in Water Sub-region G and in Growth Area 6 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

FIGURE 14-25
NEEDS SCHEMATIC
GROWTH AREA 6
WSR-G



*WRS PLAN

Related Resources

U.S. - (ARC) Demonstration Health Area (Ohio)
U.S. - (ARC) Appalachian Corridors B, C, and D
U.S. - Interstate Highway No. 64
Ohio - Vocational School and Technical Institute - Lucasville, Ohio
Ohio) - Expansion of Vocational Education at Marshall
W.Va.)- University, Huntington and at University of
Ky.) - Cincinnati and at Morehead University, Kentucky - nearby
Local - Development plans for 5 Primary and 4 Secondary Growth Centers
- Project Scioto, New Community Plan at Lucasville - combines relocated Appalachian Corridor "C" with Local Protection Project (includes Ohio Penitentiary)

Water Resources (See Figure 14-26)

State of Ohio (and Local)

Jackson Lake - Symmes Creek
Tycoon Lake Recreation - Raccoon Creek

Corps of Engineers

Complete Reservoir Monitoring System (See G.A. 5 discussions)
Kehoe Reservoir - Tygarts Creek
Grayson Reservoir - L. Sandy River
Yatesville Reserovir - Blaine Creek, Big Sandy River
East Lynn Reservoir - Twelvepole Creek
Beech Fork Reservoir - Twelvepole Creek
Meldahl Lock and Dam - Navigation - Ohio River
Greenup Lock and Dam - Navigation - Ohio River
Gallipolis Lock and Dam - Navigation - Ohio River
Barboursville, W. Va. - Guyandotte River Local Protection Project
Huntington, W. Va. - Ohio R. Local Protection Project
Huntington, W. Va. - Fourpole Creek Local Protection Project
Ceredo-Kenova, Ky. - Ohio R. Local Protection Project
Catlettsburg, Ky. - Ohio River Local Protection Project
Russell, Ky. - Ohio River Local Protection Project
Hitchens, Ky. - L. Sandy R. Local Protection Project
Grahn, Ky. - L. Sandy River Local Protection Project
Olive Hill, Ky. - Tygarts Creek Local Protection Project
Ironton, Ohio - Ohio R. Local Protection Project
Portsmouth, Ohio - Ohio River Local Protection Project
Griffithsville-Yawkey, W. Va. - Mud River Local Protection Project

USDA - SCS - Watershed Projects

Pine Creek, Ohio	Map Location No. 7
Fourpole Creek, W. Va.	Map Location No. 32
Little Fork - L. Sandy R.	Map Location No. 8

Local Programs

Gallipolis, Ohio Flood Plain Information Studies (CE report)
Ironton, Ohio Flood Plain Information Studies (CE report)
Portsmouth, Ohio Flood Plain Information Studies (CE report)
Huntington, W. Va. Flood Plain Information Studies (CE report)
Point Pleasant, W. Va. Flood Plain Information Studies (CE report)
Ashland, Ky. Flood Plain Information Studies (CE report)
Greenup Lake - Recreation - Buffalo Creek, Ky.

Cooperative - Federal - State

Southern Ohio Basins Survey - Scioto River, Little Scioto River, Hocking River, Ohio; Brush Creek, Raccoon Creek, Symmes Creek and small direct Ohio River tributaries

For authorization:

USDA - SCS - Watershed Projects

Little Scioto River, Ohio	Map Location No. 11
E. Fork Little Sandy River (Ky)	Map Location No. 16

Future studies:

A Priority

Corps of Engineers

Lucasville, Ohio Local Protection Project

USDA - SCS - Watershed Projects

Upper Mud River (Guy R.)	Map Location No. a
Middle Fork Mud River (Guy R.)	Map Location No. b
Miller Run (Scioto R. at Lucasville, O.)	Map Location No. c
Leading Creek (Ohio)	Map Location No. d

B Priority

Corps of Engineers

Symmes Creek Reservoir

Ohio

Ohio Brush Creek - Recreation Project

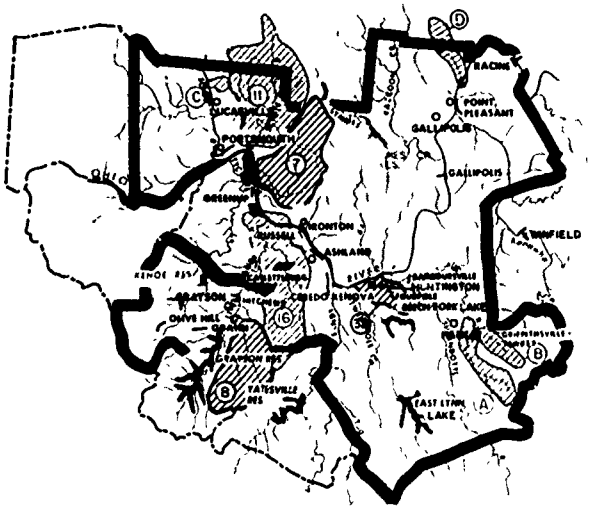
The plan is based on the assumption that ORSANCO water quality standards for Ohio River waters will be met by 1980.

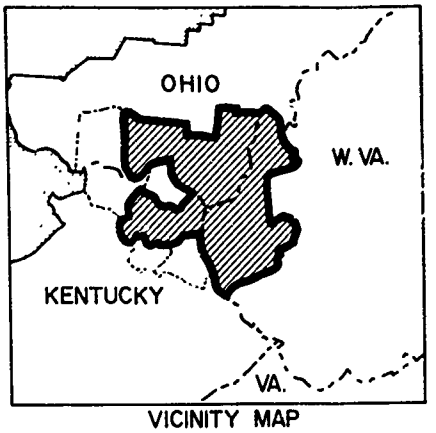
Table 14-16 presents the effectivenss of alternatives considered in Growth Area 6. A map and schematic diagram of the various alternatives considered is shown in Figure 14-26.

TABLE 14-16
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 6
LOWER OHIO RIVER MAINSTEM, SUB-REGION C
1968

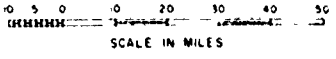
ITEM	NEEDS	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. DOWNSTREAM RESERVOIRS (CE)	USDAh/ WSHDS	PLANT NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES CONTRI-BUTION[f/]	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION[f/]	UNMET NEEDS
Water Supply (1980)	MGD	MGD	MGD	MGD	MGD		MGD	MGD		MGD	MGD
Gallipolis, O	11	11[c/]					-	0		-	0
Point Pleasant, W Va	21	21[c/]					-	0		-	0
Huntington, W Va											
Ashland, Ky	1,520	1,520[c/]					-	0		-	0
Hamlin - W Hamlin, W Va	1	-			1	Groundwater	1	0		-	0
Milton, W Va	2	-			2	Groundwater	2	0		-	0
Ironton, Ohio	225	225[c/]			-	Groundwater	-	0		-	0
Portsmouth, Ohio	12	12[c/]			-	Groundwater	-	0		-	0
Growth Area 6	1,792	1,789[c/]			3		3	0		-	0
Water Quality (1968)	MGD	MGD	MGD	MGD	MGD		MGD	MGD		MGD	MGD
Growth Area 6	17,000	17,000[c/]									
Flood Control (residual damages)	($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Point Pleasant - Gallipolis	180				180						
Huntington, W Va (reach)	905				905	(Upper Mud R. Wshd.)	248	657			
Milton, W Va	20				20	(Middle Mud R. Wshd.)	16	4			4
Hamlin - W Hamlin, W Va.	30				30	" "	24	6			6
Ashland Ky (Catlettsburg)	127				127						
Ironton, Ohio	1,045				1,045						
Portsmouth, Ohio	1,475	73[d/]		24	1,354	(USDA Miller Run Wshd.) (Lucasville L.P.P.)	75+	1,279			1,279
Ohio River Mainster (+ Trib. Wshds)	2,038	110[e/]	167	25	1,736	Hayst Res., Kanawha R - 12 Res.Sys., Leading Cr.	1,328	1,408	Symmes Creek Res. (from upstream)	447	961[g/]
Flood Plain Area	(acres)	(acres)	(acres)	(acres)	(acres)		(acres)	(acres)		(acres)	(acres)
Point Pleasant											
Huntington											
Milton											
Hamlin - W Hamlin											
Ashland											
Ironton											
Portsmouth											
Growth Area 6	10,000				6,100	Lucasville LPP	750	5,350		-	5,350
Recreation (Man-day)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area 6				134	16,866	All projects	2,000[f/]	14,866	Symmes Creek Res. Ohio Brush Res. (Ohio)	1,000[f/]	13,866

a/ White Oak Reservoir, (F.C. Benefits from St. Petersburg Res. in SR-F ($1,000,000) not included)
b/ East Fork Little Sandy River and Little Scioto River
c/ Water from Ohio River will be available for water needs and water quality control by 1980 - reaeration between centers assumed - source ORSANCO
d/ Ironton Creek Watershed
e/ Pandora Creek Res., Little Pine Little Sandy River, and Turnpike Creek
f/ Preliminary, site studies
g/ Estimated dam & red storage will not be beneficial in Ohio River backwaters, downstream from Growth Area 6.





VICINITY MAP



LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT
- LOCK & DAM

PLANNING ALTERNATIVES

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

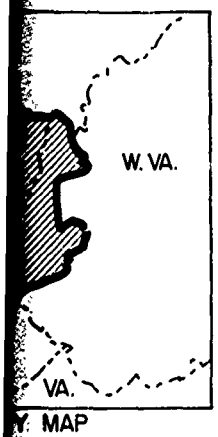
7 Pine Creek
8 Little Fork-L Sandy River
32 Fourpole Creek

ALTERNATIVES AVAILABLE FOR PLANNING

GROWTH AREA 6
OHIO-KENTUCKY-WEST VIRGINIA

LOCATION MAP

2



Y. MAP

DARY

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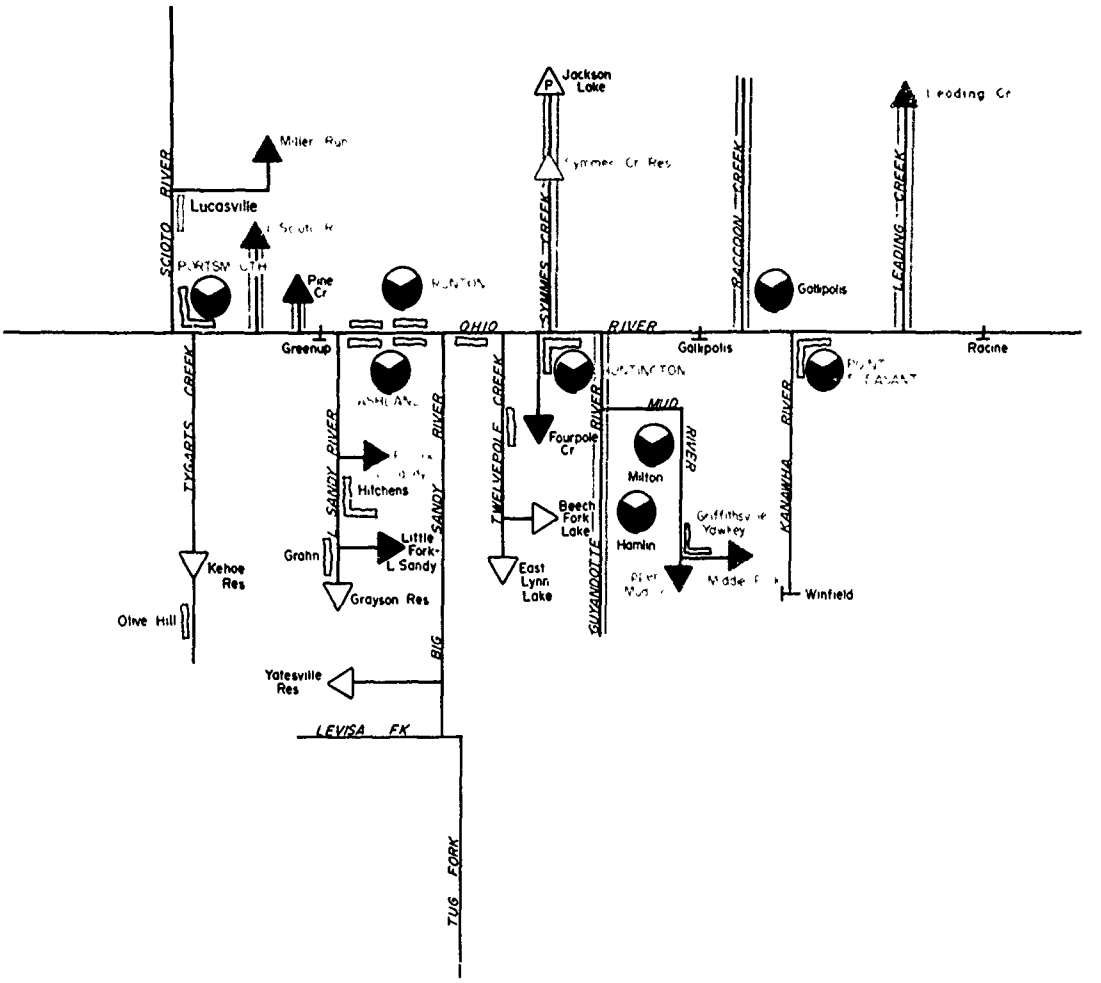
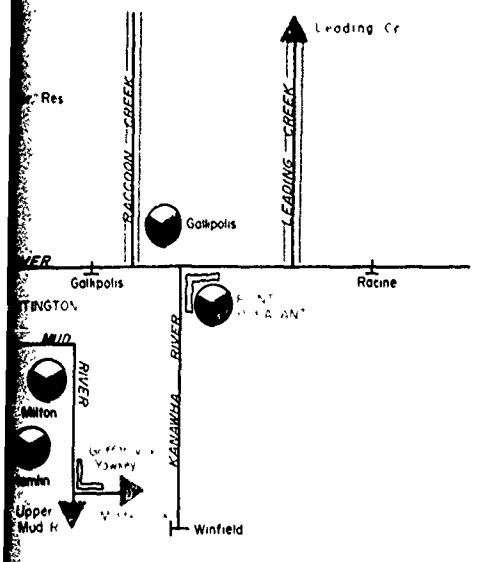
OJECT

TH AREA 6
CKY-WEST VIRGINIA

ION MAP





LEGEND

NEEDS

WATER SUPPLY

FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

△ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER

▲ UPSTREAM WATERSHED PROJECT

LPP PROJECT

⊢ LOCK & DAM

PLANNING ALTERNATIVES:

△ MAJOR RESERVOIR

▲ UPSTREAM WATERSHED PROJECT

LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

CONTINUOUSLY

INTERMITTENTLY

GROWTH AREA 6
OHIO-KENTUCKY-WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

11-14-141 FIGURE 14-26

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Tygart River Basin

Growth Area 7 contains the Primary Growth Center - Elkins-Buckhannon-Philippi.

The major constraint to economic growth today is poor access.

The major constraint to economic growth - to national levels - after 1980 will be skilled workers. (Figure 14-27 presents a schematic of needs for Growth Area 7.)

Two upsteam watershed projects, Upper Buckhannon River and French Creek above Buckhannon, were found to be feasible by the SCS. Complete studies of the Corps projects were not possible; however, they all appear to be feasible elements of a total Monongahela River Basin Plan.

Basin Plan of Development

The recommend plan of development of water and related resources for the Tygart (Monongahela) River in Growth Area 7 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S. - (ARC) Appalachian Corridors D and H
U.S. - Interstate Highway No. 79
W. Va. - Expansion of Vocational Education at West Virginia University (nearby)
Local - Development plans for three growth centers

Water Resources (See Figure 14-28)

Corps of Engineers

Tygart River Reservoir
Rowlesburg Reservoir (not in Growth Area)
Elkins Local Protection Project
Buckhannon Local Protection Project

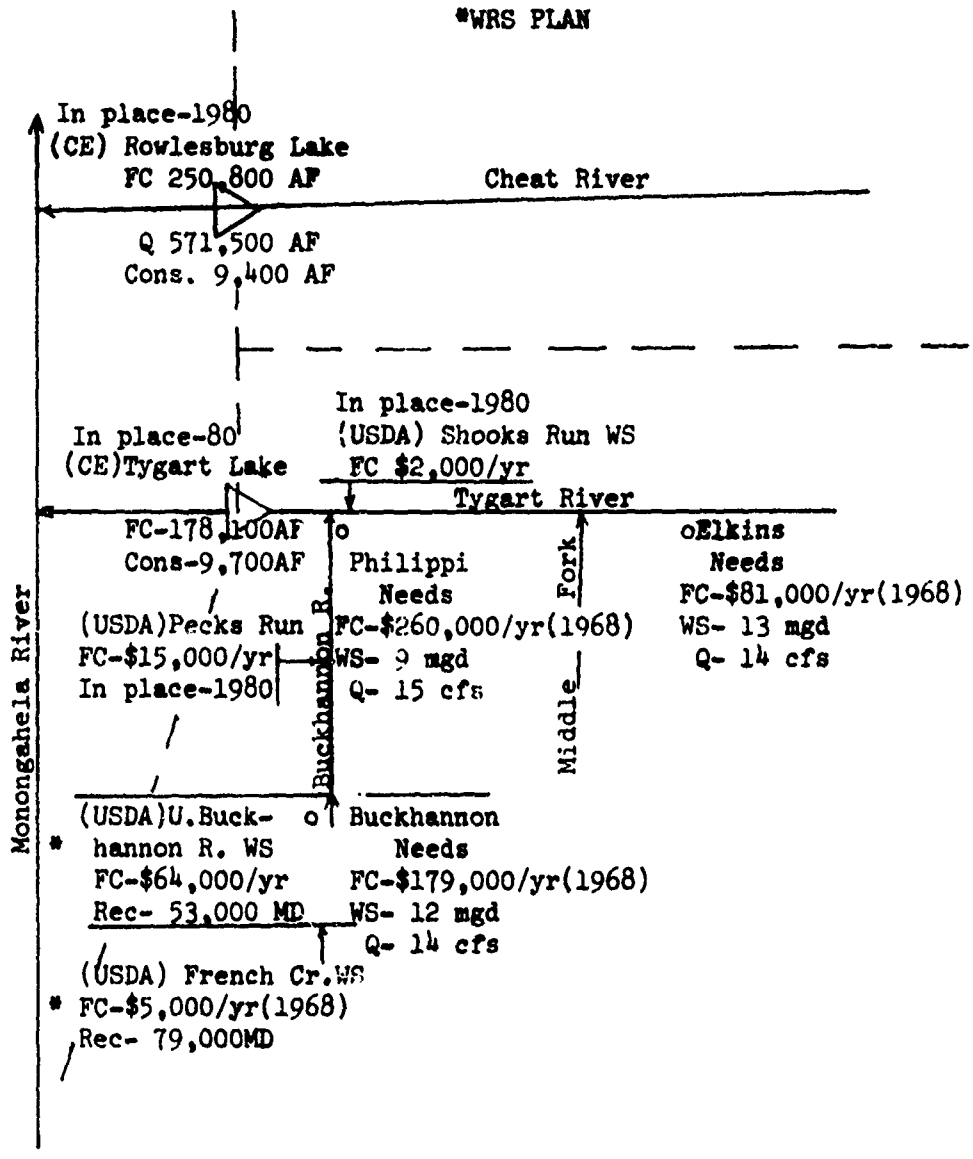
USDA - SCS - Watershed Projects

Peck's Run	Map Location No. 13
Shook's Run	Map Location No. 16

Local Programs

Elkins Flood Plain Information Studies (CE report)
Buckhannon Flood Plain Information Studies (SCS report)

FIGURE 14-27
NEEDS SCHEMATIC
GROWTH AREA 7



For authorization:

USDA - SCS - Watershed Projects

Upper Buckhannon River	Map Location No. 93
French Creek	Map Location No. 80

Future studies:

A Priority

Corps of Engineers

Middle Fork Reservoir
Tygart Valley Reservoir
Buckhannon Reservoir

B Priority

Corps of Engineers

Teter Creek Reservoir
Laurel Creek Reservoir

With the installation of the two feasibble Upstream Watershed Projects, all rural water related growth constraints at Buckhannon will be removed. There will still be a need for water quality control flows at Buckhannon and Elkins of 6 cfs addition (14 cfs total). The 15 cfs needed at Phillipi (2020) will come from reaeration of flows at Buckhannon and Philippi. Those flows, plus water supply (13 mgd at Elkins and 12 mgd at Buckhannon), could be stored in Buckhannon and Tygart Valley Reservoirs.

The five reservoirs listed for future study would be most useful for flood control and quality control on the Monongahela River. Studies are being carried out by Pittsburgh District of the Corps. (See Part II, Chapter 12.)

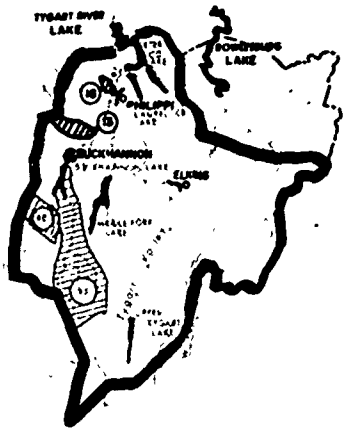
The area will need a viable industry to grow to meet national economic levels.

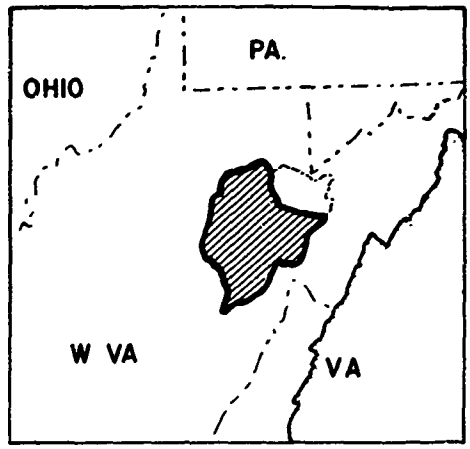
Table 14-17 presents the effectiveness of alternatives considered in Growth Area 7. A map and schematic diagram of the various alternatives considered is shown in Figure 14-28.

TABLE II-17
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 7
TYGART RIVER BASIN, SUB-SECTION C
1968

ITEM	NEEDS	PROJECT (CONTRIB. BY 1980)	CONTRIB. OF ALTER. USDA a/ WSHDS	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES GROUP A (1st priority) CONTRIBUTION	GROUP A (1st priority) UNMET NEEDS	GROUP B (2nd priority)	GROUP B (2nd priority) CONTRIBUTION b/	GROUP B (2nd priority) UNMET NEEDS
Water Supply (1980) SRD	(MGD)	(MGD)	(MGD)	(MGD)		(MGD)	(MGD)		(MGD)	(MGD)
Elkins	13	-	-	13	Tygart Valley Lake	13	0	Teter Creek Lake e/	Ind.	0
Philippi	6	-		6	Middle Valley Lake	6	0	Laurel Creek Lake	Ind.	0
Buckhannon	12	-		12	Buckhannon Lake	12	0			0
Water Quality	(1,000 AF)	(1,000 AF)	(1,000 AF)	(1,000 AF)		(1,000 AF)	(1,000 AF)		(1,000 AF)	(1,000 AF)
Growth Area 7 g/	2			2	Tygart Valley Lake Buckhannon Lake	2	0	-		0
Flood Control (residual damages)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Elkins	5	-	-	5	-		5	-	-	5
Buckhannon-Philippi Reach	37	70 b/	-	4	5 CE Lakes	5	4	-	-	4
Upstream	138	1 c/	69	92	5 CE Lakes	60+	32	-	-	32
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Growth Area 7	3,430 d/	400 (part.)	1,910	1,120	CE Lakes	1,000	120	-	-	120
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area 7	4,000 f/	-	242	3,758	1 CE Lakes	3,000 f/	758	2 CE Lakes	2,000 f/	1,242 + excess

a/ French Creek and Upper Buckhannon Creek and Forest Service recreation lakes (Monongahela National Forest) (242,000 Man-days).
b/ CE Buckhannon LPP
c/ USDA Shooks Run and Pecks Run
d/ Includes 430 acres municipal and 3,000 acres other
e/ Lakes (5) in Groups A and B can store flood or water quality water for downstream benefit - B Group would have benefits outside WSR - G
f/ Rough estimates - see WSA-F reports
g/ Storage requirements for quality control (L.P.P.) based on premise of reliability between growth centers.





VICINITY MAP

UPSTREAM WATERSHED PROJECT IDENTIFICATION

TO EXIST BY 1980

13 Peck's Run
16 Shook's Run

ALTERNATIVES AVAILABLE FOR PLANNING

42 French Creek
43 Upper Buckhannon River

LEGEND

GROWTH AREA BOUNDARY

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

LPP PROJECTS

PLANNING ALTERNATIVES

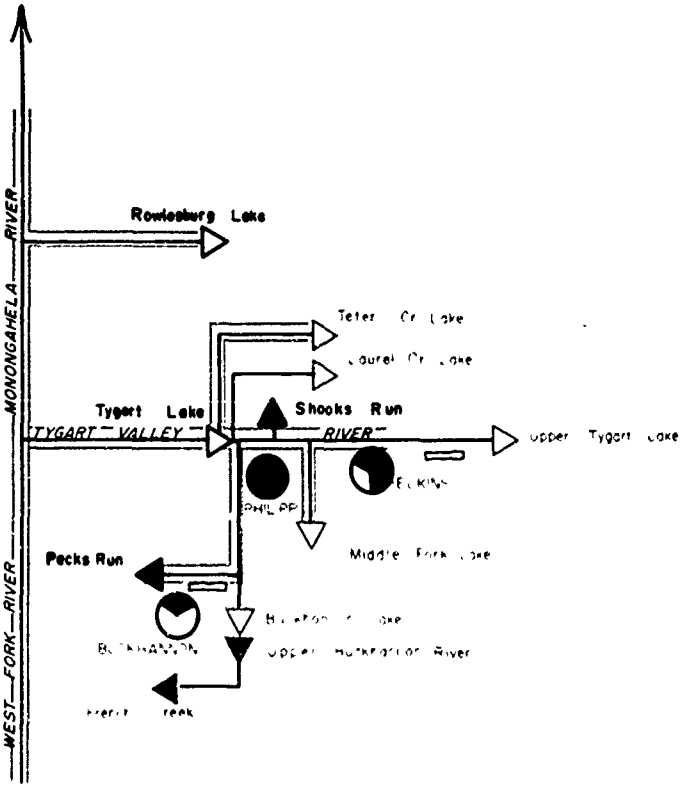
MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

GROWTH AREA 7
WEST VIRGINIA

LOCATION MAP

2



TH AREA 7
VIRGINIA

ION MAP

3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LPP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- ═══ CONTINUOUSLY
- ——— INTERMITTENTLY

GROWTH AREA 7
WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-147 FIGURE. 14-28

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Kanawha River Basin

Growth Areas 8, 9, and 10 selected plans are discussed individually later. Selection of projects for inclusion for early action within the water plan was made before 1 October 1967. The three growth area plans were then developed based on "screening" results at that time - see Section III.

The selected early action plan included two lakes in the Greenbrier Basin, Greenbrier Lake (upper) and Anthony (Creek) Lake. USDA selected projects included 27 Watershed Programs and 1 Resource Conservation and Development Project to be included in the "programmed by 1980" and "additional projects - WRS."

A "Project Package" for the Greenbrier system was completed and preliminary investigations were made for the watershed projects.

Planning within the Kanawha River Comprehensive Basin Study (Type II) has continued.

Subsequent to formulation of the interim sub-basin plan, a Natural Streams Preservation Act was enacted by the Legislature of West Virginia which designated as protected streams all of Anthony Creek and the portion of Greenbrier River from the mouth to its confluence with Knapp Creek. The Act prohibits work that will materially alter or affect the free-flowing characteristics of a substantial part of a protected stream. Responsiveness to legislative policy and intent as expressed in the Act precludes further consideration of Site 40 on Anthony Creek.

A meeting of the Coordinating Committee for the Comprehensive Basin Study was held in June 1969 to select the tentative plan for development of the water resources for the Basin for target year 2000. In addition to the three existing projects (Bluestone, Sutton, and Summersville Lakes) and the Blue Ridge pumped-storage hydroelectric power project on upper New River (license for private development pending decision of Federal Power Commission), the tentative plan approved by the Committee contains twelve (12) major reservoir projects. The following tabulation indicates the reservoir elements in the tentative plan:

Type II No.	Site	Growth Area
1-a	Pocatalico River	10
8	Big Sandy Creek (Elk)	9
11	Birch River (Elk)	9
21	Meadow River (Gauley)	9
42	Knapp Creek (Greenbrier)	9
46	Deer Creek (Greenbrier)	9
47	East Fork (Greenbrier)	9

Type II No.	Site	Growth Area
50	Indian Creek (Upper New)	9
52	Walker Creek (Upper New)	8
59	Little River (Upper New)	8
80-b	Bluestone River (Upper New)	9
94	Buffalo Creek (Elk)	9

The Committee directed retention in the plan of Site 87 (Type II No.) on Greenbrier River (Upper) for consideration as an alternate for sites 46, 47 and 94. The Committee has proposed early action on a General Investigation Study (Survey Scope) of the potential Swiss Lake Project on the Gauley River main stem. The project is included as an element in the tentative plan.

Watershed project recommendations were also different from the system already discussed. New time phasing for the original group was recommended and Little Stony Creek Watershed (in Virginia) was dropped from the active list. Dunloup Creek Watershed Project (now authorized for operations) was added. Laurel Creek, Mill Creek, Middle Creek and Upper Birch River Watersheds were added in Growth Area 9. Upper Pocatalico River, Finney Branch, Davis Creek, and Rock Branch Watersheds were added in Growth Area 10. The WDCCA USDA representative recommended that the original group be reported substantially as recommended and the additional projects be set into later (Groups A and B) time phases. That has been done.

The interim plan for the Greenbrier sub-basin that was prepared for issuance as Chapter 12, part III, of this report will not be published since the projects (sites 40 and 87) were not selected in the tentative plan approved by the Kanawha Basin Coordinating Committee and because development of Site 40 on Anthony Creek would be in conflict with the West Virginia Natural Streams Preservation Act. Site 87 is being shown as a potential project due to its designation as an alternative project. However, much of the data developed for this "interim" report can be used if the alternate (site 87) is later chosen to become part of the basin plan.

Upper New River in Virginia

Growth Area 8 contains the Primary Growth Areas of Marion-Wytheville, Galax-Hillsville, and Pulaski-Parrot; and the Secondary Growth Area of Pearisburg-Narrows. Marion is in the Tennessee River Basin. The order of discussion will be from upstream New River down.

The major water-related constraint to economic growth today is water quality control - the rate of economic growth is about national average.

A constraint to economic growth - to national levels - after 1980 will be water supplies to support industrial growth. Another constraint will be lack of qualified technical people for industry. The area actually will not have a major deterrent to growth in 1980. (Figure 14-29 presents a schematic of needs for Growth Area 8.)

Basin Plan of Development

The recommended plan of development of water and related resources for the New River in Growth Area 8 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S.	- (ARC) Appalachian Corridor Q
U.S.	- Interstate Highways No. 77 and 81
Virginia	- Vocational Education School
Local	- Development plans for 8 growth centers

Water Resources (See Figure 14-30)

Private Hydropower

Buck and Byllesby River Run Plants - Appalachian Power Co.
Claytor Lake - Appalachian Power Co.
Washington Mills Run-of-River Plant

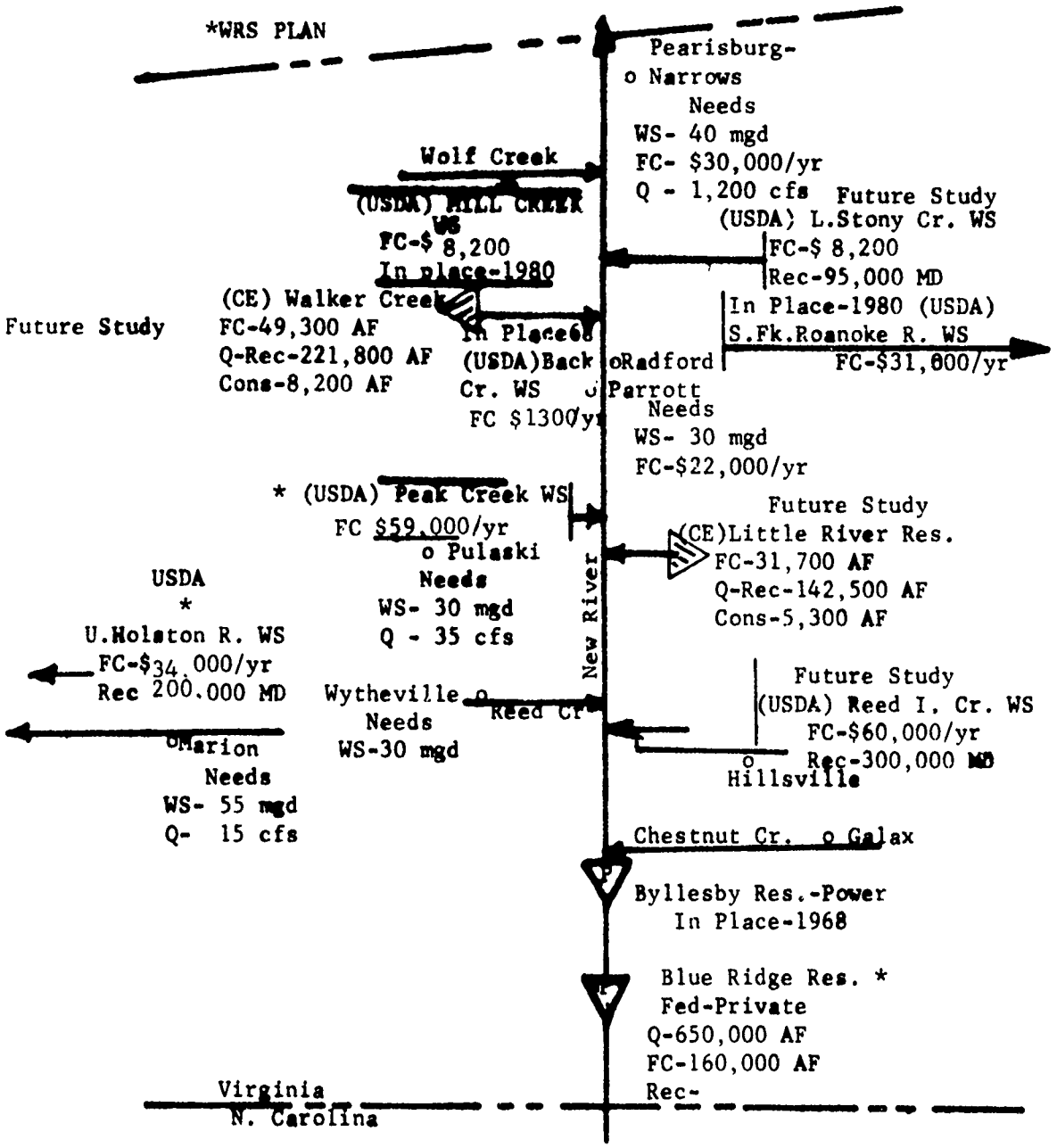
Corps of Engineers

Bluestone Lake
Galax Local Protection Project

USDA - SCS - Upstream Watershed Projects

Back Creek	Map Location No. 1 (Va.)
Mill Creek	Map Location No. 74 (Va.)
South Fork Roanoke River	Map Location No. 61 (outside Growth Area)

FIGURE 14-29
NEEDS SCHEMATIC
GROWTH AREA 8



Local Programs

Glenn Lynn to Claytor Dam Flood Plain Information Studies (CE report)
Bluefield Flood Plain Information Studies (CE report)
Marion Flood Plain Information Studies (TVA report)

For authorization:

USDA - SCS - Water Projects

Peak Creek	Map Location No. 48
Headwaters Holston River	Map Location No. 76

Federal and Private

Blue Ridge - Moores Ferry Reservoir

Future studies:

A Priority

Corps of Engineers

Walker Creek Reservoir
Little River Reservoir
Reallocation of Bluestone Lake Storage

B Priority

Corps of Engineers

Big Reed Island Creek Reservoir
Reed Creek Reservoir

USDA - SCS - Watershed Projects

Reed Island Creek	Map Location No. a
Little Stony Creek	Map Location No. 42

The plan, including A (1980) and B (2000) future studies is complete for the New River; i.e. all water needs which could affect economic growth would be satisfied within the Basin. The Reed Island Creek Watershed Project would meet a local need at Hillsville (B). Walker and Little River Reservoirs (A) would replace floodwaters reallocated to other uses and would store water for quality control, recreation and fish and wildlife. The Little Stony Creek Watershed Project in Priority B future studies, could add to recreation opportunities if needed. Further study of Big Reed Island Creek and Reed Island Creek Reservoirs (CE) has been requested by Virginia.

Advanced engineering and design studies on the Blue Ridge-Moores Ferry Dam and Reservoir can begin as soon as license is granted. The project will provide for hydropower generation, water quality improvement, flood control and recreation.

Table 14-18 and Figure 13-30 present the plan.

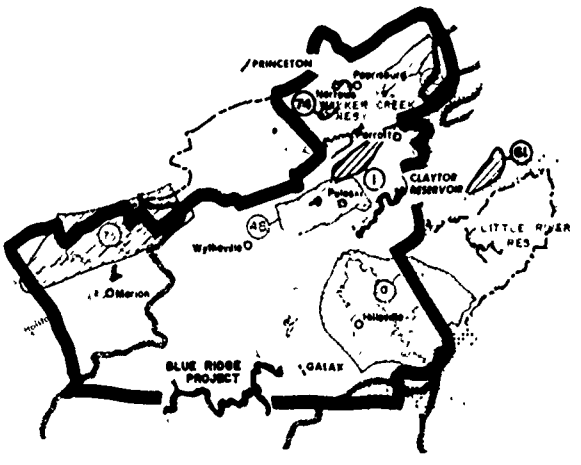
TABLE 14-18
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 8
UPPER NEW RIVER BASIN, SUB-REGION G
1968

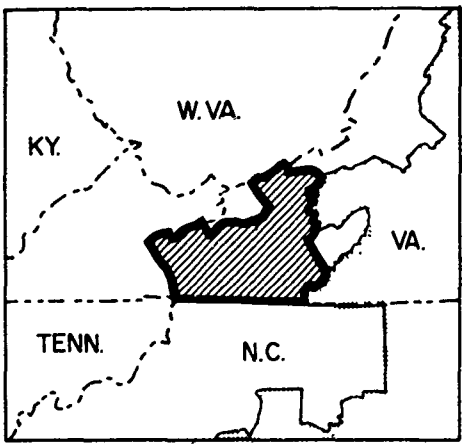
ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. WATERSHED a/	UNMET NEEDS	GROUP A (1st priority)	RECOMMENDED FUTURE STUDIES CONTRIBUTION c/	UNMET NEEDS	GROUP B (2nd priority)	CONTRIBUTION c/	UNMET NEEDS
Water Supply (1989)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Marion	55	-	-	55	Ground Water +	30	15	Groundwater	15	0
Wytheville	30	-	-	30	manufacturing	20	10	Groundwater	10	0
Galax-Hillsville	81	-	-	81	reuse	40	41	Groundwater b/	41	0
Pulaski-Parrott	60	-	-	60	Effects of Blue	60	0		0	0
Pearisburg-Narrows	40	-	-	40	Ridge Projects after 1980 b/	40	0		0	0
Water Quality	(cfs)	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)	(cfs)
Galax-Hillsville	20	-	-	20	Advanced treatment	20	0	-	-	0
Pearisburg-Narrows	350	- b/	-	0	- b/	-	0	-	-	0
Parrott	35	- b/	-	0	- b/	-	0	-	-	0
Holston River	15	-	15	0	-	-	0	-	-	0
Flood Control (residual damages)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Galax-Hillsville (reach)	10	- b/	-	10	b/	8	2	(CE) B. Reed I. Cr. Res. f/	-	2
Parrott (reach)	22	- b/	-	22	(CE) Little River Res. b/	18	4	(CE) Reed Cr. Res. f/	-	4
Pearisburg-Narrows	30	- b/	-	30	(CE) Walker Cr. Res. b/	25	5	-	3	2
Upstream	513	11	59	443	-	-	443	USDA Reed Is. Cr. d/		
								USDA L. Stony Cr. d/	68	375
Holston River	60	-	34	26	-	-	26		-	26
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Growth Area #8	1,650	-	-	1,650	b/ c/	1,200	450		200	250
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #8	8,000	-	668	7,332	L. River & Walker Creek Res. b/ c/	6,000	1,332	USDA Watersheds	400 c/	932
Performance Index #1										
Performance Index #2										

a/ Peak Creek Watershed and Holston River Watershed and Forest Service Recreation Lakes in Jefferson National Forest (239,000 Man-days).
b/ Blue Ridge Project - 650,000 A.F. for quality control and 160,000 A.F. for flood control - may be operational before 1980.
c/ Estimates from reconnaissance level investigations.
d/ Needed improvements not in any plan (1968)
e/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$

f/ Principal benefits would be outside Growth Centers.





VICINITY MAP

LEGEND

- RIVER BASIN BOUNDARY
- GROWTH AREA BOUNDARY
- APPALACHIAN REGION BOUNDARY

10 5 0 10 20 30 40 50

SCALE IN MILES

EXPECTED TO EXIST BY 1980

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT

MIDDLE

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

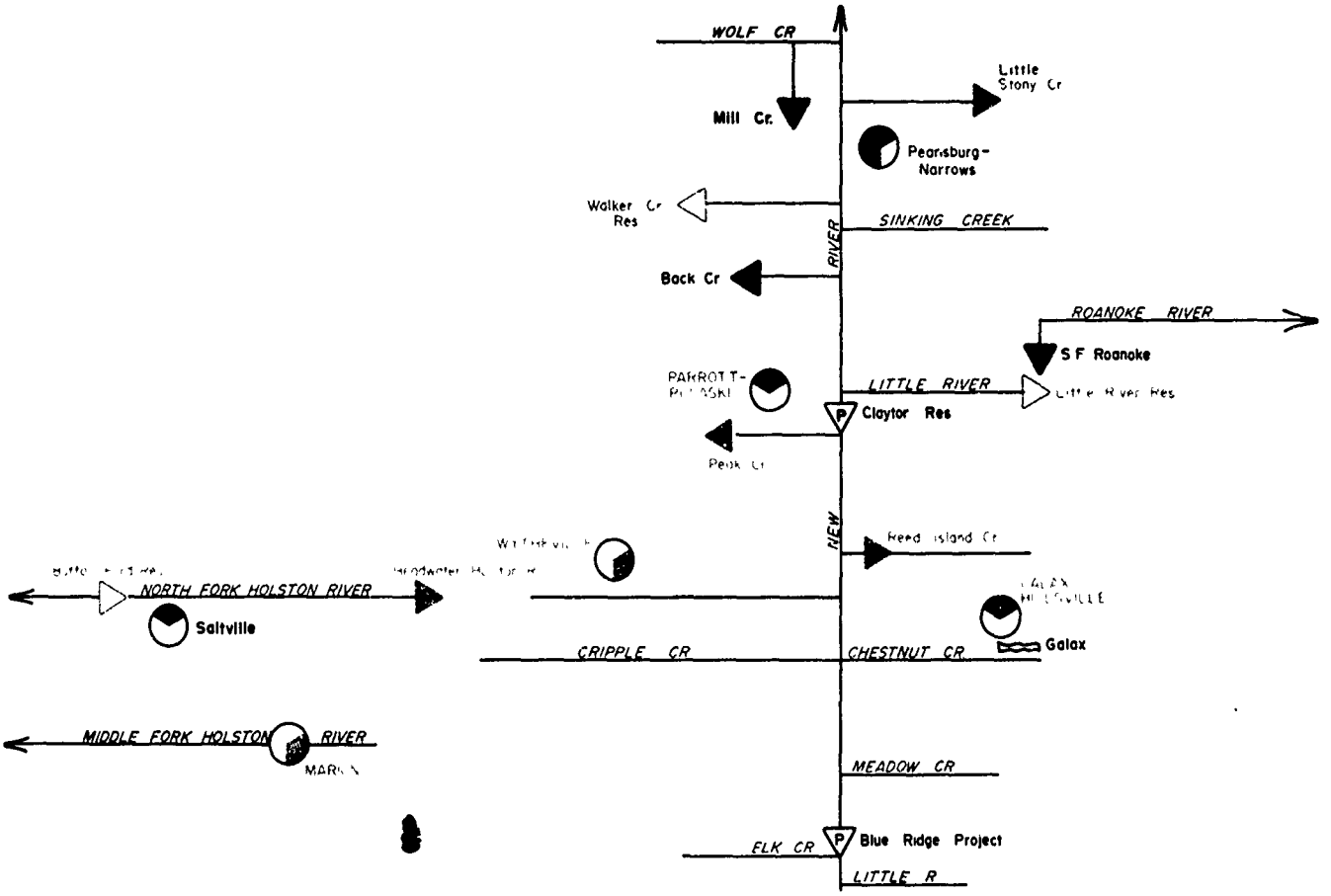
1 Back Creek
61 South Fork Roanoke River
74 Mill Creek

ALTERNATIVES AVAILABLE FOR PLANNING

[illegible] Creek
[illegible] Creek
[illegible] Creek
[illegible] River

GROWTH AREA 8
VIRGINIA

LOCATION MAP


WOLF CR
Mill Cr.
Little Stony Cr
Pearisburg-Narrows
Walker Cr Res
SINKING CREEK
RIVER
Back Cr
ROANOKE RIVER
S F Roanoke
LITTLE RIVER
Claytor Res
NEW
Reed Island Cr
NORTH FORK HOLSTON RIVER
Saltville
CRIPPLE CR
CHESTNUT CR
Galax
MIDDLE FORK HOLSTON RIVER
MEADOW CR
ELK CR
Blue Ridge Project
LITTLE R

3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- MAJOR RESERVOIR
- UPSTREAM WATERSHED PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

GROWTH AREA 8
VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-157 FIGURE 14-30

Kanawha River Tributaries

Growth Area 9 contains the Primary Growth Centers of Bluestone-Princeton in the Bluestone River Basin; the Lewisburg-Ronceverte-White Sulphur Springs Primary Growth Center, and the Marlinton Secondary Growth Center in the Greenbrier River Basin. The Summersville-Richwood Secondary Growth Center is in the Gauley River Basin; the Beckley (Piney Creek) Primary Growth Center is inland. The Hinton, Oak Hill-Mt. Hope and Montgomery Secondary Growth Centers are on the New (Kanawha) River mainstem. The Sutton-Gassoway Secondary Growth Center is in the Upper Elk River Basin.

The major constraint to economic growth today is poor access.

There will be no water related constraint to economic growth within the growth area - to national levels - after 1980. There may still be a shortage of qualified people for coal mining, forest products, and service industries. (Figure 14-31 presents a schematic of needs for Growth Area 9.)

See Growth Area 10 discussions.

Basin Plan of Development

The recommended plan of development of water and related resources for the Kanawha River Tributaries in Growth Area 9 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

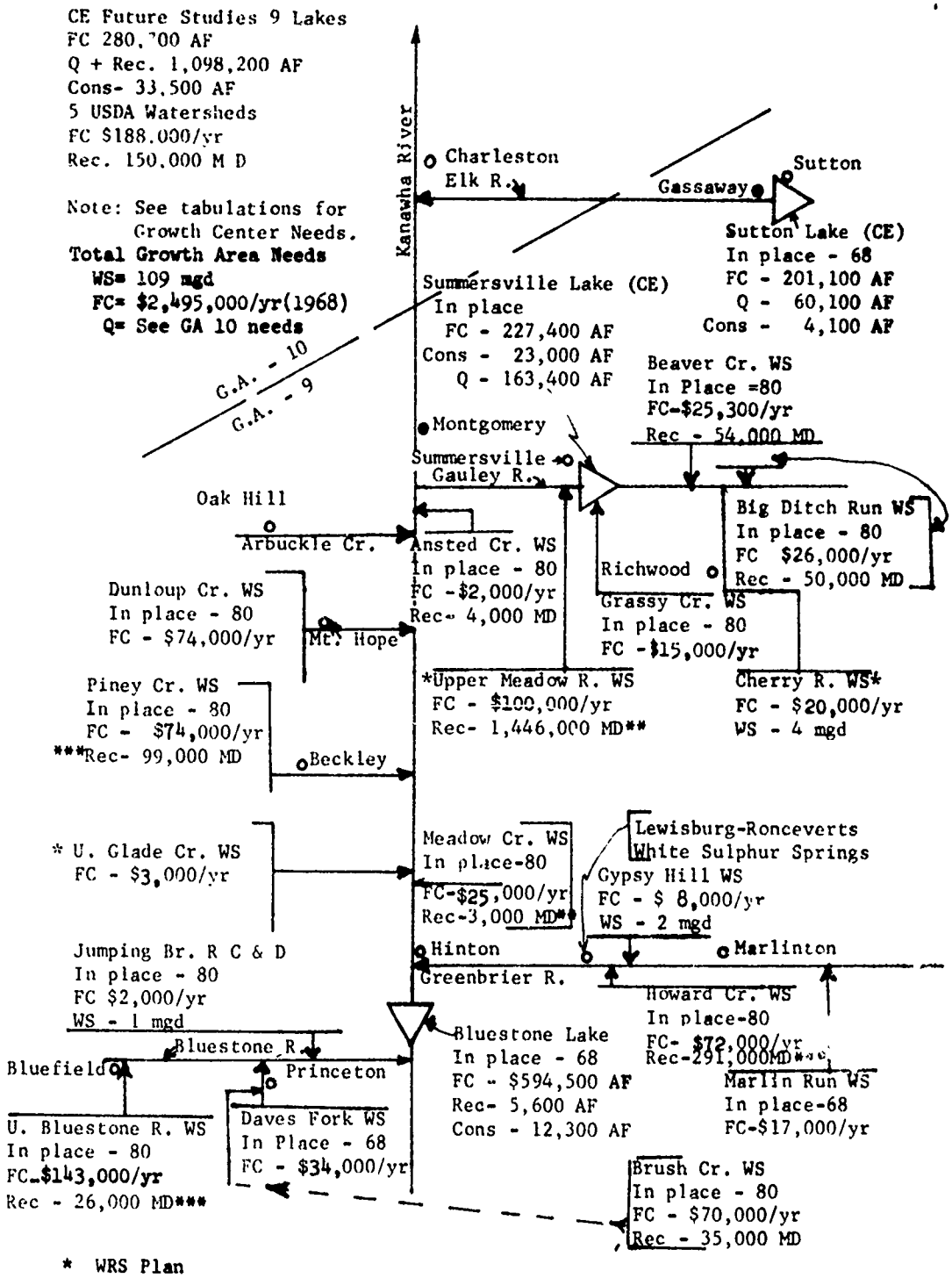
U.S.	- (ARC) Appalachian Corridors H, L, and Q
U.S.	- Interstate Highway Nos. 64, 77, and 79
W. Va.	- Expansion of Vocational Education at University West Virginia Inst. of Technology
	- Vocational Technical School (centrally located)
Local	- Development plans for 16 growth centers (includes Bluefield, Virginia)

Water Resources (See Figure 14-32)

Corps of Engineers

Bluestone Lake
Summersville Lake
Sutton Lake
Bramwell Local Protection Project
Montcalm Local Protection Project
Princeton Local Protection Project
E. Rainelle Local Protection Project
Richwood Local Protection Project

FIGURE 14-31
NEEDS SCHEMATIC
GROWTH AREA 9



* WRS Plan
** Planned plus incidental recreation
*** Incidental, not planned recreation

USDA - SCS - Upstream Watershed Projects

Upper Bluestone River	Map Location No. 6
Brush Creek	Map Location No. 9 (Bluestone R.)
Dave's Fk-Christians Fk	Map Location No. 2 (Bluestone R.)
Piney Creek	Map Location No. 52 (Small Trib.)
Howards Creek	Map Location No. 36 (Greenbrier R.)
Marlin Run	Map Location No. 3 (Greenbrier R.)
Ansted Creek	Map Location No. 19 (Small Trib.)
Meadow Creek	Map Location No. 42 (Gauley R.)
Grassy Creek	Map Location No. 22 (Gauley R.)
Beaver Creek	Map Location No. 21 (Gauley R.)
Big Ditch Run	Map Location No. 7 (Gauley R.)
Jumping Branch (R C and D)	Map Location No. 66 (Bluestone R.)
Dunloup Creek	Map Location No. a

Private Development

Flat Top Lake - Recreation - Glade Creek
Stevens Lake - Recreation - Marsh Fk. - Coal R.
Plum Orchard Lake - Recreation - Paint Creek

Local Programs

Beckley Flood Plain Information Studies (CE report)
Hinton Flood Plain Information Studies (CE report)
Montgomery Flood Plain Information Studies (CE report)
Princeton Flood Plain Information Studies (CE and SCS report)
Richwood Flood Plain Information Studies (CE and SCS report)
White Sulphur Springs Fl. Pl. Inf. Studies (CE and SCS report)
Gauley Bridge Flood Plain Information Studies (CE)
Whitesville Flood Plain Information Studies (CE)
Marlinton Flood Plain Information Studies (CE)
Webster Springs Flood Pl. Information Studies (CE)

For authorization:

USDA - SCS - Watershed Projects

Gypsy Hill	Map Location 65 (Greenbrier R.)
Upper Meadow River	Map Location No. 72 (Gauley R.)
Cherry River	Map Location No. 25 (Gauley R.)
Glade Creek	Map Location No. 33 (Bluestone R.)

USDA - Forest Service

Recreation Developments in Monongahela National Forest
Recreation Developments in Jefferson National Forest

Future studies:

A Priority

Corps of Engineers

Swiss Lake (Hydropower + FC + R + FWL - Gauley River)
Indian Creek Lake (Direct Trib.)
Birch River Lake (Elk R.)
  Knapp Creek Lake (Greenbrier R.)
  Deer Creek Lake (Greenbrier R.)
  East Fork Lake (Greenbrier R.)
  Buffalo River Lake (Elk R.)
  Greenbrier Lake - Alternate to 4 above
Bluestone River Lake
Big Sandy Lake (Elk R.)
Reallocation of storage in Sutton Lake (Elk R.)
Reallocation of Bluestone Lake storage
Reallocation of storage in Summersville Lake (Gauley R.)

USDA - SCS - Watershed Projects

Middle Creek	Map Location No. b (Elk R.)
Upper Birch River	Map Location No. c (Elk R.)

B Priority

Corps of Engineers

Meadow River Lake (Gauley R.)

USDA - SCS - Watershed Projects

Laurel Fk.	Map Location No. aa (Bluestone R.)

The Water Plan is just a beginning in the Basin. The Kanawha River Comprehensive Basin Survey (Type II) committee recommendations to date are substantially those in Priority A of future studies. Many of the projects will be placed before those listed for authorization by the Water Development Coordinating Committee to Appalachia after the completion of the Type II study. Almost all possible water needs would be satisfied by those projects. The major functions of the major reservoirs (CE) in "B" and "A" would be to provide regional recreational, fish and wildlife opportunities and to provide flood storage and water for quality control for Growth Area 10 and along the Ohio River (See Growth Area 10 discussion and Table 14-20). Swiss Lake would be a major hydropower and flood control project.

Table 14-19 presents the effectiveness of alternatives considered in Growth Area 9. A map and schematic diagram of the various alternatives considered is shown in Figure 14-32.

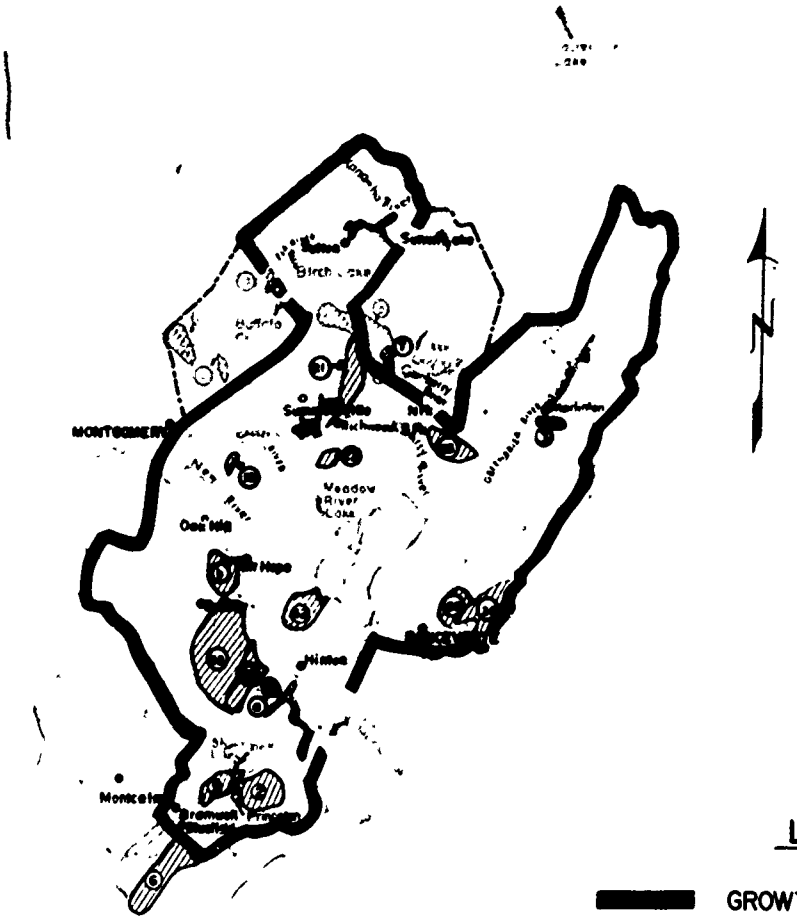
TABLE 14-19
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 9
KANAWHA RIVER TRIBUTARIES, SUB-REGION G
1968

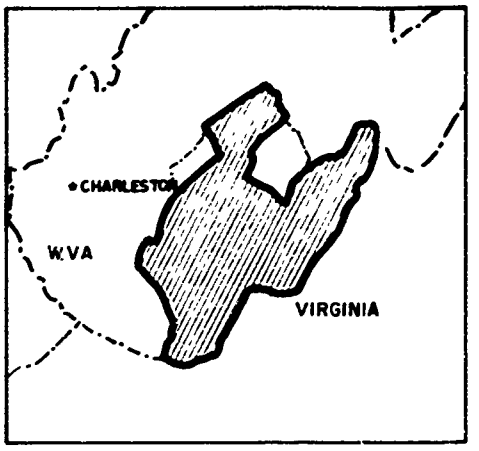
ITEM	NEEDS	PROJECT CONTRIB. BY 1980 a/	CONTRIB. OF ALTER. WSHD b/	UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP A (1st priority)	CONTRI-BUTION d/	UNMET NEEDS	GROUP B (2nd priority)	CONTRI-BUTION d/	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Sutton-Gassaway	7	-	-	7	Realloc. Sutton Lake	7	0		-	0
Summersville-Richwood	10	-	4	6	Realloc. Summersville Lake	6	0		-	0
Marlinton	6	-	2	4	(CE) Deer Creek Lake	4	0		-	0
Lewisburg-Ronceverte-White Sulphur Springs	14	-	-	14	(CE) Deer Cr. & E. Fk. Lakes	14	0		-	0
Hinton	2	-		2	New River flows	2	0		-	0
Beckley	24	-	-	24	private Lake + Groundwater	10	14	Groundwater	14	0
Montgomery	6	-	-	6	Upstream Lakes + Bluestone Lake realloc.					
Bluefield-Princeton	30	-		30	Groundwater & Private Lake	10	20	Realloc. Bluestone R. Lakes	20	0
Oak Hill-Mt. Hope	10	-	-	10	Private Lakes	5	0	Private Lakes (surf.)	5	0
Water Quality	(cfs)	(cfs)	(cfs)	(cfs)		(cfs)	(cfs)		(cfs)	(cfs)
Marlinton	15	-	-	15	(CE) Deer Cr. Lake, Knapp Cr. Lake CE East Fork Lake, (alt. CE Greenbrier Lake)	15	0		-	0
Lewisburg-Ronceverte-White Sulphur Springs	20	-		20		20	0		-	0
Richwood	8+	-	8+	-		-	0		-	0
Montgomery	1,000+			1,000+	From G.A. 8 & Lakes above	1,000+	0		-	0
Oak Hill-Mt. Hope	4	-	-	4	Tertiary Treatment	4	0		-	0
Beckley	26	2	-	24	Tertiary Treatment	20	4		-	4
Bluefield-Princeton	23	23	-	0		-	0		-	0
Flood Control (Residual Damages)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)		($1,000)	($1,000)
Marlinton (reach) c/	529	-	-	529	(CE) Deer Cr. Lake, (CE) E. Fk. Lake, (CE) Knapp Cr. Lk.	300	229		-	229
Lewisburg-Ronceverte-White Sulphur Springs	378	72	8	298		125	107		-	107
Summersville-Richwood	435	64	120	251	(CE) Swiss Lake	50	201	(CE) Meadow R. Lake	80	121
Oak Hill-Mt. Hope	120	74	-	46		-	46		-	46
Bluefield-Princeton	545	215	-	330	(CE) Bluestone R. Lake	20	310	USDA Laurel Fk. Wshd		170
Sutton-Gassaway	167	-	-	167	(CE) Buffalo Cr. & Birch R. Lakes	133	34		0	34
Beckley	150	74		76	USDA Laurel Cr. Wshd USDA Middle Cr. Wshd - Mill Cr.	-	76			76
Hinton	100	25	3	72	USDA Up. Birch R. Wshd	4	72			72
Montgomery	71	2	-	69	Upstream Lakes incl. Indian Creek Lake	65	4		-	4
Flood Plain Area (Urban)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)		(Acres)	(Acres)
Total Growth Area 9	1,800	200+	100	1,500	Total System	1,400	100		-	100
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area 9	9,000	-	1,400	7,600	Total System	14,000+	-		-	6,400 + excess
Performance Index #1 e/										
Performance Index #2 e/										

a/ Eleven USDA Watershed Projects - see Table 14-1 and "Plan" lists preceding this table.
b/ Gypsy Hill, Upper Meadow R., Cherry R., Glade Creek, Quick (Slack) Cr., Slaughter Cr., and Kellys Creek Watershed Projects.
c/ Reach annual damage totals.
d/ Based on incomplete studies.
e/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$

M-14-143





VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

GROWTH AREA BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

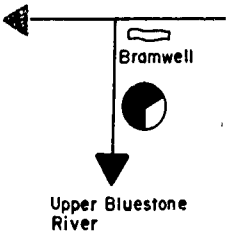
UPSTREAM WATERSHED IDENTIFICATION

EXPECTED TO EXIST BY 1980

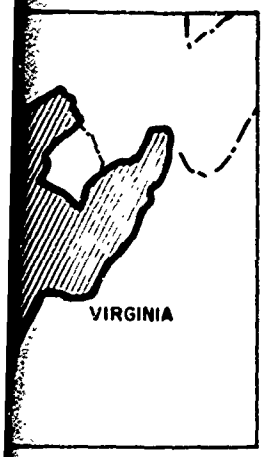
a Jumping Branch
b Dunloup Cr
2 Dave's Fk - Christian's Fk
3 Martin Run
6 Upper Bluestone River
7 Big Ditch Run
9 Brush Cr
19 Anstead Cr
21 Beaver Cr
22 Grassy Cr
36 Howard Cr
42 Meadow Cr
52 Piney Cr

ALTERNATIVE AVAILABLE FOR PLANNING

GROWTH AREA 9
WEST VIRGINIA



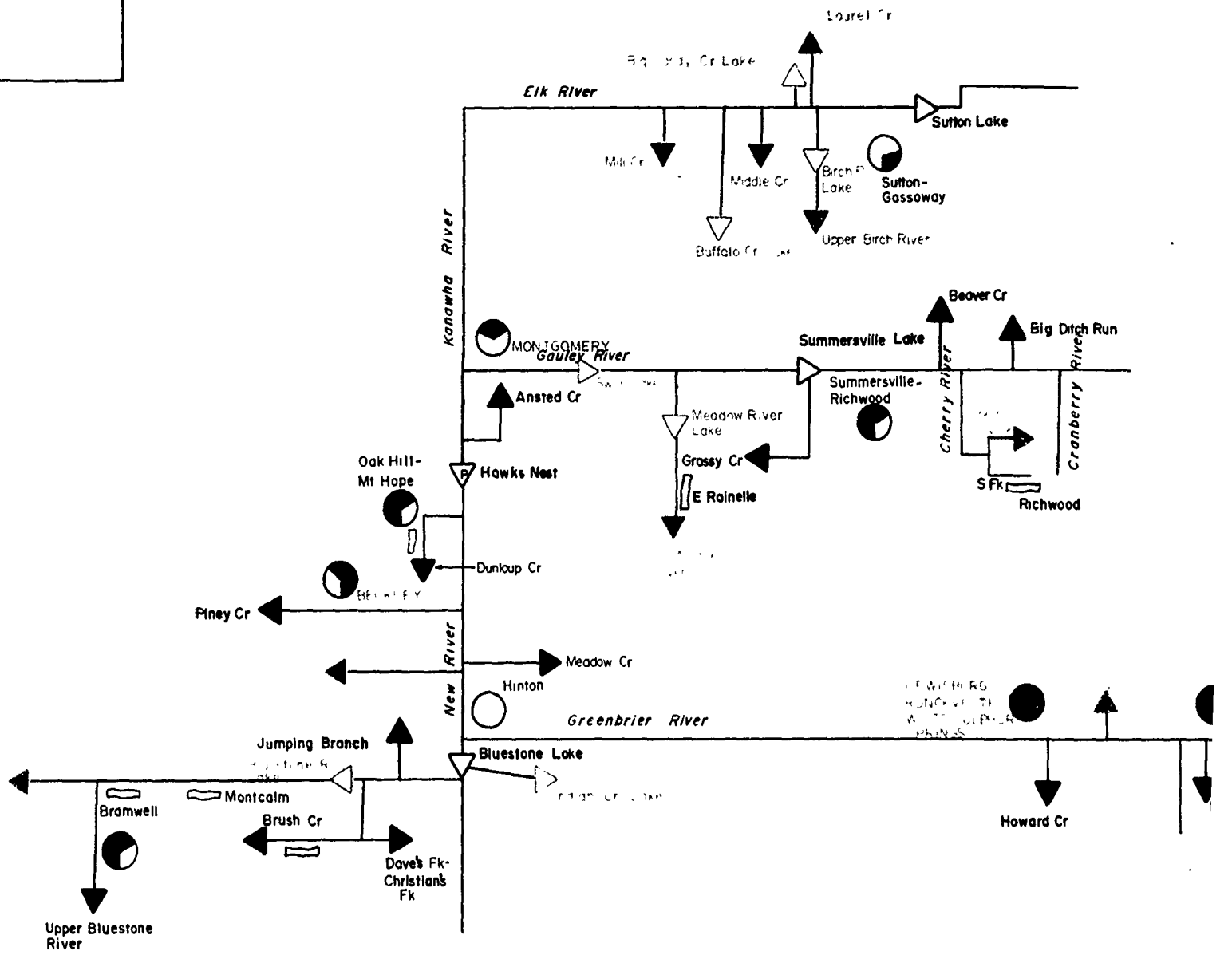
LOCATION MAP



Y MAP

OJECT

ROJECT



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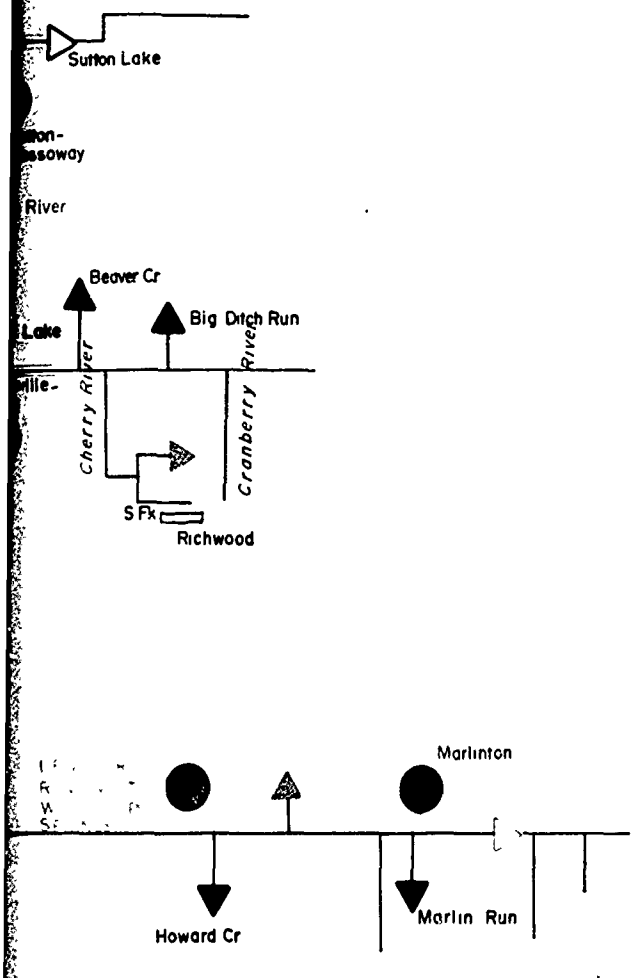

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LPP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR: P-PRIVATE
- ▲ UPSTREAM WATERSHED PROJECT
- ▭ LPP PROJECT

OTHER

TOWN NAME - PRIMARY GROWTH CENTER

Town Name - SECONDARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

—— CONTINUOUSLY

—— INTERMITTENTLY

GROWTH AREA 9
WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-165 FIGURE 14-32

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Kanawha River

Growth Area 10 contains the Primary Growth Area - Charleston, West Virginia.

The major water related constraint to economic growth today is water quality control.

Major constraints to economic growth - to national levels - after 1980 will be water supplies to support industrial growth and the ever present water quality control. (Figure 14-33 presents a schematic of needs for Growth Area 10.)

Basin Plan of Development

The recommended plan of development of water and related resources for the Kanawha River in Growth Area 10 includes the following elements:

Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S.	- (ARC) Appalachian Highway Corridor Q
U.S.	- Interstate Highway Nos. 77 and 81
W. Va.	- Expansion of Vocational Education at West Virginia State Teachers College and Morris-Harvey University
	- Two vocational - technical high schools
Local	- Development plans for growth center

Water Resources (See Figure 14-34)

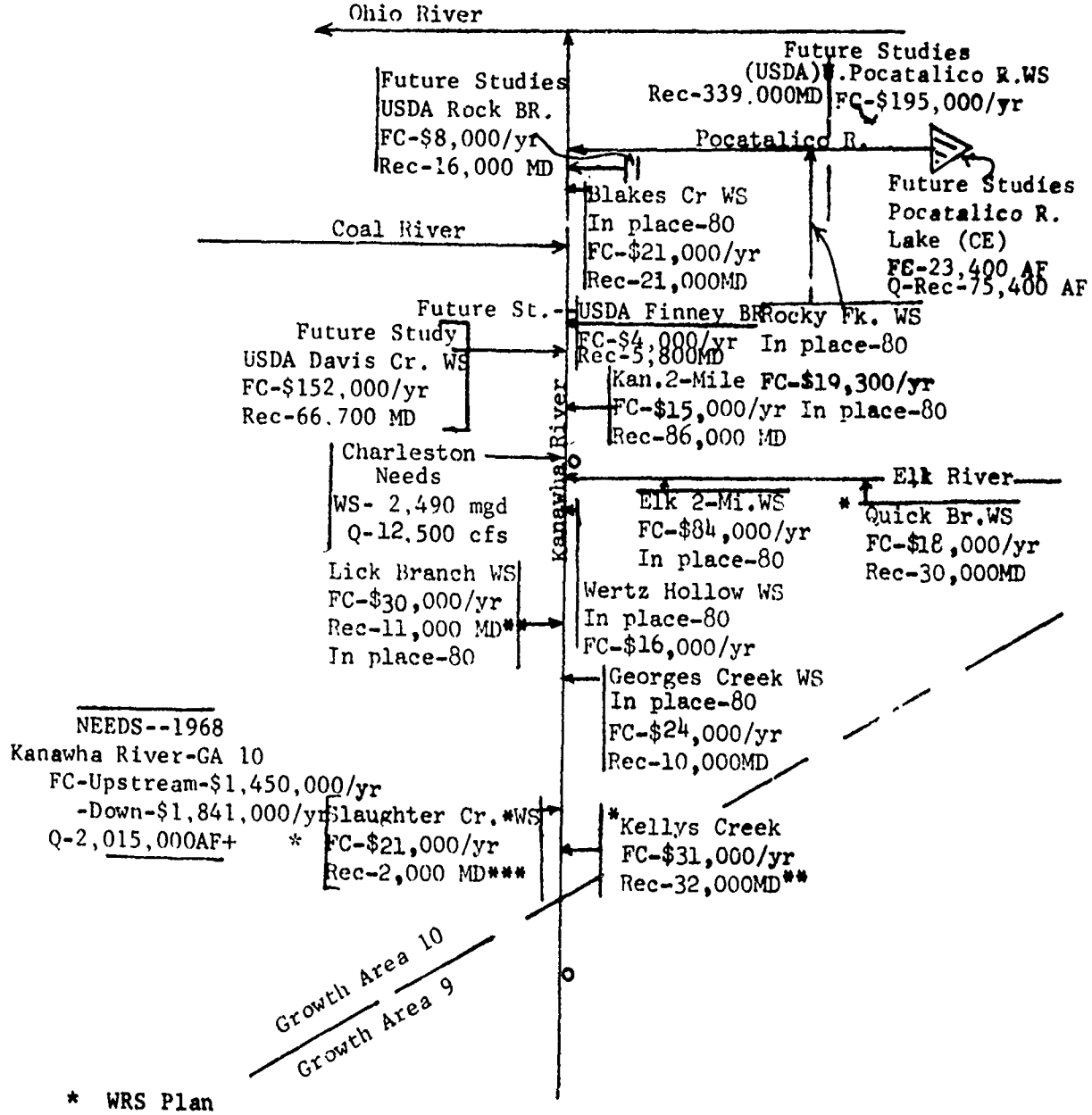
Corps of Engineers

(See lists in Growth Areas 8 and 9 - all projects upstream affect Growth Area 10)
London Lock and Dam (Kanawha River Navigation)
Marmet Lock and Dam (Kanawha River Navigation)
Winfield Lock and Dam (Kanawha River Navigation)
Pax Local Protection Project (Paint Creek)

USDA - SCS - Upstream Watershed Projects

Georges Creek	Map Location No. 31 (Small Direct Trib.)
Lick Branch	Map Location No. 31 (Small Direct Trib.)
Wertz Hollow	Map Location No. 81 (Small Direct Trib.)
Kanawha Two Mile	Map Location No. 38 (Small Direct Trib.)
Rocky Fork	Map Location No. 59 (Small Direct Trib.)
Blakes & Armours Creeks	Map Location No. 8 (Small Direct Trib.)
Elk Two-Mile Creek	Map Location No. 29 (Direct Elk R. Trib.)

FIGURE 14-33
NEEDS SCHEMATIC
GROWTH AREA 10



* WRS Plan
** Planned + incidental recreation
*** Incidental, not planned recreation

ARC et al

Implemented mine drainage pollution recommendation in present study

ORSANCO

Quality Monitoring Program

Local Programs

Charleston and St. Albans Flood Plain Information Studies (CE and SCS report)

Cooperative - Federal and State

Coal River Study

For authorization:

USDA - SCS - Watershed Projects

Quick Branch (Slack)	Map Location No. 61 (Elk R.)
Slaughter Creek	Map Location No. 78 (New R.)
Kellys Creek	Map Location No. 39 (New R.)

Future studies:

A Priority

Corps of Engineers

Reallocation of present lake storage
Updating of three Navigation Locks and Dams
Big Sandy Lake (Elk R.)
Pocatalico River Lake
(See Growth Area 8 and 9 discussions)

USDA - SCS - Watershed Projects

Mill Creek (Elk R.)	Map Location No. e
Laurel Creek (Elk R.)	Map Location No. d
Rock Branch (Kan. R.)	Map Location No. g
Finney Branch (Kan. R. Trib.)	Map Location No. h
Davis Creek (Kan. R. Trib.)	Map Location No. i

All Concerned Agencies - W. Va. and U. S.

Special Coal River Basin Study

W. Va. and Private Industry

Advanced (tertiary) waste treatment

Growth Area 10 will have the necessary water-related ingredients for growth if the pollution and water supply problems are solved and if potential flood damages are recognized and controlled. There is sufficient storage in the three existing upstream reservoirs (1,310,100 acre-feet total - 1,023,000 acre-feet flood control) plus the storage in the reservoirs contained in the development plan for water resources development in the Kanawha River Basin (see discussions for Growth Areas 8 and 9). Priorities for development and study are in consonance with the tentative plan for water resources development in Kanawha River Basin.

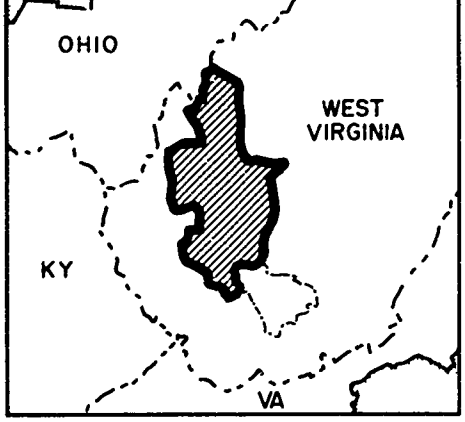
Table 14-20 presents the effectiveness of alternatives considered in Growth Area 10. A map and schematic diagram of the various alternatives considered is shown in Figure 14-34.

TABLE 14-20
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA 10
KANAWHA RIVER, SUB-REGION G
1968

ITEM	NEEDS a/	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. (CE) b/	CONTRIB. OF ALTER. WSHD c/	UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP A (1st priority)	CONTRIBUTION g/	UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP A (2nd priority)	CONTRIBUTION g/	UNMET NEEDS
Water Supply (1980)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)		(mgd)	(mgd)		(mgd)	(mgd)
Charleston	2,490	-	-	-	2,490	Industrial Reuse Kanawha System (See F.C.) Groundwater	2,000	490	Industrial Reuse	490	0
Water Quality	(1000 AF)	(1000 AF)	(1000 AF)	(1000 AF)	(1000AF)		(1000 AF)	(1000 AF)		(1000 AF)	(1000 AF)
Charleston	3,665 d/	650 b/	-	-	3,015	CE 12 Lake system incl. Pocatalico R. Lake and 11 in G.A. 8 and 9, USDA U. Pocatalico R. Wshd.	1,560	1,455	Tertiary (advanced) treatment	1,455	0
Flood Control (residual damage)	($1000)	($1000)	($1000)	($1000)	($1000)		($1000)	($1000)		($1000)	($1000)
Charleston (downstream)	1,841	-	-	-	1,841	Coal River Projects CE 12 Lakes, USDA Davis Cr. Upper Pocatalico R. Finney Br (4) and Rock Br. Watersheds	1,641	200		-	200
Upstream	1,450	206 f/	-	70	1,174		359	883		-	883
Flood Plain Area	(acres)	(acres)	(acres)	(acres)	(acres)		(acres)	(acres)		(acres)	(acres)
Charleston	3,000	-	-	0	3,000	Total System	2,500	500	-	-	500
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)		(1,000)	(1,000)
Growth Area #10	32,000	-	-	1,007	30,993	USDA Watersheds (637)	1,437	29,556	From G.A. 7 and 9	7,642	21,914
Performance Index #1 h/											
Performance Index #2 h/											

a/ Needs are for total growth center.
b/ A 2-reservoir system (Greenbrier & Anthony Creek in G.A. 9) was formulated during the WRS - now being restudied by Basin Study Committee.
c/ Quick Branch (Elk), Slaughter Creek and Kellys Creek Watersheds.
d/ Total within Kanawha Basin.
e/ Storage in Blue Ridge (multi-purpose project in Virginia) will be available about 1980.
f/ Elk-Two Mile Creek, Blakes & Armours Creeks, Rocky Fork, Kanawha-Two Mile Creek, Georges Creek, Wertz Hollow and Lick Branch Watersheds (7).
g/ Based on incomplete studies.
h/ Performance Index #1 - $\frac{\text{User and Redevelopment Benefits}}{\text{Project Costs}}$

Performance Index #2 - $\frac{\text{Regional Income Gains}}{\text{Total Costs}}$



VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

GROWTH AREA

APPALACHIAN REGION BOUNDARY

EXPECTED TO EXIST BY 1980

UPSTREAM WATERSHED PROJECTS

LOCK & DAM

PLANNING ALTERNATIVES

MAJOR RESERVOIRS

UPSTREAM WATERSHED PROJECTS

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

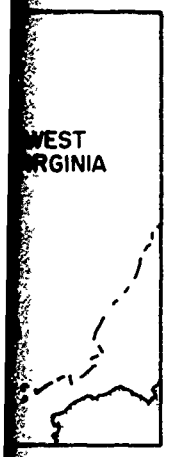
8 Blakes & Armours Creek
29 Elk-Two Mile Creek
31 Georges Creek
31 Lick Branch
31 Wertz Hollow
38 Kanawha-Two Mile Creek
59 Rocky Fork

ALTERNATIVES AVAILABLE FOR PLANNING

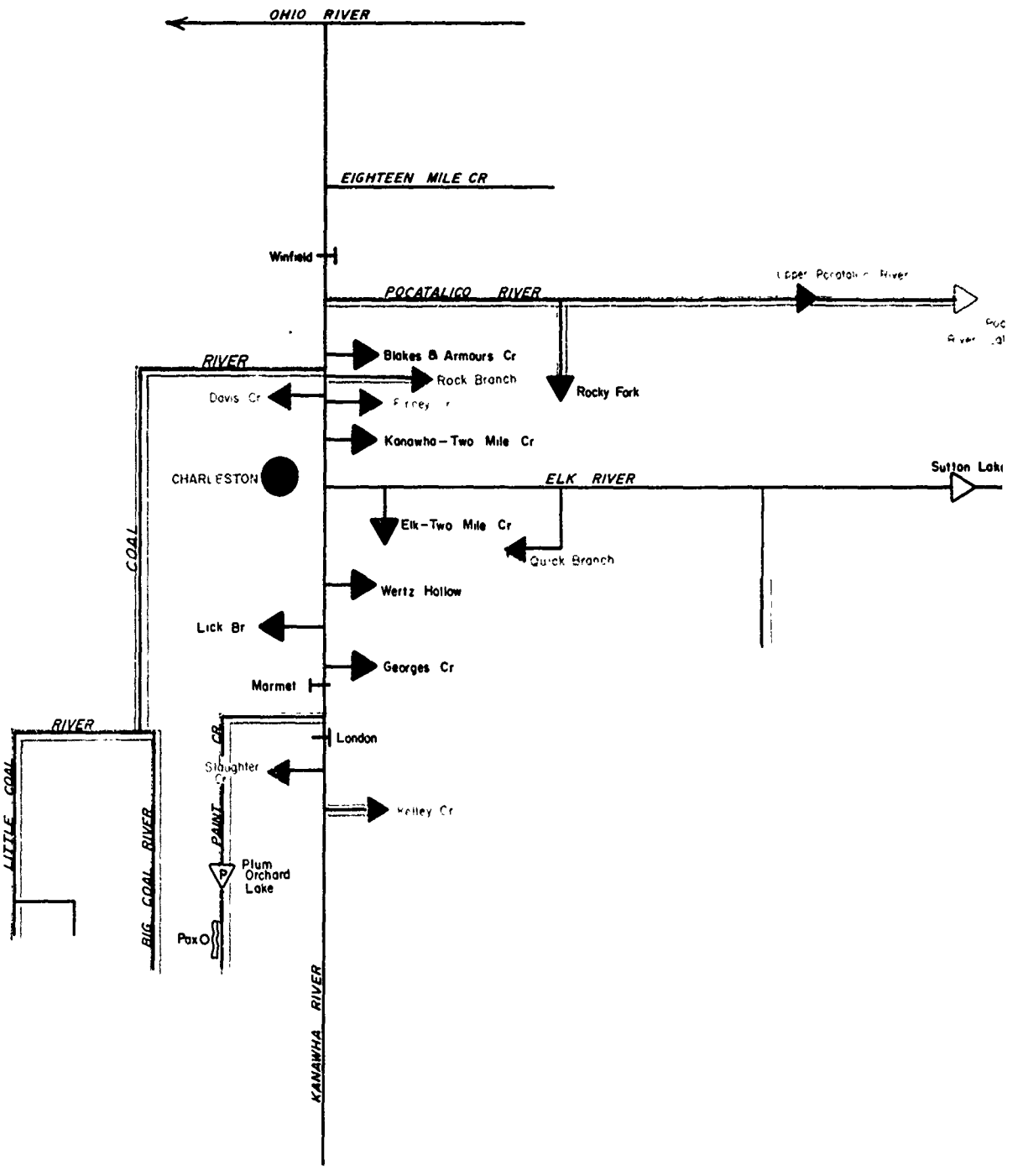
[illegible] River
[illegible] Branch
[illegible] Branch
[illegible] River
[illegible] Creek
[illegible]
[illegible]

GROWTH AREA 10
WEST VIRGINIA

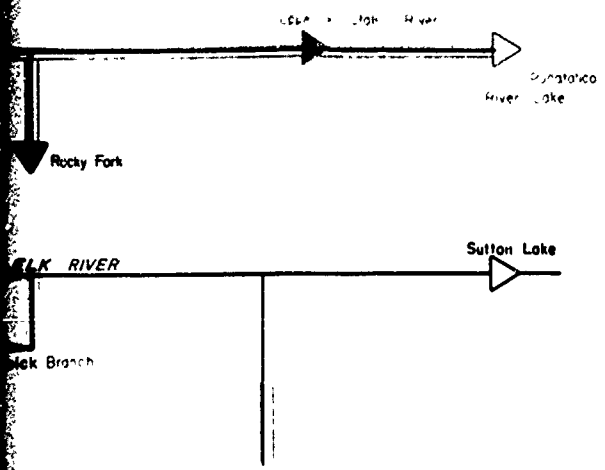
LOCATION MAP


WEST
RGINIA

2


OHIO RIVER
EIGHTEEN MILE CR
Winfield
POCATALICO RIVER
Upper Pocatalico River
RIVER
Blakes & Armours Cr
Rock Branch
Rocky Fork
Davis Cr
Kanawha-Two Mile Cr
CHARLESTON
ELK RIVER
Sutton Lak
Elk-Two Mile Cr
Quick Branch
COAL
Wertz Hollow
Lick Br
Georges Cr
Marmet
RIVER
London
CR
Slaughter Cr
Kelley Cr
LITTLE COAL
BIG COAL RIVER
PAINT
Plum Orchard Lake
Pax
KANAWHA RIVER

AP



LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR; P INDICATE NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- ≈ LPP PROJECTS
- ⊢ LOCK & DAM

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR: P-PRIVATE
- ▲ UPSTREAM WATERSHED PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

STREAM AFFECTED BY POLLUTION

- ═══ CONTINUOUSLY
- ——— INTERMITTENTLY

GROWTH AREA 10
WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-173

FIGURE 14-34

Guyandotte, Big Sandy and Licking River Basins

Growth Areas 11 and 12 contain the Logan Primary Growth Center and the Pineville-Mullens Secondary Growth Center in the Guyandotte River Basin; the Welch and Williamson-South Williamson Primary Growth Centers in the Tug Fork (Big Sandy) Basin; the Pikeville-Prestonsburg-Paintsville Primary Growth Center in the Levisa Fork (Big Sandy) Basin; and the Salyersville and Morehead-Midland Primary Growth Centers in the Licking Basin. The order of discussion will be from upstream Ohio River, i.e., Guyandotte Basin, Big Sandy Basin, and Licking River Basin.

The major constraints to economic growth today are poor access and lack of skilled workers. Environmental quality and topographic limitations are also constraints.

The major constraints to economic growth to permit attainment of Appalachian Benchmark goals after 1980 will be lack of qualified technical people for industry, lack of urban facilities, and scarcity of lands conducive to industrial development. (Figure 14-35 presents a schematic of needs for Growth Areas 11 and 12.)

The evaluations in the Upper Guyandotte River (above R. D. Bailey Lake) are continuing; they will be complete in 1971. The USDA has made a Preliminary Investigation Report for Big Creek Watershed Project; construction of the engineering measures should begin by 1980. In the upper reaches other Corps of Engineers reservoirs and USDA Watershed Projects should become operational between 1980 and 2000.

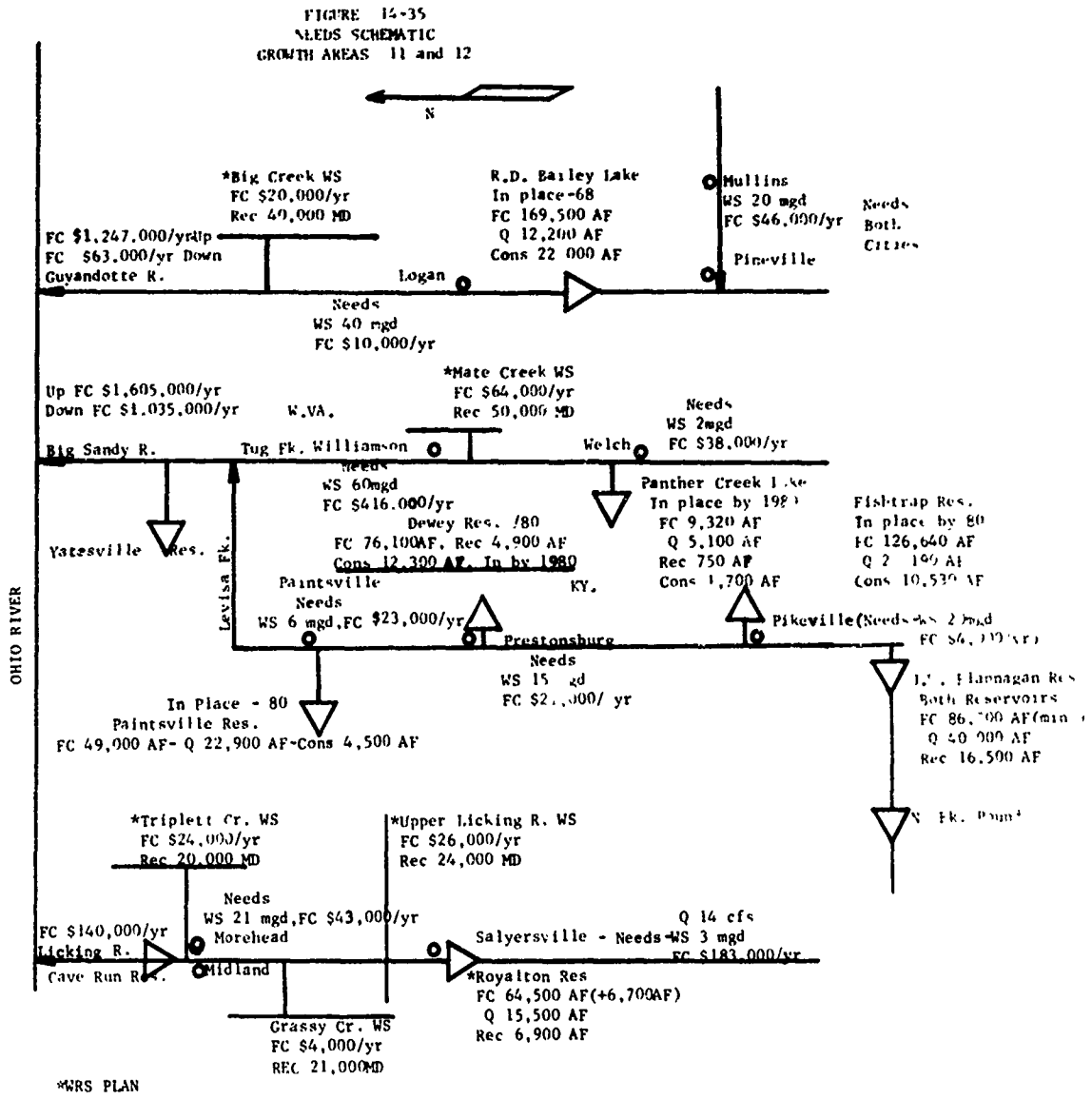
Tug Fork and Levisa Fork (of Big Sandy River) planning has been stalemated temporarily by the unsuccessful efforts to locate a feasible project (by present criteria) on Knox Creek. The findings of those studies are presented in Chapter 13 of Part III. Such a project is essential to the control of floods, maintenance of stream quality and provisions of recreation opportunity in the Williamson area. The SCS is developing a plan for flood prevention and recreation in the Mate Creek Watershed for water plan inclusion. The project will include channel improvement through Matewan, West Virginia. There is still need for local flood protection at Paintsville, Kentucky. Haysi Reservoir (CE-authorized) on upper Russell Fork (Levisa Fork) in Virginia will be needed as the area grows. The Pikeville Model Cities Program is underway. Project action by USDA watershed projects is almost precluded in upper Levia Fork sub-basin because of the low agricultural damages.

A complete developmental program has been developed for the Upper Licking River Basin (Salyersville, Kentucky). USDA planners have recommended that a multi-purpose watershed project for Triplett Creek at Morehead, Kentucky be placed in the water plan. It will become a part of the Midland "Newtown" Primary Growth Center as it expands to include Morehead.

Basin Plan of Development

The recommended water and related resources development plan for the three River Basins in Growth Areas 11 and 12 includes the following elements:

FIGURE 14-35
NEEDS SCHEMATIC
GROWTH AREAS 11 and 12



Projects in Operation or Expected to be in Place by 1980:

Related Resources

U.S.	- (ARC) Appalachian Corridors B, G, I, Q and R
U.S.	- Interstate Highways No. 64 and 75
Kentucky	- Vocational School and Technical Institute
Kentucky	- Expansion of Vocational Education at Morehead University, and at University of Kentucky - nearby
Local	- Development plans for 8 Primary and 2 Secondary Growth Centers

Water Resources (See Figure 14-36)

Corps of Engineers

R.D. Bailey Lake - Guyandotte River
Paintsville Reservoir - Big Sandy River (Levisa Fork)
Dewey Reservoir - Big Sandy River (Levisa Fork)
Fishtrap Reservoir - Big Sandy River (Levisa Fork)
N. Fork Pound River Reservoir - Big Sandy River (Levisa Fork)
John W. Flannagan Reservoir - Big Sandy River (Levisa Fork)
Panther Creek Lake - Big Sandy River (Tug Fork)
Cave Run Reservoir - Licking River
Berwind (Guyandotte River) - Local Protection Project
Williamson (Tug Fork) - Local Protection Project
South Williamson (Tug Fork) - Local Protection Project
West Williamson - Local Protection Project
Inez (Tug Fork) - Local Protection Project
Wayland-Garrett (Levisa Fork) - Local Protection Project
Langley (Levisa Fork) - Local Protection Project
Prestonsburg (Levisa Fork) - Local Protection Project
McDowell-Drift (Levisa Fork) - Local Protection Project
Martin (Levisa Fork) - Local Protection Project

USDA - SCS - Watershed Projects

Grassy Creek (Licking River) Map Location No. 7

Local Programs

Mullens, W. Va. Flood Plain Information Studies (CE report)
Logan, W. Va. Flood Plain Information Studies (CE report)
Williamson, W. Va. Flood Plain Information Studies (CE report)
Welch, W. Va. Flood Plain Information Studies (CE report)
Pikeville, Ky. Flood Plain Information Studies (CE report)
Paintsville, Ky. Flood Plain Information Studies (CE report)
Prestonsburg, Ky. Flood Plain Information Studies (CE report)
Lower Big Sandy River, W. Va. & Ky. Flood Plain Studies (CE report)

For authorization:

Corps of Engineers

Royalton Reservoir (Licking R.)
Salyersville Local Protection Project

USDA - SCS - Watershed Projects

Big Creek (Guyandotte R.)	Map Location No. 92
Mate Creek (Tug Fork)	Map Location No. 83
Triplett Creek (Licking R.)	Map Location No. 22
Upper Licking River	Map Location No. 25

Kentucky Plus Federal Agencies

Midland "Newtown" Development

Future studies:

A Priority

Corps of Engineers

Survey-scope review of water resource development on Tug Fork
Survey-scope review of water resource development in Guyandotte River Basin above R. D. Bailey Lake

Local Sponsors plus Federal Agencies

Pikeville, Ky. Model Cities Program - including CE Local Protection Project (channel cutoff)

USDA - SCS - Watersheds

Upstream Watershed Projects in Guyandotte Basin above R. D. Bailey Reservoir

Rock Castle Creek Watershed	Map Location No. a
Upper Tug Fork Watershed	Map Location No. b
Paint Creek Watershed	Map Location No. c

There are no remaining opportunities for project action in the three basins which would benefit growth centers directly, beyond those noted above. The SCS and Corps will need to work cooperatively in the Upper Guyandotte area above Pineville and Mullens.

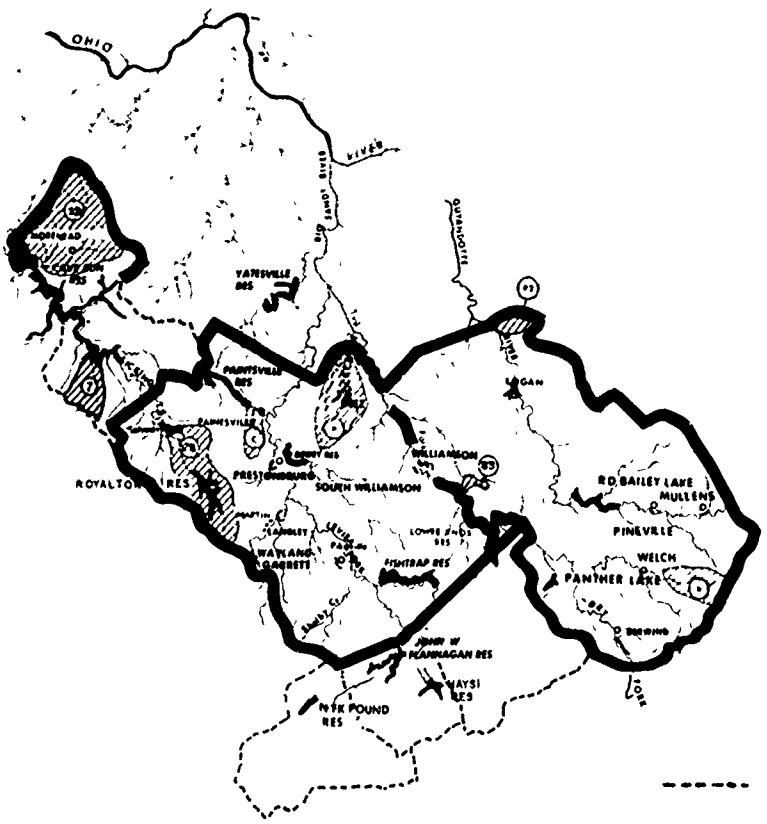
The Salyersville, Ky. "Package" should serve as a guide for future development once it is implemented.

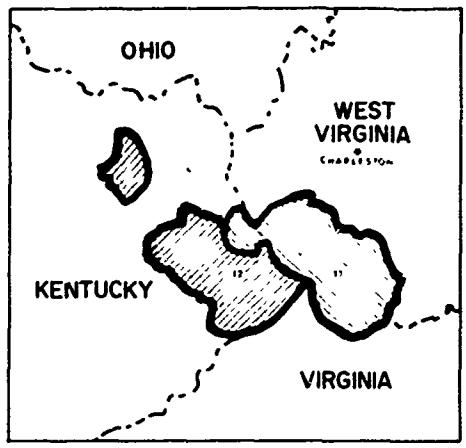
Table 14-21 and Figure 14-36 present this plan.

TABLE II-21
EFFECTIVENESS OF ALTERNATIVES CONSIDERED IN GROWTH AREA II-12
GUYANDOTTE, BIG SANDY AND LICKING RIVER BASINS, SUB-REGION C
1968

ITEM	NEEDS	PROJECT CONTRIB. BY 1980	CONTRIB. OF ALTER. DOWNSTREAM RESERVOIRS (CE)	USDA[b] WSHDS	UNMET NEEDS	GROUP A (1st priority)	CONTRI-BUTION[h]	UNMET NEEDS	RECOMMENDED FUTURE STUDIES GROUP B (2nd priority) CONTRI-BUTION	UNMET NEEDS
Water Supply (1980)	(MGD)	(MGD)	Royalton Lower Knox[i] + LPP. (MGD)	(MGD)	(MGD)		(MGD)	(MGD)	(MGD)	(MGD)
Morehead-Midland	Ind	-		Ind						
Salyersville	3		3		0	-		0	-	0
Water Quality	(1,000 AF)	(1,000 AF)	(1,000 AF)	(1,000 AF)	(1,000 AF)		(1,000 AF)	(1,000 AF)	(1,000 AF)	(1,000 AF)
Morehead-Midland	Ind.			Ind.		-	-	Ind.	-	Ind.
Salyersville	3.2		3.2	-	0	-	-	0	-	0
Williamson-S. Williamson	6			-	6	-	-	6	-	6
Flood Control (resid. dam.)	($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)	($1,000)	($1,000)	($1,000)
Logan	10	-			10					
Pineville-Mullens	46	-			46	Pineville & Mullens LPP's	40+	6	-	6
Other Guyandotte River	1,254	-		20[d]	1,234	USDA Watersheds & C.E Res.	1,100+	134	-	134
Welch	38	-			38	Welch LPP	34+	4	-	4
Williamson-S. Williamson	515[a]	58[c]	-	64[e]	393		-	393	-	393
Other Tug Fork	1,290	18[c]	-	-	1,272	Rockcastle Cr - U.Tug Fk WS	172	1,100	-	1,100
Pikeville	4	-	-	-	4	Pikeville Model City Program	4	0	-	0
Paintsville (Reach)	78	-	-	-	78	Flood Study (LPP- Paint Cr)	60	18	-	18
Prestonburg	21				21	-	-	21	-	21
Other Levisa Fork	529	-	-	-	529	Hayai Reservoir-Paint Cr WS	146	383	-	383
Salyersville	183	-	146	26[f]	11	-	-	11	-	11
Morehead-Midland	43+ [b]	-	-	24[g]	19	-	-	19	-	19
Other Licking River	17	-	-	17	17	-	-	17	-	17
Flood Plain Area	(Acres)	(Acres)	(Acres)	(Acres)	(Acres)		(Acres)	(Acres)	(Acres)	(Acres)
Logan										
Pineville-Mullens										
Welch										
Williamson-S. Williamson										
Pikeville	250	-	-	-	250	Pikeville Model City Program	250	0	-	0
Paintsville										
Prestonburg										
Salyersville	2,700	-	2,700	-	0	-	-	0	-	0
Morehead-Midland										
Growth Area #11										
Growth Area #12	15,500[j] Total									
Recreation (Man-days)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)	(1,000)	(1,000)
Growth Area #11-12	7,300		250	24[f]	7,026	C.E. Hayai Res. + USDA Wshd. + C.E. Res. (Unplanned)	4,000[h]	3,026	-	3,026
Performance Index #1										
Performance Index #2										

a/ Includes major reach of Tug Fork (Big Sandy) ($387,000 in Growth Center)
b/ Triplett Creek damages only - see Chapter II-12 WSR-H
c/ Panther Creek Lake (CE)
d/ Big Creek Watershed (USDA)
e/ Mate Creek Watershed (USDA)
f/ Upper Licking River Watershed (USDA)
g/ Triplett Creek Watershed (USDA)
h/ Estimated from incomplete studies
i/ Lower Knox Reservoir found infeasible based on present criteria
j/ Total, about 2 000 urban.





VICINITY MAP

LEGEND

COUNTY ASSOCIATED WITH GROWTH AREA

GROWTH AREA BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

7 Grassy Creek

ALTERNATIVES AVAILABLE FOR PLANNING

22 Triplett Creek

25 Upper Licking River

83 Mate Creek

92 Big Creek

a Rockcastle Creek

b Upper Tug Fork

c Paint Creek

GROWTH AREA 11&12

KENTUCKY AND WEST VIRGINIA

LOCATION MAP

TY MAP

TH

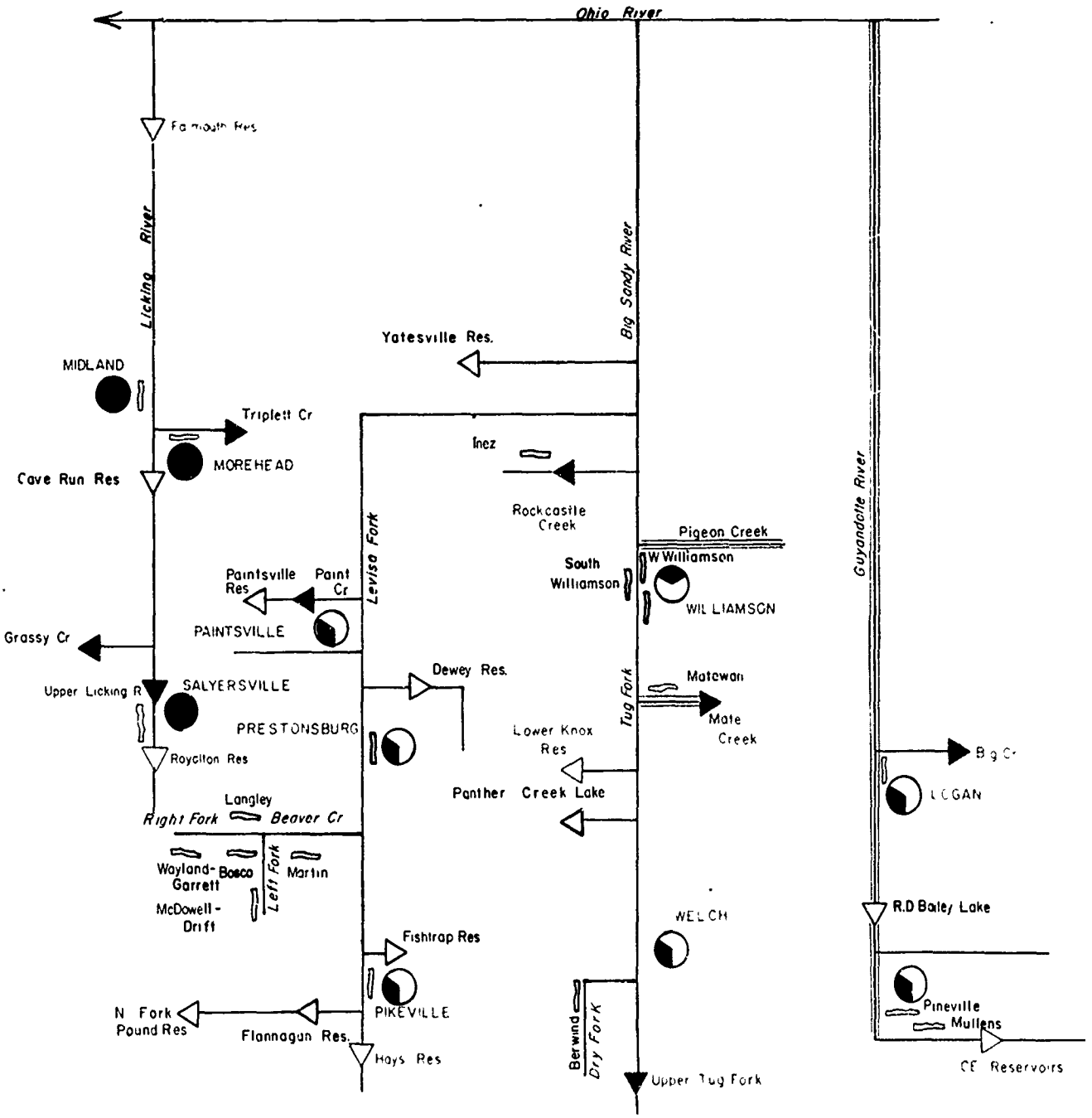
OJECT

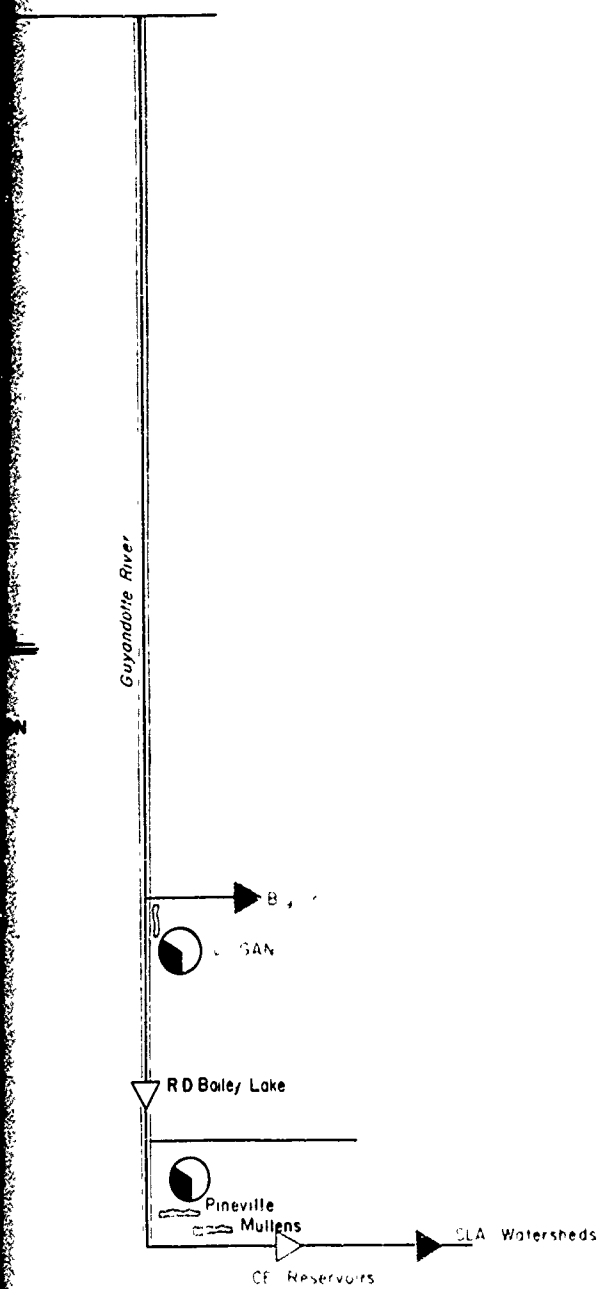
ROJECT

REA 11&12
ND WEST VIRGINIA

MAP

2





LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECT

OTHER

- TOWN NAME PRIMARY GROWTH CENTER
- Town None SECONDARY GROWTH CENTER
- STREAMS AFFECTED BY POLLUTION
  - CONTINUOUSLY
  - INTERMITTENTLY

GROWTH AREA 11&12
KENTUCKY AND WEST VIRGINIA

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

II-14-181 FIGURE 14-36

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13. THE SYSTEM - SUB-REGIONAL - GENERAL

Water Supply, Water Quality Improvement, and Flood Control

The preceding paragraphs have discussed the water supply problems that are now facing the identified growth centers and the needs that are expected to develop during the next 50 years. These identified needs total some 8583 mgd and can generally be satisfied by the long range plan recommended. The same can generally be said insofar as the elimination of serious flooding damage and provision for water quality improvement needs on the rivers. However, the sub-region as a whole has many towns, non-incorporated communities, and rural areas not in designated growth centers that will be affected by all these problems. It is estimated that about 212 mgd of water supply for domestic and industrial purposes and 25,000 acre-feet of water storage for quality improvement purposes will be needed for these non-identified areas before 2020, and that they have existing annual flood damage of about $200,000. The development of rural water districts and their distribution systems may result in an increase of the water needs estimate for those areas.

A part of the rural needs can, and will, be supplied from the improvements that will result from the studies that comprise a part of the recommended plan. Much of the water supply and flood protection can be furnished by upstream watershed projects that either have been studied by the U.S. Department of Agriculture's Soil Conservation Service or which will be studied, as the need arises. Those for which studies have been made are shown on Figure 14-37 (Page 14-193). Water supply requirements for both urban and rural use should be one of the prime purposes considered in all future investigations and plans, and the reports should furnish complete information concerning the sites where water can be impounded for this purpose, the amount of storage that could be made available, and the anticipated yield in million gallons per day.

Water quality estimates, in areas not covered by definite project proposals, were based on short cut procedures which are based on generalized assumptions. Detailed studies of assimilative capacity of localized streams could not be made within the time and monetary limitations of the study. However, the estimates should guide future investigations towards potential points of need and indicate the relative magnitude of needs. Dilution may not be a practical or economical alternative in many of the areas located very high in the drainage basins. In other areas it may be impractical because of the high cost of lake storage.

Recreation

The massive increase in needs for outdoor recreation, indicated in Figure 14-4 (Page 14-34), is based on BOR projections in Appendix F. Studies indicate that the sub-region will have enough development to meet all needs until about 1980.

In accord with present trends, the Bureau of Outdoor Recreation has estimated that by 2020 the water oriented recreation demands would be 143.3 million man-days. If the same density of use as in 1980 is used as a measure, then an area of 1.07 million acres of water surface would be required, over 4 percent of the total area of the sub-region. It appears that intensive use of water surfaces and the surrounding areas will be required, including higher mid-week use than at present. The importance of State projects in meeting outdoor recreation needs is evident. The increased importance of Ohio River navigation reaches is obvious.

Additional water surfaces will result from the studies that are recommended for future accomplishment in Section IV. Additional developments in all river basins will supplement the upstream watershed projects that are expected to be implemented by the Department of Agriculture. Twenty-three of the twenty-six recommended upstream watersheds include outdoor recreation as a project purpose. About 3,209,000 recreation man-days would be provided each year. The Bureau of Outdoor Recreation indicates that many small single purpose reservoirs or high density recreation areas near the growing metropolitan centers (primary) will be needed by the year 2020. The mainstem of the Greenbrier River and part of Gauley River have been identified as having high scenic qualities by West Virginia. Its potential as a free-flowing stream will help satisfy many of the needs for outdoor recreation opportunities.

The National Forests represent another recreation resource that can help meet both present and future needs. The forests provide both streams and artificial impoundments for the enjoyment of the fisherman, the hunter, the camper, the picnicker and the sight-seer. The forests also provide trails for hiking and riding, scenic drives, opportunities for nature study and for photography. It is estimated that these forests can provide for over eight times the 1966-453,500 man-days of this type of outdoor recreation annually.

Supplement B to Appendix F, prepared by the U.S. Forest Service, describes the recreation opportunities in the forests and some of the improvements that are expected to be made in the near future. The location and extent of the National Forest lands are shown on Figure 13-12. The reservoirs and upstream watershed projects mentioned above are shown on Figure 14-37.

Conservation

Upstream watershed development has been mentioned in Sections III and IV when the problems of the various growth centers were discussed. However, there are many constraints over the sub-region that relate to floodwater damage, erosion and sediment damage, agricultural water management, and the management of crop land, grazing land, and the forested areas. These are all problems that fall under the purview of the Department of Agriculture, particularly, to the Soil Conservation Service and the Forest Service.

Discussion of these problems is made in Appendix A of this report and detailed discussions covering the magnitude of the problems in Sub-region G are made in attachments to that appendix.

It is estimated that by 1980 in order to provide for the continued production of food and fiber from this sub-region, acceleration of accomplishments of present USDA programs over and above the present rate will be required as follows:

a. Adequately treat and protect 200,550 acres of crop land, improve 515,480 acres of pasture, and establish 120,800 acres of new pasture planting.

b. Stabilization of critical areas on 16,350 acres of roadbank and 84,250 acres of surface-mined areas.

c. Increased recreational and fish and wildlife opportunities by the construction of 579 farm ponds, management of 4,600 farm ponds for fish production, construction of 178 miles of recreational access roads, development of 18,490 acres of wildlife habitat, plan 142,190 acres for wildlife habitat preservation, and develop 7,720 acres of picnic areas and 3,080 acres of camping areas.

d. Develop 22,070 basic conservation plans and complete detailed soil survey on 7,095,750 acres of land.

In addition to the goals above, accelerate land treatment measures on state forest and private forest and woodlands as follows:

a. Plant 86,300 acres to trees.

b. Treat 19,800 acres for erosion control.

c. Treat 559,000 acres for hydrologic stand improvement, 522,300 acres of harvest cutting; and protect 191,300 acres from grazing.

d. Develop 5,527 forest and woodland management plans.

Planned recommended accelerated land treatment and structural measures for National Forests include:

Tree planting	Acres	8,900
Timber stand improvement	Acres	65,230
Soil and Water		
Gully Stabilization	Acres	40
Sheet Erosion Control	Acres	40
Streambank Stabilization	Acres	480
Stream Channel Clearing	Acres	710
Rehab. abandoned roads and trails	Acres	360
Pollution abatement	Acres	490
Mined Area Stabilization	Acres	1,270

Soil Surveys	Acres	1,000,000
Watershed Analysis	Acres	1,000,000
Fish and Wildlife		
Big Game Range Analysis	Acres	142,300
Small Game Range Analysis	Acres	153,300
Wildlife Openings	Acres	31,900
Seeding and Planting	Acres	20,300
Release of Forage Plants	Acres	10,000
Planting Waterfowl Food Plants	Acres	200
Stream and Lake Surveys	Acres	400
Water Yield		
Improvement by Vegetative Management	Acres	50,000
Range Management		
Subtotal	Acres	720
Fire Protection		
Fuel Treatment (disposal)	Acres	36,500

The structural measures include the following:

Fire Protection		
Firebreak construction	Miles	208
Fire weather stations	No.	2
Fish and Wildlife		
Waterhole Development	Acres	100
Potholes for waterfowl	Acres	160
Impoundments for waterfowl	Acres	10
Stream and lake habitat improvement	Acres	1,000
Recreation		
Recreation facilities	Acres	3,000
Recreation impoundments	Acres	1,565
Special recreation projects	No.	18
Transportation		
Road construction	Miles	1,666
Roadside developments	Acres	2,760
Observation sites	No.	52
Trail construction	Miles	767
Bridges (roads and trails)	No.	162
Land Adjustments		
Acquisition	Acres	1,267,200

Power

Provisions for meeting the electric power requirements in the Appalachian Region are described in Appendix B, "Power Supply and Requirements". It appears that present planning of the utility companies that supply this area will provide for all needs until past 1980, and it is expected that advance planning will continue.

Comprehensive studies are being recommended for the further development of the water resources of the several basins in the sub-region. These studies will consider the possible use of impoundment for supply of cooling water for thermal-electric installations. Some streams now have low-head hydroelectric installations which operate as run-of-the-river plants.

The use of pump-back peaking installations, to operate in conjunction with the thermal plants, should also be included in these studies.

Recommended Plan of Development

Figure 14-37 portrays the recommended plan of development for water resources in Water Sub-region G. The plan time phase as shown in Figure 14-37 is taken directly from Tables 14-11 through 14-21. The following discussion points out the status and relative importance of the projects. * denotes Key projects in the Plan. All projects not listed under going programs would improve economic conditions.

I. Early Action (Authorization not Required)

a. Corps of Engineers

All recommended Flood Plain Information Studies
*Logan Reservoir-Hocking River - Ohio
Panther Creek Lake-Big Sandy River - W.Va.
West Fork Lake-Lake Kanawha River - W.Va.
Leading Creek Lake-Lake Kanawha River - W.Va.
Blue Ridge Reservoirs-Kanawha River - Va.
(cooperative Federal-State-Private)
Kehoe Reservoir-Tygarts Creek - Ky.
*Rockbridge Local Protection Project-Hocking River - Ohio
Chillicothe-Local Protection Project-Scioto River - Ohio
So. Williamson Local Protection Project-B.Sandy R. - Ky.
Inez Local Protection Project-B.Sandy R. - Ky.
*Morehead Local Protection Project-Licking River - Ky.

b. U.S. Department of Agriculture Upstream Watershed Projects

Margaret Creek-Hocking R. - Ohio
Rush Creek-Hocking R. - Ohio
W. Fork Duck Creek-Ohio R. - Ohio
Buffalo Creek-Muskingum R. - Ohio
So. Fork Roanoke R.-Roanoke R. - Va.
*Pond Run-Ohio R. - W.Va.
Elk-Two Mile Creek-Kanawha R. - W.Va.
Brush Creek-Kanawha R. - W.Va.
Big Ditch Run-Kanawha R. - W.Va.
Blakes & Armours Creeks-Kanawha R. - W.Va.
Kanawha-Two Mile Creek-Kanawha R. - W.Va.
*Mate Creek-B.Sandy R. - W.Va.

II. Early Action (Authorization or Accelerated Project Studies Needed)

a. Corps of Engineers

*Whiteoak Reservoir-Ohio R. - Ohio
*Nelsonville Local Protection Project-Hocking R. - Ohio
*Logan Local Protection Project-Hocking R. - Ohio
*Lucasville Local Protection Project-Scioto R. - Ohio
*Midland "New Town" Local Protection Project

b. U.S. Department of Agriculture (Early Action)

1. Upstream Watershed Projects having economic development and expansion as a primary purpose (Early Action)

*Federal Valley Creek-Hocking R. - Ohio
*L. Salt Creek-Ohio R. - Ohio
*U. Buckhannon R.-Monongahela R. - W.Va.
*U. Middle I. Creek-Ohio R. - W.Va.

2. Upstream Watershed Projects (Early Action)

*U. Licking R.-Licking R. - Ky.
*Triplett Creek-Licking R. - Ky.
*Upper Whiteoak Creek-Ohio R. - Ohio
*Sugar Creek-Muskingum R. - Ohio
*Sunday Creek-Hocking R. - Ohio
*Miller Run-Scioto R. - Ohio
*Headwaters Holston R.-Tenn. R. - Va.
*Upper Bluestone R.-Kanawha R. - Va.
*Spring Creek-L. Kanawha R. - W.Va.
*Kanawha R. Basin Projects - see Continuing Studies paragraph.
French Creek-Monongahela R. - W.Va.

3. Upstream Watershed Projects (Acceleration)

Upstream Watershed Projects in Water Sub-region G which should be planned and/or installed under an acceleration of going programs are: Kentucky - Grassy Creek, Little Fork of Little Sandy River, and East Fork Little Sandy River. Ohio - Moxahala-Jonathan Creeks, Wakatomika Creek, O'Bannon Creek, Wolf Creek, Little Scioto River, Pine Creek, and Leading Creek. Virginia - Little Stony Creek, Mill Creek, and Peak Creek. West Virginia - Laurel Fork of Bluestone River, Mill Creek (direct Ohio trib.), Fourpole Creek, and Big Creek. See Kanawha River continuing studies narrative.

4. Accelerated Land Treatment and Watershed Protection

The U.S. Department of Agriculture recommends acceleration of land treatment and management programs on privately owned and National Forest lands to meet the most urgent needs by 1980. This acceleration will provide continued production of food and fiber and reduction of floodwater, erosion, and sediment damages. It will also increase outdoor recreational opportunities and improve the water and environmental quality of the Sub-region. Priority will be given to critically eroding areas in the drainage basins above the recommended and existing water resource developments of the States, Corps of Engineers, Tennessee Valley Authority and others to improve their efficiency and useful life. The recommendations are summarized earlier. Complete details are given in Appendix "A".

III. Continuing Studies (Projects)

a. Corps of Engineers

*Lower Knox Reservoir-B. Sandy R. - Ky.
Muskingum Basin-Reservoirs A, B & C - Ohio
Monday Creek Reservoir-Hocking R. - Ohio
Symmes Creek Reservoir-Ohio R. - Ohio
Ohio Brush Creek Reservoir-Ohio R. - Ohio

*The tentative Kanawha Basin Plan includes Pocatalico River, Big Sandy Creek (Elk R.), Birch River (Elk R.), Meadow River (Gauley R.), Knapp Creek (Greenbrier R.), Deer Creek (Greenbrier R.), East Fork (Greenbrier R.), Indian Creek (U. New R.), Bluestone River (U. New R.), and Buffalo Creek (Elk R.), projects plus Swiss Power Project (Gauley R.) in West Virginia. Projects have been proposed in Virginia on Walker Creek and Little River.

Projects being studied in the Monongahela Basin include possible Middle Fork-Buckhannon R., and Tygart Valley-Teter Creek and Laurel Creek Lakes in the Tygart River Basin.

b. U.S. Department of Agriculture Upstream Watershed Projects

The tentative Kanawha Basin Plan includes the following projects for which the relative economic developmental potential has not been determined: Lick Branch, Howard Creek, Kellys Creek, Rocky Fork, Grassy Creek, Middle Creek, Georges Creek, Beaver Creek, U. Birch River, Wertz Hollow, Gypsy Hill, Laurel Creek, Jumping Branch (RC&D), U. Meadow River, Mill Creek (Kan.), Piney Creek, Cherry River, U. Pocatalico River, Meadow Creek, Glade Creek (Upper), Davis Creek, Dunloup Creek, Quick Creek, Finney Branch, Ansted Creek, Slaughter Creek, and Rock Branch.

Other projects have been listed in I and II.

IV. Other Continuing Studies (Cooperative)

Hocking Hills National Recreation Area - Ohio
Muskingum River Basin Study (due in 1971)
Survey Report for the Big Sandy River Basin
Upper Guyandotte River Basin Study
Mill Creek at Ripley, West Virginia

V. Future Studies

Southern Ohio Basins Study - 1971 - Ohio
*Coal River (Kanawha River) Land Stabilization Study

*Studies of the effectiveness of the system of flood control reservoirs throughout the Ohio River Basin should be continued after completion of the flood plain information studies along the main stem. These studies should have as goals determination of flood hazard stages at individual developmental sites, and determination of the overall expansion benefits from adding additional flood control storage to the system.

All upstream Watershed Projects listed herein are to be completed by 1990. Plans should be developed for the feasible upstream watersheds as determined by the most recent USDA Conservation Needs Inventory for Watersheds.

Effectiveness of the Proposed Plan

The Plan displayed here for Water Sub-region G was developed on the assumption that the counties and cities in Ohio, West Virginia, Virginia, and Kentucky falling in this sub-region will be able, with the stimulation provided by the Appalachian Development Act of 1965 and related measures, to raise their economy to a level approximating the national level of economic development. For Sub-region G, this would mean a population of 4,194,000 in the year 2000 and 5,691,000 in the year 2020, compared with 2,676,200 in 1960. For employment, it would mean 1,609,000 jobs in 2000 and 2,135,000 jobs in 2020, compared with 769,000 in 1960.

The proposed plan is not designed to have a uniform effect, but is specifically designed to direct public and related private water resource investments to those communities and situations which have demonstrated the capability to grow, and, thereby, creating an opportunity to place investments where return on the public investment will be the greatest. Accordingly, the plan emphasizes the needs of regional growth centers where it seeks to remove the water related constraints to future increases in employment and productivity. While the needs of areas of demonstrated growth and areas with clear growth potential are emphasized, the needs of all communities are given consideration in the planning process, for there is frequently a close connection between growth centers and the economy of the hinterland areas.

The plan selected is based on the careful study of the several alternative ways of providing the resources required for sub-regional economic growth within the Appalachian Region. While Appalachian Regional growth is a stated objective of the Appalachian Resources Survey, the selected plan does not ignore overall national interest in that it seeks to meet regional needs by means of a series of projects economically justified from the national point of view. Indices of project performance from both the regional and national viewpoint are presented for each major project and program recommendation.

The effectiveness of the selected plan can be appraised, in part by review of Tables 14-11 through 14-21 which indicate the magnitude of the needs which could be met by the several alternative approaches considered. In some instances, it is clear that futher studies must be made to determine the best way of meeting sub-regional needs. Solutions have been found for most needs through phasing of ways to satisfy the needs is subject to further analysis.

Since the recommended plan overlays a continuing public and private program for water resources development, a definite statement of the marginal income contribution of the recommendations over the continuing programs is not possible. The definite project recommendations in Sub-region G are the same kind, but, in all probability, not the same scale as would be forthcoming if PL 89-4 had not been enacted. The Act and this study may serve to accelerate the construction of recommended projects. The unique contribution of this study is an overview of total needs and ways of meeting these needs phased in with economic expansion (growth) alone. Gains are in regional planning, and a synthesis of system requirements rather than an emphasis on the individual increments of the system.

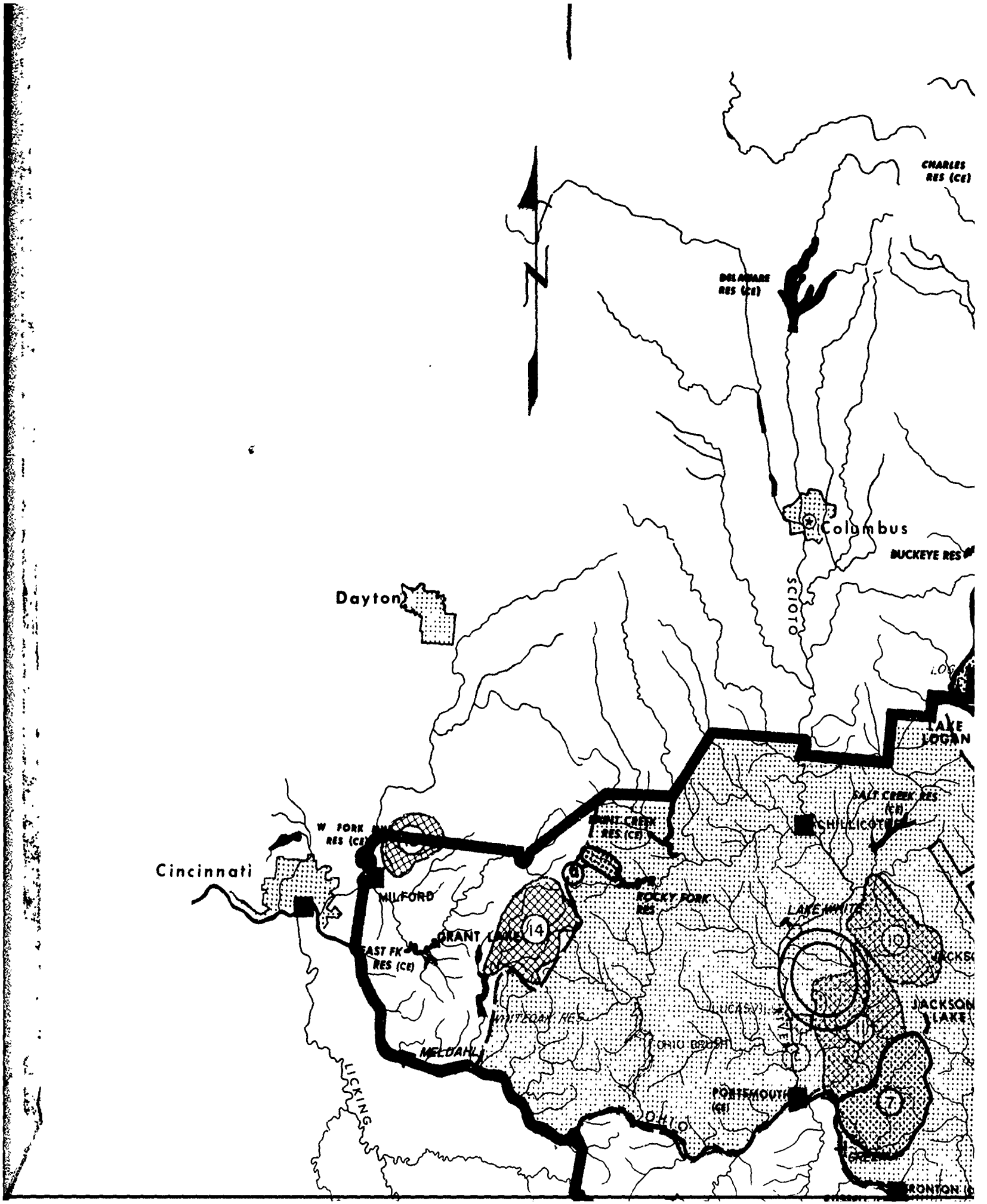
There are two principal reservoir projects recommended for early construction by the Sub-region G plan: (1) the Logan Reservoir Project and (2) the Whiteoak Reservoir Project. The needs for flood control, quality control and recreational opportunity at Logan-Athens in the Hocking River are urgent and place recommendations for Logan Project in the immediate category. Also, the need for development of a source of water supply and recreational opportunity is a current problem facing planners in the Clermont County Growth Center (Cincinnati SMSA). The selection of Whiteoak Project for early completion is the best way to meet total needs.

The 26 Upstream Watershed Projects recommended by USDA (I-b. and II-b. 1. and b. 2.) will result in flood protection, sediment control, increased recreation opportunity and water supply in the sub-region. They will also result in local employment and wage gains. The estimated total cost of the projects is $100,000,000 with an annual equivalent value of 3,700,000 dollars. The average annual benefits will be $7,300,000 (including expansion benefits for all but the Upper Licking River Watershed).

The estimated total annual equivalent costs of Whiteoak and Logan Reservoirs will be 5,563,000 dollars. The average annual benefits, including expansion benefits will be 98,823,000 dollars.

Detailed estimates of employment and wage gain permitted by the implementation of the Logan and Whiteoak Projects and their associated investment programs have been made. Increments of population and employment gains which could be associated with these projects total 45,600 and 19,070 respectively. Now the same gains could be accomplished with other higher cost alternatives or some substitution of "dry" for "wet" industries might be possible if water supply needs cannot be met. Thus, there is some question of defining the absolute net advantage of the plans in terms of income and employment.

Perhaps the best description of the effectiveness of the Plan would be that the Plan (Definite Project Proposals and Future Studies) appears to be capable of meeting the water needs imposed by accelerating economic development of Sub-region G to the point that rough parity with the Nation in per capita income, in employment, and population growth, would be attainable by 2020. The proposals would appear to be practical and obtainable measures by which the water needs could be met. There are no obvious alternatives which are more efficient at this time.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CHARLES RES (CE)
DELAWARE RES (CE)
Columbus
BUCKEYE RES
SCIOTO
Dayton
LAKE LOGAN
SALT CREEK RES (CE)
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PAINT CREEK RES (CE)
Cincinnati
MILFORD
ROCKY FORK RES
LAKE HOPE
GRANT LAKE
14
10
EAST FK RES (CE)
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JACKSON LAKE
MEIGS
OHIO BRUSH
LICKING
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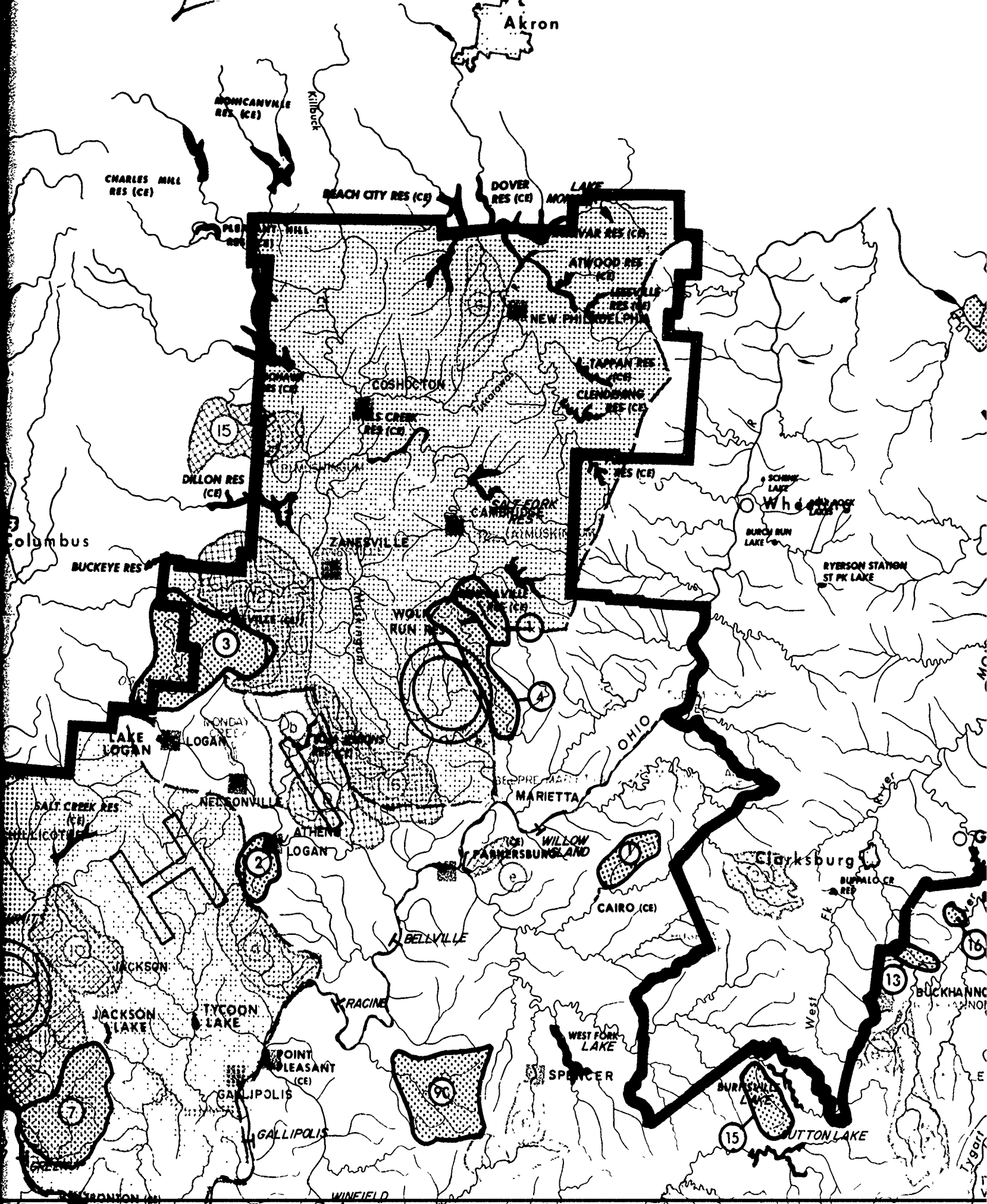
7
IRONTON


Akron
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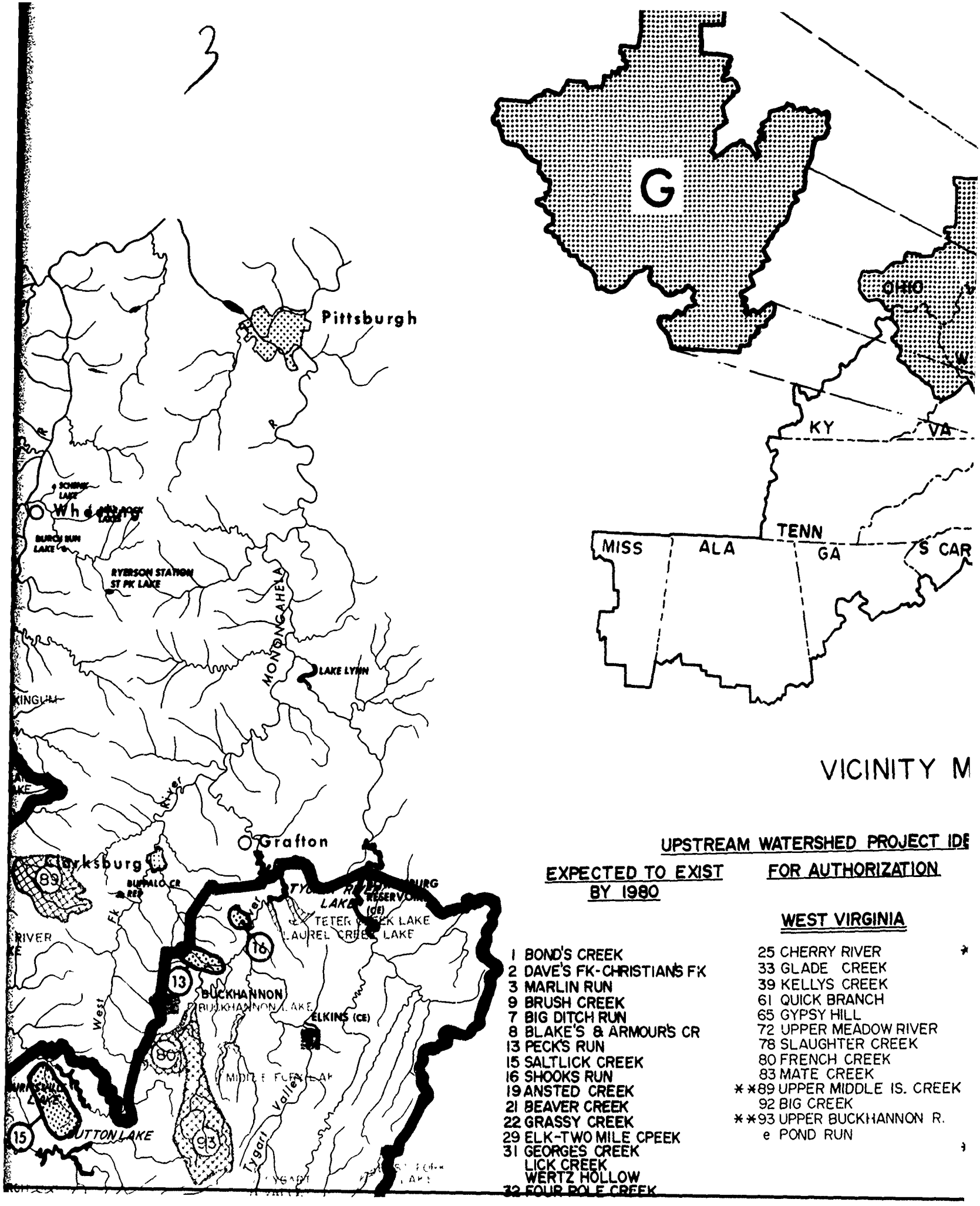
Killbuck
CHARLES MILL RES (CE)
BEACH CITY RES (CE)
DOVER RES (CE)
LAKE
ATWOOD RES (CE)
NEW PHILADELPHIA
TAPPAN RES (CE)
CLENDENING RES (CE)
COSHOCTON
WAKATOMIKA
DILLON RES (CE)
SALT FORK CAMBRIDGE RES
ZANESVILLE
Columbus
BUCKEYE RES
WOLF RUN RES
SCHINE LAKE
BURCH RUN LAKE
RYERSON STATION ST PK LAKE
OHIO
LAKE LOGAN
LOGAN
NELSONVILLE
SALT CREEK RES (CE)
ATHENS
MARIETTA
WILLOW ISLAND
PARKERSBURG
Clarksburg
BUFFALO CR RES
CAIRO (CE)
BELLVILLE
JACKSON
JACKSON LAKE
TYCOON LAKE
RACINE
POINT PLEASANT (CE)
GALLIPOLIS
WEST FORK LAKE
SPENCER
BURNSVILLE LAKE
SUTTON LAKE
BUCKHANNON
West Fk River
WINFIELD

3



VICINITY M

UPSTREAM WATERSHED PROJECT IDE

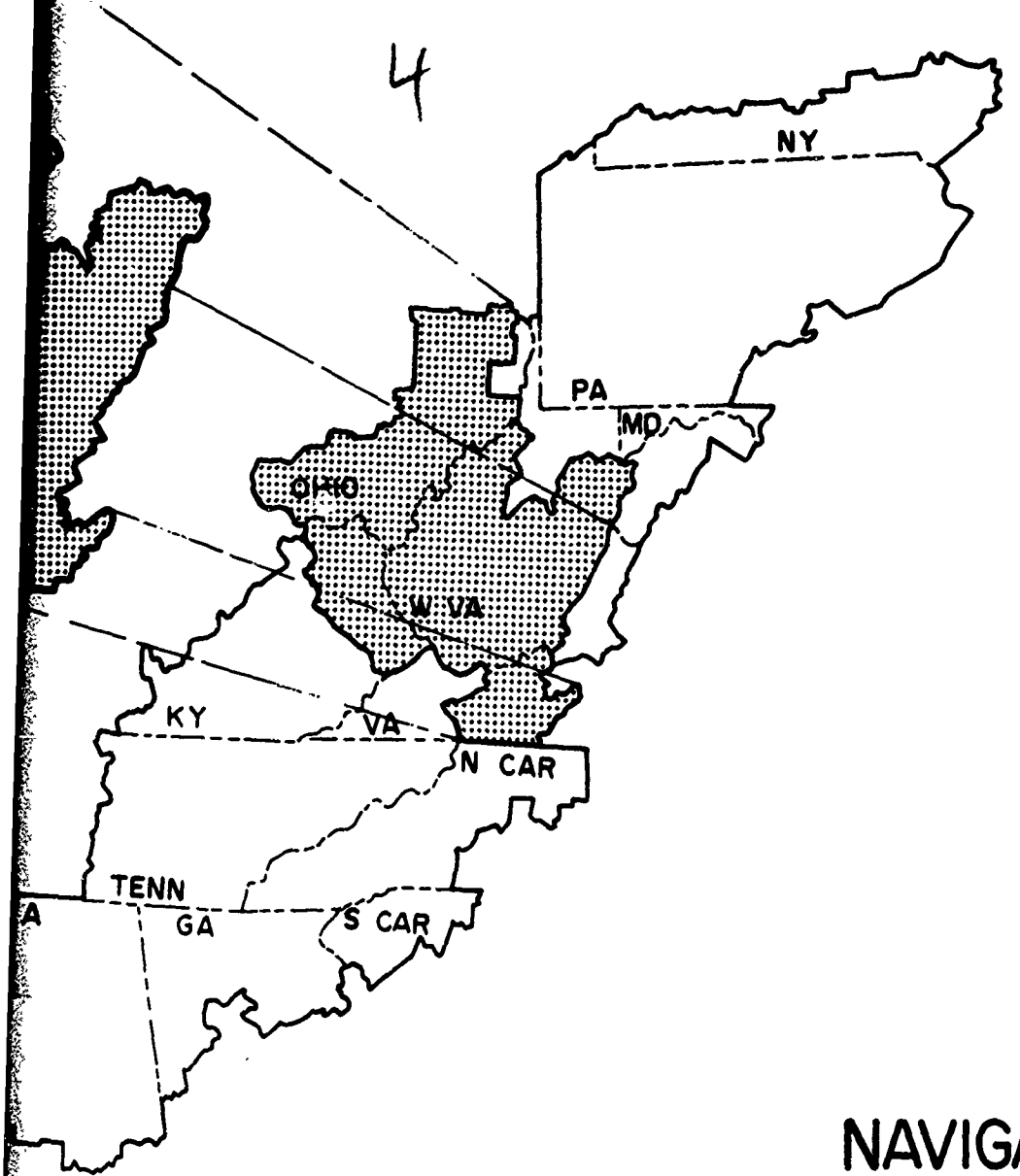
EXPECTED TO EXIST BY 1980

1 BOND'S CREEK
2 DAVE'S FK-CHRISTIANS FK
3 MARLIN RUN
9 BRUSH CREEK
7 BIG DITCH RUN
8 BLAKE'S & ARMOUR'S CR
13 PECK'S RUN
15 SALTLICK CREEK
16 SHOOKS RUN
19 ANSTED CREEK
21 BEAVER CREEK
22 GRASSY CREEK
29 ELK-TWO MILE CPEEK
31 GEORGES CREEK
LICK CREEK
WERTZ HOLLOW
32 FOUR POLE CREEK

FOR AUTHORIZATION

WEST VIRGINIA

25 CHERRY RIVER *
33 GLADE CREEK
39 KELLYS CREEK
61 QUICK BRANCH
65 GYPSY HILL
72 UPPER MEADOW RIVER
78 SLAUGHTER CREEK
80 FRENCH CREEK
83 MATE CREEK
**89 UPPER MIDDLE IS. CREEK
92 BIG CREEK
**93 UPPER BUCKHANNON R.
e POND RUN



VICINITY MAP

STRUCTURAL

NAVIGATION PROJECT

⊢ LOCK AND DAM

UPSTREAM WATERSHE

EXPECTED TO EXIST

FOR AUTHORIZATION

FOR CONTINUING PLANI

MAJOR RESERVOIR

EXPECTED TO EXIST

EAM WATERSHED PROJECT IDENTIFICATION

FOR AUTHORIZATION	FOR CONTINUING PLANNING
WEST VIRGINIA	
25 CHERRY RIVER	*6 UPPER SPRING CREEK
33 GLADE CREEK	
39 KELLYS CREEK	a UPPER MUD RIVER
61 QUICK BRANCH	b MIDDLE FORK MUD RIVER
65 GYPSY HILL	c MIDDLE CREEK
72 UPPER MEADOW RIVER	d UPPER BIRCH RIVER
78 SLAUGHTER CREEK	f UPPER TUG FORK
80 FRENCH CREEK	g LAUREL CREEK
83 MATE CREEK	h MILL CREEK
**89 UPPER MIDDLE IS. CREEK	i UPPER POCATALICO RIVER
92 BIG CREEK	j ROCK BRANCH
**93 UPPER BUCKHANNON R.	k FINNEY BRANCH
e POND RUN	l DAVIS CREEK
	*m LAUREL FORK (BLUESTONE R)

5

/STRUCTURAL/

IGATION PROJECT

⊢ LOCK AND DAM

STREAM WATERSHED PROJECT

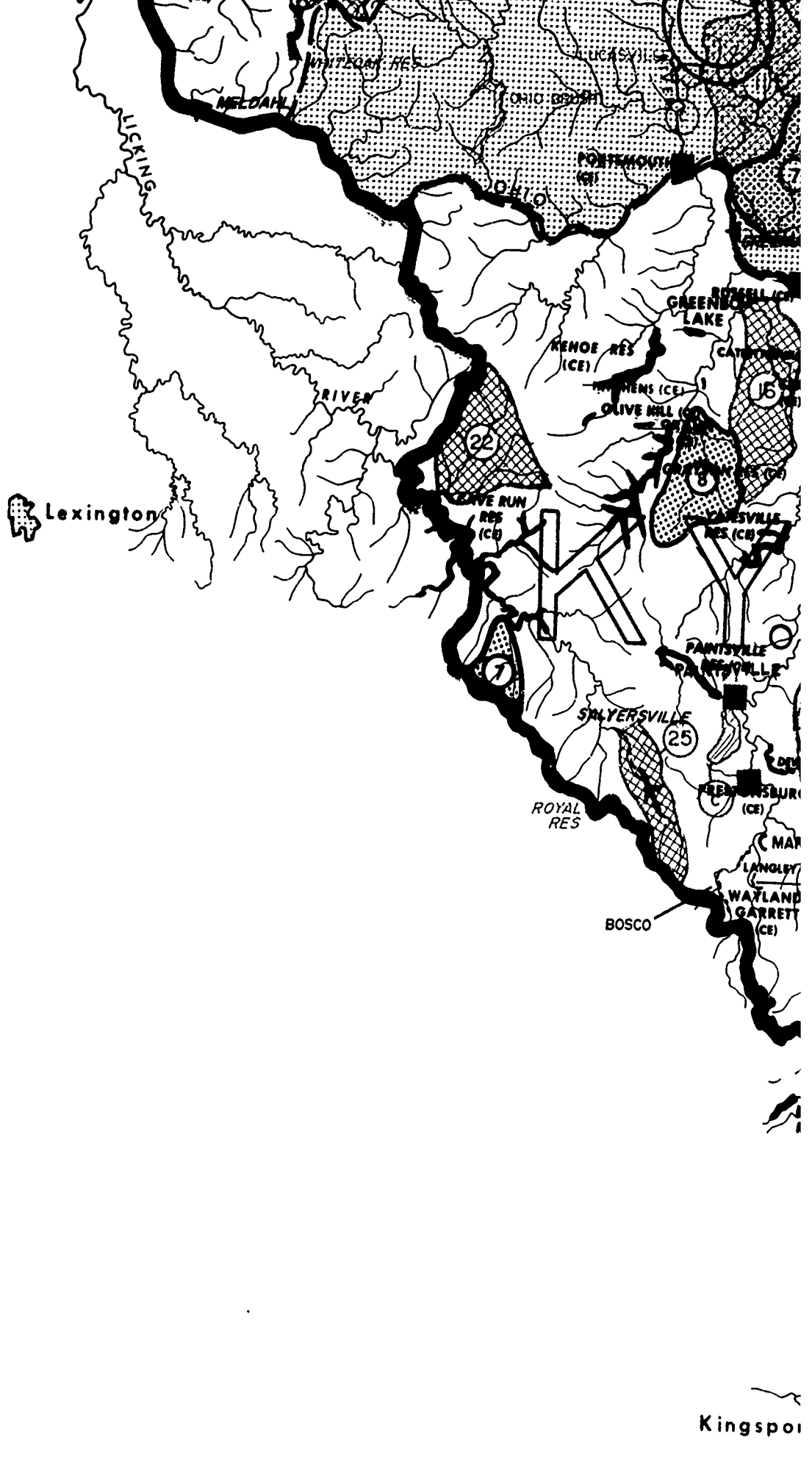
EXPECTED TO EXIST BY 1980 1/

FOR AUTHORIZATION

FOR CONTINUING PLANNING

OR RESERVOIR

EXPECTED TO EXIST BY 1980 1/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RIVER
Lexington
MEL DAHL
OHIO
PORTSMOUTH
GREENUP LAKE
KEHOE RES (CE)
OLIVE HILL
CAVE RUN RES (CB)
PAINTSVILLE
SALYERSVILLE
ROYAL RES
BOSCO
WAYLAND
GARRETT (CE)
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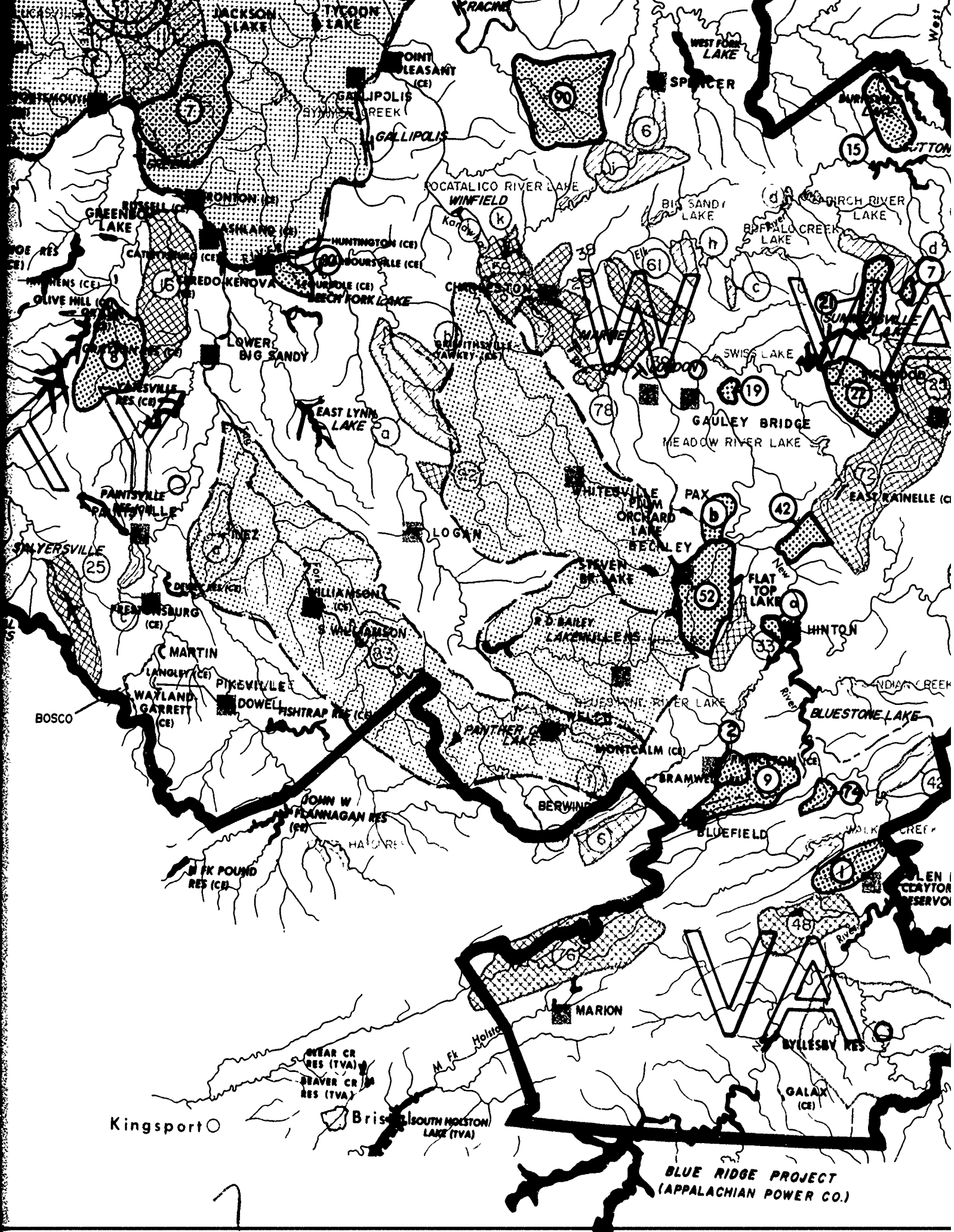
Kingspo


JACKSON LAKE
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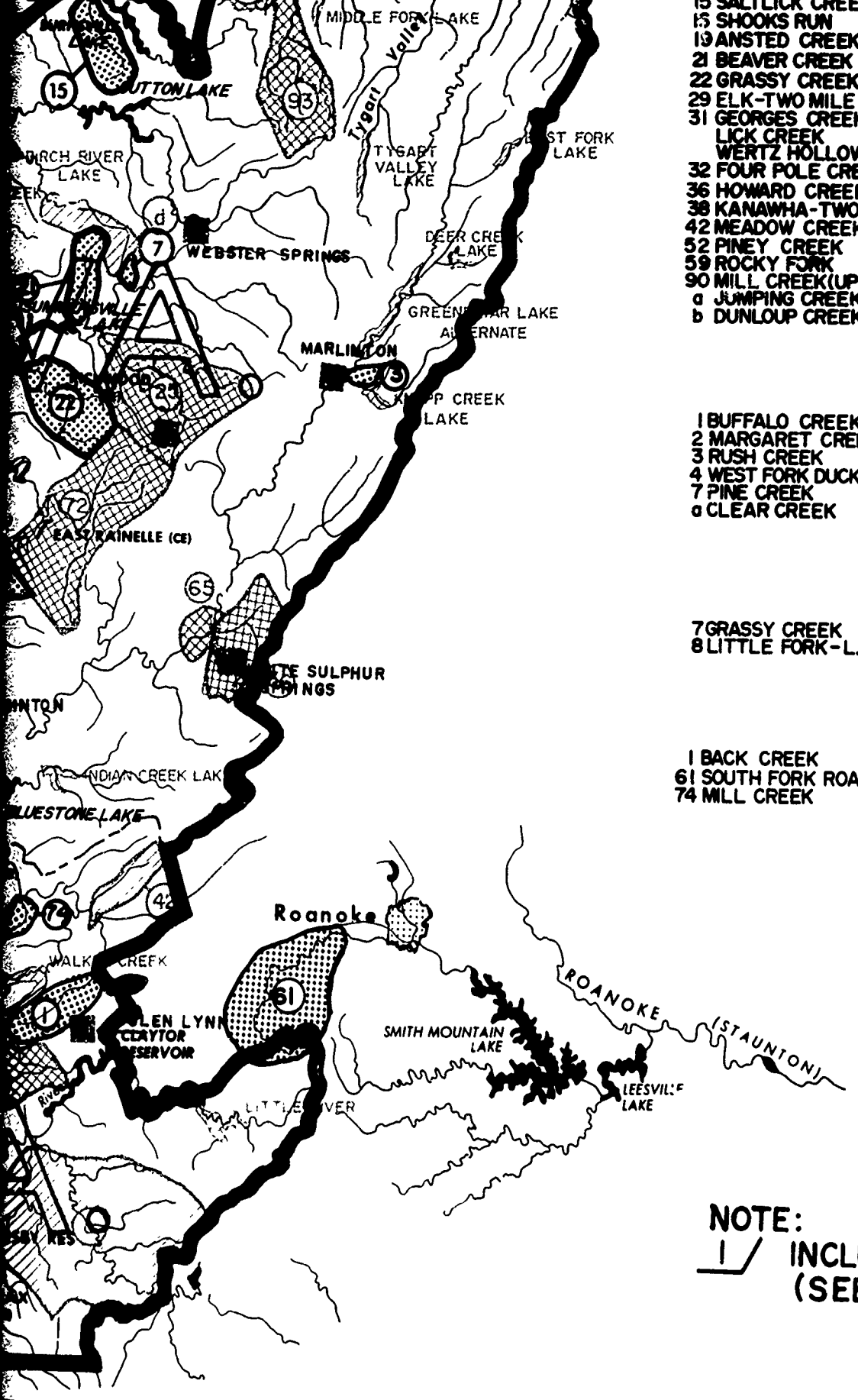
GALLIPOLIS
GALLIPOLIS
RACINE
WEST FORK LAKE
SPENCER
BURNSVILLE LAKE
CUTTONSVILLE
POCATALICO RIVER LAKE
WINFIELD
BIG SANDY LAKE
BIRCH RIVER LAKE
BUFFALO CREEK
RUSSELL (CE)
GREENBO LAKE
ASHLAND (CE)
HUNTINGTON (CE)
CATLETTSBURG (CE)
GREENUP (CE)
ASHLAND (CE)
HUNTINGTON (CE)
SOUR LAKE (CE)
SOURSVILLE (CE)
ATHENS (CE)
OLIVE HILL (CE)
GRAYSON RES (CE)
LAKESVILLE RES (CE)
LOWER BIG SANDY
BEECH FORK LAKE
CHARLESTON
SUMMERSVILLE LAKE
SUMMERSVILLE
SWISS LAKE
GAULEY BRIDGE
MEADOW RIVER LAKE
EAST LYNN LAKE
WHITESVILLE
PLUM ORCHARD LAKE
BECKLEY
PAX
EAST RAINELLE (CE)
PAINTSVILLE
PAINTSVILLE
LOGAN
STEVEN BR. LAKE
SALYERSVILLE
PREZ
DEWEY RES (CE)
WILLIAMSON (CE)
FREDERICKSBURG (CE)
S. WILLIAMSON
R.D. BAILEY LAKE
MILLERS
FLAT TOP LAKE
HINTON
MARTIN
LANGLEY (CE)
PIKEVILLE
WAYLAND GARRETT (CE)
DOWELL
FISHTRAP RES (CE)
BOSCO
PANTHER CREEK LAKE
MONTCALM (CE)
BRAMWELL
BLUESTONE LAKE
BERWIND
JOHN W FLANNAGAN RES (CE)
BLUEFIELD
N FK POUND RES (CE)
MARION
HOLSTON
M Fk
BYLLESBY RES
GALAX (CE)
SHEAR CR RES (TVA)
BEAVER CR RES (TVA)
Kingsport
SOUTH HOLSTON LAKE (TVA)
BLUE RIDGE PROJECT
(APPALACHIAN POWER CO.)



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15 SHOOKS RUN
19 ANSTED CREEK
21 BEAVER CREEK
22 GRASSY CREEK
29 ELK-TWO MILE CREEK
31 GEORGES CREEK
LICK CREEK
WERTZ HOLLOW
32 FOUR POLE CREEK
36 HOWARD CREEK
38 KANAWHA-TWO MILE CREEK
42 MEADOW CREEK
52 PINEY CREEK
59 ROCKY FORK
90 MILL CREEK(UPPER)
a JUMPING CREEK
b DUNLOUP CREEK

80 FRENCH CREEK
83 MATE CREEK
**89 UPPER MIDDLE IS.
92 BIG CREEK
**93 UPPER BUCKHANNO
e POND RUN

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2 MARGARET CREEK
3 RUSH CREEK
4 WEST FORK DUCK CREEK
7 PINE CREEK
a CLEAR CREEK

** 9 FEDERAL VALLEY C
**10 LITTLE SALT CREEK
11 LITTLE SCIOTO RIVE
12 MOXAHALA-JONATH
13 O'BANNON CREEK
*14 UPPER WHITEOAK C
15 WAKATOMIKA CREE
16 WOLF CREEK

KENTUCKY

7 GRASSY CREEK
8 LITTLE FORK-L. SANDY RIVER

18 EAST FORK-LITTLE
*22 TRIPLETT CREEK
25 UPPE. LICKING RIV

VIRGINIA

1 BACK CREEK
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74 MILL CREEK

48 PEAK CREEK
*76 HEADWATERS-HOLS
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11 LITTLE SCIOTO RIVER
12 MOXAHALA-JONATHAN CR.
13 O'BANNON CREEK
14 UPPER WHITEOAK CREEK
15 WAKATOMIKA CREEK
16 WOLF CREEK

*a SUGAR CREEK
*b SUNDAY CREEK
*c MILLER RUN
d LEADING CREEK

LOCAL PROTECTION PRO

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22 TRIPLETT CREEK
25 UPPER LICKING RIVER

a ROCKCASTLE CREEK
c PAINT CREEK

VIRGINIA

8 PEAK CREEK
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FIGURE 14-37

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DEVELOPMENT
OF
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IN
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MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 15 - WATER SUB-REGION H TODAY

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CHAPTER 15 - WATER SUB-REGION H TODAY

SECTION I - THE REGION TODAY

1. POLITICAL

Water Sub-region H (see Figure 15-1), located completely in the eastern section of Kentucky, is composed of 18 counties. These are Bath, Breathitt, Clark, Estill, Fleming, Garrard, Knott, Lee, Leslie, Letcher, Lincoln, Madison, Menifee, Montgomery, Owsley, Perry, Powell, and Wolfe. The largest towns (1960 population) include Richmond (12,168), Winchester (10,187), Hazard (5,958), Mt. Sterling (5,370), Berea (4,302), and Jackson (1,852).

Kentucky has designated multi-county development districts, to which Appalachian State Planning Sub-regions (SPSR) have been adapted. Water Sub-region H encompasses State Planning Sub-region 32A (Middle Kentucky River Development Area); 32B (Upper Kentucky River Development Area); 35A (Foothills Development Area); Garrard and Lincoln Counties in 35B; Bath, Menifee, and Montogomery Counties in 36A (Gateway Development Area); and Fleming County in 36B (Buffallo Trace Development Area). (See Figure 15-14 on Page 15-43 in Section II of this Chapter.)

Additionally, Kentucky has established an Area Development Office responsible for the design, planning, and coordination of development programs. Economic problems and constraints are, in order of priority: access; labor force education and training; health; physical problems, including flood and pollution control; urbanization; housing; and resource conservation and development. A strategy for growth has been developed for each of the multi-county development areas by the Commonwealth.

Seventeen of the 18 Appalachian counties in Water Sub-region H are in Economic Sub-region 13 - one of the economic sub-regions delimited by the Office of Business Economics (OBE), U.S. Department of Commerce (see Figure 15-14). Fleming County is in Economic Sub-region 9.

The eight counties in State Planning Sub-regions 32A and 32B are in the 60-county Central Appalachian Region, which contains portions of Kentucky, Tennessee, Virginia, and West Virginia. This region is receiving special planning emphasis, by the states and the Appalachian Regional Commission, with the objective of improving economic and social conditions to assist regional development of a self-sustaining economy.

Water Sub-region H is located mostly in the Louisville District, Ohio River Division, U.S. Army Corps of Engineers. The area planning structure includes 18 Soil Conservation Districts, seven Conservancy Districts, three Local Development Districts, and one Industrial Development Area.

2. PHYSICAL

Physiography and Geology

Most of Water Sub-region H is in the Appalachian Plateaus Physiographic Province; the western part is in the Interior Low Plateaus Physiographic Province (see Figure 15-2). The sub-region is underlain by rock ranging in age from Ordovician to Pennsylvanian. Generally, the rock is massive, flat-lying limestone, sandstones, and shales.

The total surface area of the water sub-region is 3,419,600 acres (5,343 square miles) with less than 0.5 percent covered with water. The present land-use acreage is: forest and woodland 2,022,600 acres; pasture 594,000; cropland 543,100; and other land 259,900 acres.

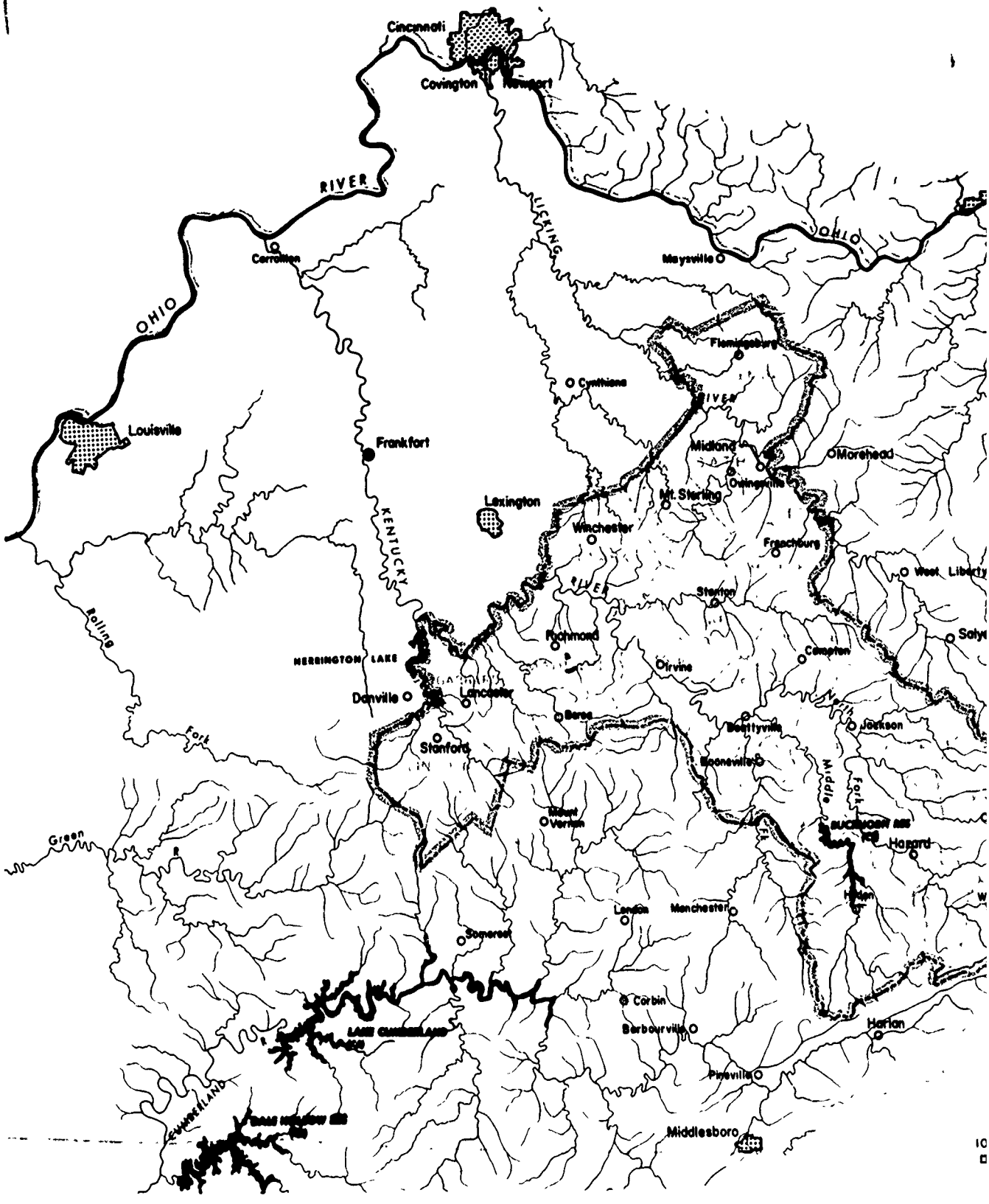
The Kentucky River and its tributaries drain the major portion of the water sub-region. The Licking River and headwaters of Cumberland, Green, and Big Sandy River Systems drain certain portions of the area. Ground water occurs in openings associated with major bedrock faults in the western portion of the area. Fractures of intergranular pore space in the sandstone and shale contain ground water in the eastern portion of the water sub-region. Large dependable supplies of ground water for municipal and industrial use are lacking in most of the water sub-region.

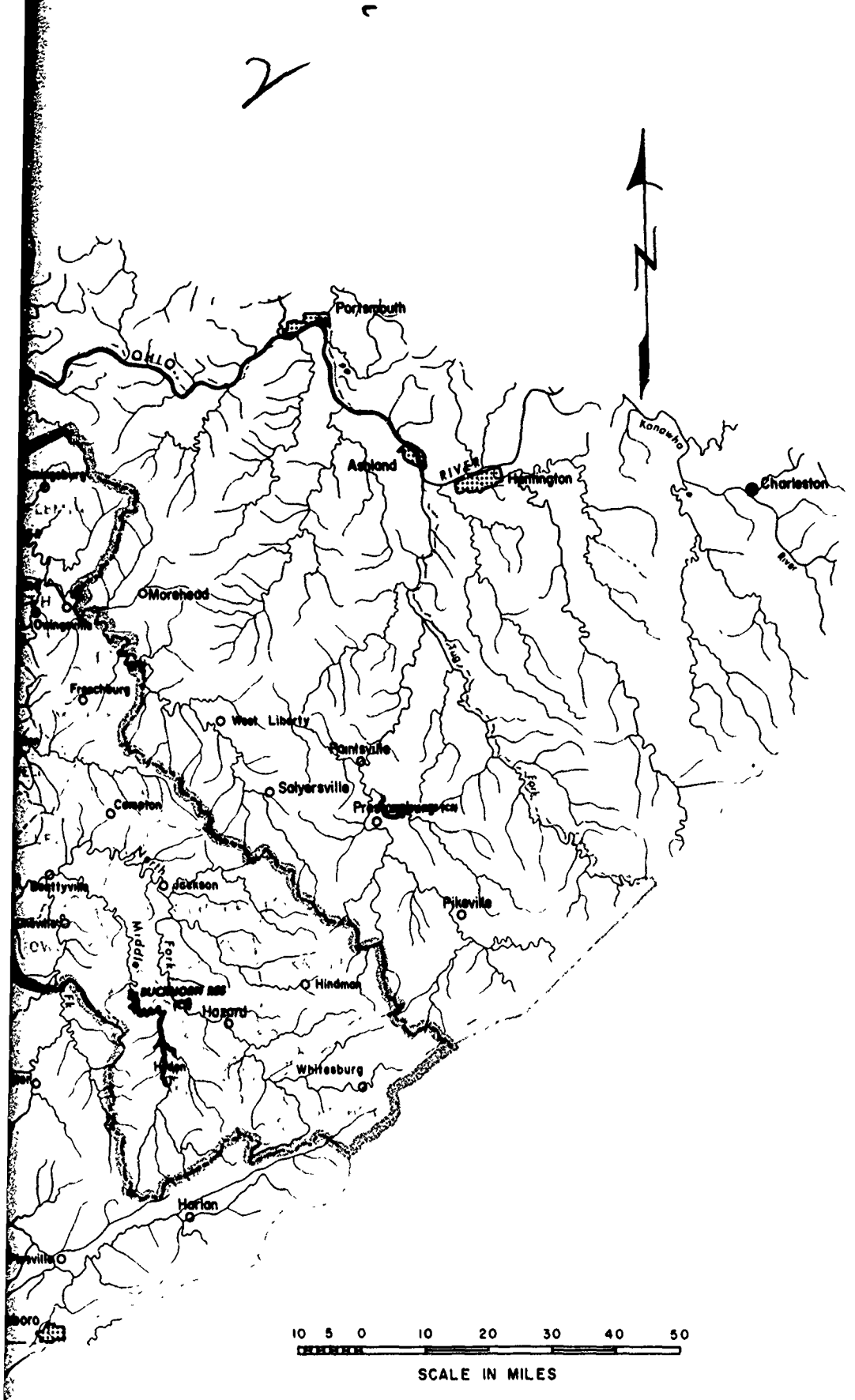
Climate

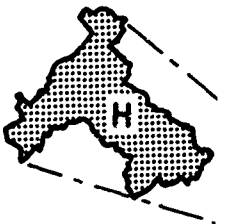
The climate is characterized by seasonal changes, frequent temperature changes, much rainfall, high humidity and moderate cloudiness and windiness. The annual mean temperature is approximately 56 degrees Fahrenheit, with extremes of -22 degrees and 100 degrees. Average annual precipitation is about 45 inches; average annual snowfall, 17 inches. Precipitation data for selected stations are shown in Figure 15-3 on Page 15-7.

Runoff

Sub-region H runoff is primarily conveyed to the Ohio River by two major river systems, the Kentucky and Licking Rivers. Except for Menifee, Bath and Fleming Counties, which border the Licking River, the sub-region lies almost entirely in the Kentucky River Basin. Small portions of several other counties in the sub-region are drained by the Cumberland, Green, and Big Sandy River Systems. The streams have poor low flow characteristics; many experience no flow in dry seasons. Winter and spring months produce the highest runoff, while the lowest runoff occurs during late summer and fall. Using the gaging station on the North Fork of the Kentucky River at Jackson, Kentucky, as representative of the sub-region, the information in Table 15-1 (see Page 15-7) was compiled.


Cincinnati
Covington
Newport
RIVER
OHIO
LICKING
OHIO
Carrollton
Maysville
Louisville
Frankfort
Cynthiana
Flemingsburg
RIVER
Midland
Morehead
Owingsville
Mt. Sterling
Lexington
Winchester
Frenchburg
KENTUCKY
RIVER
Stanton
West Liberty
Rolling
Fork
NEBBINGTON LAKE
Richmond
Irvine
Compton
Danville
Lancaster
Berea
Stanford
Beattyville
Jackson
Booneville
Middle
Fork
Robert
Vernon
Hazard
Green
London
Manchester
Somerset
Corbin
Barbourville
Harlan
Pineville
Middlesboro





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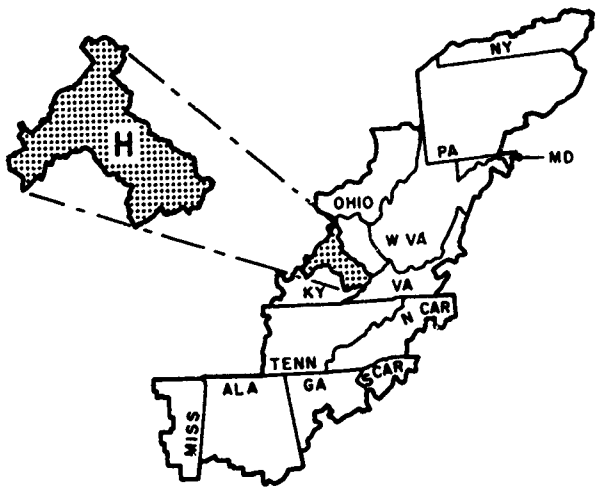


VICINITY MAP

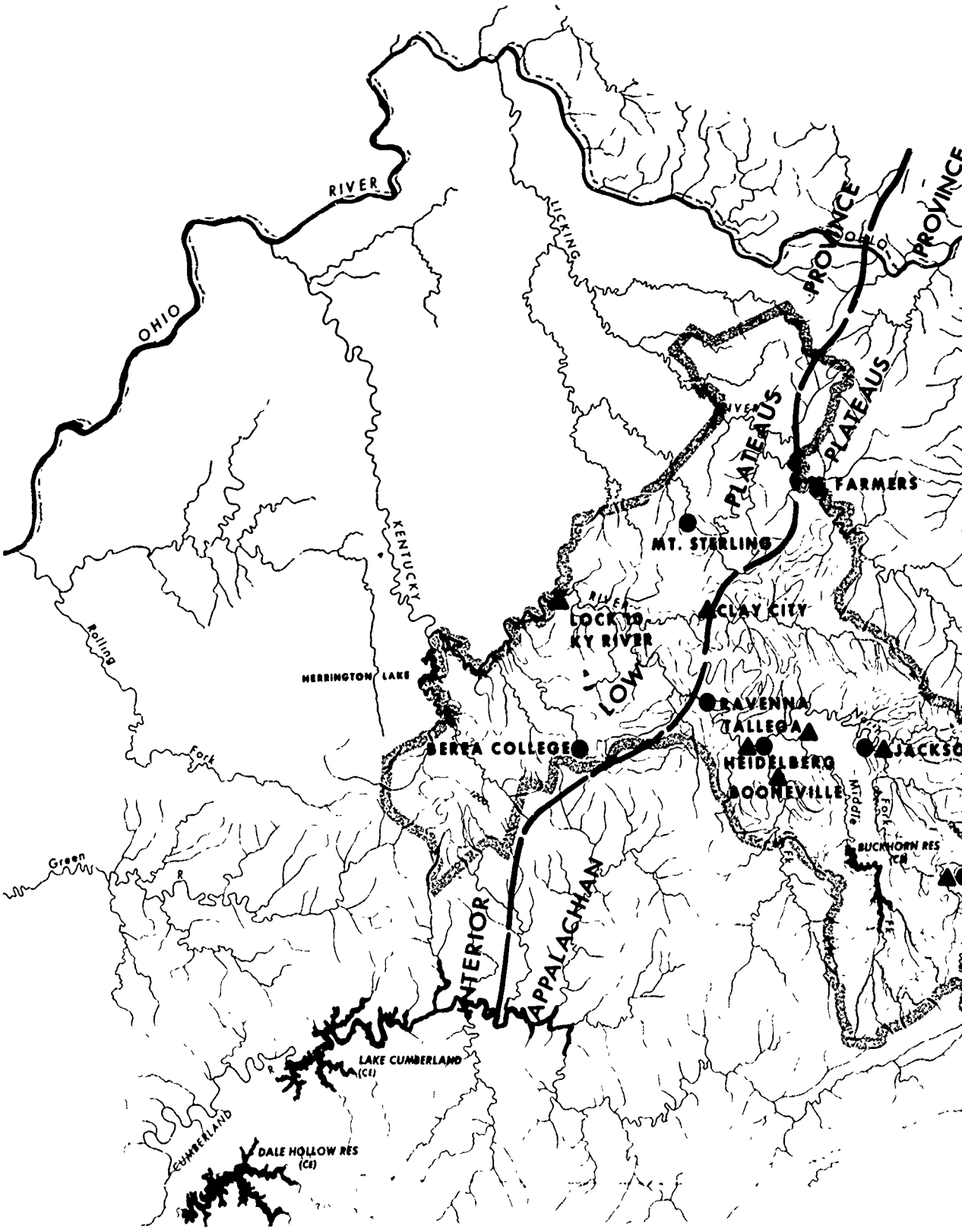
REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

LOCATION MAP

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-3 **FIGURE 15-1**


OHIO
RIVER
LICKING
KENTUCKY
RIVER
Rolling
Fork
Green
R.
PROVINCE
PROVINCE
PLATEAUS
PLATEAUS
FARMERS
MT. STERLING
CLAY CITY
LOCK 10
KY RIVER
HERRINGTON LAKE
LOW
RAVENNA
TALLEGA
BEREA COLLEGE
HEIDELBERG
JACKSO
BOONEVILLE
BUCKHORN RES
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INTERIOR
APPALACHIAN
LAKE CUMBERLAND
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DALE HOLLOW RES
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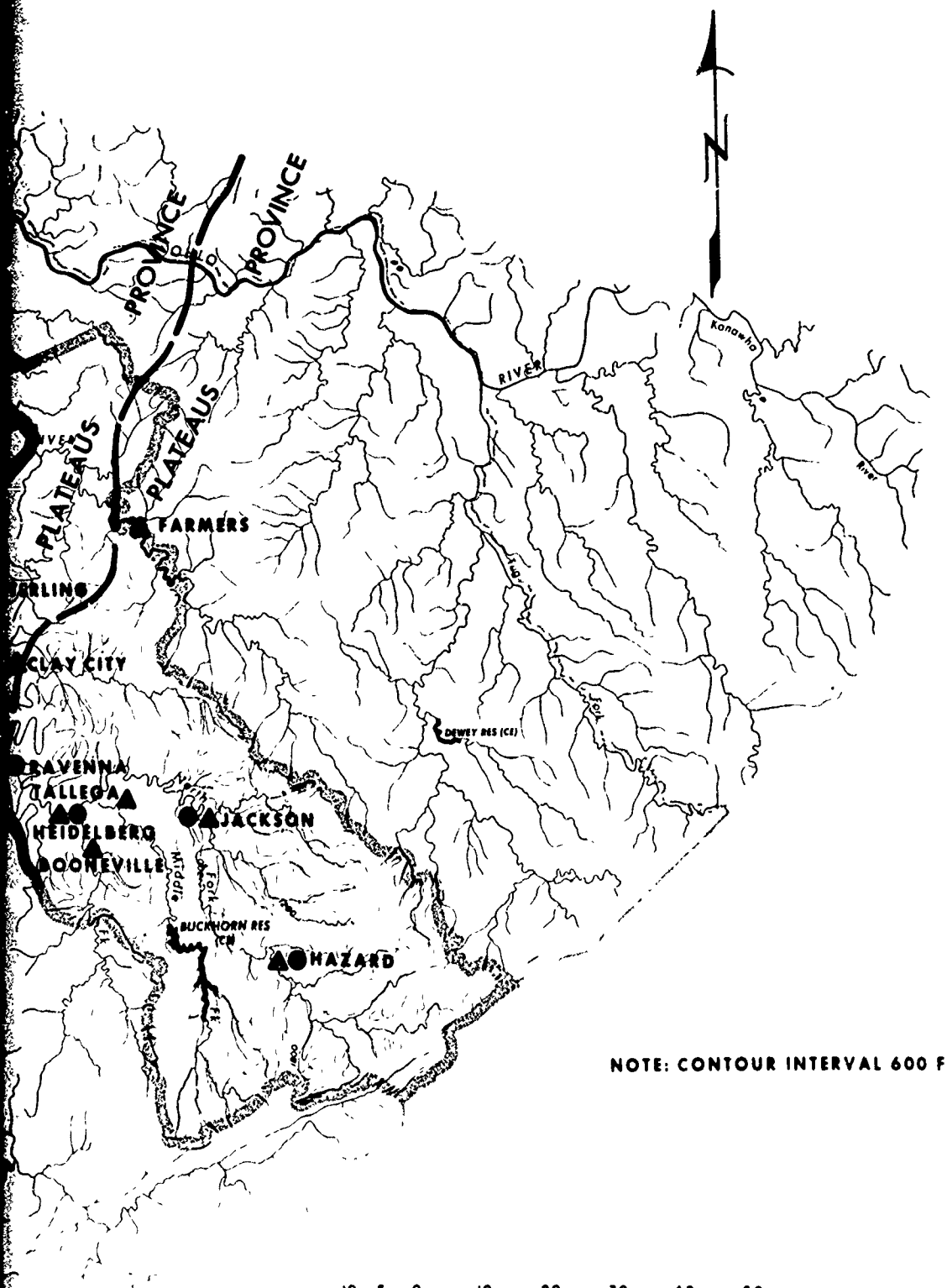

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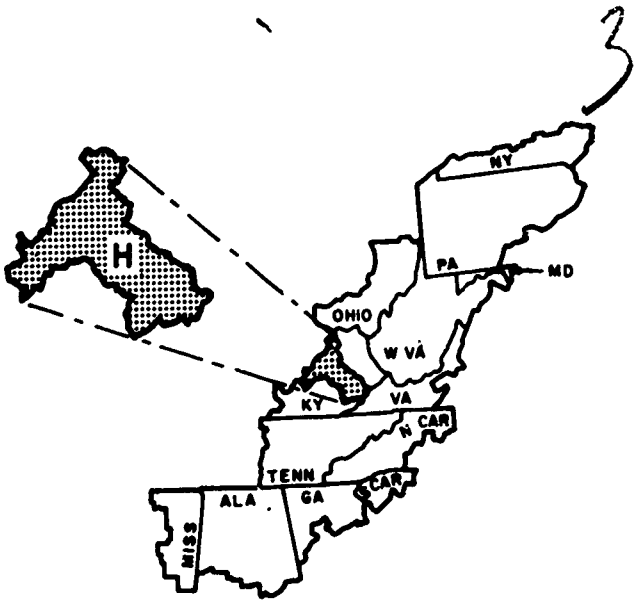

VICINITY MAP

LEGEND

● PRECIPITATION STATIONS

▲ STREAM GAGING STATIONS

——— PHYSIOGRAPHIC BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

PHYSICAL FEATURES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-5 FIGURE 15-2

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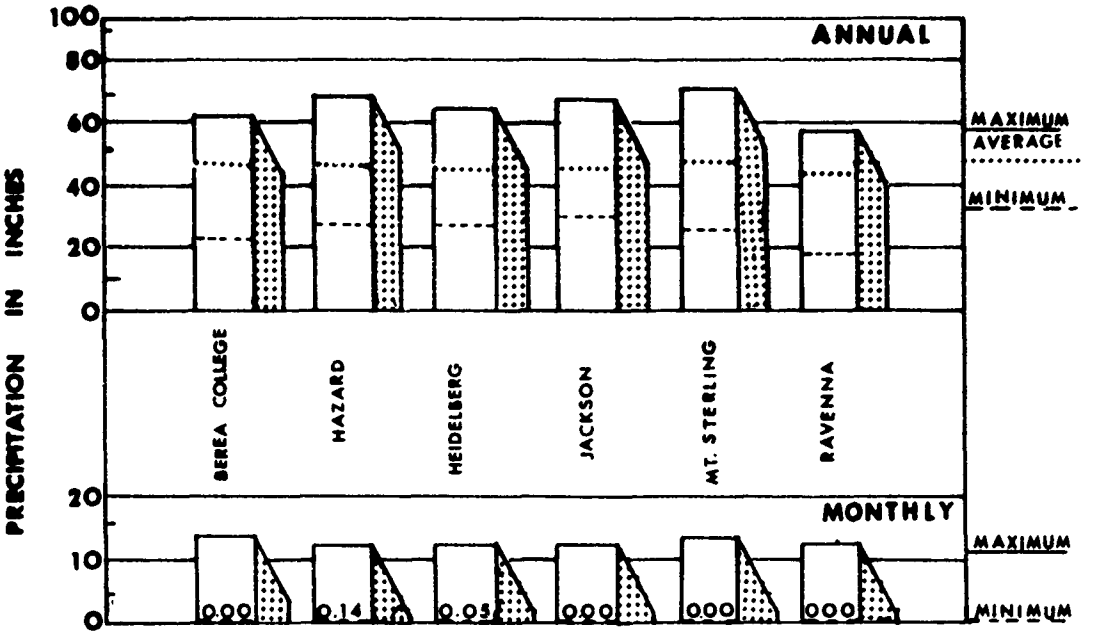


Figure 15-3. Average Precipitation at Selected Stations, Water Sub-region H.

TABLE 15-1
STREAM GAGE DATA
JACKSON, KY.

Miles above Mouth	Drainage Area (Sq. Mi.)	Period of Runoff	Discharge (cfs) Maximum	Minimum	Mean
49.8	1,101	1905-1907 1917-1921 1927-1931 1938-1965	53,500	0	1,283

RUNOFF DATA (Inches)

Month	Maximum	Minimum	Mean
October	1.11	.01	.16
November	1.51	.02	.60
December	4.47	.08	1.30
January	5.60	.18	2.40
February	6.48	.19	2.83
March	10.72	1.22	3.49
April	4.95	.43	2.22
May	4.42	.20	1.19
June	2.07	.15	.61
July	3.20	.02	.67
August	2.38	.02	.45
September	1.26	.01	.20
Annual	23.9	5.4	16.12

Floods have occurred in every month of the year. Floods in summer and fall ordinarily have less areal coverage than those in winter and spring. Flooding, on the three forks of the Kentucky River and their tributaries, is of the flash-flood type with rapid rise and fall of flood waters. These streams seldom stay above flood stage longer than one or two days. Flow is slower on the main stem of the Kentucky and Licking Rivers with resultant prolonged flood stages. No one flood produced the highest known stages throughout the sub-region; however, the January 1957 flood had the highest discharge on record for gages on the three forks of the Kentucky River.

Droughts have occurred in the water sub-region for extended periods of time. Using the Jackson gage as again representative of the sub-region, the information for Table 15-2 was compiled.

TABLE 15-2
ANNUAL RUNOFF AT JACKSON GAGE

Period	Years	Yearly Runoff	Percent of Mean Runoff (16.12)
1930	1	6.65	41
1931	1	10.86*	67
1940	1	8.32	52
1941	1	5.41	34
1953	1	12.08	75
1954	1	8.08	50
1930-31	2	8.76	54
1940-41	2	6.87	43
1953-54	2	10.08	63

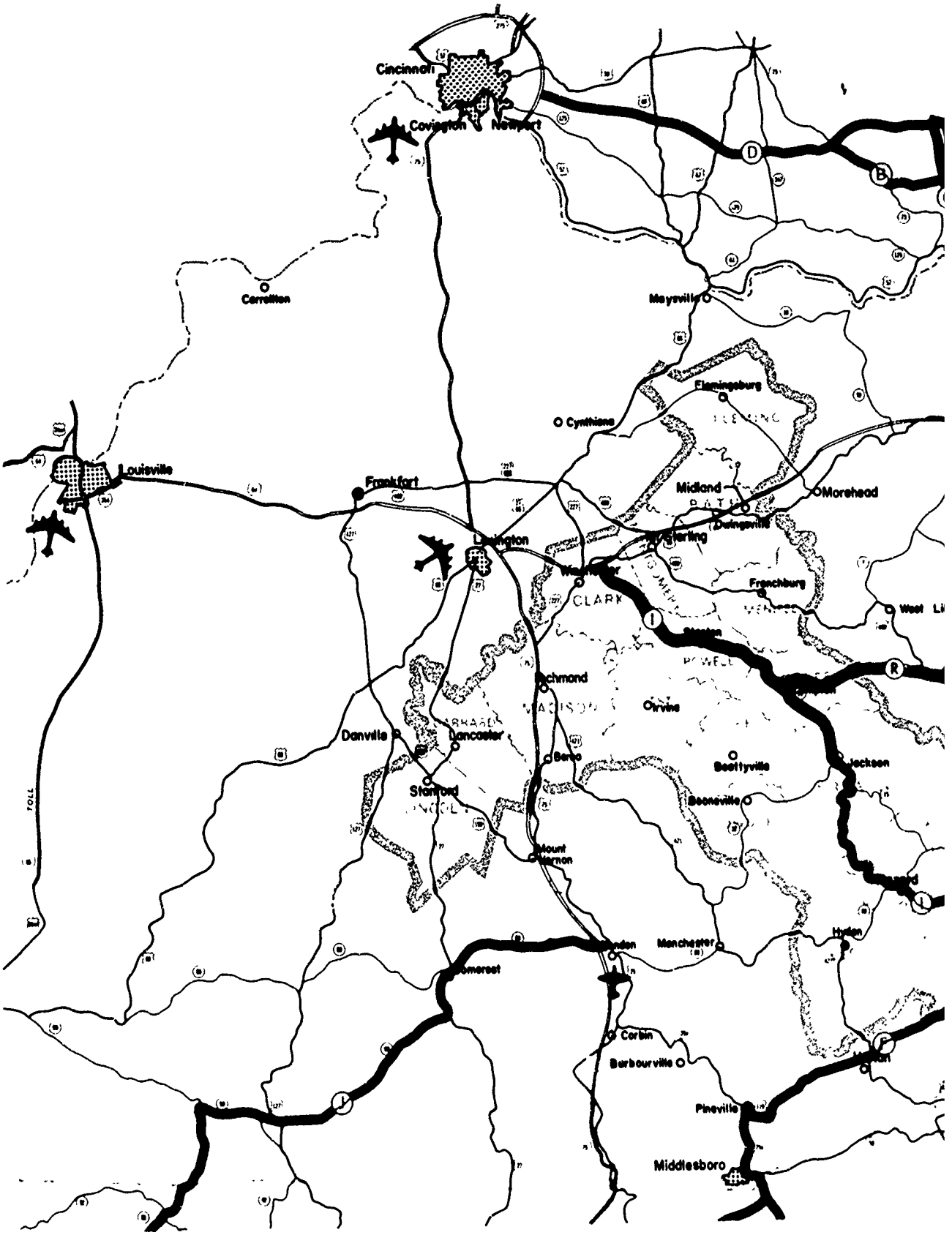
* In 1931, 7.91 inches of runoff were recorded in the first nine months with no record available for October through December at Jackson. However, 2.95 inches of runoff were recorded at Lock 10 on the Kentucky River near Winchester, and can be considered typical for the sub-region for October-December 1931. Therefore a total runoff of 10.86 inches occurred at Jackson during 1931.

The data indicates that at least three drought periods have occurred, each lasting two years. The worst drought occurred in 1940-41, when the runoff averaged less than half of the mean runoff.

Transportation

Inadequate roads and highways have retarded development in Water Sub-region H; however, concentrated federal and state efforts have begun to alleviate this constraint.

The planned Interstate and Development Highways serving Sub-region H are shown in Figure 15-4. These highways are the essential framework


Cincinnati
Covington
Newport
Carrollton
Maysville
Flemingsburg
Cynthiana
Louisville
Frankfort
Midland
Morehead
Lexington
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Winchester
Franchburg
CLARK
Richmond
Irvine
Danville
Lancaster
Berea
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Stanford
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Barbourville
Pineville
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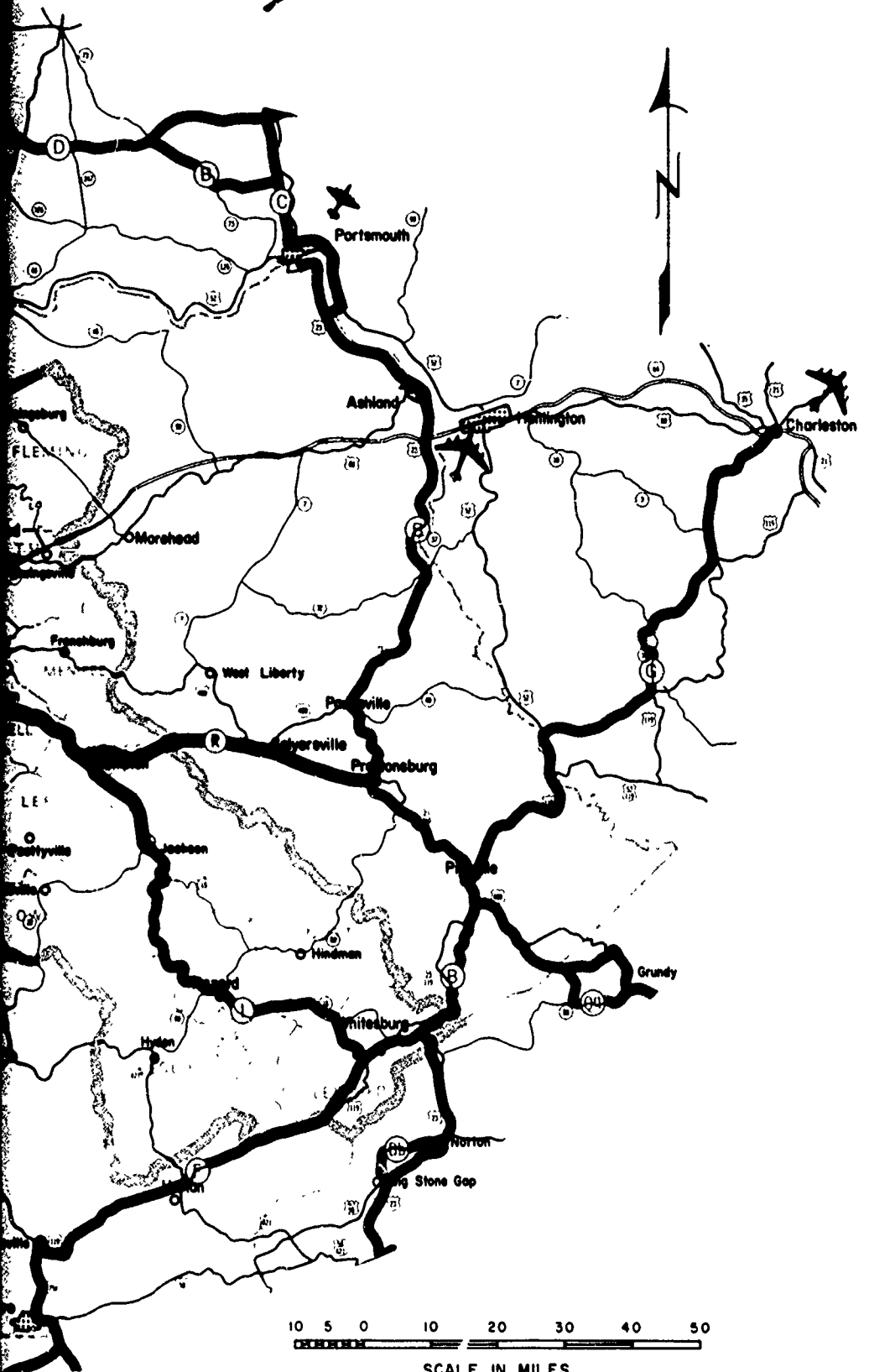

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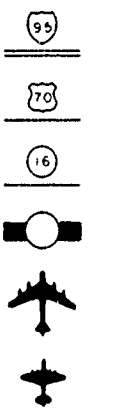

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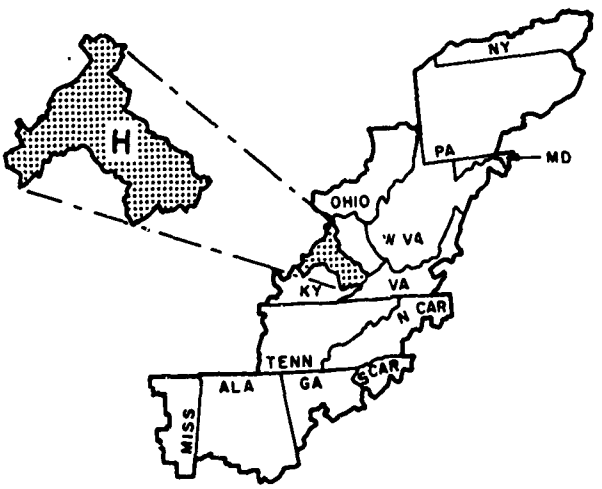

VICINITY MAP

LEGEND

Interstate Highway

Federal Highway

State Highway

Appalachian Corridor

Includes Jet Service

Scheduled Prop Service

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

HIGHWAYS & AIRPORTS

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-9 **FIGURE 15-4**

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for the highway program necessary to support economic development objectives within Sub-region H. Interstate Highways 75 and 64, Corridors I and R (which both include the completed Mountain Parkway) and parts of Corridors Q and B provide necessary interstate and interregional access to this region.

The Commonwealth of Kentucky, in recognition of the primary need to break down Appalachian Kentucky's historical isolation and capitalize on tourism and recreational potential, is planning vigorously for major supplementation of this basic system; upgrading of the secondary road system; and provision of additional access roads.

The Kentucky Water Supplement, Part V Chapter 3 includes discussion of these improvements. Briefly, the major plans for these improvements which would serve Water Sub-region H include:

A state sponsored authorized toll road from London to Hazard with completion of the section of Highway 80 from Garrett to Hindman, thus providing the east-west linkage between Corridors J and Q;

A north-south (Ohio River to Booneville Reservoir) linkage from Maysville to Manchester; and

An east-west linkage from Richmond to Jackson (I-75 to Corridor I).

With these additions the Highway and Road System of Water Sub-region H should prove adequate for substantial growth, and will be a key factor in the strategy for the sub-region.

General aviation airports exist at Winchester, Mt. Sterling, Berea-Richmond, Stanton, Whitesburg, and Hazard, but there are no scheduled airlines operating in the sub-region. Scheduled air service is provided to cities adjacent to the sub-region, such as Lexington and London, Kentucky and Huntington (Tri-State Airport), West Virginia (see Figure 15-4).

Railraod networks generally cover the sub-region (See Figure 15-5). The Louisville and Nashville Railroad is the predominate rail carrier with a major transfer point at Winchester. Also, the northern portion of the sub-region is traversed by the Chesapeake and Ohio Railroad's main line through Ashland to Louisville, Kentucky. Rail terminal facilities are available at Winchester and scattered points throughout the water sub-region.

The Kentucky River is navigable from its mouth upstream to the vicinity of Beattyville (Lee County), Kentucky, in the central portion of the water sub-region (see Figure 15-5). In recent years, commercial navigation has declined considerably. At the present time the locks and dams within the sub-region are mostly used by recreational boating interests. Figure 15-6 shows the location of the locks and dams.

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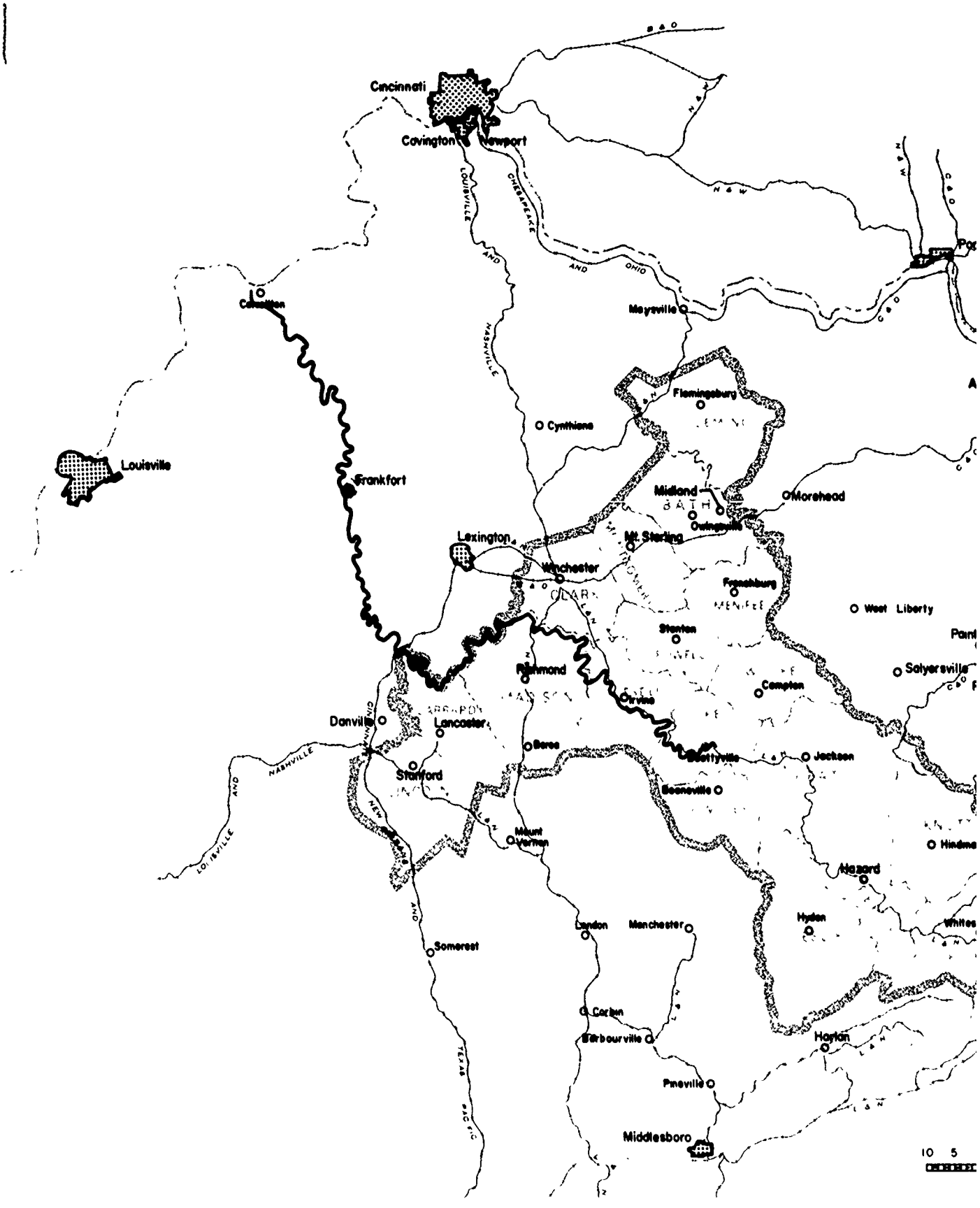

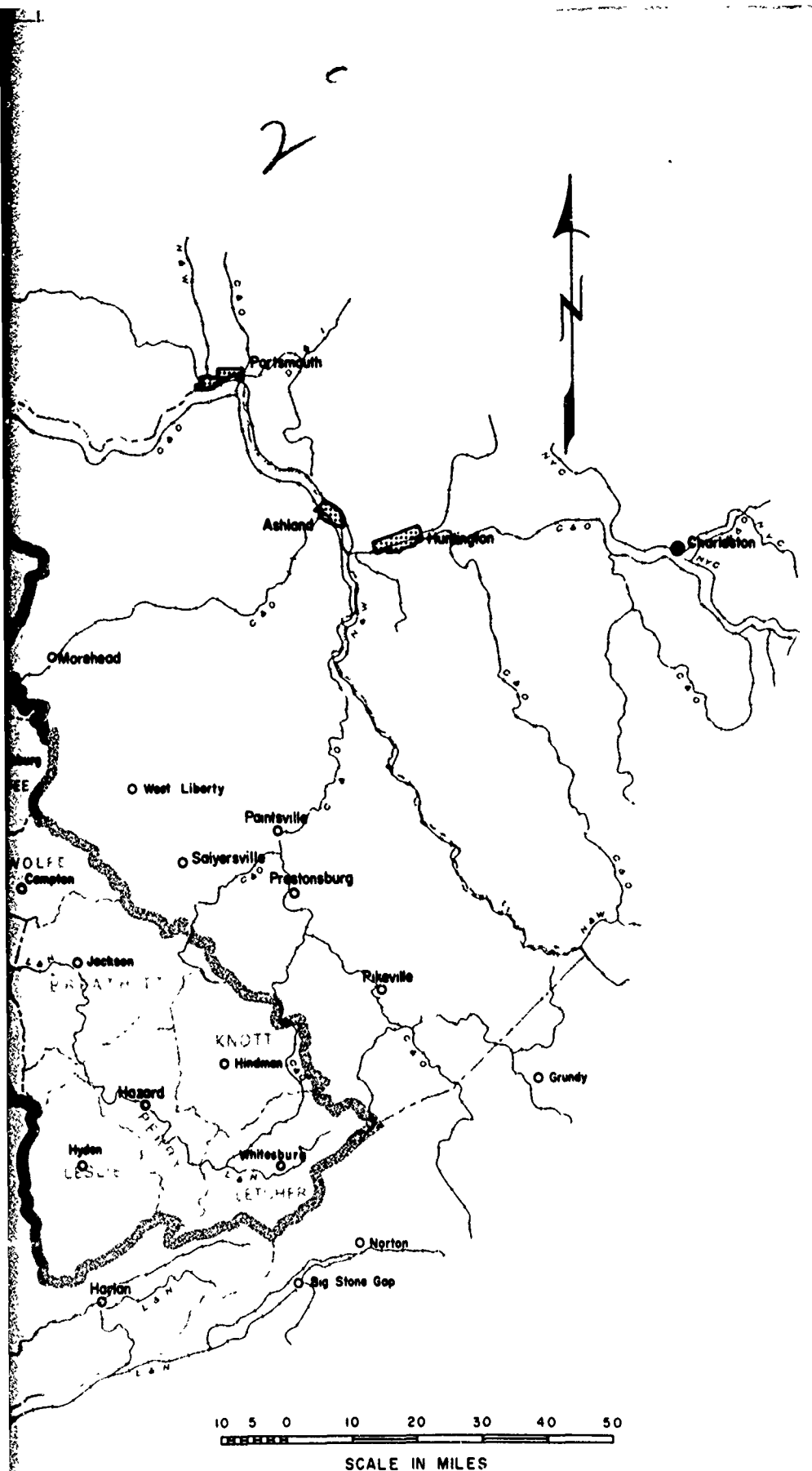

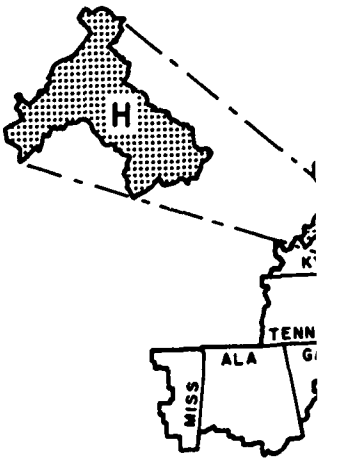

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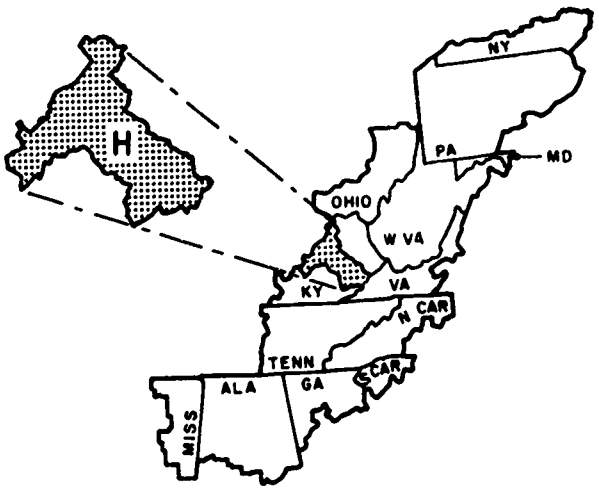

VICINITY MAP

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REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

RAILROADS & NAVIGATION

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-13 **FIGURE 15-5**

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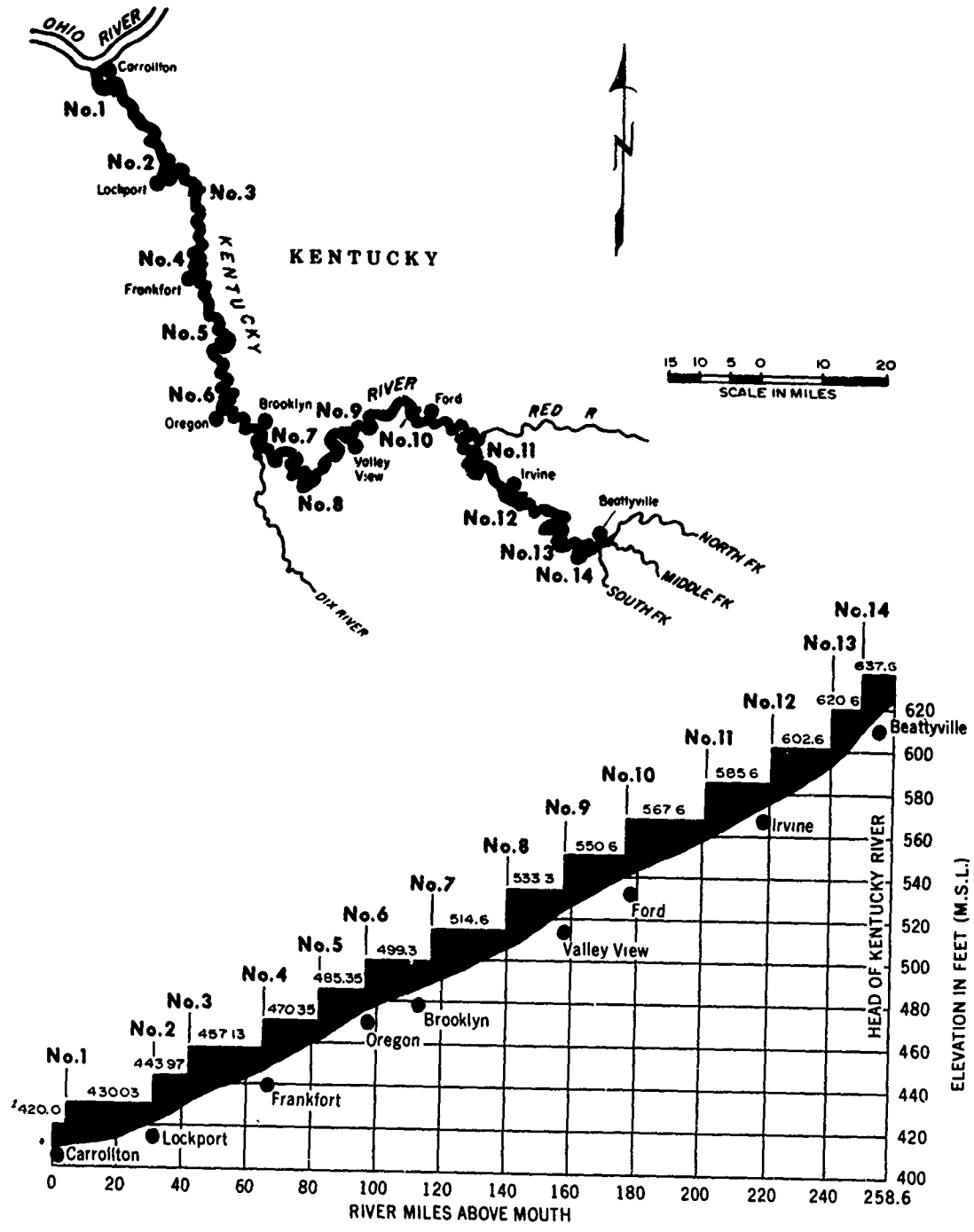

[1] Pool above McAlpine Dam, Ohio River.

REPORT FOR
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IN
APPALACHIA

WATER SUB-REGION H

KENTUCKY RIVER NAVIGATION SYSTEM
GENERAL PLAN AND PROFILE

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-15 **FIGURE 15-6**

3. RESOURCES DEVELOPMENT

Human

In 1960, Water Sub-region H had a population of approximately 266,000; about evenly divided between males and females. This represented a decrease in the total population of over 13 percent from 1950. Comparatively, the nations population increased 19 percent during the 1950-1960 period. Only 17 percent of the 1960 regional population were urban dwellers; whereas, the 1960 national population was nearly 70 percent urban. As shown in Figure 15-7, the majority of the region's rural population is non-farm.

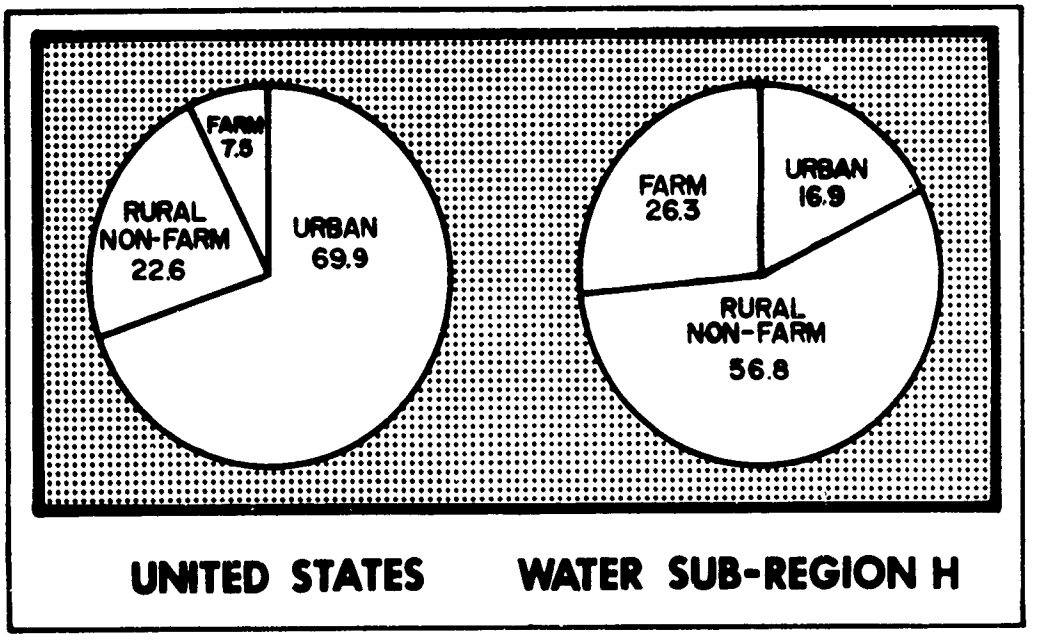

Figure 15-7. Distribution of Urban, Rural Non-Farm and Farm Population in Sub-region H Compared to the United States, 1960.

High out-migration rates and mass unemployment have been common for several decades. Income levels and educational attainment are substantially below national averages. New industrial development has not replaced the once-dominant coal industry, resulting in a lack of available work opportunities. No significant industrial or agricultural base has evolved. Urban areas have similarly failed to develop, and the majority of people remain in isolated rural areas.

Of all counties in the water sub-region, only Clark, Madison, and Montgomery Counties registered population gains from 1950-1960.

Declines as large as 29.6 percent (Leslie County) occurred and all counties recorded net rates of out-migration during the period. These range from 60.8 percent in Leslie and 46.9 percent in Perry to 4.3 percent in Clark. Several counties have reduced out-migration significantly, according to 1965 estimates, but population gains occurred in only six of the counties during the 1960-65 period.

As shown in Figure 15-8, the water sub-region has a larger percentage of its total population in its younger age groups than has the United States. Thus, the water sub-region has relatively more youngsters requiring educational investment. If educational requirements are met, and out-migration is stemmed, an adequate labor force would appear to be achievable for the future.

About 71 percent of the total population of the water sub-region exceeding 25 years of age have only completed 8 or less years of school, with the lack of education relatively more concentrated among older people, farm residents, and males. In Water Sub-region H, only about 17 percent of the population had completed high school in 1960, compared to about 41 percent for the nation. A comparison of educational attainment between Water Sub-region H and the nation is shown in Figure 15-9 on Page 15-19.

Education levels, in terms of years of schooling, in all 18 counties of the water sub-region are below those of the nation. Only Clark County (8.7 years) equals the Kentucky mean. Educational deficiencies are most pronounced in Leslie (6.9), Breathitt (7.3), Owsley (7.4), and Knott (7.6) Counties.

Past low educational attainment is partially reflected in the area's median annual family income levels. Clark ($4,076) also is the only county to exceed the state median annual family income ($4,051). Owsley ($1,324), Breathitt ($1,432), and Wolfe ($1,455) Counties rank lowest.

Vocational schools are expected to help develop a skilled labor force. Progress has been made in both academic and vocational education. The state's vocational education objective is to locate a training program within reasonable commuting distance of every interested citizen. A new vocational school at Richmond, in the advanced planning stage, is an example of the continuing effort to provide adequate vocational training.

In 1965, 41 percent of the high school graduates in the water sub-region entered a college or university. Many of the college and university graduates now find employment out of the area. If job opportunities become available in the water sub-region, however, future graduates would probably return to, or remain in, the area. Figure 15-10, on Page 15-21, shows higher educational facilities within the water sub-region.

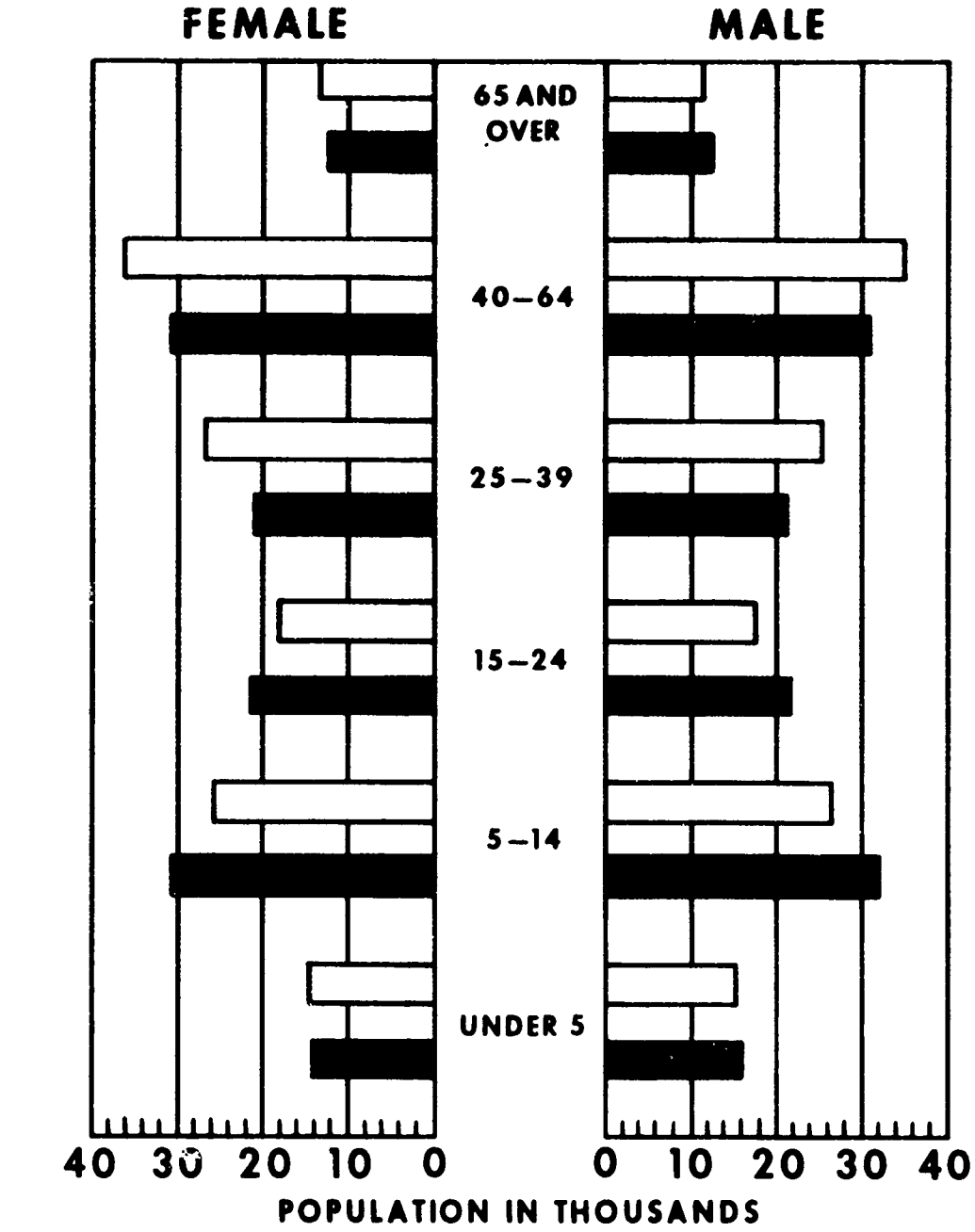

FIGURE 15-8 POPULATION DISTRIBUTION BY AGE AND SEX.

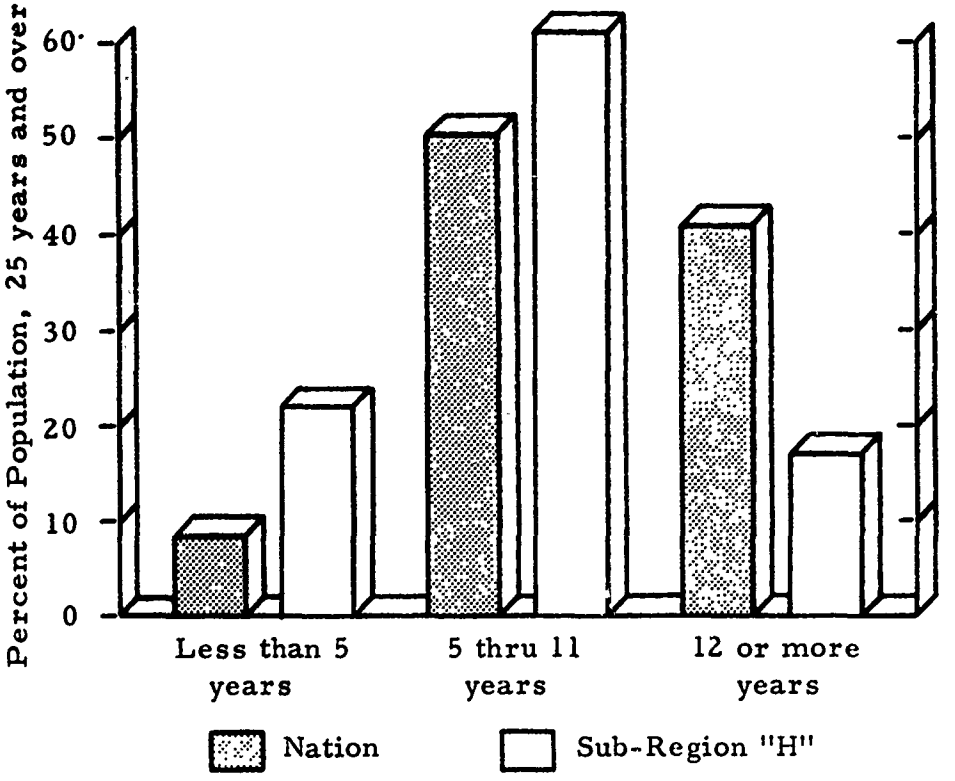

Figure 15-9. Percent of Population Completing Less than 5 Years, 5 through 11 Years, and 12 or More Years of Education (1960).

People in the water sub-region have been plagued by poor health, inadequate medical facilities, and severe shortages of physicians and other medical personnel. The number of people per doctor and the persons per number of hospital beds for the water sub-region are about 2,800 and 350, respectively. This compares with about 2,200 and 275 for the state.*/

Internal parasites and respiratory disease are two major health problems in the water sub-region. The environment of the area is a major cause of existing health problems. The internal parasite problem stems primarily from a lack of adequate water and sewage facilities. Thus, investment in water and sewage disposal facilities would contribute to alleviation of this problem.

Treatment of respiratory disease is inhibited by distance from health centers and lack of facilities and trained personnel. New regional health facilities and planned expansion would ameliorate this difficulty, as would improvement in housing, community development, urban services development and improvement in social services.

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*/ Kentucky State Board of Health, 1965.

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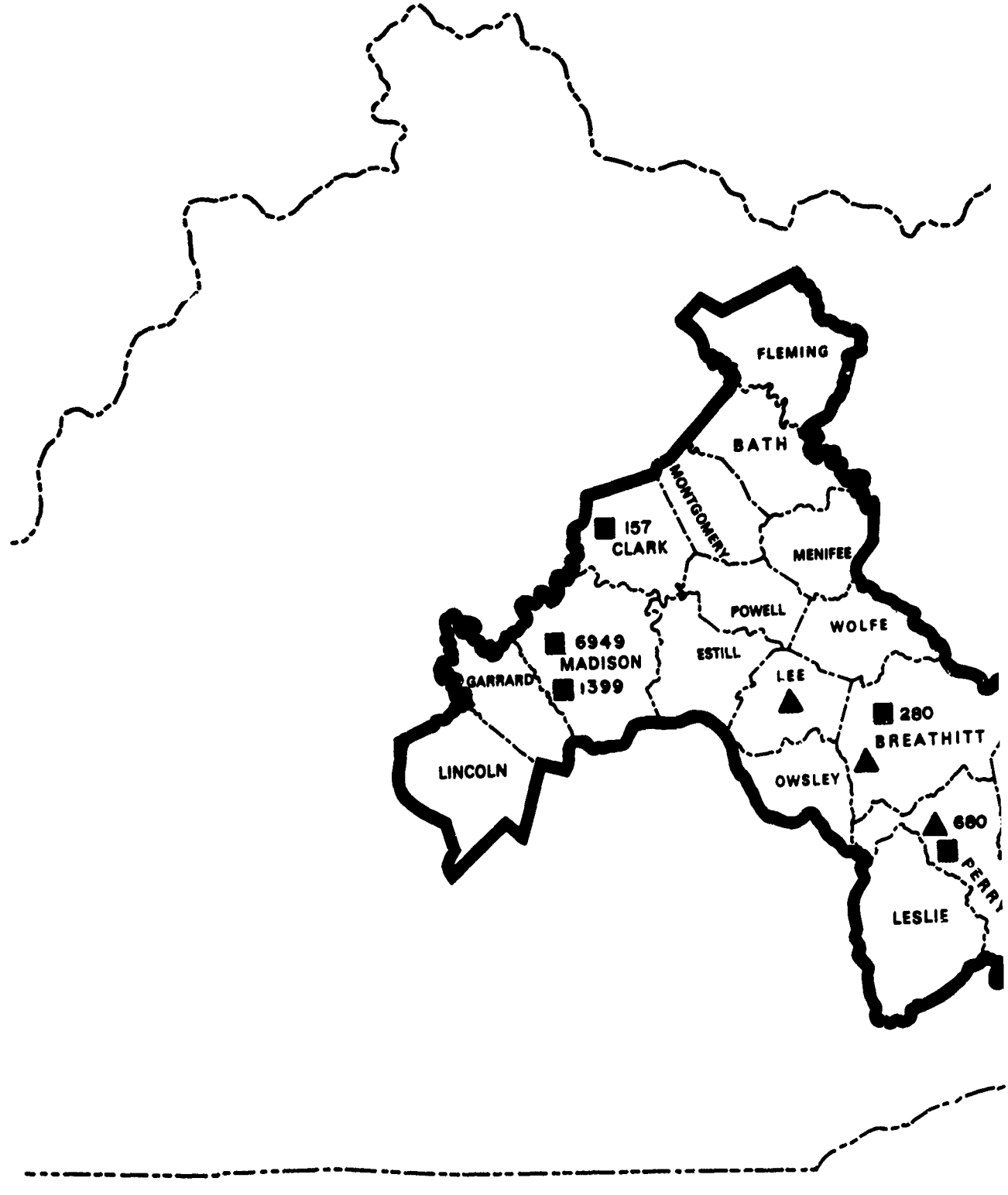

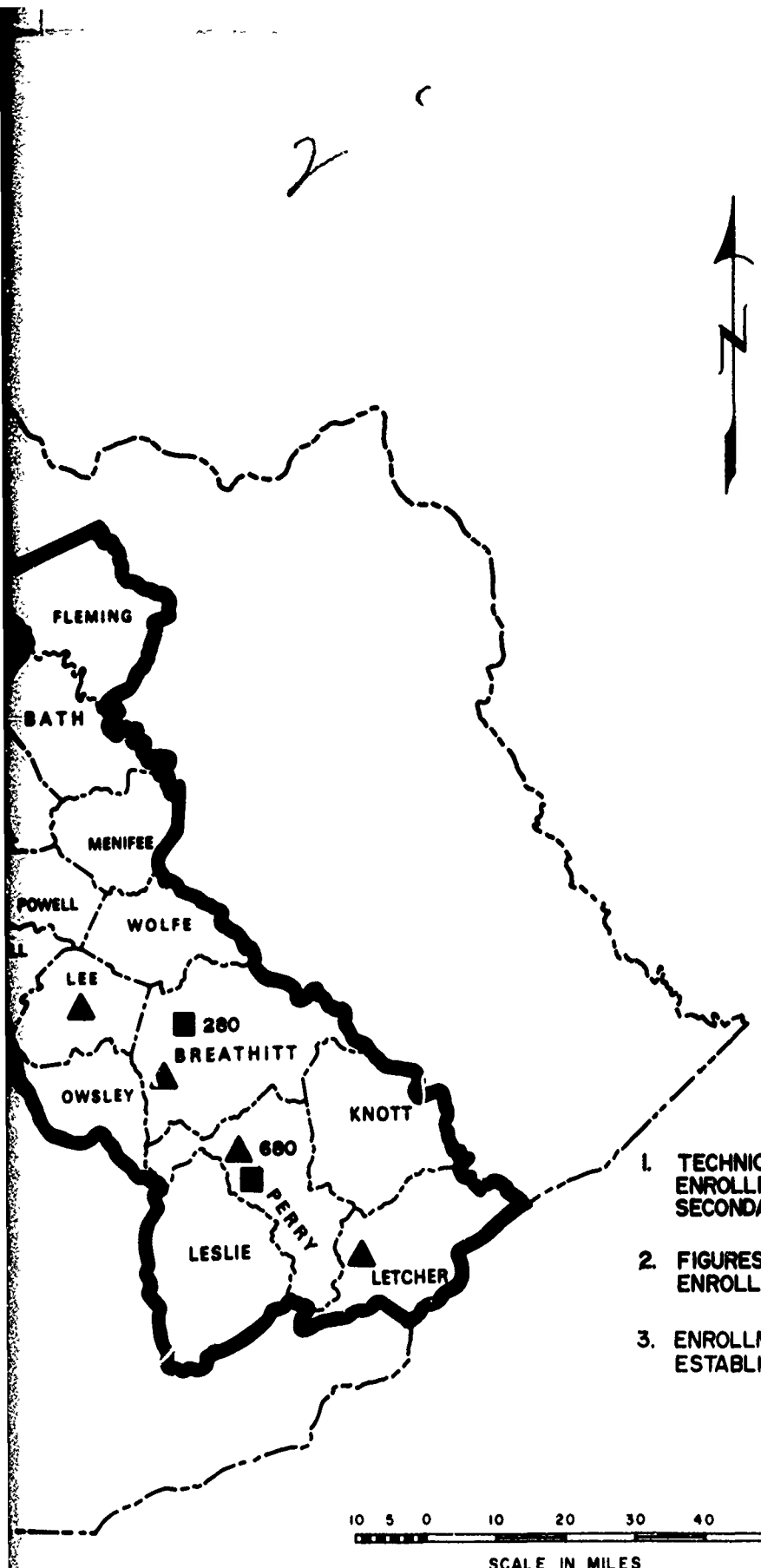

NOTES

1. TECHNICAL AND VOCATIONAL SCHOOLS AND ENROLLMENTS ARE SHOWN ONLY BEYOND SECONDARY LEVEL.
2. FIGURES ADJACENT TO SYMBOLS REPRESENT ENROLLMENT.
3. ENROLLMENT IS NOT SHOWN FOR FACILITIES ESTABLISHED AFTER 1966.

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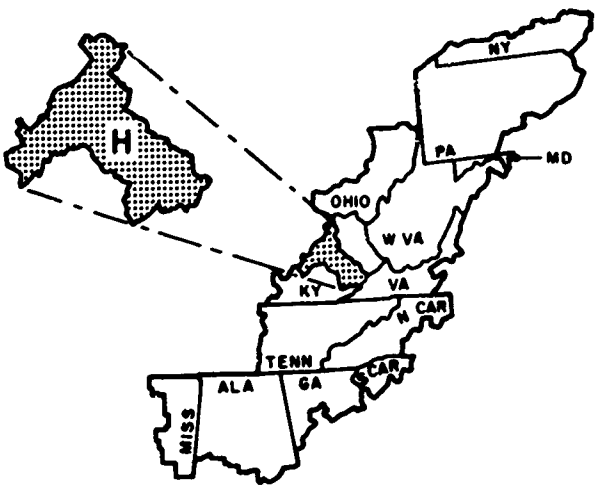

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REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

HIGHER EDUCATION FACILITIES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-15-21 FIGURE 15-10

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Minerals

The mineral industry*/ is important to the economy of Water Sub-region H. In the eastern part of the water sub-region, coal mining directly provides more than half of the personal income of the residents. Additional personal income is provided indirectly, through service and supporting industries such as timber, steel, petroleum, rubber, and plastics. In the western part of the water sub-region, the mineral industry is a minor part of the economy. Minerals produced therein include clay, limestone, petroleum, and natural gas.

Value of mineral production in the water sub-region in 1965 was $80 million. Bituminous coal accounts for 76.1 percent; petroleum, 11.6 percent; natural gas, 8.6 percent; and construction minerals, clay and limestone, 3.7 percent of total 1965 mineral production in the water sub-region. Bitumunous coal is produced in the eastern counties only. The western counties produce small amounts of limestone, petroleum, natural gas, and clay.

Bituminous coal was produced in the eight eastern counties of Breathitt, Knott, Lee, Leslie, Letcher, Owsley, Perry, and Wolfe, in 1965. Total 1965 production was 14.4 million tons, or 31 percent of the eastern Kentucky production. Coal production from Lee, Owsley, and Wolfe Counties was about 0.2 percent; Letcher County, 40 percent; Perry County, 27.1 percent; Knott County, 16.4 percent; Leslie County, 12.9 percent; and Breathitt County, 3.3 percent of the water sub-region total in 1965.

Crude petroleum was produced in 13 counties of Water Sub-region H in 1965. Lee County was the leading producer, with 2.6 million barrels, or 85.4 percent of total petroleum production in the water sub-region. Powell and Estill Counties produced 147,000 and 164,000 barrels, respectively. Lee, Powell, and Estill Counties account for 96 percent of the total sub-regional oil production of 3.0 million barrels in 1965. Sub-region production was 15.4 percent of the total Kentucky crude oil production during this period.

Natural gas production in Water Sub-region H, estimated by the Kentucky Geological Survey, was 27 million cubic feet in 1965, valued at $6.5 million. This was about 40 percent of the total Eastern Kentucky production of natural gas.

Crushed limestone was produced from 10 counties of the water sub-region in 1965. Total production was 1.7 million tons.

Clay for use in the manufacture of heavy-clay products such as brick and pipe is produced at two open pit mines in Powell County. Ample reserves are available to meet future demand.

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*/ Information is available from the Area II Mineral Resource Office, Bureau of Mines, U.S. Department of the Interior, Knoxville, Tennessee. See also Appendix I (Mineral Industry) for more information.

Lands

The total land area of Water Sub-region H is 3.4 million acres, with over 3.3 million acres in agriculture. Present agriculture land use acreage is: cropland, 543,100; pasture, 594,000; state and private forest and woodland, 1,906,300; and other land, 196,900 acres. Additionally, there are 116,300 acres of National Forest land in the water sub-region.

The sub-region has about 63,000 acres of non-agriculture land, including other federal land, urban and built-up areas, water areas less than 40 acres, and streams less than one-eighth mile wide. The latter two groups, amounting to 14,000 acres, or about 0.4 percent of the total land area, include farm ponds and upstream watershed structures for recreation, fish and wildlife, irrigation, and water supply (3,800 acres).

Approximately 60 percent of the water sub-region is in forest and woodland. Principal forest cover types are oak-hickory and oak-pine. The present cover holds soil reasonably, but past misuse, as well as land clearing, heavy livestock grazing, poor timber cutting practices, and forest fires have destroyed much of the humus and organic matter in the upper surface layer of the soil.

These conditions have left 40 percent of the forest land in poor hydrologic condition, and have materially reduced its capacity to absorb and store precipitation. About 40 percent of the forest land has a high to medium potential for hydrologic improvement if given proper management and protection.

About 99 percent of the forest land is well suited for timber production and capable of producing commercial timber. The U.S. Department of Agriculture's Conservation Needs Inventory indicates an increase in forest acreage of about 101,500 acres between 1958 and 1975. This trend will probably continue at about the same rate. Most of the acreage increase will come from abandoned crop or pastureland.

The total agriculture land in the sub-region is 3,356,600 acres. This acreage is expected to decrease to approximately 3,340,200 acres by 1975. The expected reduction in agriculture land will be mainly due to increases in either federal or state-owned land, land occupied by reservoirs, or land converted to urban development. The U.S. Soil Conservation Service has completed soil surveys on about 2 million acres of the sub-region's agriculture land. Of the inventoried acreage, only about 19 percent is suited for intensive long-term cultivation. The remaining 81 percent is suited only to permanent type vegetation, such as grass, trees, and shrubs.

Land suitable for development is scarce in the mountainous portion of the sub-region. The stream valleys, containing most of the flat land, have been extensively built-up with residential development, leaving only small tracts suitable for industrial development and these are usually subject to flooding. Figure 15-11 shows the areas that are potentially suitable for development. The seven counties on the western Appalachian boundary have potentially an adequate amount of developable land.

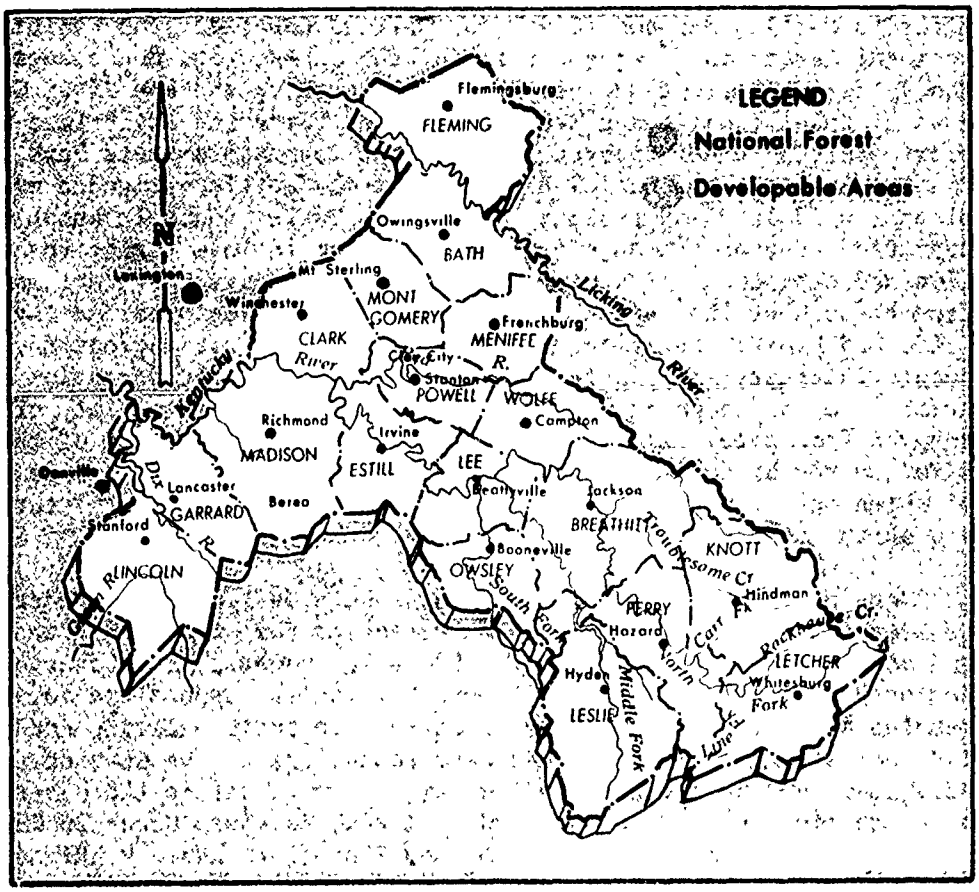


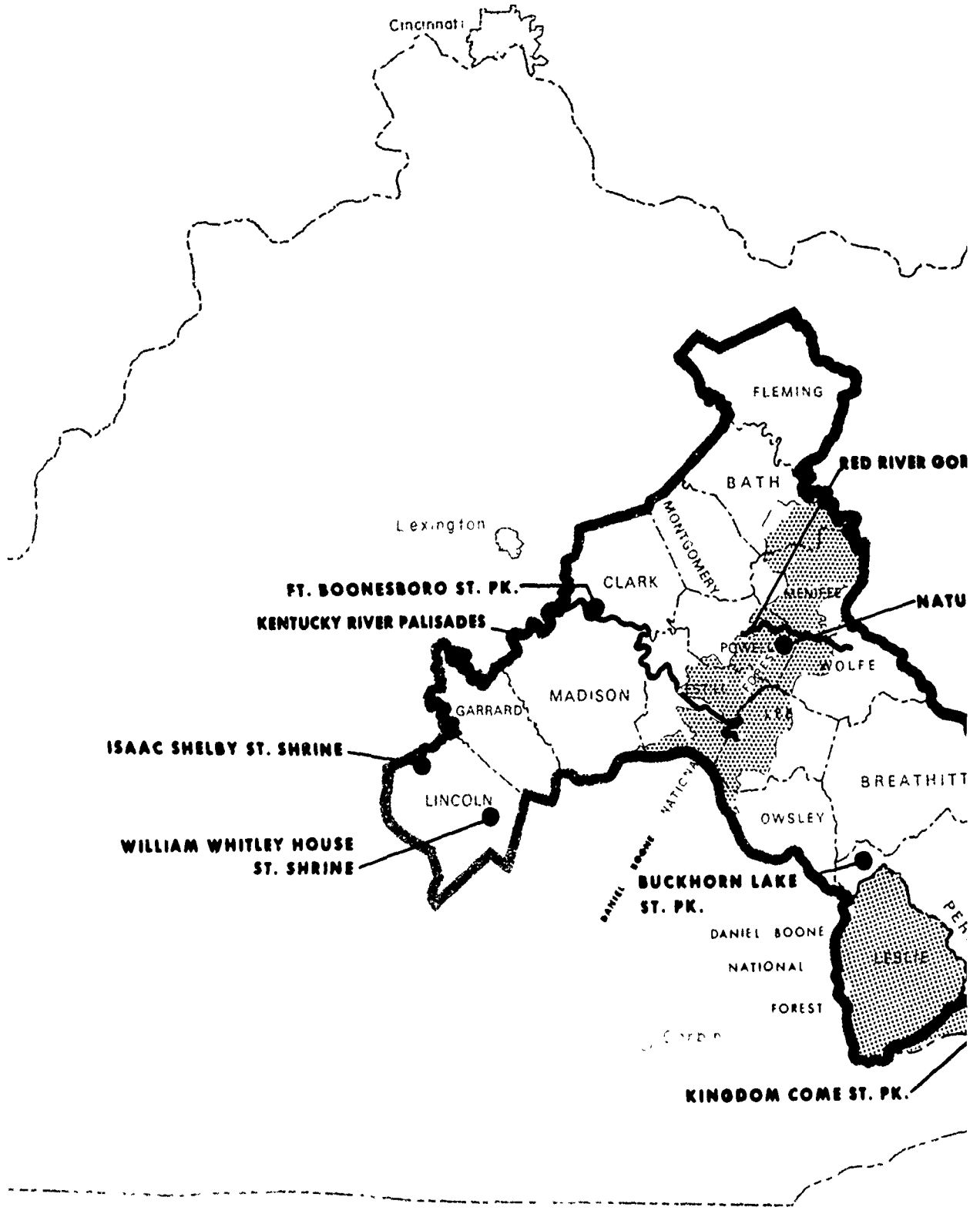
Figure 15-11. Location of Major Land Areas Potentially Suitable For Development.

Environmental Resources

Water Sub-region H is noted for its scenic landscape, woods, and streams. The western counties of the sub-region lie on the fringe of the Kentucky Bluegrass Area and thus have some of the pastoral scenic qualities of the bluegrass country. The other counties of the sub-region are characterized more by hills and rather narrow valleys, providing variety in scenic experiences. Particularly notable features of the sub-region include Natural Bridge State Park in Powell County; Kingdom Come State Park in Letcher County; Palisades of the Kentucky River in Estill, Madison, Clark and Garrard Counties; the Daniel Boone National Forest covering about 1/3 of the sub-region, and a segment of the Jefferson National Forest in Letcher County; the Red River Gorge area of Powell, Wolfe and Menifee Counties featuring Sky Bridge and approximately 30 other natural arches; Fort Boonesboro State Park featuring the original site of Daniel Boone's Kentucky settlement and a myriad of plants, wild life and geologic features. Daniel Boone is known to have traversed many of the sub-region's hills and valleys during the exploration and settlement of Kentucky. Many historic sites attract many people from throughout the nation. The land of natural bridges, mainly in Powell, Wolfe and Menifee Counties, provides opportunity for a great number of people interested in plants, flowers and the geologic formation of the area. The Palisades of the Kentucky River contains a variety of features, ranging from sheer cliffs rising some 300 feet or more out of the Kentucky River to the historical attributes of the existing locks and dams, some of which were constructed in the mid 1800's. (Scenic and historical sites are shown in Figure 15-12.)

None of the sub-region streams have been designated as Federal wild or scenic rivers nor have any been scheduled for study under the Wild and Scenic Rivers Act (Public Law 90-542). However, the Governor of Kentucky has appointed a Wild Rivers Commission responsible for recommending streams which should be preserved in their existing condition. The Commission has not yet made recommendations to the Governor; however, newspaper reports indicate that several streams within the sub-region are being considered as wild and scenic rivers; Buckhorn Creek in Knott and Breathitt Counties; the portion of the South Fork Kentucky River in Owsley County, and Buck Creek; and a tributary of the Cumberland River in Lincoln County. The Kentucky River upstream to Beattyville and the Licking River in Fleming, Bath, and Menifee Counties are being considered as recreational rivers.

The area has many fair to good fishing streams, ponds and two large man-made lakes. With the addition of reservoirs now under construction, the area will have more fishing potential. The fish population in the North Branch of the Kentucky River is limited as this stream has an increased sulfate load and is intermittently or potentially acidic from its headwaters near Whitesburg to the edge of the Appalachian Plateau near Madison County. Pollution from mine drainage is more intense in the Hazard area, while sedimentation from strip mines opened on steep hillsides is a problem throughout the basin. Organic wastes from municipal


Cincinnati
Lexington
FLEMING
BATH
RED RIVER GOR
MONTGOMERY
CLARK
FT. BOONESBORO ST. PK.
KENTUCKY RIVER PALISADES
MENIFEE
NATU
POWELL
WOLFE
MADISON
GARRARD
ISAAC SHELBY ST. SHRINE
LINCOLN
WILLIAM WHITLEY HOUSE ST. SHRINE
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OWSLEY
BUCKHORN LAKE ST. PK.
DANIEL BOONE NATIONAL FOREST
LESLIE
KINGDOM COME ST. PK.

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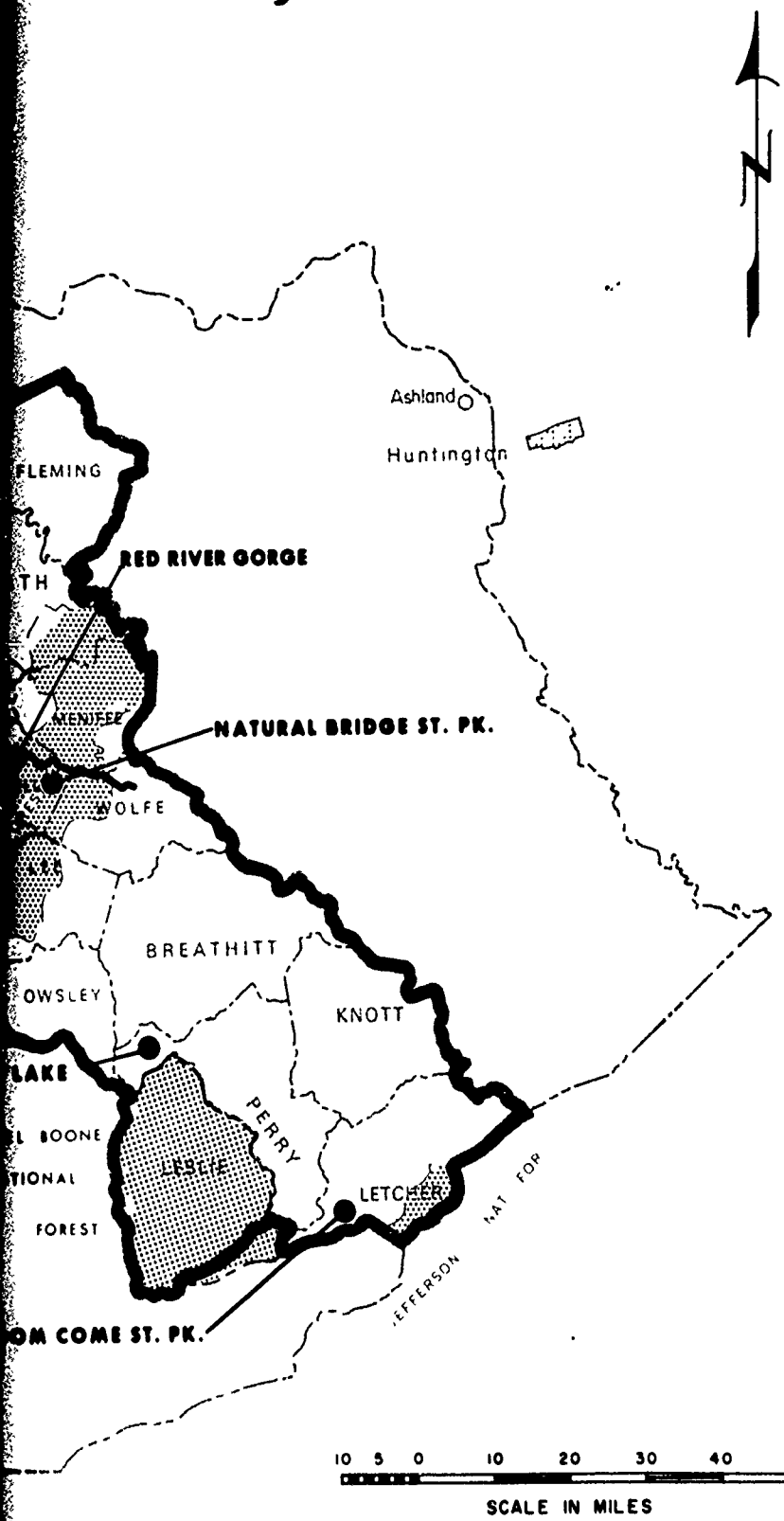

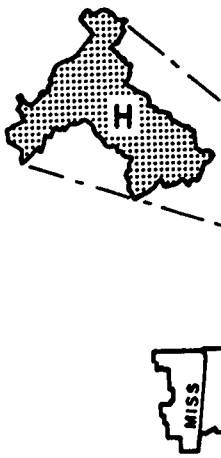

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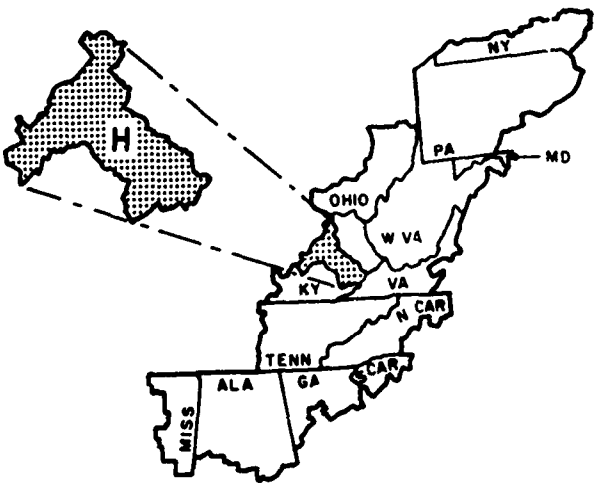

VICINITY MAP

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

SCENIC & HISTORICAL SITES

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-27 FIGURE 15-12

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sewage and chloride concentrates from brine pits are serious pollutants in the vicinity of Hazard and Jackson, especially during periods of low flow.

Wildlife habitat within the water sub-region is of low-to-moderate value. Hunting pressure is heavy on small game such as cottontail rabbits, bobwhite quail, ruffed grouse and gray squirrels and comparatively light on big game such as white-tailed deer.

The western part of the water sub-region is mostly forest and woodland, interspersed with farmland with deer, grouse, pheasant, rabbits, and squirrels. The eastern part of the area is heavily forested and mountainous, with deer, grouse, turkey, and black bear. The eastern part also has the most suitable water for cold water species of fish. A total of 256 farm ponds are being stocked and managed for the production of fish, primarily of the warm water species.

Individual basic conservation plans, covering about 716,900 acres, have been implemented by 6,510 landowners and operators. Results of this effort include the conversion of 3,000 acres to wildlife and recreational uses, and the development and preservation of 6,000 acres for wildlife habitat.

The U.S. Department of Agriculture's Upstream Watershed projects authorized for operations as of July 1, 1967, include additional storage and development for recreation. These developments provide 51 acres of water surface, with an adjacent land area that will accommodate 16,300 recreation days. In addition, there are 12,500 farm ponds with a water surface of 3,750 acres. Some of these ponds are used in income-producing recreational enterprises, but are most commonly limited to the use of the farm owners and their guests.

Public-owned forest land in Water Sub-region H also provides substantial opportunities for outdoor recreation. During 1966, about 121,500 recreation visits were made to National Forests in the water sub-region. An estimated 2,300 visits were made to state forests in the same year.

Strip mining and auger mining have had an adverse effect on the quality of the environment in the coal producing counties. However, restorative measures and relatively recent state legislation regarding the extractive mineral industries are designed to prevent further deterioration of the environment and to mitigate some environmental abuses of the past. The existing Kentucky law has not been in effect long enough to measure its effectiveness.

In summary, Sub-region H provides a great variety of environmental features all of which are within less than 250 miles of over 30,000,000 people and which are accessible by an excellent system of federal and state highways.

Water Resources Development - Federal

Corps of Engineers

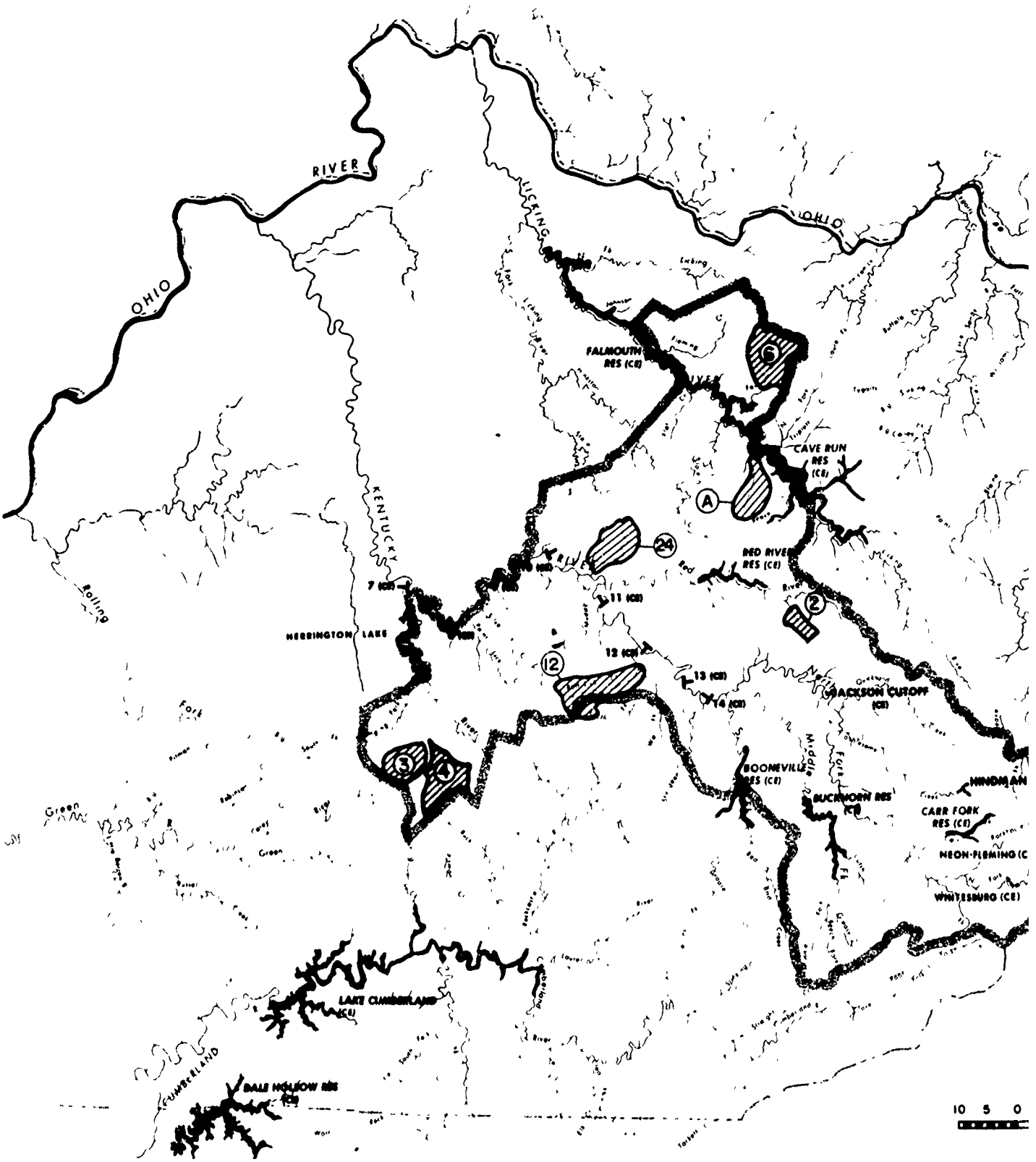
Navigation. The existing water resources development in Sub-region H originated in the middle of the 19th century, when the Commonwealth of Kentucky canalized the Kentucky River from its mouth to the vicinity of Beattyville, Ky., County Seat of Lee County. This canalization provides a six-foot-navigable-depth passage along the Kentucky River by a series of 14 locks and dams. Lock and Dam Nos. 7 through 14 are within or partially within Sub-region H. For many years these locks and dams facilitated the transport of coal and other extracted mineral resources from the area. The use of these facilities has declined considerably. At the present time the locks and dams, within the sub-region, are little utilized for commercial navigation, but they are used considerably in recreational boating and for sources of water supply. The lower 5 locks and dams on the Kentucky River were ceded to the United States Government by the Commonwealth of Kentucky in 1880 and have been and are operated by the Corps of Engineers. Although somewhat inadequate for modern day commercial transportation needs, they are still in generally good repair and serve many recreation users. A profile of these locks is presented in Figure 15-6 (Page 15-15), their location in Figure 15-13, and pertinent data in Table 15-3 (Page 15-33).

Major Reservoirs. In the Flood Control Act of 1936, Cave Run Reservoir, on the Licking River, was authorized by the Congress for construction. Currently under construction, this reservoir will provide flood control for downstream areas, improve downstream flow quality, and provide recreational opportunities, including additional fish and wildlife recreational opportunities.

Falmouth Reservoir, with the damsite downstream from the sub-region, was also authorized for construction by the same Act. The upstream portion of this reservoir area, in Fleming and Bath Counties, lies within the sub-region. This project will have detailed planning and design when funds are appropriated by Congress.

In the Flood Control Act of 1938, three additional reservoirs were authorized by the Congress. These three reservoirs, lying within or partially within the sub-region, are the Jessamine Creek Reservoir on the main stem of the Kentucky River generally in the pool area of Lock and Dam 6, just downstream from the sub-region; the Booneville Reservoir on the South Fork of the Kentucky River; and the Buckhorn Reservoir on the Middle Fork of the Kentucky River. Jessamine Creek Reservoir was deauthorized in 1962; Buckhorn Reservoir was completed in 1960; and Booneville Reservoir is presently in pre-construction planning.

In 1962, two additional reservoirs in this sub-region were authorized; the Red River Reservoir on the Red River, a tributary of the Kentucky River, and the Carr Fork Reservoir on Carr Fork, a tributary of the North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CAVE RUN RES (CE)
RED RIVER RES (CE)
HERRINGTON LAKE
7 (CE)
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13 (CE)
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JACKSON CUTOFF (CE)
BOONEVILLE RES (CE)
BUCKHORN RES (CE)
CARR FORK RES (CE)
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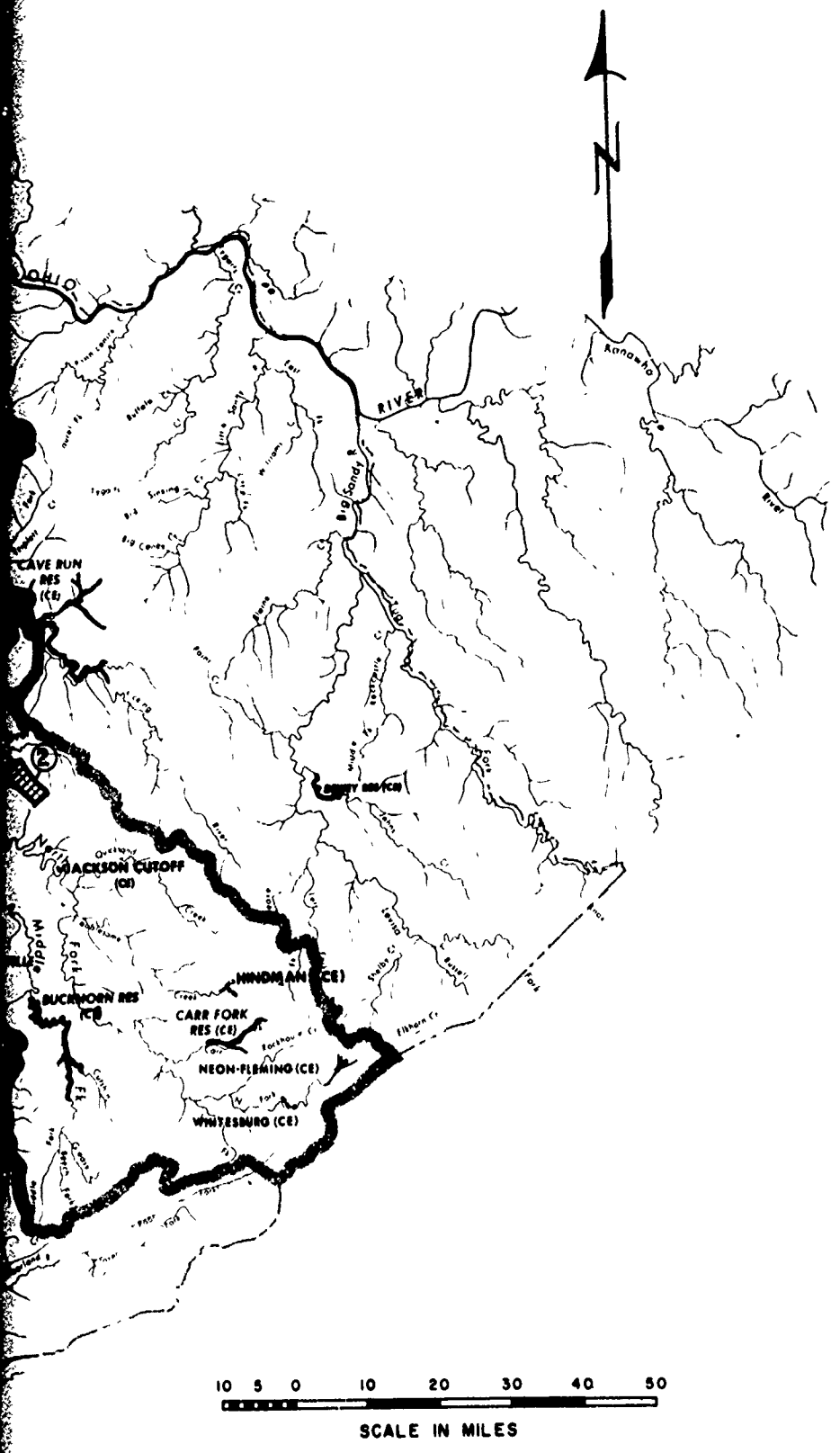

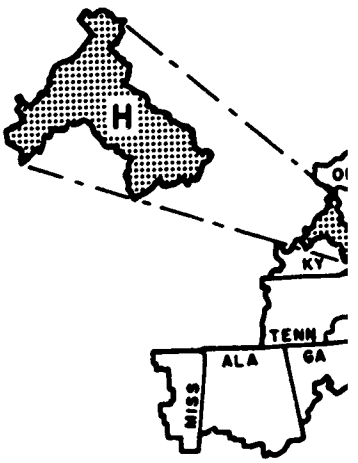

VICINITY

COMPLETED

UPSTREAM WATERSHEDS (3)

MAJOR RESERVOIRS

CHANNEL IMPROVEMENTS ---------

LOCK(S) & DAM

REPORT
DEVELOPMENT OF W
IN
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WATER SUB-

WATER RE
DEVELO

OFFICE OF APPALACHIAN

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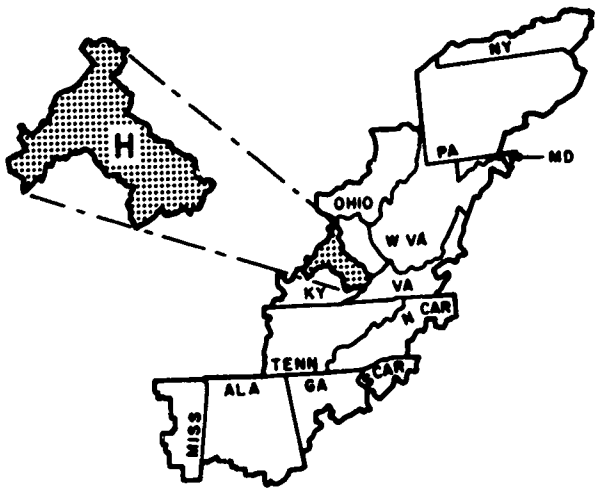
3



VICINITY MAP

	COMPLETED	EXPECTED TO BE COMPLETED BY 1980
UPSTREAM WATERSHEDS	(3)	(6)
MAJOR RESERVOIRS		
CHANNEL IMPROVEMENTS	---------	
LOCK(S) & DAM	⊣	

REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

WATER RESOURCES DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-15-31 FIGURE 15-13

TABLE 15-3
SUMMARY OF PERTINENT DATA
NAVIGATION PROJECTS, WATER SUB-REGION H

	Kentucky River Kentucky
LENGTH OF WATERWAY:	
Total above Confluence with Ohio River (Mi.0)	255
*Length in Appalachia (Mi.) (Sub-region H)	137
CHANNEL DIMENSIONS (Ft.)	6x400 in Lower End 6x250 in Upper End
LIFT:	
Waterway Total (Ft.)	215.8
*Lift in Appalachia (Ft.) (Sub-region H)	123.0
LOCKS AND POOLS:	
Total Number	14
*Number in Appalachia (Sub-region H)	8
Minimum Depth Over Sills (Ft.)	6.0
Chamber Dimensions (Ft.) Lock and Dam	Controlling Size
1-5	38x145
6-7	52x147
8	52x146
9-14	52x148

* Includes portion of Kentucky River that borders the Appalachian Region.

Fork of the Kentucky River. These two reservoirs were authorized specifically to provide flood control for downstream areas and to increase recreational opportunities for the area. The Carr Fork Reservoir is presently under construction by the Corps of Engineers. The Red River Reservoir has been the subject of controversy between conservationists and those desiring flood control. At present, Red River Reservoir planning has been suspended pending determination of the best location for reservoir construction.

Local Protection. A cutoff, which would shorten the stream in the North Fork Kentucky River in the vicinity of Jackson, Kentucky, County Seat of Breathitt County, was completed in 1957. Within the last few years, the Corps of Engineers, in cooperation with the local communities, has also effected channel improvements; deepening, widening, and straightening the channel in sub-region communities. These improvements are on the North Fork, Kentucky River in the vicinity of Whitesburg and Neon-Fleming, both in Letcher County, and on Troublesome Creek in the vicinity of Hindman, Kentucky. These channel improvements have reduced flood damages in the areas of influence.

Figure 15-13 (Page 15-31) shows the location of the water resource developments in Water Sub-region H. Pertinent data for major reservoirs are shown in Table 15-4 and for local protection projects in Table 15-5.

Outstanding or Going Studies. All of Sub-region H is included in the area of outstanding survey report studies. Major portions of the sub-region are included in the Kentucky River and tributaries and Licking River and tributaries studies, presently scheduled to be completed by the Louisville District in 1970 and 1971, respectively. The remainder is mostly included in going studies of the Cumberland River and tributaries by Nashville District and Big Sandy River and tributaries by Huntington District.

U.S. Department of Agriculture

Upstream Watershed Projects. Several upstream watershed projects have been completely installed under authority of Public Law 566. These projects are the Red River Watershed on Stillwater Creek, a tributary of Red River in Wolfe County, Kentucky, and the Upper Green River Watershed in Lincoln County, Kentucky (see Watershed Numbers 2 and 3, respectively, on Figure 15-13). The Stillwater Creek Project primarily improves the channel, whereas the Upper Green River Project channel improvement is supplemented by five flood water retention structures. Each of these structures was developed primarily in the interest of decreasing the flood damages in downstream areas.

In addition, two projects, Buck Creek Watershed in Lincoln County, Ky. and Fox Creek Watershed in Fleming County, Ky., are authorized for

TABLE 15-4
SUMMARY OF PERTINENT DATA
MAJOR RESERVOIRS, WATER SUB-REGION H

ITEM	Corps of Engineers						Kentucky Utilities Co.
	Buckhorn Reservoir	Booneville Reservoir 1/	Red River Reservoir 1/	Cave Run Reservoir	Carr Fork Reservoir	Falmouth Reservoir	Herrington Lake
Stream	M Fork Ky R	S Fork Ky R	Red River	Licking River	Carr Fork	Licking River	Dix River
River Mile	43.3	16.9	47.5	173.6	8.8	60.6	3.0
County	Perry & Leslie	Owsley	Powell	Bath & Rowan	Knott	Pendleton, Harrison, Bracken, Robertson, Fleming, Nicholas & Bath	Mercer & Garrard
State	Kentucky	Kentucky	Kentucky	Kentucky	Kentucky	Kentucky	Kentucky
Status	Completed	Under Const.	AE&D 2/	Under Const.	Under Const.	Authorized	Completed
Auth. Purposes 3/	FC	FC,WQ	FC,WQ,WS	FC,WQ	FC,WQ	FC	Power
Completion Date	1960	-	-	-	-	-	1925
Drainage Area Above (Sq. Mi.)	408	686	219	826	58	2,258	439
Elevation (ft. msl)							
Top of Upper Pool	840	790	799	765	1,055	650	750
Top of Seasonal Pool	782	723	748	730	1,027	620	-
Storage Allocated to (AF)							
Flood Control	157,700	403,100	117,600	438,500	31,660	648,600	-
Power	-	-	-	-	-	-	123,000
Water Quality	-	10,600	)	28,300	4,330	-	-
Water Supply	-	-	)32,599	-	-	-	N.A.
Sediment	10,300	36,400	12,600	43,700	2,800	249,700	-
Total	168,000	450,100	162,700	614,100	47,700	898,300	N.A.
Surface Area (Ac)							
Top of Pool	3,610	9,000	2,840	14,870	1,120	25,700	2,650
Top of Seasonal Pool	1,230	3,050	1,510	8,270	710	12,300	-
Power Installation							
Capacity (1,000 KW)	-	-	-	-	-	-	28.3
No. of Units	-	-	-	-	-	-	-
Yield (MGD)							
Water Supply	-	-	74.3	-	-	-	2.2
Water Quality	-	188.1	120.2	96.9	18.1	-	-
Low Flow Augmentation	96.9	-	-	-	-	-	-

1/ Subject to minor modifications. 2/ Advanced Engineering and Design. 3/ FC-Flood Control; WQ-Water Quality; WS-Water Supply.
NA - Not Available.

TABLE 15-5
SUMMARY OF PERTINENT DATA
LOCAL PROTECTION PROJECTS - CHANNEL IMPROVEMENTS

ITEM				
LOCATION	Jackson Breathitt Co., Ky.	Hindman Knott Co., Ky.	Whitesburg Letcher Co., Ky.	Neon, Fleming Letcher Co., Ky.
STREAM	North Fork Kentucky River	Troublesome Creek	North Fork Kentucky River	Boone, Wright, and Yonts Forks of North Fork Kentucky River
TYPE	Cutoff	Channel Improvement (Sec. 208)	Channel Improvement (Sec. 208)	Channel Improvement (Sec. 205)
DRAINAGE AREA AT SITE (Sq. Miles)	1,100	25.7	86.1	13.5
TOTAL LENGTH OF STREAM (Miles)	167.7	48.5	167.7	Boone Fork (3.4) Wright Fork (2.4) and Yonts Fork (1.7)
LENGTH OF IMPROVED CHANNEL (Miles)	0.0284 (150 ft.)	4.7	5.25	1.0 Boone Fork, 0.8 Wright Fork and 0.15 Yonts Fork
KIND OF IMPROVEMENT				
Clearing and Snagging (ft.)	-	4.7	5.25	10,300
Channel Excavation (ft.)	0.0284 (150 ft.)	-	5.25	10,300
BOTTOM WIDTH OF IMPROVED CHANNEL (ft.)	350	20 ft. on left Fork 30 ft. on Main Stem	20 ft. min.	10 ft. Wright and Yonts Fork and 15 ft. on Boone Fork
IMPROVED CHANNEL CAPACITY (cfs)	26,700	1,640	3,000 est.	1,500
YEAR COMPLETED	Jan. 1957	Sep. 1966	Apr. 1967	Oct. 1962

installation by the Soil Conservation District. Also, Red Lick Creek, Upper Howard Creek, and Salt Lick Creek Watersheds are being investigated or planned and are expected to be completed by 1980. These projects are shown on Figure 15-13 and are identified as Watershed Numbers 4, 6, 12, 24, and A, respectively.

Pertinent data for the upstream watershed projects are shown in Table 15-6.

Land Use Programs. A considerable number of soil conservation measures have been applied or installed in this sub-region. These measures consist generally of land treatment necessary for production of food and fiber and to maintain and improve basic soil and water resources and quality of the environment. The land treatment program of the U.S. Department of Agriculture contributes significantly to water quality improvement in the sub-region mainly through erosion reduction and stabilization and protection of soil resources. Of over 3-1/2 million acres of land in Sub-region H, only about 10 percent is considered to have been adequately treated by the Department of Agriculture. Basic conservation plans have been developed by 9,600 landowners cooperating with their local soil conservation districts for approximately 716,000 acres of land. The Forest Service also administers about 116,300 acres of the Daniel Boone National Forest in the sub-region. These lands are managed, in the multiple-use concept, to produce high quality water for recreation, timber, and fish and wildlife. The results of research in water yield improvement made in other places are being applied in this area.

Other Water Resource Programs. The Farmers Home Administration, U.S. Department of Agriculture, has received requests from many of the communities for planning and construction grants and loans for water and sewage treatment and for comprehensive planning.

Water Resources Development - Non-Federal

Kentucky Utilities Company

One hydroelectric power generating plant has been constructed by the Kentucky Utilities Company. This structure, Dix Dam, is located on the Dix River on the western edge of Garrard County, at the western edge of the sub-region. The lake formed by the dam, Herrington Lake, provides substantial recreation opportunities and fish and wildlife habitat. (See Figure 15-13 and Table 15-4.)

Municipal

Table 15-7, on Page 15-41, presents an inventory of water supply sources for cities exceeding 5,000 population in the sub-region.

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TABLE 15-6

SUMMARY OF PERTINEN
UPSTREAM WATERSHED PROJECTS,

Map Reference Number (Figure 15-13)	Name of Watershed	Status	Drainage Area of Watershed (Square Miles)
Kentucky			
2	Red River (Stillwater Creek)	completed	24.4
3	Upper Green River	completed	38.0
4	Buck Creek	authorized	57.3
6	Fox Creek	authorized	78.8
	TOTAL		198.5

*/ Includes only those projects that have been completed or authorized

**/ Includes sediment and fish and wildlife

***/ This is a channel improvement project: data not comparable

TABLE 15-6

SUMMARY OF PERTINENT DATA
WATERSHED PROJECTS, WATER SUB-REGION H */

Drainage Area of Watershed (Square Miles)	Drainage Area Regulated (Square Miles)	Number of Structures		Storage Volume by Purpose (Acre Feet)			
		Flood Retention	Multi-Purpose	Flood Water	Recreation	M&I Water Supply	Other**
24.4	***/	***/	***/	***/	***/	***/	***/
38.0	3.7	5	0	646	0	0	76
57.3	15.0	3	0	2772	0	0	405
78.8	25.3	4	1	3915	246	0	1557
198.5	44.0	12	1	7333	246	0	2038

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TABLE 15-7
WATER SUB-REGION H
MUNICIPAL WATER FACILITIES* - CITIES EXCEEDING 5,000 POPULATION

City	Est. Pop. Served	Source of Supply	Rated Plant Cap. MGD	Average Plant Output MGD
HAZARD	8,000	North Fork Kentucky River	2.000	.600
MOUNT STERLING	5,500	Slate Creek/Impounded Reservoir	.742	.700
RICHMOND	13,000	2 Lakes & Otter Creek	1.250	.850
WINCHESTER	16,000	Kentucky River & 2 Lakes	2.200	1.000
BEREA**	6,200	Lakes & Springs	.720	.600

* 1963 Data
** City itself has a population less than 5,000

4. INTRODUCTION

Planning Devices

Appalachia has been divided into ten water sub-regions, labeled "A" through "J," corresponding closely with drainage basins, physical areas, and to areas for which various participating Corps of Engineer Districts and the Tennessee Valley Authority are responsible. Water sub-region boundary adjustments were made to accommodate the state planning sub-regions. Figure 15-14 shows the different planning areas located in Water Sub-region H.

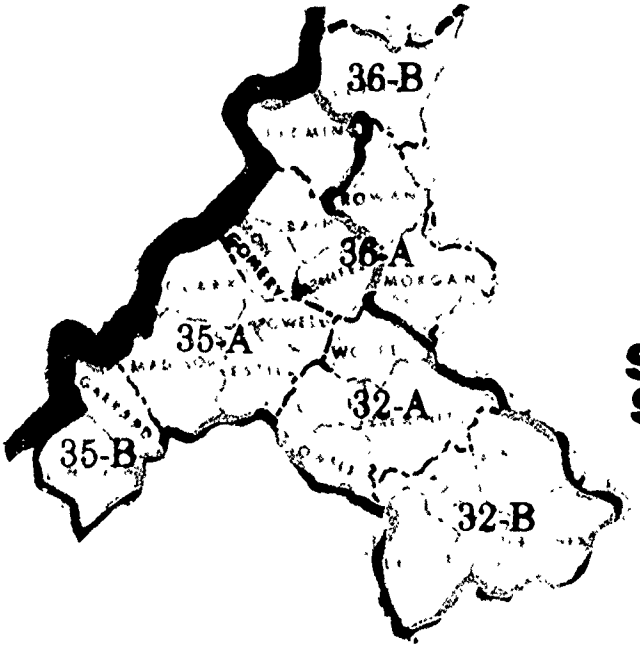
The Office of Business Economics (OBE) has regionalized Appalachian Counties into twenty-seven economic sub-regions, each containing a trade center. Projections made for the OBE economic sub-regions have been adapted to the 10 water sub-regions, to the water areas, and to a limited extent to the 63 state planning sub-regions (see Appendix E). Within Water Sub-region H lie portions of two OBE Economic Sub-regions. Fleming County is in Economic Sub-region 9 and oriented to Cincinnati. All remaining counties of Water Sub-region H are in Economic Sub-region 13, oriented to Frankfort-Lexington.

Sixty-three state planning sub-regions, each with urban growth centers, have been established by the Appalachian States to implement planning and administer programs on the local level. Each state planning sub-region is wholly contained within one state. The states have used various criteria to derive these state planning areas. Some criteria emphasize physiographic factors, while others emphasize trade flows and related economic characteristics. The differences between state delineation methods has, to some extent, been overcome by use of economic sub-regions and identified growth centers, of a variety of types and sizes, for planning purposes.

Within each of the state planning sub-regions, the States, as part of their Appalachian development plans, have designated one or more areas with significant potential for future growth (growth areas). Such areas have been defined by the Appalachian Regional Commission (ARC) as:

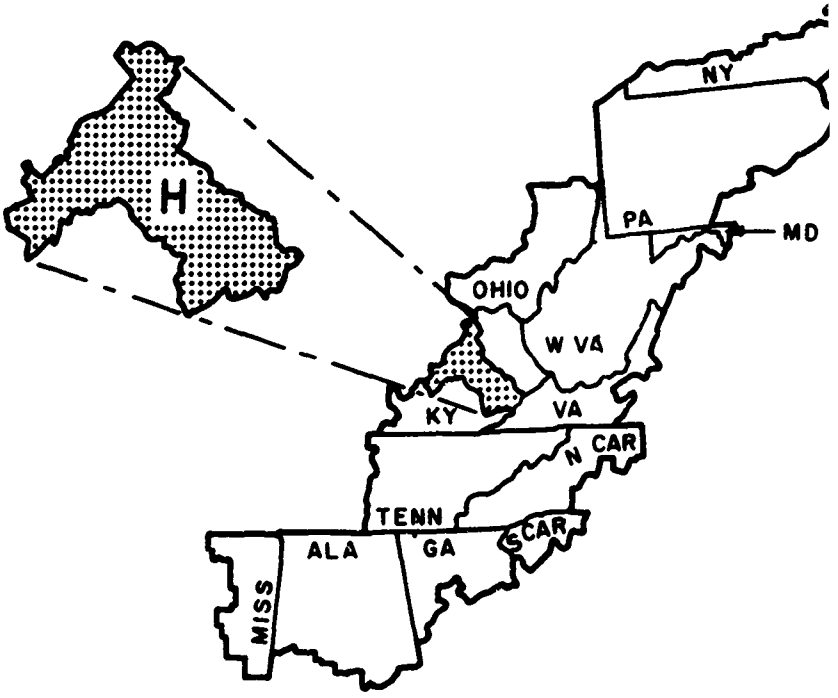
"An area consisting of an urban center or centers and their hinterland where the state has determined significant future growth is likely or can be induced."

"By a center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide a range of cultural, social, employment, trade, and service functions for itself and its associated rural hinterlands. Though a center may not be fully developed to provide all these functions, it should provide, or potentially provide, some elements of each, and



STATE PLANNING SUB-REGIONS

ECONOMIC SUB-REGIONS



VICINITY MAP

APPALACHIAN REGIONAL BOUNDARY

WATER SUB-REGION H BOUNDARY

REPORT FOR
DEVELOPMENT OF WATER RESOURCE
IN
APPALACHIA

WATER SUB-REGION H

PLANNING AREAS

OFFICE OF APPALACHIAN STUDIES JUNE 196

11-15-43 FIGURE 15-1

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presently provide a sufficient range and magnitude of these functions to be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland."

There are three state planning sub-regions in Water Sub-region H, each of which is sub-divided. Their identifying number, name and growth centers are listed below:

State Planning Sub-region No.	Name	Growth Centers
Kentucky 32A	Middle Kentucky River	Jackson
Kentucky 32B	Upper Kentucky River	Hazard-Whitesburg
Kentucky 35A	Foothills	Winchester, Richmond-Berea
Kentucky 35B	--	
Kentucky 36A	Gateway	Midland-Morehead, Mt.Sterling
Kentucky 36B	Buffalo Trace	

Initially, Sub-region H contained two state planning sub-regions. Since that time, Kentucky State Planning Sub-regions have been rearranged so that, in addition to those counties in Sub-region H, State Planning Sub-region 36A and 36B contain three counties in Water Sub-region G. These counties are Lewis (in 36B), and Rowan and Morgan (in 36A). Graphic and tabular comparisons of the state planning sub-regions with the water sub-region are included in the following sections, and for purposes of these comparisons, the three additional counties are included in the statistics.

Water resources analysis requires projections of 50 to 100 years in the future. For this analysis, the current data were prepared by the ARC, the long-range projections were prepared by the Office of Business Economics for the Corps of Engineers, and the benchmarks were prepared by the Office of Appalachian Studies. The projections were prepared by water sub-region and water areas, while the ARC data were prepared by state planning sub-regions. In this section where ARC data are utilized, the information is presented by state planning sub-regions and their associated growth centers. The long-range projections are presented by water sub-region and follow in Chapter 16.

Growth centers are emphasized in this section, but not all projects for water resources development will be located at these centers. There are some places, not now recognized as growth centers, which may have developmental potential with a water resource project. Also, some projects serve wide regional interests and thus are not strictly related to local Appalachian growth centers; for example, a hydroelectric power project or a major upstream development might provide flood control, water supply or water quality control for a downstream urban area outside of Appalachia.

The following paragraphs present socio-economic characteristics of Water Sub-region H and an analysis of each state planning sub-region contained therein.

Economic Characteristics

Water Sub-region H has most of the prominent economic problems found in the Appalachian Region. Increasing and mass unemployment, high rates of out-migration, low income and education levels, and a rural population isolated by the physical landscape, characterize much of the area.

This region has been historically separated from the other parts of the nation by rugged topography and poor transportation. Where other regions developed economically because of unique local resources, or progressed because of some other competitive advantage, this region remained dependent upon coal mining and agricultural activities.

The area's mining industry mechanized, as substitute fuels were demanded nationally and low cost coal deposits were exhausted. Mechanization in turn, caused large-scale unemployment. Since the region had little other economic orientation, the unemployed work force had no local employment alternatives. New industry was hesitant to move into the region because of inadequate transportation facilities, an unskilled labor force, and a rugged terrain that often made difficult the construction of industrial facilities on sites in narrow valleys subject to frequent inundation.

From 1940 to 1960, the sub-region experienced substantial decline in population, employment, and relative income, while the rest of the nation exhibited substantial increases in these fields:

	Percent Population Change 1/		Percent Employment Change 1/		Percent Income Change 1/ 2/
	1940-1950	1950-1960	1940-1950	1950-1960	1950-1960
Nation	+ 14%	+ 19%	+ 18%	+ 15%	+ 84%
Sub-region H	- 5%	- 13%	+ 7%	- 20%	+ 73%

1/ From County and City Data Books, 1956 and 1962, and from Volume II, Ohio River Comprehensive Survey.

2/ Based on Family Median Income.

Agriculture, with low income because most of the land is unsuited for modern farming practices, is the leading employer in the area. Figure 15-15 shows the number of employed persons in major occupations in 1940, 1950 and 1960. Figure 15-16 shows the source of income by major sectors for Water Sub-region H, Appalachia, and the Nation for 1966.

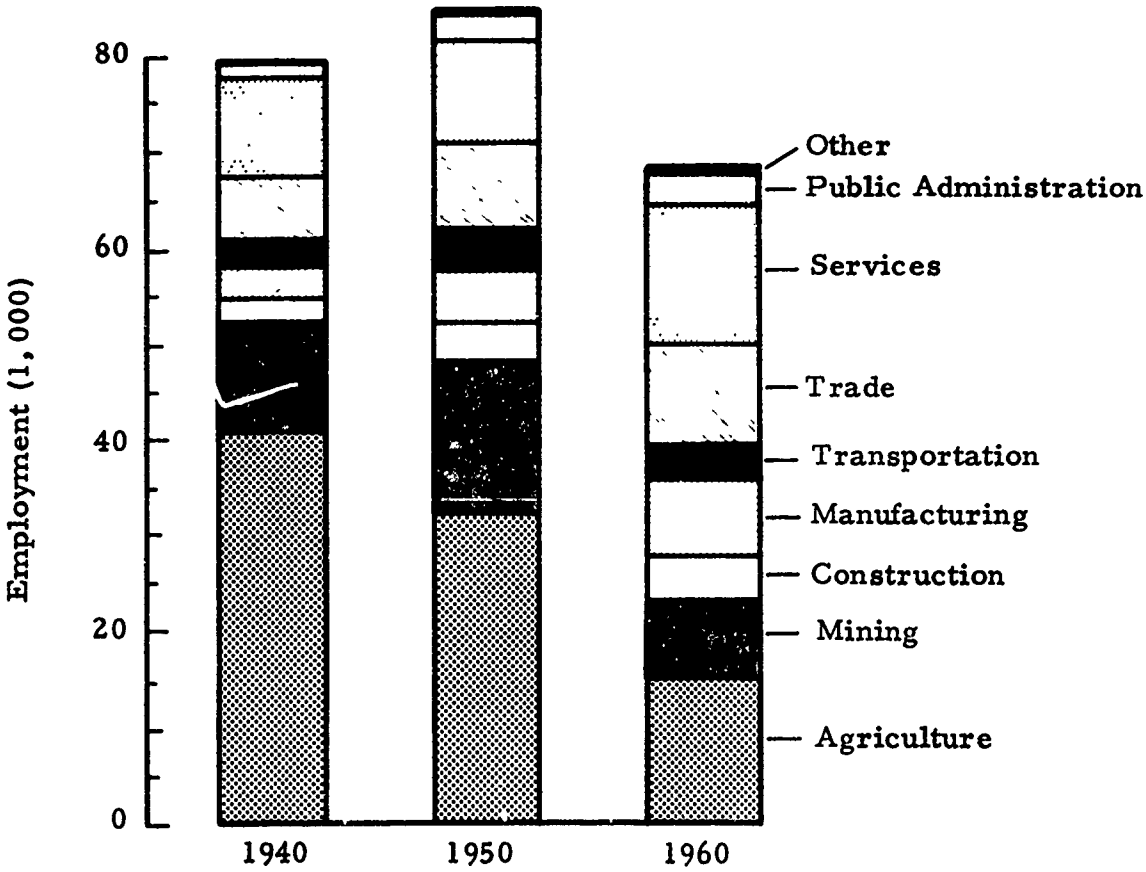


Figure 15-15. Distribution of Employment in Sub-region "H."

Agricultural production of both field crops (such as corn, tobacco, and hay) and livestock, is of local importance, but on a scale relatively smaller than in other water sub-regions. In 1964, the value of farm products sold reached a high of $61.5 million dollars. Crop sales accounted for 56 percent of the total, and livestock with its products accounted for most of the remaining 44 percent (see Figure 15-17). The trend toward mechanized and larger farm units, resulting in a higher percentage of land in cash crops, is a major factor in increasing sales.

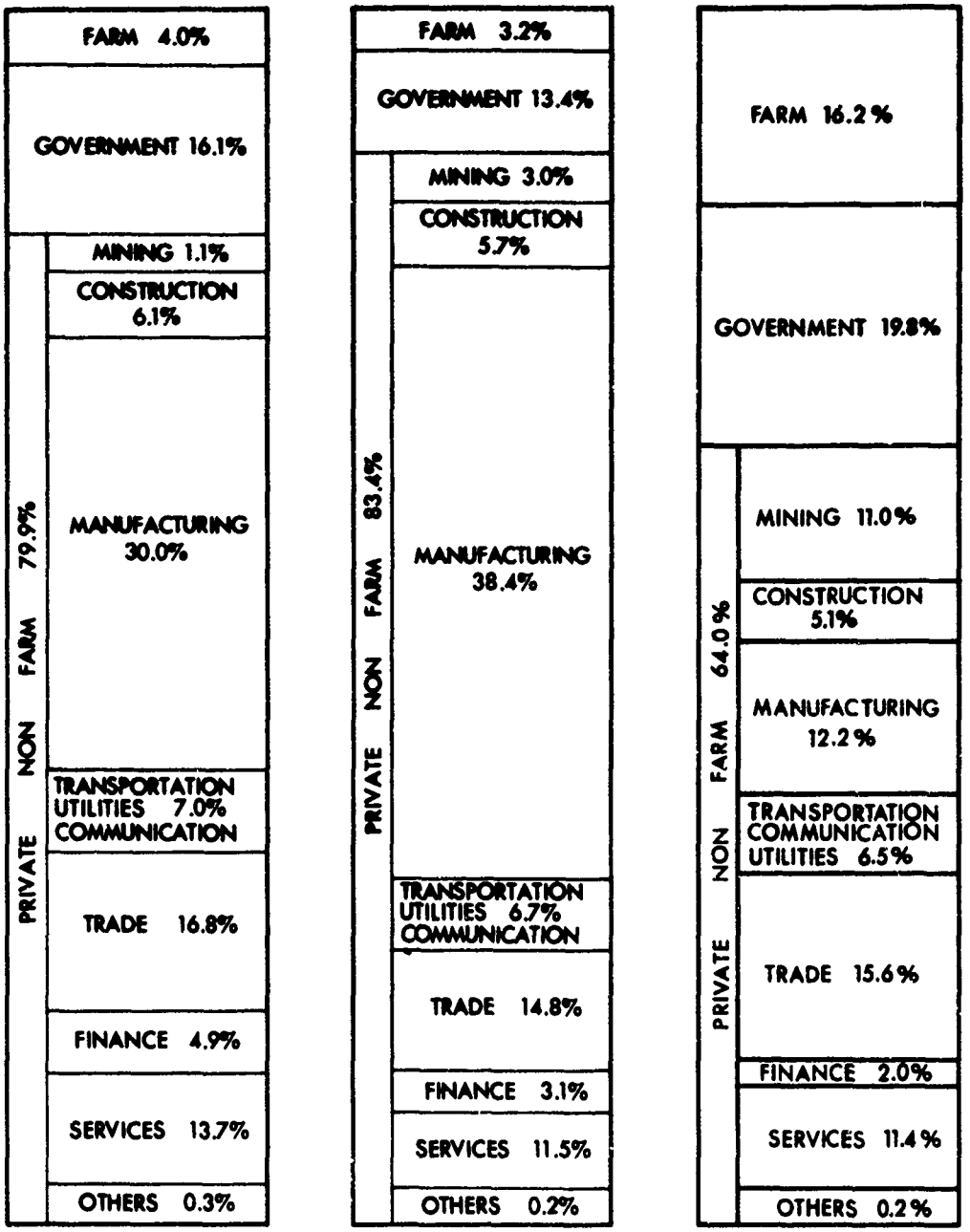
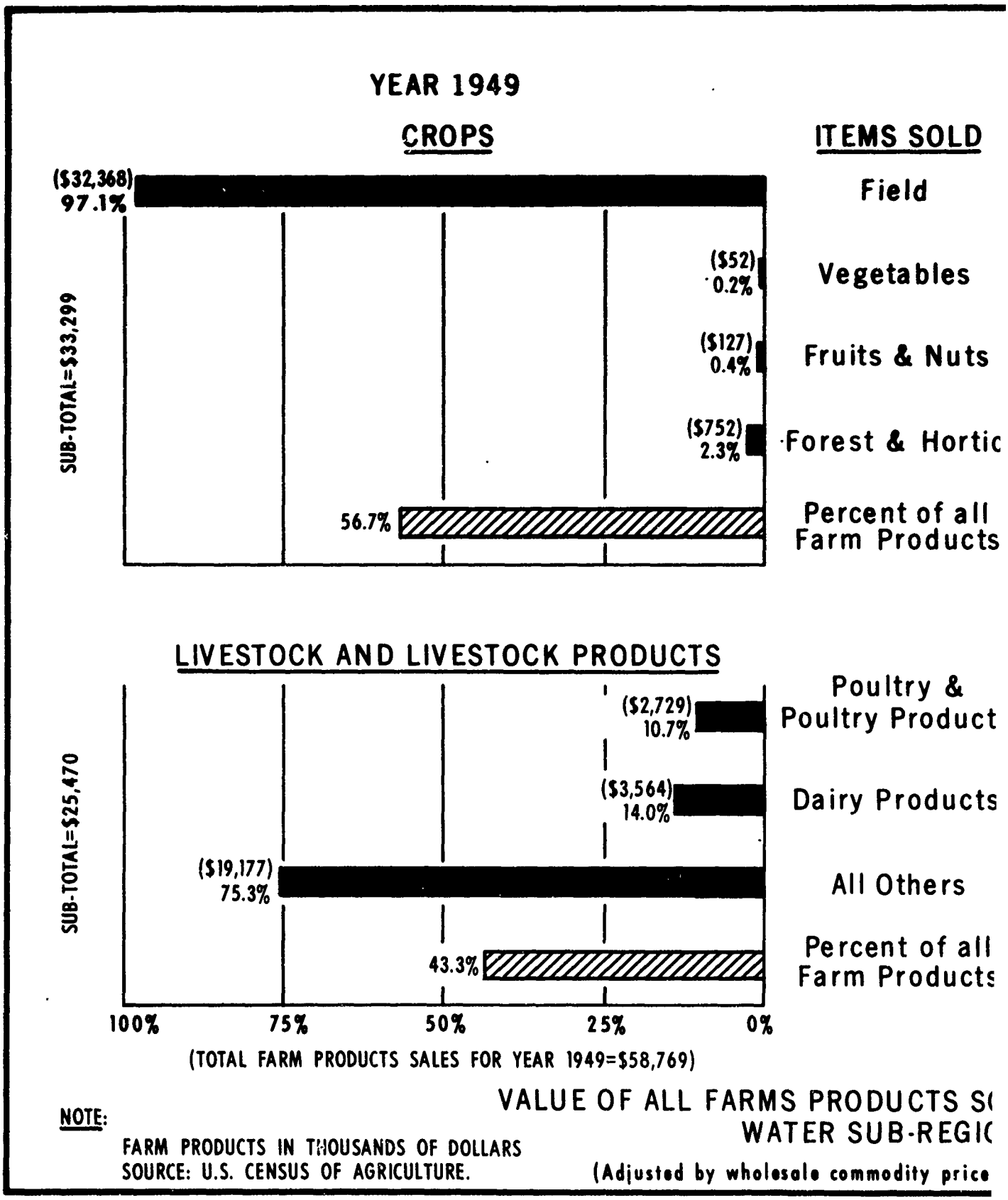
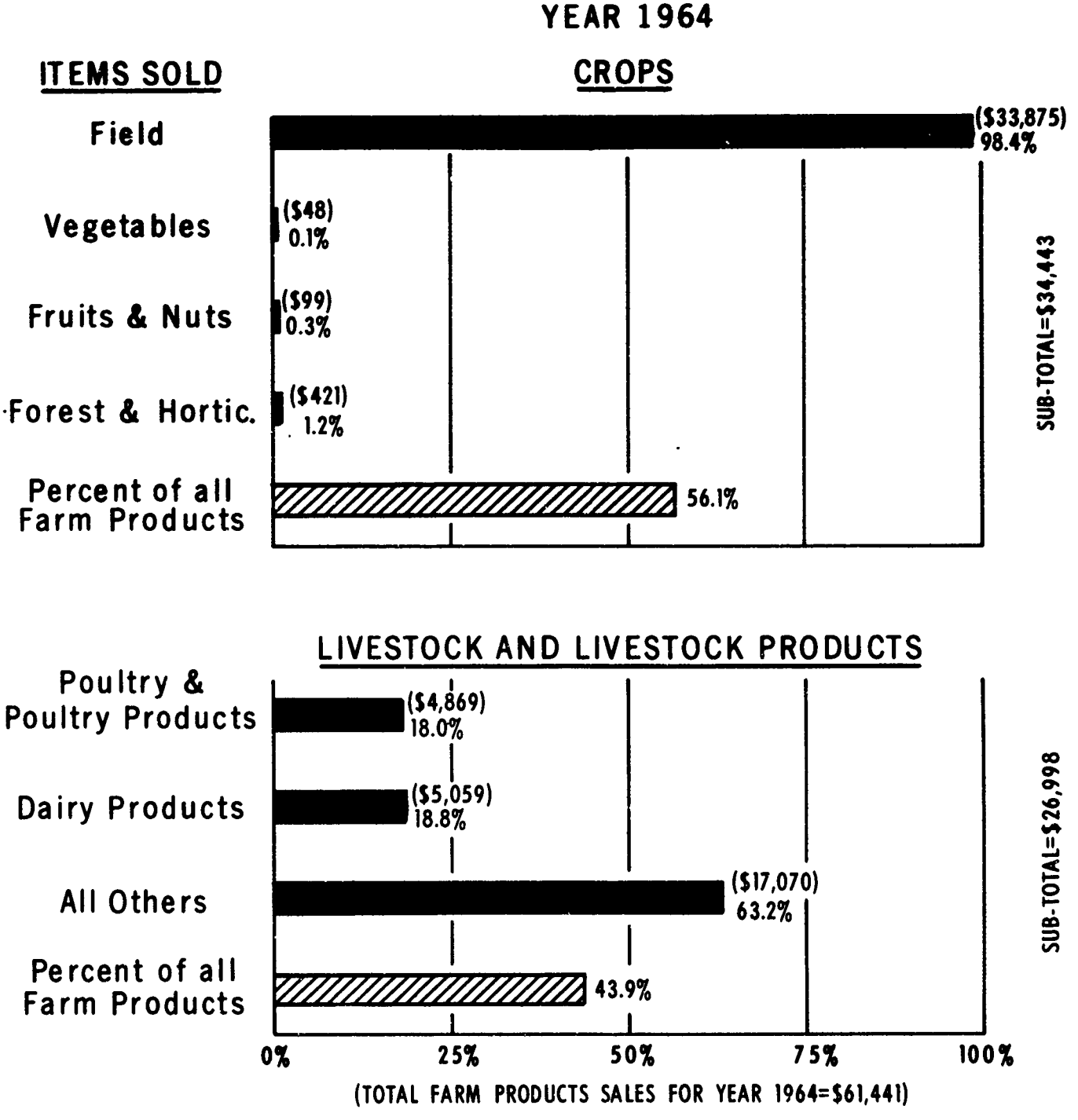


FIGURE 15-16 SOURCES OF INCOME


YEAR 1949
CROPS
ITEMS SOLD
($32,368)
97.1%
Field
($52)
0.2%
Vegetables
($127)
0.4%
Fruits & Nuts
($752)
2.3%
Forest & Hortic
SUB-TOTAL=$33,299
56.7%
Percent of all
Farm Products
LIVESTOCK AND LIVESTOCK PRODUCTS
($2,729)
10.7%
Poultry &
Poultry Product
($3,564)
14.0%
Dairy Products
($19,177)
75.3%
All Others
SUB-TOTAL=$25,470
43.3%
Percent of all
Farm Products
100%
75%
50%
25%
0%
(TOTAL FARM PRODUCTS SALES FOR YEAR 1949=$58,769)
NOTE:
FARM PRODUCTS IN THOUSANDS OF DOLLARS
SOURCE: U.S. CENSUS OF AGRICULTURE.
VALUE OF ALL FARMS PRODUCTS S(
WATER SUB-REGIC
(Adjusted by wholesale commodity price



MS PRODUCTS SOLD,1949 AND 1964
ATER SUB-REGION H

lesale commodity price index(1957-59=100))

FIGURE 15-17

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However, this trend is also a major factor in decreasing agricultural employment. In 1964 the farmland ownership and operation was distributed as follows: full owners, 62 percent; part owners, 22 percent; tenants, 14 percent, and managers, 2 percent.

In 1962, the volume of timber products output was 9 million cubic feet of sawlogs, veneer logs, and miscellaneous products; 1 million cubic feet of pulpwood; and 4 million cubic feet of fuelwood. The total estimated value of the timber output was about $3.3 million. Sawlogs and veneer logs accounted for more than one-half of the total value. The estimated employment in 1962 in timber-based manufacturing industries was about 975 persons. All were employed in the lumber and wood products industry. There is no pulp, paper, and allied products industry in the sub-region.

Even though the economic importance of the coal mining industry today is far smaller than it was during the past peak years, it is still of major importance to the eastern counties of the sub-region. In 1965, the coal mining industry provided about 60 percent of the personal income of the eastern counties. The production in Eastern Kentucky's underground mines in 1960 was about 10.9 man-day tons, compared to 4.2 man-day tons in 1940. These figures clearly show why employment in the mining industry has decreased even though production has remained approximately the same. The value of mineral production in Sub-region H in 1965 was about $80 million with coal contributing 78 percent of the total. In the past, there has been heavy reliance on mining, lumber, oil, and gas production for export.

A breakdown of the available labor force, by sex, is shown by county in Figure 15-18.

This water sub-region is among those with a high unemployment rate. Of the 18 counties in the sub-region, 15 had an unemployment rate exceeding 4 percent in 1966 and in two (Breathitt and Owsley) the rate was over 31 percent. Figure 15-19 displays the unemployment rate in 1966 by county. With this high unemployment there is a large supply of labor (26,000 persons in 1966) available in the sub-region. This valuable resource is composed of three groups: unemployed persons; men and women who could shift from low paying jobs; and women who would enter the labor force if jobs were available. There is also a substantial group of unemployed persons who have not been accounted for in the employment statistics of the water sub-region.

In 1960, 56 percent of the families in the sub-region had incomes of less than $3,000, and the average per capita income was about $900. By contrast, only 21 percent of the families in the nation had incomes of less than $3,000, and the national average per capita income was $1,994. (See Figures 15-20 and 15-21 respectively, on Page 15-55.)

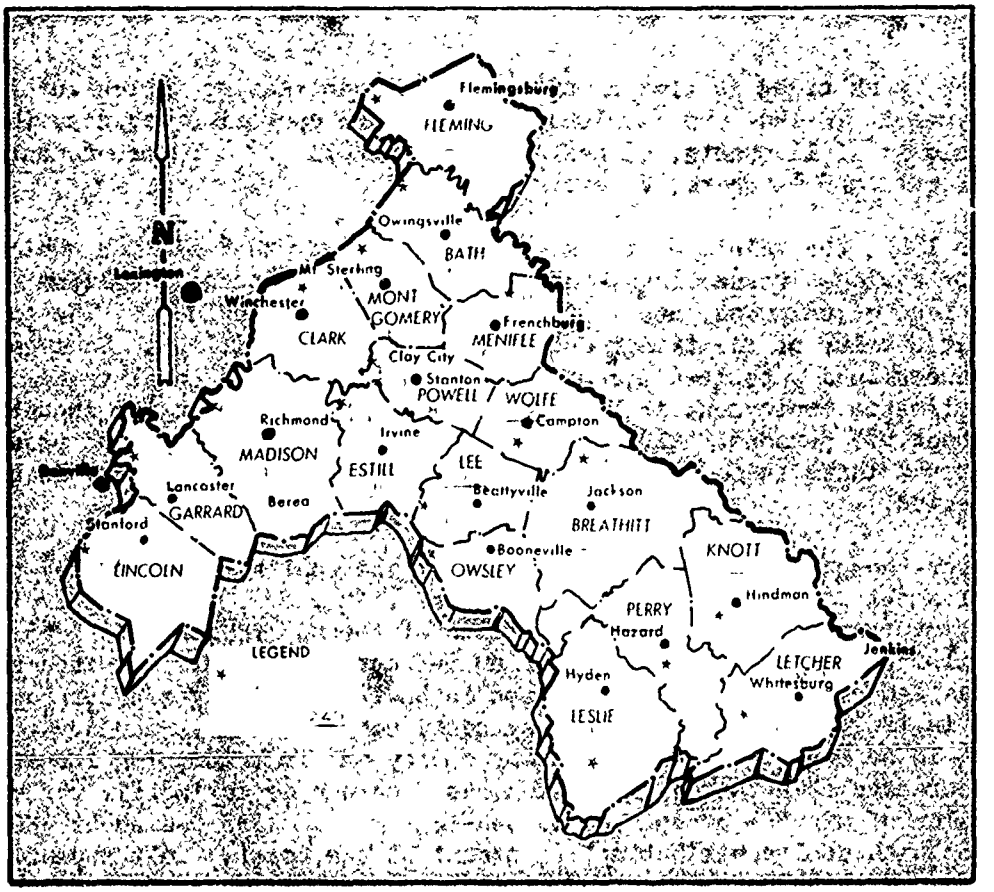
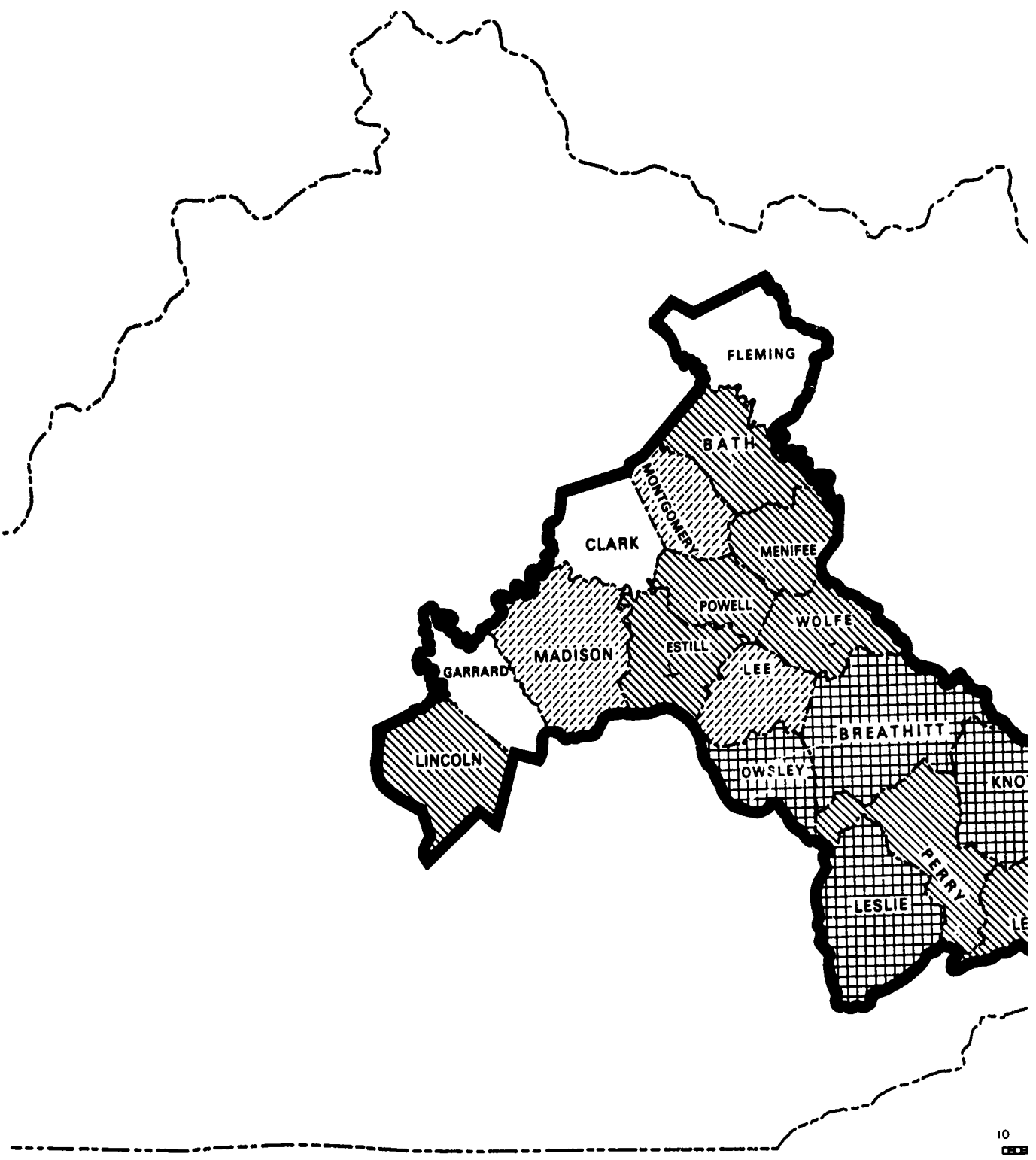


Figure 15-18. Distribution of the Available Labor Supply within Sub-region "H." (1966)


FLEMING
BATH
MONTGOMERY
CLARK
MENIFEE
POWELL
WOLFE
ESTILL
MADISON
GARRARD
LEE
BREATHITT
LINCOLN
OWSLEY
PERRY
LESLIE

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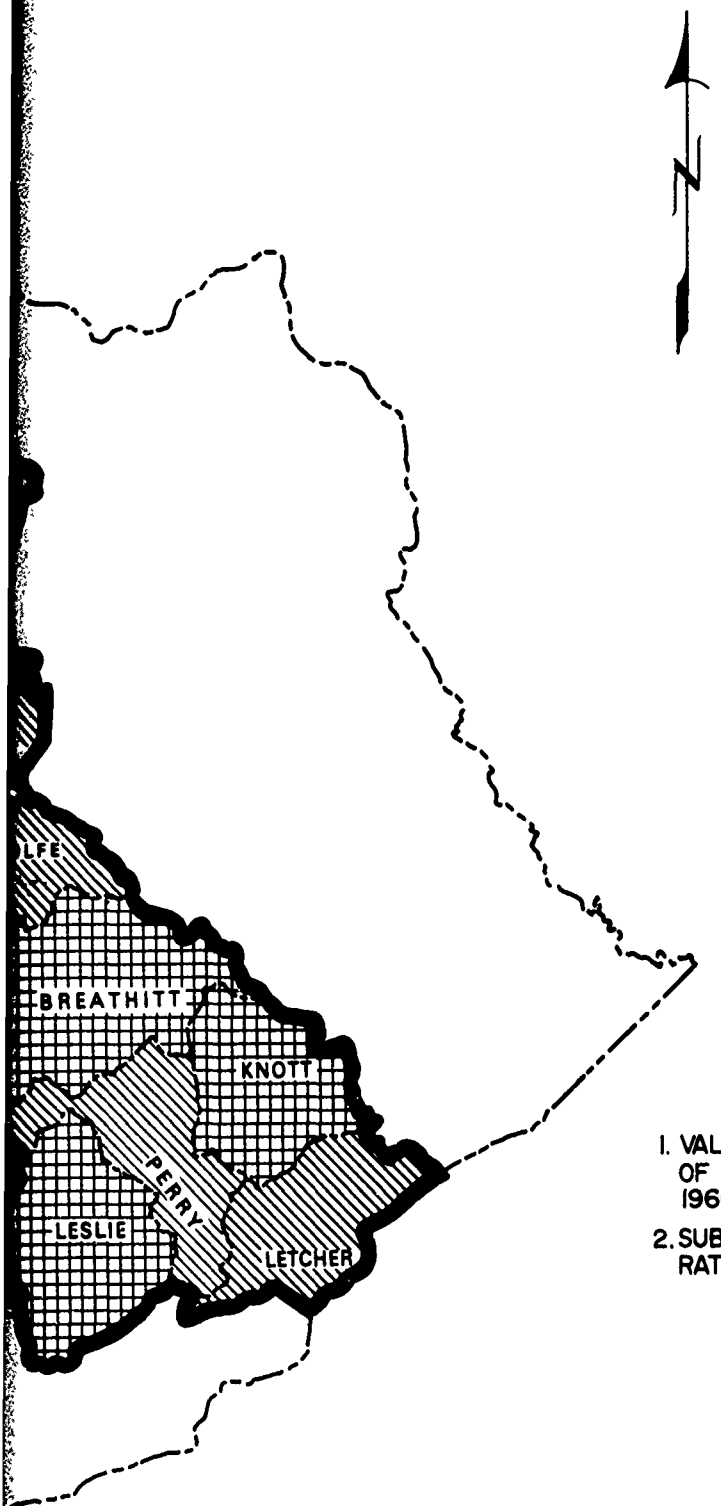

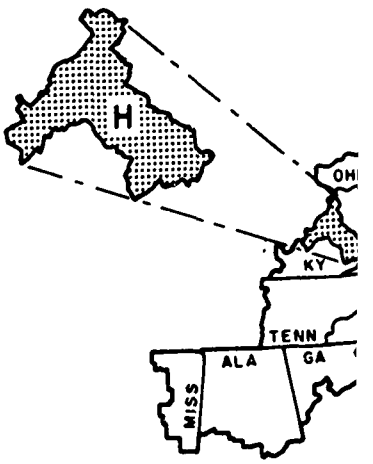

VICINITY M

LEGEND

- LESS THAN 4.0 %
- 4.0%–9.9%
- 10.0%–19.9%
- 20.0%–31.7%

NOTES

1. VALUES SHOWN ARE PERCENTAGE OF CIVILIAN LABOR FORCE FOR 1966.
2. SUB-REGION H UNEMPLOYMENT RATE : 10.5%.

10 5 0 10 20 30 40 50

SCALE IN MILES

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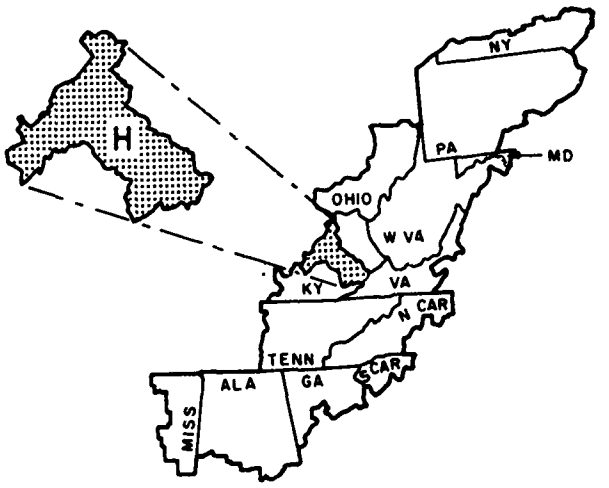

VICINITY MAP

LEGEND

- LESS THAN 4.0 %
- 4.0% – 9.9%
- 10.0% – 19.9%
- 20.0% – 31.7%

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FOR
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REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

UNEMPLOYMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

11-15-53 **FIGURE 15-19**

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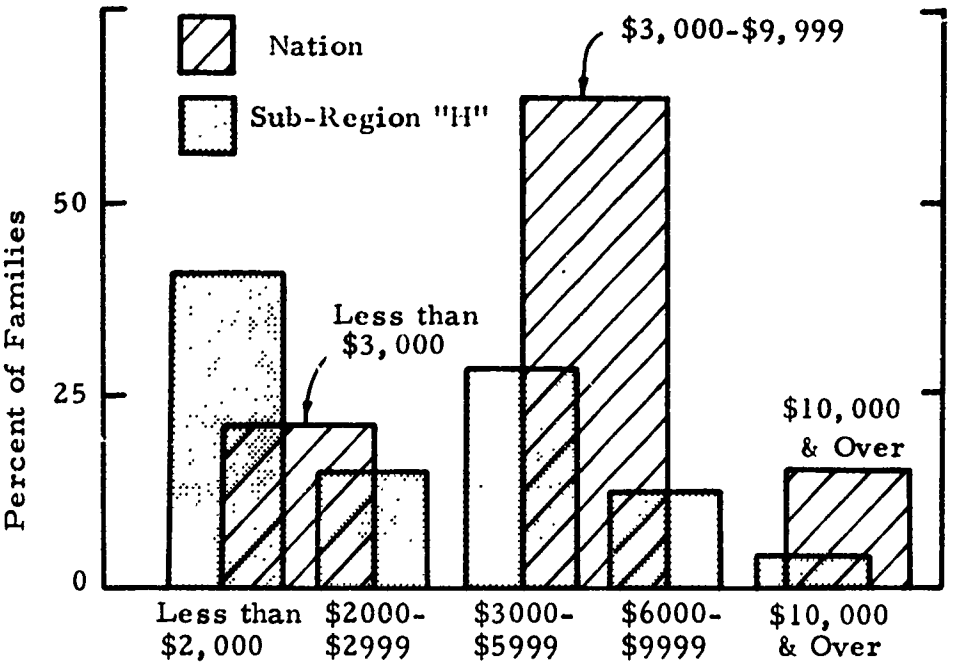


Figure 15-20. Distribution of Annual Family Income for Nation and Sub-region H (1960).

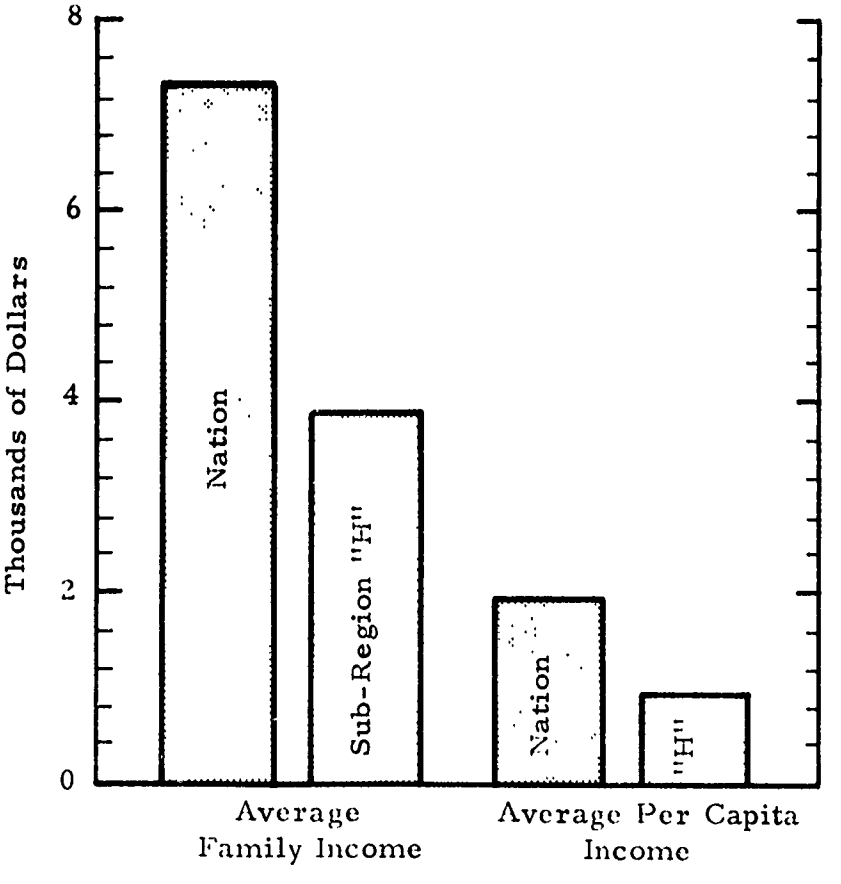


Figure 15-21. Comparison of Average Family Income and Average Per Capita Income for Nation and Sub-region (1960).

Few communities in Water Sub-region H have adequate service facilities. Economic Development Administration (EDA) assistance has enabled many towns to improve water and sewage facilities, but such improvements are incomplete. Areas having significant growth potential lack water and sewage lines large enough to handle future demands. Existing facilities are not extensive enough to permit annexation of areas surrounding existing city limits. While electricity is presently available in most areas, natural gas facilities are either inadequate or non-existent.

Housing, private and public, is inadequate both in quantity and quality. Whole residential areas in most communities require renovation or renewal. Many places in the water sub-region could not adequately house increased population associated with industrial expansion or immigration from rural areas.

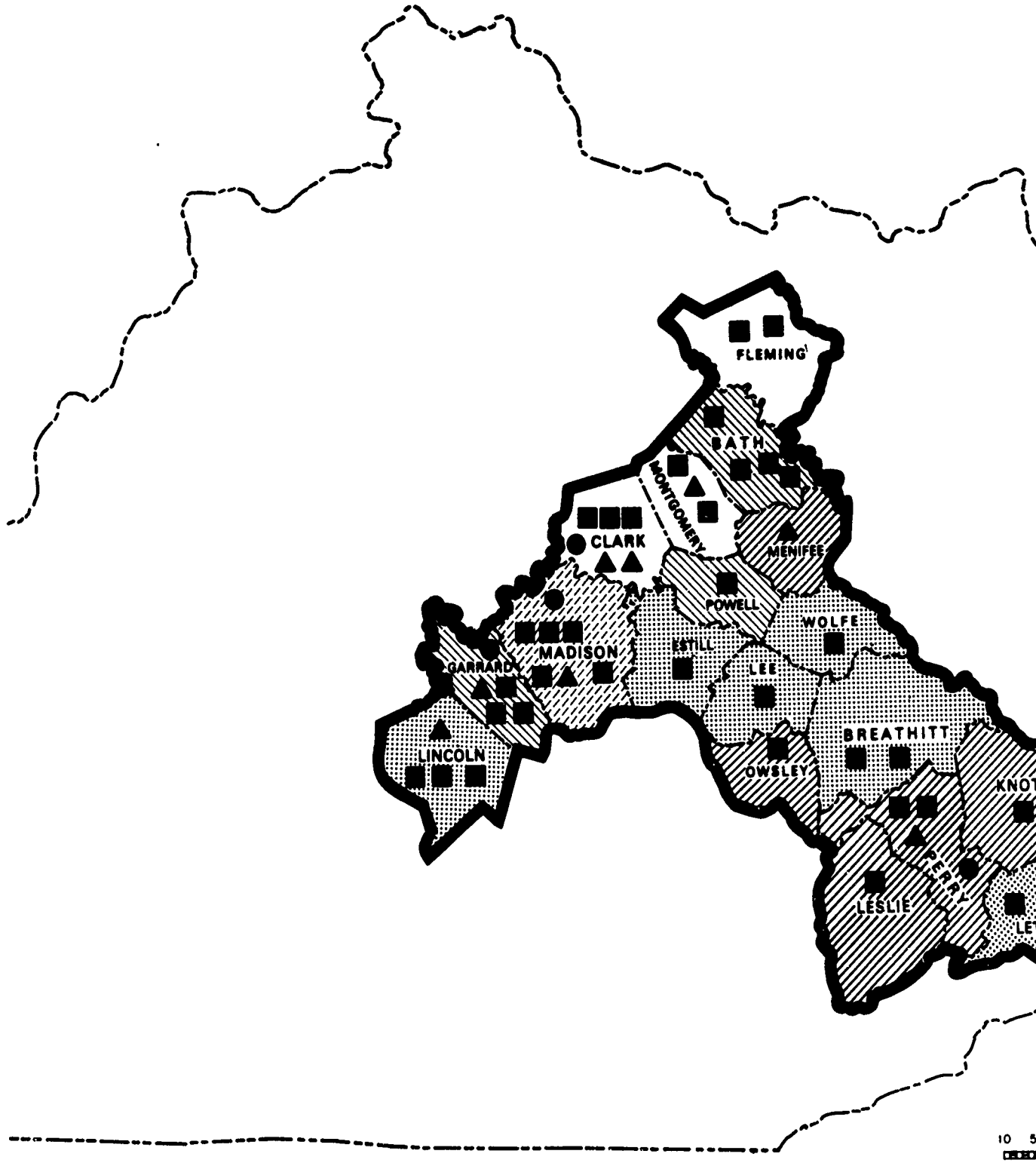
Capital Availability

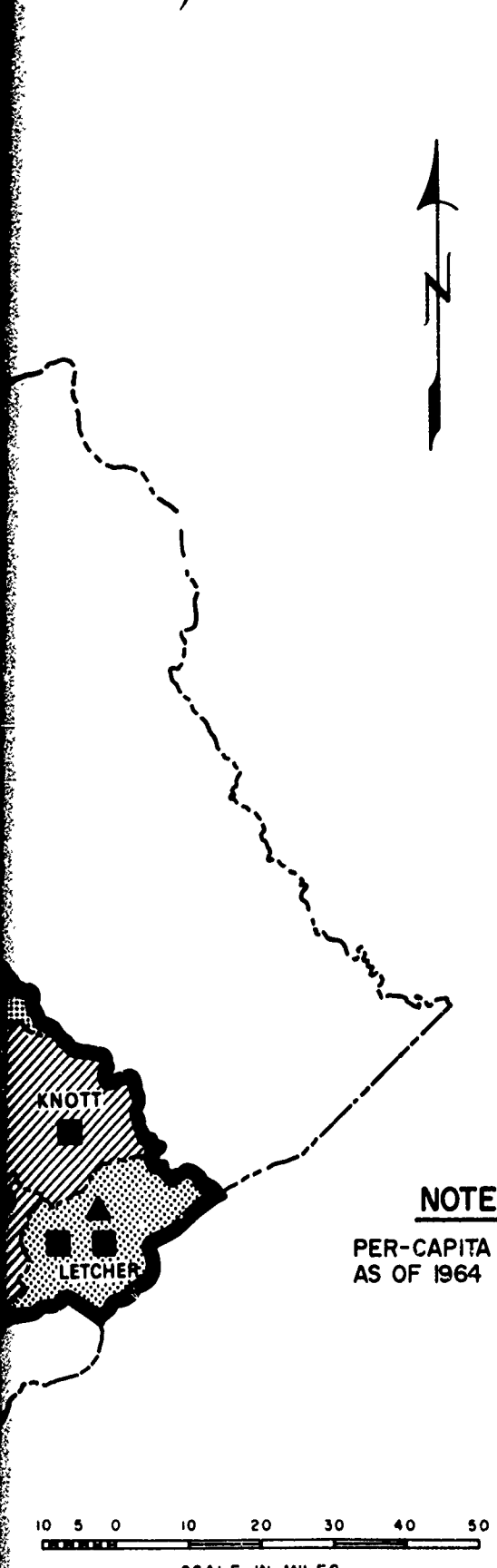
Numerous federal agencies, such as the Economic Development Administration and the Department of Housing and Urban Development (HUD) are sources for loans and grants that could be used for industrial, residential or municipal development in Water Sub-region H.

The 35 commercial banks, four industrial loan companies and nine savings and loan associations located in the study area (see Figure 15-22) are essential for financing required for area-wide development. This is particularly so where special knowledge of local conditions and people is necessary. Local sources of capital are expected to expand as development plans materialize. Also, capital is sufficiently mobile to be obtained from outside sources, particularly from the Lexington area.

Local Attitudes

Residents of the water sub-region are divided in their attitudes toward the future. Most businessmen, civic groups and organizations are trying to bring economic development into the area. State development areas are active in all but two of the 18 counties of the water sub-region. One local industrial development group is active in the area.


FLEMING
BATH
MONTGOMERY
CLARK
MENIFEE
POWELL
WOLFE
MADISON
ESTILL
GARRARD
LEE
LINCOLN
BREATHITT
OWSLEY
KNOT
LESLIE
PERRY
LE

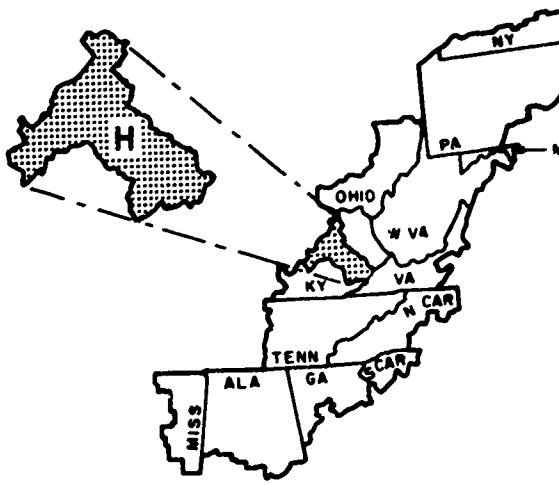


NOTE

PER-CAPITA DEPOSITS
AS OF 1964

10 5 0 10 20 30 40 50

SCALE IN MILES



VICINITY MAP

LEGEND

- ▲ SAVINGS & LOAN ASSOCIATION
- ■ COMMERCIAL BANKS
- ● INDUSTRIAL LOAN COMPANIES

BANK DEPOSITS PER-CAPITA BY COUNTY:

- LESS THAN $300
- $300 - $499
- $500 - $799
- $800 - $999
- $1000 - $1299

REPORT FOR
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IN
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WATER SUB-REGION H

FINANCIAL SITUATION

OFFICE OF APPALACHIAN STUDIES JUNE

11-15-57 FIGURE 1

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5. STATE PLANNING SUB-REGIONS

The relationship of state planning sub-regions and Water Sub-region H has been described (Paragraph 1) and is shown on Figure 15-14 (Page 15-43). The state planning sub-regions are used in Sub-region H as the principal geographic division for display of economic data. Graphical comparisons of the state planning sub-regions with the water sub-region are included in each of the following paragraphs.

The state planning sub-regions, within Water Sub-region H, are in two areas: State Planning Sub-regions 32A and 32B are in the mountain areas and are considered part of Central Appalachia. State Planning Sub-regions 35A, 35B, 36A, and 36B are on the western fringe of the mountains and are economically linked to Lexington, outside the sub-region.

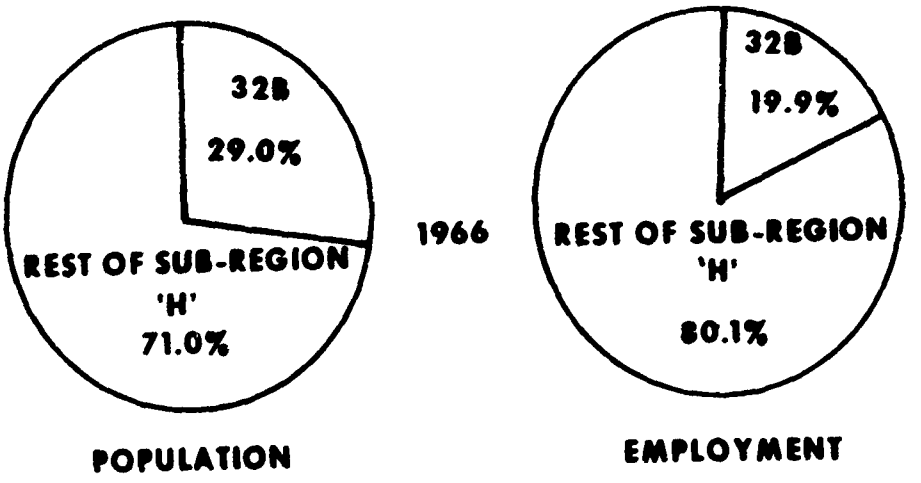
State Planning Sub-region 32B

State Planning Sub-region 32B (the Upper Kentucky River Development Area), comprised of Knott, Leslie, Letcher, and Perry Counties and situated at the headwaters of the Kentucky River, is extremely mountainous with the level land severely restricted to narrow valley floors.

The primary economic activity in the sub-region is coal mining. Leslie County has smaller coal mining operations and some marginal agriculture.

In 1960, nearly 85 percent of the area's population was classified as rural non-farm (less than 10 percent were urban dwellers) with the remainder being rural farm. Because of the nature of the dominant employment sectors, mining and agriculture, job opportunities are dispersed throughout the rural periphery. In 1966, about 29 percent of the water sub-region's population and 20 percent of the sub-region's jobs were found in State Planning Area 32B (see Figure 15-23). Commercial activity is centered in Hazard (Perry County) and the Whitesburg-Jenkins section of U.S. 119 in Letcher County. Hazard-Whitesburg has been designated by the Appalachian Regional Commission as a secondary growth area. Each of these currently active centers is or will be at an intersection of a major highway.

This planning sub-region has the least amount of developable flat land in Eastern Kentucky. Land suitable for industrial sites is limited to a few small tracts near Hazard, and along U.S. 119 in Letcher County. Highway transportation will be considerably improved with completion of Appalachian Development Highway (Interstates) Corridors R, F, and B. Corridor I, southern extension of the Mountain Parkway, will extend through sections of Knott, Perry, and Letcher Counties and will intersect with Corridor F at Whitesburg. Corridor F will intersect Corridor B at Jenkins in Letcher County. These routes will provide most of these counties with access to larger cities, north and south. Also, the State of Kentucky has recently announced plans for toll road construction, parallelling Kentucky 80 from Hazard to London and connecting with I-75.



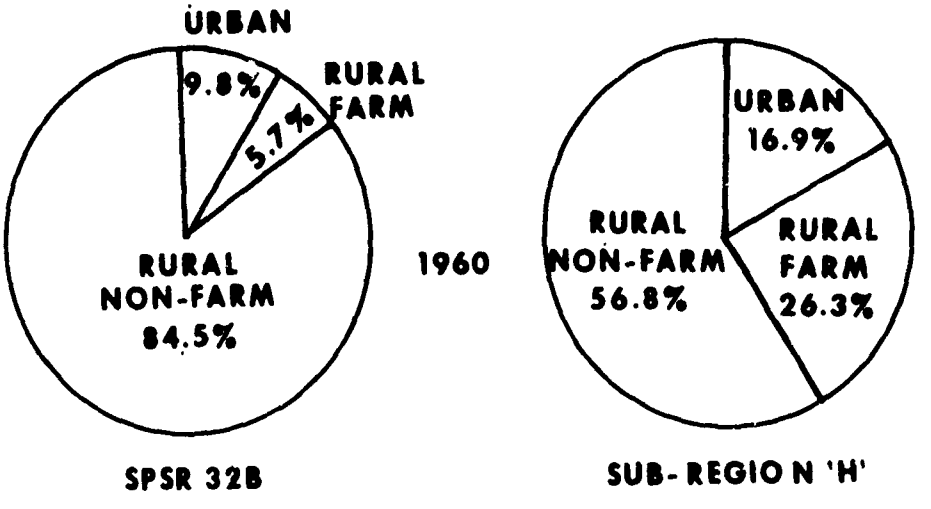


Figure 15-23. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 32B Compared to Water Sub-region H.

Rail transportation services all counties. Air service is limited to light aircraft at airports in Hazard and Whitesburg. The nearest airport with regular scheduled air service is at London-Corbin.

Population, 121,900 in 1950, declined by almost 25 percent to 93,400 in 1960. Part of this decline was due to out-migration of over 55,000 persons, a 45.6 percent out-migration rate. Population losses and out-migration continued in the 1960-1965 period at lower rates. Population declined by 6.9 percent to an estimated 87,000. The out-migration rate was 16.1 percent for the period.

The educational attainment level in the sub-region has remained rather low. In 1960, of all persons over 25 years of age, 76 percent had not received more than an eighth grade education. Eighteen percent had one to four years of high school and 6 percent had one or more years of college.

The state planning sub-region has experienced considerable unemployment. Between 1962 and 1965 the unemployment rate varied from a low of 14.7 percent to a high of 19.0 percent. Almost 3,000 people, or 17 percent of the available labor force, were unemployed in 1965.

Low income persists in State Planning Sub-region 32B. Approximately 44 percent of the sub-region's families earned under $2,000 per year in 1965, and almost 60 percent had incomes of less than $3,000. Relative gains in higher income classes and losses in lower classes were recorded between 1950 and 1960.

Hazard-Whitesburg

The Hazard-Whitesburg area has been designated as a secondary growth area by the Appalachian Regional Commission. Historically, the area has served as a service center for the coal mining industry. When mining mechanized, employment decreased and as a consequence, population in the towns declined. Hazard had a 1940 population of 7,397, declined to 6,985 by 1950 and 5,958 by 1960. Whitesburg, a much smaller community, had a population of 1,616 in 1940, decreased to 1,393 in 1950, but reversed the trend to reach a 1960 population of 1,774.

Coal mining continues to be the major employer with over one-third of the jobs in the area being in the mining sector. Second most important is the trade and service sector, mainly to serve the mining industry and those working in the industry. Manufacturing is limited and consists of food processing, lumber, furniture manufacturing, and some printing.

A large vocational school is located at Hazard and is willing to make arrangements with local plants to establish specific training courses to meet their needs. However, due to the lack of employment opportunities, many of the graduates move to Cincinnati, Detroit, and other large cities. Also, a community college at Hazard and a vocational school at Whitesburg have recently been established.

These communities have been interested in developing tourist attractions and facilities; each have a set of plans. One, known as Cloud City is in the Whitesburg area, and the other, Magic Mountain, is in Hazard.

One of the major problems in the area is the lack of suitable land for industrial sites. Most of the available tracts are small and located in bottomlands subject to flooding.

Tables 15-8 and 15-9 present the most recent census data for Kentucky State Planning Sub-region 32B.

TABLE 15-8
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 32B

	1950	1960	Absolute Change
TOTAL ALL SECTORS	28,263	17,208	- 11,055
PRIMARY ACTIVITIES	18,442	7,264	- 11,178
Agriculture	4,442	319	- 4,123
Forestry & Fisheries	11	9	- ?
Mining	13,989	6,936	- 7,053
SECONDARY ACTIVITIES	2,384	1,659	- 725
Contract Construction	823	762	- 61
Food & Kindred Products	143	241	98
Textile Mill Products	0	4	4
Apparel	2	0	- 2
Lumber, Wood Products, Furniture	1,252	459	- 793
Printing & Publishing	44	32	- 12
Chemicals & Allied Products	7	8	1
Electrical & Other Machinery	41	60	19
Motor Vehicles & Equipment	12	31	19
Other Transportation Equipt.	2	6	4
Other & Miscellaneous	58	56	- 2
TERTIARY ACTIVITIES	7,040	7,675	635
Transportation & Communications	859	659	- 200
Utilities & Sanitary Service	247	210	- 37
Wholesale Trade	244	288	44
Retail Trade	2,438	2,307	- 131
Finance, Ins. & Real Estate	146	140	- 6
Personal Services	1,118	1,084	- 34
Professional Services	1,337	2,201	864
Recreational Services	111	136	25
Public Administration	517	642	125
Armed Forces	23	8	- 15
NOT REPORTED	397	610	213

TABLE 15-9
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 32B
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	87,000
Absolute Change 1960-1965	-6,400
Percent Change 1960-1965	- 6.9

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	93,366	46,797	46,569	5,309	78,897	9,160
Percent Distribution	100.00	50.12	49.88	5.69	84.50	9.81
Percent Change 1950-1960	-23.44	-24.35	-22.50	-88.60	28.38	-34.13

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	8,895	3,062	5,120	2,244	718	20,039
Percent Distribution	44.39	15.28	25.55	11.20	3.58	100.00
Percent Change 1950-1960	-39.01	-47.57	61.01	331.54	241.90	-19.10

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	40,929	29,115	7,320	2,591
Percent Distribution	100.00	71.14	17.88	6.33
Percent Change 1950-1960	-14.29	-18.10	2.88	4.48

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	16,875	2,010	13,306	1,876	3,569	134
Percent Distribution	89.36	10.64	87.64	12.36	96.38	3.62
Percent Change 1950-1960	-40.25	71.79	-46.64	84.28	7.96	-11.84

RATE OF UNEMPLOYMENT, 1962-65

1962	18.8
1963	14.7
1964	19.0
1965	17.2

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	19,271	38,853	15,190	13,601	4,081	25,252
Percent Distribution	33.15	66.85	52.76	47.24	13.91	86.09
Percent Change 1950-1960	-34.53	-11.53	-41.51	20.82	17.91	-22.69

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	16.9	-0.7	-4.0
Tot. Employment	14.0	-0.3	-2.1
Unemployment	2.9	-0.4	-12.1

Includes persons in the Armed Forces.

State Planning Sub-region 32A

State Planning Sub-region 32A (Middle Kentucky River Development Area) is comprised of Breathitt, Lee, Owsley, and Wolfe Counties. Although the terrain is not as mountainous as that at the headwaters of the Kentucky River, elevations of 700 feet to 1400 feet above the valley floors are common. Level land consists almost entirely of floodable river and creek bottoms, except below dams or behind local flood protection works.

Economic activity is limited in this lightly-populated area. Wholesale and retail trade, and marginal agriculture heavily dependent on tobacco constitute the main activities. Total employment has declined with the decline in coal mining activity. Manufacturing has been concentrated in the lumber and wood products industry.

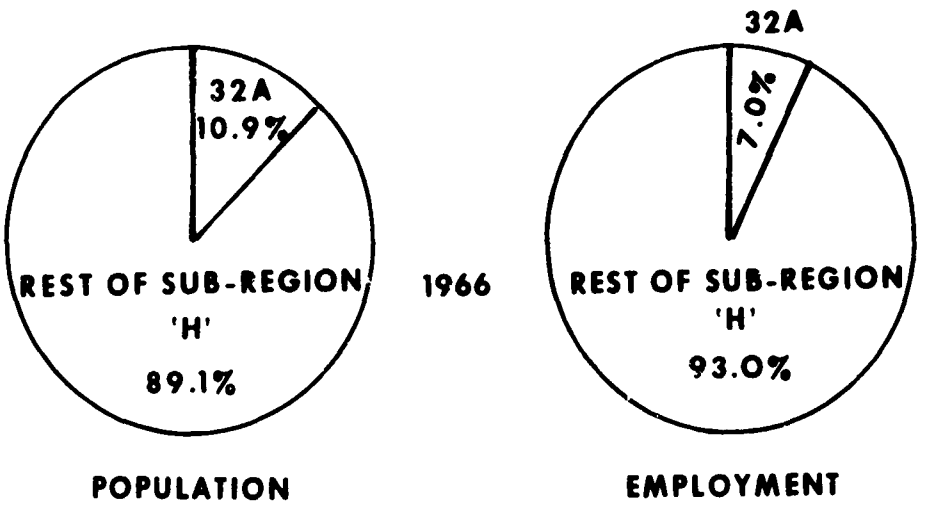
Because of population out-migration, due to continual decline of jobs, large population losses have been experienced for several decades. The 1950 population of 43,600 declined by over 20 percent to a level of 34,800 in 1960. A net out-migration rate of over 39 percent was registered for the same period. Approximately 65 percent of all persons in the 20-29 year age category left the state planning sub-region during the period.

A population decline of 6 percent occurred from 1960 to 1965, due mainly to an out-migration rate of over 13 percent. The majority of migrants are younger, better-educated, and more skilled persons of the area, who seek better work opportunities in urbanized northern areas. There were no towns large enough to be classified as urban centers; however, Jackson (population 1,852) has been classified as a secondary growth center. Beattyville (population 1,048) is the second largest community in the sub-region.

In 1960, the sub-region population was classified as 61.3 percent rural non-farm and 38.7 percent rural farm. In 1966, about 11 percent of Water Sub-region H's population and 7 percent of its jobs were located in State Planning Sub-region 32A. (See Figure 15-24.)

Although the level of educational attainment is increasing, the area population is relatively under-educated. Among persons 25 years of age and over, 80 percent have 8 years or less education; less than 10 percent have a high school education. The number of college graduates in the state planning sub-region is decreasing; again, largely because of out-migration.

Incomes of resident families are among the nation's lowest. In 1960, 65 percent of all families had an annual income of less than $2,000; 75 percent of area families received less than $3,000. Per-capita income in 1960 ranged from $763 in Lee County to $435 in Wolfe



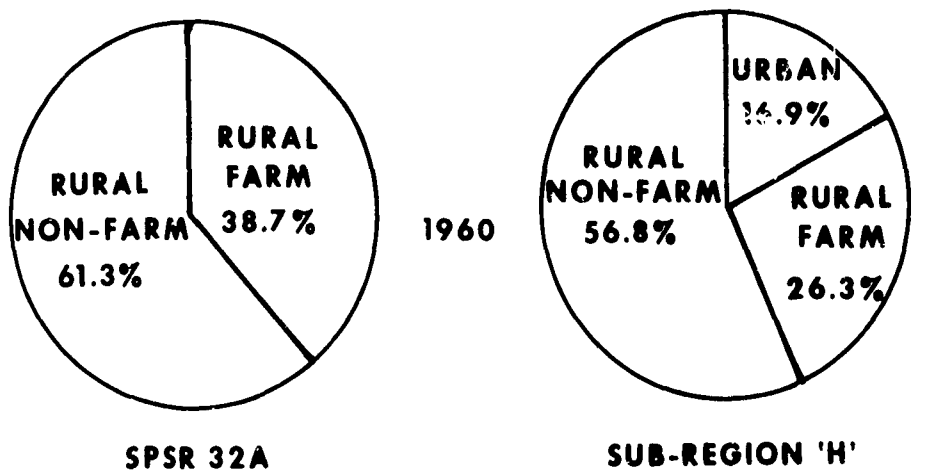


Figure 15-24. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 32A Compared to Water Sub-region H.

County. Low incomes in the state planning sub-region result from a lack of employment opportunities rather than low wages. The only source of income for many families is welfare payments. Often, working members of a family are employed only seasonally or part-time.

Unemployment rates as much as four times the national average, are commonly recorded. For State Planning Sub-region 32A, the 1965 rate was 23.4 percent, an increase from the 1962 figure of 18 percent. Increases in recent years have resulted from increases in the available work force and reduction in employment opportunities. For the same period, the absolute number of people employed has remained fairly constant.

The principal limits to rapid industrial expansion are the absence of a large population and available work force and a general shortage of land that is accessible, flood-free and level enough for inexpensive development into industrial sites. Protected level land is not served by adequate highways.

Jackson

Jackson, County Seat of Breathitt County, had a 1960 population of 1,852, which was 6.4 percent less than the 1950 population. Agriculture is the dominant economic activity of Breathitt County. Much of the farming, however, is part-time. About 65 percent of total farms are classified as part-time farms, having annual farm marketing receipts of under $2,500.

The wholesale and retail trade sectors accounted for 169 of the 367 industrial jobs in 1965. Practically all manufacturing is concentrated in the highly seasonal, low paying, lumbering and sawmill industry. Of the 105 manufacturing jobs, 73 percent were in this category.

Wages are low in the Jackson area. In 1963 the average weekly wage was $61.88 for all industries and $51.81 for manufacturing. The state averages for the same period were $89.54 and $102.47, respectively.

Tables 15-10 and 15-11 present the most recent census data for Kentucky State Planning Sub-region 32A.

TABLE 15-10
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 32A

	1950	1960	Absolute Change
TOTAL ALL SECTORS	11,298	6,361	- 4,937
PRIMARY ACTIVITIES	8,177	2,594	- 5,583
Agriculture	7,115	2,067	- 5,048
Forestry & Fisheries	12	11	- 1
Mining	1,050	516	- 534
SECONDARY ACTIVITIES	740	886	146
Contract Construction	365	454	89
Food & Kindred Products	21	16	- 5
Textile Mill Products	0	0	0
Apparel	0	0	0
Lumber, Wood Products, Furniture	252	307	55
Printing & Publishing	16	7	- 9
Chemicals & Allied Products	1	3	2
Electrical & Other Machinery	22	21	- 1
Motor Vehicles & Equipment	19	15	- 4
Other Transportation Equipt.	0	3	3
Other & Miscellaneous	44	60	16
TERTIARY ACTIVITIES	2,184	2,442	258
Transportation & Communications	359	210	- 149
Utilities & Sanitary Service	45	53	8
Wholesale Trade	66	56	- 10
Retail Trade	592	682	90
Finance, Ins. & Real Estate	28	38	10
Personal Services	284	262	- 22
Professional Services	517	790	273
Recreational Services	26	30	4
Public Administration	256	317	61
Armed Forces	11	4	- 7
NOT REPORTED	197	439	242

TABLE 15-11
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 32A
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	32,700
Absolute Change 1960-1965	-2,100
Percent Change 1960-1965	- 6.0

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	34,813	17,550	17,263	13,489	21,324	-
Percent Distribution	100.00	50.41	49.59	38.75	61.25	-
Percent Change 1950-1960	-20.23	-21.03	-19.40	-58.71	94.37	-

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	4,814	975	1,334	434	129	7,686
Percent Distribution	62.63	12.69	17.36	5.65	1.68	100.00
Percent Change 1950-1960	-32.67	0.00	151.70	520.00	545.00	-14.84

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	16,241	11,980	2,183	982
Percent Distribution	100.00	73.76	13.44	6.05
Percent Change 1950-1960	-12.31	-17.92	18.64	-4.20

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	6,682	563	5,054	495	1,628	68
Percent Distribution	92.23	7.77	91.08	8.92	94.99	4.01
Percent Change 1950-1960	-40.80	171.98	-49.94	176.54	36.58	142.86

RATE OF UNEMPLOYMENT, 1962-65

1962	18.0
1963	22.7
1964	23.4
1965	23.4

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	6,871	15,865	5,553	5,859	1,318	10,006
Percent Distribution	30.22	69.78	48.66	51.34	11.64	88.36
Percent Change 1950-1960	-40.28	1.07	-46.00	64.35	7.94	-17.52

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	6.4	0.3	4.9
Tot. Employment	4.9	0.1	2.0
Unemployment	1.5	0.4	36.4

State Planning Sub-region 35A

State Planning Sub-region 35A (the Foothills Development Area) is composed of Clark, Madison, Estill, and Powell Counties situated along the eastern and southeastern edges of the central bluegrass area of Kentucky. The terrain varies from the gently rolling land of the bluegrass to the foothills of the Cumberland Plateau. It is deeply cut by the meandering Kentucky River and its tributaries. The area can be divided into two portions from the economic standpoint. One portion is oriented toward Richmond, 25 miles southeast of Lexington on Interstate Highway 75. Berea and Irwin are closely related to Richmond. Richmond-Berea has been designated as a secondary growth area. The other portion is related to Winchester, 15 miles to the east of Lexington, at the intersection of I-64 and the Mountain Parkway. Winchester, which has been designated a primary growth area, is also an important railroad junction.

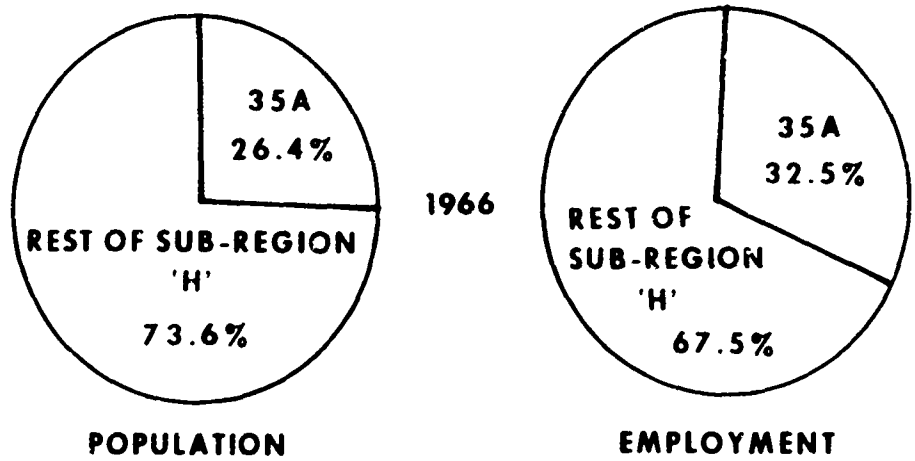
State Planning Sub-region 35A has a diverse manufacturing base. Products manufactured or processed in th area include furniture, pressure gauges, rubber rings, pottery, work clothing, coal processing, rough lumber, lamps, poultry, meat products, vehicle axles, metal tubing, mattresses and bed springs, and charcoal.

The state planning sub-region has experienced continuous population increases since 1950, with urban population also increasing over this same period. In 1960, over 40 percent of the population was classified as urban, 36 percent rural non-farm, and the remaining 24 percent rural farm. The state planning sub-region contained about 26 percent of the population in Water Sub-region H and over 32 percent of the water sub-region's jobs in 1966 (see Figure 15-25).

Transportation in the sub-region is generally good. With the exception of Estill County, four-lane, limited access highways traverse the counties and Estill County will soon be connected with Richmond by an improved highway, Kentucky 52. Rail transportation is very good with service to all counties except Powell. Air transportation is limited to light aircraft with airports at Richmond-Berea and Stanton. Scheduled air service is available from nearby Lexington.

Unlike the mountain areas of Sub-region H, the population in State Planning Sub-region 35A has continued to increase since 1950. The 1960 population of 73,697 was an increase of nearly three percent over the 1950 population. Since 1960, the population has increased to nearly 82,000.

In 1960, of all persons over 25 years of age, over 58 percent had received no more than an eighth grade education. About 26 percent had gone to high school one or more years and 12 percent had entered college.



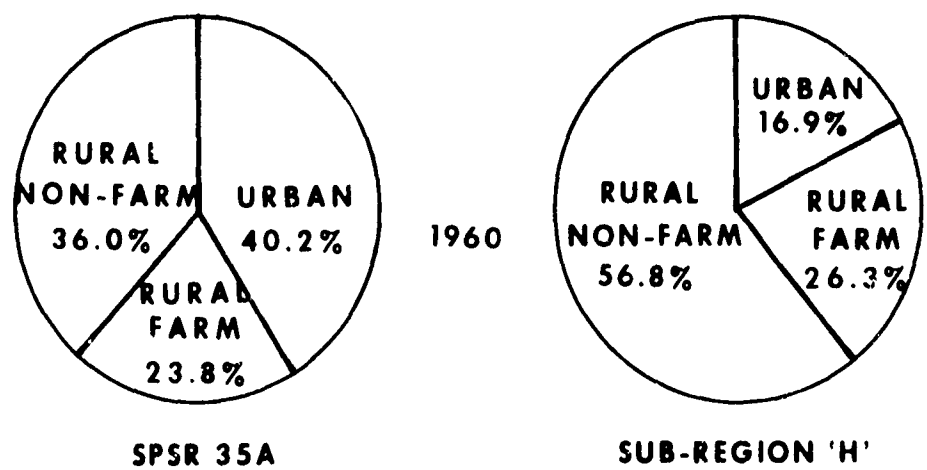


Figure 15-25. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 35A Compared to Water Sub-region H.

The state planning sub-region had an unemployment rate of 10.9 in 1962. This steadily declined to 5.7 by 1966. Clark County had the lowest rate (3.0) while Estill County had the highest (17.4 percent) in 1966.

Families with annual incomes of less than $3,000 declined from 12,520 to 8,284 over the period 1950-1960. This was still 45 percent of all families in 1960. Families with annual incomes greater than $7,000 increased from 565 in 1950 to 2,939 in 1960.

Richmond-Berea

This secondary growth area, located in Madison County, has had a net increase in population for the last six decades. Richmond had a 1960 population of 12,168, an increase of 18.5 percent over 1950 while Berea population increased 27.6 percent from 1950 to 4,302 by 1960. Madison County followed the same pattern showing a 7.4 percent increase for the same period.

Agriculture is the largest employment sector with 2,986 people reported employed in the fall of 1959. In June 1965, there were 1,526 manufacturing jobs in Madison County and 1,392 persons employed in wholesale and retail trade. Products manufactured or processed in the area include electric light bulbs, dairy and meat products, soft drinks, newsprint and publishing, tools and dies, furniture, lumber, pressure gauges, rubber seals, and blankets. There are two colleges in the area; Berea College in Berea and Eastern Kentucky State College in Richmond.

Madison County wage rates are below the state average. During 1961, weekly wages were $63.88 for all industries and $77.92 for manufacturing. State averages for this period were $83.44 and $96.07, respectively.

Winchester

This primary growth area, located in Clark County, has shown a net population increase in each decade in the past 60 years except in the 1920's. The 1960 population was 10,187, an increase of 9.9 percent over 1950.

Agriculture was the largest employment sector in Clark County in the fall of 1959 with 1,727 hired or family workers. Manufacturing employed 1,603 persons in June 1965. Also, there were 3,337 additional persons employed in non-agricultural industries at that time. Textile-apparel operations, food processing and the manufacture of tubing, bedsprings, and electric lamps are of importance.

Winchester is the crossing point of the main line of the Chesapeake and Ohio and the Louisville and Nashville Railroads. This, along

with the construction of Interstate 64 and Appalachian Corridor I, which intersect in the city, have enhanced the developmental potential of Winchester.

Tables 15-12 and 15-13 present the most recent census data for Kentucky State Planning Sub-region 35A.

TABLE 15-12
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 35A

	1950	1960	Absolute Change
TOTAL ALL SECTORS	23,534	24,405	871
PRIMARY ACTIVITIES	8,144	4,984	- 3,160
Agriculture	7,908	4,679	- 3,229
Forestry & Fisheries	25	19	- 6
Mining	211	286	75
SECONDARY ACTIVITIES	3,527	5,771	2,244
Contract Construction	1,499	1,832	333
Food & Kindred Products	197	352	155
Textile Mill Products	65	89	24
Apparel	547	616	69
Lumber, Wood Products, Furniture	434	380	- 54
Printing & Publishing	93	198	105
Chemicals & Allied Products	65	65	0
Electrical & Other Machinery	414	1,348	934
Motor Vehicles & Equipment	16	40	24
Other Transportation Equipt.	2	12	10
Other & Miscellaneous	195	839	644
TERTIARY ACTIVITIES	11,312	13,188	1,876
Transportation & Communications	1,452	1,129	- 323
Utilities & Sanitary Service	281	466	185
Wholesale Trade	433	400	- 33
Retail Trade	2,580	3,555	975
Finance, Ins. & Real Estate	310	481	171
Personal Services	1,901	1,974	73
Professional Services	2,644	3,490	846
Recreational Services	129	130	1
Public Administration	1,546	1,537	- 9
Armed Forces	36	26	- 10
NOT REPORTED	551	462	- 89

TABLE 15-13
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 35A
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	79,200
Absolute Change 1960-1965	5,500
Percent Change 1960-1965	7.5

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	73,697	36,236	37,461	17,521	26,564	29,612
Percent Distribution	100.00	49.17	50.83	23.77	36.04	40.18
Percent Change 1950-1960	2.98	1.70	4.24	-38.43	56.41	13.35

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	5,612	2,672	6,035	2,829	1,150	18,298
Percent Distribution	30.67	14.60	32.98	15.46	6.28	100.00
Percent Change 1950-1960	-37.92	-23.22	96.90	454.71	303.51	5.43

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or more Yrs. of College
Number	38,241	22,422	9,817	4,724
Percent Distribution	100.00	58.63	25.67	12.35
Percent Change 1950-1960	5.84	2.27	22.64	3.03

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	24,379	1,612	16,532	1,206	7,849	406
Percent Distribution	93.80	6.20	93.20	6.80	95.08	4.92
Percent Change 1950-1960	3.75	82.97	-9.05	63.86	47.48	180.00

RATE OF UNEMPLOYMENT, 1962-65

1962	10.9
1963	9.6
1964	7.4
1965	5.8

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	26,017	26,461	17,764	7,732	8,253	18,729
Percent Distribution	49.58	50.42	69.67	30.33	30.59	69.41
Percent Change 1950-1960	6.56	-1.24	-6.24	21.12	50.91	-8.23

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	
Tot.Work Force	24.3	.4	6.1
Tot.Employment	22.9	2.3	12.1
Unemployment	1.4	-1.1	-44.0

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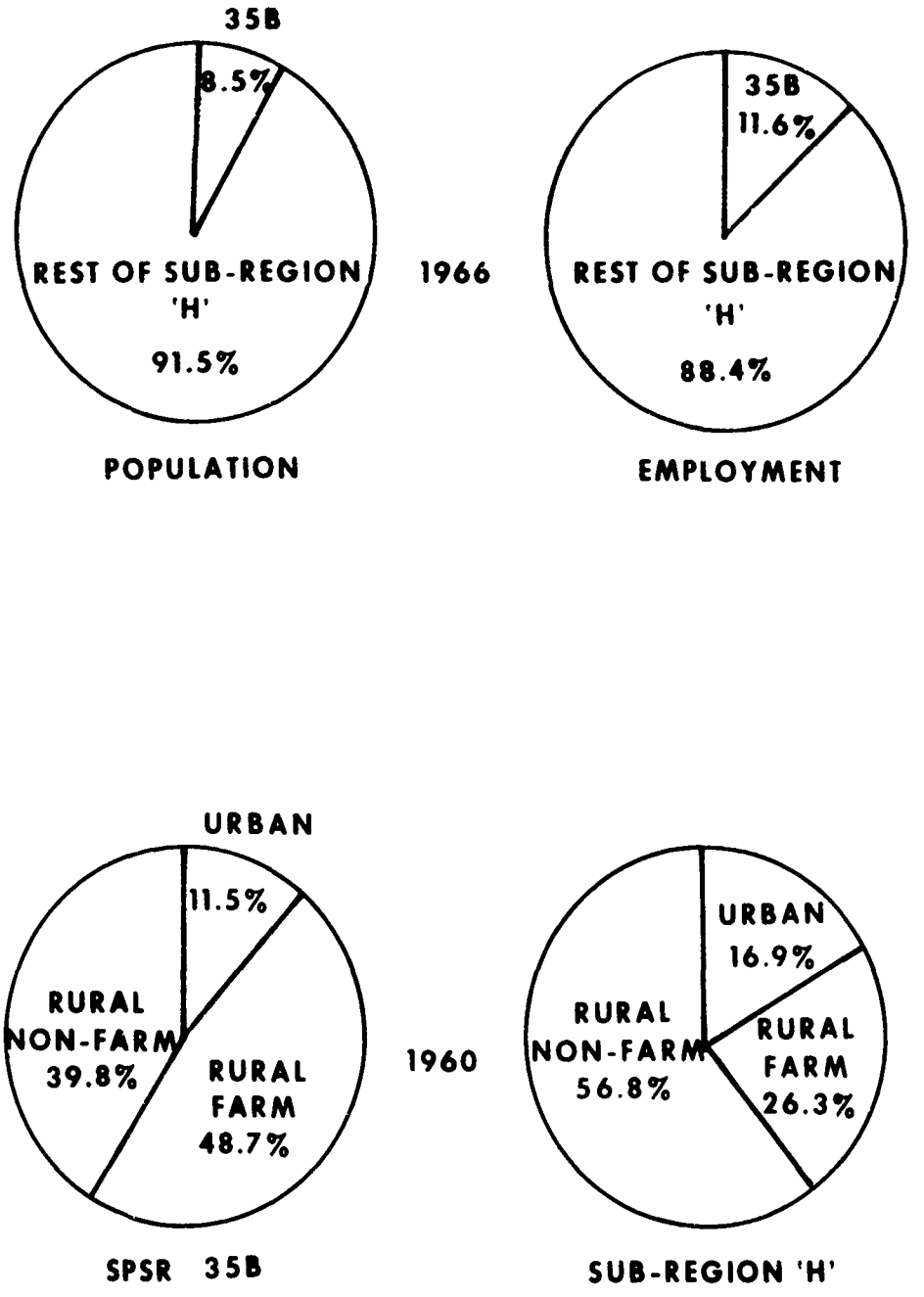


Figure 15-26. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 35B Compared to Water Sub-region H.

of over $6,000. Although these figures indicate low family income, they are much improved over the 1950 situation.

Tables 15-14 and 15-15 present the most recent census data for Kentucky State Planning Sub-region 35B.

TABLE 15-14
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 35B

	1950	1960	Absolute Change
TOTAL ALL SECTORS	9,500	8,519	- 981
PRIMARY ACTIVITIES	5,468	3,442	- 2,026
Agriculture	5,440	3,391	- 2,049
Forestry & Fisheries	2	0	- 2
Mining	26	51	25
SECONDARY ACTIVITIES	1,087	1,988	901
Contract Construction	430	521	91
Food & Kindred Products	101	161	60
Textile Mill Products	2	0	- 2
Apparel	344	756	412
Lumber, Wood Products, Furniture	94	122	28
Printing & Publishing	21	28	7
Chemicals & Allied Products	7	8	1
Electrical & Other Machinery	11	130	119
Motor Vehicles & Equipment	6	8	2
Other Transportation Equipt.	0	4	4
Other & Miscellaneous	71	250	179
TERTIARY ACTIVITIES	2,683	2,995	312
Transportation & Communications	357	251	- 106
Utilities & Sanitary Service	39	39	0
Wholesale Trade	102	126	24
Retail Trade	851	1,036	185
Finance, Ins. & Real Estate	89	125	36
Personal Services	594	582	- 12
Professional Services	440	613	173
Recreational Services	33	16	- 17
Public Administration	176	203	27
Armed Forces	2	4	2
NOT REPORTED	262	94	- 168

TABLE 15-15
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 35B
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	25,700
Absolute Change 1960-1965	- 600
Percent Change 1960-1965	- 2.3

POPULATION 1960						
	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	26,250	13,198	13,052	12,776	10,453	3,021
Percent Distribution	100.00	50.28	49.72	48.67	39.82	11.51
Percent Change 1950-1960	-11.61	-11.86	-11.36	-30.40	-7.83	-

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	2,660	1,079	2,062	870	255	6,926
Percent Distribution	38.41	15.58	29.77	12.56	3.68	100.00
Percent Change 1950-1960	-40.02	-11.92	84.11	461.29	410.00	-6.78

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	14,402	9,209	3,577	1,092
Percent Distribution	100.00	63.94	24.84	7.58
Percent Change 1950-1960	-6.30	-12.88	24.42	-11.94

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	8,515	460	6,168	357	2,347	103
Percent Distribution	94.87	5.13	94.53	5.47	95.80	4.20
Percent Change 1950-1960	-10.35	226.24	-22.88	257.00	56.47	151.22

RATE OF UNEMPLOYMENT, 1962-65

1962	13.0
1963	10.8
1964	12.8
1965	9.9

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	8,979	9,631	6,529	2,768	2,450	6,863
Percent Distribution	48.25	51.75	70.23	29.77	26.31	73.69
Percent Change 1950-1960	-6.87	-13.83	-19.39	17.24	5.22	-21.15

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	9.1	- 0.1	- 1.1
Tot. Employment	8.2	0.2	2.5
Unemployment	0.9	- 0.3	-25.0

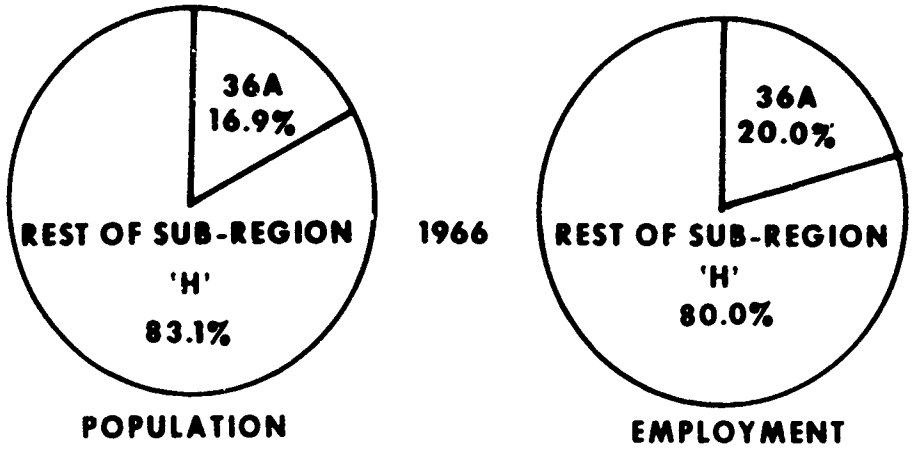
State Planning Sub-region 36A

State Planning Sub-region 36A (the Gateway Development Area) is composed of Montgomery, Bath, Rowan, Morgan, and Menifee Counties situated along the edge of the Cumberland Plateau, midway between Lexington and Ashland, Kentucky. A large portion of the sub-region is in the Licking River Watershed. The terrain, is very hilly with the exception of the Licking River bottoms below the new Cave Run Dam and some of the rolling agricultural lands in Bath and Montgomery Counties.

Rowan and Morgan Counties are located in Water Sub-region G, but are discussed in this section since they relate closely to the other three counties of State Planning Sub-region 36A which lie within Water Sub-region H.

Two communities have been designated as growth areas in this state planning sub-region. The Midland-Morehead area has been designated as a primary growth area and the community of Mount Sterling as a secondary growth area. From an economic standpoint, the state planning sub-region can be divided into three zones. Of these, the Mount Sterling labor shed is the most active industrially. Nearly all new manufacturing growth has been occurring there, and a diverse economy has developed. In addition to Montgomery County, much of Bath and Menifee Counties are also included in this labor shed zone. The second zone centers around Morehead and will include the new community of Midland, which is to be built below the Cave Run Dam now under construction. Morehead State University and wood processing comprise the economic base for this zone at the present time. The third zone is centered around West Liberty in Morgan County. Morgan County is the only county with important commercial coal production and to a certain extent resembles Central Appalachia more than it does the remaining counties in the Gateway Development Area.

State Planning Sub-region 36A has a diverse manufacturing base. Products manufactured or processed in the sub-region include hermetic motors, mattresses, bedding, home dishwashers, coveralls, mens shorts, tobacco, clay sewer pipe, dimension stock, hardwood flooring, barrel staves, and poultry. The state planning sub-region experienced a decline in population between 1950 and 1960. However, current estimates indicate that the population has been increasing since 1960. In 1960, about 19 percent of the population was classified as urban, 43 percent rural non-farm, and the remaining 38 percent rural farm. In 1966, the state planning sub-region contained about 17 percent of the population in Water Sub-region H and 20 percent of the water sub-region's jobs (see Figure 15-27).



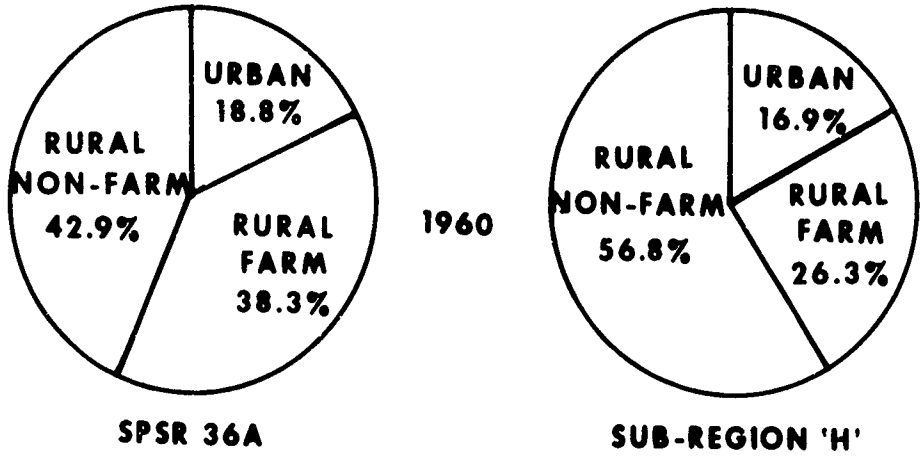


Figure 15-27. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 36A Compared to Water Sub-region H.

Highway transportation in the sub-region is fairly good. Interstate 64 traverses the northern portion of the sub-region and connects Mount Sterling, Midland, and Morehead. The Commonwealth of Kentucky has recognized the importance of developing access roads to link county seat towns to Midland and to serve the tourist industry. The main line of the C&O Railroad serves the planning sub-region in the general vicinity of Interstate 64. Air transportation is limited to light aircraft at Mount Sterling. Scheduled air service is available from nearby Lexington and Ashland-Huntington.

Population in the sub-region declined over seven percent from 1950 to 1960. Since 1960, the trend has reversed and the population has increased from 50,715 to a total of 52,400 in 1966.

As of 1960, about 69 percent of all persons over 25 years of age had received no more than an eighth grade education. Nearly 20 percent had one to four years of high school and about ten percent had one or more years of college.

The unemployment rate has been fairly high for the planning sub-region. In 1962, it was 15.2 percent, and it declined to 8.5 percent in 1966. The rate has varied considerably among the counties. In 1966, Montgomery reported only four percent unemployment, while Menifee County reported 19.5 percent.

In 1960, sixteen percent of the families in the state planning sub-region had incomes of less than $3,000. This was a decline from 1,980 families in 1950 to 1,883 families in 1960. Families with annual incomes greater than $7,000 increased from 255 in 1950 to 871 in 1960, with nearly half located in Montgomery County.

The Commonwealth of Kentucky reported that the problems of the sub-region include a general shortage of developable industrial land at points other than at Midland; poor access roads serving I-64; inadequate performance of the public school system; and incomplete urban services at existing centers. Although Midland will be highly interrelated with the development of the area, the preliminary program developed for this planning sub-region concerns itself with area-wide development to both foster and accommodate development of the Midland area.

Midland-Morehead

The Midland-Morehead area has been designated as a primary growth area, centered on the new town of Midland. The existing community of Morehead had a population of 4,170 in 1960. This was an increase of 1,068 over the 1950 census. The 1940 population was 1,901 persons. Morehead is the county seat of Rowan County, a predominantly rural county with employment in agriculture and manufacturing. There were 861 workers employed in agriculture in the fall of 1959.

As of September, 1962, there were 789 employees in manufacturing and 386 in wholesale and retail trade. Total employment at that time in all industries was 1,530 persons, excluding those directly employed in agriculture. Most of the manufacturing is in lumber processing and apparel. There is also employment in concrete and asphalt mixing, soft drink and dairy food processing.

Because of the lack of urban centers of adequate size to service the population of Water Sub-region H, as well as the problems associated with renovating existing towns, the Area Development Office of the Commonwealth of Kentucky has proposed that a completely new town be built on a 22,000 acre site located in the Licking River Valley in Bath County. The site, located midway between Lexington and Ashland, would be made flood free through construction of Cave Run Reservoir and a local protection project by the Corps of Engineers. These projects would also provide necessary water supply.

Midland, the proposed name of the new town, would be strategically located in terms of transportation arteries, with rail, I-64, U.S. 60 and State routes already available. A small airport also exists. Relatively large land sites would permit low-cost construction of industrial and commercial facilities.

Midland's industrial base would provide job opportunities for a significant portion of the citizens of Water Sub-region H. Jobs could be situated there or in smaller towns on the periphery where small industry might locate. Commuting distances to Midland from many points in the water sub-region are reasonable.

A detailed analysis of Midland can be found in Part III - Chapter 16 of this report entitled "Midland Local Protection Project."

Mount Sterling

Mount Sterling, located in Montgomery County, has been designated a secondary growth center. The city, which had a population of 5,370 in 1960, has been experiencing a steady increase of population since 1870, with a slight decrease of -1.9 percent occurring in 1900. The largest increases were during the period 1930 to 1950 and the smallest, 1.4 percent, occurred during the period 1950 to 1960.

Montgomery County is primarily rural; thus agriculture accounts for the largest employment sector. There were 1,109 family workers and 117 hired workers employed in agriculture in the fall of 1959. Manufacturing was next largest, with 786 workers reported in March of 1964. Total employment at that time in all industries, excluding agriculture, was 1,808. The clothing, textile, and leather industries account for the largest employment in the Mount Sterling area, with 605 employees reported in 1964. The second largest manufacturing employment sectors

are machinery, metal products, and equipment, which is the high wage industry. Other forms of manufacturing include tobacco redrying, food processing, newspaper publishing and the manufacturing of concrete pipe and blocks.

Mount Sterling has good rail and truck service. Interstate Highway 64 gives access to markets in four directions and the Chesapeake and Ohio Railroad provides good rail service.

Tables 15-16 and 15-17 present the most recent census data for Kentucky State Planning Sub-region 36A.

TABLE 15-16
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 36A

	1950	1960	Absolute Change
TOTAL ALL SECTORS	16,256	14,453	- 1,803
PRIMARY ACTIVITIES	8,655	4,775	- 3,880
Agriculture	8,395	4,581	- 3,814
Forestry & Fisheries	9	24	15
Mining	251	170	- 81
SECONDARY ACTIVITIES	2,215	2,987	772
Contract Construction	892	1,106	214
Food & Kindred Products	86	175	89
Textile Mill Products	9	5	- 4
Apparel	405	553	148
Lumber, Wood Products, Furniture	463	611	148
Printing & Publishing	38	85	47
Chemicals & Allied Products	3	11	8
Electrical & Other Machinery	18	76	58
Motor Vehicles & Equipment	11	20	9
Other Transportation Equipt.	2	4	2
Other & Miscellaneous	288	341	53
TERTIARY ACTIVITIES	4,993	6,435	1,442
Transportation & Communications	497	492	- 5
Utilities & Sanitary Service	224	238	14
Wholesale Trade	211	317	106
Retail Trade	1,522	1,913	391
Finance, Ins. & Real Estate	159	203	44
Personal Services	1,012	1,174	162
Professional Services	914	1,476	562
Recreational Services	68	99	31
Public Administration	374	508	134
Armed Forces	12	15	3
NOT REPORTED	393	256	- 137

TABLE 15-17
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 36A
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965	
Total	50,900
Absolute Change 1960-1965	200
Percent Change 1960-1965	0.4

POPULATION 1960	Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Number	50,715	25,620	25,095	19,444	21,731	9,540
Percent Distribution	100.00	50.52	49.48	38.34	42.85	18.81
Percent Change 1950-1960	-7.06	-7.20	-6.92	-38.16	-47.58	13.63

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	5,113	1,993	3,641	1,179	373	12,299
Percent Distribution	41.57	16.20	29.60	9.59	3.03	100.00
Percent Change 1950-1960	-38.55	0.66	141.93	328.73	239.09	-3.12

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	25,825	17,796	5,010	2,431
Percent Distribution	100.00	68.91	19.40	9.41
Percent Change 1950-1960	-1.97	-6.53	21.16	19.75

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	14,438	931	10,836	785	3,602	146
Percent Distribution	93.94	6.06	93.24	6.76	96.10	3.90
Percent Change 1950-1960	-11.12	96.41	-21.14	88.70	43.91	151.72

RATE OF UNEMPLOYMENT, 1962-65

1962	15.2
1963	9.0
1964	7.9
1965	7.2

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	15,384	19,988	11,636	6,056	3,748	13,932
Percent Distribution	43.49	56.51	65.77	34.23	21.20	78.80
Percent Change 1950-1960	-8.05	-2.09	-17.87	32.69	46.29	-12.10

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Tot. Work Force	15.2	- 0.6	- 3.8
Tot. Employment	14.1	0.7	5.2
Unemployment	1.1	- 1.3	-54.2

State Planning Sub-region 36B

State Planning Sub-region 36B consists of Fleming and Lewis Counties which are a part of a five county area known as the Buffalo Trace Development Area. The area, situated along the south bank of the Ohio River midway between Cincinnati and Portsmouth, Ohio, is a level to rolling plateau deeply cut by tributaries of the Ohio River with a high escarpment overlooking most of the bottomlands along the river. The area's economy is divided between agriculture, primarily in Fleming County, and manufacturing plants which have recently located in Flemingsburg and Vanceburg. Manufacturing activities include automotive parts and metal stamping and apparel.

Lewis County is located in Water Sub-region G but is included in this discussion rather than being presented separately in Part II, Chapter 13 of this report.

The 1960 population for the two counties was 24,005. Approximately 54 percent was rural non-farm and 46 percent was rural farm. There were no towns in the sub-region large enough to be classified as urban. The two major communities are Flemingsburg and Vanceburg with a population of 2,067 and 1,881, respectively. As of 1966, the sub-region contained about eight percent of the total population in Water Sub-region H and nine percent of the employment in the water sub-region (see Figure 15-28).

The present transportation system is deficient and constrains the development of the area. The only strong elements are the C&O rail service and barge service available at Vanceburg and along the south shore of the Ohio River in general. The L&N Railroad has a spur to Maysville from Winchester, which crosses the tip of Fleming County. There is no air service available in the state planning sub-region. The highway system is also inadequate with no class AAA highways serving the area. U.S. Highway 68, Kentucky 11 from Maysville to Flemingsburg, and Kentucky 32 running east-west through Flemingsburg are all rated AA (59,600 pounds gross limit), but are substandard with respect to modern requirements, especially with respect to alignment. All other highways are restricted to 42,000 pound loads and restricted bridges exist throughout the area.

The 1960 population of 24,005 represented a decline of 5.8 percent over the 1950 population. Following 1960, the decline stopped and the estimated population in 1965 was 25,100, a 4.5 percent increase over 1960.

Nearly 72 percent of all persons over 25 years of age had received no more than an eight grade education in 1960. At this same time, only 20 percent had attended high school one or more years and about six percent attended college for more than one year.

The unemployment rate in this planning sub-region has been lower than most of those in Water Sub-region H. The 1962 rate was 8.2

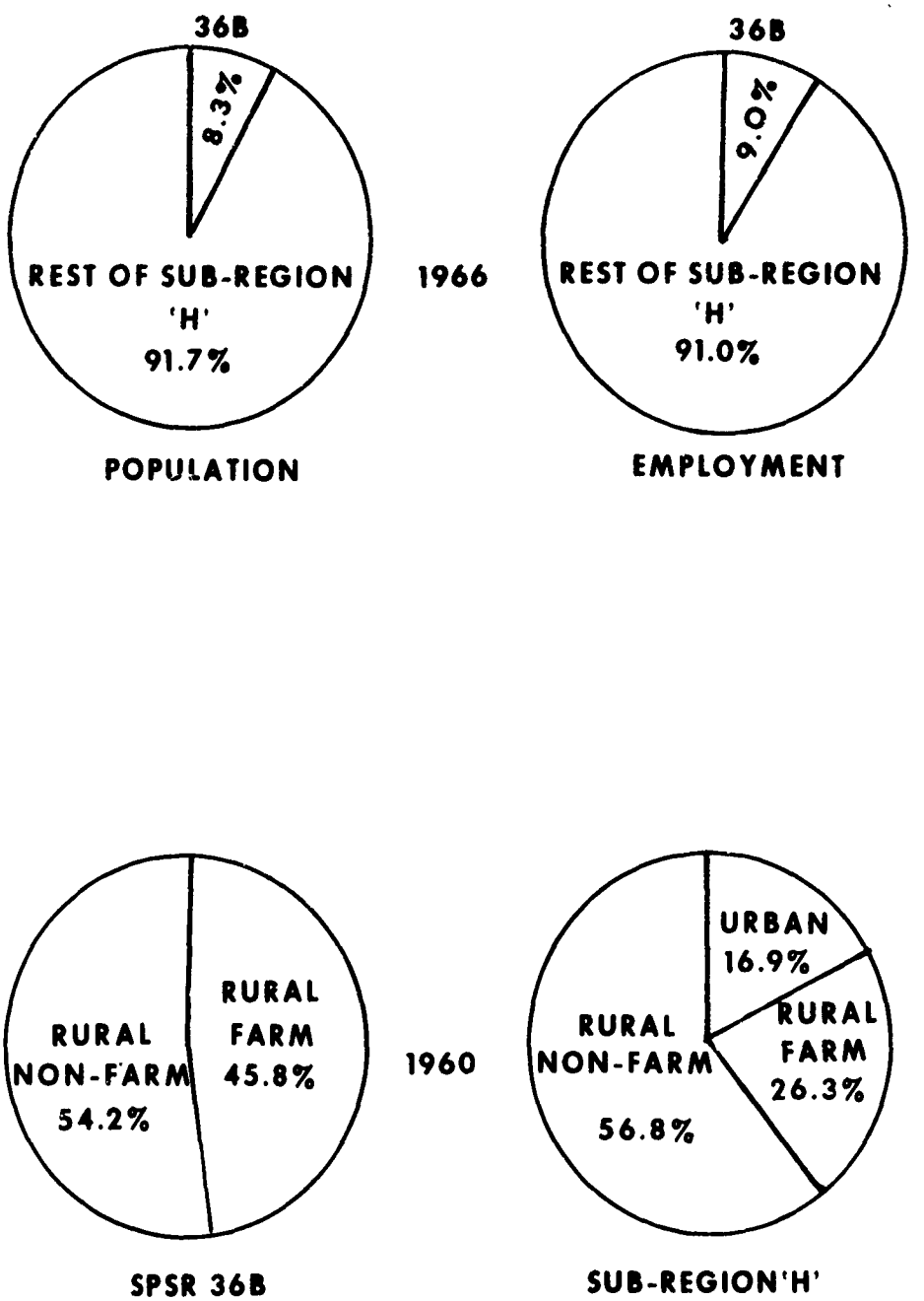


Figure 15-28. Population, Employment and Urban-Rural Population Distribution of State Planning Sub-region 36B Compared to Water Sub-region H.

percent. This has steadily gone down reaching 2.6 percent in 1966; Fleming County had 1.8 and Lewis County 3.6 percent rates, respectively.

There were 3,253 families in the sub-region in 1960 with less than $3,000 income. This was 54 percent of the families. Approximately 15 percent of the families had $6,000 or more annual income.

Tables 15-18 and 15-19 present the most recent census data for Kentucky State Planning Sub-region 36B.

TABLE 15-18
EMPLOYMENT BY SECTORS FOR 1950 AND 1960
KENTUCKY STATE PLANNING SUB-REGION 36B

	1950	1960	Absolute Change
TOTAL ALL SECTORS	7,778	7,060	- 718
PRIMARY ACTIVITIES	4,757	2,739	- 2,018
Agriculture	4,719	2,718	- 2,001
Forestry & Fisheries	7	13	6
Mining	31	8	- 23
SECONDARY ACTIVITIES	1,028	1,808	780
Contract Construction	463	589	126
Food & Kindred Products	21	62	41
Textile Mill Products	5	31	26
Apparel	7	111	104
Lumber, Wood Products, Furniture	237	206	31
Printing & Publishing	10	26	16
Chemicals & Allied Products	1	4	3
Electrical & Other Machinery	27	47	20
Motor Vehicles & Equipment	3	54	51
Other Transportation Equipt.	7	66	59
Other & Miscellaneous	247	612	365
TERTIARY ACTIVITIES	1,827	2,340	513
Transportation & Communications	321	187	- 134
Utilities & Sanitary Service	71	82	11
Wholesale Trade	43	55	12
Retail Trade	599	860	261
Finance, Ins. & Real Estate	62	101	39
Personal Services	283	400	117
Professional Services	284	517	233
Recreational Services	17	37	20
Public Administration	140	91	- 49
Armed Forces	7	10	3
NOT REPORTED	166	173	7

TABLE 15-19
SOCIO-ECONOMIC CHARACTERISTICS
KENTUCKY STATE PLANNING SUB-REGION 36B
(For Dates and Periods Indicated)

ESTIMATED POPULATION 1965		POPULATION 1960						
			Total	Male	Female	Rural Farm	Rural Non-Farm	Urban
Total	25,100	Number	24,005	12,125	11,880	10,996	13,009	-
Absolute Change 1960-1965	1,100	Percent Distribution	100.00	50.51	49.49	45.81	54.19	-
Percent Change 1960-1965	4.6	Percent Change 1950-1960	-5.80	-7.62	-3.86	-32.17	40.33	-

DISTRIBUTION OF FAMILIES BY INCOME, 1960

	Under $2000	$2000-$2999	$3000-$5999	$6000-$9999	$10,000 & Over	Total
Number	2,369	884	1,851	690	232	6,026
Percent Distribution	39.31	14.67	30.72	11.45	3.85	100.00
Percent Change 1950-1960	-41.29	-13.76	164.43	711.76	4,540.00	-2.02

EDUCATION OF PERSONS 25 YRS. AND OVER, 1960

	Total	1-8 Years Elementary School	1-4 Years High School	1 or More Yrs. of College
Number	12,593	9,048	2,561	699
Percent Distribution	100.00	71.85	20.34	5.55
Percent Change 1950-1960	-2.95	-8.24	27.41	13.66

Total includes persons who have never attended school, or who have less than one year of schooling.

EMPLOYMENT STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	Employed	Unemployed	Employed	Unemployed	Employed	Unemployed
Number	7,050	383	5,316	326	1,734	57
Percent Distribution	94.85	5.15	94.22	5.78	96.82	3.18
Percent Change 1950-1960	-9.28	121.39	-22.53	118.79	90.34	137.50

RATE OF UNEMPLOYMENT, 1962-65

1962	8.2
1963	4.8
1964	3.2
1965	3.0

LABOR FORCE STATUS BY SEX - 14 AND OVER, 1960

	Total		Male		Female	
	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force	In Labor Force	Out of Labor Force
Number	7,443	9,081	5,652	2,634	1,791	6,447
Percent Distribution	45.04	54.96	68.21	31.79	21.74	78.26
Percent Change 1950-1960	-6.39	-4.94	-13.42			

Includes persons in the Armed Forces.

PERCENT CHANGE 1962-65 IN WORK FORCE, EMPLOYMENT AND UNEMPLOYMENT

	1965 Number	Chng. 1962-65 No.	Chng. 1962-65 %
Labors Force	5.6	0.5	1.2
Tot Employment	5.4	0.8	14.3
Unemployment	.2	0.3	-60.0

DEVELOPMENT
OF
WATER RESOURCES
IN
APPALACHIA

MAIN REPORT
PART II
SHAPING A PLAN

CHAPTER 16 - SHAPING THE PLAN FOR SUB-REGION H

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CHAPTER 16 - SHAPING THE PLAN FOR SUB-REGION H

SECTION I - FUTURE GROWTH PATTERNS

1. WATER SUB-REGION

Projections of the future levels of employment (by sector) and population for economic Sub-Regions 13 and 9 were prepared by the Office of Business Economics. (See Figure 15-14, Page 15-43 for Planning Areas.) These projections were then aggregated and disaggregated to Water Sub-region H as shown below and graphically in Figure 16-1.

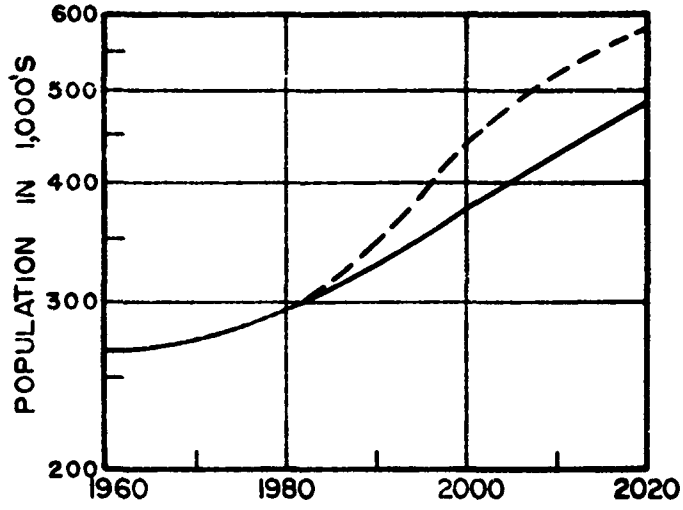
	Years			
	1960	1980	2000	2020
		(Thousands)		
Population	265.9	292.0	372.0	484.0
Employment	68.4	79.0	107.0	146.0

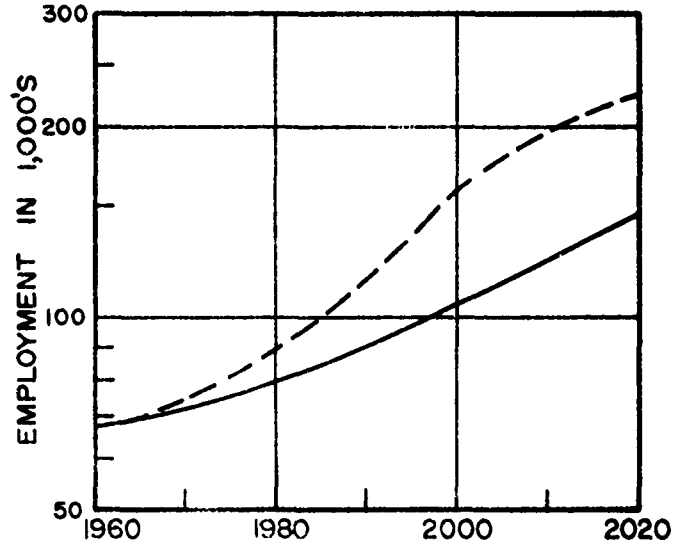
The economy of the sub-region, concomitant with other regions of Appalachia, has consistently lagged behind the nation as a whole. This gap has been reduced in recent years, but the above projections, based on normal investment programs, indicate that the sub-region's economy will continue on a lower relative level for the foreseeable future. With the stimulation to be provided by the Appalachian program, a new set of objectives in terms of population, employment and income were developed. These new objectives are called developmental benchmarks and are intended to measure and describe the amount of growth that can occur as a result of an accelerated program of public and private investment. These benchmarks are presented in detail in Appendix E and are shown below and graphically in Figure 16-1.

	Years		
	1980	2000	2020
		(Thousands)	
Population	292	443	578
Employment	90	161	224

2. STATE PLANNING SUB-REGIONS

As previously discussed, Water Sub-region H has also been divided by the Commonwealth of Kentucky into State Planning Sub-regions. (See Figure 15-14 on Page 15-43.) The developmental benchmark objectives have been disaggregated on this set of boundaries and are as follows:





LEGEND

——— Office of Business Economics' Projections
----- Benchmark Projections

Figure 16-1. Projections of Population and Employment, Sub-region H.

State Planning Sub-region		Years			
		1960	1980	2000	2020
32 A & B	Population	128,179	128,000	145,000	175,000
	Employment	23,569	37,000	60,000	77,000
35 A & B	Population	99,947	109,000	167,000	235,000
	Employment	32,924	34,000	61,000	84,000
36 A & B	Population	74,720	104,000	223,000	263,000
	Employment	21,513	33,000	66,000	100,000

3. DEVELOPMENTAL CONSTRAINTS

Inadequacy of transportation facilities within Sub-region H is a hindrance to economic development. Railroad service is available in 11 of the 18 counties. In most of the sub-region, narrow roads, steep grades and sharp curves are general characteristics of the network of Federal, State and county highways.

The rugged terrain is also a factor seriously restricting growth in most of the region, where steep slopes restrict the land available for building construction to narrow valleys subject to severe and frequent flooding. Of course, some areas have already developed significant portions of their floodplains and suffer rather intensive damages at the present. Good water management programs will be required to guide development in these areas in a way to maximize the development potential of the region. In addition, cities, downstream of the Appalachian area such as Lexington, use streams of this sub-region as their source of water supply.

Other notable constraints are limited education and skill levels. Average educational attainment in the sub-region is below the national median and also less than the Kentucky state median. These deficiencies point to the need for added educational training facilities and upgraded public school curricula.

As a means of correcting these problems and as a part of the Appalachian program, Kentucky has established an Area Development Office, which is responsible for the design, planning, and coordination of development programs. The Area Development Office is assisted by Spindletop Research. Kentucky has established a priority list of problems and restraints common to various parts of its Appalachian Region. These problems and restraints, and their order of priority, are: access; labor force -- education and training; health; physical problems including flood and pollution control; urbanization; and resource conservation and development.

As a guide to use in determining where public investments should be made, the Commonwealth has identified, in their State Development Plan, two bases as follows:

Investments for the improvement of manpower and natural resources should be located as close to the people to be served as the necessary scale of an effective project will permit. Projects functionally related to an immobile natural resource or scenic attraction will, of necessity, also be placed where that resource exists.

Investments in physical facilities or services where the intent is to provide urban services will be placed in geographic areas where it is determined there is a potential for developing a strong urban growth center.

4. PATTERN OF GROWTH ANTICIPATED

The economy of Sub-region H has been primarily based on mining and agricultural activities. In 1950, about 27 percent of total earnings were from mining and 29 percent from agriculture. By 1966, these had dropped to 11 and 16 percent, respectively. Earnings have been increasing in other sectors, such as manufacturing, trade, construction, and services, with the largest increase in manufacturing and services.

Population and employment of the sub-region declined by about 41,000 and 16,000, respectively, between 1950 and 1960. The population increased to 267,100 between 1960 and 1965. During the 1960 to 1965 period, total non-farm employment, manufacturing employment and manufacturing wages have increased.

The problems of Sub-region H vary between localities. In the mountain area, or Upper and Middle Kentucky River Areas, coal has been the primary employer. While the farms are small units, the population is concentrated in narrow valleys and the area is in a region that has the densest rural non-farm population in the United States. The mining operations in the eastern portion of the region are fully mechanized and firmly established, and are the mainstay of economic activity in this area. The projected employment for coal mining is to continue fairly constant at the 1960 level. Hazard, the largest city in the area, lacks suitable industrial sites for much additional growth. In the Beattyville and Booneville area, land is available; however, highway access is limited.

The need for urban services will continue in the mountainous, southeastern counties of the sub-region because coal and timber production will retain some of the population, while other people will remain to work in service firms. Either Hazard and/or Whitesburg would be developed into viable service center(s), providing those amenities associated with urban centers. Whitesburg has relatively level land that could be utilized for industrial, commercial, or residential buildings. Whitesburg has modernized and expanded its urban utilities, but its commercial center is congested and antiquated. As previously mentioned, the strategy for this area

additionally calls for new highways. Developmental plans should reflect the timing in completion of the new highway nets and anticipate the complementary problems which should be resolved in order to maintain the most effective growth rate. Needed special studies for the Hazard-Whitesburg areas are discussed later in this Chapter.

Most economic growth in the sub-region has occurred in the lower area counties of Madison (Richmond-Berea), Clark (Winchester), and Montgomery (Mt. Sterling). This area is undergoing urbanization as Fayette County increases in population and economic activity. During the period of 1950 to 1960, manufacturing employment more than doubled in the three counties. Several plants such as apparel, auto parts, metal fabricating, electronics and food are located in this area. Employment for the sub-region is projected to increase by three times by the year 2020 with most of this increase occurring in this three-county area.

Growth in the three towns demonstrates the benefit of level land combined with modern transportation networks. Interstate Route 75 has recently been completed through Richmond, and I-64 passes through Winchester and Mt. Sterling, connecting them with Lexington and Ashland. Winchester also benefits from the newly constructed Mountain Parkway, making commuting possible from the previously isolate counties of Powell, Lee, Menifee, Wolfe and Breathitt. Rail facilities are also available in each community.

All three towns (Richmond, Winchester, and Mt. Sterling) have complete and modern utilities available and are willing to expand them to meet the needs of industry and residential development. Commercial facilities in each city are adequate to serve their present needs, but would require major innovation should they become economic centers of the sub-region.

The agricultural lands in the lower area are well suited to cash crops such as burley tobacco and livestock production.

5. ADDITIONAL CENTERS HAVING POTENTIAL FOR GROWTH

Because of the lack of urban centers of adequate size to serve the population of the sub-region, as well as the problems associated with renovating the existing towns, the Area Development Office of the Commonwealth of Kentucky has proposed that a completely new city be built on a 7,000-acre site located in the Licking River Vally in Bath and Rowan Counties. Two USDA Upstream Watershed Projects and acceleration of land treatment programs will be part of the overall development in the area. The site will be made flood-free through construction of local protection projects as well as the Cave Run Reservoir; the latter would also provide necessary water supplies. See Part III, Chapter 16, and Appendix A for details.

Midland, the proposed name of the new city, would be strategically located in terms of transportation arteries, with rail, highways (I-64 and U.S. 60), and state routes already available. A small airport also exists. Also, relatively large land sites would permit low-cost construction of another needed, large, urban facility.

Midland's industrial base would provide job opportunities for 36,000 persons and serve a significant portion of the study area's citizens. A nine-county area centered around the development project would receive the principal economic impact.

SECTION II - WATER RELATED NEEDS

6. INTRODUCTION

The analysis of water needs in the context of the developmental objectives of PL 89-4 is based on several considerations. These include:

1. Immediate needs;

2. The needs that result from the continued development of the sub-region and contiguous areas, with a normal water development program;

3. The needs that will result from accelerated development that is generic to development of an economy within the full capacity of the area to supply industrial sites, provide labor, developmental capital, and other needs.

The latter aspect has been approached by the setting of the benchmarks for population, employment, and income. These higher planning goals reflect potential, more than historical, trends.

From the socio-economic analysis of the sub-region and the overlay of the benchmark projections, a judgment of the developmental impediments associated with water resource management has evolved. The procedure used to make this judgment was to spatially locate the benchmark projection on the sub-region. This process is by the way of successive disaggregation of the projections from larger to smaller areas. Of course, error limits increase as the process narrows the projections to smaller areas. This is an inherent risk associated with long-range planning, but the validity of the analysis can be improved by design of greater flexibility into project recommendations and by hedging future needs by the way of staged construction.

Water resources planning is dominated by the hydrologic delimitation of space. Since water can be reused many times on its way to the sea or back to the atmosphere, the regions delimited for economic analysis were overlain generally on watersheds for the derivation of water needs. Benchmark projections were allocated (by the disaggregation procedures) to state planning sub-regions; thence to river basins. If the analysis indicates a new set of water problems or water related impediments to the attainment of developing the region to its potential, these problems or impediments become the needs against which water management proposals would be designed.

7. WATER RESOURCE NEEDS IN THE SUB-REGION

The Problems in General

The relevant water and related land resource needs of the sub-region are primarily concerned with flood control, land conservation and development, water supply, maintenance of stream quality, power and recreation. Other needs related to irrigation, drainage, and sedimentation control exist and will continue, but are expected to be adequately considered in planning for other water-use projects, and so should not be inhibiting factors to the economic growth and development of the sub-region. The term "needs" is used here in a specialized sense. It refers to projected demands less the supply that will be available by virtue of the present development plus additional installation expected through 1980.

Flood Control

The relatively high annual rainfall in the sub-region coupled with a terrain notable for its narrow valleys has led to frequent flooding and severe damage to many communities. It has also prevented use of valley floors for industrial site development.

The primary service centers are: Winchester and Midland. Four secondary service centers are located in the area: Hazard-Whitesburg, Richmond-Berea, Mount Sterling, and Jackson. Although not specifically mentioned in the State Development Plan, Lancaster, Stanford, Beattyville and the Stanton-Clay City areas offer development potential. These centers essentially have the necessary basic facilities and conditions for growth. All have water resource needs of one type or another. Midland, Hazard, Jackson, Whitesburg, Beattyville, Stanton and Clay City have flood problems. Water damage prevention is essential to these towns. Flood prevention is also needed along the main stem of the Kentucky River and most upstream tributaries. Existing residual annual flood damages, after the authorized reservoirs are completed, are shown on Figure 16-2. Estimates of residual damages by growth centers are presented in Table 16-1 on Page 16-10.

The greatest flood damages and therefore the greatest needs for flood damage prevention are in the Hazard, Beattyville, and Stanton-Clay City areas. Flood damages at Hazard and vicinity amounted to about $7,400,000 for the 1957 flood and about $3,000,000 for the March 1963 flood.

The Stanton-Clay City area and about 8,000 acres of agricultural land in the Red River basin flood frequently. There have been 11 major floods, in the last 21 years in the Stanton-Clay City reach of Red River which caused damages in the range of $100,000 and up in 1968 monetary value. The Red River Reservoir will be effective in reducing these damages. Agricultural damages are primarily on the main stem

of the Kentucky and Red Rivers and to a lesser degree on the narrow flood plains of the tributaries of the Kentucky and Licking Rivers. An estimate of urban land requirements in the flood plains and outside by growth centers is given in Table 16-2 on Page 16-11.

The U.S. Department of Agriculture's 1967 Conservation Needs Inventory for watersheds shows that floodwater and sediment damages, occurring in upstream areas and requiring project action, total an estimated $39,000 annually.

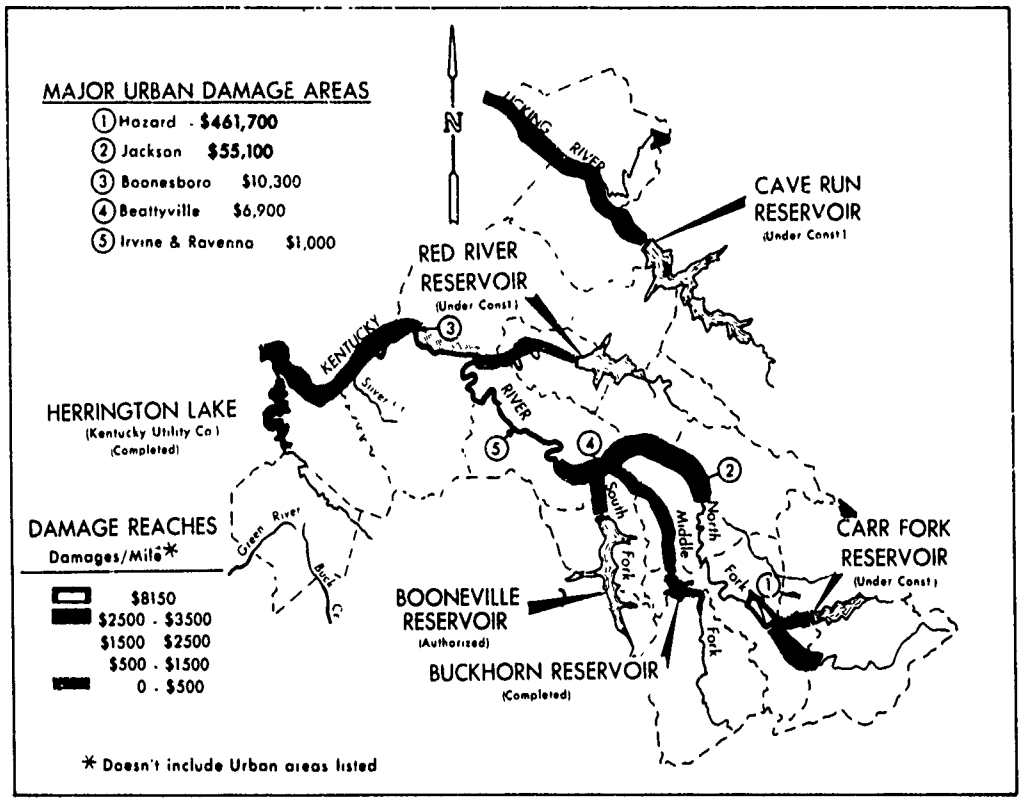


Figure 16-2. Residual Annual Flood Damages in Sub-region H.

TABLE 16-1

FLOOD CONTROL NEEDS & RESIDUAL NEEDS BY GROWTH CENTER

WATER SUB-REGION H ($1,000)

Item	Stream	Estimated Annual Damages 1968	Reduction By Projects To Be In Place By 1980	Residual Needs	Reduction By Alternatives Studied For AWRS	Residual Damages	Effective Projects	
							Programmed By 1980	Additional Projects
KENTUCKY								
Kentucky River Basin								
Hazard	North Fork Kentucky River	737.1	275.4	461.7	445.1	16.6	Carr Fork	North Fork Ky. River
Whitesburg	North Fork Kentucky River	54.4 */	--	54.4	--	54.4		
Jackson	North Fork Kentucky River	62.3	7.2	55.1	55.1	--	Carr Fork	North Fork Ky. River (35.8) Troublesome Creek (19.3)
Licking River Basin								
Midland	Licking River	234.0	187.7	46.3	46.3	--	Cave Run (136.1) & Upstream U.S.D.A. Structures (51.6)	Local Protection Project

*/ Exclusive of damages prevented by the Whitesburg Channel Improvement Project.

TABLE 16-2
LAND DEVELOPMENT NEEDS AND ALTERNATIVES BY GROWTH CENTER
WATER SUB-REGION H

	Urban Land Needs 1/		Area Protected to a Minimum of 100-Year Recurrence Interval			
	Total Acres	Flood Plain Acres	Troublesome Cr.	Carr Fork	North Fk, Ky R	Cave Run
KENTUCKY						
Midland	7,090	2,300				2,300 2/
Mt. Sterling	2,280	--				
Winchester	5,140	--				
Richmond - Berea	2,320	--				
Jackson	260	240	120	20	100	
Hazard	210	210		30	140	
Whitesburg	20	10				
TOTAL		2,760				

1/ Over 1960 land use.

2/ Includes lands to be protected by proposed local protection works. (See Part III Chapter 16)

Watershed Land Management

The problems and needs with respect to proper watershed land management are those associated with needed changes in present land use and the application of needed conservation treatment for its proper use.

The principal conservation problems on cropland are erosion and drainage. By 1980, there is expected to be about 116,500 acres of cropland which should be converted to less intensive use, such as pasture, woodland, and wildlife. Many acres of existing pasture need improvement, establishment of better cover, and proper management.

About 325,600 acres of cropland need treatment to control erosion. Drainage of excess water from an additional 43,600 acres will also be required. Unfavorable soil conditions, such as salinity, alkalinity, acidity, low fertility, shallowness to rock, or some other condition that limits root development or moisture-holding capacity will be the dominant problem on an additional 50,200 acres.

Pasture land treatment needs include pasture planting on about 146,800 acres, and improvement of vegetative cover on another 278,700 acres. Protection from overgrazing and invasion by undesirable plants is needed for an estimated 89,400 acres.

It is estimated that a total of 9,700 acres of spoil area from surface mines will need to be reclaimed to keep pace with surface mining operations. Proper treatment and management of these and other critical areas are essential for economic development.

Some of the conservation needs for forest land include establishment of a timber stand on about 318,700 acres, treatment to prevent or reduce erosion on about 106,200 acres, stand improvement measures on 297,400 acres, careful thinning and harvesting on 127,400 acres, and protection of 552,300 acres from grazing by domestic livestock. Small, fragmented ownerships within exterior boundaries of public forest lands where development and management will not otherwise be accomplished should be acquired by State, Federal, or other Government units.

It is expected that by 1980 the following land use acreages will be needed to support planned and expected development.

Land Use	Acres 1958	Acres Needed by 1980
Cropland	543,100	525,800
Pasture	594,000	611,300
Forest and Woodland:		
State and Private	1,906,300	1,961,300
National Forest	116,300	162,800
Other Land	196,900	79,000
Non-Agricultural Land	63,000	79,400
TOTAL	3,419,600	3,419,600

The demand for land for industrial, commercial, and urban residential site development in the sub-region is projected to be 2,600, 11,400 and 10,600 acres during each of the 20-year periods 1960-80, 1980-2000, and 2000-20, respectively. This totals about 24,600 acres, or about 1.5 times the present area in urban use. These acreages are based on population and employment projections (Benchmarks, see Section I of this Chapter) and allow 24 workers per acre for manufacturing, 10 per acre for transportation, 30 per acre for trades, and 150 per acre for services. Residential land needs are based on 15 persons per acre. As shown on Figure 16-3, the seven counties on the western Appalachian boundary have potentially an adequate amount of developable land.

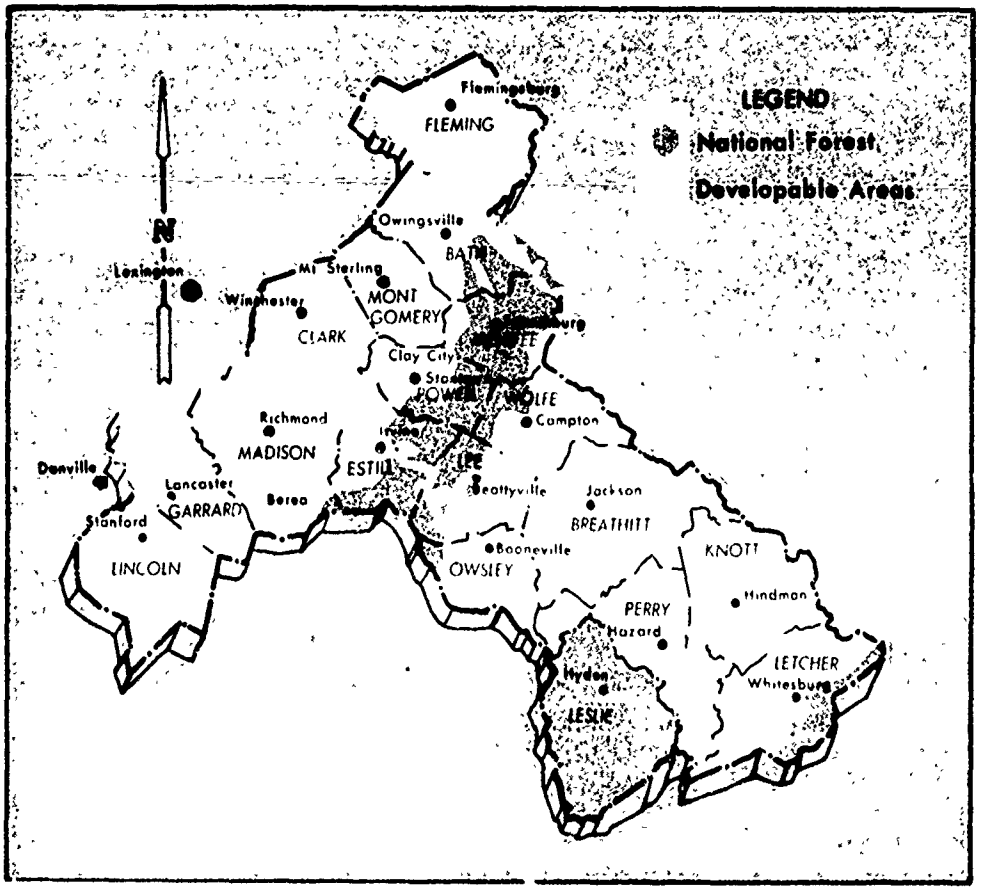


Figure 16-3. Location of Major Land Areas Potentially Suitable for Development.

Water Supply

Current and projected water supply "demand" estimates for Sub-Region H are given in Table 16-3. Water supply "needs" (the increment of "demand" over the available 1980 supply) are also given in Table 16-3 and portrayed graphically in Figure 16-4 on Page 16-16.

Table 16-3 shows that the estimated daily domestic demand in 1960 was about 25 MGD, and the total manufacturing intake was about 4 MGD. In the year 2020, it is estimated that total daily demands on municipal water supply systems in Sub-Region H will be about 68 MGD, and the total manufacturing use will be about 72 MGD with about 2 MGD of this being a part of the total 68 MGD municipal water system demand. While this will require a somewhat higher degree of runoff regulation, the annual runoff of the area would easily permit such usage.

It is noteworthy here that many large and small communities along the Kentucky River inside and outside of Appalachia utilize the pools of the navigation locks and dams for water supply. In this regard there is a continuing urgent need, although not quantified, to conserve these supplies. Dependable supplies indicated in the following include this pool usage.

Estimated water supply needs by growth center vary slightly from those estimated by FWPCA in Appendix D due to differences in magnitude of water use per unit of manufacturing output and other factors which could influence the intensity of water use. An example of the estimates derived for this report for Midland is shown below:

	Municipal Use			Manufacturing Use			
Year	Pop. 1/	GCPD 2/	Use (MGD)	Manuf. Emp. per	Water Use Emp (GDP)	Use (MGD)	Total (MGD)
1960	700	94	0.1	-	500	-	0.1
1980	5,700	100	0.6	400	700	0.3	0.9
2000	16,000	107	1.7	1,070	1,000	1.1	2.8
2020	30,000	115	3.4	2,400	1,250	3.0	6.4

1/ Actual and projected.

2/ From Appendix D.

TABLE 16-3
ESTIMATED GROSS WATER DEMANDS AND NEEDS
FOR SUB-REGION H (IN MGD)

Year	Gross Manufacturing Demand					Domestic 1/ Demand	Total Demand	Needs 2/
	From Company Systems			From Municipal Systems	Total			
	Surface	Ground	Total					
1960	4	--	4	--	4	25	29	0
1980	17	--	17	--	17	29	46	0
2000	33	1	34	1	35	47	82	36
2020	68	2	70	2	72	66	138	92

1/ Per Capita Consumption estimated at: 94 Gallons per day in 1960
100 Gallons per day in 1980
107 Gallons per day in 2000
115 Gallons per day in 2020

2/ Increment between 1980 demand (which is assumed to be "supply") and gross needs.

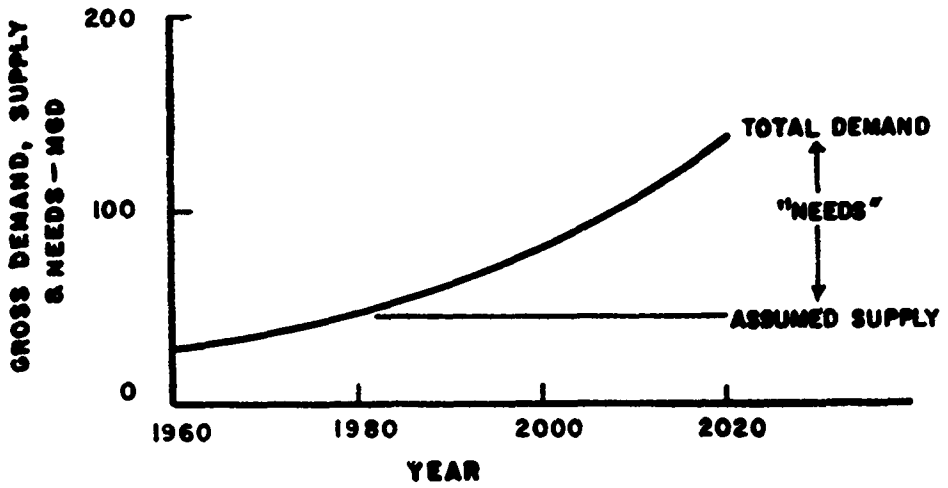


FIGURE 16-4. WATER SUPPLY DEMAND AND NEEDS SUB-REGION H

The aggregate demand values presented above appear to be adequate indicators of the magnitude of water needs. However, for more detailed analysis, an estimate of gross water needs by growth centers over time was related to the supply which could reasonably be expected to be available as a source of potable water to each growth center by 1980. This analysis required a judgment of both quality and quantity available, both of which were introduced as constraints on available supply. The difference between gross needs and estimated available supplies were calculated to indicate the magnitude of additional water supply sources which should be developed to meet the regional development objectives.

Table 16-4 presents the estimated gross demands, as estimated by APS, for water by growth centers as of 1980, 2000, and 2020. The increment between gross demand in 2020 and dependable supply expected to be available in 1980 is referred to as unmet needs in Table 16-5 and is the subject of planning studies outlined later. Table 16-6 presents the relative costs associated with the development of ground water supplies and surface impoundment for the magnitude of unmet needs outlined in Table 16-5. The cost comparisons are necessarily oversimplified, because transmission costs are omitted, but do serve to indicate if ground water sources would clearly be competitive with surface impoundment at the level of needs anticipated. A summary of unmet water supply needs and alternatives is presented in Table 16-7.

TABLE 16-4
ESTIMATED GROSS NEEDS FOR WATER SUPPLY FOR
GROWTH CENTERS IN WATER SUB-REGION H
(MGD)

Item	1980	2000	2020
KENTUCKY			
Kentucky River Basin			
Winchester	2.7	9.1	18.5
Richmond-Berea	3.5	6.8	15.1
Jackson	0.3	0.7	1.3
Hazard	1.0	1.4	2.1
Whitesburg	0.3	0.4	0.5
Licking River Basin			
Midland	0.9	2.8	6.4
Mt. Sterling	1.4	4.5	8.4

TABLE 16-5
WATER SUPPLY NEEDS, AVAILABLE SUPPLY AND UNMET NEEDS
WATER SUB-REGION H

Item	Gross Demand (2020) MGD	Dependable Supply By 1980 MGD	Unmet Needs MGD
Kentucky			
Kentucky River Basin			
Winchester	18.5	18.5	--
Richmond-Berea	15.1	8.8	6.3
Jackson	1.3	1.3	--
Hazard	2.1	1.0	1.1
Whitesburg	0.5	0.3	0.2
Licking River Basin			
Midland	6.4	6.4	--
Mt. Sterling	8.4	8.4	--

TABLE 16-6
ALTERNATIVE SOURCES AND COSTS FOR WATER SUPPLY
WATER SUB-REGION H

Item	Alternative Costs for 1000 Gal. Dependable Yield 1/ Groundwater At Well Head	Surface Storage At Site	Notes
Kentucky River Basin	$0.25-0.75	$0.14	Average Cost For Red River Reservoir

1/ Does not include transmission costs

TABLE 16-7
WATER SUPPLY NEEDS AND ALTERNATIVES
WATER SUB-REGION H

Item	Unmet Needs In 2020 (MGD)	Alternative Projects	Dependable Yield (MGD) Gross	Net
Kentucky River Basin				
Richmond-Berea	6.3	Ford Reservoir	200	160
Hazard	1.1	N. Fork Ky. River Reservoir	6	5
Whitesburg	0.2	N. Fork Ky. River Reservoir	6	5

The estimated gross needs for the Sub-region have not included the needs for Lexington and Frankfort which are located downstream from Appalachia. Their potential growth will depend upon an adequate water supply from the Kentucky River Basin. The gross needs will be about 72 MGD at the year 2020.

Maintenance of Stream Quality

The establishment and maintenance of stream classification standards is primarily a state function, but a Federal interest is exerted through the Federal Water Pollution Control Administration (FWPCA). All water resource planning must be concerned with maintaining water quality.

Projected stream pollutional loadings for Sub-region H are given in Appendix D of this report, written by the FWPCA. This Appendix shows that untreated waste loadings, expressed in thousands of population-equivalents, will be 85, 150, 400, and 750 in 1960, 1980, 2000 and 2020, respectively. These figures refer to loadings before treatment, and are specific indicators of the investment required in new treatment facilities. While this Appendix does not pinpoint specific problem areas, certain problem areas have been studied separately in some detail by the FWPCA. Water quality needs were derived for the growth centers by APS, utilizing information from FWPCA, where available, and are summarized in Table 16-8.

The streams, particularly the smaller ones in the sub-region, generally have poor low flow characteristics which intensify water quality problems during these low flow periods. Problems due to sewage presently exist on Otter Creek below Richmond, Whiteoak Creek below Lancaster, Logan Creek below Stanford, Strodes Creek below Winchester, Hinkston Creek below Mt. Sterling, and the North Fork of the Kentucky River below Whitesburg, and Tripplet Creek below Morehead. These problems, except at Whitesburg, are due to lack of water for dilution of effluent after secondary treatment. At Richmond and Whitesburg the problem is lack of adequate collection and treatment facilities. As additional sewerage and sewage disposal systems are built, many of which are being built with Federal loans and grants, additional water will need to be stored for water quality purposes. In the Eastern Kentucky coalfields of Sub-region H, water quality is often impaired by acid mine drainage and by improper coal washing activities. The acid water may cause extra cost for treatment, early replacement of water treatment facilities and rapid deterioration of corrugated metal culverts and other structures it may come in contact with. The principal way of eliminating pollution caused by acid water and coal fines is treatment at the source; however, some water will need to be stored for dilution purposes. Principal areas of needs are Leatherwood Creek, Yellow Creek, and other small tributaries of Carr Fork. In addition to the above, there is a need for dilution water at Hazard, Jackson, Beattyville, Irvine-Ravenna and along the entire central Kentucky section of the Kentucky River, which need will have to be met by storage in Appalachia in the headwater areas.

Winchester obtains its water supply from the Kentucky River Basin and discharges treated sewage effluent into Strodes Creek where design flow is negligible. It is estimated by APS that total flows in the order of 40 cfs would be needed by 2020. Similar estimates for Whiteoak Creek below Lancaster and Logan Creek below Stanford, show flows in the order of 12 cfs by 2020 would be needed. Since most of these areas are in the headwater regions, sites are not available for storage of water for regulation of the streamflow and, therefore, intensive treatment is indicated.

TABLE 16-8
WATER QUALITY NEEDS, ALTERNATIVES, AND NEEDS SATISFIED BY GROWTH CENTERS IN WATER SUB-REGION H

Item	Needs 2020 (cfs)	Satisfied By Alternative Projects By 1980	Residual Needs (cfs)	Satisfied By Alternative Projects By 2020	Unmet Needs 2020 (cfs)
Kentucky					
Midland	60	7	53	53	--
Mt. Sterling	15	8	7	7	--
Winchester	40	15	25	25	--
Richmond	45	15	30	30	--
Whitesburg	15	--	15	15	--
Hazard	20	8	12	12	--
Jackson	25	10	15	15	--

In the North Fork of the Kentucky River, in addition to unsatisfactory stream conditions below Hazard due to residual organic discharges when streamflow is low, problems of high sulfate and chloride concentrations exist as the result of runoff from mine drainage and brine pits from oil production. The organic problem can be abated by discharges from proposed reservoirs, but the discharge of mineral pollutants must be controlled at the source.

Many programs of the U.S. Department of Agriculture play an important role in the maintenance of stream quality. Particularly important are those programs concerned with development of upstream watersheds, the proper use of all land, and its treatment and management to control erosion and reduce sediment. There are four principal programs:

a. Upstream Watershed Program (PL-566).

b. Technical assistance by the Soil Conservation Service to individual landowner, operator, or user in determining proper land use, planning and installing the needed conservation practices and measures, and technical assistance on forest land by State Forester in cooperation with U.S. Forest Service.

c. Cost sharing by the Agricultural Stabilization and Conservation Service with landowners and operators for carrying out needed conservation practices and measures, under either ACP or Sec. 203, PL 89-4.

d. Water development and soil conservation loans by the Farmers Home Administration to landowners and operators in putting into effect basic soil and water conservation plans.

Emphasis is needed on proper land use and those conservation measures and practices to stabilize eroding gullies, channels, roadbanks, ditches, strip-mine spoil, and new residential, industrial, and highway construction, and to improve all vegetative cover. These programs can help provide improved water quality management in the sub-region. Table 16-8 compares water quality needs, alternatives and needs satisfaction by growth centers.

Power

A discussion concerning electric power needs, probable future installation of generating capacity and cooling water needs for the Appalachian Region, on a regional basis, is contained in Chapter 4 of Part I, Summary Report.

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Recreation

An unsatisfied demand for outdoor recreation opportunities is expected to the year 1980 in Sub-region H. The "demand" is estimated to be 4,100,000 recreation days (1980) and would require an estimated 38,600 acres of water to meet needs for boating, swimming, camping, picnicking, hunting and fishing. The Appendices prepared by the Bureau of Outdoor Recreation (Appendix F) and the Fish and Wildlife Service (Appendix G) present a detailed discussion and additional projections to the year 2020.

Information from these Appendices has been summarized and is shown graphically in Figure 16-5. It will be noted that all activities have been reduced to a common measure of man-days annually. A separate chart has been included in Figure 16-5 to show the water-using portions of outdoor recreation needs. Since the emphasis in this report is on water resources, it has been necessary to recognize that certain activities require a rather definite water surface area, while others are less directly related to water surface. A summary of water-using recreation needs and means for their satisfaction considered in this report is presented in Table 16-9. Needs are derived as the increment between demands in 1980 and 2020.

TABLE 16-9
WATER USING RECREATION NEEDS AND ALTERNATIVES
WATER SUB-REGION H

Item	Annual Recreation Days (1,000)
RECREATION NEEDS	17,600 1/
PROJECTS (Ultimate Use)	
Red Bird River	300
Walkers Creek	400
Little Goose Creek	200
Cutshin Creek	150
Greasy Creek	100
Troublesome Creek	200
North Fork Kentucky River	600
Station Camp Creek	500
Ford	1,300
Royalton 2/	250
Redlick Creek Watershed	20
Upper Howard Creek Watershed	20
Hanging Fork Creek Watershed	15
Silver Creek Watershed	20
Upper Red River Watershed	15

1/ The increment between 1980 and 2020 demand for water using activities (See Figure 16-5).

2/ Located in Sub-region G.

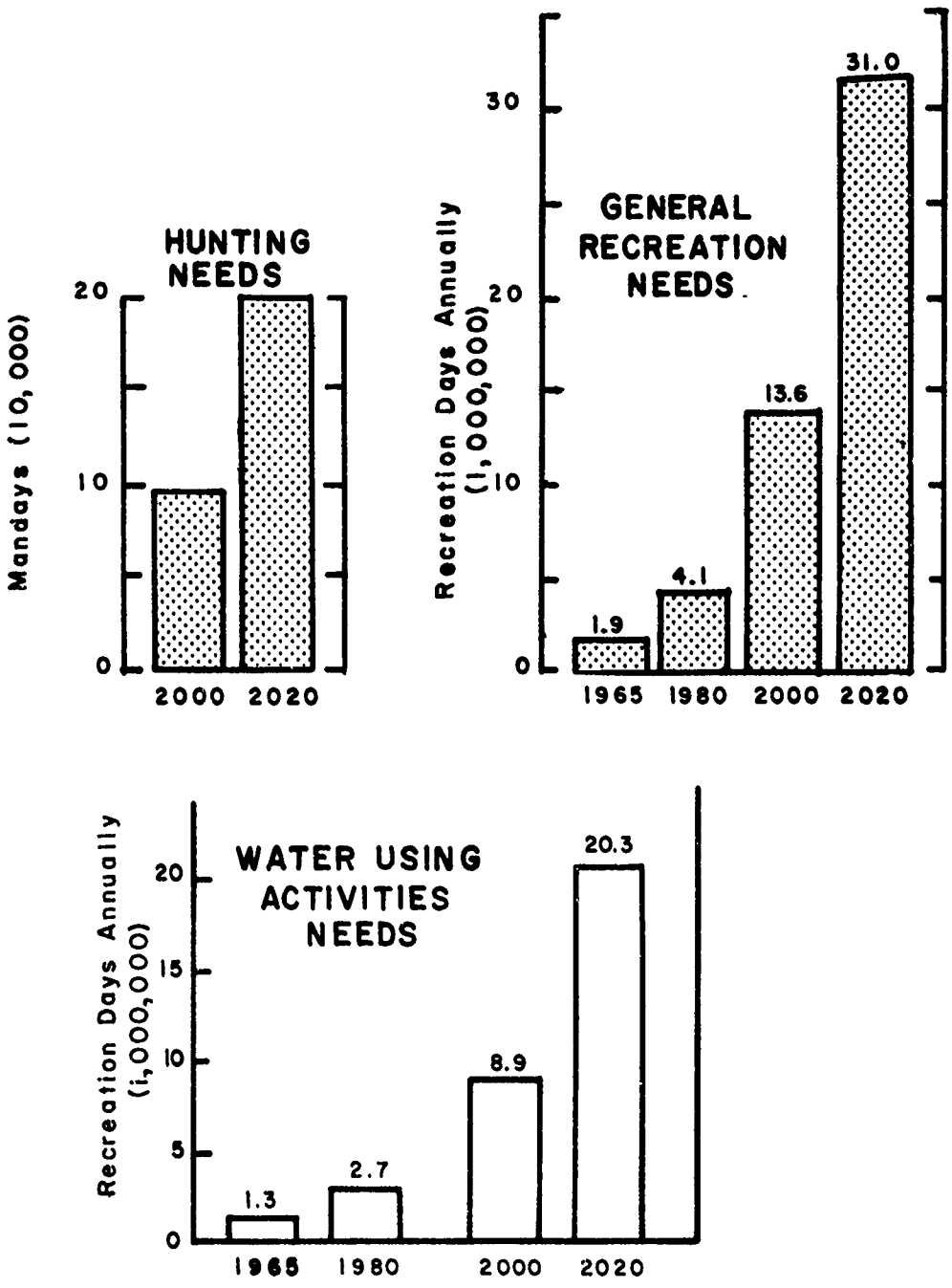

Figure 16-5. Estimate of Outdoor Recreation Needs in Sub-region H.

Development of additional public and private outdoor recreation facilities can be accelerated through various programs of the U.S. Department of Agriculture. Increased technical and financial assistance to landowners, operators, small rural and urban groups, and others cooperating with soil conservation districts can accelerate land use conversion to, and development of, recreation areas. Recommended acceleration of recreational developments and facilities in the Daniel Boone National Forest will help meet the needs of the Sub-region. See Appendix A and Supplement B to Appendix F for full details.

It should be noted that the provision of recreational opportunities is the responsibility of many entities - Federal, State, municipal, county and private.

Other and Summary

The Kentucky River is the only navigable stream in the Sub-Region. It has a 6 foot channel from the vicinity of Beattyville 255 miles downstream to its mouth. About 137 miles of this navigable water is in the Sub-Region. The volume of commercial navigation is small as shown in the following table.

	Tonnage (1,000) 1964			
Commodity	Inbound	Downbound	Total	Total Ohio River
All commodities	409	53	462	96,000
Sand, gravel, crushed stone	341	0	341	
Gasoline	68	0	68	
Coal	0	53	53	

Barging of coal essentially stopped in 1965 when the East Kentucky Rural Electric Coop. ceased to buy barged coal. There have been some indications recently that there may be a resumption of coal barging on a limited scale. The locks and dams in the study area are considered obsolete for modern commercial traffic but if rehabilitated would be adequate for pleasure craft. There is considerable pleasure craft traffic on the Kentucky River during summer months as shown in the following table.

	Lock & Dam No. 1				Lock & Dam No. 4				Lock & Dam No. 10			
1967	Type of Craft				Type of Craft				Type of Craft			
Month	Cru	Hbt	Outbd	Misc	Cru	Hbt	Outbd	Misc	Cru	Hbt	Outbd	Misc
June	51	37	140		34	21	89	14	15	6	77	8
July	246	95	284		147	73	132	35	68	12	202	14
August	216	68	168		82	56	111	17	33	15	140	10
TOTALS	513	200	592		263	150	332	66	116	33	419	32

There is a need for maintaining the navigation facilities on the Kentucky River for recreation purposes. The palisades reach, which extends from just upstream from Frankfort to about Boonesboro, is worth considering as an element of a national recreation area, together with the Daniel Boone National Forest, Natural Bridge and the Sky Bridge area. If the area should be designated as a national recreation area there would be a need for rehabilitation of navigation facilities on the Kentucky River for the use of pleasure craft and excursion boats.

As discussed previously, most communities along the Kentucky River are vitally dependent upon the navigation pools for water supply. Considerable flood damages could occur upon failure of lock and dam structures.

There are additional needs in the sub-region involving alleviation of flood problems in minor tributaries, minor drainage and bank stabilization problems, vector control and reclamation of orphan strip-mine spoil banks (those that were created prior to passage of the Strip Mine Reclamation Act). There is also a need for further study for development of water resources in most tributary areas and a need for further studies for development of public and private recreation areas in the sub-region.

Water resource related needs are shown for each growth area in Table 16-10. The footnotes to this table explain the underlying assumptions. It should be noted that the needs of these growth centers are not restricted to the named communities, and that in certain cases needs were computed using the population of relevant townships, etc. A table of this type is necessarily oversimplified to allow convenient comparison without too many distracting qualifications.

8. WATER RESOURCE NEEDS BY RIVER BASINS

The broad water needs previously discussed for the sub-region were disaggregated to river basins and sub-basins. A primary determinant of water needs is the implication of the economic analysis contained in paragraph 5 of Chapter 15 and in Section 1 of Chapter 16. While the state planning sub-regions do not follow river basin divisions, there is enough commonality in areas to indicate trends and relative magnitude of possible population and employment growth by each basin. The following paragraphs relate the economic analysis by state planning sub-regions and the major river basin areas.

Kentucky River Basin

That portion of the Kentucky River Basin that is within Appalachian Sub-Region H is generally contained within State Planning Sub-Regions 32A, 32B, 35A and 35B. Figure 16-6 (Page 16-28) indicates the magnitude of population and employment implied by the developmental benchmark objectives.

TABLE 16-10
ESTIMATED WATER RESOURCE NEEDS TO SUPPORT FUTURE GROWTH OF GROWTH CENTERS IN SUB-REGION H 1/

State/River/Basin Growth Center	Water Supply (MGD)	Flood Control: Current Damage ($1,000)2/	Flood Control: Flooded Area (Acres)	Recreation Days (1,000) 4/	Water Quality (cfs)
KENTUCKY					
Kentucky River Basin					
Winchester	---	---	---	2,500	25
Richmond	6.3	---	---	1,300	30
Jackson	---	55.1	220	1,800	15
Hazard	1.1	461.7	180	2,900	12
Whitesburg	0.2	54.4	10	700	15
Licking River Basin					
Midland	---	46.3	---	1,000	53
Mt. Sterling	---	---	---	1,100	7
TOTAL GROWTH CENTERS	7.6	617.5	410	11,300	--
TOTAL SUB-REGION H	92	1,145.8	3/	17,600	--

1/ Needs are expressed in terms of increment between "supply" of and "demands" for the water goods and services to 2020.

2/ Residual damages remaining after 1980 (1968 development).

3/ Total estimated needs for urban land uses by 2020 in Sub-region H is 24,600 acres with 18,300 in growth centers.

4/ Limited to water using activities.

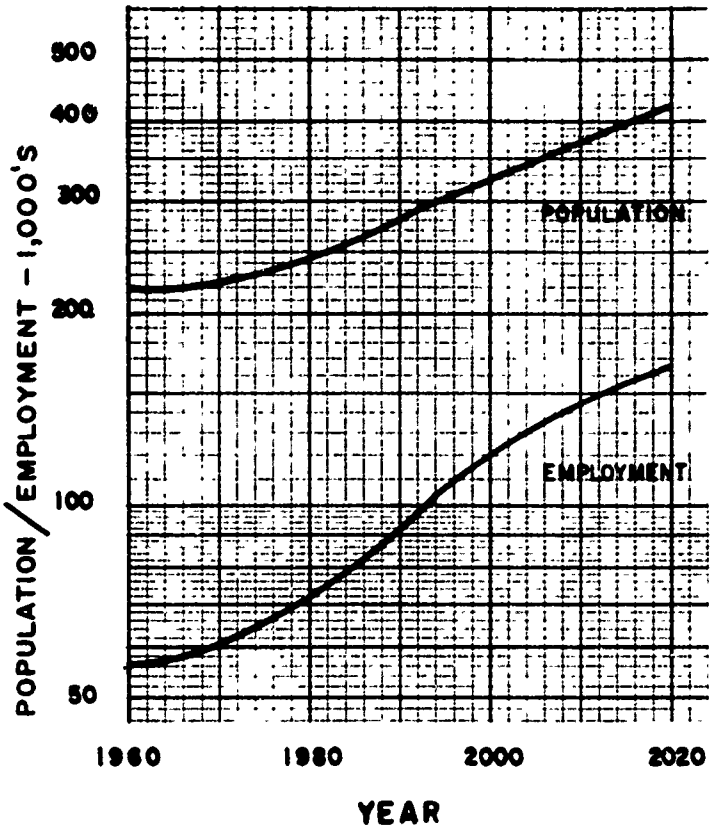

FIGURE 16-6 STATE PLANNING SUB-REGIONS 32 & 35

State Planning Sub-region 32B

This sub-region (Upper Kentucky River Development Area) includes Knott, Leslie, Letcher and Perry Counties. Growth centers located in the area include the secondary centers of Hazard and Whitesburg and the satellite centers of Hindman and Hyden. Primary needs exist for increasing the supply of developable land by removing the threat of floods along the Kentucky River and other streams in the area. Additional needs for the area include reclaiming land around vacated strip mines, coordinated management of water, land and timber resources, development of plans pertaining to the utilization of land which will be, in future years, flood free and removed from strip-mining activity, and establishment and organization of a timber development organization for the area.

Special innovative coordinated studies are urgently needed to assure optimum land use and environmental improvements so that Hazard and Whitesburg can be rehabilitated to become viable urban service centers.

State Planning Sub-region 32A

This sub-region (Middle Kentucky River Development Area) includes Breathitt, Lee, Owsley, and Wolfe Counties. Included in the area are

the growth centers of Jackson (secondary), Campton (tertiary), and Beattyville and Booneville (satellite). The most critical need in the area is the management and impoundment of water resources for service, safety and recreation use. Additional needs in this sub-region include development of the timber of the area and planning for the utilization of certain lands, which in future years, will be flood free, removed from strip mining activity, and developable.

State Planning Sub-regions 35A and 35B

These sub-regions include Clark, Madison, Estill, Powell, Garrard and Lincoln Counties. The primary growth center of Winchester, the secondary centers of Richmond-Berea, and the tertiary centers of Lancaster, Stanford, Stanton, and the satellite center of Irvine-Ravenna are all located within the area. An adequate supply of developable land is available for these areas. More land will become available for development upon removing the threat of floods along the Kentucky River and other streams in the area.

Licking River Basin

That part of the Licking River Basin that is within Appalachian Sub-Region H is contained in portions of State Planning Sub-Regions 36A and 36B. Figure 16-7 indicates the magnitude of population and employment implied by the developmental benchmark objectives.

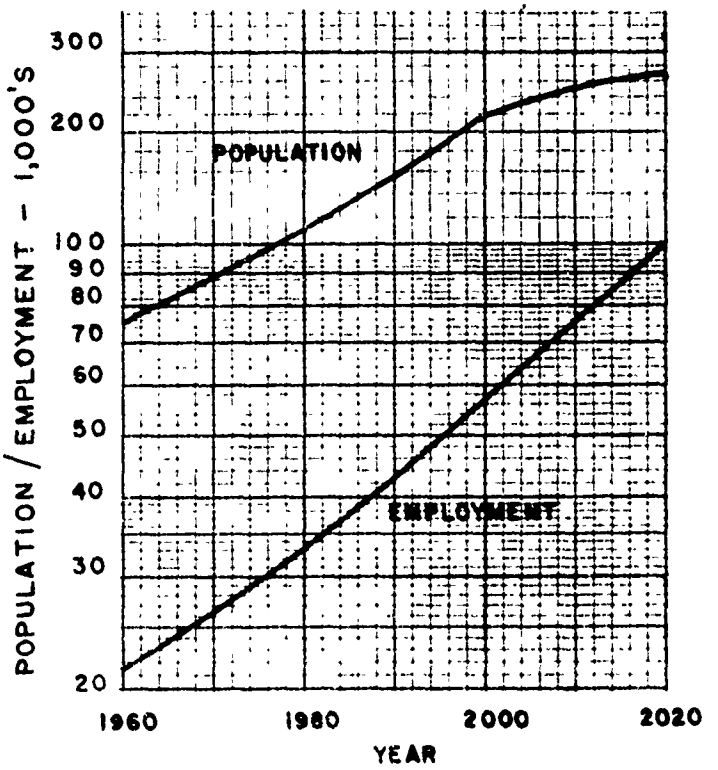

FIGURE 16-7 LICKING RIVER BASIN (APPALACHIAN SUB-REGION H PORTION)

State Planning Sub-regions 36A and 36B

The portions of State Planning Sub-regions 36A and 36B that are within Appalachian Sub-region H contain Bath, Montgomery, Menifee and Fleming Counties. The primary growth center of Midland, the secondary center of Mt. Sterling, the tertiary growth center of Flemingsburg, and the satellite centers of Owingsville and Frenchburg are included in the area. The management and impoundment of water resources for service, safety, and recreation use forms a primary need for the area. There is also a need for development of the timber resources of the area.

Table 16-10 (Page 16-27) presents a detailed estimate of needs by growth centers in the Sub-region H portion of the Kentucky and Licking River Basins.

Other River Basins

Approximately six percent of the area of Sub-Region H is drained by the headwaters of the Green River, Buck Creek and Beaver Creek, including a small portion drained by the Poor Fork of the Cumberland River. The Green River, Buck Creek and Poor Fork flow into Sub-Region I.

9. INTER-BASIN AND INTERSTATE TRANSFER OF WATER

Transbasin diversions for water supply are already a reality in the area. They may well become a necessary provision for augmenting flows for waste dilution as well. Winchester, Kentucky, is in the Licking River Basin but presently withdraws its water from the Kentucky River.

If those growth centers which are located high in the drainage basin are to continue to grow, it may become necessary to acquire an adequate supply of water from other drainage basins.

SECTION III - ALTERNATIVES FOR MEETING NEEDS

10. STRUCTURAL

Structural alternatives have been selected from an array of Federal, State and private water resource development opportunities. Consideration for provision of flood protection includes storage of flood flows in impoundments, levees, flood walls, channel improvements and combinations thereof. Alternatives for provision of water supply considered both surface and groundwater sources. Water quality improvements would be accomplished by the most advantageous means, whether by dilution or by a higher degree of treatment of water. The relevant structural alternatives are discussed below.

Kentucky River Basin

There are seven growth centers located in the Kentucky River Basin, of which one, Winchester, is classified as primary. Of the remaining six, Richmond-Berea, Jackson, Hazard, Whitesburg, are classified as secondary. Lancaster and Stanford are tertiary centers.

Winchester. There are no significant flood damage or water supply requirements that would impede growth in the Winchester area. There are ample lands suited for future industrial, commercial, municipal and residential development in the area. Water for future municipal and industrial purposes can be supplied by the authorized Red River Reservoir, which is under construction, and the authorized Booneville Reservoir, which is in advance engineering and design stage. Facilities to supply water-oriented recreation in the amount of 2.5 million recreation days will be needed between 1980 and 2020. Part of this can be met by the potential USDA Upper Howard Creek Upstream Watershed project.

Richmond-Berea. There are little, if any, flood damages in this complex. Ample lands are available for future municipal, industrial and residential growth in the area. About 15.1 MGD for municipal and industrial water supply, along with 45 cfs for water quality improvement purposes will be needed prior to 2020. The water-oriented recreation needs are estimated to be 1.3 million recreation days between 1980 and 2020. To meet these needs are the authorized Red River and Booneville Reservoirs, the potential Ford Reservoir and the potential Silver Creek and Redlick Creek Upstream Watershed projects. Additional potential upstream reservoirs in the basin should play a part in meeting the needs of the area.

Jackson. The most serious water related problem in this growth center is flood damage along the North Fork of the Kentucky River.

Although the existing local protection project has reduced flood damages to some extent, current flood damages amount to about $62,300 annually. These damages will be reduced to about $55,100 annually when the Carr Fork Reservoir is completed, expected prior to 1980. The potential North Fork Kentucky River Reservoir and Troublesome Creek Reservoir would reduce damages to a negligible amount. Future needs for urban land use of the flood plain are estimated to be 240 acres by 2020, the majority of which would be essentially flood-free as a result of the above reservoirs. There appears to be no problems concerning water supply for domestic and industrial purposes, and water quality improvement flows should be met by the potential reservoirs. Water-oriented recreation needs are estimated to be 1.8 million recreation days annually between 1980 and 2020.

Hazard. This growth center experiences an average of about $737,100 of flood damages annually from the North Fork of the Kentucky River. Completion of the Carr Fork Reservoir, expected prior to 1980, will reduce the flood damage to about $461,700 annually. The potential North Fork Kentucky River Reservoir would effect further reductions in damages to about $16,600. About 210 acres of flood plain lands will be needed for urban uses by 2020. In the period 1980 to 2020, the Hazard growth center will have need of an additional 1.1 MGD for water supply, and about 12 cfs for water quality improvement. The water-oriented recreation needs are estimated to be 2.9 million recreation days. Some of these needs will be met by completion of Carr Fork Reservoir and consideration for meeting the remaining needs will be given to the potential North Fork Kentucky River Reservoir.

Whitesburg. The Whitesburg growth center experiences about $54,400 flood damage annually from the North Fork Kentucky River. There is no potential alternative project that would provide reduction to these damages. The growth center will require an additional 0.2 MGD for water supply, and about 15 cfs for water quality improvement. Consideration for meeting part of these needs will be given to the potential North Fork Kentucky River Reservoir.

Special innovative coordinated federal, state and local comprehensive studies of all alternatives and combinations of alternatives is needed to rejuvenate Hazard and Whitesburg so that they can become viable urban service areas.

Other

Lancaster. This growth center experiences little, if any, flood damages and no flood plain acreage is needed for future development. About 3.1 MGD for municipal and industrial water supply, along with 12 cfs for water quality improvement purposes will be needed prior to 2020.

Facilities to supply water-oriented recreation needs in the amount of 400,000 recreation days will also be needed in the period between 1980 and 2020. Projects to be considered to meet the water-related needs include Kentucky Utility Company's Herrington Lake, Booneville and Red River Reservoirs, and the remaining potential upstream reservoirs in the Kentucky River Basin.

Stanford. The water related problems that will affect, to some degree, the growth in this area are water supply, water quality control and power supply. Flood damages are not a problem in this area. Sufficient land should be available for future municipal, industrial and residential development. Water supply needs for the area are estimated at 1.3 MGD by 2020. Water-oriented recreation needs are estimated to increase to about 1.8 million recreation days between 1980 and 2020. As at Lancaster, the projects to be considered to meet the water related needs of the area include Herrington Lake, Booneville and Red River Reservoirs and additional potential reservoirs in the upstream Kentucky River Basin. Some needs might also be met by the potential Hanging Fork Creek Upstream Watershed project.

Licking River Basin

The Licking River Basin has two growth centers - Midland - Morehead, considered primary, and Mt. Sterling, which is secondary. Morehead is in Sub-region G.

Midland-Morehead. This growth center (Midland) */ is to be built in the Licking River Basin under the "new town" concept. Flood damages in the area amount to $234,000 annually. Completion of Cave Run Reservoir, expected prior to 1980, will reduce the damages to $97,900. The site can be made flood-free through construction of a phased local protection project. Estimated water supply needs will amount to 6.4 MGD and water quality needs will amount to 60 cfs by 2020. Water-oriented recreation needs are estimated to be about one million recreation days per year. Projects to be considered to meet these needs include the Cave Run Reservoir and the Salt Lick and Triplett Creek potential upstream watershed projects.

Mt. Sterling. There are no significant flood damage or water supply requirements that would impede growth in the Mt. Sterling area. Facilities to supply water-oriented recreation in the amount of 1.1 million recreation days will be needed in the period 1980-2020.

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*/ More detailed analysis of the Midland Project is contained in Part III - Chapter 16 of the Main Report.

Other Sub-regional Needs

The needs discussed in the paragraphs above are those that are identified with specific growth centers. It is estimated that water resource related needs that will occur in those portions of the sub-region that are not associated with specific growth centers discussed above will amount to about 87 MGD water supply and 4.1 million recreation days per year for water-oriented recreation. It is also estimated that about $528,300 in flood damages occur in the areas outside specific growth centers each year. Portions of these needs will be satisfied by the projects that are being considered in connection with the specific growth centers described above.

11. NON-STRUCTURAL

An active program of flood plain information studies accompanied by flood plain zoning and management policies should accompany any structural water control plan. Alert action based on sound hydrologic and hydraulic studies can guide the developmental potential, minimize the unwitting encroachment into areas of high risk flood hazards and promote wise land use policies.

Non-structural means of minimizing water quality and quantity problems are important components of any effective water management plan. The combined Federal and State program for establishing and controlling water quality standards will contribute to the wise use of this resource. Technological improvements in treatment systems, in reuse or closed cycle process in industrial plants and other applications promise gains for both quality and quantity problems.

These and other relevant non-structural alternatives have been carefully considered in the development of the comprehensive water resource plan.

SECTION IV
EVALUATION OF THE SUB-REGION WATER RESOURCES DEVELOPMENT PLAN

12. SELECTION OF BEST SOLUTIONS

Water resource needs for the growth centers in Sub-region H have been described in Section II, and probable sources for meeting these needs were described in Section III. Certain assumptions have been made in order to facilitate selection of the best apparent plan for the provision of these needs. These are: (1) development of presently authorized projects will continue; (2) water supply requirements sufficient to supply the 1980 needs will be provided or contracted for by states or municipalities prior to that time; and (3) minimum releases from all reservoirs would be equal to inflow.*/ Existing, authorized and potential projects whether developed by the Corps of Engineers, Department of Agriculture, state, city, or public utility have been considered. Non-structural alternatives have also been given consideration in the derivation of this plan. The plan, as discussed herein, gives consideration to many potential reservoirs in the sub-region. Future studies of these potential reservoirs will probably result in revision of the tentative data presented here.

Kentucky River Basin.

There are seven growth centers located in the Kentucky River Basin; Whitesburg, Hazard, Jackson, Winchester, Richmond-Berea, Lancaster and Stanford. Winchester is the only primary growth center; the remaining growth centers are considered secondary and/or tertiary.

Diagrams showing the relative locations of the growth centers and the existing or potential units of development from which needs can be met are shown on Pages 16-37 thru 16-41. The diagrams are presented for the North Fork, Middle Fork, South Fork and the Kentucky River proper below the confluence of the three forks.

Whitesburg. The Whitesburg growth center is partially located in the floodplain of the North Fork of the Kentucky River. There is no identified potential alternative project that would provide reduction to the current flood damages of $54,400 annually. Accomplishment of a floodplain information study for the Whitesburg area would appear to be the first step in helping to identify alternatives for alleviation of these damages.

It is estimated that the needs for municipal and industrial water supply will increase from 0.3 MGD in 1980 to 0.5 MGD by 2020. It would appear that sufficient flow is available to meet present water supply needs. Consideration for meeting future needs will be given to North Fork Kentucky River Reservoir or other intermediate or small reservoirs.

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*/ To meet riparian obligations. For purposes of this Study it was assumed that recorded minimum natural low flow would be available for use by all riparian owners.

Hazard. Flood damages remaining after the effects of Carr Fork Reservoir amount to $461,700 annually for this growth center. Land development needs are estimated to require 210 acres of floodplain lands for urban uses by 2020. About 2.1 MGD of water supply will be needed by 2020 along with some 20 cfs for water quality.

The potential North Fork Kentucky River Reservoir would reduce current flood damages from $461,700 to $16,600 annually and provide an adequate degree of protection to about 170 acres of floodplain lands. Increase in the residual flood damages can be inhibited by providing floodplain information for the Hazard area. Water supply and water quality storage allocations in the North Fork Reservoir are included to help meet the needs at Hazard as well as partially provide for downstream needs.

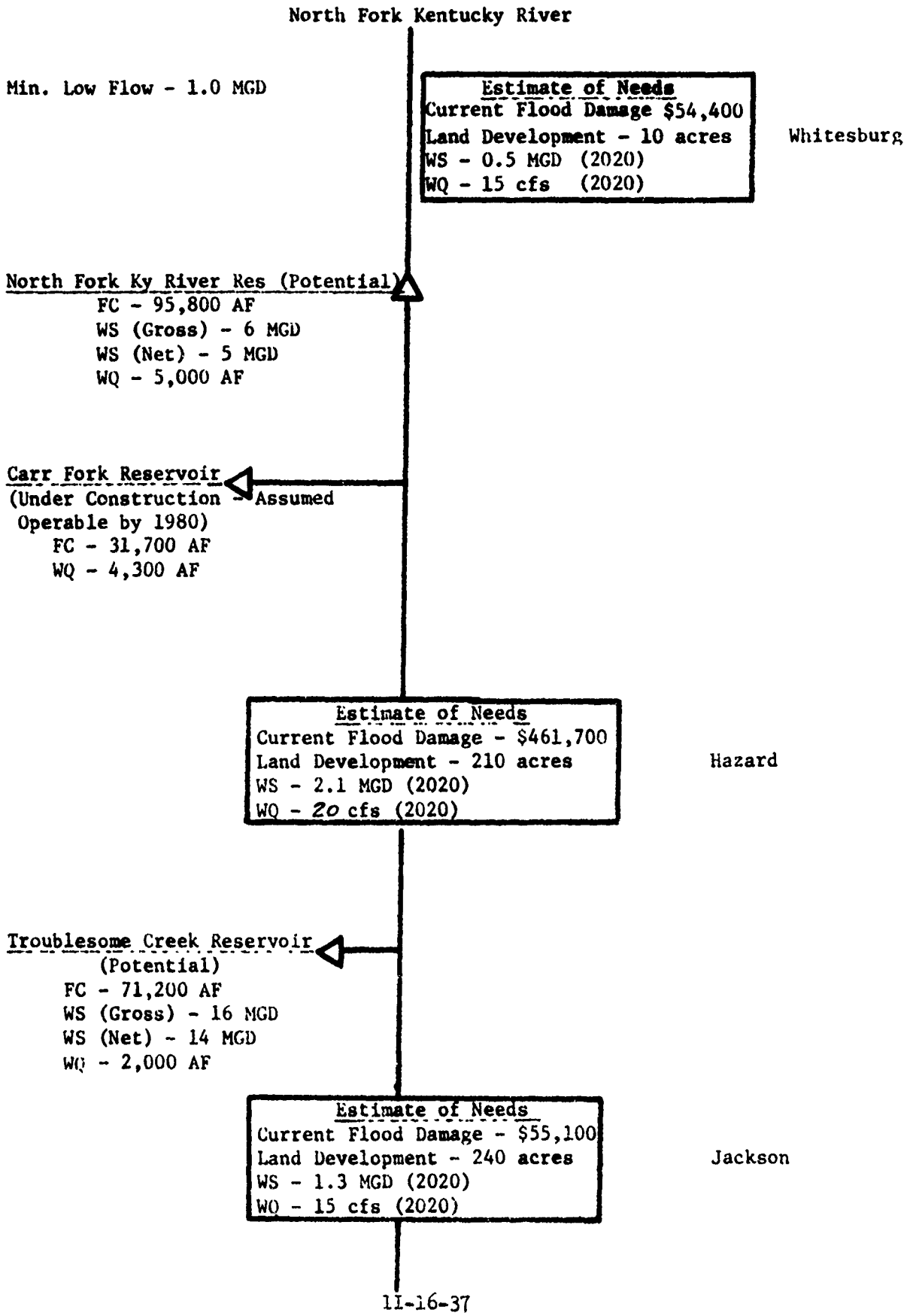
Jackson. Assuming that the growth rate for Jackson increases and parallels the rate established by the benchmark studies, it is expected that the growth center will require 1.3 MGD for water supply by 2020. Water supply is now obtained from the North Fork Kentucky River. Consideration to provision of future water supply and water quality needs will be given to North Fork Kentucky River Reservoir and Troublesome Creek Reservoir, both potential reservoirs upstream from Jackson. Current flood damages are estimated to be $55,100 annually and should be essentially alleviated by the two potential reservoirs, allowing use of the required 240 floodplain acres required for urban development by 2020. A floodplain information study may minimize an increase to the residual damages.

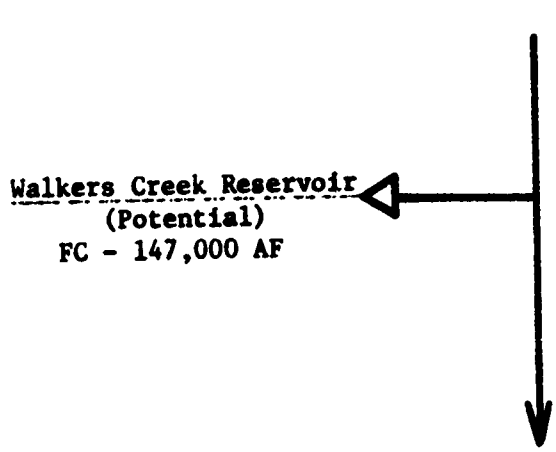
Winchester. Water needs for the primary growth center of Winchester amount to 18.5 MGD for water supply and 40 cfs for water quality control by 2020. Present source of water supply is the Kentucky River. Ample future supplies should be available from the authorized Red River and Booneville Reservoirs, which should be installed before 1980. Additional potential upstream reservoirs would also be instrumental in supplying future needs. There are no significant flood damages and ample lands should be available for future urban land needs.

Richmond-Berea. This secondary growth complex has needs for water resource development of about 15.1 MGD for water supply and 45 cfs for water quality control by 2020. Flood damages and development of adequate lands for future growth should present no problems in the area. The present source of water supply is two small local impoundments and a transmission line from the Kentucky River. Future supplies will be available from Red River and Booneville Reservoirs and additional supplies, if required, from the potential Ford Reservoir.

Other

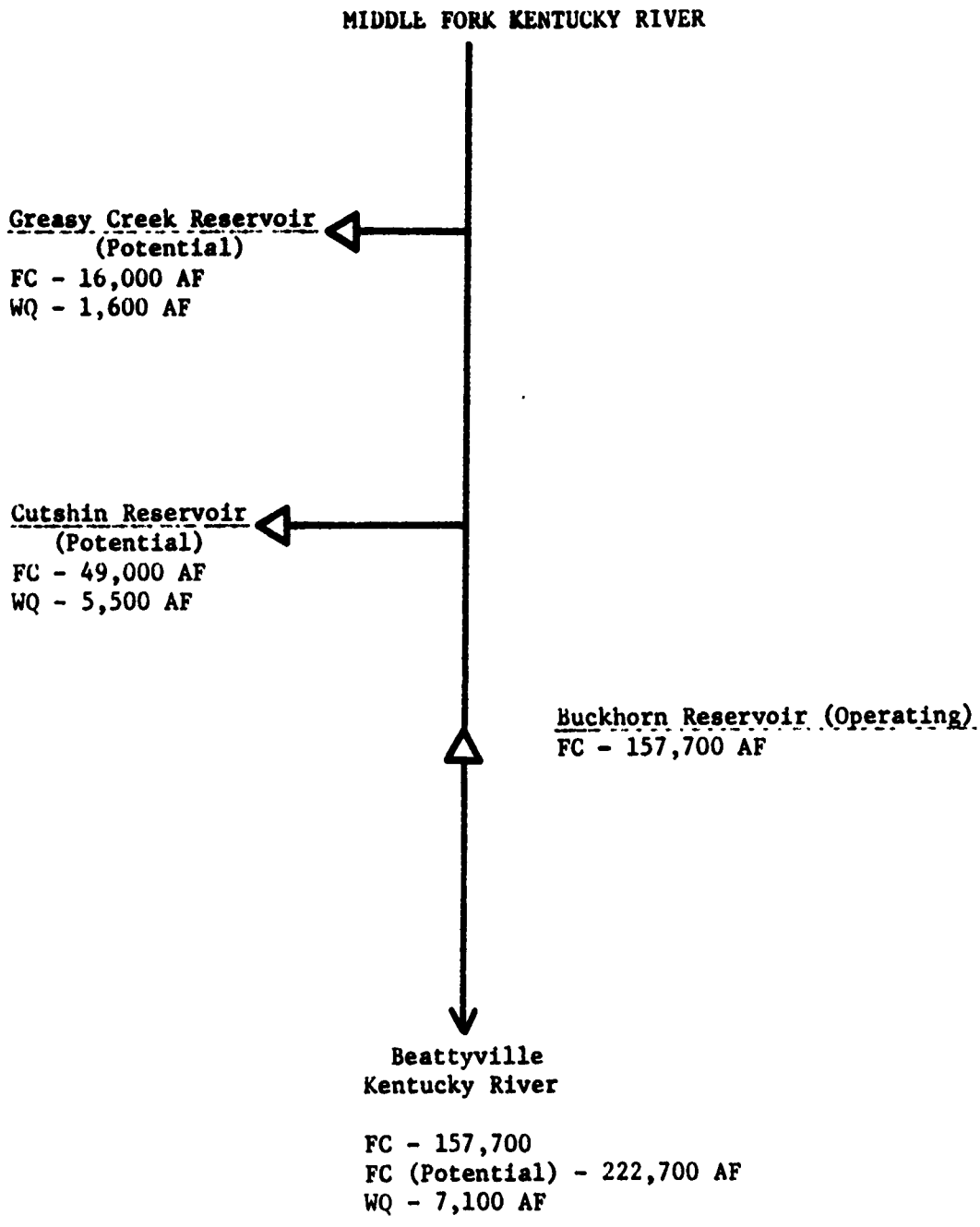
Lancaster. Water needs for the Lancaster growth center consist of an estimated need for 3.1 MGD for water supply and 12 cfs for water quality control by 2020. Water is presently supplied for the area from two small surface impoundments. Future supplies should be adequate as


North Fork Kentucky River
Min. Low Flow - 1.0 MGD
Estimate of Needs
Current Flood Damage $54,400
Land Development - 10 acres
WS - 0.5 MGD (2020)
WQ - 15 cfs (2020)
Whitesburg
North Fork Ky River Res (Potential)
FC - 95,800 AF
WS (Gross) - 6 MGD
WS (Net) - 5 MGD
WQ - 5,000 AF
Carr Fork Reservoir
(Under Construction - Assumed Operable by 1980)
FC - 31,700 AF
WQ - 4,300 AF
Estimate of Needs
Current Flood Damage - $461,700
Land Development - 210 acres
WS - 2.1 MGD (2020)
WQ - 20 cfs (2020)
Hazard
Troublesome Creek Reservoir
(Potential)
FC - 71,200 AF
WS (Gross) - 16 MGD
WS (Net) - 14 MGD
WQ - 2,000 AF
Estimate of Needs
Current Flood Damage - $55,100
Land Development - 240 acres
WS - 1.3 MGD (2020)
WQ - 15 cfs (2020)
Jackson

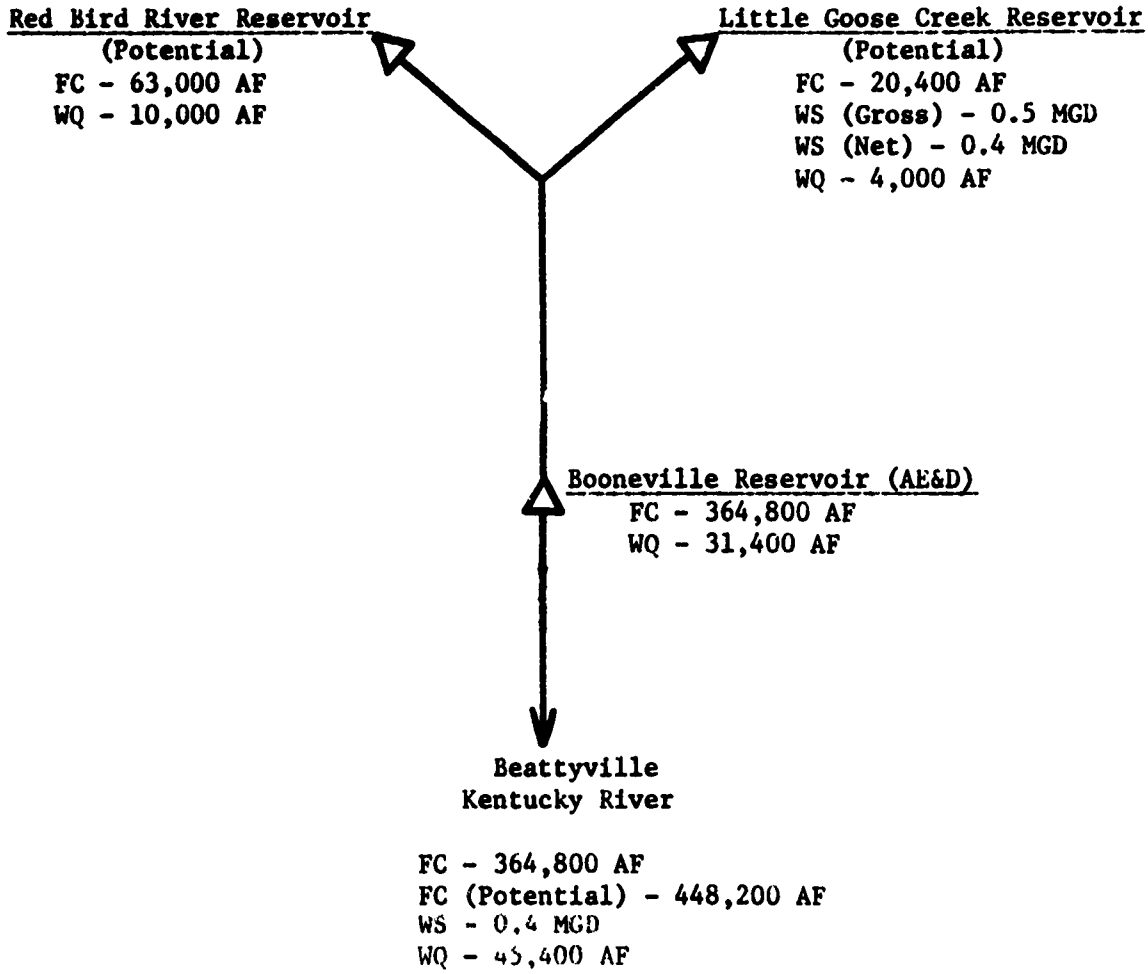


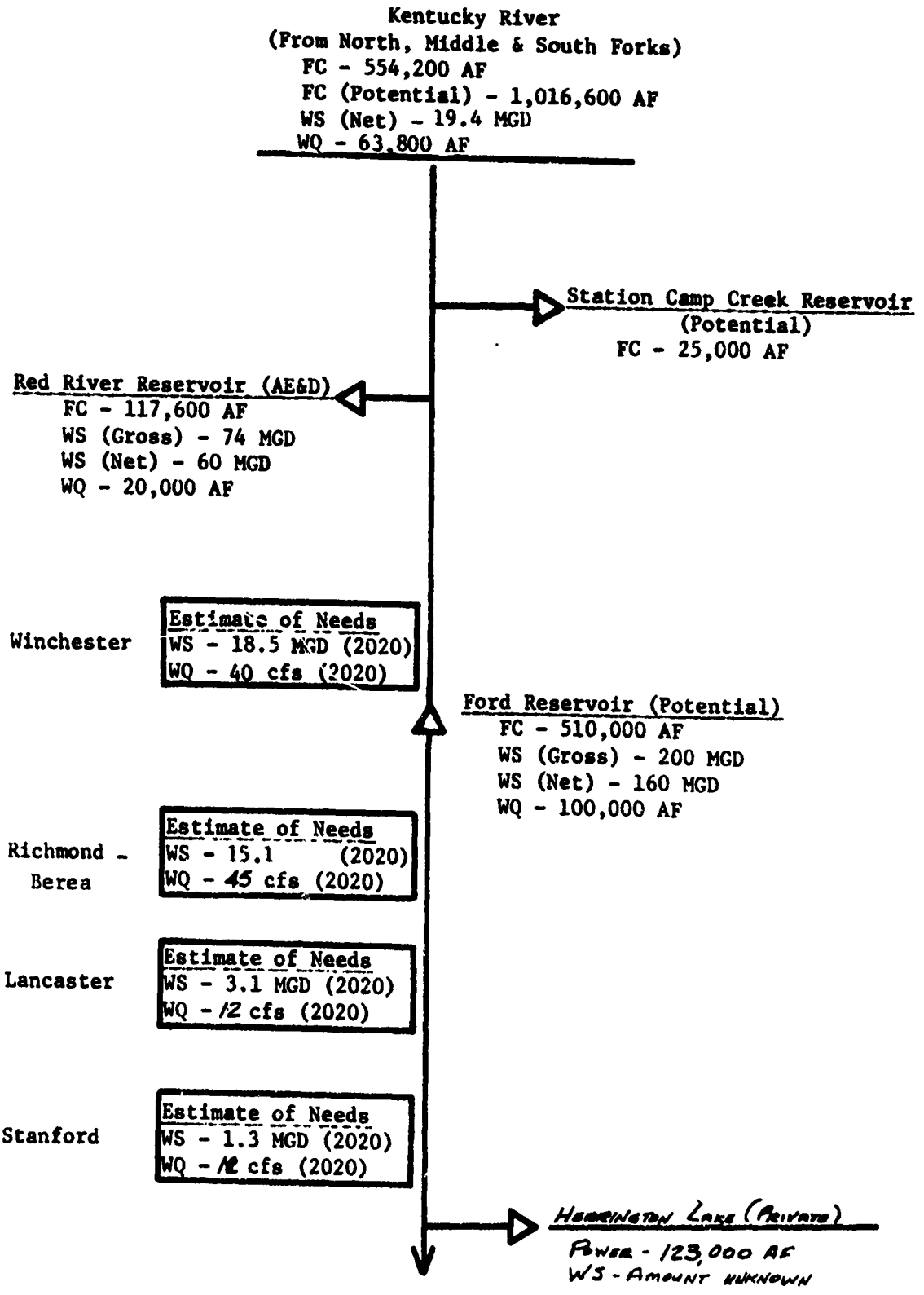
Beattyville
Kentucky River

FC - 31,700 AF
FC (Potential) - 345,700 AF
WS (Net) - 19 MGD
WQ - 11,300 AF


MIDDLE FORK KENTUCKY RIVER
Greasy Creek Reservoir
(Potential)
FC - 16,000 AF
WQ - 1,600 AF
Cutshin Reservoir
(Potential)
FC - 49,000 AF
WQ - 5,500 AF
Buckhorn Reservoir (Operating)
FC - 157,700 AF
Beattyville
Kentucky River
FC - 157,700
FC (Potential) - 222,700 AF
WQ - 7,100 AF

South Fork Kentucky River




Kentucky River
(From North, Middle & South Forks)
FC - 554,200 AF
FC (Potential) - 1,016,600 AF
WS (Net) - 19.4 MGD
WQ - 63,800 AF
Station Camp Creek Reservoir
(Potential)
FC - 25,000 AF
Red River Reservoir (AE&D)
FC - 117,600 AF
WS (Gross) - 74 MGD
WS (Net) - 60 MGD
WQ - 20,000 AF
Winchester
Estimate of Needs
WS - 18.5 MGD (2020)
WQ - 40 cfs (2020)
Ford Reservoir (Potential)
FC - 510,000 AF
WS (Gross) - 200 MGD
WS (Net) - 160 MGD
WQ - 100,000 AF
Richmond - Berea
Estimate of Needs
WS - 15.1 (2020)
WQ - 45 cfs (2020)
Lancaster
Estimate of Needs
WS - 3.1 MGD (2020)
WQ - 12 cfs (2020)
Stanford
Estimate of Needs
WS - 1.3 MGD (2020)
WQ - 12 cfs (2020)
Herrington Lake (Private)
Power - 123,000 AF
WS - Amount unknown

provided by the potential Ford Reservoir and/or the Kentucky Utilities Company's Herrington Lake on Dix River. The authorized Red River and Booneville Reservoirs will also augment the water supply resources of Lancaster. Flood damages and adequate lands for future development should not hinder growth in the area.

Stanford. The only water resource development needs expected to affect the future growth of Stanford are an estimated need for 1.3 MGD for water supply and 12 cfs for water quality control by 2020. Future needs can most probably be supplied from Dix River and Herrington Lake. Availability of adequate lands for future growth should be no problem.

The analysis in the preceding paragraphs applies to only the problems associated with the growth centers that have been identified in the various economic studies. There are, however, problems of flood damage and inadequate water supply in other communities in the basin which are not now identified as growth centers. The establishment of rural water districts will create many demands for public water supply. Many of these needs can be met by the inclusion of multiple-purpose reservoirs in the plans for upstream watershed development as formulated by the Soil Conservation Service.

It should also be pointed out at this time that many of the potential reservoirs described herein have been studied in a cursory manner only, and additional continuing studies of the Kentucky River Basin in more detail will provide additional information concerning these plans.

Lexington and Frankfort are located downstream below Appalachia and their potential growth will depend upon an adequate water supply from the Kentucky River Basin.

In order to meet the water supply demands of the Lexington and Frankfort area at the year 2020, through a drought period of once in 30 year recurrence level, storage is needed to provide approximately 25 MGD above the base flow of the Kentucky River at the point of the Lexington intake.

The most critical reach for water quality control demands from reservoir storage is the reach of the Kentucky River in the vicinity of Lexington.

Projects in Operation or Expected to be in Place by 1980 in Kentucky River Basin:

Corps of Engineers

Carr Fork Reservoir
Buckhorn Reservoir
Booneville Reservoir
Red River Reservoir

USDA Upstream Watershed Projects

Stillwater Creek
Upper Green
Buck Creek
Redlick Creek
Upper Howard Creek

For Continuing Planning:

Corps of Engineers

North Fork Kentucky River Reservoir
Troublesome Creek Reservoir
Walkers Creek Reservoir
Greasy Creek Reservoir
Cutshin Creek Reservoir
Red Bird River Reservoir
Little Goose Creek Reservoir
Station Camp Creek Reservoir
Ford Reservoir

USDA Watershed Projects

Hanging Fork Creek
Silver Creek
Upper Red River

Future Studies

Hazard-Whitesburg (Special)

Non-Structural

Flood Plain Information Studies at:

Hazard, Kentucky
Irvine-Ravenna, Ky.
Beattyville, Ky.
Clay City - Stanton, Ky.
Whitesburg, Ky.
Jackson, Ky.

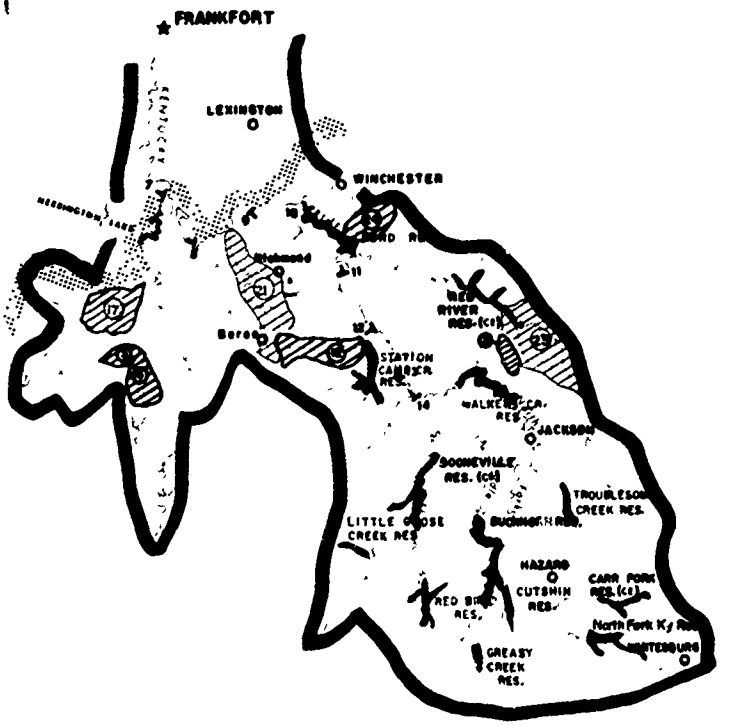
Table 16-11 shows the effectiveness of the potential plan in satisfying the flood control, water supply, and water quality control problems of the growth centers in the Kentucky River Basin. A map and schematic diagram of the various alternatives considered is shown on Figure 16-8.

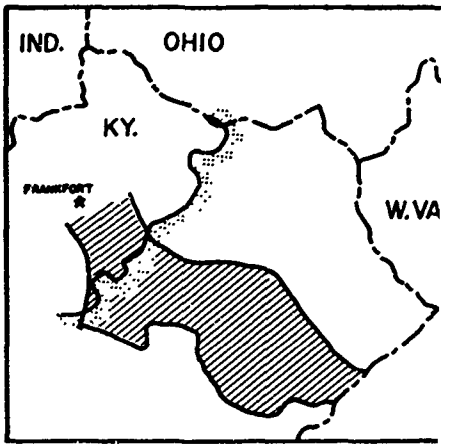
TABLE 16-11

EFFECTIVENESS OF ALTERNATIVES CONSIDERED
IN KENTUCKY RIVER BASIN, SUB-REGION H

Item	Needs 1/	OUTPUT OF ALTERNATIVE PROJECTS												
		North Fork Kentucky River Res.	Trouble-some Creek Res.	Walkers Creek Res.	Greasy Creek Res.	Cutshin Creek Res.	Red Bird River Res.	Little Goose Creek Res.	Herr-ington Lake (Private)	Upstream Water-shed Proj.	Ford Res. Res.	Station Camp Creek Res.	Unmet Needs	Indicated Future Studies
Water Supply (MGD)														
Whitesburg	0.2	0.2											--	
Hazard	1.1	1.1											--	
Richmond-Berea	6.3									4.3	2.0		--	
Lancaster	1.(										1.4		--	
Stanford	0.3								0.3				--	
Water Quality (cfs)														
Whitesburg	15	15											--	
Hazard	12	12											--	
Jackson	15		15										--	
Winchester	25						25						--	
Richmond-Berea	30			20		5		5					--	
Lancaster	6						6						--	
Stanford	6				6								--	
Flood Control (Current Damage - $1,000)														
Whitesburg	54.4												54.4	Flood Plain Management
Hazard	461.7	445.1											16.6	Flood Plain Management
Jackson	55.1	35.8	19.3										--	
Flood Control (Future Urban Land Use in Flood Plain-Acres)														
Whitesburg	10												10	Flood Plain Management
Hazard	180	140											40	Flood Plain Management
Jackson	220	100	120										--	
Recreation Days (1,000)	11,400	600	200	400	100	150	300	200	--	90	1,300	500	7,560	More Intensive Use

1/ Assuming Carr Fork, Buckhorn, Booneville and Red River Reservoirs operating.





VICINITY MAP

LEGEND

APPALACHIAN REGIONAL BOUNDARY

KENTUCKY RIVER BASIN BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

10 5 0 10 20 30 40 50

SCALE IN MILES

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

2 Stillwater Creek
3 Upper Green River
4 Buck Creek
12 Red Lick Creek
24 Upper Howard Creek

ALTERNATIVES AVAILABLE FOR PLANNING

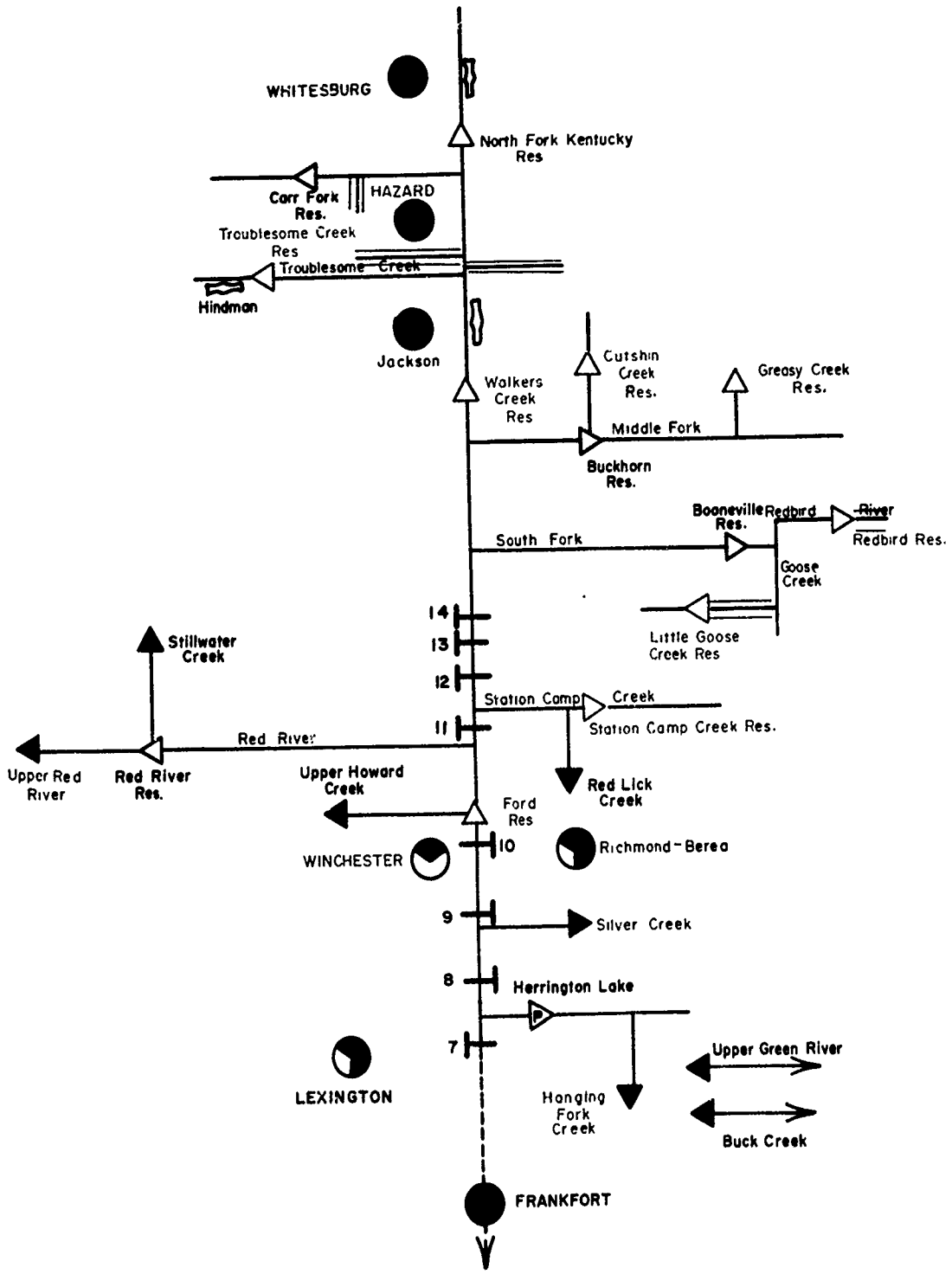
21 Silver Creek
23 Upper Red River
17 Hanging Fork Creek

KENTUCKY RIVER BASIN
KENTUCKY

LOCATION MAP

2

W.VA.


WHITESBURG
North Fork Kentucky Res
Carr Fork Res.
HAZARD
Troublesome Creek Res
Troublesome Creek
Hindman
Jackson
Cutshin Creek Res.
Greasy Creek Res.
Walkers Creek Res
Middle Fork
Buckhorn Res.
Booneville Res.
Redbird
River
Redbird Res.
South Fork
Goose Creek
Little Goose Creek Res
14
13
12
11
Stillwater Creek
Station Camp
Creek
Station Camp Creek Res.
Red River
Upper Red River
Red River Res.
Upper Howard Creek
Red Lick Creek
Ford Res
WINCHESTER
10
Richmond-Berea
9
Silver Creek
8
Herrington Lake
7
LEXINGTON
Hanging Fork Creek
Upper Green River
Buck Creek
FRANKFORT

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR, P INDICATES NON-FEDERAL OWNER
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

STREAMS AFFECTED BY POLLUTION

- CONTINUOUSLY
- INTERMITTENTLY

KENTUCKY RIVER BASIN
KENTUCKY

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

FIGURE 16-8

Licking River Basin

There are two growth centers */ in the Licking River Basin in Sub-region H: Midland-Morehead, which is a primary center, and Mt. Sterling, which is a secondary center. A diagram showing the relative locations of growth centers and alternatives is shown on the following page.

Midland-Morehead. The Midland growth center has current flooding damages of about $234,000 annually and needs for about 2,300 acres of flood plain lands for urban uses by 2020. The area will be made flood-free through the construction of a local protection project. About 6.4 MGD for water supply and 60 cfs for water quality control will be needed by 2020. It is anticipated that water supply and water quality control needs will be met by Cave Run Reservoir. The Morehead area needs additional land for future growth. This will be provided by the Triplett Creek Upstream Watershed and Midland growth area.

Mt. Sterling. Flood damages and land requirements for future growth at Mt. Sterling should not be a hindering factor. Water supply and water quality control requirements by 2020 are expected to amount to 8.4 MGD and 15 cfs, respectively. These needs should be adequately supplied by the Red River Reservoir, presently under construction in the Kentucky River Basin.

Basin Plan (Potential). The flooding problems at the Midland "new town" area can be met by means of Cave Run Reservoir, presently under construction, a local protection project, and flood plain management, if required. It may be necessary to effect a reallocation of storage space in the Cave Run Reservoir to provide the necessary water supply and water quality control needs.

The investigation of the Midland Local Protection Project has progressed to the point that a definite recommendation for authorization can be made. A complete discussion of this project is presented in Part III, Chapter 16 of this report.

The potential plan of development of water resources in the Licking River Basin portion of Appalachia would include the following:

Projects in Operation or Expected to be in Place by 1980:

Corps of Engineers
- Cave Run Reservoir

USDA Watershed Projects
- Fox Creek
- Salt Lick Creek

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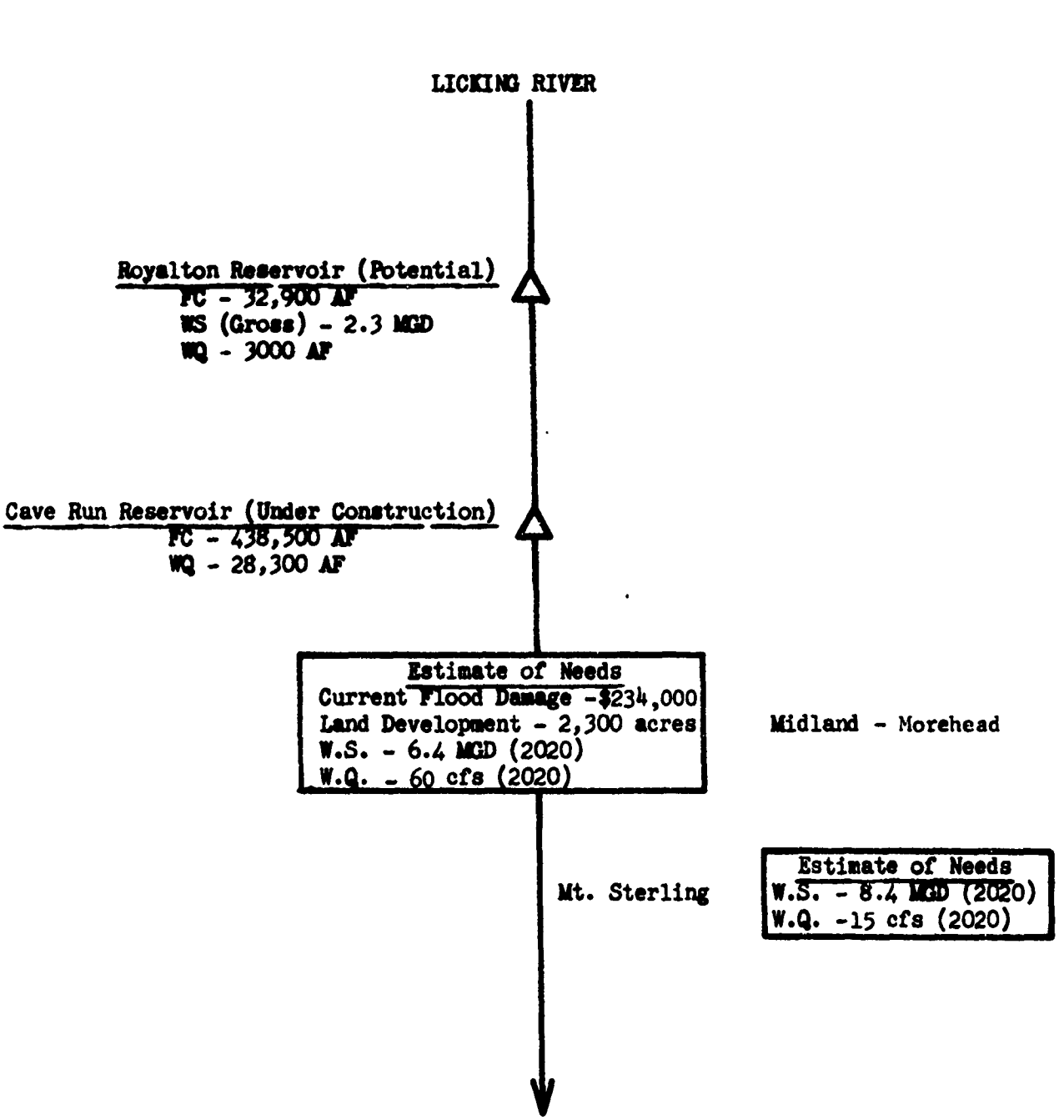
*/ Salyersville, in the Licking River Basin, is a secondary growth center. See Part II Chapters 13 and 14 (Sub-region G) and Part III, Chapter 1 for details.


LICKING RIVER
Royalton Reservoir (Potential)
FC - 32,900 AF
WS (Gross) - 2.3 MGD
WQ - 3000 AF
Cave Run Reservoir (Under Construction)
FC - 438,500 AF
WQ - 28,300 AF
Estimate of Needs
Current Flood Damage -$234,000
Land Development - 2,300 acres
W.S. - 6.4 MGD (2020)
W.Q. - 60 cfs (2020)
Midland - Morehead
Mt. Sterling
Estimate of Needs
W.S. - 8.4 MGD (2020)
W.Q. -15 cfs (2020)

For Authorization:

Corps of Engineers
Midland Local Protection Project

For Continuing Planning:

Non-Structural
Flood Plain Information Studies at:
Midland, Ky.

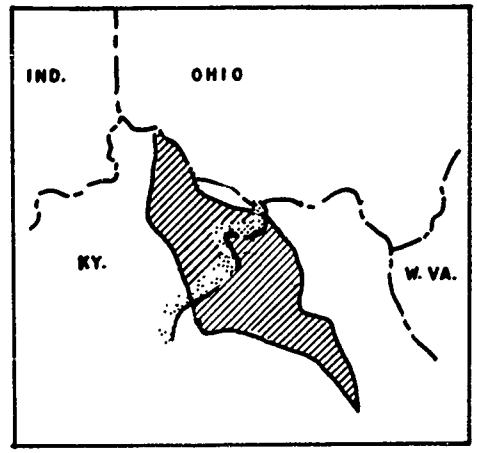
Table 16-12 shows the effectiveness of the potential plan in satisfying the flood control, water supply, and water quality control problems of the growth centers in the Licking River Basin. A map and schematic diagram of the various alternatives considered is shown on Figure 16-9.

TABLE 16-12
EFFECTIVENESS OF ALTERNATIVES CONSIDERED
IN LICKING RIVER BASIN, SUB-REGION H

ITEM	NEEDS 1/	OUTPUT OF ALTERNATIVE PROJECTS		Unmet NEEDS	Indicated Future STUDIES
		Local Protection Proj.	Royalton Res. 2/		
Flood Control (Current Damage - $1,000)					
MIDLAND	97.9	97.9		---	Flood Plain Management, If Required
Flood Control (Future Urban Land Use in Flood Plain - Acres)					
MIDLAND	2,300	2,300		---	Flood Plain Management, If Required
Recreation Days ($1,000)	2,100		250	1,850	

1/ Assuming Cave Run Reservoir Operating.

2/ Located in Sub-region G.



VICINITY MAP

10 5 0 10 20 30 40 50

SCALE IN MILES

LEGEND

APPALACHIAN REGIONAL BOUNDARY

LICKING RIVER BASIN BOUNDARY

EXPECTED TO EXIST BY 1980

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES

MAJOR RESERVOIR

UPSTREAM WATERSHED PROJECT

LPP PROJECT

UPSTREAM WATERSHED PROJECT IDENTIFICATION

EXPECTED TO EXIST BY 1980

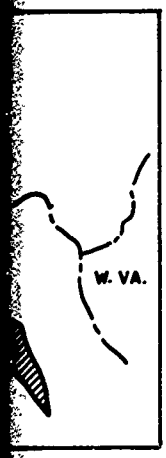
6 Fox Creek
22 Triplett Creek
a Salt Lick Creek

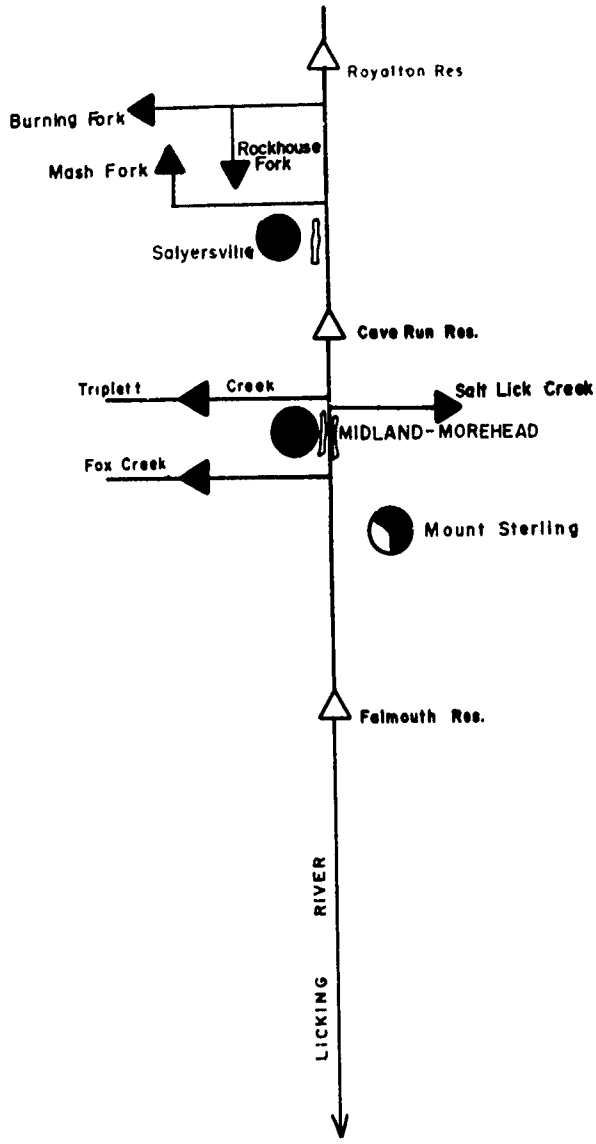
ALTERNATIVES AVAILABLE FOR PLANNING

b Mash Fork
c Rockhouse Fork
d Burning Fork

LICKING RIVER BASIN
KENTUCKY

LOCATION MAP





ONAL BOUNDARY
SIN BOUNDARY
30
R
SHED PROJECT

R
SHED PROJECT

BASIN

MAP

EXP

PLA

TOWN

Town

3

LEGEND

NEEDS

- WATER QUALITY
- WATER SUPPLY
- FLOOD CONTROL

ALTERNATIVES

EXPECTED TO EXIST BY 1980:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT

PLANNING ALTERNATIVES:

- △ MAJOR RESERVOIR
- ▲ UPSTREAM WATERSHED PROJECT
- LPP PROJECT

OTHER

TOWN NAME PRIMARY GROWTH CENTER

Town Name SECONDARY GROWTH CENTER

LICKING RIVER BASIN
KENTUCKY

SCHEMATIC OF WATER NEEDS AND ALTERNATIVE SOLUTIONS

FIGURE 16-9

13. THE SYSTEM - SUB-REGIONAL - GENERAL

Water Supply, Water Quality Improvement, and Flood Control

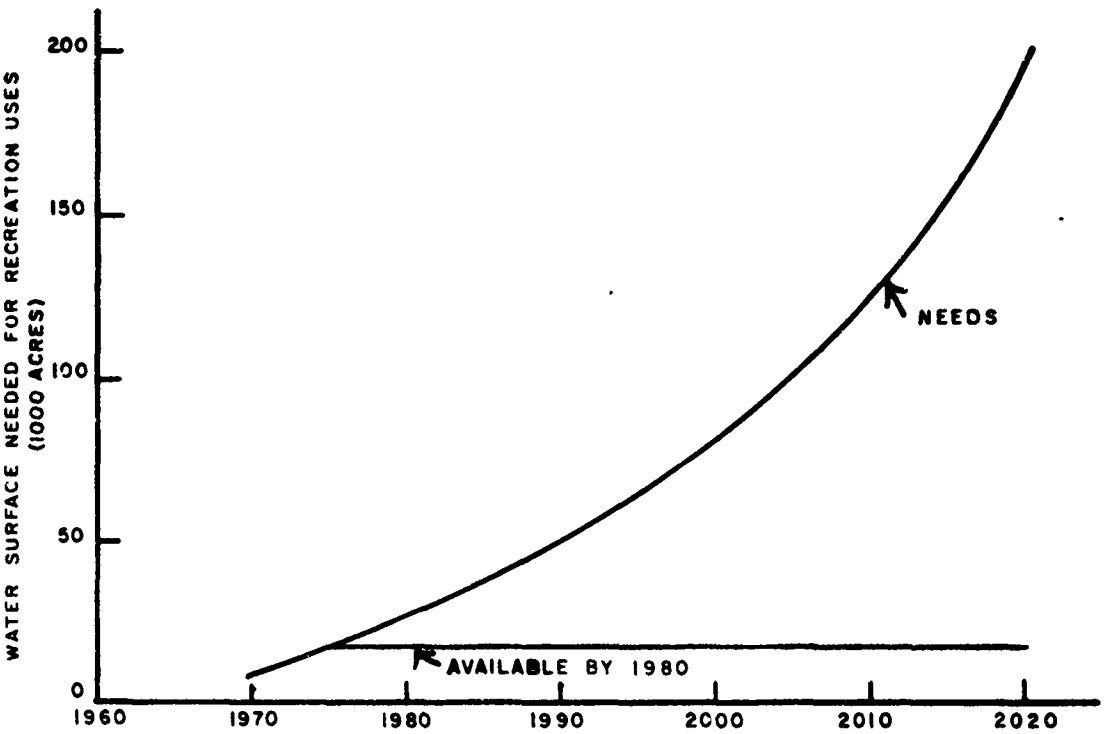
The preceding paragraphs have discussed the water supply problems that are now facing the identified growth centers and the needs that are expected to develop during the next 50 years. These identified gross needs amount to some 52.4 MGD, and provisions to meet these needs will be considered in the projects recommended for continuing study. The same can generally be said insofar as the elimination of serious flooding damage and provision for water quality improvement needs in the growth centers. However, the sub-region as a whole has many towns, non-incorporated communities, and rural areas that will be affected by all these problems. It is estimated that about 87 MGD of water supply for domestic and industrial purposes will be needed for these unidentified areas before 2020, and that they have existing annual flood damages of about $528,300. The development of rural water districts and their distribution systems may result in an increase of the above quoted estimate for these areas.

Satisfaction of a part of these needs will be given consideration in the investigation of the projects recommended for continuing study. Some of the water supply and flood protection needs can be met by upstream watershed projects that either have been studied by the U.S. Department of Agriculture's Soil Conservation Service or which will be studied as the need arises. Those for which studies have been made are shown on Figure 16-11 (Page 16-61) at the end of this chapter. Water supply requirements for both urban and rural use should be one of the prime purposes considered in all future investigations and plans, and the reports should furnish complete information concerning the sites where water can be impounded for this purpose, the amount of storage that could be made available, and the anticipated yield in million gallons per day.

Water quality estimates were based on short cut procedures which are based on generalized assumptions. Detailed studies of assimilative capacity of localized streams could not be made within the time and monetary limitations of the study. However, the estimates should guide future investigations toward potential points of need and indicate the relative magnitude of needs. Dilution may not be a practical or an economical alternative in many of the areas located very high in the drainage basins.

Recreation

The massive increase in needs for outdoor recreation, indicated in Figure 16-5 (Page 16-24), is based on BOR projections in Appendix F. A simplified estimate of water surface area required to meet needs for fishing, boating and swimming, based on BOR estimated relationships in 1980, is included in Figure 16-10. While the estimated availability omits water surface of rivers and streams and many small impoundments, the figure indicates that the sub-region has had enough development to meet all needs until about 1975.



Available by 1980

	Area (acres)
Buckhorn	1,230
Booneville	3,050
Carr Fork	710
Red River	1,510
Cave Run	8,270
Upper Howard Cr.	90
Redlick Cr.	90
Fox Cr.	50
Herrington Lake	2,650
Total	17,650

Figure 16-10. Water Surface Needs & Supply for Outdoor Recreation Use in Water Sub-region H.

In accord with present trends, the Bureau of Outdoor Recreation has estimated that by 2020 the water oriented recreation demands would be 20.3 million man days annually. If the same density of use as in 1980 is used as a measure, then 191,000 acres of water surface would be required, equal to about 6% of the total area of the sub-region. This would indicate that more intensive use of water surfaces and the surrounding areas will be required, including higher mid-week use than at present.

Five recommended Soil Conservation Service upstream watersheds include outdoor recreation as a project purpose. The projects would provide about 540 acres of water and 90,000 recreation days annually. Station Camp Creek, in Estill and Jackson Counties, has been designated as a potential "wild river" by the Commonwealth of Kentucky and should provide many outdoor recreation opportunities.

The National Forests represent another recreation resource that can help meet both present and future needs. The forests provide both streams and artificial impoundments for the enjoyment of the fisherman, the hunter, the picnicker and the sight-seer. In 1966, the recreation use at Daniel Boone National Forest reached 121,500 visitor-days. The 84 acres developed for recreation use can accomodate 680 persons at one time.

Supplement B to Appendix F, prepared by the Forest Service, describes the recreation opportunities in the forests and some of the improvements that are expected to be made in the near future.

The Kentucky River basin and a portion of the Licking River basin are being studied to determine if the area meets the requirements for a National Recreation Area. The study will include the Red River and Red River Reservoir now planned for that stream. The Cave Run Reservoir, because of its proximity to the area, is also being considered for inclusion in the study.

The study will consider some of the following potentials for further development of recreation facilities:

1. Extensive development of several major recreation areas on the Kentucky River.

2. Rehabilitate old roads and bridges and river ferries, and build new roads and bridges which will provide access to prominent areas of scenic beauty, interesting landforms and physical features.

3. Acquisition of land of special value to the recreation development and use that would be despoiled if not in public ownership.

4. Preservation of magnificent scenery by means of scenic easement acquisition.

5. Rehabilitation of the locks and dams on the Kentucky River.

The potential benefits to public for a National Recreation Area on the Kentucky River cannot be estimated at this time.

Conservation

Upstream watershed development has been mentioned in preceding paragraphs when discussing the problems of the various growth centers. However, there are many problems over the sub-region that revolve around floodwater damage, erosion and sediment damage, agricultural water damage, and the management of cropland, grazing land, and the forested areas. These are all problems that fall under the purview of the Department of Agriculture and particularly to the Soil Conservation Service and the Forest Service.

Discussion of these problems is made in Appendix A of this report.

It is estimated that by 1980, in order to provide for the continued production of food and fiber from this sub-region, acceleration of accomplishments of present USDA programs over and above the present rate will be required as follows:

a. Adequately treat and protect 87,240 acres of cropland, improve 146,520 acres of pasture, and establish 171,700 acres of new pasture planting.

b. Stabilization of critically eroding areas on 1,460 acres of roadbank and 9,670 acres of surface-mined areas.

c. Increase recreational and fish and wildlife opportunities by the construction of 730 farm ponds, management of 260 farm ponds for fish production, development of 6,620 acres of wildlife habitat, plan for wildlife habitat preservation of 14,740 acres, revegetate 140 acres, and develop 430 acres of picnic and camping areas.

d. Develop 11,500 basic conservation plans and complete detailed soil survey on 13,489,840 acres of land.

In addition to the above, accelerate land treatment measures on National Forest and private forest and woodlands as follows:

a. Plant 57,930 acres to trees.

b. Treat 62,410 acres for erosion control, and stabilize 2,060 acres of critically eroding and sediment-producing areas, including streambanks and channel clearing.

c. Treat 47,600 acres for hydrologic cultural operations, 25,500 acres harvest cutting, and 18,590 acres of timber stand improvement, and protect 66,300 acres from grazing.

d. Wildlife habitat survey on 50,000 acres and intensively develop 1,500 acres of wildlife habitat, acquire 275,000 acres for public ownership for watershed protection and recreation use. In addition, improve approximately 30 miles of streams for fish habitat.

e. Need for watershed survey and analysis on about 15 National Forest watershed units (approximately 80,000 acres) and standard soil surveys of about 62,000 acres.

On National Forest lands, construct 872 miles of roads and trails; develop 610 acres for recreational sites and four special recreational projects such as the Mount Rogers and Spruce Knob - Seneca Rocks National Recreation Areas; develop and improve fire protection by construction of three lookout towers, one heliport and 200 helispots; develop 50 acres of waterholes and improve 60 acres of stream and lake habitat for fish and wildlife.

Power

The studies of potential projects which have been recommended for further investigation should consider the possible use of impoundments for supply of cooling water for thermal-electric installations.

The use of pump-back peaking installations, to operate in conjunction with the thermal plants, should also be included in these studies.

Selected Plan

Figure 16-11 (Page 16-61) portrays the recommended plan of development for water resources in Water Sub-region H. There are two categories of project portrayed on this plate. The current program of water development which can be assumed to be in place in 1980 is shown as "existing," while new proposals are in the "selected" category. Recommendations for further studies are outlined by area involved or by specific location if the area is quite limited.

A ranking of proposals by urgency of implementation is indicated below, to show the priorities for programming studies and construction. The priorities implied may be modified when capabilities are considered and the effects of continuing investigations are added. These priorities thus indicate the current status of information and omit consideration of capabilities to implement studies or projects. The most urgent classification (I) should be given immediate priority and expeditious implementation. The second order of classification (II) implies implementation within about five years, the third order (III) would be deferred for more than five years, and the fourth order (IV) would be implemented throughout a ten-year period.

I - Immediate Implementation

a. Authorization of Midland Local Protection Project.

b. North Fork Kentucky River Reservoir. This area is included in existing survey study.

c. Flood Plain Information study at Hazard, Kentucky.

d. USDA Watershed projects: Redlick Creek and Upper Howard Creek.

II - Implementation Within The Next Five Years

a. Flood Plain Information Studies at: Irvine - Ravenna, Ky. and Beattyville, Ky.

b. Continuing studies of USDA Watershed projects at Hanging Fork Creek, Silver Creek and Upper Red River.

c. Continuing studies on multiple-purpose reservoirs: Troublesome Creek Reservoir and Ford Reservoir.

III - Implementation May Be Deferred For Five Years Or Longer

a. Flood Plain Information Studies at:

Clay City - Stanton, Ky.
Midland, Ky.
Whitesburg, Ky.
Jackson, Ky.

b. Continuing studies on multiple-purpose reservoirs:

Station Camp Creek Reservoir
Walkers Creek Reservoir
Red Bird River Reservoir
Little Goose Creek Reservoir
Cutshin Creek Reservoir
Greasy Creek Reservoir

IV - Accelerated Land Treatment and Watershed Protection Programs

The U.S. Department of Agriculture recommends acceleration of land treatment and management programs on privately owned and National Forest lands to meet the most urgent needs by 1980. This acceleration will provide continued production of food and fiber and reduction of floodwater, erosion, and sediment damages. It will also increase outdoor recreational opportunities and improve the water and environmental quality of the Sub-region. Priority will be given to critically eroding areas and the drainage areas above the recommended and existing water resource developments of the State, Corps of Engineers and others to improve their efficiency and useful life. The recommendations are on Page II-16-56 under Conservation.

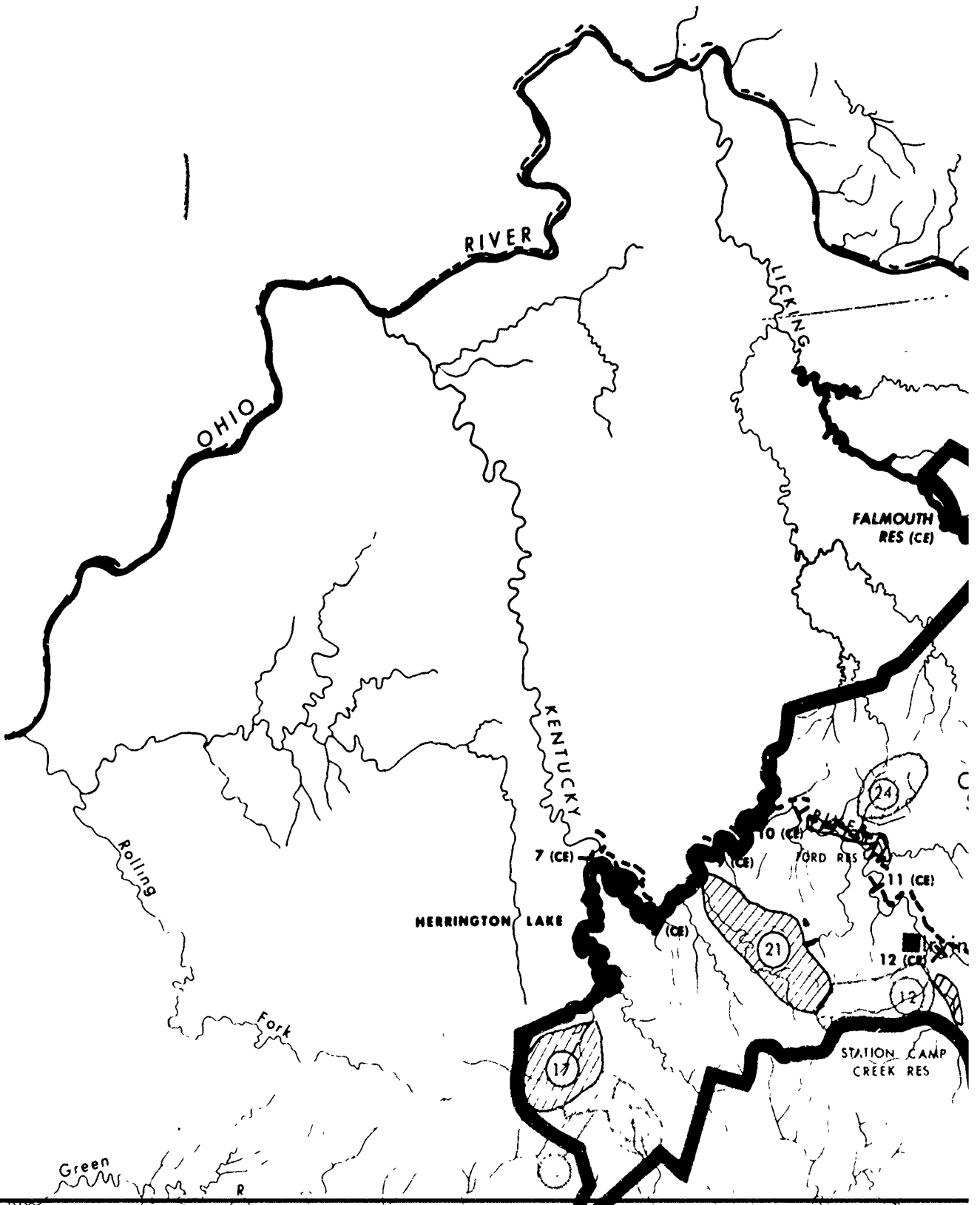
Effectiveness of the Proposed Plan

The water resource plan for this Sub-Region has been developed with emphasis on stimulating economic growth. The considered Midland project and growth centers on the North Fork Kentucky River are in need of flood protection for future growth to take place. The potential reservoirs in the sub-region that are recommended for future study will give prime consideration to the needs of the area relating to flood control, water supply, water quality control, recreation and power supply to provide stimulation for raising the sub-regions economy to a level approximating the national level of economic development.

The total first costs of local protection works and the cost of the developmental plan at Midland will total $631,500,000 by 2020. Benefits credited to the local flood protection works consist of user and expansion benefits which are assigned to national and regional accounts and total $92,380,000 annually.

This development would primarily affect the economics of the 9 Appalachian counties lying within a 25 mile radius of Midland. Detailed estimates of employment and wage gain permitted by the implementation of the Midland project have been made. Total employment in the area is expected to reach 35,600 by 2020 and wages resulting from this employment are expected to total about $326,000,000.

The plan, including both definite proposals and future studies, appears to be capable of meeting the water needs imposed by accelerating economic development of Sub-Region H to the point that rough parity with the nation in per capita income, in employment and in population growth, would be attainable by 2020. The proposals would appear to be practical and obtainable measures by which water needs could be met.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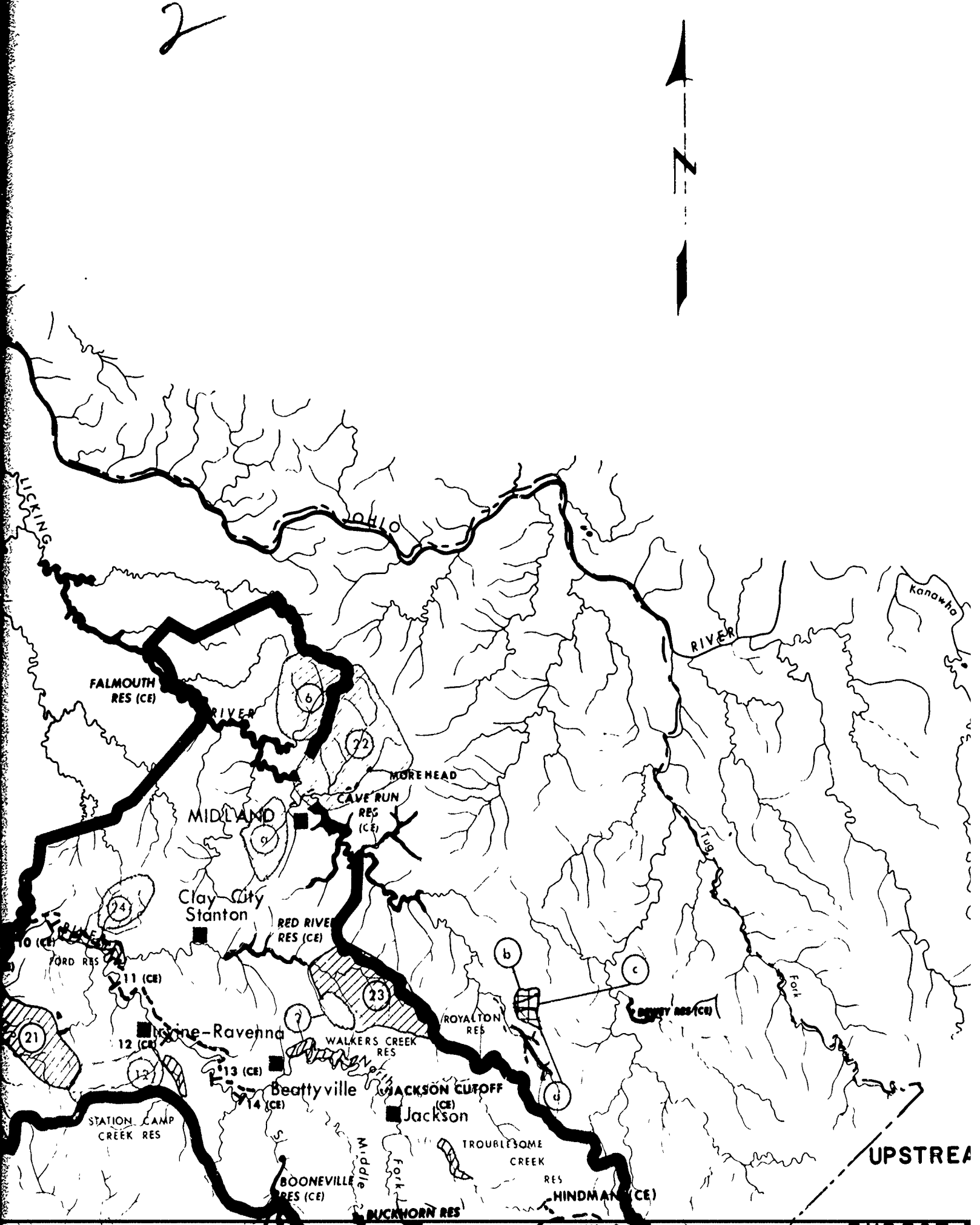
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RES
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Beattyville
14 (CE)
JACKSON CUTOFF
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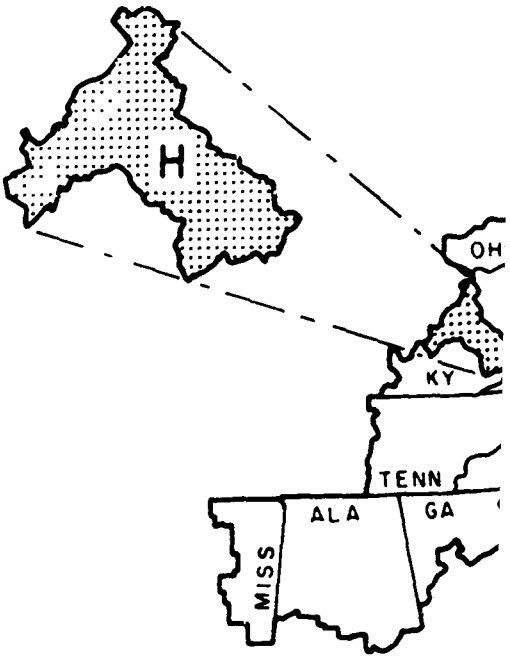

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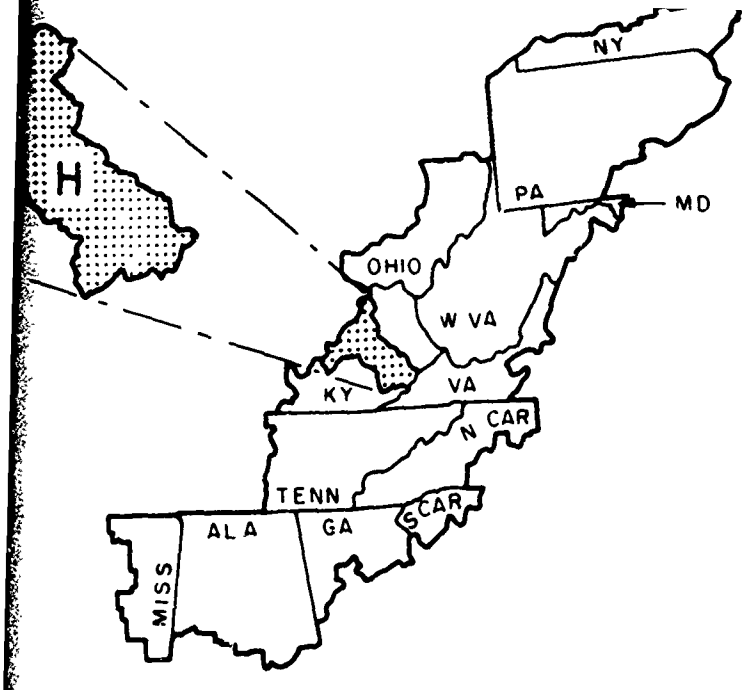

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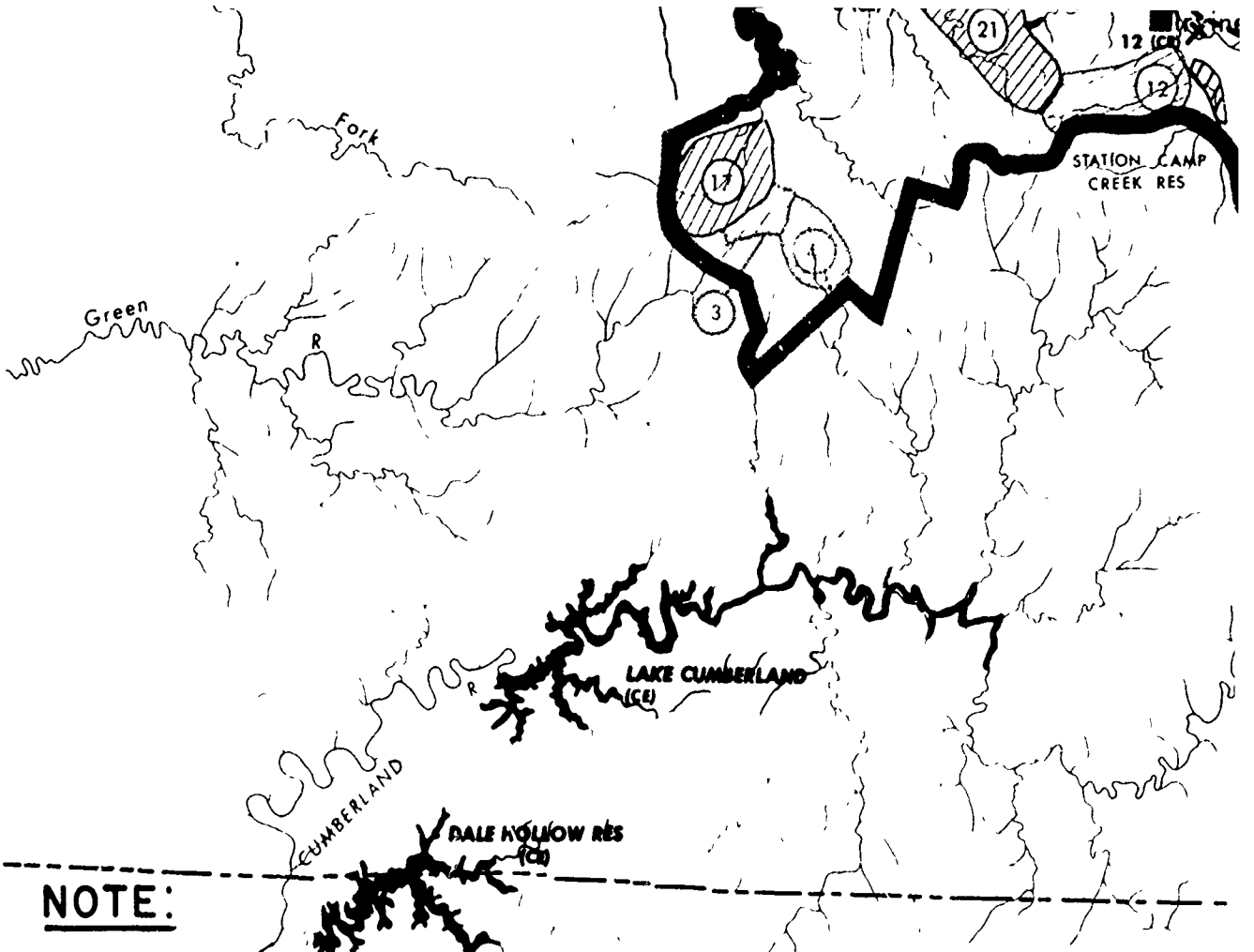

NOTE:

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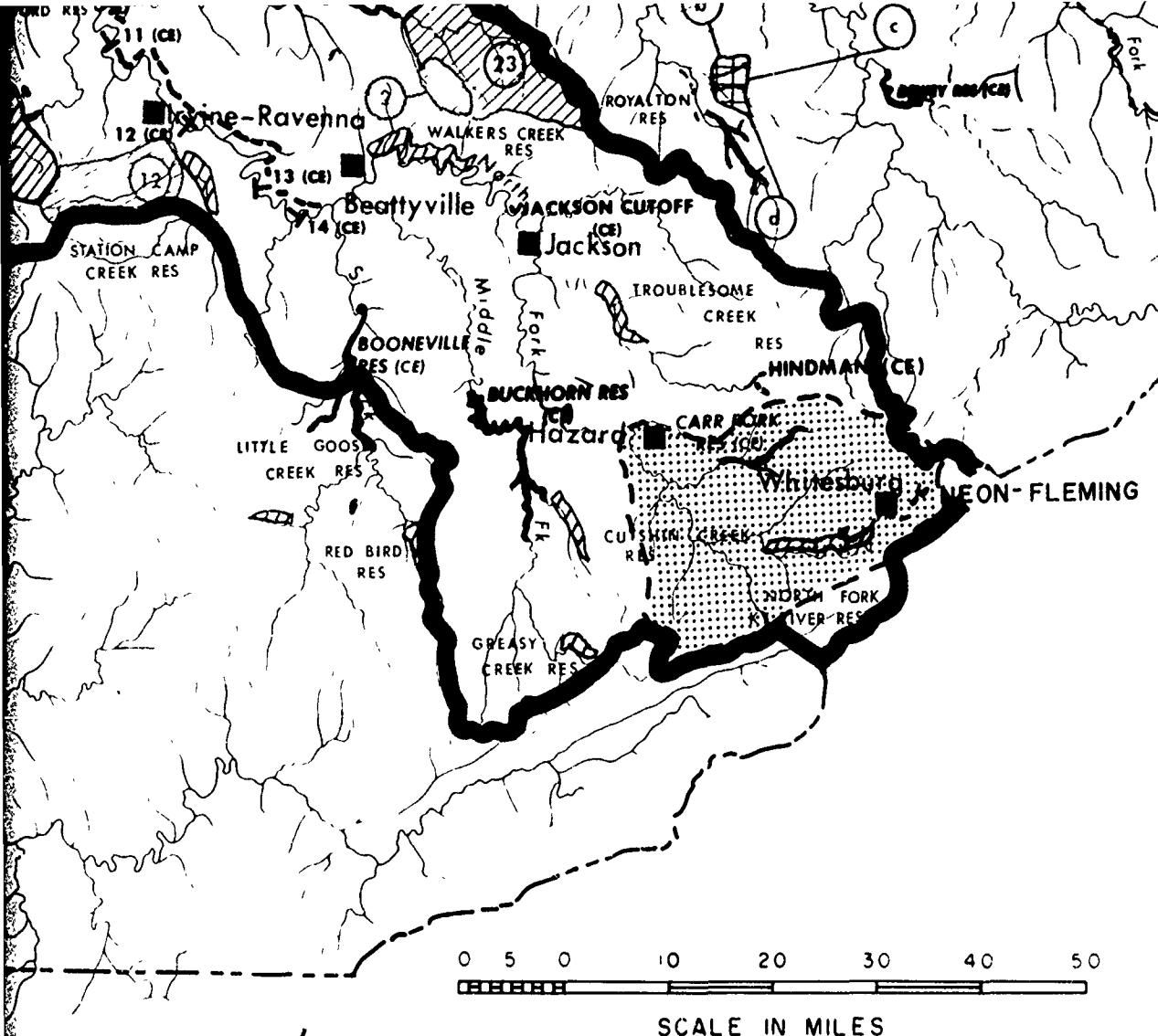

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KENTUCKY		
2. Stillwater Creek	17. Hanging Fork Creek	b Mash Fork
3. Upper Green River	21. Silver Creek	c Rockhouse Fork
4. Buck Creek	23. Upper Red River	d Burning Fork
6. Fox Creek		
12. Redlick Creek		
22. Triplett Creek		
24. Upper Howard Creek		
a Salt Lick Creek		

* Recommended for Early Action

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REPORT FOR
DEVELOPMENT OF WATER RESOURCES
IN
APPALACHIA

WATER SUB-REGION H

LAN OF DEVELOPMENT

OFFICE OF APPALACHIAN STUDIES JUNE 1968

II-16-61 FIGURE 16-11

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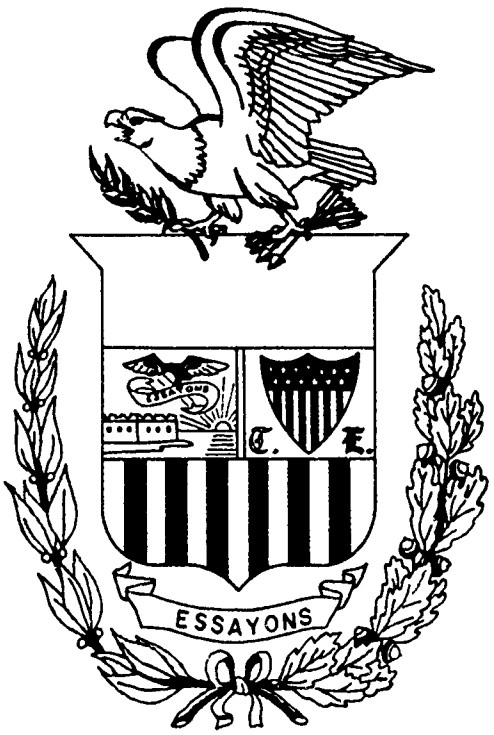

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