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# WATER AVAILABILITY IN PERRY COUNTY, ALABAMA

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## ABSTRACT

The principal sources of large quantities of ground water in Perry County are sand and gravel aquifers in the Coker, Gordo, and Eutaw Formations of the Upper Cretaceous Series. Upper Cretaceous deposits, which dip to the southwest at about 35 feet per mile, range in thickness from about 400 feet in the northern part of the county to about 2,300 feet in the southernmost part. Most wells tapping Upper Cretaceous deposits range in depth from 20 to 950 feet; the deposits are potential sources of water to depths of 2,000 feet. Yields of wells that tap individual aquifers in the Upper Cretaceous Series range from about 0.5 to 2 mgd (million gallons per day). ~~Wells tapping all three aquifers in the southwestern half of the county probably will yield at least 3 mgd.~~ Water levels in wells tapping the Upper Cretaceous deposits range from 40 feet above land surface in low areas along the major streams to 245 feet below land surface in upland areas.

Beds of sand and gravel in the alluvial deposits underlying the major stream valleys and terraces along these valleys are sources of water to wells. Where these beds are hydraulically connected to streams, they potentially will yield large supplies of water to wells.

Annual rainfall averages about 55 inches and the average rate of runoff per square mile is about 0.8 mgd. The Cahaba River and Oakmulgee Creek are the largest sources of surface water in the county. The Cahaba River at Sprott has an average flow of about 1,300 mgd and a 7-day low flow (7-day $Q_2$) of 200 mgd. Oakmulgee Creek near Perryville has an average flow of about 140 mgd and a 7-day $Q_2$ of about 15 mgd. The total average flow of all streams in the county is about 1,800 mgd.

Water from aquifers and streams in Perry County is chemically suitable for most uses. Water from wells ranges from soft to moderately hard but locally is hard and has an iron content that exceeds 0.3 mg/l (milligrams per liter). Water from streams has a low mineral content and is generally soft.

Water use in Perry County in 1968 was about 4 mgd which was less than 1 percent of the available quantity.

## INTRODUCTION

The U.S. Geological Survey, in cooperation with the Geological Survey of Alabama, is conducting a reconnaissance of the geology and availability of water and mineral resources of Alabama. The State was divided into seven study areas, corresponding generally to major river basins; however, the work is being done by counties and the results are to be published on the basis of county reports. The boundaries of the seven areas and the status of the studies are shown on figure 1.

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The purpose of this report is to present graphically and pictorially general information on the water availability of Perry County, which is in east-central Alabama (Ala-35-C) study area. The report can be used (1) to quickly appraise the water resources of the county and (2) for comparison with similar reports for all 67 counties in Alabama. The report utilizes information contained in earlier reports, which are listed in the selected references, and information collected since those reports were prepared. In addition, it contains water-availability maps and other water-resources information not presented in previous reports.

Figure 1. --Status of geologic and water-availability studies in Alabama.

## PHYSICAL CHARACTERISTICS

Perry County is an irregularly shaped area of 734 square miles in central Alabama. The southwestern part of the county is relatively flat in contrast to the fairly rugged northern and eastern parts. The eastern half of the county is drained by the Cahaba River and its chief tributary, Oakmulgee Creek. Both streams flow southward to the Alabama River. The western half is drained chiefly by Big Brush and Big Prairie Creeks, that flow westward to the Black Warrior River, and by Boguechitto and Washington Creeks that flow southward to the Alabama River.

## GENERAL GEOLOGY

Geologic units of the Upper Cretaceous, Pleistocene, and Holocene Series (table 1) are exposed in Perry County. These units are of sedimentary origin and consist of sand, sandstone, gravel, silt, clay, chalk, and limestone. The Upper Cretaceous Series includes, in ascending order, the Coker and Gordo Formations of the Tuscaloosa Group, and the Eutaw Formation, and the Mooreville and Demopolis Chalks and the Ripley Formation of the Selma Group. These formations strike northwestward and dip southwestward 35 to 50 feet per mile. Upper Cretaceous deposits range in thickness from about 400 feet in the northernmost part of the county to about 2, 300 feet in the southernmost part. The Pleistocene and Holocene Series, which consist of high terrace deposits along the valleys of the Cahaba River, Oakmulgee Creek, and Little Oakmulgee Creek and of low terrace deposits and alluvium underlying most of the stream valleys in the county, have a maximum thickness of about 50 feet.

## SOURCE AND OCCURRENCE OF WATER

The source of all fresh water in Perry County is precipitation, which averages about 55 inches annually and is distributed fairly evenly throughout the year. Some precipitation runs off directly to streams, some returns to the atmosphere by evaporation and transpiration, and some percolates downward through the soil to underlying ground-water reservoirs. The amount of precipitation that percolates downward to underground reservoirs is governed largely by the character of the rock strata underlying the land surface. Deposits of chalk in the southwestern part of the county are relatively impermeable and less than 1 inch of rainfall percolates downward into the chalk; the remainder of the precipitation is returned to the atmosphere by evapotranspiration or runs off rapidly and directly to streams. In contrast, about 5 inches of the rainfall percolates downward into beds of permeable sand and gravel that underlie the northern, central, and southeastern parts of the county. Water infiltrates to the zone of saturation where all openings are filled with water. The upper surface of the saturated zone is called the water table. Where an aquifer is overlain by relatively impermeable beds of clay or chalk, water commonly is confined within the aquifer. Confined aquifers are called artesian aquifers and water levels stand above the top of the aquifer in wells tapping such aquifers. The imaginary surface to which water will rise in wells tapping an artesian aquifer is called the potentiometric surface. A generalized profile of the potentiometric surface for the Coker, ~~Gordo,~~ and Eutaw Formations, which generally

slopes gently southwestward, is shown on the cross section of figure 2.

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Where the potentiometric surface of an aquifer is above land surface, wells tapping the aquifer will flow at land surface. Areas of artesian flow occur in several of the stream valleys in the county and are shown on figure 3.

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Figure 2. --Water availability, Perry County, Alabama.

Figure 3. --Areas of flowing wells in Perry County.

## AVAILABILITY OF WATER

### Ground Water

All formations that crop out in Perry County except the Mooreville and Demopolis Chalks are sources of fresh ground water. The water-bearing characteristics of the geologic units underlying the county are given in table 1. The principal aquifers or sources of large quantities of ground water in Perry County are sand and gravelly sand beds in the lower parts of the Coker, Gordo, and Eutaw Formations. Aquifers in the Coker or the Gordo Formations will yield from 0.5 to 1 mgd (million gallons per day) to individual wells in the northern half of the county and 1 mgd or more in the southern half. The principal aquifer in the Eutaw Formation will yield 0.5 to 1 mgd to individual wells in the southeastern, central, and west-central parts of the county and 1 to 2 mgd in the southwestern part. A well tapping all three formations in the southwest half of the county will probably yield at least 3 mgd.

The water availability map (fig. 2) shows by contour lines the estimated depths, in feet below mean sea level, to the base of the principal aquifers in the Coker, Gordo, and Eutaw Formations. The relative positions of these aquifers are shown on the cross section of figure 2. The approximate depth below land surface to the base of a specific aquifer can be calculated by adding the land surface altitude at a well site to the approximate depth below mean sea level of the base of the aquifer at the site. Records of wells shown on figure 2 are given in table 2 and available sample and drillers' logs of wells are given in tables 5 and 6.

Low terrace deposits and alluvium in the flood plain of the Cahaba River and along the lower reaches of Oakmulgee Creek are potential sources of large supplies of ground water. Where permeable sand and gravel beds of these deposits lie adjacent to perennial streams and are hydraulically connected to streams, large sustained yields of water may be available through induced recharge. In some areas along the valleys high terrace deposits will yield small supplies of water to wells; however, there are no known wells in the county that develop water from these deposits.

A well that will yield 10 gpm (gallons per minute) is considered adequate for domestic supply. The depths below land surface to aquifers that will yield sufficient water for domestic needs are shown in figure 4.

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## Surface Water

Streamflow in Perry County is derived almost entirely from rainfall. The availability of water from streams, however, is not only dependent upon the amount of rainfall but also on the flow characteristics of streams. Streamflow consists of varying proportions of water running directly off the land surface during and immediately following rainfall and of water that is discharged from ground-water reservoirs. The proportion of water entering the streams from direct runoff or from ground-water discharge is influenced by vegetation, topography, size of drainage area and the types of rock underlying individual drainage basins.

Figure 4. --Depths to aquifers that will yield water for domestic supply.

High and low flows tend to occur in seasonal patterns. Typical seasonal patterns of flow are shown by the hydrograph of monthly mean discharges for the Cahaba River at Sprott (fig. 5). Streamflows in the

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county tend to be highest in the early part of the year when rainfall is greatest and evapotranspiration is least; flows begin to recede in spring when evapotranspiration increases and rainfall diminishes. The recession of flow generally tends to continue through the summer months, although summer thundershowers may cause a temporary increase in flow. Lowest flows usually occur in late summer and early autumn during the period of least rainfall; flows increase rapidly late in the year when evapotranspiration decreases and winter rains begin.

Figure 5. --Hydrograph of monthly mean discharges of Cahaba River at Sprott, Alabama.

The average flow of a stream is the arithmetic mean of all flows on record. In general, the longer the period of record, the more accurate the determination of average flow. Average flow data can be used in evaluating the availability of water in a stream because it represents the water yield of its drainage basin. Average flow data in this report were available at one streamflow station within the county. Records for this station were adjusted to the base period 1940-66 and correlated with nearby streamflow records. Average flows greater than 10 mgd are shown on figure 2. The average runoff per square mile in the county is about 0.8 mgd, or 620 mgd for the entire county.

The low flow of streams in the county is derived almost entirely from ground-water discharge. Thus, low-flow characteristics are greatly influenced by the geologic characteristics of drainage basins. Streams draining the outcrop of the Demopolis and Mooreville Chalks generally have little or no flow during rainless periods. Streams that drain other areas of the county generally have sufficient ground-water discharge to maintain flow for several months without rainfall.

Low-flow characteristics of streams may be described in several ways. The low-flow index used in this report for appraising the normal dry-weather flows of streams is the 7-day $Q_2$, the lowest average flow for 7 consecutive days that occurs at average intervals of 2 years. However, 7-day low flows may be less than or more than the 7-day $Q_2$ for several consecutive years. The approximate range of the 7-day $Q_2$ for major streams in Perry County is shown on figure 2.

## QUALITY OF WATER

Ground water and surface water in the county is generally of good quality and suitable for most uses. Ground water in some localities may be objectionable for some uses because of its high iron content or hardness. Iron in excess of 0.3 mg/l (milligram per liter) may cause staining of plumbing fixtures, dishes, cooking utensils, and clothing. Hard water is objectionable for some uses because it increases soap consumption and may deposit scale in pipes, boilers, and cooking utensils. General terms used in this report to describe the hardness of water are as follows: soft, 0-60 mg/l; moderately hard, 61-120 mg/l; hard, 121-180 mg/l; and very hard, 181 mg/l or more.

## Ground Water

Water from the Coker Formation generally is soft or moderately hard; sporadically it is hard. In the northern half of the county the iron content generally exceeds 0.3 mg/l. Specific conductance data for water from the Coker Formation indicate that the dissolved-solids content in most of the county is less than 300 mg/l. However, data from wells in adjacent counties (Newton, ~~personal~~ oral communication, June 1969) indicate that south of Uniontown water in the Coker Formation may have a dissolved-solids content in excess of 1,000 mg/l.

Water from the Gordo Formation ranges from soft to moderately hard but generally is soft. The iron content exceeds 0.3 mg/l in the northern half of the county but generally is less than 0.3 mg/l in the southern half. Data from wells in adjacent areas indicate that south of Uniontown, the dissolved-solids content of water from the Gordo Formation may exceed 1,000 mg/l.

Water from the Eutaw Formation generally is soft and has an iron content less than 0.3 mg/l in all parts of the county except in an area approximately 10 miles wide extending from the west-central to the south-central parts of the county (fig. 6).

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The fluoride content of water from well W-1 in the southwest part of the county is 2.0 mg/l (table 3), which indicates that south of Uniontown water from the Eutaw Formation may contain objectionable amounts of fluoride.

Water from the low terrace deposits and alluvium is soft and generally contains less than 0.3 mg/l iron. Water from the high terrace deposits probably is similar to water in the low terrace deposits and alluvium, except that the iron content may exceed 0.3 mg/l. Chemical analyses of water from wells and one spring are given in table 3.

Figure 6. --Distribution of hardness and iron content of water from the Eutaw Formation in Perry County.

## Surface Water

Dissolved minerals in surface water result from the solvent action of water on soil and rock and the activities of man that add minerals to the water. The concentration of dissolved solids in surface water tends to be the lowest during periods of high flow and the highest during periods of low flow. Overland flow generally contains less dissolved minerals than water discharged to the streams from ground-water reservoirs owing to the difference in time of contact with rocks and soils.

Specific conductance data indicate that the water in streams in Perry County has a low dissolved-solids content. The water is soft, except for that of the Cahaba River, which ranges from soft during periods of high flow to moderately hard during periods of low flow. The headwaters of the Cahaba drain areas north of Perry County that have significantly different geologic characteristics than the areas drained by other streams in the county. The results of chemical analyses made since October 1967 are tabulated in table 4 and the locations of sampling sites are shown on figure 2. Chemical-quality data obtained earlier at these sites and others are contained in several reports listed in the selected references.

## WATER USE

The average daily use of water in Perry County in 1968 was estimated to be 3,847,000 gallons. A summary of the ground-water and surface-water use is given below:

| Use | Ground water (gallons per day) | Surface water (gallons per day) |
|---|---|---|
| Rural | | |
| Domestic | 467,000 | |
| Schools | 26,000 | |
| Livestock | 358,000 | 238,000 |
| Municipal | 425,000 | |
| Industrial | 330,000 | |
| U.S. Fish Hatchery | 2,000,000 | |
| Total | 3,609,000 | 238,000 |

Flowing wells discharged about 1.6 million gallons of water daily in 1968. Most of this water was not used. The amount of water used in 1968 was less than 1 percent of the total amount available; thus, the potential for development is very large.

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