

GEOLOGICAL SURVEY CIRCULAR 341



PUBLIC AND INDUSTRIAL WATER
SUPPLIES OF THE MISSISSIPPIAN
PLATEAU REGION, KENTUCKY

PROPERTY OF
U. S. GEOLOGICAL SURVEY
PUBLIC INQUIRIES OFFICE
SAN FRANCISCO, CALIFORNIA

Prepared in cooperation with
the Agricultural and Industrial
Development Board of Kentucky

UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

GEOLOGICAL SURVEY CIRCULAR 341

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF THE MISSISSIPPIAN
PLATEAU REGION, KENTUCKY

By Richmond F. Brown

Prepared in cooperation with
the Agricultural and Industrial
Development Board of Kentucky

CONTENTS

	Page		Page
Abstract	1	Water resources	5
Introduction	1	Utilization	5
Purpose and scope of report	1	Quality of water	10
Previous investigations	1	Surface water	12
Methods of investigation and presentation		Ground water	12
of data	2	Ohio River valley	12
Acknowledgments	2	Interfluvial area	12
Geography	2	Clifty area	12
General description	2	Greensburg area	13
Subregions	3	Pennyroyal area	13
Mineral resources	3	Mountain Margin area	13
Geology	5	Marion area	13
Stratigraphy	5	Descriptions and analyses	14
Structural features	5	Literature cited	38

ILLUSTRATIONS

	Page
Plate 1. Map of the Mississippian Plateau region, Kentucky, showing source of public and industrial water supplies and average daily use	In pocket
2. Map of the Mississippian Plateau region, showing chemical analyses of public and industrial ground-water supplies	In pocket
Figure 1. Index map of Kentucky, showing location of this report and progress of ground-water investigations	Facing 1
2. Index map of the Mississippian Plateau region, showing ground-water areas	4
3. Water utilization and source in the Mississippian Plateau region	9

TABLES

	Page
Table 1. Generalized section of the geologic formations exposed or penetrated in the Mississippian Plateau region, Kentucky, 1951	6
2. Pumpage and source of ground water for public and industrial supplies in the Mississippian Plateau region, 1951-1953	7
3. Pumpage of surface water for public and industrial supplies in the Mississippian Plateau region, 1951-1953	8
4. Average daily pumpage of water for public and industrial supplies, by areas, in the Mississippian Plateau region, 1951-1953	8
5. Elements and substances commonly found in ground water	11

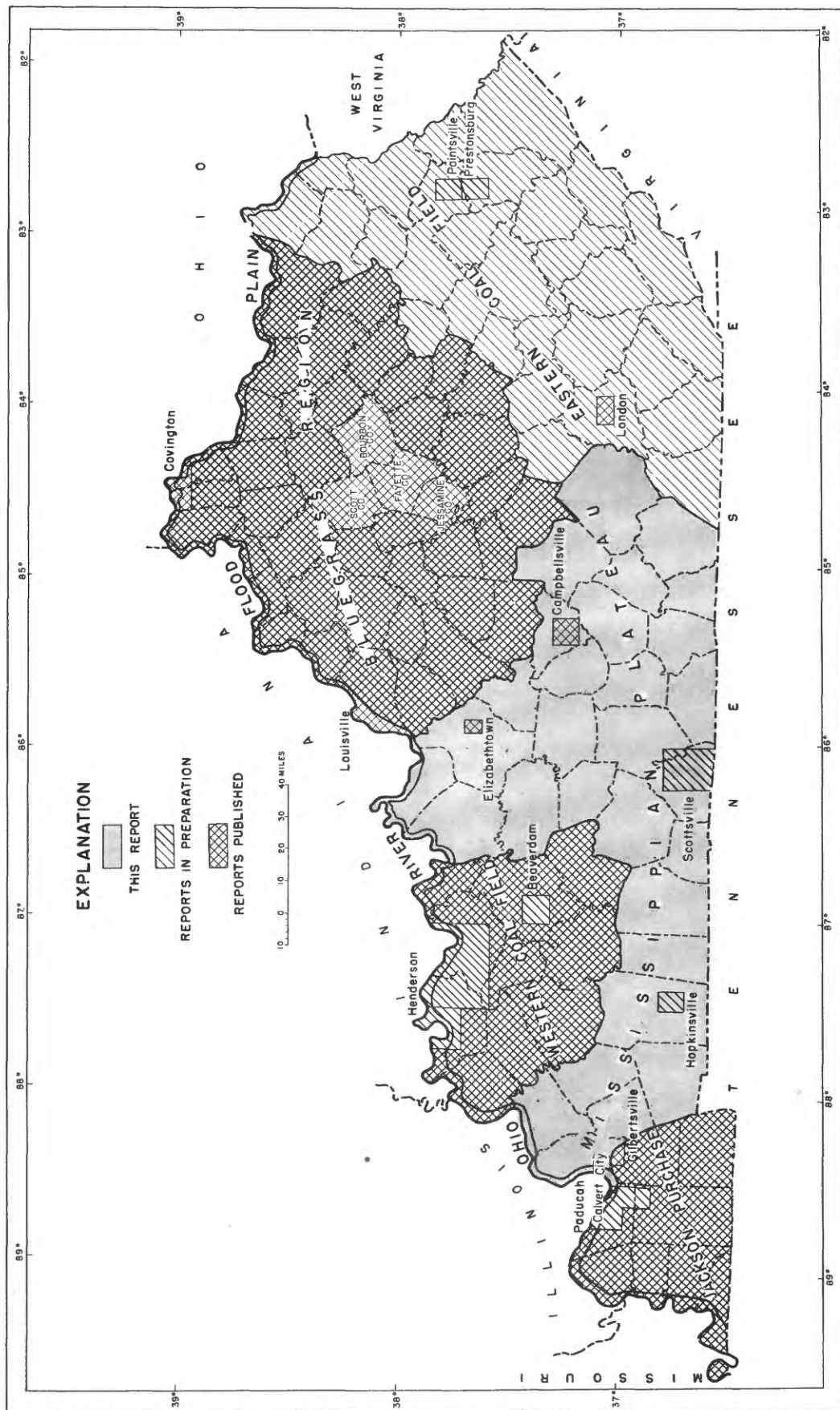


Figure 1.--Index map of Kentucky, showing location of this report and progress of ground-water investigations.

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF THE MISSISSIPPIAN PLATEAU REGION, KENTUCKY

By Richmond F. Brown

ABSTRACT

This report presents data on public and industrial water supplies in the Mississippian Plateau region of central Kentucky. The data were obtained during the years 1951-1953. Thirty counties, comprising 11,887 square miles, are included.

The region is typically a gently rolling plain underlain by soluble limestone and dotted with solution depressions. Sandstone overlies the limestone in the higher areas, and thick alluvium is present along the Ohio River. In much of the area drainage is through subsurface solution channels. The principal industry is agriculture. The climate is of the humid continental type. The major structural features in the region are the Cincinnati arch in the eastern part and the western geosyncline and Cumberland River arch in the western part.

The total daily pumpage of water is about 33 million gallons. About 25 million gallons is pumped from ground-water sources and about 8 million gallons from surface water. Of the total amount of water pumped, 12 million gallons per day is for public supplies; the remaining 21 million gallons is for industrial uses.

The public supplies inventoried furnish water to about 128,000 people. Those obtained from surface-water sources furnish water to about 82,000 people; ground-water sources supply about 46,000 people. Ground water is used by 8 industrial and 37 public water-supply plants.

The chief aquifers are the middle Mississippian limestones and the alluvium in the Ohio River valley. The former are the source of 32 of the ground-water supplies; the latter supplies the largest producing wells in the region and the greatest amount of water. Sixteen public supplies and four industrial supplies are obtained from springs. A number of large springs are not now utilized.

Analyses of water, in most cases raw water, from 46 water plants indicate a wide range in chemical quality. In general the water ranges from hard to very hard, but otherwise it is suitable for public supplies and most industrial uses.

INTRODUCTION

Purpose and Scope of Report

In order that the use and conservation of the water resources of the State of Kentucky may be planned most effectively, the State, through the Agricultural and Industrial Development Board of Kentucky, has entered into cooperative agreements with the United States Geological Survey providing for studies of the water resources. This report, prepared as a part of the cooperative ground-water investigations, is one of a series of five presenting data on the public and industrial water supplies of the State. The others cover the Blue Grass, Eastern Coal Field, Western Coal Field, and Jackson Purchase regions.

The Mississippian Plateau is a U-shaped region lying in the west-central part of the State (see fig. 1) and, as defined in this report, includes 30 counties. It comprises an area of 11,887 square miles or about 30 percent of the State.

The report presents information on the water supplies of 58 of the cities, larger towns, and institutions of the area and of 10 industries that have their own water supplies. With few exceptions, water supplies of less than 5,000 gallons per day (gpd) are not described. In 1951 the public water-supply systems in the Mississippian Plateau region served a population of about 128,000, which is about 25 percent of the total population in the region and about 4.3 percent of the total population of the State. The report presents data on source, pumpage, treatment, and storage facilities at the water plants and chemical analyses of 44 ground-water supplies and 2 surface-water supplies.

Previous Investigations

A detailed study of the public and industrial water supplies of the Mississippian Plateau region has not been undertaken previously. E. G. Otton (1948a and b) described ground-water conditions in the vicinity of Elizabethtown and Campbellsville, and E. H. Walker ^{1/} made a study of ground-water resources in

^{1/} Walker, E. H., The ground-water resources of the Hopkinsville area, Ky. [In preparation]

the vicinity of Hopkinsville. Information on pumpage and quality of two of the larger municipal surface-water supplies, those of Hopkinsville and Bowling Green, is included in a report by E. W. Lohr and others (1952). All these investigations have been made by the U. S. Geological Survey, most of them in cooperation with Kentucky State agencies.

Methods of Investigation and Presentation of Data

The public and industrial water supplies described in this report were visited by Philip U. Martin in 1951 and by William B. Hopkins and the writer in 1952 and 1953. Samples of surface water were taken at Bowling Green and Hopkinsville, and samples were taken at each plant inventoried that used ground water. These samples were analyzed in the regional laboratory of the Quality of Water Branch of the U. S. Geological Survey at Columbus, Ohio, under the direction of W. L. Lamar, district chemist.

An attempt was made to include all municipal supplies; other public supplies and industrial supplies were limited to those larger than 5,000 gpd. Most of the pumpage figures are based on estimated pumping rates and hours pumped per day. Where available the figures are given for average pumpage per day for each month. The accuracy of all data obtained ranged from good to poor, but they were the best available at the time the inventory was made.

Ground-water investigations are under the general direction of A. N. Sayre, chief, Ground Water Branch, U. S. Geological Survey, and in Kentucky under the direction of M. I. Rorabaugh, district engineer. The information was gathered and the report was written under the supervision of E. H. Walker and G. E. Hendrickson, geologists.

Detailed information on each water supply is given under the heading "Descriptions and analyses" and is summarized in maps, figures, and tables accompanying this report. The pumpage is shown in average gallons per day and gallons per year where this information was available. Where pumpage is seasonal or intermittent, the pumpage is shown in gallons per day while in operation.

Included in the report are a brief description of the geography and geology of the region, and a general discussion of the water resources.

The wells and other sources of the ground-water supplies described in this report are numbered to conform to the numbering system used throughout Kentucky by the Ground Water Branch. Under this system the State has been divided into rectangles bounded by 5-minute meridians of longitude and 5-minute parallels of latitude. Each rectangle has been assigned a number based on the longitude and latitude at its southeast corner. Well 8600-3705-1 at Park City, for example, is the first well or spring to have been enumerated in the rectangle bounded on the east by longitude 86°00' and on the south by latitude 37°05'. (See pl. 1.) Surface-water supplies are designated by town or institution names, or by capital letters if industrial. For example, the surface-water supply of the Tennessee Gas Transmission Co. near Campbellsville is the first to have been enumerated in

rectangle 8520-3720, and is designated by the letter "A." (See pl. 1.)

Acknowledgments

This report is based chiefly on information furnished by owners and operators of the public and industrial supplies, and the report could not have been prepared without the cooperation of these officials. The officials of the county health departments of the various counties also furnished information of many of the public water supplies.

GEOGRAPHY

General Description

The Mississippian Plateau region, as defined in this report, consists of 30 counties in the west-central part of the State. (See fig. 1.) Some of the marginal counties include areas not generally considered to be a part of the Mississippian Plateau region; however, they are included here for convenience in order to draw the regional boundary along county lines. The region is bounded on the east by the Eastern Kentucky Mountains or the Eastern Coal Field, on the north and northeast by the Blue Grass region and the Ohio River, on the northwest by the Western Coal Field and the Ohio River, on the west by the Jackson Purchase region, and on the south by the State of Tennessee.

The Mississippian Plateau is typically a gently rolling plain underlain by soluble limestone. The plateau is dotted with numerous enclosed depressions or sinkholes, some of which were formed by collapse of the surface into subterranean caverns. These caverns were formed by the solution of the underlying limestone by ground water. This sinkhole surface is everywhere developed on the limestones of Meramec age. Along the Cincinnati arch, the northern and eastern border of the region, and in a number of areas where sandstones or shales are dominant, a mature topography with deeply entrenched streams is developed.

Agriculture is the most important industry in the region. The chief crops are tobacco and corn; however, dairying is becoming increasingly important as land is converted to pasture. Manufacturing and the quarrying of limestone are the next largest industries. In some areas oil and gas are produced.

The Mississippian Plateau region has a humid continental climate. The mean annual temperature is about 57° F. Minimum temperatures below 0° F occur occasionally in December, January, and February, but cold weather seldom lasts longer than 2 months. The periods of cold weather are always broken by intervals of moderate temperature. Maximum temperatures higher than 100° F are reached on several days of each summer. The growing season, or frost-free period, is about 187 days. The annual precipitation ranges from 40 to 50 inches. About half this amount falls during the warm period from April to September. Usually there is sufficient rain for staple crops, although prolonged droughts do occur.

Subregions

In order to describe the Mississippian Plateau adequately it has been subdivided into seven subregions: Ohio River valley, Interfluvial area, Clifty area, Greensburg area, Pennyroyal area, Mountain Margin area, and Marion area. (See fig. 2.) The boundaries of these subregions are modified from Sauer (1927) and most of them approximate geologic boundaries.

The Ohio River valley contains extensive terrace deposits. Along the Kentucky side of the Ohio River these deposits in this area range in width from a feather edge to several miles and attain a maximum measured thickness of 134 feet. The terrace surfaces are relatively flat and well suited for farming. Several large industries and three small towns are situated on these terraces.

Flood-plain and terrace deposits also occur along several tributaries of the Ohio River in the area, notably the Cumberland, Green, and Barren Rivers.

Between Kentucky Lake and the Cumberland River lies the Interfluvial area. The surface materials in most places are Cretaceous, Tertiary, and Quaternary sediments consisting largely of sand, gravel, and clay. These are underlain by cherty limestones of late Osage and early Meramec age. There is very little flatland suitable for farming except on the flood plain of the Cumberland River. Most of the area is included in the Kentucky Woodlands Wildlife Refuge of the U. S. Fish and Wildlife Service. Eddyville, in Lyon County, is the largest town in the area.

The Clifty area bounds the Pennyroyal area on the north and west (fig. 2). The topographic break between the areas is distinct in most places. Steep, resistant hills capped by sandstones of late Mississippian and early Pennsylvanian age rise suddenly from the relatively flat Pennyroyal plateau to form the Dripping Springs escarpment. Outlying hills of limestone protected by a sandstone cap are present in many places. Mature topography produced by surface drainage is well developed in most of the area; however, sinkhole depressions are found near the perimeter of the Clifty area, drainage into them having developed after the overlying sandstone formation had collapsed into caverns in the underlying limestone. In general, farms and towns are small. Hardinsburg and Leitchfield are the major towns.

The Greensburg area is largely underlain by impure limestone and shales of Osage age. Remnants of formations of Meramec age, with some small solution depressions, are found on the highest levels. In the remainder of the area, the Green and the Barren Rivers and their tributaries have developed normal, mature topography. The valley sides are steep, and the bottom lands are narrow and subject to periodic flooding. The larger towns in the area include Glasgow, Campbellsville, Columbia, and Greensburg.

The Pennyroyal area is largely underlain by limestones of Meramec age which are very soluble in ground water. The topography is gently rolling and dotted with solution depressions. Land is fertile over most of the area, and farms are large and prosperous. The Green and the Barren Rivers drain the central

part of the area, and here normal topography is developed adjacent to the rivers; however, away from these rivers tributary drainage is largely into solution depressions, and discharge to the rivers occurs from springs and seeps. The largest towns in the Mississippian Plateau region lie in the Pennyroyal area and include Bowling Green, Hopkinsville, and Elizabethtown.

Between the Cumberland River and the Eastern Coal Field lies the Mountain Margin area. The land adjacent to the Cumberland River is very dissected, valleys are steep sided, and most of the area is forested. Formations of Osage and older age underlie this surface. On either side of the river, limestone formations of Meramec age underlie the surface, and the topography is very similar to that of the Pennyroyal area; solution depressions are common. Surface streams flowing down to this level from the mountains generally drain into the solution depressions in the limestone, and the water then enters the Cumberland River from springs and seeps. The soils here are good, and the farms are prosperous. East of the Mountain Margin area, the limestone surface gives way to the Eastern Kentucky Mountains. Formations of Chester age and younger are exposed adjacent to the mountains. Here the topography is characterized by considerable relief, and most of the land is forested. Monticello and Albany are the chief towns in the Mountain Margin area; both are on the limestone plain.

The Marion area is similar to the Pennyroyal area except that it has been modified by faulting. Solution depressions are prominent where the Meramec formations are at the surface, but where faulting has brought other formations to the surface, normal surface drainage is developed. The sides of the valleys are steep, and there is little flat land available for farming. Much of the area is forested. Fluorspar mining is an important industry near Marion and Salem, the largest towns in the area.

Mineral Resources

A variety of mineral resources is present in the Mississippian Plateau region. At present, only limestone, asphalt, petroleum, fluorspar, and water are of major economic importance.

Limestone suitable for building stone, road metal, railroad ballast, lime, agricultural limestone, portland cement, or rock wool is quarried throughout the Mississippian Plateau region from rocks of Mississippian age. Fluorspar is mined extensively in the Marion area, especially in central Crittenden County from vein deposits associated with the extensive faulting that has occurred there.

Asphalt is quarried in Edmonson and Grayson Counties from large deposits of natural rock asphalt in the lower Pennsylvanian and upper Mississippian sandstone formations.

Petroleum and natural gas are produced from formations ranging in age from Ordovician to Mississippian. Petroleum is currently being obtained from all but Adair, Casey, Edmonson, Livingston, Lyon, Russel, and Trigg Counties.

EXPLANATION



INTERFLUVIAL AREA



CLIFTY AREA



MOUNTAIN MARGIN AREA



PENNYROYAL AREA



GREENSBURG AREA



MARION AREA



OHIO RIVER VALLEY

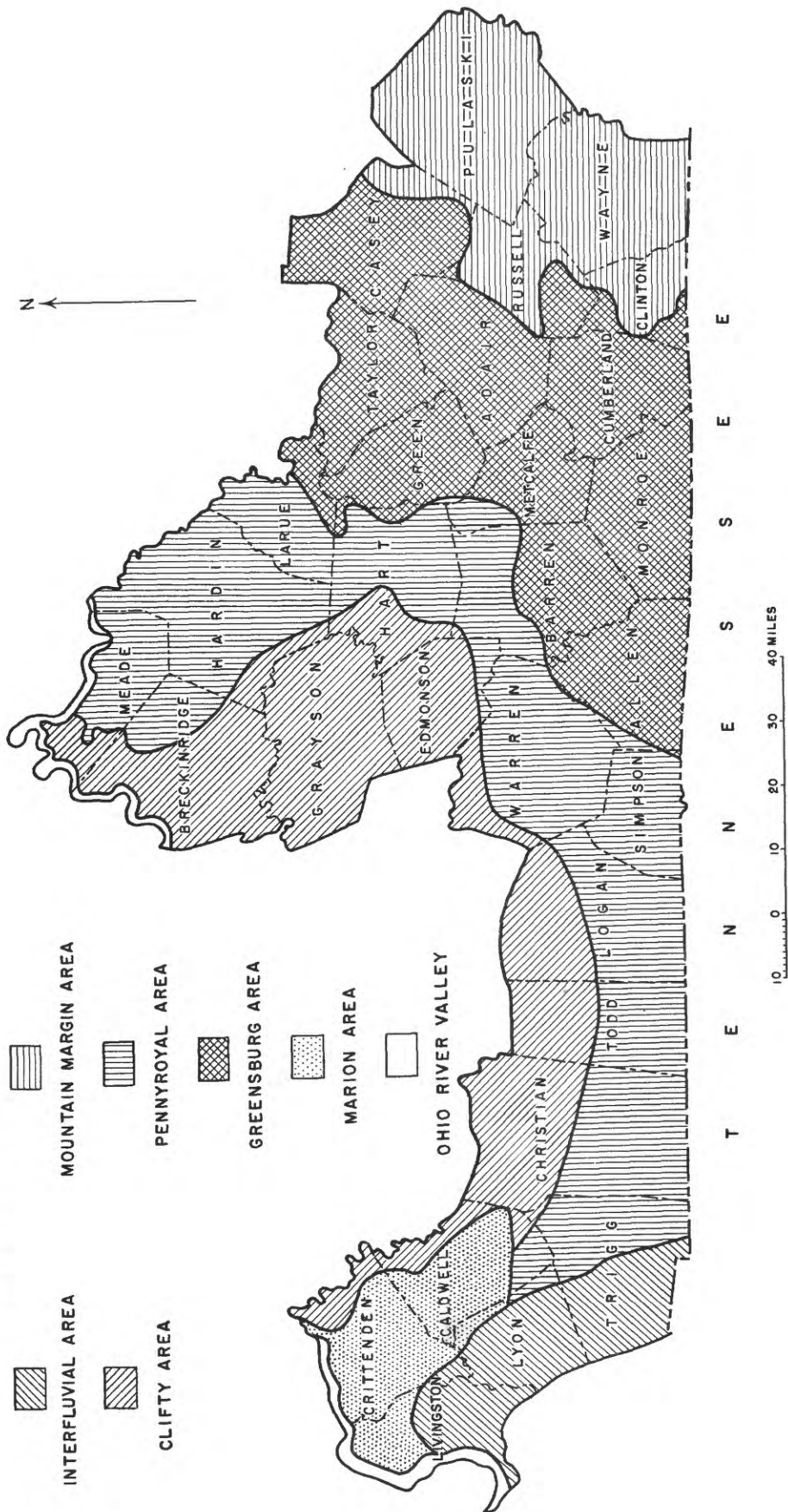


Figure 2.--Index map of the Mississippian Plateau region showing ground-water areas.

Sand, gravel, and sandstone suitable for building purposes, roads, and abrasives are found in small quantities at scattered points throughout the region. Iron was once produced from deposits in Lyon and Trigg Counties, but the ores are of little economic value at the present time. The Chattanooga shale, which crops out over much of the region, contains petroleum and radioactive elements, but their removal is not practical with present processes.

GEOLOGY

Stratigraphy

The rocks that crop out in the Mississippian Plateau region range in age from Ordovician to Quaternary and are of sedimentary origin, with the exception of a few dikes in the fluorspar area. Table 1 shows a generalized geologic section with a brief summary of the ground-water characteristics of the different rock units. The oldest rocks exposed are of Ordovician age and crop out in the gorge of the Cumberland River where it crosses the Cincinnati arch. The area of outcrop is small, and the rocks, impure limestone and shale, are of little importance in the Mississippian Plateau region. Enough water for domestic and stock use is available in some places from solution cavities in the limestone. No large supplies have been developed.

Above the Ordovician rocks are limestones and shales of Silurian age. These are exposed in the gorges of several streams along the southern edge of the region and along the boundary between the Pennyroyal area and the Blue Grass region. At some horizons the limestones are very soluble and large quantities of ground water may be obtained from solution channels; the water is generally satisfactory for domestic use when encountered at shallow depth. A number of large springs issue from the more soluble limestones, and the water from these springs is of good quality.

Limestones and shales of Devonian age crop out in about the same areas as do the underlying Silurian formations but are less soluble than the limestones of the Silurian formations. They yield small quantities of water to shallow domestic wells and springs. No known large supplies have been developed from the Devonian formations in the Mississippian Plateau region.

The Mississippian rocks crop out at the surface over most of the Mississippian Plateau region. They may be divided into three major groups. The lowest group, the Osage, is exposed at the surface over most of the Greensburg area and part of the Interfluvial area. It consists of shale and impure limestones and generally yields enough water for domestic use from shallow wells and from springs.

Rocks of the Meramec group of middle Mississippian age are exposed at the surface over most of the Mississippian Plateau region and form the surface over nearly all of the Pennyroyal area, part of the Mountain Margin area, and part of the Marion area. The Meramec group is composed of pure massive limestones and some interbedded shale and chert. For the most part, the limestones are very soluble

in ground water and extensive solution channels are produced wherever these formations are present. Large quantities of ground water are available from springs and from wells that enter the solution channels. Wells not entering solution channels yield little or no water.

The Chester group of late Mississippian age crops out along the south perimeter of the Clifty area and the east edge of the Mountain Margin area. It is composed of beds of limestone and sandstone, with some lenses of shale. Most wells penetrating this group yield enough water for domestic use and a few yield as much as 100 gallons per minute (gpm). A great number of small springs are present at horizons where the downward movement of the water is interrupted by the relatively impermeable shale beds.

Pennsylvanian formations are exposed in patches in the Clifty area and the Mountain Margin area. The formations exposed are dominantly sandstones of Pottsville age. They yield small quantities of water to domestic wells.

Alluvial deposits lie in the valleys of most of the major streams in the region and over the surface of the Interfluvial area. Except for the deposits in the Ohio River valley, they are not important as a source of public or industrial water supplies. The alluvial deposits in the Ohio River valley reach a known maximum thickness of about 134 feet and consist of heterogeneous mixtures of clay, sand, and gravel or lenticular bodies of these materials. In places the alluvium extends as much as 70 feet below the pool level of the Ohio River and yields large quantities of water to wells.

Structural Features

The major structural features in the Mississippian Plateau region are the Cincinnati arch, the western geosyncline, and the Cumberland River arch. In the east-central part of the region the axis of the Cincinnati arch trends north-northeast from southeastern Monroe County northeastward through central Casey County. The axis of the Cumberland River arch trends northward through the west edge of the region. Between these elevated areas, in the northwestern part of the State, lies the western geosyncline.

Many faults are associated with these major structural features, especially in Crittenden, Lyon, Caldwell, and Christian Counties. Minor folds, faults of small displacement, and collapse structures occur throughout the Mississippian Plateau region.

WATER RESOURCES

Utilization

The pumpage of ground and surface water for both public and industrial use is shown in tables 2, 3, and 4, figure 3, and plate 1. Pumpage of steam plants is not included in these figures. The pumpage has been summarized in average daily figures. These were based on total yearly pumpage when the operation of the water plant was continuous and on daily pumpage figures when the operation of the plant was

Table 1. —Generalized section of the geologic formations exposed or penetrated in the Mississippian Plateau region, Kentucky, 1951
[Area: Shaded boxes indicate none of indicated strata exposed or penetrated]

Era	System	Subdivision	Thickness (feet)	Area			Lithology	Water-bearing characteristics
Cenozoic	Quaternary	Alluvium	0-134	Ohio River valley	Interfluvial area	Shaded	Clay, silt, sand, or gravel, in lenticular bodies and heterogeneous mixtures.	Low yield in clay and silt. Yields 200-300 gpm to wells, and up to 5,000 gpm to collectors, in sand and gravel. Water is hard and high in dissolved solids.
	Tertiary	Alluvium	0-100					
	Cretaceous	Alluvium	0-170					
Paleozoic	Pennsylvanian	Pottsville	0-300	Shaded	Cliffy area	Shaded	Sandstone, shale, and con- glomerate.	Yields 25 to 100 gpm to wells. Water is generally soft and is low in dissolved solids.
		Chester	0-1,300				Sandstone, limestone, and shale.	Yields moderate quantities of water to wells and springs. Water ranges from soft to very hard.
	Mississippian	Meramec	0-900	Shaded	Penny- royal area	Shaded	Limestone; locally con- tains interbedded chert and shale.	Yields moderate to large quantities of water to wells encountering solution openings. Locally supplies very large springs. Water is hard.
		Osage	50-550				Impure limestone, chert, and shale.	Yields small to moderate quantities of water to wells. Water is hard and in some areas contaminated with brines.
		-	0-50				Black shale and limestone.	Low yields and poor quality from shales. Limestones are unimportant in this region.
	Silurian	-	0-40	Shaded	Greensburg area	Shaded	Limestone and shale.	Yields small to moderate quantities of water to wells. Locally supplies large springs from solution cavities. Water from springs is of good quality; water from wells is generally of very poor quality.
		-	0-100				Limestone and shale.	Unimportant as an aquifer in this region.

Table 2. — Pumpage and source of ground water for public and industrial supplies in the Mississippian Plateau region, Kentucky, 1951-1953

County	Nearest city or town	Industry or institution	Population served	Water-bearing formation and pumpage in gallons per day					Silurian
				Quaternary alluvium	Pennsylvanian	Mississippian			
						Chester	Meramec	Osage	
Allen.....	Scottsville...	.....	2,600	-	-	-	-	-	100,000
Barren.....	Cave City.....	.....	1,119	-	-	-	100,000	-	-
Do.....	..do.....	Louisville & Nashville Railroad Co.	-	-	-	-	22,000	-	-
Do.....	Park City.....	.....	357	-	-	-	16,000	-	-
Breckinridge	Cloverport.....	.....	1,300	78,000	-	-	-	-	-
Do.....	..do.....	Sohio Petroleum Co.	-	^a 400,000	-	-	-	-	-
Do.....	Irvington.....	.....	820	-	-	-	35,000	-	-
Do.....	Kingswood.....	.....	215	-	-	6,000	-	-	-
Caldwell....	Princeton.....	.....	5,990	-	-	-	421,000	-	-
Do.....	..do.....	Princeton Hosiery Mills, Inc.	-	-	-	-	^a 45,000	-	-
Do.....	..do.....	Citizens Ice Co.	-	-	-	-	^a 72,000	-	-
Christian...	Edgoten.....	Partners Trailer Court	280	-	-	-	9,900	-	-
Do.....	Macedonia.....	Pennyrile State Park	500	-	1,000	-	-	-	-
Do.....	Oak Grove.....	Braboy Trailer Court	212	-	-	-	24,000	-	-
Do.....	..do.....	Oak Grove Trailer Court	350	-	-	-	30,000	-	-
Do.....	Outwood.....	U. S. Veterans Administration Hospital	586	-	100,000	-	-	-	-
Do.....	Pembroke.....	.....	500	-	-	-	19,000	-	-
Clinton.....	Albany.....	.....	1,270	-	-	-	73,000	-	-
Edmonson....	Kyrock.....	.....	300	-	-	12,000	-	-	-
Do.....	Mammoth Cave..	Mammoth Cave National Park	2,000	-	-	24,000	-	-	-
Grayson....	Leitchfield...	.....	2,380	-	-	103,000	-	-	-
Hardin.....	Elizabethtown..	.....	6,650	-	-	-	743,000	-	-
Do.....	Vine Grove.....	.....	1,250	-	-	-	50,000	-	-
Do.....	West Point.....	.....	1,500	93,000	-	-	-	-	-
Hart.....	Horse Cave.....	.....	1,300	-	-	-	57,000	-	-
LaRue.....	Athertonville..	Hunter-Wilson Distilling Co., Inc.	-	-	-	-	^a ^b 960,000	-	-
Do.....	Hodgenville...	.....	1,750	-	-	-	^b 60,000	-	-
Do.....	..do.....	Lincoln National Historical Park	300	-	-	-	5,000	-	-
Livingston..	Smithland.....	.....	570	15,000	-	-	-	-	-
Logan.....	Auburn.....	.....	1,400	-	-	-	126,000	-	-
Lyon.....	Kuttawa.....	.....	1,000	-	-	-	57,000	-	-
Meade.....	Brandenburg...	.....	980	-	-	-	100,000	-	-
Do.....	..do.....	Mathieson Chemical Co.	-	18,000,000	-	-	-	-	-
Do.....	Ekron.....	Schenley Distillers, Inc.	-	-	-	-	^a 450,000	-	-
Do.....	Flaherty.....	.....	120	-	-	-	6,500	-	-
Metcalfe....	Edmonton.....	.....	475	-	-	-	-	41,000	-
Russell.....	Jamestown.....	.....	980	-	-	-	33,000	-	-
Do.....	Russell Springs	.....	1,090	-	-	-	34,000	-	-
Todd.....	Elkton.....	.....	1,260	-	-	-	182,000	-	-
Do.....	Guthrie.....	.....	1,050	-	-	-	1,714,000	-	-
Do.....	Trenton.....	.....	500	-	-	-	15,000	-	-
Trigg.....	Cadiz.....	.....	1,570	-	-	-	200,000	-	-
Warren.....	Bowling Green..	Pet Milk Co....	-	-	-	-	359,000	-	-
Do.....	Smiths Grove..	.....	1,030	-	-	-	65,000	-	-
Wayne.....	Monticello.....	.....	2,520	-	-	-	165,000	-	-
Totals.....			^c 46,324	18,586,000	101,000	145,000	6,248,400	41,000	100,000

a When in operation.

b Uses surface water also (see table 3).

c Does not include Hodgenville, which obtains most of its supply from surface water.

Table 3. —Pumpage of surface water for public and industrial supplies in the Mississippian Plateau region, Kentucky, 1951-1953

County	Nearest city or town	Industry or institution	Population served	Pumpage in gallons per day
Adair.....	Columbia.....	.....	1,820	85,800
Barren.....	Glasgow.....	.....	7,350	614,000
Breckinridge.....	Hardinsburg.....	.....	997	80,000
Casey.....	Liberty.....	.....	1,230	60,000
Christian.....	Hopkinsville.....	.....	12,750	1,185,000
Crittenden.....	Marion.....	.....	2,970	171,000
Cumberland.....	Burkesville.....	.....	1,160	41,000
Edmonson.....	Brownsville.....	.....	384	35,000
Green.....	Gabe.....	Tennessee Gas Transmission Co.....	.....	133,000
Do.....	Greensburg.....	.....	1,590	99,000
Hart.....	Munfordville.....	.....	615	44,000
LaRue.....	Athertonville.....	Hunter-Wilson Distilling Co.....	.....	a b 240,000
Do.....	Hodgenville.....	.....	1,750	b 250,000
Logan.....	Adairville.....	.....	770	25,000
Do.....	Russellville.....	.....	4,400	262,000
Lyon.....	Eddyville.....	.....	1,400	73,000
Do.....	..do.....	Kentucky State Penitentiary.....	1,000	235,000
Monroe.....	Tompkinsville.....	.....	1,750	177,000
Pulaski.....	Burnside.....	.....	610	30,000
Do.....	Somerset.....	.....	10,300	739,000
Russell.....	Wolf Creek Dam Village.....	.....	60	8,000
Simpson.....	Franklin.....	.....	5,340	362,000
Taylor.....	Campbellsville.....	.....	5,400	250,000
Do.....	..do.....	Tennessee Gas Transmission Co.....	.....	160,000
Warren.....	Bowling Green.....	.....	18,000	2,315,000
Totals.....	.....	.....	81,646	7,673,800

a When in operation.

b Uses ground water also (see table 2).

Table 4. —Average daily pumpage (gallons) of water for public and industrial supplies, by areas, in the Mississippian Plateau region, Kentucky, 1951-1953

Usage and source	Ohio River valley	Interfluvial area	Clifty area	Greensburg area	Pennroyal area	Mountain Margin area	Marion area
Public usage:							
Surface water.....	0	308,000	115,000	1,285,800	4,443,000	818,000	171,000
Ground water.....	186,000	57,000	246,000	141,000	3,557,400	305,000	421,000
Totals.....	186,000	365,000	361,000	1,426,800	8,000,400	1,123,000	592,000
Industrial usage:							
Surface water.....	0	0	0	293,000	240,000	0	0
Ground water.....	18,400,000	0	0	0	1,791,000	0	117,000
Totals.....	18,400,000	0	0	293,000	2,031,000	0	117,000
Combined usage:							
Surface water.....	0	308,000	115,000	1,578,800	4,683,000	818,000	171,000
Ground water.....	18,586,000	57,000	246,000	141,000	5,348,400	305,000	538,000
Totals.....	18,586,000	365,000	361,000	1,719,800	10,031,400	1,123,000	709,000

intermittent. A part of the water tabulated as public supplies is used for various industrial purposes, especially in the larger cities; but, except where the quantity of water used by industries is kept as a separate record by the town, this further subdivision of information has not been made.

The total average daily pumpage in the region amounts to about 33 million gallons of which 12 million gallons, or about 36.7 percent, is used for public

supplies, and the remaining 21 million gallons, or 63.3 percent, is used for industrial purposes. (See fig. 3.)

The total average daily pumpage is distributed for the several areas as follows: Ohio River valley, 56.4 percent; Interfluvial area, 1.1 percent; Clifty area, 1.1 percent; Greensburg area, 5.2 percent; Pennroyal area, 30.7 percent; Mountain Margin area, 3.3 percent; and Marion area, 2.2 percent.

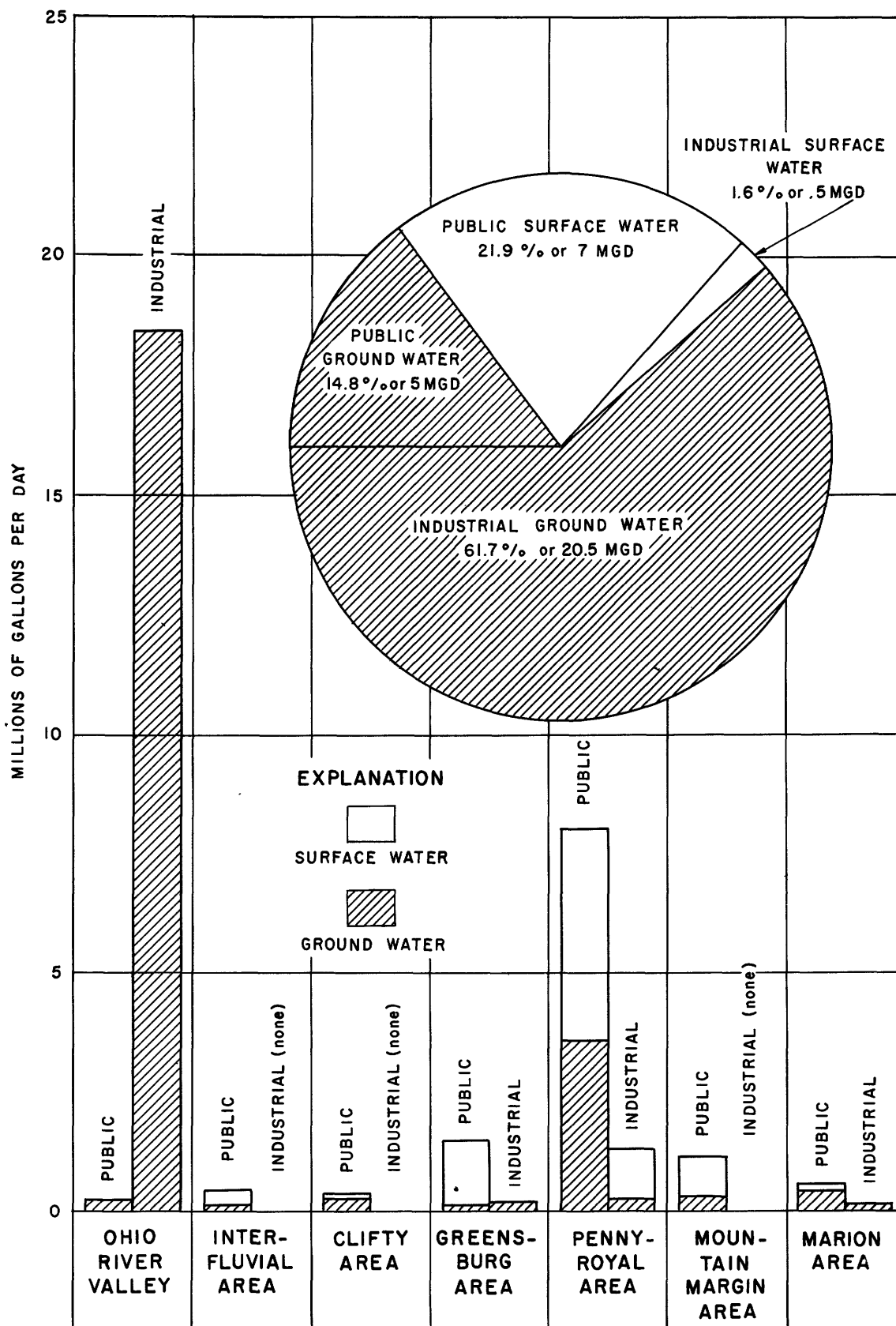


Figure 3. --Water utilization and source in the Mississippian Plateau region, Kentucky.

The 12 million gallons used for public supplies each day is distributed as follows: Ohio River valley, 1.6 percent; Interfluvial area, 3.0 percent; Clifty area, 3.0 percent; Greensburg area, 11.9 percent; Pennyroyal area, 66.7 percent; Mountain Margin area, 8.9 percent; and Marion area, 4.9 percent.

Most of the water pumped for industrial use is obtained from the alluvial deposits in the Ohio Valley; however, the greatest number of industries in the Mississippian Plateau region obtain their water from wells and springs in the Meramec group. Industries that use their own water plants pump 21 mgd in the region; 88.3 percent of this is obtained from the Ohio River valley, 1.4 percent from the Greensburg area, 9.7 percent from the Pennyroyal area, and 0.6 percent from the Marion area.

Quality of Water

The data on chemical quality relate primarily to the analyses of individual sources of raw water from wells and springs. Forty-four samples of ground water were analyzed by the U. S. Geological Survey; the analyses are tabulated with other descriptive material under "Descriptions and analyses." Data on chemical quality of surface waters in the region are presented in a previous report by W. L. Lamar and L. B. Laird (1953). The dissolved chemical constituents are reported in parts per million. A part per million is a unit weight of a constituent in a million unit weights of aqueous solution (water). Results in parts per million can be converted to grains per United States gallon by multiplying by 0.0584. Natural waters contain silica, iron, manganese (sometimes), calcium, magnesium, sodium, potassium, bicarbonate, carbonate (sometimes), sulfate, chloride, small amounts of fluoride (frequently), and nitrate (frequently). Except for silica these constituents are considered to be in ionic solution. The ions of iron, manganese, calcium, magnesium, sodium, and potassium are called cations and carry positive electrical charges. The others are called anions and carry negative electrical charges.

The cations and anions in combination form chemical compounds. Ionic combinations are calculated from the combining or reacting capacity of the ions. For this purpose the ionic constituents may be reported in equivalents per million. Equivalents per million, an expression of concentration in terms of the combining or reacting capacity of the ions, is the number of unit equivalent weights of an ion contained in one million unit weights of water. One equivalent of sodium (22.997 ppm), for example, will combine exactly with one equivalent of chloride (35.457 ppm) to form the compound sodium chloride (common salt). Equivalents are used to calculate chemical combinations and to express analyses graphically as on plate 2. In the graphic diagrams on plate 2, the left column of cations and the right column of anions are equal in height. In these diagrams small quantities of fluoride and nitrate are included with the chloride. When the nitrate content was more than 10 ppm it is shown separately in solid black.

The hardness of water is reported in terms of calcium carbonate (CaCO_3). Most hardness in water is caused by calcium and magnesium. The results

reported in the analyses show the hardness caused by these two constituents. The hardness caused by calcium and magnesium equivalent to the bicarbonate and carbonate is called carbonate hardness; the hardness caused by calcium and magnesium in excess of this quantity is called noncarbonate hardness. In this report, waters having a hardness range from 0 to 60 ppm are considered soft; those having a range from 61 to 120 ppm, moderately hard; 121 to 200 ppm, hard; and above 200 ppm, very hard.

The other characteristics of water reported are pH, specific conductance, and temperature. The hydrogen-ion concentration is commonly reported in terms of the pH. The pH represents the negative logarithm of the number of moles of ionized hydrogen per liter of water. Neutral water has a pH of 7.0; that is, both the hydrogen (H^+) and hydroxyl (OH^-) ions have a concentration of 10^{-7} moles per liter. The specific conductance of water is a measure of the ability of the water to conduct a current of electricity. This ability is due to the dissolved constituents which ionize. The conductance varies with the concentration and degree of ionization of the constituents and with the temperature of the water. When considered in conjunction with results for other constituents, specific conductance is helpful in detecting changes in concentration of ionized substances in water. It is particularly useful in maintaining controls in industrial water supplies.

The economies and general satisfaction resulting from the availability of a water supply of good quality are a valuable asset. For human consumption water must be free from disease-causing bacteria. Color, taste, odor, and turbidity are the visible or noticeable characteristics. These may be of purely esthetic significance, or they may be related to harmful conditions. Water having these characteristics to a noticeable extent is not desirable in the home, in food and beverage processing, or in industrial processes in which these characteristics would affect the quality of the product.

Water for human consumption must not contain toxic chemical substances in concentrations that would affect the health or well-being of the consumers. Toxic chemical substances in water generally come from certain industrial wastes and are more likely to be found in surface waters polluted with these wastes. These include such constituents as arsenic, beryllium, cyanide, hexavalent chromium, lead, and radioactive materials. Fluoride, which generally is of natural origin, is of particular significance. Studies have indicated that when water containing up to about 1.0 ppm in fluoride content is consumed by children, the incidence of dental caries (decayed teeth) is reduced; Dean (1936) has discussed the association of dental fluorosis (mottled enamel) with water containing more than about 1.5 ppm in fluoride content. Pending further studies, water exceeding 45 ppm in nitrate (NO_3) content should be regarded as having a possible lethal effect on infants and thus is unsafe for baby feeding (Maxey, 1950). Infants under 6 months of age apparently are the most susceptible. Table 5 shows the general significance of the common chemical characteristics of natural waters.

For different industrial uses of water the requisite chemical and related physical characteristics of water

Table 5. —Elements and substances commonly found in ground water

Constituent	Source	Significance
Silica (SiO ₂)	Siliceous minerals present in essentially all formations.	Forms hard scale in pipes and boilers. Inhibits deterioration of zeolite-type water softeners.
Iron (Fe)	The common iron-bearing minerals present in most formations.	Oxidizes to a reddish-brown sediment. More than about 0.3 ppm stains laundry and utensils reddish brown, is objectionable for food processing and beverages. Larger quantities impart taste and favor the growth of iron bacteria.
Manganese (Mn)	Manganese-bearing minerals.	Rarer than iron; in general has same objectionable features; brown to black stain.
Calcium (Ca) and magnesium (Mg)	Minerals that form limestone and dolomite and occur in some amount in almost all formations. Gypsum also a common source of calcium.	Cause most of the hardness and scale-forming properties of water; soap consuming.
Sodium (Na) and potassium (K)	Feldspars and other common minerals; ancient brines, sea water; industrial brines and sewage.	Large amounts cause foaming in boilers and other difficulties in certain specialized industrial water uses.
Bicarbonate (HCO ₃) and carbonate (CO ₃)	Action of carbon dioxide in water on carbonate minerals.	In combination with calcium and magnesium forms carbonate hardness which decomposes on application of heat, with attendant formation of scale and release of corrosive carbon dioxide gas.
Sulfate (SO ₄)	Gypsum, iron sulfides, and other rarer minerals; common in waters from coal-mining operations and many industrial wastes.	Sulfates of calcium and magnesium form hard scale.
Chloride (Cl)	Found in small to large amounts in all soils and rocks; natural and artificial brines, sea water, sewage.	Large enough amounts may give salty taste; objectionable for various specialized industrial uses of water.
Fluoride (F)	Various minerals of widespread occurrence; in minute amounts.	In water consumed by children, about 1.5 ppm and more may cause mottling of the enamel of teeth, but up to about 1.0 ppm appears to reduce incidence of tooth decay.
Nitrate (NO ₃)	Decayed organic matter, sewage, nitrate fertilizers, nitrates in soil.	Values higher than the local average may suggest pollution. There is evidence that more than about 45 ppm NO ₃ may cause methemoglobinemia (infant cynosis), sometimes fatal. Waters of high nitrate content should not be used for baby feeding.

are highly varied. Some industries require water very low in dissolved solids and practically free from certain chemicals and characteristics. In the domestic use of water, and also in a number of industrial uses, the characteristics of iron, manganese, and hardness are of particular significance. Iron and manganese even in minute quantities must be removed from water for some industrial processes. These constituents cause considerable annoyance in the home also. They stain clothing and bathroom fixtures and clog water pipes and tanks. When iron is present in appreciable amounts, it oxidizes to produce a muddy-appearing precipitate in the water which later settles out as a sludge. To a lesser extent manganese, if present, also oxidizes, but the stain or sludge is darker and brown to black.

Hardness is a significant factor, as hard waters may be unsatisfactory for many industrial uses. Some industries require very soft water. Hardness of water is troublesome and uneconomic in the home. It causes the wasting of soap, as may be evidenced from difficulty in forming a lather and from the so-called "bathtub ring." Use of detergents reduces this waste,

but it may affect the treatment of the water for subsequent use, as by a downstream community. The other harmful effects of hardness are scaling and clogging of pipes, particularly hot-water lines, hot-water tanks, and radiators. Many of the ground waters in this area are very hard. Although these hard waters are widely used for public supply, they cannot be considered satisfactory without softening.

Corrosion causes extensive economic losses both in industry and in the home. Corrosion is related to the hydrogen-ion concentration of the water. The pH of water containing dissolved constituents will vary in accordance with the type and association of these constituents. The water generally is progressively more active toward metal surfaces as the pH decreases, owing to increasing hydrogen-ion concentration. However, at a noticeably high pH the activity toward some metal surfaces may also accelerate. For example, at a very high pH the solubility of zinc surfaces is noticeably accelerated. It is usually necessary to maintain the pH above 8 to inhibit corrosion, but this does not mean that the water will then not have any corrosive activity.

Dissolved gases such as oxygen and carbon dioxide are noticeably aggressive toward the common metal surfaces.

The U. S. Public Health Service (1946) has issued recommended drinking-water standards, which are mandatory only on interstate carriers but have been adopted by many States. These standards in respect to chemical quality are as follows:

<u>Constituent</u>	<u>Limit (ppm)</u>
Iron (Fe) and manganese (Mn) together.....	0.3
Chromium (Cr), hexavalent.....	.05
Copper (Cu).....	3.0
Lead (Pb).....	.1
Zinc (Zn).....	15
Arsenic (As).....	.05
Selenium (Se).....	.05
Magnesium (Mg).....	125
Sulfate (SO ₄).....	250
Chloride (Cl).....	250
Fluoride (F).....	1.5
Phenolic compounds (in terms of phenol) ...	.001

The temperature of water is important in many industrial uses involving cooling, heat exchange, or other temperature control. Drinking water, of course, becomes unpalatable if the temperature is too high. The temperature of surface water fluctuates with the air temperature, varying from 32° F to more than 80° F. The temperature of ground water is relatively constant, that from depths below a few tens of feet generally varying not more than a few degrees during the year. The average temperature of ground water in this area is about 60° F. Shallow ground water, at a depth of only a few feet, varies somewhat in temperature, though less than surface water. Ground water derived by induced infiltration from streams, as along the Ohio River, also varies in temperature, but again less than does the surface source.

Surface Water

About 7.7 mgd is pumped from surface-water sources in the Mississippian Plateau region. This is 23 percent of all water pumped in the region.

The surface-water sources in the region are of two major types: those from surface streams and those from reservoirs created by impounding a stream or diverting a part of its flow. The public supplies of Bowling Green in Warren County, Glasgow in Barren County, and Brownsville in Edmonton County are examples of the first type; those of Campbellsville in Taylor County, Russellville in Logan County, and Hopkinsville in Christian County are examples of the second type.

Although relatively large supplies are available from the Cumberland, Green, Barren, Tennessee, and Ohio Rivers, many of the major towns have developed on the flat limestone plains where most of the drainage is subsurface, and large surface-water supplies are not available. A characteristic of much of the region is its lack of surface drainage. The following figures, which are the surface-water parts of the

total daily pumpage in the subregions, show the relative importance of surface water to the subregions: Ohio River valley, 0 percent; Interfluvial area, 85 percent; Clifty area, 32 percent; Greensburg area, 90 percent; Pennyroyal area, 48 percent; Mountain Margin area, 70 percent; Marion area, 24 percent.

Ground Water

Ohio River Valley

The Ohio River valley area includes the area of flood-plain and terrace deposits along the Kentucky side of the Ohio River. Smithland in Livingston County, Cloverport in Breckinridge County, and West Point in Hardin County all obtain municipal supplies from the alluvium in the Ohio River valley. Single vertical wells at West Point and Cloverport are reported to yield 300 gpm. Compound horizontal wells serving industries in this area yield as much as 5,000 gpm. The alluvium in the Ohio River valley is the only known potential source of very large public and industrial supplies of ground water in the region.

The water is hard to very hard, ranging in hardness from 165 to 484 ppm. Objectionable quantities of nitrate were found in 2 of 5 areas sampled.

Interfluvial Area

Most of the Interfluvial area is underlain by deposits of sand, gravel, and clay of Cretaceous, Tertiary, and Quaternary age. These are underlain by rocks of the Osage and Meramec groups of Mississippian age. Numerous springs in the area discharge from these limestones; however, no single spring is known to yield large quantities of water, and no large yields have been developed from wells. Kuttawa in Lyon County is the only town in the area that utilizes ground water. The town obtains water from a lake formed by damming several small springs. Most of the springs discharge from rocks of the Meramec group.

The only water sample taken in the area was from the public water supply at Kuttawa. This water was hard but otherwise satisfactory for domestic use.

Clifty Area

The Clifty area includes the outcrop area of the Chester group of Mississippian age and of some rocks of Pennsylvanian age. Leitchfield, in Grayson County, obtains about 100 gpm from each of two wells in a sandstone bed believed to be in the upper part of the Chester group. Probably not more than 200 gpm could be obtained from any one well in the sandstones of Chester age in this area. A large number of springs discharge at the top of shale beds in the Chester, some from sandstones and others from limestones. The public water supply for the Mammoth Cave National Park is obtained from springs that discharge from a limestone of Chester age where it is underlain by a relatively impermeable shale, and a large number of smaller springs discharge from a sandstone exposed along the southward-facing Dripping Springs escarpment. Many springs in the Chester group yield enough water for small municipal

supplies, but none are known to yield large quantities of water.

The U. S. Veterans Administration Hospital north of Hopkinsville in Christian County obtains water from four wells in rocks of Pennsylvanian age. They range in yield from 60 to 100 gpm. This is probably near a maximum for the rocks of late Pennsylvanian age in this region.

The average total hardness of water from 5 of the 6 supplies sampled in the Clifty area was 57 ppm. One of these supplies contained 37 ppm of iron, but the others did not contain objectionable quantities of any constituent. The water supply of Leitchfield in Grayson County was harder than any of the other supplies tested in the area, averaging 215 ppm for the three wells sampled. Probably the other supplies are more nearly typical of the quality of water in the area.

Greensburg Area

The Greensburg area includes outcrop areas of rocks of Ordovician, Silurian, Devonian, and Mississippian age. A large number of small springs discharge from these rocks, some of them yielding minimum flows of 20 to 50 gpm. No wells that yield large supplies have been constructed in the area. Two towns utilize ground water for public water supply. Edmonton in Metcalfe County obtains water from wells that end in rocks of the Osage group. Scottsville in Allen County obtains water from a spring that discharges from rocks of Silurian age. The minimum flow of this spring is approximately 450 gpm. A few other springs in the region are known to discharge large quantities of water from the Silurian; however, none have been developed for public or industrial supplies.

Both supplies sampled in the area were acceptable for public water supply; however, the sample obtained from Edmonton was very hard.

Pennyroyal Area

The Pennyroyal area includes most of the area in which rocks of the Meramec group of Mississippian age crop out. A large number of towns and several industries obtain water from wells and springs in these cavernous limestones. Elizabethtown in Hardin County, the largest town in the region using ground water, obtains its municipal water supply from a spring having a minimum flow of about 1,200 gpm. Other towns in the area that obtain their water supply from springs include Vine Grove in Hardin County, Brandenburg in Meade County, Cadiz in Trigg County, Auburn in Logan County, and Guthrie in Todd County. Both Schenley Distillers in Meade County and the Pet Milk Co. in Warren County obtain water for industrial use from springs that have a minimum flow of more than 1,000 gpm. Several unused springs in this area have minimum flows as great as 1,000 gpm.

The possibility of obtaining large quantities of water from wells in the Meramec group has not been adequately investigated. Twelve towns in the area obtain their municipal water supplies from wells in rocks of the Meramec group; however, none has made any

effort to obtain larger supplies of water. Well 8555-3705-1 supplies Cave City and yields a reported 300 gpm, which is probably the largest yield of any well in the area. Several other wells are reported to yield as much as 100 gpm.

Most samples of water obtained from this area were very hard. Two wells at Irvington in Breckinridge County and one well at Trenton in Todd County yielded water having a hardness of more than 400 ppm. The average total hardness of all the other supplies was 210 ppm. Three supplies contained more than 2 ppm of fluoride and three contained 12 ppm of nitrate. Supplies from six springs averaged 196 ppm in hardness.

Mountain Margin Area

The Mountain Margin area includes an outcrop area of rocks ranging in age from Ordovician through Pennsylvanian; however, the only towns in the area using ground water obtain their supplies from rocks of the Meramec group of Mississippian age. Albany in Clinton County, Monticello in Wayne County, and Russell Springs and Jamestown in Russell County obtain water from limestone in the Meramec group. Monticello utilizes two wells that pump 250 gpm each from a cavernous zone in the limestone; the other towns obtain their supplies from springs. A great number of large springs discharge into the Cumberland River from rocks of Meramec age. Many of these springs discharge from an altitude considerably above the level of Lake Cumberland and form cascades as the water runs down the face of the cliffs. Several large springs near Albany flow from this same horizon.

The quality of the water of the public supplies utilized in this area is similar to that of waters from the Pennyroyal area, but the water is slightly softer, probably because the supplies are all from tubular springs. Water moves rapidly through solution openings to these springs and does not have an opportunity to acquire high concentrations of dissolved solids from the rocks with which it comes in contact. Well water, however, usually moves more slowly from a recharge point to a discharge point and therefore has time to dissolve larger quantities of the material with which it is in contact; however, well water does not always contain a higher concentration of dissolved solids than water in the same area that is discharged from springs.

Marion Area

The Marion area includes the faulted area in the northwest part of the Mississippian Plateau region. Rocks that crop out here range in age from the middle Mississippian (Meramec group) to Pennsylvanian. Most of the large supplies of water come from the formations in the Meramec group. Princeton utilizes a spring having a reported minimum discharge of 2,000 gpm. Several other large springs are in the area. Two wells in Princeton obtain moderate yields from these same formations. No large supplies are known from any of the other formations in the area; however, wells yield small supplies from several other formations. Marion in Crittenden County utilized two wells for an emergency water supply during

a dry period in 1952; one of these wells yielded about 25 gpm from a sandstone of Mississippian age, the other yielded about 15 gpm from a formation, probably limestone, in the Meramec group.

Three of the ground-water supplies inventoried in the Marion area were pumped from rocks of the Meramec group; these supplies averaged 296 ppm in hardness. The two wells at Marion yielded water that was considerably harder than the other supplies. The water from the deeper well, which is believed to have entered the Meramec, contained 1,110 ppm of dissolved solids, had a hardness of 700 ppm, and contained 14 ppm of iron. The shallower well obtains water from a sandstone believed to be of Chester age, and the water has a hardness of 424 ppm.

DESCRIPTIONS AND ANALYSES

The following descriptions and analyses include the detailed information gathered on the water supply of each city, town, institution or industry, arranged alphabetically by county and within each county alphabetically by city or town. Where available, complete information was gathered, but not all communities, institutions, and industries have kept records. The material is listed according to the following plan:

1. Name of county.
2. Name of city or town or nearest city or town, or name of institution or industry if not a municipal supply.
3. Population served: For cities and towns, this is an estimate of consumers determined by multiplying 3.5 times the number of outlets. For institutions, this is the average number of residents.
4. Ownership: This is the ownership of the water plant.
5. Source: Ground water: Wells—identification number and location, depth, diameter, date drilled, water-bearing formation, "static" (nonpumping) water level, and yield of wells; springs—identification number and location, minimum flow. Surface water: Name of stream or type of reservoir, identification number or letter, and location.
6. Treatment: Description of treatment and location of treatment plant.
7. Capacity: For surface-water supplies, this is the rated capacity of the filters in gallons per day; for ground-water supplies, it is the capacity of either the filters or the pumps, or both.
8. Storage: Capacity and location of storage reservoirs, elevated tanks, and standpipes for finished water.
9. Total distribution of water: The total amount of water pumped for 1951 or other year or average year. In some, this figure is based on an average daily pumpage. When available, pumpage by months is given.

10. Breakdown of annual distribution as to use: This is available only for some of the larger municipal supplies.

11. Average daily pumpage: In most, this figure is based on the yearly pumpage divided by 365. When pumpage was intermittent or seasonal, the figure given is for daily pumpage while in operation.

12. Analyses: Chemical analyses of ground water made by the U. S. Geological Survey.

13. The 30 counties covered by this report are as follows:

Adair	Edmonson	Metcalfe
Allen	Grayson	Monroe
Barren	Green	Pulaski
Breckinridge	Hardin	Russell
Caldwell	Hart	Simpson
Casey	Larue	Taylor
Christian	Livingston	Todd
Clinton	Logan	Trigg
Crittenden	Lyon	Warren
Cumberland	Meade	Wayne

ADAIR COUNTY

Columbia

Population served: 1,820.
Ownership: Municipal.
Source: Russell Creek, 1 mile south of Stanford Bridge.
Treatment: Lime and alum added to coagulate solids, precipitate them in a settling tank, and to adjust pH; filtered through sand and gravel to remove small solids; chlorinated to disinfect water before being pumped into mains. Treatment plant located near intake.
Rated capacity of treatment plant: 600,000 gpd.
Storage: 75,000-gal elevated steel tank situated on Lindsay Hill.
Total distribution of water for 1950: 31,357,000 gal.
Average daily pumpage, 1950: 85,800 gal.

ALLEN COUNTY

Scottsville

Population served: 2,600.
Ownership: Municipal.
Source: One spring, 8 miles east of Scottsville.
Spring 8600-3640-3. Water-bearing strata, Silurian; estimated minimum flow, 450 gpm.
Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to spring.
Rated capacity of treatment plant: 360,000 gpd.
Storage: 117,000-gal steel standpipe at east edge of town.
Total distribution of water for 1953: 36,000,000 gal.
Average daily pumpage, 1953: 100,000 gal.

Analysis, in parts per million, spring 8600-3640-3

(Collected Feb. 21, 1953)

Silica (SiO ₂)	7.0
Iron (Fe)	.18
Manganese (Mn)	.00
Calcium (Ca)	26
Magnesium (Mg)	7.3
Sodium (Na)	1.9
Potassium (K)	.5
Bicarbonate (HCO ₃)	102
Sulfate (SO ₄)	12
Chloride (Cl)	2.1
Fluoride (F)	.1
Nitrate (NO ₃)	4.0
Dissolved solids	106
Hardness as CaCO ₃	
Total	96
Noncarbonate	-
Temperature (°F)	51
pH	7.7
Specific conductance at 25°C (micromhos)	207

BARREN COUNTY

Cave City

Population served: 1,119.
 Ownership: Municipal.
 Source: One well, at the northeast end of White Street.
 Well 8555-3705-1. Depth, 145 ft; diameter, 10 in.;
 date drilled, 1949; water-bearing strata,
 Meramec group; static water level (reported), 90
 ft below land surface; yield, 300 gpm.
 Treatment: Chlorinated to disinfect water. Treatment
 plant located adjacent to well.
 Rated capacity of treatment plant: 432,000 gpd.
 Storage: 65,000-gal elevated steel tank located near
 Kentucky Highway 70 at the southeast edge of town.
 Total distribution of water for 1951: 36,500,000 gal.
 Average daily pumpage, 1951: 100,000 gal.

Analysis, in parts per million, well 8555-3705-1

(Collected Apr. 26, 1951)

Silica (SiO ₂)	11
Iron (Fe)	1.1
Manganese (Mn)	-
Calcium (Ca)	85
Magnesium (Mg)	28
Sodium (Na)	7.7
Potassium (K)	.4
Bicarbonate (HCO ₃)	231
Sulfate (SO ₄)	135
Chloride (Cl)	8.2
Fluoride (F)	1.0
Nitrate (NO ₃)	.0
Dissolved solids	415
Hardness as CaCO ₃	
Total	326
Noncarbonate	138
Temperature (°F)	58
pH	7.6
Specific conductance at 25°C (micromhos)	607

Cave City, Louisville & Nashville Railroad Co.

Ownership: Louisville & Nashville Railroad Co.
 Source: One spring, 700 ft east of intersection of
 U. S. Highway 31-W and the Old Bardstown Road.
 Spring 8555-3705-3. Water-bearing strata,
 Meramec group; estimated minimum flow, 200
 gpm.
 Treatment: Softening with National Aluminate Corp.
 "ABB Balls."
 Storage: 150,000-gal elevated wooden tank.
 Average daily pumpage, 1950: 22,000 gal.
 Remarks: Distribution of water in 1951 is not avail-
 able but would be almost none inasmuch as the water
 was used in steam locomotives that have now been
 replaced with diesel locomotives which do not con-
 sume water.

Analysis, in parts per million, spring 8555-3705-3

(Collected Apr. 26, 1951)

Silica (SiO ₂)	9.1
Iron (Fe)	.17
Manganese (Mn)	-
Calcium (Ca)	50
Magnesium (Mg)	6.8
Sodium (Na)	1.2
Potassium (K)	1.1
Bicarbonate (HCO ₃)	182
Sulfate (SO ₄)	4.4
Chloride (Cl)	1.9
Fluoride (F)	.1
Nitrate (NO ₃)	9.7
Dissolved solids	167
Hardness as CaCO ₃	
Total	154
Noncarbonate	4
Temperature (°F)	58
pH	7.2
Specific conductance at 25°C (micromhos)	295

Glasgow

Population served: 7,350.
 Ownership: Municipal.
 Source: Beaver Creek, 2.5 miles north of Glasgow.
 Treatment: Alum added to coagulate solids; lime added
 to adjust pH; solids precipitated in settling tank;
 filtered through sand and gravel to remove small
 solids; chlorinated to disinfect water. Treatment
 plant located near intake.
 Rated capacity of treatment plant: 1,000,000 gpd.
 Storage: Two elevated steel tanks: one 175,000-gal
 tank near intersection of the Old Bowling Green
 Road and West Main Street; one 450,000-gal tank
 1 mile northwest of Glasgow on the old Cave City
 Road.
 Total distribution of water for 1951: 220,410,000
 gal.
 Breakdown of annual distribution as to use:
 Domestic 110,000,000 gal
 Industrial and commercial 60,000,000 gal
 Other public use, leakage,
 and waste 50,410,000 gal
 Remarks: During the latter part of July 1951, a large
 main broke and this source of leakage was not
 located until 1952.

Average pumpage, in gallons per day, 1951

January	598,000	July	547,000
February	512,000	August	775,000
March	450,000	September	716,000
April	512,000	October	710,000
May	507,000	November	704,000
June	502,000	December	698,000

Park City

Population served: 357.

Ownership: W. L. Gardner.

Source: Two wells, 1 block east of the intersection of U. S. Highway 31-W and Kentucky Highway 255 in Park City.

Well 8600-3705-1. Depth, 225 ft; diameter, 10 in.; date drilled, 1945; water-bearing strata, Meramec group; yield, 60 gpm.

Well 8600-3705-2. Depth, 212 ft; diameter, 8 in.; date drilled, 1949; water-bearing strata, Meramec group; yield, 40 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 144,000 gpd.

Storage: 1,500-gal sunken pressure tank in pumphouse.

Total distribution of water for 1951: 6,000,000 gal.

Average daily pumpage, 1951: 16,000 gal.

Analysis, in parts per million, well 8600-3705-1

(Collected June 14, 1951)

Silica (SiO ₂)	9.5
Iron (Fe) .....	.20
Manganese (Mn)	-
Calcium (Ca)	72
Magnesium (Mg)	16
Sodium (Na)	1.9
Potassium (K) .....	.9
Bicarbonate (HCO ₃)	194
Sulfate (SO ₄)	85
Chloride (Cl)	3.0
Fluoride (F) .....	.4
Nitrate (NO ₃)	2.9
Dissolved solids	295
Hardness as CaCO ₃	
Total	246
Noncarbonate	86
Temperature (°F)	59
pH	7.7
Specific conductance at 25°C (micromhos)	464

BRECKINRIDGE COUNTY

Cloverport

Population served: 1,300.

Ownership: Municipal.

Source: Two wells, in Cloverport.

Well 8635-3750-1. Depth, 80 ft; diameter, 13 in.; date drilled, 1920; water-bearing strata, alluvium; static water level, 44 ft below land surface; yield, 300 gpm.

Well 8635-3750-2. Depth, 80 ft; diameter, 13 in.; date drilled, 1920; water-bearing strata, alluvium; static water level, 44 ft below land surface; yield, 300 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 125,000 gpd.

Storage: 75,000-gal elevated steel tank located in Cloverport.

Total distribution of water for 1950: 28,470,000 gal.

Breakdown of annual distribution as to use:

Domestic 23,410,000 gal

Industrial and commercial 4,560,000 gal

Other public use, leakage,

and waste 500,000 gal

Average daily pumpage, 1950: 78,000 gal.

Analysis, in parts per million, well 8635-3750-2

(Collected Mar. 19, 1953)

Silica (SiO ₂)	14
Iron (Fe) .....	.18
Manganese (Mn) .....	.00
Calcium (Ca)	121
Magnesium (Mg)	33
Sodium (Na)	22
Potassium (K)	1.6
Bicarbonate (HCO ₃)	426
Sulfate (SO ₄)	93
Chloride (Cl)	26
Fluoride (F) .....	.1
Nitrate (NO ₃)	5.6
Dissolved solids	512
Hardness as CaCO ₃	
Total	436
Noncarbonate	88
Temperature (°F)	-
pH	7.3
Specific conductance at 25°C (micromhos)	854

Cloverport, Sohio Petroleum Co.

Ownership: Sohio Petroleum Co.

Source: Two wells, 0.75 mile west of the center of Cloverport.

Well 8635-3750-1. Depth, 78 ft; diameter, 12 in.; date drilled, 1951; water-bearing strata, alluvium; static water level (reported), 46 ft below land surface; yield, 300 gpm.

Well 8635-3750-7. Depth, 78 ft; diameter, 13 in.; date drilled, 1951; water-bearing strata, alluvium; static water level, unknown; yield, 250 gpm.

Treatment: None.

Storage: None.

Total distribution of water for 1952: 42,325,000 gal.

Average daily pumpage, 1952: 400,000 gal.

• Analysis, in parts per million, well 8635-3750-1

(Collected Oct. 25, 1951)

Iron (Fe)	0.20
Bicarbonate (HCO ₃)	394
Sulfate (SO ₄)	144
Chloride (Cl)	26
Fluoride (F) .....	.3
Nitrate (NO ₃)	38
Hardness as CaCO ₃	
Total	478
Specific conductance at 25°C (micromhos)	923

Hardinsburg

Population served: 997.

Ownership: Municipal.

Source: Reservoir formed by impounding Hardins Creek.

Intake at east end of reservoir, 0.8 mile northwest of city square on Kentucky Highway 259.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids and through activated charcoal to remove odors and tastes; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 360,000 gpd.

Storage: 30,000-gal concrete reservoir at plant; 50,000-gal elevated steel tank 0.3 mile east of city square on U. S. Highway 60; reservoir in Hardins Creek, capacity unknown.

Total distribution of water for 1951: 29,200,000 gal.

Average daily pumpage, 1951: 80,000 gal.

Remarks: Treatment plant modernized during summer of 1952. Total distribution of water for 1951 based on estimated pumpage.

Irvington

Population served: 820.

Ownership: Municipal.

Source: Three wells near U. S. Highway 60 at north city limits.

Well 8615-3750-1. Depth, 235 ft; diameter, 6 in.; date drilled, 1934; water-bearing strata, Meramec group; static water level (reported), 95 ft below land surface; yield, 100 gpm.

Well 8615-3750-2. Depth, 240 ft; diameter, 6 in.; date drilled, 1934; water-bearing strata, Meramec group; static water level (reported), 105 ft below land surface; yield, 100 gpm.

Well 8615-3750-3. Depth, 247 ft; diameter, 6 in.; date drilled, 1934, redrilled 1952; water-bearing strata, Meramec group; static water level (reported), 127 ft below land surface; yield, 10 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 336,000 gpd.

Storage: 50,000-gal underground reservoir at treatment plant; 50,000-gal elevated steel tank near intersection of Grand and Woodlawn Streets.

Total distribution of water for 1951: 12,775,000 gal.

Average daily pumpage, 1951: 35,000 gal.

Analysis, in parts per million, well 8615-3750-1

(Collected July 22, 1952)

Silica (SiO ₂)	11
Iron (Fe) .....	.45
Manganese (Mn) .....	.00
Calcium (Ca)	98
Magnesium (Mg)	45
Sodium (Na)	9.2
Potassium (K)	1.0
Bicarbonate (HCO ₃)	266
Sulfate (SO ₄)	215
Chloride (Cl)	12
Fluoride (F)	2.4
Nitrate (NO ₃)	2.2
Dissolved solids	565
Hardness as CaCO ₃	
Total	432
Noncarbonate	212
Temperature (°F)	63
pH	7.5
Specific conductance at 25°C (micromhos)	826

Analysis, in parts per million, well 8615-3750-2

(Collected July 22, 1952)

Silica (SiO ₂)	11
Iron (Fe) .....	.28
Manganese (Mn) .....	.00
Calcium (Ca)	128
Magnesium (Mg)	48
Sodium (Na)	13
Potassium (K)	3.2
Bicarbonate (HCO ₃)	292
Sulfate (SO ₄)	286
Chloride (Cl)	16
Fluoride (F)	1.0
Nitrate (NO ₃)	4.3
Dissolved solids	699
Hardness as CaCO ₃	
Total	516
Noncarbonate	277
Temperature (°F)	63
pH	7.2
Specific conductance at 25°C (micromhos)	972

Kingswood

Population served: 215.

Ownership: Municipal.

Source: One spring, 0.5 mile north of Kingswood.

Spring 8620-3740-1. Water-bearing strata, Chester group; estimated minimum flow, 10 gpm.

Treatment: None.

Storage: 500-gal elevated wooden tank situated near the spring.

Total distribution of water for 1951: 2,200,000 gal.

Average daily pumpage, 1951: 6,000 gal.

Analysis, in parts per million, spring 8620-3740-1

(Collected Jan. 9, 1953)

Silica (SiO ₂)	12
Iron (Fe)	.18
Manganese (Mn)	.31
Calcium (Ca)	15
Magnesium (Mg)	2.4
Sodium (Na)	4.6
Potassium (K)	1.0
Bicarbonate (HCO ₃)	34
Sulfate (SO ₄)	9.3
Chloride (Cl)	5.4
Fluoride (F)	.1
Nitrate (NO ₃)	18
Dissolved solids	84
Hardness as CaCO ₃	
Total	47
Noncarbonate	19
Temperature (°F)	60
pH	7.3
Specific conductance at 25°C (micromhos)	128

CALDWELL COUNTY

Princeton

Population served: 5,990.
 Ownership: Municipal.
 Source: One spring, 3.5 miles southwest of Princeton.
 Spring 8755-3705-1. Water-bearing strata, Meramec group; estimated minimum flow, 2,000 gpm.
 Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; aerated to destroy bacteria; chlorinated to disinfect water. Treatment plant located 0.4 mile southwest of city square.
 Rated capacity of treatment plant: 800,000 gpd.
 Storage: 175,000-gal concrete reservoir at treatment plant; 150,000-gal elevated steel tank at northeast corner of city square.
 Total distribution of water for 1951: 153,763,000 gal.
 Breakdown of annual distribution as to use:
 Domestic 105,000,000 gal
 Industrial and commercial 40,000,000 gal
 Other public use, leakage, and waste 8,763,000 gal
 Average daily pumpage, 1951: 421,000 gal.

Average pumpage, in gallons per day, 1951

January	376,000	July	456,000
February	431,000	August	495,000
March	403,000	September	422,000
April	371,000	October	411,000
May	451,000	November	399,000
June	442,000	December	398,000

Analysis, in parts per million, spring 8755-3705-1

(Collected Oct. 3, 1951)

Silica (SiO ₂)	11
Iron (Fe)	.79
Manganese (Mn)	-
Calcium (Ca)	68
Magnesium (Mg)	7.8
Sodium (Na)	2.9
Potassium (K)	2.1
Bicarbonate (HCO ₃)	228
Sulfate (SO ₄)	10
Chloride (Cl)	2.1
Fluoride (F)	.1
Nitrate (NO ₃)	3.3
Dissolved solids	229
Hardness as CaCO ₃	
Total	202
Noncarbonate	15
Temperature (°F)	59
pH	7.6
Specific conductance at 25°C (micromhos)	380

Princeton, Citizens Ice Co.

Ownership: Citizens Ice Co.

Source: One well, 1 block south of Kentucky Highway 91 on Kentucky Highway 139.

Well 8750-3705-4. Depth, 125 ft; diameter, 8 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 41 ft below land surface; yield, 150 gpm.

Treatment: None.

Storage: None.

Average daily pumpage, 1951: 72,000 gal.

Analysis, in parts per million, well 8750-3705-4

(Collected Sept. 4, 1952)

Silica (SiO ₂)	14
Iron (Fe)	.43
Manganese (Mn)	.00
Calcium (Ca)	107
Magnesium (Mg)	10
Sodium (Na)	18
Potassium (K)	2.4
Carbonate (CO ₃)	12
Bicarbonate (HCO ₃)	270
Sulfate (SO ₄)	75
Chloride (Cl)	9.0
Fluoride (F)	.1
Nitrate (NO ₃)	6.8
Dissolved solids	400
Hardness as CaCO ₃	
Total	310
Noncarbonate	67
Temperature (°F)	63
pH	8.4
Specific conductance at 25°C (micromhos)	626

Princeton, Princeton Hosiery Mills

Ownership: Princeton Hosiery Mills.

Source: One well in court behind hosiery mill building, 0.4 mile southwest of city square. Well 8750-3705-1. Depth, 103 ft; diameter, 6 in.; date drilled, 1920; water-bearing strata, Meramec group; static water level (reported), 30 ft below land surface; yield, 330 gpm.

Treatment: Permutit softened to 0 ppm. Treatment plant located adjacent to well.

Rated capacity of treatment plant: 66,000 gpd.

Storage: Two steel standpipes located in court behind hosiery mill building, 60,000 gal each. 66,000-gal steel tank inside building.

Average daily pumpage, 1951: 45,000 gal.

Remarks: Present water supply is supplemented with water purchased from the city of Princeton. A new well is to be drilled near the present one during 1953. It is hoped that the new well and the present one will make the mill independent of the city water supply.

Analysis, in parts per million, well 8750-3705-1

(Collected Sept. 4, 1952)

Silica (SiO ₂)	14
Iron (Fe)	.12
Manganese (Mn)	.00
Calcium (Ca)	125
Magnesium (Mg)	16
Sodium (Na)	30
Potassium (K)	2.1
Bicarbonate (HCO ₃)	342
Sulfate (SO ₄)	116
Chloride (Cl)	26
Fluoride (F)	.4
Nitrate (NO ₃)	10
Dissolved solids	513
Hardness as CaCO ₃	
Total	376
Noncarbonate	97
Temperature (°F)	-
pH	7.3
Specific conductance at 25°C (micromhos)	805

CASEY COUNTY

Liberty

Population served: 1,230.

Ownership: Municipal.

Source: Green River, intake 50 yards upstream from Kentucky Highway 70 bridge.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 360,000 gpd.

Storage: 100,000-gal elevated steel tank near north-west edge of town.

Total distribution of water for 1951: 22,700,000 gal.

Average daily pumpage, 1951: 60,000 gal.

CHRISTIAN COUNTY

Edgaten

Population served: 280.

Ownership: Partner's Trailer Court.

Source: One well, 0.8 mile west of Edgaten.

Well 8725-3635-1. Depth, 168 ft; diameter, 6 in.; date drilled, 1951; water-bearing strata, Meramec group; static water level (reported), 80 ft below land surface, 1951; yield, 11 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to well.

Rated capacity of treatment plant: 15,900 gpd.

Storage: 1,000-gal underground steel tank located near well.

Total distribution of water for 1952: 3,600,000 gal.

Average daily pumpage, 1952: 9,900 gal.

Remarks: Distribution and daily pumpage based on estimated hours of pumpage.

Analysis, in parts per million, well 8725-3635-1

(Collected Oct. 29, 1952)

Silica (SiO ₂)	9.5
Iron (Fe)	.08
Manganese (Mn)	.00
Calcium (Ca)	30
Magnesium (Mg)	21
Sodium (Na)	2.4
Potassium (K)	.9
Bicarbonate (HCO ₃)	174
Sulfate (SO ₄)	20
Chloride (Cl)	1.8
Fluoride (F)	2.0
Nitrate (NO ₃)	.2
Dissolved solids	170
Hardness as CaCO ₃	
Total	161
Noncarbonate	19
Temperature (°F)	56
pH	7.7
Specific conductance at 25°C (micromhos)	310

Hopkinsville

Population served: 12,750.

Ownership: Municipal.

Source: Little River tributaries, impounded to form Lakes Tandy and Morris, 4.5 miles northeast of town; two abandoned quarries located north of town. Intakes are located at both lakes and both quarries.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water; fluoride added to decrease dental caries. Treatment plant located on north side of city.

Rated capacity of treatment plant: 1,500,000 gpd.

Storage: 150,000-gal steel standpipe 1 mile northeast of center of town; 300,000-gal elevated steel tank located at intersection of U. S. Highways 68 and 41. Raw water storage in two reservoirs and two quarries, 667,000,000 gal.

Total distribution of water for 1951: 433,912,000 gal.

Breakdown of annual distribution as to use:

Domestic 354,898,000 gal

Industrial 79,014,000 gal

Other public use, leakage,

and waste Included in domestic

Average daily pumpage, 1951: 1,185,000 gal.

Average pumpage, in gallons per day, 1951

January 1,030,000

February 1,075,000

March 1,070,000

April 1,075,000

May 1,255,000

June 1,316,000

July 1,320,000

August 1,470,000

September 1,315,000

October 1,215,000

November 1,038,000

December 1,030,000

Analysis, in parts per million, composite sample
public water supply

(Collected Apr. 30, 1951)

Silica (SiO ₂)	4.2
Iron (Fe) .....	.15
Manganese (Mn) .....	.00
Calcium (Ca)	42
Magnesium (Mg)	4.4
Sodium (Na)	4.1
Potassium (K) .....	.3
Bicarbonate (HCO ₃)	104
Sulfate (SO ₄)	40
Chloride (Cl)	4.5
Fluoride (F) .....	.1
Nitrate (NO ₃)	1.5
Dissolved solids	155
Hardness as CaCO ₃	
Total	124
Noncarbonate	7
Temperature (°F)	67
pH	7.8
Specific conductance at 25°C (micromhos)	257

Macedonia, Pennyrile State Park

Population served: 500.

Ownership: Commonwealth of Kentucky.

Source: Well 8735-3700-1. Depth, 210 ft; diameter, 10 in.; date drilled, 1936; water-bearing strata, Pottsville group; static water level, 121 ft below land surface, 1953; yield, 25 gpm.

Treatment: None.

Storage: Two elevated wooden tanks located near well, total capacity, 7,500 gal.

Average daily pumpage: 1,000 gal.

Remarks: Not in operation during winter.

Analysis, in parts per million, well 8735-3700-1

(Collected Feb. 13, 1953)

Silica (SiO ₂)	10
Iron (Fe)	4.2
Manganese (Mn)	1.0
Calcium (Ca)	3.6
Magnesium (Mg)	3.2
Sodium (Na)	2.8
Potassium (K)	1.1
Bicarbonate (HCO ₃)	10
Sulfate (SO ₄)	21
Chloride (Cl)	1.5
Fluoride (F) .....	.0
Nitrate (NO ₃) .....	.0
Dissolved solids	47
Hardness as CaCO ₃	
Total	22
Noncarbonate	14
Temperature (°F)	-
pH	6.1
Specific conductance at 25°C (micromhos)	69.5

Oak Grove, Braboy Trailer Court

Population served: 212.

Ownership: Mr. Braboy.

Source: Two wells, 0.1 mile east of Oak Grove.

Well 8725-3640-20. Depth, 100 ft; diameter, 6 in.; date drilled, 1952; water-bearing strata, Meramec group; static water level (reported), 70 ft below land surface, 1952; yield, 15 gpm.

Well 8725-3640-21. Depth, 100 ft; diameter, 6 in.; date drilled, 1951; water-bearing strata, Meramec group; static water level (reported), 60 ft below land surface, 1951; yield, 15 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 42,500 gpd.

Storage: Steel pressure tank near each well; total storage, 160 gal.

Total distribution of water for 1952: 8,760,000 gal.

Average daily pumpage, 1952: 24,000 gal.

Remarks: Distribution and daily pumpage based on estimated hours of pumpage.

Analysis, in parts per million, well 8725-3640-20

(Collected Sept. 12, 1952)

Silica (SiO ₂)	12
Iron (Fe)	.17
Manganese (Mn)	.00
Calcium (Ca)	74
Magnesium (Mg)	6.1
Sodium (Na)	2.0
Potassium (K)	1.0
Bicarbonate (HCO ₃)	248
Sulfate (SO ₄)	5.6
Chloride (Cl)	3.5
Fluoride (F)	.1
Nitrate (NO ₃)	8.7
Dissolved solids	235
Hardness as CaCO ₃	
Total	211
Noncarbonate	7
Temperature (°F)	62
pH	8.0
Specific conductance at 25°C (micromhos)	412

Oak Grove, Oak Grove Trailer Court

Population served: 350.

Ownership: J. B. Riggins.

Source: Four wells, 0.1 mile east of Oak Grove.

Well 8725-3635-2. Depth, 100 ft; diameter, 6 in.; date drilled, 1950; water-bearing strata, Meramec group; static water level (reported), 57 ft below land surface, 1950; yield, 10 gpm.

Well 8725-3635-3. Depth, 100 ft; diameter, 6 in.; date drilled, 1950; water-bearing strata, Meramec group; static water level (reported), 57 ft below land surface, 1950; yield, 6.5 gpm.

Well 8725-3635-4. Depth, 100 ft; diameter, 6 in.; date drilled, 1952; water-bearing strata, Meramec group; static water level (reported), 57 ft below land surface, 1952; yield, 10 gpm.

Well 8725-3635-5. Depth, 100 ft; diameter, 6 in.; date drilled, 1952; water-bearing strata, Meramec group; static water level (reported), 57 ft below land surface, 1952; yield, 5 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 43,000 gpd.

Storage: Steel pressure tanks near each well; total storage, 320 gal.

Total distribution of water for 1952: 10,950,000 gal.

Average daily pumpage, 1952: 30,000 gal.

Remarks: Distribution and daily pumpage based on estimated hours of pumpage.

Analysis, in parts per million, well 8725-3635-2

(Collected Sept. 12, 1952)

Silica (SiO ₂)	14
Iron (Fe)	.12
Manganese (Mn)	.00
Calcium (Ca)	82
Magnesium (Mg)	4.9
Sodium (Na)	9.3
Potassium (K)	1.3
Bicarbonate (HCO ₃)	280
Sulfate (SO ₄)	4.6
Chloride (Cl)	6.0
Fluoride (F)	.1
Nitrate (NO ₃)	4.9
Dissolved solids	269
Hardness as CaCO ₃	
Total	224
Noncarbonate	0
Temperature (°F)	-
pH	7.1
Specific conductance at 25°C (micromhos)	464

Outwood

Population served: 586.

Ownership: U. S. Veterans Administration Hospital.

Source: Four wells on hospital grounds.

Well 8735-3705-1. Depth, 400 ft; diameter, 6 in.; date drilled, 1922; water-bearing strata, Pottsville group; static water level (reported), 235 ft below land surface, 1949; yield, 60 gpm.

Well 8735-3705-2. Depth, 418 ft; diameter 6 in.; date drilled, 1922; water-bearing strata, Pottsville group; static water level (reported), 218 ft below land surface, 1951; yield, 60 gpm.

Well 8735-3705-3. Depth, 470 ft; diameter 8 in.; date drilled, 1943; water-bearing strata, Pottsville group; static water level (reported), 229 ft below land surface, 1951; yield, 60 gpm.

Well 8735-3705-7. Depth, 408 ft; diameter, 8 in.; date drilled, 1943; water-bearing strata, Pottsville group; static water level (reported), 208 ft below land surface, 1951; yield, 100 gpm.

Treatment: Aerated over coke to improve taste; filtered through sand to remove small solids; chlorinated to disinfect water. Treatment plant located near wells.

Rated capacity of treatment plant: 150,000 gpd.

Storage: 125,000-gal elevated steel tank on hospital grounds.

Total distribution of water for fiscal year, 1952:

36,578,000 gal.

Average daily pumpage, fiscal year 1952: 100,000 gal.

Average pumpage, in gallons per day, fiscal year 1952:

July	104,000	January	120,000
August	121,000	February	74,000
September	104,000	March	89,000
October	95,000	April	83,000
November	96,000	May	99,000
December	95,000	June	120,000

Analysis, in parts per million, well 8735-3705-7

(Collected Dec. 12, 1951)

Silica (SiO ₂)	7.1
Iron (Fe)	37
Manganese (Mn)	.62
Calcium (Ca)	15
Magnesium (Mg)	10
Sodium (Na)	4.4
Potassium (K)	.8
Bicarbonate (HCO ₃)	58
Sulfate (SO ₄)	38
Chloride (Cl)	2.2
Fluoride (F)	.1
Nitrate (NO ₃)	.2
Dissolved solids	144
Hardness as CaCO ₃	
Total	80
Noncarbonate	31
Temperature (°F)	58
pH	6.9
Specific conductance at 25°C (micromhos)	186

Pembroke

Population served: 500.

Ownership: Municipal.

Source: Two wells, 0.1 mile southeast of the intersection of the Louisville & Nashville Railroad and Kentucky Highway 115.

Well 8720-3645-107. Depth, 114 ft; diameter, 8 in.; date drilled, 1952; water-bearing strata, Meramec group; static water level (reported), 65 ft below land surface, 1952; yield, 100 gpm.

Well 8720-3645-108. Depth, 126 ft; diameter, 6 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 65 ft below land surface, 1952; yield, 30 gpm.

Treatment: Chlorine added to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 144,000 gpd.

Storage: 50,000-gal elevated wooden tank located 0.1 mile northeast of intersection of U. S. Highway 41 and Kentucky Highway 115.

Total distribution of water for 1952: 7,200,000 gal.

Average daily pumpage, 1952: 19,000 gal.

Remarks: Pumpage and distribution figures based on estimates made from 2-month's records.

Analysis, in parts per million, well 8720-3645-107

(Collected Sept. 5, 1952)

Silica (SiO ₂)	15
Iron (Fe)	.09
Manganese (Mn)	.14
Calcium (Ca)	117
Magnesium (Mg)	20
Sodium (Na)	14
Potassium (K)	1.2
Bicarbonate (HCO ₃)	351
Sulfate (SO ₄)	90
Chloride (Cl)	16
Fluoride (F)	.2
Nitrate (NO ₃)	12
Dissolved solids	469
Hardness as CaCO ₃	
Total	374
Noncarbonate	87
Temperature (°F)	59
pH	7.4
Specific conductance at 25°C (micromhos)	737

CLINTON COUNTY

Albany

Population served: 1,270.

Ownership: Municipal.

Source: One spring, 0.1 mile south of city square on Kentucky Highway 35.

Spring 8505-3640-1. Water-bearing strata, Meramec group; estimated minimum flow, 850 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids and through activated charcoal to remove odors and tastes; chlorinated to disinfect water. Treatment plant located 1 block south of city square on Kentucky Highway 35.

Rated capacity of treatment plant: 240,000 gpd.

Storage: 50,000-gal elevated steel tank located at the intersection of Kentucky Highways 35 and 90.

Total distribution of water for 1951: 26,630,000 gal.

Average daily pumpage, 1951: 73,000 gal.

Remarks: Water flowing from spring is contaminated with oil and must be treated with 5 gal of carbon to 80,000 gal of water to make it palatable. Pollution first occurred during the summer of 1951.

Analysis, in parts per million, well 8505-3640-1

(Collected July 13, 1951)

Silica (SiO ₂)	10
Iron (Fe)	.67
Manganese (Mn)	.00
Calcium (Ca)	65
Magnesium (Mg)	7.3
Sodium (Na)	3.4
Potassium (K)	1.2
Bicarbonate (HCO ₃)	218
Sulfate (SO ₄)	9.3
Chloride (Cl)	5.0
Fluoride (F)	.2
Nitrate (NO ₃)	11
Dissolved solids	217
Hardness as CaCO ₃	
Total	192
Noncarbonate	14
Temperature (°F)	60(?)
pH	8.0
Specific conductance at 25°C (micromhos)	378

CRITTENDEN COUNTY

Marion

Population served: 2,970.

Ownership: Municipal.

Source: Reservoir on Crooked Creek. Intake at north end of reservoir, 1.5 miles southwest of Marion. Supplemental supply, two wells near north end of reservoir.

Well 8805-3720-1. Depth, 240 ft, sealed off at 185 ft; diameter, 8 in.; date drilled, 1952; water-bearing strata, Chester group(?); static water level (reported), 40 ft below land surface; yield, 25 gpm.

Well 8805-3720-3. Depth, 425 ft; diameter, 8 in.; date drilled, 1952; water-bearing strata, Meramec group(?); static water level (reported), 60 ft below land surface; yield, 15 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; copper sulfate added to prevent algal growth; filtered through sand and gravel to remove small solids and through activated charcoal to remove odors and tastes; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 442,000 gpd.

Storage: 150,000-gal elevated steel tank, located at south end of Depot Street.

Total distribution of water for 1951: 62,500,000 gal. Average daily pumpage, 1951: 171,000 gal.

Remarks: Surface water supply was inadequate during the summer of 1952. Two wells were drilled and incorporated into the water system during this shortage but the quantity of water available from these combined sources was still insufficient. In December of 1952, efforts were being made to obtain water from an abandoned fluorspar mine that underlies the town's elevated steel storage tank.

Average pumpage, in gallons per day, 1951

January	194,000	July	163,000
February	218,000	August	155,000
March	173,000	September	130,000
April	199,000	October	111,000
May	176,000	November	163,000
June	217,000	December	158,000

Analysis, in parts per million, well 8805-3720-1

(Collected Dec. 10, 1952)

Silica (SiO ₂)	15
Iron (Fe) .....	.30
Manganese (Mn) .....	.00
Calcium (Ca)	97
Magnesium (Mg)	44
Sodium (Na)	94
Potassium (K)	6.6
Carbonate (CO ₃)	22
Bicarbonate (HCO ₃)	382
Sulfate (SO ₄)	256
Chloride (Cl)	16
Fluoride (F) .....	.4
Nitrate (NO ₃) .....	.0
Dissolved solids	732
Hardness as CaCO ₃	
Total	424
Noncarbonate	73
Temperature (°F)	59
pH	8.1
Specific conductance at 25°C (micromhos)	1,100

Analysis, in parts per million, well 8805-3720-3

(Collected Dec. 10, 1952)

Silica (SiO ₂)	15
Iron (Fe)	14
Manganese (Mn)	1.6
Calcium (Ca)	170
Magnesium (Mg)	67
Sodium (Na)	60
Potassium (K)	5.7
Bicarbonate (HCO ₃)	292
Sulfate (SO ₄)	572
Chloride (Cl)	12
Fluoride (F) .....	.1
Nitrate (NO ₃)	1.6
Dissolved solids	1,110
Hardness as CaCO ₃	
Total	700
Noncarbonate	460
Temperature (°F)	60
pH	7.9
Specific conductance at 25°C (micromhos)	1,400

CUMBERLAND COUNTY

Burkesville

Population served: 1,160.

Ownership: Municipal.

Source: Cumberland River. Intake at the east end of Upper River Street.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located 1 block west of city square.

Rated capacity of treatment plant: 120,000 gpd.

Storage: 75,000-gal concrete reservoir located 0.5 mile west of city square.

Total distribution of water for 1951: 14,955,000 gal.

Average daily pumpage, 1951: 41,000 gal.

Remarks: Pumpage and distribution figures do not include leakage and waste.

Average pumpage, in gallons per day, 1951

January	29,000	July	44,000
February	41,000	August	43,000
March	34,000	September	45,000
April	32,000	October	35,000
May	41,000	November	36,000
June	47,000	December	32,000

EDMONSON COUNTY

Brownsville

Population served: 384.

Ownership: Municipal.

Source: Green River. Intake on north edge of town. Treatment: None.

Storage: Two concrete reservoirs located 0.2 mile east of town. 18,000- and 135,000-gal capacities. Total distribution of water for 1951: 12,700,000 gal. Average daily pumpage, 1951: 35,000 gal.

Remarks: Brownsville expects to build a new treatment plant in the future, probably in 1954.

Kyrock

Population served: 300.

Ownership: Kentucky Rock Asphalt Co.

Source: One spring, 0.3 mile north of Kentucky Rock Asphalt store.

Spring 8615-3715-1. Water-bearing strata, Chester group; estimated minimum flow, 15 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located near spring.

Rated capacity of treatment plant: 15,000 gpd.

Storage: 35,000-gal elevated wooden tank located 1 mile southwest of town.

Total distribution of water for 1951: 4,380,000 gal.

Average daily pumpage, 1951: 12,000 gal.

Remarks: Distribution and daily pumpage based on estimated hours of pumpage. Entire water system will probably be abandoned in about 3 years.

Analysis, in parts per million, spring 8615-3715-1

(Collected Aug. 19, 1952)

Silica (SiO ₂)	8.7
Iron (Fe)	.09
Manganese (Mn)	.00
Calcium (Ca)	23
Magnesium (Mg)	2.7
Sodium (Na)	2.4
Potassium (K)	1.0
Bicarbonate (HCO ₃)	72
Sulfate (SO ₄)	5.5
Chloride (Cl)	4.8
Fluoride (F)	.1
Nitrate (NO ₃)	5.9
Dissolved solids	88
Hardness as CaCO ₃	
Total	68
Noncarbonate	10
Temperature (°F)	56
pH	7.1
Specific conductance at 25°C (micromhos)	158

Mammoth Cave, Mammoth Cave National Park

Population served: 2,000.

Ownership: United States Government.

Source: Two springs.

Spring 8600-3710-1. 1.1 miles northeast of Mammoth Cave Post Office. Water-bearing strata, Chester group; estimated minimum flow, 25 gpm.

Spring 8600-3710-2. 1.5 miles northeast of Mammoth Cave Post Office. Water-bearing strata, Chester group; estimated minimum flow, 10 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to each spring.

Rated capacity of treatment plant: Unknown.

Storage: 200,000-gal concrete surface reservoirs located near each spring.

Total distribution of water for 1951: 9,000,000 gal.

Average daily pumpage, 1951: 24,000 gal.

Analysis, in parts per million, spring 8600-3710-1

(Collected June 20, 1951)

Silica (SiO ₂)	9.8
Iron (Fe)	.16
Manganese (Mn)	-
Calcium (Ca)	24
Magnesium (Mg)	1.9
Sodium (Na)	1.5
Potassium (K)	1.5
Bicarbonate (HCO ₃)	84
Sulfate (SO ₄)	1.6
Chloride (Cl)	1.2
Fluoride (F)	.0
Nitrate (NO ₃)	.8
Dissolved solids	83
Hardness as CaCO ₃	
Total	68
Noncarbonate	0
Temperature (°F)	58
pH	7.8
Specific conductance at 25°C (micromhos)	145

GRAYSON COUNTY

Leitchfield

Population served: 2,380.

Ownership: Municipal.

Source: Three wells, 0.75 mile southeast of town.

Well 8615-3725-1. Depth, 100 ft; diameter, 6 in.; date drilled, 1939; water-bearing strata, Chester group; static water level, unknown; yield, 100 gpm.

Well 8615-3725-2. Depth, 100 ft; diameter, 8 in.; date drilled, 1939; water-bearing strata, Chester group; static water level, unknown; yield, 100 gpm.

Well 8615-3725-5. Depth, 900 ft; diameter, 6.5 in.; date drilled, 1917; water-bearing strata, unknown; yield (pumped), 200 gpm (flows 5 to 6 gpm at surface).

Treatment: Alum added to coagulate solids; lime added to adjust pH; carbon dioxide added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant adjacent to wells.

Rated capacity of treatment plant: 360,000 gpd.

Storage: 75,000-gal elevated steel tank located 1 block west of the intersection of U. S. Highway 62 and Kentucky Highway 65.

Total distribution of water for 1951: 37,714,000 gal.

Breakdown of annual distribution as to use:

Domestic, other public use,

leakage, and waste 36,714,000 gal

Industrial and commercial 1,000,000 gal

Average daily pumpage, 1951: 103,000 gal.

Average pumpage, in gallons per day, 1951

January	123,000	July	90,000
February	119,000	August	105,000
March	93,000	September	111,000
April	100,000	October	107,000
May	101,000	November	89,000
June	110,000	December	95,000

Analysis, in parts per million, well 8615-3725-1

(Collected July 8, 1952)

Silica (SiO ₂)	9.9
Iron (Fe)	.81
Manganese (Mn)	.09
Calcium (Ca)	60
Magnesium (Mg)	8.5
Sodium (Na)	5.7
Potassium (K)	.7
Bicarbonate (HCO ₃)	202
Sulfate (SO ₄)	27
Chloride (Cl)	5.5
Fluoride (F)	.1
Nitrate (NO ₃)	1.5
Dissolved solids	227
Hardness as CaCO ₃	
Total	185
Noncarbonate	19
Temperature (°F)	56
pH	7.2
Specific conductance at 25°C (micromhos)	393

Analysis, in parts per million, well 8615-3725-2

(Collected July 8, 1952)

Silica (SiO ₂)	7.7
Iron (Fe)	1.2
Manganese (Mn)	.05
Calcium (Ca)	64
Magnesium (Mg)	9.0
Sodium (Na)	4.8
Potassium (K)	1.8
Bicarbonate (HCO ₃)	218
Sulfate (SO ₄)	28
Chloride (Cl)	6.0
Fluoride (F)	.1
Nitrate (NO ₃)	.2
Dissolved solids	238
Hardness as CaCO ₃	
Total	198
Noncarbonate	18
Temperature (°F)	67
pH	7.3
Specific conductance at 25°C (micromhos)	406

Analysis, in parts per million, well 8615-3725-5

(Collected July 8, 1952)

Silica (SiO ₂)	7.8
Iron (Fe)	.36
Manganese (Mn)	.00
Calcium (Ca)	50
Magnesium (Mg)	33
Sodium (Na)	3.6
Potassium (K)	1.1
Bicarbonate (HCO ₃)	221
Sulfate (SO ₄)	78
Chloride (Cl)	2.4
Fluoride (F)	2.0
Nitrate (NO ₃)	.0
Dissolved solids	282
Hardness as CaCO ₃	
Total	261
Noncarbonate	79
Temperature (°F)	59
pH	7.5
Specific conductance at 25°C (micromhos)	489

GREEN COUNTY

Gabe

Population served: 19.

Ownership: Tennessee Gas Transmission Co., Gabe Division.

Source: Green River. Intake 0.5 mile south of plant. Treatment: Water used in cooling towers: untreated except for settling in storage tank. Water used in cooling jackets: alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids and softened with zeolite softeners. Water used for domestic use: receives same treatment as water used in cooling jackets except the zeolite softening process is omitted and chlorine is added to disinfect the water. Treatment plant located at factory.

Rated capacity of treatment plant: 2,000 gpd.

Storage: Elevated steel tank located at the south edge of the plant site, 300,000 gal untreated water. No storage for treated water.

Total distribution of water for 1952: 48,720,000 gal.

Breakdown of annual distribution as to use:

Domestic 720,000 gal

Industrial 48,000,000 gal

Average daily pumpage, 1952: 133,000 gal.

Greensburg

Population served: 1,590.

Ownership: Municipal.

Source: Green River. Intake 0.5 mile south of city square.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; copper sulfate added to prevent algal growth; filtered through sand and gravel to remove small solids and through activated charcoal to remove odors and tastes; chlorinated to disinfect water; fluoride added to decrease dental caries. Treatment plant located on southeast side of city square.

Rated capacity of treatment plant: 312,000 gpd.

Storage: 100,000-gal elevated steel tank located 0.3 mile northwest of square on U. S. Highway 61.

Total distribution of water for 1951: 36,000,000 gal.

Average daily pumpage, 1951: 99,000 gal.

HARDIN COUNTY

Elizabethtown

Population served: 6,650.

Ownership: Municipal.

Source: One spring, 1 mile southwest of city square.

Spring 8550-3740-57. Water-bearing strata, Meramec group; estimated minimum flow, 1,200 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water; fluoride added to decrease dental caries. Treatment plant located near spring.

Rated capacity of treatment plant: 210,000 gpd.

Storage: 120,000-gal steel standpipe located 0.5 mile east of plant. 210,000-gal elevated steel tank located in Helm Woods subdivision.

Total distribution of water for 1951: 271,222,000 gal.

Average daily pumpage, 1951: 743,000 gal.

Remarks: Spring 8550-3735-1, located 4 miles southwest of Elizabethtown, will probably be connected to the city supply during 1954. This spring has an estimated minimum yield of 290 gpm.

Average pumpage, in gallons per day, 1951

January	672,000	July	876,000
February	669,000	August	804,000
March	636,000	September	752,000
April	750,000	October	697,000
May	836,000	November	674,000
June	848,000	December	706,000

Analysis, in parts per million, spring 8550-3740-57

(Collected July 9, 1952)

Silica (SiO ₂)	8.5
Iron (Fe) .....	.14
Manganese (Mn) .....	.18
Calcium (Ca)	46
Magnesium (Mg)	13
Sodium (Na)	1.3
Potassium (K) .....	.5
Bicarbonate (HCO ₃)	196
Sulfate (SO ₄)	9.7
Chloride (Cl)	1.1
Fluoride (F) .....	.1
Nitrate (NO ₃)	3.0
Dissolved solids	184
Hardness as CaCO ₃	
Total	170
Noncarbonate	8
Temperature (°F)	56
pH	7.5
Specific conductance at 25°C (micromhos)	325

Vine Grove

Population served: 1,250.

Ownership: Municipal.

Source: One spring, at east city limits near Louisville & Nashville Railroad.

Spring 8555-3745-1. Water-bearing strata, Meramec group; estimated minimum flow, 100 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near spring.

Rated capacity of treatment plant: 100,000 gpd.

Storage: 60,000-gal elevated wooden tank located 1 block south of Kentucky Highway 64 on College Street.

Total distribution of water for 1951: 19,200,000 gal.

Average daily pumpage, 1951: 50,000 gal.

Analysis, in parts per million, spring 8555-3745-1

(Collected Nov. 4, 1952)

Silica (SiO ₂)	8.5
Iron (Fe) .....	.07
Manganese (Mn) .....	.00
Calcium (Ca)	81
Magnesium (Mg)	11
Sodium (Na)	3.5
Potassium (K) .....	.9
Bicarbonate (HCO ₃)	276
Sulfate (SO ₄)	23
Chloride (Cl)	4.5
Fluoride (F) .....	.1
Nitrate (NO ₃)	2.7
Dissolved solids	273
Hardness as CaCO ₃	
Total	246
Noncarbonate	21
Temperature (°F)	59
pH	7.1
Specific conductance at 25°C (micromhos)	478

West Point

Population served: 1,500.

Ownership: Municipal.

Source: Two wells, 3/4 block west of Main Street on 6th Street.

Well 8555-3755-12. Depth, 78 ft; diameter, 12 in.; date drilled, 1946; water-bearing strata, alluvium; static water level (reported), 40 ft below land surface; yield, 300 gpm.

Well 8555-3755-13. Depth, 86 ft; diameter, 12 in.; date drilled, 1946; water-bearing strata, alluvium; static water level (reported), 40 ft below land surface; yield, 200 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near wells.

Rated capacity of treatment plant: 384,000 gpd.

Storage: 55,000-gal elevated steel tank located near wells.

Total distribution of water for 1951: 34,000,000 gal.

Average daily pumpage, 1951: 93,000 gal.

Analysis, in parts per million, well 8555-3755-12

(Collected July 9, 1952)

Silica (SiO ₂)	13
Iron (Fe)	1.5
Manganese (Mn)	.29
Calcium (Ca)	84
Magnesium (Mg)	36
Sodium (Na)	26
Potassium (K)	1.7
Bicarbonate (HCO ₃)	320
Sulfate (SO ₄)	101
Chloride (Cl)	28
Fluoride (F)	.3
Nitrate (NO ₃)	23
Dissolved solids	494
Hardness as CaCO ₃	
Total	361
Noncarbonate	95
Temperature (°F)	56
pH	7.4
Specific conductance at 25°C (micromhos)	788

Analysis, in parts per million, well 8555-3755-13

(Collected July 9, 1952)

Silica (SiO ₂)	9.4
Iron (Fe)	.64
Manganese (Mn)	.22
Calcium (Ca)	88
Magnesium (Mg)	30
Sodium (Na)	19
Potassium (K)	1.1
Bicarbonate (HCO ₃)	320
Sulfate (SO ₄)	71
Chloride (Cl)	28
Fluoride (F)	.1
Nitrate (NO ₃)	15
Dissolved solids	428
Hardness as CaCO ₃	
Total	342
Noncarbonate	81
Temperature (°F)	56
pH	7.5
Specific conductance at 25°C (micromhos)	717

HART COUNTY

Horse Cave

Population served: 1,300.

Ownership: Horse Cave Water Co., Inc.

Source: Two wells, 0.1 mile southwest of intersection of U. S. Highway 31-W and Kentucky Highway 218.

Well 8550-3710-1. Depth, 265 ft; diameter, 8 in.; date drilled, 1930; water-bearing strata, Meramec group; static water level (reported), 186 ft below land surface, 1946; yield, 85 gpm.

Well 8550-3710-4. Depth, 315 ft; diameter, 8 in.; date drilled, 1946; water-bearing strata, Meramec group; static water level (reported), 142 ft below land surface, 1947; yield, 146 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids and through activated charcoal to remove odors and tastes; chlorinated to disinfect water. Treatment plant located near wells.

Rated capacity of treatment plant: 216,000 gpd.

Storage: 200,000-gal elevated steel tank located near treatment plant.

Total distribution of water for 1950: 21,000,000 gal.

Average daily pumpage, 1950: 57,000 gal.

Analysis, in parts per million, composite sample, wells 8550-3710-1, 4

(Collected June 14, 1951)

Silica (SiO ₂)	9.9
Iron (Fe)	.27
Manganese (Mn)	-
Calcium (Ca)	55
Magnesium (Mg)	16
Sodium (Na)	10
Potassium (K)	2.6
Bicarbonate (HCO ₃)	210
Sulfate (SO ₄)	31
Chloride (Cl)	10
Fluoride (F)	.8
Nitrate (NO ₃)	4.1
Dissolved solids	246
Hardness as CaCO ₃	
Total	202
Noncarbonate	31
Temperature (°F)	56
pH	7.9
Specific conductance at 25°C (micromhos)	422

Munfordville

Population served: 615.

Ownership: Munfordville Water Co.

Source: Green River. Intake 1,500 ft northeast of U. S. Highway 31-W bridge.

Treatment: Chlorinated to disinfect water. Treatment plant located near reservoir.

Rated capacity of treatment plant: 417,000 gpd.

Storage: 265,000-gal concrete reservoir located on the northeast side of town.

Total distribution of water for 1951: 16,100,000 gal.

Average daily pumpage, 1951: 44,000 gal.

Remarks: Town expects to buy water system and construct a filter plant during 1953.

LARUE COUNTY

Athertonville

Ownership: Hunter-Wilson Distilling Co., Inc.
Source: Knob Creek. Intake 0.1 mile southeast of plant site.

Well 8535-3735-1 furnishes some water during summer months. Located on plant site. Depth, 145 ft; diameter, 8 in.; date drilled, 1937; water-bearing strata, Meramec group; static water level (reported), 10 ft below land surface, 1953; yield, 50 gpm.

Spring 8535-3735-2 furnishes 80 percent of flow in Knob Creek. Located 3 miles southwest of plant site. Water-bearing strata, Meramec group; estimated minimum flow, 500 gpm.

Treatment: None.

Storage: 4,000,000-gal surface reservoir located at plant site.

Average daily pumpage, 1951: 1,200,000 gal.

Analysis, in parts per million, well 8535-3735-1

(Collected Sept. 24, 1952)

Silica (SiO ₂)	10
Iron (Fe)	50
Manganese (Mn)	.70
Calcium (Ca)	45
Magnesium (Mg)	11
Sodium (Na)	19
Potassium (K)	2.0
Bicarbonate (HCO ₃)	125
Sulfate (SO ₄)	46
Chloride (Cl)	36
Fluoride (F)	.1
Nitrate (NO ₃)	2.0
Dissolved solids	243
Hardness as CaCO ₃	
Total	159
Noncarbonate	55
Temperature (°F)	65
pH	7.4
Specific conductance at 25°C (micromhos)	375

Note: Pumped 1 hour at 10 gpm before sample taken. 72 gal of dilute HCl added in July 1952. Not pumped till day sample was taken. Turbid when collected.

Analysis, in parts per million, spring 8535-3735-2

(Collected Sept. 24, 1952)

Silica (SiO ₂)	6.7
Iron (Fe)	.09
Manganese (Mn)	.00
Calcium (Ca)	47
Magnesium (Mg)	6.8
Sodium (Na)	2.7
Potassium (K)	1.5
Bicarbonate (HCO ₃)	163
Sulfate (SO ₄)	17
Chloride (Cl)	4.5
Fluoride (F)	.1
Nitrate (NO ₃)	1.1
Dissolved solids	169
Hardness as CaCO ₃	
Total	146
Noncarbonate	12
Temperature (°F)	-
pH	7.6
Specific conductance at 25°C (micromhos)	298

Hodgenville

Population served: 1,750.

Ownership: Municipal.

Source: Nolin River, impounded. Intake on north side of city near Kentucky Highway 61. One well, next to impounded river.

Well 8540-3730-1. Depth, 69 ft; diameter, 8 in.; date drilled, 1946; water-bearing strata, Meramec group; static water level (reported), 30 ft below land surface, 1946; yield, 200 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. During the summer, water from the Nolin River is aerated to improve the taste. Treatment plant located near intake.

Rated capacity of treatment plant: 430,000 gpd.

Storage: 65,000-gal elevated steel tank near intersection of Forest and South College Avenues.

Total distribution of water for 1951: 113,000,000 gal.

Average daily pumpage, 1951: 310,000 gal.

Remarks: Water supply was inadequate during summer of 1952.

Analysis, in parts per million, well 8540-3730-1

(Collected July 22, 1952)

Silica (SiO ₂)	7.9
Iron (Fe)	2.2
Manganese (Mn)	.00
Calcium (Ca)	61
Magnesium (Mg)	11
Sodium (Na)	4.4
Potassium (K)	4.0
Bicarbonate (HCO ₃)	190
Sulfate (SO ₄)	32
Chloride (Cl)	7.5
Fluoride (F)	.1
Nitrate (NO ₃)	12
Dissolved solids	240
Hardness as CaCO ₃	
Total	198
Noncarbonate	42
Temperature (°F)	66
pH	7.4
Specific conductance at 25°C (micromhos)	413

Hodgenville, Lincoln National Historical Park

Population served: 300.

Ownership: United States Government.

Source: Well 8540-3730-3. Depth, 65 ft; diameter 6 in.; date drilled, 1900; water-bearing strata, Meramec group; static water level (reported), 40 ft below land surface, 1951; yield, 17 gpm.

Treatment: Filtered through sand to remove small solids; chlorinated to disinfect water. Treatment plant located adjacent to well.

Rated capacity of treatment plant: 10,000 gpd.

Storage: 3,000-gal underground steel tank located near pump.

Total distribution of water for 1951: 1,850,000 gal.

Average daily pumpage, 1951: 5,000 gal.

LIVINGSTON COUNTY

Smithland

Population served: 570.

Ownership: Municipal.

Source: Two wells on the northwest side of town adjacent to the Ohio River.

Well 8820-3705-1. Depth, 33 ft; diameter, 8 in.; date drilled, 1939; water-bearing strata, alluvium; static water level (reported), 25 ft below land surface, 1952; yield, 100 gpm.

Well 8820-3705-2. Depth, 75 ft; diameter, 8 in.; date drilled, 1952; water-bearing strata, alluvium; static water level (reported), 25 ft below land surface, 1952; yield, 100 gpm.

Treatment: Solids allowed to settle in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near wells.

Rated capacity of treatment plant: Unknown.

Storage: 40,000-gal elevated steel tank located 4 blocks east of pumping plant.

Total distribution of water for 1951: 5,400,000 gal.

Average daily pumpage, 1951: 15,000 gal.

Remarks: Well 8820-3705-1 failed during summer, 1953.

Well 8820-3705-2 adequate for demands.

Analysis, in parts per million, well 8820-3705-1

(Collected Oct. 3, 1951)

Silica (SiO ₂)	14
Iron (Fe)	6.6
Manganese (Mn)	.00
Calcium (Ca)	33
Magnesium (Mg)	11
Sodium (Na)	160
Potassium (K)	4.4
Carbonate (CO ₃)	10
Bicarbonate (HCO ₃)	344
Sulfate (SO ₄)	115
Chloride (Cl)	46
Fluoride (F)	.3
Nitrate (NO ₃)	9.7
Dissolved solids	563
Hardness as CaCO ₃	
Total	126
Noncarbonate	0
Temperature (°F)	65
pH	8.2
Specific conductance at 25°C (micromhos)	886

LOGAN COUNTY

Adairville

Population served: 770.

Ownership: Municipal.

Source: South fork of Red River. Intake south of town adjacent to the river.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 150,000 gpd.

Storage: 50,000-gal elevated steel tank located at the intersection of Townsend Avenue and High Street.

Total distribution of water for 1951: 9,000,000 gal.

Average daily pumpage, 1951: 25,000 gal.

Remarks: New sediment basin will be built in 1953 which will double the present capacity.

Auburn

Population served: 1,400.

Ownership: Municipal.

Source: One spring, 1 block south of Main Street on Spring Street.

Spring 8640-3650-1. Water-bearing strata, Meramec group; estimated minimum flow, 150 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located adjacent to spring.

Rated capacity of treatment plant: 100,000 gpd.

Storage: 65,000-gal elevated steel tank located near intersection of Main and Pond Streets.

Total distribution of water for 1951: 46,800,000 gal.

Average daily pumpage, 1951: 126,000 gal.

Analysis, in parts per million, spring 8640-3650-1

(Collected Oct. 5, 1951)

Silica (SiO ₂)	9.0
Iron (Fe)	1.7
Manganese (Mn)	.00
Calcium (Ca)	71
Magnesium (Mg)	7.8
Sodium (Na)	2.1
Potassium (K)	2.7
Bicarbonate (HCO ₃)	246
Sulfate (SO ₄)	.0
Chloride (Cl)	3.5
Fluoride (F)	.2
Nitrate (NO ₃)	4.7
Dissolved solids	233
Hardness as CaCO ₃	
Total	210
Noncarbonate	8
Temperature (°F)	59
pH	7.6
Specific conductance at 25°C (micromhos)	391

Russellville

Population served: 4,400.
Ownership: Municipal.
Source: Mud River and reservoir, filled by diverting Mud River. Mud River intake is 3 miles north of town; reservoir intake is 5 miles north of town.
Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located 0.2 mile north of city square on Kentucky Highway 75.
Rated capacity of treatment plant: 400,000 gpd.
Storage: 1,000,000-gal concrete tank located 1 mile south of city square; 61,000,000-gal reservoir.
Total distribution of water for 1951: 95,744,000 gal.
Average daily pumpage, 1951: 262,000 gal.
Remarks: Three deep wells are available for emergency use. They were formerly the city's main source of supply but have not been used for several years.

Average pumpage, in gallons per day, 1951

January	231,000	July	284,000
February	251,000	August	304,000
March	242,000	September	260,000
April	236,000	October	260,000
May	290,000	November	251,000
June	282,000	December	249,000

LYON COUNTY

Eddyville

Population served: 1,400.
Ownership: Municipal.
Source: Cumberland River, intake 0.2 mile west of city hall.
Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located 1 block east of the intersection of U. S. Highway 62 and Kentucky Highway 58.
Rated capacity of treatment plant: 900,000 gpd.
Storage: 75,000-gal steel reservoir located near treatment plant.
Total distribution of water for 1951: 26,807,000 gal.
Average daily pumpage, 1951: 73,000 gal.
Remarks: The high daily pumpage in February was due to a large number of breaks in the water mains caused by freezing of water in the pipes during an extended period of low temperatures.

Average pumpage, in gallons per day, 1951

January	67,000	July	73,000
February	102,000	August	64,000
March	71,000	September	60,000
April	76,000	October	56,000
May	78,000	November	60,000
June	83,000	December	72,000

Eddyville, Kentucky State Penitentiary

Population served: 1,000.
Ownership: Commonwealth of Kentucky.
Source: Cumberland River, intake on the west edge of penitentiary property.
Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.
Rated capacity of treatment plant: 500,000 gpd.
Storage: 125,000-gal elevated steel tank located on penitentiary grounds.
Total distribution of water for 1951: 85,600,000 gal.
Average daily pumpage, 1951: 235,000 gal.

Kuttawa

Population served: 1,000.
Ownership: Municipal.
Source: Lake, formed by damming outlets to approximately 20 springs, 0.4 mile southwest of town.
Treatment: Chlorinated to disinfect water.
Rated capacity of treatment plant: 500,000 gpd.
Storage: 30,500-gal concrete reservoir 0.5 mile west of city hall.
Total distribution of water for 1951: 20,800,000 gal.
Average daily pumpage, 1951: 57,000 gal.
Remarks: Distribution and daily pumpage based on estimated hours of pumpage.

Analysis, in parts per million, spring 8805-3700-1

(Collected Oct. 15, 1952)

Silica (SiO ₂)	10
Iron (Fe) .....	.09
Manganese (Mn) .....	.00
Calcium (Ca)	59
Magnesium (Mg)	3.6
Sodium (Na)	2.8
Potassium (K)	1.0
Bicarbonate (HCO ₃)	196
Sulfate (SO ₄)	4.1
Chloride (Cl)	3.0
Fluoride (F) .....	.2
Nitrate (NO ₃)	4.1
Dissolved solids	183
Hardness as CaCO ₃	
Total	162
Noncarbonate	1
Temperature (°F)	55
pH	7.2
Specific conductance at 25°C (micromhos)	324

Analysis, in parts per million,
lake (spring fed) 8805-3700-2

(Collected Oct. 30, 1952)

Silica (SiO ₂)	4.9
Iron (Fe)	.28
Manganese (Mn)	.09
Calcium (Ca)	58
Magnesium (Mg)	4.6
Sodium (Na)	3.9
Potassium (K)	1.0
Bicarbonate (HCO ₃)	199
Sulfate (SO ₄)	3.7
Chloride (Cl)	2.5
Fluoride (F)	.1
Nitrate (NO ₃)	1.3
Dissolved solids	186
Hardness as CaCO ₃	
Total	165
Noncarbonate	1
Temperature (°F)	51
pH	7.3
Specific conductance at 25°C (micromhos)	334

MEADE COUNTY

Brandenburg

Population served: 980.

Ownership: Municipal.

Source: Two springs, 1 mile east of town.

Spring 8605-3755-2. Water-bearing strata, Meramec group; estimated minimum flow, 150 gpm.

Spring 8605-3755-3. Water-bearing strata, Meramec group; estimated minimum flow, 50 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located near springs.

Rated capacity of treatment plant: 432,000 gpd.

Storage: 50,000-gal elevated steel tank located near the north end of Green Street.

Total distribution of water for 1951: 36,500,000 gal.

Average daily pumpage, 1951: 100,000 gal.

Analysis, in parts per million, spring 8605-3755-2

(Collected July 8, 1952)

Silica (SiO ₂)	6.6
Iron (Fe)	.20
Manganese (Mn)	.00
Calcium (Ca)	78
Magnesium (Mg)	8.0
Sodium (Na)	1.4
Potassium (K)	.8
Bicarbonate (HCO ₃)	261
Sulfate (SO ₄)	8.1
Chloride (Cl)	1.8
Fluoride (F)	.1
Nitrate (NO ₃)	3.7
Dissolved solids	246
Hardness as CaCO ₃	
Total	228
Noncarbonate	14
Temperature (°F)	58
pH	7.6
Specific conductance at 25°C (micromhos)	442

Brandenburg, Mathieson Chemical Co.

Ownership: Mathieson Chemical Co.

Source: Three wells, 2 miles east of Brandenburg near the Ohio River.

Well 8605-3800-27. Depth, 134 ft; diameter, 13 ft; date drilled, 1951; water-bearing strata, alluvium; static water level (reported), 122 ft below land surface, 1951; yield, 5,000 gpm.

Well 8605-3800-28. Depth, 134 ft; diameter, 13 ft; date drilled, 1951; water-bearing strata, alluvium; static water level (reported), 122 ft below land surface, 1951; yield, 5,000 gpm.

Well 8605-3800-29. Depth, 134 ft; diameter, 13 ft; date drilled, 1951; water-bearing strata, alluvium; static water level (reported), 122 ft below land surface, 1951; yield, 5,000 gpm.

Treatment: Nalco (copper citrate) and Nalco No. 918 added as a sequestering agent for corrosion control and to maintain iron in solution.

Storage: None.

Average daily pumpage, 1951: 18,000,000 gal.

Remarks: Each of the wells is a Ranney Collector and utilizes 1,000 ft of horizontal 8-inch screen.

Analysis, in parts per million, well 8605-3800-27

(Collected Nov. 4, 1952)

Silica (SiO ₂)	11
Iron (Fe)	.09
Manganese (Mn)	2.2
Copper (Cu)	.0
Calcium (Ca)	156
Magnesium (Mg)	22
Sodium (Na)	16
Potassium (K)	1.9
Bicarbonate (HCO ₃)	218
Sulfate (SO ₄)	71
Chloride (Cl)	193
Fluoride (F)	.2
Nitrate (NO ₃)	1.7
Dissolved solids	582
Hardness as CaCO ₃	
Total	480
Noncarbonate	301
Temperature (°F)	63
pH	7.5
Specific conductance at 25°C (micromhos)	1,070

Note: 15 lb Nalco (copper citrate) and 50 lb Nalco No. 918 were added 6 hr before sampling. Sample also contaminated by water from waste reservoir.

Analysis, in parts per million, well 8605-3800-28

(Collected Nov. 4, 1951)

Silica (SiO ₂)	13
Iron (Fe)	1.9
Manganese (Mn)	6.6
Copper (Cu)	.0
Calcium (Ca)	512
Magnesium (Mg)	49
Sodium (Na)	27
Potassium (K)	2.6
Bicarbonate (HCO ₃)	212
Sulfate (SO ₄)	70
Chloride (Cl)	930
Fluoride (F)	.1
Nitrate (NO ₃)	.3
Dissolved solids	2,034
Hardness as CaCO ₃	
Total	1,480
Noncarbonate	1,310
Temperature (°F)	63
pH	6.9
Specific conductance at 25°C (micromhos)	2,910

Note: 15 lb Nalco (copper citrate) and 50 lb Nalco No. 918 were added 6 hr before sampling. Sample also contaminated from waste reservoir.

Analysis, in parts per million, well 8605-3800-29

(Collected Nov. 4, 1951)

Silica (SiO ₂)	15
Iron (Fe)	.05
Manganese (Mn)	.00
Copper (Cu)	.0
Calcium (Ca)	94
Magnesium (Mg)	23
Sodium (Na)	22
Potassium (K)	.9
Bicarbonate (HCO ₃)	195
Sulfate (SO ₄)	74
Chloride (Cl)	100
Fluoride (F)	.2
Nitrate (NO ₃)	5.2
Dissolved solids	443
Hardness as CaCO ₃	
Total	330
Noncarbonate	169
Temperature (°F)	63
pH	7.5
Specific conductance at 25°C (micromhos)	764

Note: 15 lb Nalco (copper citrate) and 50 lb Nalco No. 918 were added 6 hr before sampling. Sample also contaminated from waste reservoir.

Ekron, Schenley Distillers, Inc.

Ownership: National Distilleries.

Source: One spring, 5.5 miles southeast of Brandenburg, east of U. S. Highway 60.

Spring 8605-3755-4. Water-bearing strata, Meramec group; estimated minimum flow, 2,500 gpm.

Treatment: None.

Storage: None.

Average daily pumpage, 1951: 450,000 gal.

Analysis, in parts per million, spring 8605-3755-4

(Collected July 8, 1952)

Silica (SiO ₂)	8.7
Iron (Fe)	.46
Manganese (Mn)	.00
Calcium (Ca)	111
Magnesium (Mg)	15
Sodium (Na)	2.0
Potassium (K)	.8
Bicarbonate (HCO ₃)	259
Sulfate (SO ₄)	127
Chloride (Cl)	2.1
Fluoride (F)	.2
Nitrate (NO ₃)	8.2
Dissolved solids	412
Hardness as CaCO ₃	
Total	338
Noncarbonate	126
Temperature (°F)	58
pH	7.1
Specific conductance at 25°C (micromhos)	643

Flaherty

Population served: 120.

Ownership: Municipal.

Source: One well, near the south edge of town.

Well 8600-3745-1. Depth, 290 ft; diameter, 6 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 150 ft below land surface, 1952; yield, 60 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to well.

Rated capacity of treatment plant: 43,000 gpd.

Storage: 400-gal steel pressure tank near well.

Total distribution of water for 1951: 2,400,000 gal.

Average daily pumpage, 1951: 6,500 gal.

Analysis, in parts per million, well 8600-3745-1

(Collected Jan. 9, 1953)

Silica (SiO ₂)	14
Iron (Fe)	.20
Manganese (Mn)	.00
Calcium (Ca)	58
Magnesium (Mg)	26
Sodium (Na)	3.6
Potassium (K)	.6
Bicarbonate (HCO ₃)	276
Sulfate (SO ₄)	28
Chloride (Cl)	2.2
Fluoride (F)	1.3
Nitrate (NO ₃)	5.2
Phosphate (PO ₄)	.00
Dissolved solids	272
Hardness as CaCO ₃	
Total	254
Noncarbonate	25
Temperature (°F)	-
pH	8.0
Specific conductance at 25°C (micromhos)	471

METCALFE COUNTY

Edmonton

Population served: 475.

Ownership: Municipal.

Source: Two wells, 0.4 mile north of Edmonton.

Well 8535-3655-1. Depth, 255 ft; diameter, 10 in.; date drilled, unknown; water-bearing strata, Osage group; static water level, unknown; yield, 190 gpm.

Well 8535-3655-2. Depth, 259 ft; diameter, 10 in.; date drilled, unknown; water-bearing strata, Osage group; static water level, unknown; yield, 190 gpm.

Treatment: Chlorinated to disinfect water. Treatment plant located adjacent to wells.

Rated capacity of treatment plant: 576,000 gpd.

Storage: 85,000-gal elevated steel tank located 200 yd west of the county courthouse.

Total distribution of water for 1951: 15,000,000 gal.

Average daily pumpage, 1951: 41,000 gal.

Analysis, in parts per million, well 8535-3655-1

(Collected June 13, 1951)

Silica (SiO ₂)	13
Iron (Fe) 1/	2.5
Iron (Fe) 2/	.15
Manganese (Mn)	-
Calcium (Ca)	104
Magnesium (Mg)	21
Sodium (Na)	86
Potassium (K)	4.5
Bicarbonate (HCO ₃)	272
Sulfate (SO ₄)	158
Chloride (Cl)	104
Fluoride (F)	.2
Nitrate (NO ₃)	2.7
Dissolved solids	642
Hardness as CaCO ₃	
Total	346
Noncarbonate	123
Temperature (°F)	62
pH	7.7
Specific conductance at 25°C (micromhos)	1,027

1/ In solution and sediment.

2/ In solution when analyzed.

Analysis, in parts per million, well 8535-3655-2

(Collected June 13, 1951)

Silica (SiO ₂)	12
Iron (Fe)	1.6
Manganese (Mn)	-
Calcium (Ca)	99
Magnesium (Mg)	21
Sodium (Na)	86
Potassium (K)	4.8
Bicarbonate (HCO ₃)	274
Sulfate (SO ₄)	156
Chloride (Cl)	104
Fluoride (F)	.2
Nitrate (NO ₃)	3.3
Dissolved solids	648
Hardness as CaCO ₃	
Total	334
Noncarbonate	109
Temperature (°F)	62
pH	7.8
Specific conductance at 25°C (micromhos)	1,034

MONROE COUNTY

Tompkinsville

Population served: 1,750.

Ownership: Municipal.

Source: Town Creek, impounded. Intake on the north-east edge of town.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 200,000 gpd.

Storage: 75,000-gal elevated steel tank located 0.3 mile north of county courthouse on Kentucky Highway 63.

Total distribution of water for 1951: 65,000,000 gal.

Average daily pumpage, 1951: 177,000 gal.

Remarks: Water supply low in 1953.

PULASKI COUNTY

Burnside

Population served: 610.

Ownership: Municipal.

Source: Lake Cumberland. Intake on the north edge of town.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 150,000 gpd.

Storage: 100,000-gal elevated steel tank at the intersection of Ash and Oak Streets.

Total distribution of water for 1951: 10,800,000 gal.

Average daily pumpage, 1951: 30,000 gal.

Somerset

Population served: 10,300.

Ownership: Kentucky Water Service Co., Inc.

Source: Pitman Creek, impounded. Intake 1 mile north of Somerset. Lake Cumberland is used as an emergency supply; intake 5 miles south of town.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near Pitman Creek intake.

Rated capacity of treatment plant: 1,440,000 gpd.

Total distribution of water for 1951: 269,380,000 gal.

Breakdown of annual distribution as to use:

Domestic 85,870,200 gal

Industrial and commercial 98,886,600 gal

Other public use, leakage, and waste 84,624,200 gal

Average daily pumpage, 1951: 739,000 gal.

Average pumpage, in gallons per day, 1951

January	677,000	July	829,000
February	729,000	August	823,000
March	668,000	September	704,000
April	684,000	October	732,000
May	775,000	November	696,000
June	789,000	December	735,000

RUSSELL COUNTY

Jamestown

Population served: 980.
 Ownership: Municipal.
 Source: One spring, 1 mile southeast of Jamestown.
 Spring 8500-3655-1. Water-bearing strata, Meramec group; estimated minimum flow, 50 gpm.
 Treatment: Chlorinated to disinfect water. Treatment plant located near spring.
 Rated capacity of treatment plant: 32,000 gpd.
 Storage: 60,000-gal elevated steel tank located near the intersection of Shelby and Franklin Streets.
 Total distribution of water for 1951: 12,000,000 gal.
 Average daily pumpage, 1951: 33,000 gal.

Analysis, in parts per million, spring 8500-3655-1

(Collected Sept. 19, 1952)

Silica (SiO ₂)	8.9
Iron (Fe)	.09
Manganese (Mn)	.00
Calcium (Ca)	47
Magnesium (Mg)	8.3
Sodium (Na)	1.6
Potassium (K)	.9
Bicarbonate (HCO ₃)	175
Sulfate (SO ₄)	6.6
Chloride (Cl)	2.6
Fluoride (F)	.1
Nitrate (NO ₃)	4.6
Dissolved solids	163
Hardness as CaCO ₃	
Total	151
Noncarbonate	8
Temperature (°F)	58
pH	7.0
Specific conductance at 25°C (micromhos)	294

Russell Springs

Population served: 1,090.
 Ownership: Municipal.
 Source: One spring, 0.5 mile west of Russell Springs.
 Spring 8500-3700-1. Water-bearing strata, Meramec group; estimated minimum flow, 100 gpm.
 Treatment: Chlorinated to disinfect water. Treatment plant located near spring.
 Rated capacity of treatment plant: 216,000 gpd.
 Storage: 55,000-gal elevated steel tank located near the center of town.
 Total distribution of water for 1951: 12,600,000 gal.
 Average daily pumpage, 1951: 34,000 gal.

Analysis, in parts per million, spring 8500-3700-1

(Collected July 21, 1952)

Silica (SiO ₂)	11
Iron (Fe)	.04
Manganese (Mn)	.00
Calcium (Ca)	18
Magnesium (Mg)	2.9
Sodium (Na)	2.1
Potassium (K)	3.0
Bicarbonate (HCO ₃)	56
Sulfate (SO ₄)	3.9
Chloride (Cl)	4.0
Fluoride (F)	.0
Nitrate (NO ₃)	10
Dissolved solids	85
Hardness as CaCO ₃	
Total	57
Noncarbonate	11
Temperature (°F)	58
pH	6.7
Specific conductance at 25°C (micromhos)	140

Wolf Creek Dam Village

Population served: 60.
 Ownership: U. S. Army Engineers.
 Source: Wolf Creek Reservoir. Intake in the base of dam.
 Treatment: Alum added to coagulate solids; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located 0.5 mile southwest of town.
 Rated capacity of treatment plant: 86,400 gpd.
 Storage: Two elevated steel tanks located 0.5 mile northeast of village. Total capacity: 17,500 gal.
 Total distribution of water for 1951: 3,180,000 gal.
 Average daily pumpage, 1951: 8,000 gpd.
 Remarks: Pumping and treatment plant will be rebuilt and improved in 1953.

SIMPSON COUNTY

Franklin

Population served: 5,340.
 Ownership: Municipal.
 Source: Drakes Creek. Intake 1 mile east of county courthouse on Kentucky Highway 100.
 Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.
 Rated capacity of treatment plant: 1,500,000 gpd.
 Storage: 100,000-gal elevated steel tank located 0.4 mile east of county courthouse.
 Total distribution of water for 1951: 132,000,000 gal.
 Average daily pumpage, 1951: 362,000 gal.

TAYLOR COUNTY

Campbellsville

Population served: 5,400.

Ownership: Municipal.

Source: Pitman Creek, impounded. Intake 0.5 mile north of city limits.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near intake.

Rated capacity of treatment plant: 1,000,000 gpd.

Storage: 250,000-gal elevated steel tank located near the intersection of Bell and Gowdy Avenues.

138,000-gal elevated steel tank located near the intersection of Lebanon and High Streets. Raw water storage in impounded Pitman Creek, 310,000,000 gal.

Total distribution of water for 1951: 91,199,000 gal.

Average daily pumpage, 1951: 250,000 gal.

Remarks: Capacity and storage figures given above are those for the new water system completed in December 1952.

Average pumpage, in gallons per day, 1951

January	208,000	July	270,000
February	210,000	August	283,000
March	218,000	September	306,000
April	247,000	October	273,000
May	211,000	November	274,000
June	285,000	December	214,000

Campbellsville, Tennessee Gas Transmission Co.

Population served: 32.

Ownership: Tennessee Gas Transmission Co.

Source: Two reservoirs, 8525-3725-A; one located 1.5 miles southwest of plant and second located 0.2 mile north of office on tributaries to Pitman Creek.

Treatment: Cooling water: Zeolite softened.

Domestic water: ferrous sulfate added to coagulate small solids; lime added to raise pH; hypochlorite added to disinfect water. Treatment plant located at factory.

Rated capacity of treatment plant: Cooling water: 626,000 gpd. Domestic water: 24,000 gpd.

Storage: 4,000-gal elevated steel tank located on plant site.

Total distribution of water for 1951: 58,400,000 gal.

Breakdown of annual distribution as to use:

Domestic 1,300,000 gal.

Industrial 57,100,000 gal.

Average daily pumpage, 1951: 160,000 gal.

TODD COUNTY

Elkton

Population served: 1,260.

Ownership: Municipal.

Source: Two wells, 0.1 mile northeast of county courthouse.

Well 8705-3645-1. Depth, 90 ft; diameter, 10 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 30 ft below land surface, 1951; yield, 325 gpm.

Well 8705-3645-2. Depth, 123 ft; diameter 6 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 30 ft below land surface, 1951; yield, 225 gpm.

Treatment: Filtered through sand and gravel to remove small solids; chlorinated to disinfect water.

Treatment plant located near wells.

Rated capacity of treatment plant: 300,000 gpd.

Storage: 140,000-gal elevated steel tank located near the intersection of Garth Lane and Streets Avenue.

Total distribution of water for 1951: 66,000,000 gal.

Average daily pumpage, 1951: 182,000 gal.

Remarks: New well reported drilled in summer of 1952. Supply inadequate in 1953.

Analysis, in parts per million, well 8705-3645-2

(Collected June 27, 1951)

Silica (SiO ₂)	8.1
Iron (Fe)	1.6
Manganese (Mn)	-
Calcium (Ca)	59
Magnesium (Mg)	10
Sodium (Na)	18
Potassium (K)	6.6
Bicarbonate (HCO ₃)	216
Sulfate (SO ₄)	34
Chloride (Cl)	12
Fluoride (F) .....	.3
Nitrate (NO ₃)	8.4
Dissolved solids	270
Hardness as CaCO ₃	
Total	190
Noncarbonate	11
Temperature (°F)	60
pH	7.5
Specific conductance at 25°C (micromhos)	475

Guthrie

Population served: 1,050.

Ownership: Municipal.

Source: One spring, 3 miles east of Guthrie.

Spring 8710-3635-1. Water-bearing strata, Meramec group; estimated minimum flow, 2,000 gpm.

Treatment: Filtered through sand and gravel to remove small solids; chlorinated to disinfect water.

Treatment plant located in Guthrie. Industrial water not treated.

Rated capacity of treatment plant: 300,000 gpd.

Storage: 150,000-gal elevated steel tank located on east edge of town.

Total distribution of water for 1951: 625,000,000 gal.

Average daily pumpage, 1951: 1,714,000 gal.

Analysis, in parts per million, spring 8710-3635-1

(Collected June 27, 1951)

Silica (SiO ₂)	9.5
Iron (Fe)	2.4
Manganese (Mn)	-
Calcium (Ca)	42
Magnesium (Mg)	4.9
Sodium (Na)	1.4
Potassium (K)	2.9
Bicarbonate (HCO ₃)	134
Sulfate (SO ₄)	6.6
Chloride (Cl)	7.0
Fluoride (F)	.1
Nitrate (NO ₃)	12
Dissolved solids	151
Hardness as CaCO ₃	
Total	124
Noncarbonate	15
Temperature (°F)	63
pH	7.6
Specific conductance at 25°C (micromhos)	254

Trenton

Population served: 500.

Ownership: Municipal.

Source: Two wells.

Well 8715-3640-1. 1 1/2 blocks south of U. S.

Highway 41 near the Louisville & Nashville Railroad station; depth, 90 ft; diameter, 10 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 75 ft below land surface; yield, 90 gpm.

Well 8715-3640-2. 1/2 block south of U. S. Highway

41 near the Louisville & Nashville Railroad station; depth, 290 ft; diameter, 6 in.; date drilled, unknown; water-bearing strata, Meramec group; static water level (reported), 200 ft below land surface; yield, 25 gpm.

Treatment: Settled by gravity in storage tank to remove sediment; chlorinated to disinfect water.

Treatment plant located near wells.

Rated capacity of treatment plant: 144,000 gpd.

Storage: 55,000-gal elevated steel tank located 1 block south of U. S. Highway 41 near the Louisville & Nashville Railroad station.

Total distribution of water for 1951: 5,500,000 gal.

Average daily pumpage, 1951: 15,000 gal.

Analysis, in parts per million, well 8715-3640-1

(Collected June 27, 1951)

Silica (SiO ₂)	11
Iron (Fe)	2.0
Manganese (Mn)	.24
Calcium (Ca)	44
Magnesium (Mg)	3.9
Sodium (Na)	2.1
Potassium (K)	1.4
Bicarbonate (HCO ₃)	141
Sulfate (SO ₄)	8.6
Chloride (Cl)	1.8
Fluoride (F)	.1
Nitrate (NO ₃)	9.9
Dissolved solids	151
Hardness as CaCO ₃	
Total	126
Noncarbonate	10
Temperature (°F)	59
pH	8.3
Specific conductance at 25°C (micromhos)	252

Analysis, in parts per million, well 8715-3640-2

(Collected June 27, 1951)

Silica (SiO ₂)	11
Iron (Fe)	2.8
Manganese (Mn)	.00
Calcium (Ca)	136
Magnesium (Mg)	76
Sodium (Na)	19
Potassium (K)	1.7
Bicarbonate (HCO ₃)	194
Sulfate (SO ₄)	496
Chloride (Cl)	18
Fluoride (F)	2.6
Nitrate (NO ₃)	1.0
Dissolved solids	925
Hardness as CaCO ₃	
Total	652
Noncarbonate	493
Temperature (°F)	63
pH	7.9
Specific conductance at 25°C (micromhos)	1,139

TRIGG COUNTY

Cadiz

Population served: 1,570.

Ownership: Cadiz Water Co.

Source: One spring, 1 block south of county courthouse in Cadiz.

Spring 8750-3650-1. Water-bearing strata, Meramec group; estimated minimum flow, 2,500 gpm.

Treatment: Solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Treatment plant located near spring.

Rated capacity of treatment plant: 500,000 gpd.

Storage: 187,000-gal elevated steel tank near the intersection of Main and Lafayette Streets.

Total distribution of water for 1951: 73,000,000 gal.

Average daily pumpage, 1951: 200,000 gal.

Analysis, in parts per million, spring 8750-3650-1

(Collected Oct. 3, 1951)

Silica (SiO ₂)	10
Iron (Fe)	.40
Manganese (Mn)	.00
Calcium (Ca)	66
Magnesium (Mg)	7.8
Sodium (Na)	3.2
Potassium (K)	.9
Bicarbonate (HCO ₃)	226
Sulfate (SO ₄)	7.4
Chloride (Cl)	5.5
Fluoride (F)	.1
Nitrate (NO ₃)	4.1
Dissolved solids	219
Hardness as CaCO ₃	
Total	196
Noncarbonate	12
Temperature (°F)	50
pH	7.7
Specific conductance at 25°C (micromhos)	365

WARREN COUNTY

Bowling Green

Population served: 18,000.
 Ownership: Municipal.
 Source: Barren River. Intake at southeast end of Chestnut Street.
 Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; ammonia added to retain chlorine content; chlorinated to disinfect water. Treatment plant located near intake.
 Rated capacity of treatment plant: 4,500,000 gpd.
 Storage: 150,000-gal elevated steel tank located on the Western Kentucky State Teacher's College campus. Two reservoirs on "Reservoir Hill" in city limits, combined capacity, 2,000,000 gal.
 1,000,000-gal steel standpipe located 2 1/2 miles southwest of the center of Bowling Green.
 Total distribution of water for 1951: 845,109,000 gal.
 Average daily pumpage, 1951: 2,315,000 gal.

Average pumpage, in gallons per day, 1951

January	2,200,000	July	2,590,000
February	2,380,000	August	2,640,000
March	2,250,000	September ...	2,310,000
April	2,180,000	October	2,150,000
May	2,400,000	November	2,050,000
June	2,540,000	December	2,090,000

Analysis, in parts per million, finished water,
 Barren River, public supply

(Collected Apr. 17, 1951)

Silica (SiO ₂)	5.3
Iron (Fe) .....	.20
Manganese (Mn) .....	.00
Calcium (Ca)	32
Magnesium (Mg)	5.3
Sodium (Na)	2.2
Potassium (K) .....	.7
Bicarbonate (HCO ₃)	104
Sulfate (SO ₄)	13
Chloride (Cl)	5.0
Fluoride (F) .....	.0
Nitrate (NO ₃)	3.4
Dissolved solids	114
Hardness as CaCO ₃	
Total	102
Noncarbonate	-
Temperature (°F)	-
pH	7.8
Specific conductance at 25°C (micromhos)	202

Bowling Green, Pet Milk Co.

Ownership: Pet Milk Co.
 Source: One spring, 2 miles northwest of Bowling Green.
 Spring 8625-3700-1. Water-bearing strata, Meramec group; estimated minimum flow, 1,000 gpm.
 Treatment: None.
 Storage: 4,000-gal elevated steel tank near spring.
 Total distribution of water for 1951: 131,000,000 gal.
 Average daily pumpage, 1951: 359,000 gal.

Analysis, in parts per million, spring 8625-3700-1

(Collected Apr. 26, 1951)

Silica (SiO ₂)	8.7
Iron (Fe) .....	.66
Manganese (Mn)	-
Calcium (Ca)	66
Magnesium (Mg)	8.3
Sodium (Na)	2.9
Potassium (K) .....	.8
Bicarbonate (HCO ₃)	192
Sulfate (SO ₄)	34
Chloride (Cl)	3.2
Fluoride (F) .....	.1
Nitrate (NO ₃)	11
Dissolved solids	228
Hardness as CaCO ₃	
Total	200
Noncarbonate	41
Temperature (°F)	-
pH	7.5
Specific conductance at 25°C (micromhos)	374

Smiths Grove

Population served: 1,030.
 Ownership: Mr. S. Ford Thomas.
 Source: Three wells in Smiths Grove.
 Well 8610-3700-1. Depth, 240 ft; diameter, 8 in.; date drilled, 1920; water-bearing strata, Meramec group; static water level (reported), 180 ft below land surface, 1951; yield, 75 gpm.
 Well 8610-3700-2. Depth, 240 ft; diameter, 8 in.; date drilled, 1920; water-bearing strata, Meramec group; static water level (reported), 180 ft below land surface, 1951; yield, 75 gpm.
 Well 8610-3700-3. Depth, 240 ft; diameter, 8 in.; date drilled, 1920; water-bearing strata, Meramec group; static water level (reported), 180 ft below land surface, 1951; yield, 75 gpm.
 Treatment: Alum added to coagulate solids; solids precipitated in settling tank; chlorinated to disinfect water. Treatment plant located near wells.
 Rated capacity of treatment plant: 100,000 gal.
 Storage: 50,000-gal elevated wood tank located near wells. 75,000-gal concrete reservoir located near wells.
 Total distribution of water for 1951: 23,700,000 gal.
 Average daily pumpage, 1951: 65,000 gal.

Analysis, in parts per million,
 wells 8610-3700-1, 2, and 3

(Collected June 20, 1951)

Silica (SiO ₂)	9.9
Iron (Fe)	1.0
Manganese (Mn)	-
Calcium (Ca)	54
Magnesium (Mg)	15
Sodium (Na)	7.6
Potassium (K)	1.8
Bicarbonate (HCO ₃)	210
Sulfate (SO ₄)	25
Chloride (Cl)	10
Fluoride (F) .....	.4
Nitrate (NO ₃)	7.9
Dissolved solids	237
Hardness as CaCO ₃	
Total	196
Noncarbonate	24
Temperature (°F)	60
pH	7.5
Specific conductance at 25°C (micromhos)	414

WAYNE COUNTY

Monticello

Population served: 2,520.

Ownership: Municipal.

Source: Two wells, near the intersection of Ridgewood and Shrewsbury Avenues.

Well 8450-3650-1. Depth, 68 ft; diameter, 8 in.; date drilled, 1930; water-bearing strata, Meramec group; static water level (reported), 65 ft, 1951; yield, 250 gpm.

Well 8450-3650-2. Depth, 70 ft; diameter, 8 in.; date drilled, 1930; water-bearing strata, Meramec group; static water level (reported), 65 ft, 1951; yield, 250 gpm.

Treatment: Alum added to coagulate solids; lime added to adjust pH; solids precipitated in settling tank; filtered through sand and gravel to remove small solids; chlorinated to disinfect water. Copper sulfate added to raw water during summer months to inhibit algal growths. Treatment plant located near wells.

Rated capacity of treatment plant: 366,000 gpd.

Storage: 60,000-gal elevated steel tank located near wells.

Total distribution of water for 1951: 60,000,000 gal.

Average daily pumpage, 1951: 165,000 gal.

Analysis, in parts per million, well 8450-3650-1

(Collected July 13, 1951)

Silica (SiO ₂)	10
Iron (Fe)	.20
Manganese (Mn)	.00
Calcium (Ca)	55
Magnesium (Mg)	5.8
Sodium (Na)	3.8
Potassium (K)	.9
Bicarbonate (HCO ₃)	176
Sulfate (SO ₄)	13
Chloride (Cl)	8.5
Fluoride (F)	.0
Nitrate (NO ₃)	8.1
Dissolved solids	190
Hardness as CaCO ₃	
Total	162
Noncarbonate	17
Temperature (°F)	60
pH	7.8
Specific conductance at 25°C (micromhos)	329

LITERATURE CITED

Dean, H. T., 1936, Chronic endemic dental fluorosis: Am. Med. Assoc. Jour., v. 107, p. 1,269-1,272.

Lamar, W. L., and Laird, L. B., 1953, Chemical character of surface waters of Kentucky, 1949-1951: Agr. and Indus. Devel. Board of Ky. Bull.

Lohr, E. W., Billingsly, G. A., Geurin, J. W., and Lamar, W. L., 1952, The industrial utility of public water supplies in the East South Central States, 1952: U. S. Geol. Survey Circ. 197.

Maxey, K. F., 1950, Report on the relation of nitrate concentrations in well waters to the occurrence of methemoglobinemia: Nat. Research Council, Bull. Sanitary Eng., App. D, p. 265.

Otton, E. G., 1948a, Ground-water supplies of the Campbellsville area, Ky.: Ky. Dept. of Mines and Minerals, Geol. Div., 22 p.

1948b, Ground-water resources of the Elizabethtown area, Ky.: Ky. Dept. of Mines and Minerals, Geol. Div., 27 p.

Sauer, C. O., 1927, Geography of the Pennyroyal region, Ky.: Ky. Geol. Survey, ser. 6, v. 23, p. 35.

United States Public Health Service, 1946, Drinking water standards: Repr. 2697, Public Health Repts., v. 16, p. 371-384.