

STATE OF ARKANSAS

ARKANSAS GEOLOGICAL COMMISSION

Norman F. Williams, Director

ARKANSAS SOIL AND WATER CONSERVATION COMMISSION

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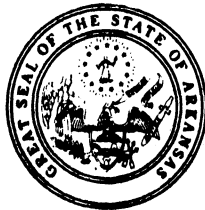
WATER RESOURCES SUMMARY NUMBER 16

USE OF WATER IN ARKANSAS, 1985

By

Terrance W. Holland

U. S. Geological Survey



**Prepared by the U. S. Geological Survey in cooperation
with the Arkansas Soil and Water Conservation Commission
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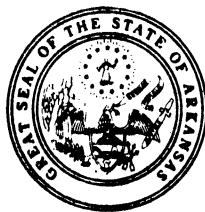
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Water use in Arkansas, 1985, was funded in part with a grant from the Water Development Fund, prepared under the USGS Cooperative Program with the ASWCC and published by the AGC under the Water Resources Summary Series.

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CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, rather than the inch-pound units used in this report, the following conversion factors may be used:

<u>Multiply inch-pound unit</u>	<u>By</u>	<u>To obtain metric unit</u>
acre	4047	square meter (m ²)
acre	0.4047	square hectometer (hm ²)
acre-foot (acre-ft)	1233	cubic meter (m ³)
acre-foot (acre-ft)	1.233 x 10 ⁻³	cubic hectometer (hm ³)
foot (ft)	0.3048	meter (m)
gallon (gal)	3.785 x 10 ⁻³	cubic meter (m ³)
gallon per day (gal/d)	3.785 x 10 ⁻³	cubic meter per day (m ³ /d)
inch (in.)	25.4	millimeter (mm)
million gallon per day (Mgal/d)	3785	cubic meter per day (m ³ /d)
million gallon per day (Mgal/d)	3.785 x 10 ⁻³	cubic hectometer per day (hm ³ /d)

USE OF WATER IN ARKANSAS, 1985

By Terrance W. Holland

ABSTRACT

This report summarizes the results of the 1985 Arkansas water-use inventory. The water-use categories considered and the total quantity of water used in each category are public supply, 261 million gallons per day (Mgal/d); industrial (self-supplied), 172 Mgal/d; domestic (self-supplied), 60.4 Mgal/d; agriculture (irrigation), 3,870 Mgal/d; agriculture (non-irrigation), 384 Mgal/d; mining, 3.28 Mgal/d; commercial, 7.97 Mgal/d; electric-energy generation, 61,000 Mgal/d. These data are tabulated by county, by hydrologic unit, and by source.

Water withdrawals during 1985 were approximately 65,800 Mgal/d, of which ground-water sources provided 3,810 Mgal/d and surface-water sources supplied 62,000 Mgal/d. The largest use of water was for electric-energy generation, which accounted for 93 percent of the total withdrawals. Excluding hydroelectric diversions, 1985 surface-water use was 2,050 Mgal/d, and 1985 ground-water use was 3,810 Mgal/d. Five percent (3,210 Mgal/d) of the total withdrawals was consumed.

INTRODUCTION

Water is one of Arkansas' most valuable natural resources. Much of the State's agriculture and industry is dependent upon having an adequate supply of good-quality water. A periodic inventory of the ground- and surface-water withdrawals in Arkansas is done by the Arkansas Soil and Water Conservation Commission in cooperation with the U.S. Geological Survey.

Data collected during the inventory are shared by State and Federal agencies to document the State's total water use and to facilitate planning the most effective use of Arkansas' water resources for the economic and social well-being of the people of Arkansas and the Nation.

Site-specific water-use data collected during the inventory are available from the U.S. Geological Survey's "New Site Specific Water Use Data System" (NEWSWUDS). Water-use data aggregated by county and hydrologic units are stored in the Survey's "Estimated Use of Water in the United States" (EUOWITUS) data for Arkansas.

Data for this report were provided by many public agencies, industries, public utilities, other organizations, and individuals. Principal contributors include the Arkansas Soil and Water Conservation Commission; Arkansas Geological Commission; Arkansas Department of Health; Arkansas Department of Pollution Control and Ecology; the Cooperative Extension Service, College of Agriculture, University of Arkansas; the Agricultural Stabilization and Conservation Service, Soil Conservation Service, Statistical Reporting Service, and other bureaus of the U.S. Department of Agriculture; the Bureau of Mines, and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior; U.S. Army Corps of Engineers; Arkansas Game and Fish Commission; Arkansas Power and Light Company; Arkansas Department of Parks and Tourism; Arkansas State Highway and Transportation Department; Westinghouse Hanford Company; and the U.S. Department of Energy.

Previous Studies

The first detailed estimates of ground-water use in the United States were made in 1945 (Guyton, 1950). Mackichan (1951) developed estimates of State totals for rural, municipal, industrial, and irrigation uses for both ground- and surface-water sources. Formal publication of detailed water-use information for Arkansas began with the 1960 water-use inventory (Stephens and Halberg, 1961). Subsequent water-use reports for 1965, 1970, 1975, 1980, 1981, and 1982 are available (Halberg and Stephens, 1966; Halberg, 1972; Halberg, 1977; Holland and Ludwig, 1981; Hall and Holland, 1984; and Holland and Hall, 1986).

Present Study

This report presents the results of the 1985 Arkansas water-use inventory. It summarizes water withdrawals by major-use categories from ground-water and surface-water sources in Arkansas during 1985 and compares selected data from previous inventories with the 1985 data.

Information on the quantity of water withdrawn for use in Arkansas was obtained from many sources during the inventory. These data are presented by the following categories: public supply, commercial, mining, industrial (self-supplied), domestic (self-supplied), agricultural (non-irrigation), agriculture (irrigation), and thermoelectric and hydroelectric energy. Water-use data in this report are then further categorized by county and hydrologic unit. Information concerning non-withdrawal uses, such as wildlife impoundments, navigation and water-based recreation, was not collected. Water-use and consumptive use data are tabulated under the county and hydrologic unit where the water is used, not under the location of the source.

TERMINOLOGY

Water use, or pumpage, as used in this report, is water withdrawn or diverted from a source for use. The principal requisite for withdrawal use is that water must be taken from a ground-water or surface-water source and conveyed to the place of use. Water used more than once by recycling, such as in enclosed steam-electric generation systems, is tallied only when it is withdrawn from the source. If the water is returned to a lake, stream, or aquifer and then withdrawn again, it is tallied each time it is withdrawn.

Public supplies are defined as systems or wells that furnish water for drinking or general domestic use in incorporated municipalities or unincorporated communities consisting of 10 or more connections or of 25 or more people for a period of 60 days or more each year. Public water supplies also serve commercial or industrial users. Individual families and small communities not served by a public water-supply system are categorized as domestic self-supplied water users.

Industrial establishments using their own water-source facilities are categorized as self-supplied industrial. The industries that make up the majority of this category include the primary metals industry, chemical and allied products industry, paper and allied products industry, and the petroleum and coal products industry.

Commercial establishments using their own water-source facilities are categorized as self-supplied commercial. The facilities in this category include hotels, motels, restaurants, banks, office buildings, government and military facilities, gas stations, and retail sales stores.

Mining-water use includes water used for the extraction of minerals, i.e. naturally occurring solids, such as coal and ores; liquids, such as crude petroleum; and gases, such as natural gas. This category also includes quarrying, well operations (de-watering), milling (crushing, screening, washing, floatation, etc.) and other preparations customarily done at a mine site, or as part of a mining activity.

Agriculture (non-irrigation) water use includes water used for stock watering, feed lots, daily operations, fish farming, and other on-farm needs.

Water used to generate hydroelectric power or for cooling purposes in thermoelectric generation is also included as withdrawal use in the report because of its diversion through power plants.

Non-withdrawal uses encompass all uses taking place within the river channel itself, such as navigation and recreation, and are not included in this report.

Part of the water withdrawn is consumed. In this report "consumptive use" is defined as water that is evaporated or transpired, incorporated into a product, or is ingested by humans or animals. It is not returned to a source and is not available for reuse.

The only saline water used in Arkansas at the present time (1985) is associated with the bromine and petroleum industries in southern Arkansas. Brines containing recoverable amounts of bromine are withdrawn from deep wells for processing. Brines are also used for developing oil wells. Saline-water use in Arkansas is not tabulated in this report.

"Hydrologic Unit" refers to one of nine Hydrologic Accounting Units of the U.S. Geological Survey's Hydrologic Unit map of 1974 for Arkansas (U.S. Geological Survey, 1977) (fig. 6). This map delineates the boundaries of major river basins in the United States to help standardize the collection and dissemination of water data. Each hydrologic unit is identified by a unique four-digit code number.

Water-use data are reported herein as the average daily use, which generally is derived from the annual use. For example, irrigation water is applied only during the growing season; but it is tabulated as though the water were applied at a constant rate throughout the year.

The majority of the data in table 2 are site specific. Therefore, totals for table 2 are displayed to the hundredths position in order to show the data as they are reported and stored.

Totals in most other tables are rounded to three significant figures. This is to compensate for different levels of accuracy associated with the individual values used to calculate the totals.

This precision was used only in order to facilitate tabulation. Slight discrepancies occur in some of the summary tables as a result of the rounding process.

WATER USE AND CONSUMPTION

Arkansas used an average of 65,800 Mgal/d of fresh ground and surface water in 1985. Ninety-three percent (61,000 Mgal/d) was used for thermo-electric- and hydroelectric-energy generation (table 1). For all uses other than power generation, Arkansas used 4,760 Mgal/d of ground and surface water. Seventy-nine percent, or 3,810 Mgal/d, was withdrawn from ground-water sources and the rest (951 Mgal/d) was supplied by surface water (table 1). The amount of water used for each of the principal-use categories is shown in figure 1. County totals of ground- and surface-water use, including electric-energy generation, are shown in figure 2.

More water was used in Pope County (1,020 Mgal/d) than in any other county (table 2). However, practically all of this water was used for thermoelectric-power generation. The smallest quantity of water (0.66 Mgal/d) was used in Calhoun County. Exclusive of the counties in which large surface-water diversions are used for electric-power generation, the largest amount of water (378 Mgal/d) was used in Arkansas County, primarily for irrigation.

Consumptive use averaged 3,200 Mgal/d of ground and surface water in Arkansas in 1985 (table 1). Seventy-nine percent of the consumed water was withdrawn from ground-water sources.

Water-use data also are available for years between 1980 and 1985. Water-use data by category for the years 1980-84, are shown in table 3.

Table 1.--Use and consumption of water in Arkansas, 1985

[In million gallons per day]

Use category	Ground water	Surface water	Total
Public supply-----	104	156	260
Industrial (self-supplied) -----	64	108	172
Domestic-----	60.4	0	60.4
Commercial-----	6.03	1.94	7.97
Agriculture (irrigation)-----	3,330	541	3,870
Agriculture (non-irrigation)-----	242	142	384
Mining-----	1.03	2.25	3.28
Subtotal-----	3,810	951	4,760
Electric energy:			
Thermoelectric-----	1.09	1,090	1,090
Hydroelectric-----	0	59,900	59,900
Subtotal-----	1.09	61,000	61,000
Total-----	3,810	62,000	65,800
Consumption			
All categories-----	2,530	672	3,200

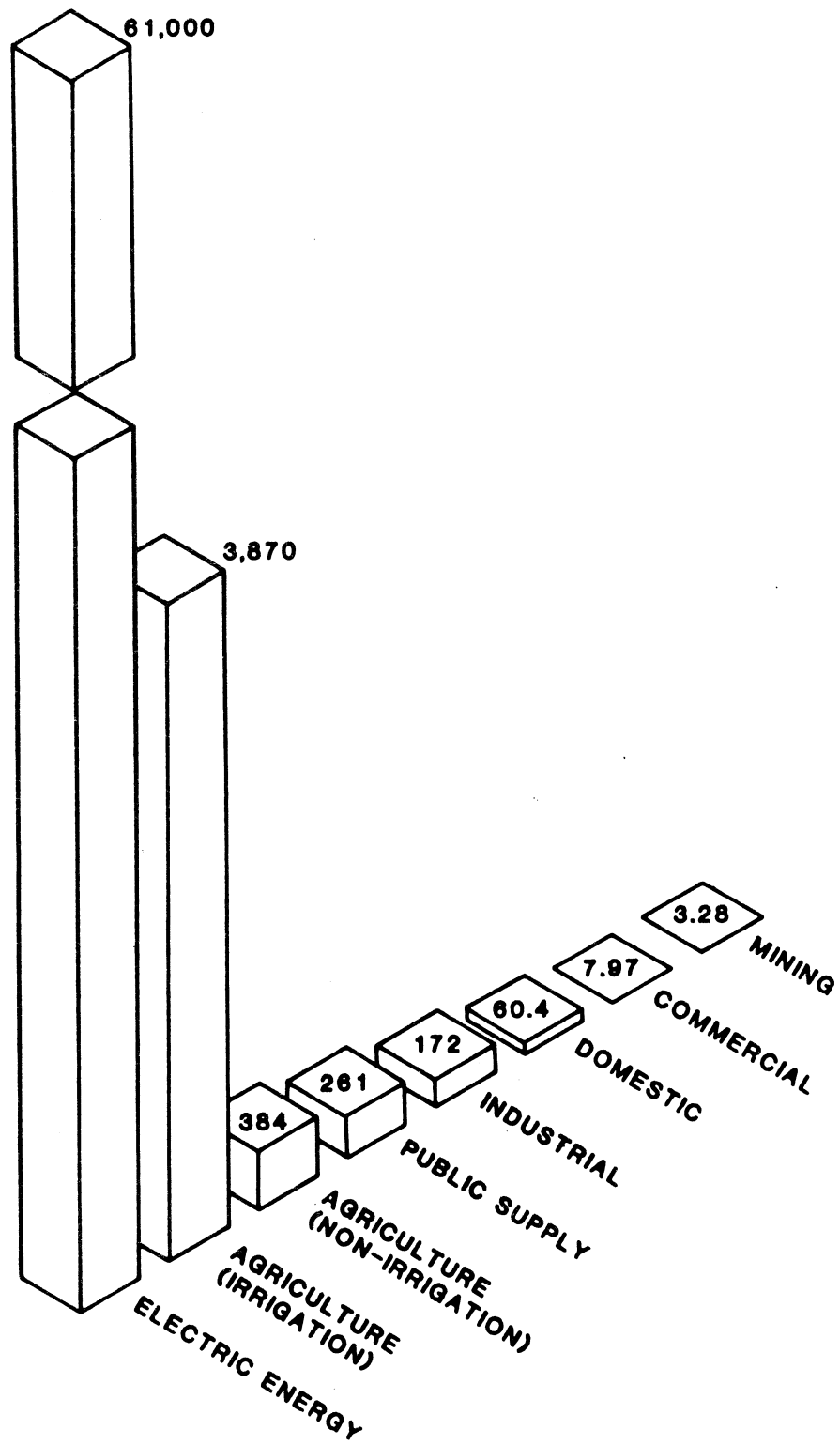


Figure 1.--Water used in Arkansas, 1985 (in million gallons per day).

Table 2.--Use of water

[In million gallons per day; does not include

County	Public Supply		Domestic		Commercial		Industrial		Mining	
	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water
ARKANSAS	3.49	---	0.29	---	0.05	---	0.02	---	---	---
ASHLEY	2.09	---	.69	---	---	---	9.96	34.52	---	---
BAXTER	.46	1.94	1.32	---	.31	---	.08	---	---	---
BENTON	.43	9.16	2.79	---	.45	---	.08	---	0.01	---
BOONE	1.22	.03	1.13	---	---	---	---	---	---	---
BRADLEY	.99	---	.17	---	.01	---	.44	---	---	---
CALHOUN	.28	---	.24	---	---	---	.01	---	---	---
CARROLL	1.75	.92	.75	---	---	---	---	---	---	---
CHICOT	1.68	---	.44	---	---	---	.02	---	---	---
CLARK	.42	2.06	.47	---	.01	0.16	.05	1.18	.01	---
CLAY	1.09	---	.73	---	---	---	---	---	---	---
CLEBURNE	.13	1.83	.14	---	.43	---	.01	---	---	---
CLEVELAND	.43	---	.47	---	---	---	---	---	---	---
COLUMBIA	3.00	---	.83	---	.10	---	3.17	---	---	---
CONWAY	1.12	---	.71	---	.05	.18	.01	5.87	---	---
CRAIGHEAD	6.90	---	.25	---	---	---	---	---	---	---
CRAWFORD	---	5.40	1.44	---	---	---	.03	---	---	0.03
CRITTENDEN	6.03	---	.77	---	---	---	---	---	.02	---
CROSS	2.02	---	.49	---	---	---	.25	---	---	---
DALLAS	.85	---	.34	---	---	---	.13	---	---	---
DESHA	4.22	---	.43	---	---	---	1.98	13.55	.03	---
DREW	2.79	---	.40	---	---	---	---	---	---	---
FAULKNER	.82	3.52	2.21	---	---	---	---	---	.05	---
FRANKLIN	---	2.41	.66	---	.11	.03	.06	---	.05	---
FULTON	.34	---	.52	---	---	---	---	---	---	---
GARLAND	.13	8.99	1.52	---	.40	---	.40	2.58	.01	---
GRANT	1.04	.04	.28	---	---	---	.07	---	---	---
GREENE	2.33	---	1.08	---	.12	---	.01	---	---	---
HEMPSTEAD	1.91	---	1.08	---	---	---	---	---	.02	---
HOT SPRING	.09	1.97	.85	---	.18	.24	.02	1.30	.01	.01
HOWARD	.14	1.70	.59	---	---	---	---	---	.46	.28
INDEPENDENCE	1.13	2.89	1.13	---	---	---	.02	---	.02	.01
IZARD	.86	---	.43	---	---	---	.01	---	.01	.11
JACKSON	1.66	---	.33	---	---	---	.74	---	---	---
JEFFERSON	10.97	---	.43	---	.89	---	30.09	---	---	---
JOHNSON	---	2.11	.99	---	---	---	.05	---	.05	---
LAFAYETTE	.96	---	.34	---	---	---	.14	---	---	---
LAWRENCE	1.43	.05	.67	---	---	---	.01	---	---	.04
LEE	1.31	---	.41	---	---	---	---	---	---	---
LINCOLN	.85	---	.15	---	.33	---	---	---	---	---
LITTLE RIVER	.97	---	.73	---	.20	.21	.27	39.53	.25	.63
LOGAN	.09	1.37	.97	---	.03	---	.03	.01	---	---
LONOKE	2.34	---	1.72	---	.01	---	1.08	---	---	---
MADISON	.02	1.37	.85	---	.15	---	.01	---	---	---
MARION	.50	---	.65	---	.32	---	---	---	---	---
MILLER	.21	2.59	1.05	---	---	---	.16	---	.02	---
MISSISSIPPI	5.05	---	.66	---	.65	---	1.73	---	---	---
MONROE	1.41	---	.18	---	---	---	---	---	---	---
MONTGOMERY	---	.44	.57	---	.20	---	.01	.01	---	.01
NEVADA	.56	---	.55	---	.02	---	.03	---	---	---
NEWTON	.09	---	.64	---	---	---	.12	---	---	---
OUACHITA	.91	2.42	.30	---	---	---	2.26	8.69	---	---
PERRY	.10	.19	.46	---	.15	---	---	---	---	---
PHILLIPS	3.27	---	.44	---	---	---	2.36	---	---	---
PIKE	.06	.51	.56	---	.18	---	---	---	---	---
POINSETT	2.53	---	.21	---	.02	---	.14	---	---	---
POLK	.20	.67	.94	---	.08	---	.01	---	---	---
POPE	---	4.92	1.84	---	.16	---	.04	---	.01	---
PRAIRIE	.80	---	.09	---	---	---	---	---	---	---
PULASKI	1.81	47.57	4.67	---	.11	1.12	.52	---	---	.14
RANDOLPH	.21	.82	.71	---	.03	---	.01	---	---	---
ST. FRANCIS	3.04	---	.51	---	---	---	.01	---	---	.99
SALINE	1.43	3.88	1.99	---	---	---	---	---	.01	---
SCOTT	---	.77	.68	---	---	---	.01	---	---	---
SEARCY	.24	---	.59	---	---	---	.01	---	---	---
SEBASTIAN	.13	21.28	1.10	---	---	---	.04	---	.03	---
SEVIER	.18	1.06	.66	---	---	---	.05	.05	---	---
SHARP	1.30	.12	.47	---	---	---	---	---	---	---
STONE	.02	.44	.61	---	---	---	.01	---	---	---
UNION	7.45	---	.38	---	---	---	6.02	.39	---	---
VAN BUREN	.04	.76	.64	---	---	---	---	---	---	---
WASHINGTON	.02	15.38	2.67	---	.08	---	.07	---	---	---
WHITE	.49	4.12	1.35	---	---	---	.01	---	.01	---
WOODRUFF	.73	---	.27	---	---	---	---	---	---	---
YELL	.93	.76	.75	---	.20	---	1.14	.27	---	---
Total	104.49	156.46	60.42	---	6.03	1.94	64.01	107.95	1.03	2.25

In Arkansas counties
water-use for hydroelectric power generation]

Agriculture (non-irrigated)		Agriculture (irrigated)		Thermoelectric Energy		County Totals			County
Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Ground Water	Surface Water	Total	
3.67	13.57	214.23	143.04	---	---	221.75	156.61	378.36	ARKANSAS
5.27	3.46	60.61	3.62	---	---	78.62	41.60	120.22	ASHLEY
.14	3.63	---	---	---	---	2.31	5.57	7.88	BAXTER
3.00	3.07	---	.79	---	1.31	6.76	14.33	21.09	BENTON
.31	.87	---	.08	---	---	2.66	.98	3.64	BOONE
.28	1.49	.28	1.21	---	---	2.17	2.70	4.87	BRADLEY
.02	.08	---	.03	---	---	.55	.11	.66	CALHOUN
.32	2.08	---	.06	---	---	2.82	3.06	5.88	CARROLL
3.59	2.37	72.05	69.18	---	---	77.78	71.55	149.33	CHICOT
1.15	.47	1.01	3.98	---	---	3.12	7.85	10.97	CLARK
1.18	.15	174.37	12.27	---	---	177.37	12.42	189.79	CLAY
.52	12.16	---	.02	---	---	1.23	14.01	15.24	CLEBURNE
.19	.44	---	.22	---	---	1.09	.66	1.75	CLEVELAND
1.14	.74	.06	.06	---	---	8.30	.80	9.10	COLUMBIA
.59	1.41	1.84	.54	---	---	4.32	8.00	12.32	CONWAY
.21	.40	196.46	13.31	---	---	203.82	13.71	217.53	CRAIGHEAD
.46	1.13	3.68	1.13	---	---	5.61	7.69	13.30	CRAWFORD
3.38	.77	110.20	---	---	---	120.40	.77	121.17	CRITTENDEN
2.89	1.40	255.25	---	---	---	260.90	1.40	262.30	CROSS
.14	.08	---	.19	---	---	1.46	.27	1.73	DALLAS
21.62	1.87	106.45	36.49	---	---	134.73	51.91	186.64	DESHA
1.00	.79	40.13	8.72	---	---	44.32	9.51	53.83	DREW
.38	1.34	.29	8.22	---	---	3.70	13.08	16.78	FAULKNER
.54	.90	.32	.28	---	.99	1.74	4.61	6.35	FRANKLIN
.08	1.21	---	.05	---	---	.94	1.26	2.20	FULTON
.08	.93	---	.01	---	32.64	2.54	45.15	47.69	GARLAND
.23	.39	---	.03	---	---	1.62	.46	2.08	GRANT
7.67	.87	124.25	7.01	---	---	135.46	7.88	143.34	GREENE
.76	1.66	1.05	.72	---	---	4.82	2.38	7.20	HEMPSTEAD
.11	2.10	.34	1.94	---	---	1.60	7.56	9.16	HOT SPRING
.89	2.13	---	.02	---	---	2.08	4.13	6.21	HOWARD
.39	1.07	31.65	.05	---	17.32	34.34	21.34	55.68	INDEPENDENCE
.15	.61	.03	.03	---	---	1.49	.75	2.24	IZARD
2.80	.80	197.66	4.44	---	---	203.19	5.24	208.43	JACKSON
6.33	2.16	123.56	14.58	---	13.64	172.27	30.38	202.65	JEFFERSON
.44	1.54	2.43	.57	---	---	3.96	4.22	8.18	JOHNSON
.92	1.27	14.67	2.03	1.06	---	18.09	3.30	21.39	LAFAYETTE
1.10	.42	150.34	---	---	---	153.55	.51	154.06	LAWRENCE
.30	2.46	96.33	---	---	---	98.35	2.46	100.81	LEE
1.19	2.78	84.62	18.77	---	---	87.14	21.55	108.69	LINCOLN
.23	.56	1.04	2.39	---	---	3.69	43.32	47.01	LITTLE RIVER
.63	.94	1.51	---	---	---	3.26	2.32	5.58	LOGAN
92.36	2.12	201.36	36.64	---	---	298.87	38.76	337.63	LONOKE
.46	2.74	---	.10	---	---	1.49	4.21	5.70	MADISON
3.28	.38	---	---	---	---	4.75	.38	5.13	MARION
.88	.89	17.76	3.75	---	---	20.08	7.23	27.31	MILLER
2.05	.01	48.28	29.53	---	---	58.42	29.54	87.96	MISSISSIPPI
8.75	.68	114.40	12.83	---	---	124.74	13.51	138.25	MONROE
.34	.62	---	.04	---	---	1.12	1.12	2.24	MONTGOMERY
.34	.50	.49	.18	---	---	1.99	.68	2.67	NEVADA
.04	.20	---	.03	---	---	.89	.23	1.12	NEWTON
.13	.22	.22	.09	---	1.90	3.82	13.32	17.14	OUACHITA
.27	.64	---	3.65	---	---	.98	4.48	5.46	PERRY
.07	.12	71.63	.47	---	21.96	77.77	22.55	100.32	PHILLIPS
.51	.77	.98	---	---	---	2.29	1.28	3.57	PIKE
2.69	3.68	296.76	---	---	---	302.35	3.68	306.03	POINSETT
.88	1.57	---	.03	---	---	2.11	2.27	4.38	POLK
.80	1.31	3.88	---	1,002.93	---	6.73	1,009.16	1,015.89	POPE
41.99	22.16	147.17	40.49	---	---	190.05	62.65	252.70	PRAIRIE
1.11	1.70	22.19	3.02	.03	---	30.44	53.55	83.99	PULASKI
.43	.68	41.08	2.33	---	---	42.47	3.83	46.30	RANDOLPH
.34	1.63	106.97	7.59	---	---	110.87	10.21	121.08	ST. FRANCIS
.16	.35	.04	.07	---	---	3.63	4.30	7.93	SALINE
.54	.86	---	.01	---	---	1.23	1.64	2.87	SCOTT
.08	.44	---	.02	---	---	.92	.46	1.38	SEARCY
.27	1.27	1.03	.06	---	---	2.60	22.61	25.21	SEBASTIAN
.66	1.00	---	.10	---	---	1.55	2.21	3.76	SEVIER
.08	.93	.04	.01	---	---	1.89	1.06	2.95	SHARP
.20	1.05	---	---	---	---	.84	1.49	2.33	STONE
.46	.59	---	.12	---	---	14.31	1.10	15.41	UNION
.13	.87	.02	.06	---	---	.83	1.69	2.52	VAN BUREN
2.83	3.98	---	.54	---	---	5.67	19.90	25.57	WASHINGTON
1.19	4.09	47.43	39.98	---	---	50.48	48.19	98.67	WHITE
.50	3.86	140.68	---	---	.89	142.18	4.75	146.93	WOODRUFF
.84	1.69	3.62	3.52	---	---	7.48	6.24	13.72	YELL
241.95	142.17	3,332.74	541.34	1.09	1,090	3,811.76	2,045.69	5,857.45	Total

Table 3.--Arkansas water-use totals for calendar years
1980 through 1984

[In million gallons per day]

Year	Ground-water use	Surface-water use	Total use
PUBLIC SUPPLY			
1980	109.96	152.85	262.81
1981	104.00	142.00	246.00
1982	99.10	147.00	246.10
1983	100.58	158.37	258.95
1984	102.23	158.82	261.05
INDUSTRIAL			
1980	90.04	146.07	236.11
1981	92.00	145.00	237.00
1982	83.00	109.00	192.00
1983	78.82	119.83	198.65
1984	78.27	122.33	200.60
RURAL DOMESTIC AND LIVESTOCK			
1980	78.75	39.38	117.95
1981	78.00	42.00	120.00
1982	77.00	39.80	116.80
1983	56.29	40.65	96.94
1984	58.80	40.36	99.16
POWER-FUEL-ELECTRIC			
1980	3.07	901.93	908.00
1981	2.37	660.00	662.37
1982	5.24	490.27	495.51
1983	3.12	582.00	585.12
1984	3.12	513.51	516.63
POWER-NUCLEAR			
1980	---	877.32	877.32
1981	---	964.00	964.00
1982	---	939.73	939.73
1983	---	1,076.04	1,076.04
1984	---	1,076.04	1,076.04

**Table 3.--Arkansas water-use totals for calendar years
1980 through 1984--Continued**

Year	Ground-water use	Surface-water use	Total use
POWER-HYDRO-ELECTRIC			
1980	---	25,783.00	25,783.00
1981	---	17,400.00	17,400.00
1982	---	25,700.00	25,700.00
1983	---	45,586.53	45,586.53
1984	---	45,279.59	45,279.59
IRRIGATION			
1980	3,484.49	597.72	4,082.21
1981	3,760.00	618.00	4,378.00
1982	3,390.00	549.00	3,940.00
1983	2,942.82	476.80	3,419.62
1984	3,363.29	562.13	3,925.42
FISH FARMING			
1980	284.98	130.14	415.12
1981	232.92	119.51	352.43
1982	237.51	120.12	357.63
1983	210.27	120.06	330.33
1984	212.07	90.32	302.39
STATE TOTALS (Excluding hydroelectric power)			
1980	4,051.11	2,845.41	6,896.52
1981	4,269.29	2,690.51	6,959.80
1982	3,891.85	2,394.92	6,286.77
1983	3,317.57	2,667.39	5,984.96
1984	3,752.62	2,654.89	6,407.51

Water use is tabulated by county, category of use, and source in table 2. Figures 3, 4, and 5 show distribution of ground- and surface-water withdrawals by county. Water use is also tabulated by hydrologic unit (table 4). A generalized delineation of hydrologic unit boundaries for the State is shown in figure 6.

Public Supply

The total amount of water withdrawn in 1985 for public supply systems (fig. 7) was 260 Mgal/d (table 2). Surface water furnished 156 Mgal/d, whereas ground water supplied 104 Mgal/d. The water was distributed to about 1,680,000 people from 749 water systems. Of the 260 Mgal/d used for public supplies, 89 Mgal/d was used for commercial and industrial purposes. Water-use information for public-supply systems was obtained primarily from a questionnaire, distributed by the Arkansas Soil and Water Conservation Commission. Pumpage figures for some of the smaller systems were compiled from the Arkansas Soil and Water Conservation Commission's records or were estimated based on a per-capita-use rate for the population served. Per-capita-use factors were developed from an analysis of use in 20 community water systems which were known to include only residential users. A per-capita-use factor of 109 gallons per person per day was obtained from this analysis and was used to compute municipal use for towns where production figures were not available. This was the average amount of water produced by a water system for each person served. It was estimated that 15 percent of this amount was lost through leakage or was used for backflushing lines.

Consumptive use figures were computed from information supplied by the municipalities or were estimated to be 20 percent of withdrawals if no consumption figures were available. Consumptive use was assumed to be 100 percent of withdrawals for those communities that have no sewage systems. Information on communities having sewage systems was obtained from the Arkansas Department of Pollution Control and Ecology.

Commercial

Water withdrawals for commercial (self-supplied) use in Arkansas (fig. 8) for 1985 amounted to 7.97 Mgal/d. Ground water supplied 6.03 Mgal/d and surface water provided 1.94 Mgal/d. About 70 percent or 5.61 Mgal/d were consumed by commercial users in 1985.

Mining

The mining industry in Arkansas (fig. 9) withdrew a total of 3.28 Mgal/d. About 1.03 Mgal/d was withdrawn from ground water, and the remaining 2.25 Mgal/d was from surface water. Consumptive use in this category is considered to be 100 percent because the water is used for dust control and the washing of sand and gravels.

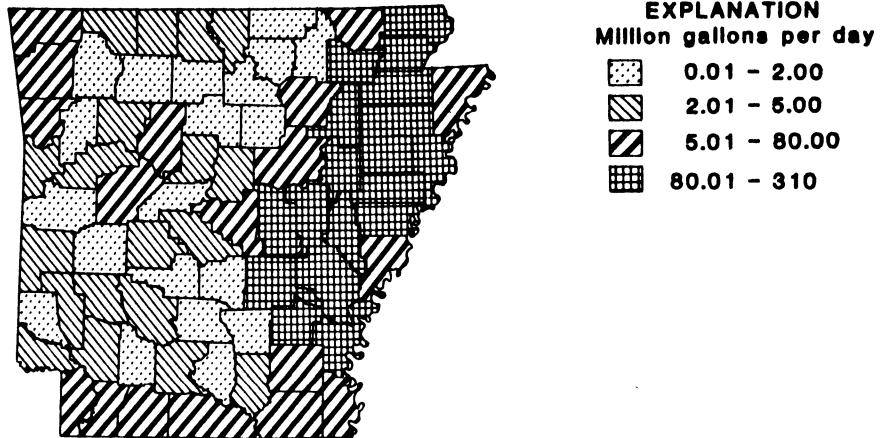


Figure 3.--Ground-water withdrawals in Arkansas counties, 1985.

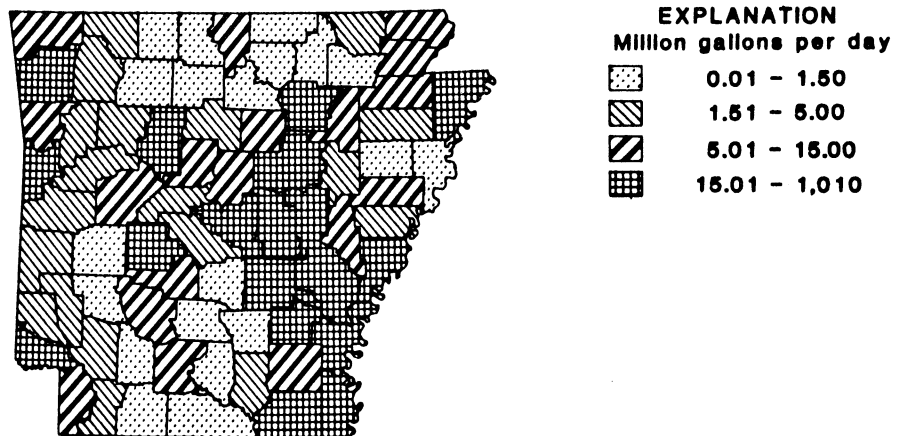


Figure 4.--Surface-water withdrawals in Arkansas counties, 1985.

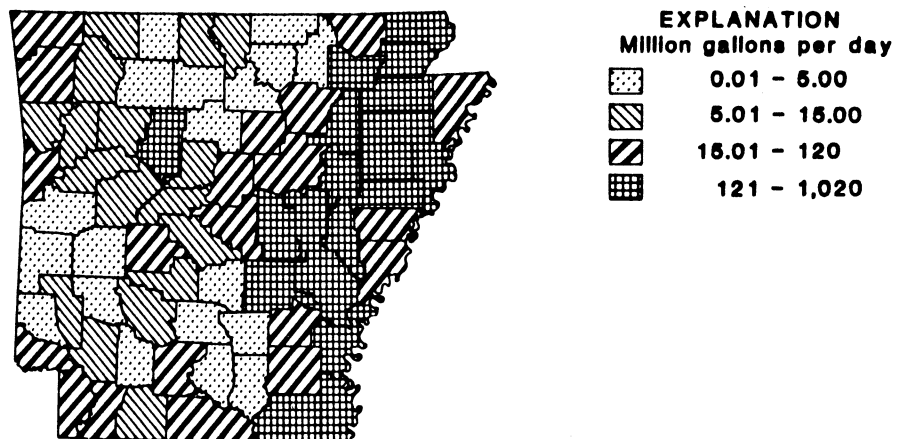


Figure 5.--Combined ground- and surface-water withdrawals for Arkansas, 1985.

Table 4.--Total offshore water use by hydrologic units, in Arkansas, 1985
 [In million gallons per day; numbers rounded to three significant figures]

Water Resources Council subregion	Use			Total consumption
	Ground water	Surface water	Total	
0801, Mississippi--- Hatchie	14.8	3.16	17.9	13.9
0802, Mississippi--- St. Francis	2,780	422	3,200	2,220
0803, Mississippi--- Yazoo.	24.1	13.5	37.6	27.5
0804, Ouachita-----	230	160	390	207
0805, Mississippi--- Tensas.	167	105	272	204
1101, White-----	434	96.4	530	359
1107, Verdigris----- Neosho	3.88	8.69	12.6	4.68
1111, Lower----- Arkansas	102	1,170	1,270	118
1114, Lower Red-----	58.9	64.8	124	52.5
State totals-----	3,810	2,050	5,860	3,210

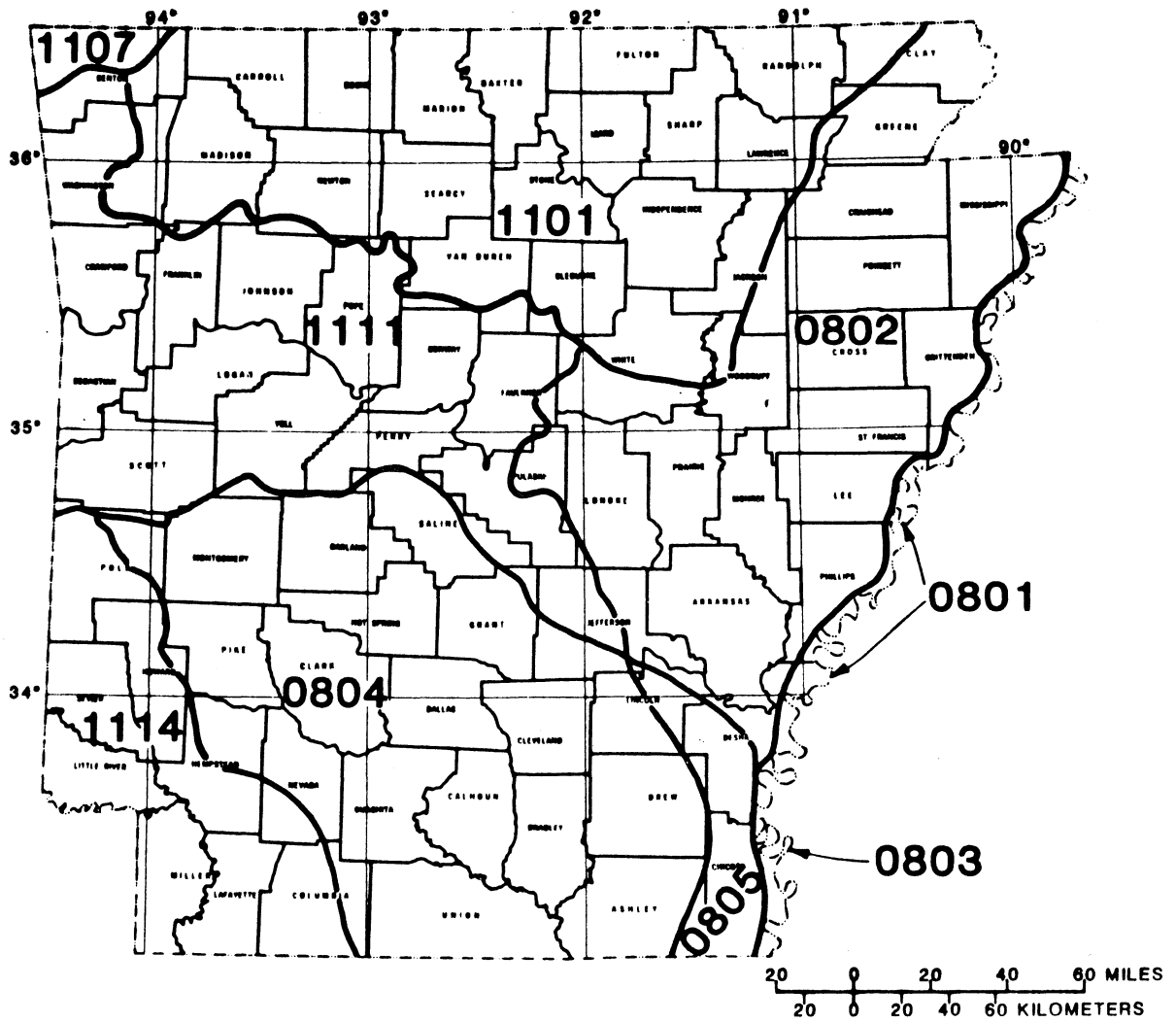


Figure 6.--Generalized hydrologic unit map. (Modified from U.S. Geological Survey, 1977).

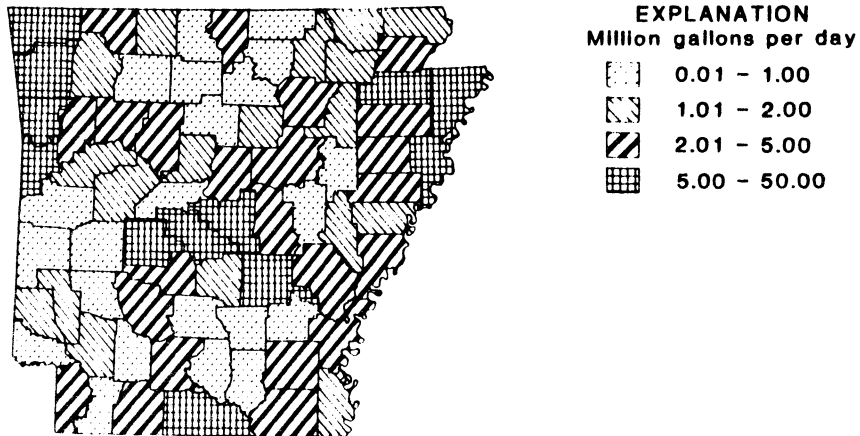


Figure 7.--Withdrawals for public suppliers in Arkansas, 1985.

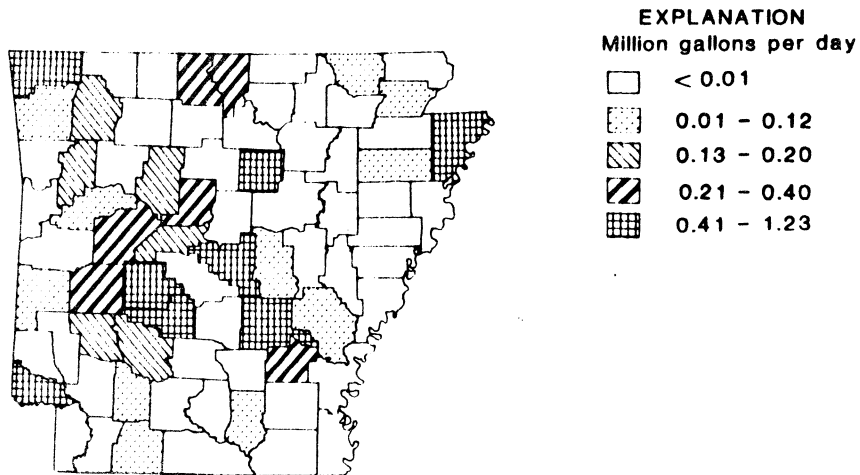


Figure 8.--Commercial water use in Arkansas counties, 1985.

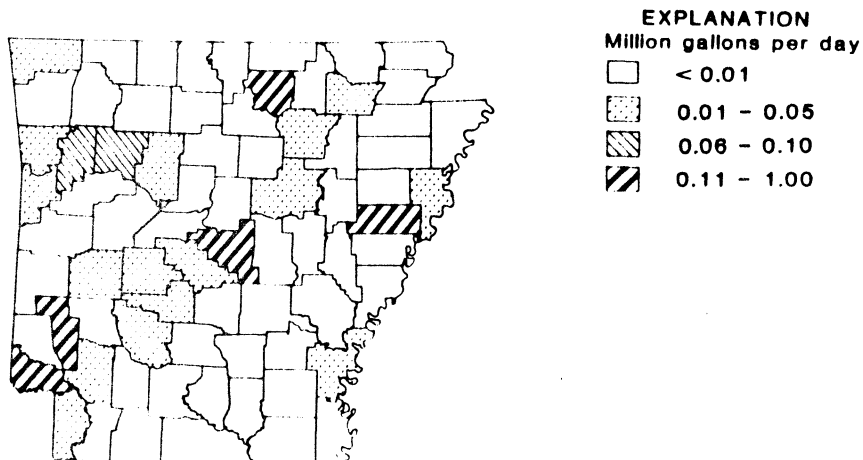


Figure 9.--Mining water use in Arkansas counties, 1985.

Industrial

Total industrial water withdrawals (fig. 10), including the amount furnished by public supply, were 172 Mgal/d in 1985. Ground water supplied 64 Mgal/d and surface-water sources provided 108 Mgal/d. The water was used by agricultural, chemical, metal, paper, petroleum, and other types of manufacturing.

Industrial self-supplied water withdrawals were obtained from a telephone and mail canvas of industries in the State (Harrington and Childers, 1985). More than 95 percent of these industries were accounted for either by questionnaire return, telephone contact, or staff knowledge.

Domestic

Domestic use in Arkansas for 1985 (fig. 11) was estimated to be 60.4 Mgal/d (table 2). About 678,000 people in the State furnish their own water supplies. The domestic use in each county was computed by multiplying the population not served by a public-supply system by a per-capita-use factor (89 gal/d per person). The per-capita-water use was derived by averaging the per-capita use in 20 rural water systems as described previously herein, but excluding the 15-percent transmission loss associated with municipal water systems. An estimated 95 percent of the rural residents in Arkansas have running water in their homes. A per-capita-use factor of 20 gal/d per person was applied to the remaining 5 percent of the rural residents.

All rural-domestic withdrawals were assumed to be obtained from ground-water sources.

Agriculture (Non-Irrigation)

Water withdrawals for non-irrigation agriculture in 1985 (fig. 12) were estimated to be 384 Mgal/d. About 242 Mgal/d (55 percent) of the water withdrawn was from ground water, the remaining 142 Mgal/d was from surface water.

Non-irrigation agricultural use consists primarily of the summation of two user groups. The first and foremost being fish and minnow farming. The second user group consists of the livestock industry.

Most of the fish and minnow farms are located in the Grand Prairie region, where the fish are raised in large levee ponds. In 1985, approximately 36,000 acres of ponds were used to raise catfish and minnows. About 32,000 acres of rough fish ponds and fishing lakes were used for commercial fish farming.

About 60 percent of the water used by livestock was withdrawn from wells. The remainder was from surface-water sources. County cattle and hog populations were provided by the U.S. Department of Agriculture Statistical Reporting Service (1985), and poultry populations were obtained from the Cooperative Extension Service. The water-use estimates for livestock are based on a fixed amount of water used per head, for each type of animal. Daily consumption rates (table 5) provided the basis for these calculations.

In this report, 100 percent of the water used by livestock is considered to be consumed.

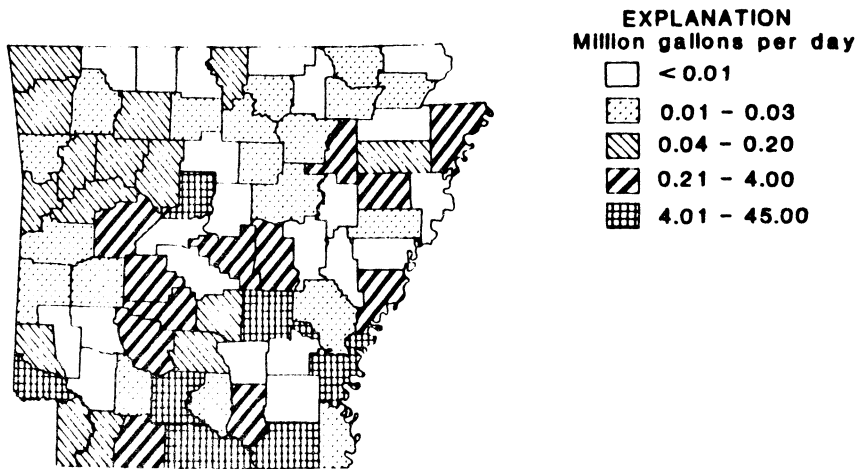


Figure 10.--Industrial water use in Arkansas counties, 1985.

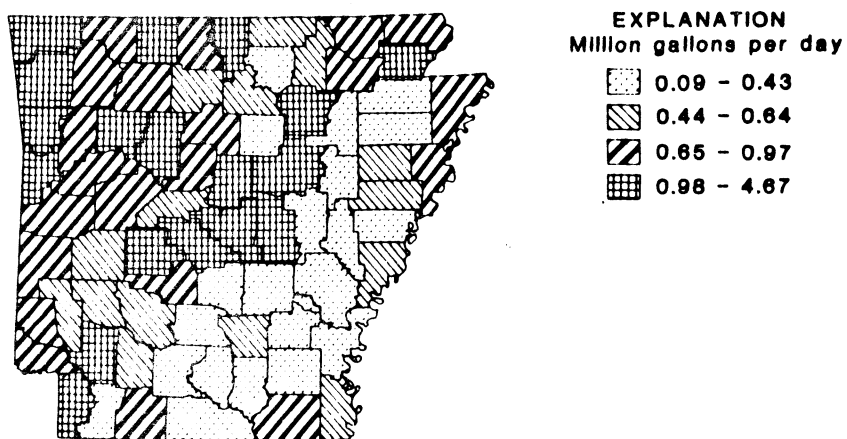


Figure 11.--Domestic water use in Arkansas counties, 1985.

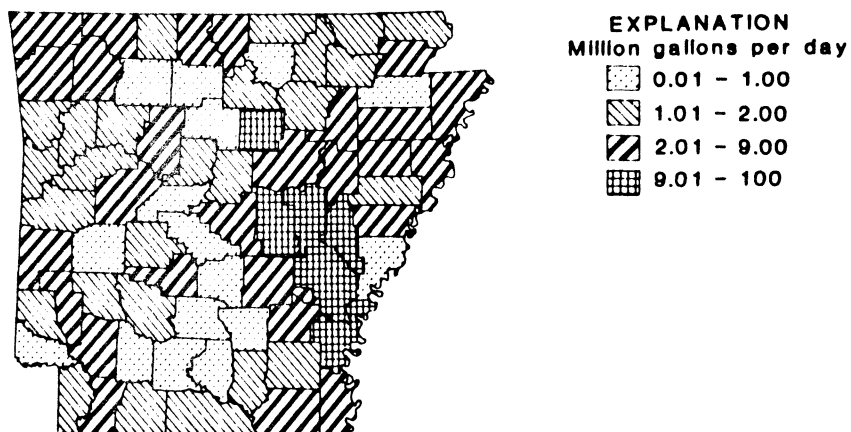


Figure 12.--Agriculture (non-irrigation) water use in Arkansas counties, 1985.

Table 5.--Estimated livestock water requirements used for calculation of water use

Livestock	Water use (gallons/day)
Milk cows-----	30
Cattle-----	15
Hogs-----	2
100 broilers-----	4
100 hens-----	6
100 turkeys-----	8

Agriculture (Irrigation)

Withdrawals for irrigation during 1985 (fig. 13) were estimated to be 3,870 Mgal/d annually (table 2). Of this amount, 86 percent (3,330 Mgal/d) was ground water and 14 percent (541 Mgal/d) was from surface-water sources. Most of the water was applied during May, June, and July, but it is tabulated as though the water was applied at a constant rate throughout the entire year.

A total of 2,790 Mgal/d of water was used for irrigation of 1,060,000 acres of rice in 1985. Estimates of water use were obtained by multiplying an application rate, in inches, by the number of acres of rice. Results of previous investigations have shown that the application rate for rice varies from place to place in the State and depends on soil types, water-management practices, and precipitation. Based on previous studies, the application rates used for different parts of the State are as follows: east of Crowley's Ridge, 39 inches; between White River and Bayou Meto (Grand Prairie), 34 inches; between Bayou Meto and the Arkansas River, 39 inches; south of the Arkansas River, 45 inches in the areas underlain by alluvial flood-plain deposits and 32 inches in areas underlain by terrace deposits; and 30 inches in all other areas.

Of the 1,080 Mgal/d of water used to irrigate crops other than rice, most of the water (1,060 Mgal/d) was used to irrigate soybeans and cotton. Application rates for crops other than rice are shown in table 6.

The acreage figures used to compute water use for cotton, soybeans, vegetable and fruit trees, and other crops and pastures were obtained from the U.S. Department of Agriculture (Statistical Reporting Service and Soil Conservation Service, 1985). Rice acreage figures used were supplied by the U.S. Department of Agriculture (W. Schaller, Agriculture Stabilization and Conservation Service, written commun., 1985).

Consumptive use of irrigation water was estimated to be 75 percent of use for rice and 70 percent of that applied to all other crops.

Table 6.--Estimated irrigation water application rates used for calculation of water use

Crop	Water use (inches)
Rice-----	28-44
Cotton-----	14
Soybeans-----	15
Vegetables and fruit trees-----	12
Other crops and pasture-----	4

Electric Energy

Thermoelectric

Nearly all the 1,090 Mgal/d of water used in thermoelectric generation (table 7) was river water that was diverted for "once through" cooling and then was returned to the stream. A relatively small amount (1.09 Mgal/d) of ground water was used, primarily for recirculation. More than 92 percent of the water used in this category was for cooling at a nuclear-fueled powerplant in Pope County (table 7, fig. 14).

Hydroelectric

In 1985, 59,900 Mgal/d of surface water was diverted through 9 hydroelectric powerplants in the State (table 7, fig. 15). Hydroelectric energy is generated at many of the dams on the Arkansas, Little Red, White, and Ouachita Rivers.

CHANGES IN WATER USE, 1980 THROUGH 1985

The total amount of water used in Arkansas in 1985 for all purposes increased by 38 percent compared with that used in 1980 (table 8). The greatest increase was for the generation of hydroelectric power, which accounts for the largest single category of use. Hydroelectric-power generation use increased from 25,800 Mgal/d in 1980 to 59,900 Mgal/d in 1985; an increase of 132 percent.

Water use for thermoelectric power generation in Arkansas was 1,090 Mgal/d, in 1985, compared to 970 Mgal/d in 1980, an increase of 12 percent. One notable decrease was in the mining industry, which went from 5.86 Mgal/d in 1980 to 3.28 Mgal/d in 1985, a decrease of 44 percent.

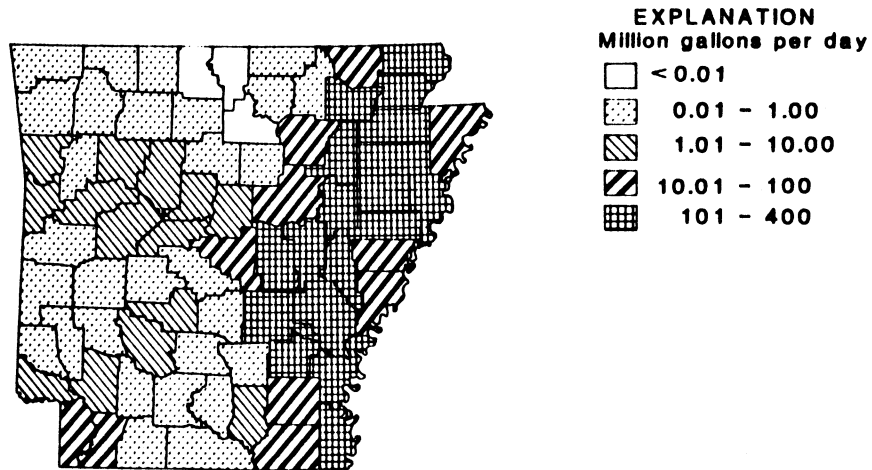


Figure 13.--Agriculture (irrigation) water use in Arkansas counties, 1985.

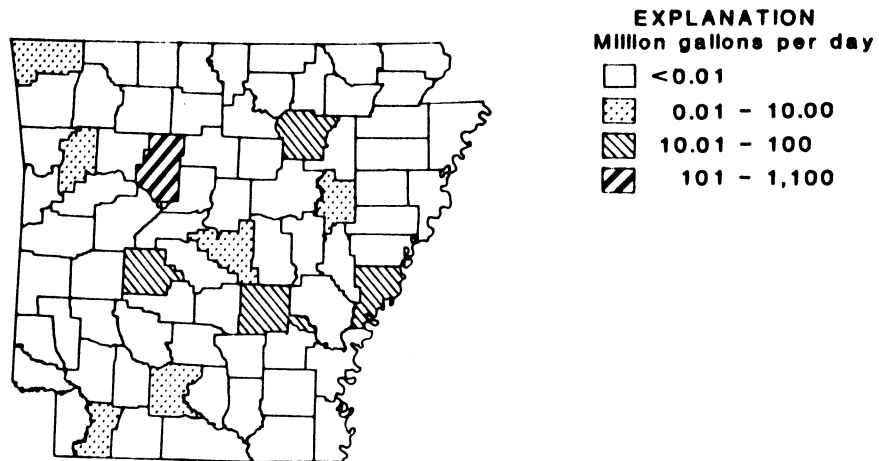


Figure 14.--Thermoelectric water use in Arkansas counties, 1985.

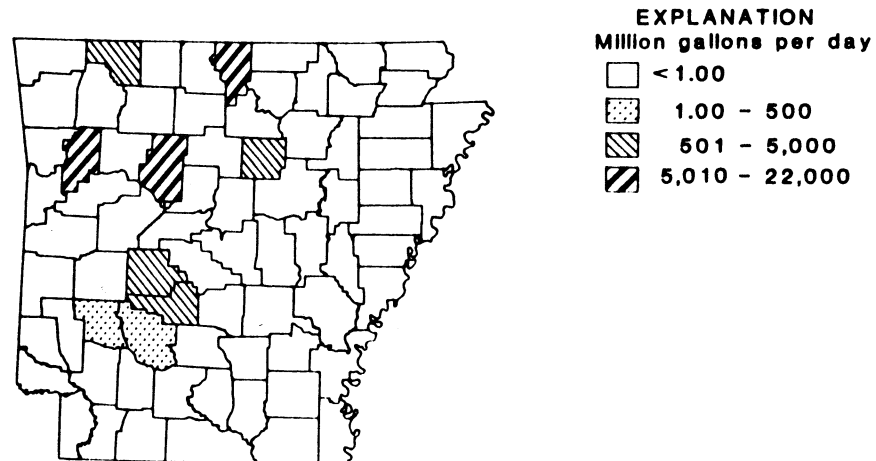


Figure 15.--Hydroelectric water use in Arkansas counties, 1985.

Table 7.--Use of water to generate electric energy

[In million gallons per day; data rounded to three-significant figures]

County	Hydro- electric energy surface water	Thermoelectric energy			County total
		Ground water	Surface water	Total	
Baxter	9,690	---	---	---	9,690
Benton	---	---	1.31	1.31	1.31
Carroll	1,420	---	---	---	1,420
Clark	494	---	---	---	494
Cleburne	1,590	---	---	---	1,590
Franklin	20,300	---	.99	.99	20,300
Garland	1,360	---	32.6	32.6	1,390
Hot Spring	3,050	---	---	---	3,050
Independence	---	---	17.3	17.3	17.3
Jefferson	---	---	13.6	13.6	13.6
Lafayette	---	1.06	---	1.06	1.06
Ouachita	---	---	1.90	1.90	1.90
Phillips	---	---	22.0	22.0	22.0
Pike	276	---	---	---	276
Pope	21,700	---	1,000	1,000	22,700
Pulaski	---	.03	---	.03	.03
Woodruff	---	---	.89	.89	.89
Total	59,900	1.09	1,090	1,090	61,000

Table 8.--Changes in water use, 1980 through 1985

[In million gallons per day]

Use category	1980			1985			1980-85 percent change
	Ground water	Sur- face water	Total	Ground water	Sur- face water	Total	Percent difference
Public supply---	110	153	263	105	156	261	-0.8
Domestic-----	60.2	0	60.2	60.4	0	60.4	+0.3
Commercial -----	0	0	0	6.03	1.94	7.97	--
Industrial ----	88.0	142	230	64	108	172	-25
Mining-----	1.84	4.02	5.86	1.03	2.25	3.28	-44
Agriculture (non-irrigation)	307	170	477	242	142	384	-20
Agriculture (irrigation)----	3,480	598	4,080	3,330	540	3,870	-5
Thermoelectric--	3	968	971	1	1,090	1,091	+11
Hydroelectric---	0	25,800	25,800	0	59,900	59,900	+132
Total-----	4,060	36,700	40,800	3,810	62,000	65,800	+61

SOURCE OF GROUND-WATER WITHDRAWALS

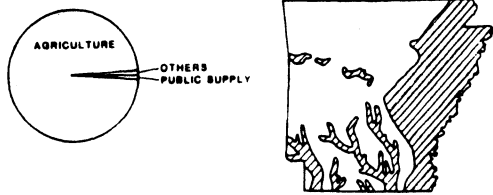
Ground-water withdrawals comprised about 64 percent of the total amount, (excluding water used for hydroelectric-power generation) of water used in Arkansas in 1985. A tabulation, by county, of the amount of water withdrawn from each of the aquifers in the State is shown in table 9 and figure 16. Practically all the water was withdrawn in the Coastal Plain, where most of it was pumped from the deposits of Quaternary age and the Sparta Sand of Eocene age.

The most productive deposits of Quaternary age underlie much of eastern Arkansas and the Arkansas and Red River Valleys. The deposits of Quaternary age supplied most of the ground water for irrigation and fish farming. However, in many places in the Coastal Plain in south-central Arkansas and in the river valleys in the Interior Highlands, alluvial deposits are important locally as sources of water for domestic wells. The Sparta Sand supplied much of the water used by industry and public-supply systems in south-central and east-central Arkansas.

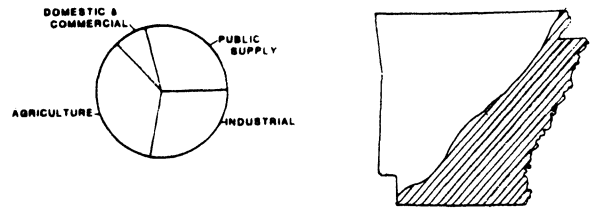
Table 9.--Withdrawals of ground water from aquifers in Arkansas counties, 1985

[In million gallons per day]

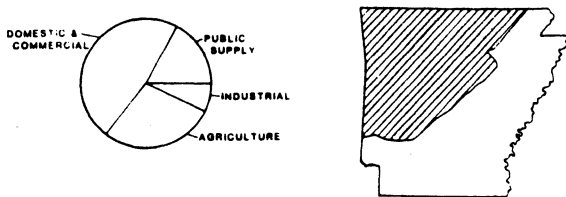
County	Deposits of Quaternary age	Cockfield Formation	Sparta-Memphis Sand	Cane River Formation	Wilcox Group, undifferentiated	Nacatoch Sand	Tokio Formation	Rocks of Paleozoic age, undifferentiated	County total
Arkansas	185.07		36.50					222	
Ashley	77.43	1.18						79	
Baxter							2.31	2	
Benton							6.76	7	
Boone							2.66	3	
Bradley	.56	.17	1.44					2	
Calhoun	.02		.53					1	
Carroll							2.82	3	
Chicot	75.71	2.12						78	
Clark	2.17					.91	.04	3	
Clay	175.87					1.13		177	
Cleburne							1.23	1	
Cleveland	.19	.05	.85					1	
Columbia	1.20		7.10					8	
Conway	4.19						.13	4	
Craighead	202.84		.40		.47			204	
Crawford	4.15						1.46	6	
Crittenden	113.68				6.80			120	
Cross	261.00							261	
Dallas	.27		1.19					1	
Desha	128.62	.18	6.45					135	
Drew	41.08	.13	3.06					44	
Faulkner	.67						3.03	4	
Franklin	.96						.78	2	
Fulton							.94	1	
Garland							2.54	3	
Grant	.23		1.39					2	
Greene	131.79			2.12	1.21	.09		135	
Hempstead	1.81					.15	2.86	5	
Hot Spring	.46						1.14	2	
Howard							.14	2	
Independence	32.57						1.80	34	
Izard							1.49	1	
Jackson	203.53							204	
Jefferson	133.97		42.38					176	
Johnson	2.87						1.09	4	
Lafayette	16.62		.14	1.30				18	
Lawrence	153.69						.16	154	
Lee	96.60		1.72					98	
Lincoln	86.06		1.03					87	
Little River	3.22		.47					4	
Logan	.33						2.93	3	
Lonoke	293.84		3.43		1.35			299	
Madison							1.49	1	
Marion							4.75	5	
Miller	18.77		.09	.59	.66			20	
Mississippi	50.36		.01		8.12			58	
Monroe	124.11		.51					125	
Montgomery							1.21	1	
Nevada	.83			.05	1.11			2	
Newton							.89	1	
Ouachita	.36		3.46					4	
Perry							.98	1	
Phillips	71.76		6.00					78	
Pike	.98					.06	1.25	2	
Poinsett	299.77		.02		2.14			302	
Polk							2.11	2	
Pope	6.53						.20	7	
Prairie	169.56		20.70					190	
Pulaski	29.54		.85				.01	30	
Randolph	42.05						.44	42	
St. Francis	110.90							111	
Saline	.20		3.43					4	
Scott							1.23	1	
Searcy							.92	1	
Sebastian	1.07						1.53	3	
Sevier	.04					.79	.72	2	
Sharp							1.89	2	
Stone							.84	1	
Union	.46		13.85					14	
Van Buren							.83	1	
Washington							5.67	6	
White	50.50							51	
Woodruff	142.37							142	
Yell	5.96						1.52	7	
STATE	3,560	5	157		21	3	4	64	3,820



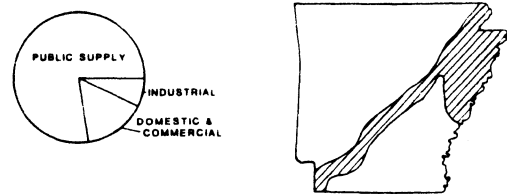
ALLUVIAL AQUIFERS
3,560 Mgal/d



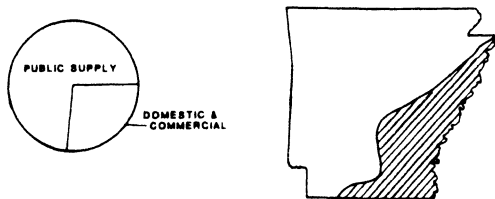
SPARTA-MEMPHIS AQUIFER
157 Mgal/d



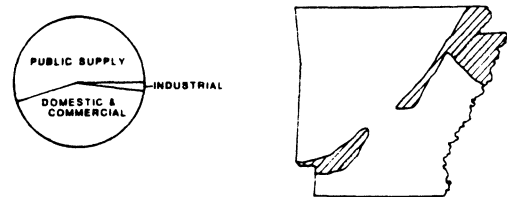
PALEOZOIC UNDIFFERENTIATED AQUIFERS
64 Mgal/d



WILCOX AQUIFER
21 Mgal/d



COCKFIELD AQUIFER
5 Mgal/d



NACATOCH AQUIFER
3 Mgal/d

Figure 16.--Ground-water withdrawals by principal aquifer. Each map shows the generalized areal extent of an aquifer that contains water with less than 3,000 milligrams per liter of dissolved solids (Hosman, 1969; Haley, 1976; Petersen, Broom, and Bush, 1985).

There are several other locally important water-bearing formations on the Coastal Plain. The Wilcox Group supplied nearly all the water used by public supply and by industry in Crittenden, Mississippi, and eastern Poinsett Counties, and much of the water used for public supply in eastern Craighead and Greene Counties. The Nacatoch Sand and Tokio Formation furnish much of the water used for public and domestic supplies in southwestern Arkansas. The Cockfield Formation furnished much of the water used for public and domestic supplies in Ashley, Chicot, and Desha Counties.

The remaining use occurs in the Interior Highlands. In the northern part of the Interior Highlands, the Roubidoux Formation and Gunter Sandstone member of the Gasconade-Van Buren Formation of Paleozoic age furnished water for public supplies and some industries. Elsewhere in the Interior Highlands, the rocks of the Paleozoic age are capable of supplying only small amounts of water, mainly for domestic use.

SUMMARY

Water withdrawals during 1985 for all purposes in Arkansas totaled approximately 65,800 Mgal/d. Excluding hydroelectric power generation (59,900 Mgal/d), Arkansas' withdrawals totaled 5,900 Mgal/d. The total ground-water withdrawal was 3,800 Mgal/d, and surface water accounted for the remaining 2,100 Mgal/d. Irrigation accounted for 87 percent (3,330 Mgal/d) of the total ground-water withdrawn, while the largest user of surface water (thermo-electric generation) accounted for 52 percent of the total amount of surface water used excluding uses for hydroelectric generation.

Approximately 71 percent of the population in Arkansas was served by public-water systems during 1985. These systems withdrew approximately 260 Mgal/d. Most of the water, 60 percent, was from surface-water sources. The Statewide average for per-capita residential use from public systems was 109 gal/d. Non-irrigation agricultural water use includes water withdrawn for such things as catfish and minnow farming and livestock and poultry operations. Total withdrawals in this category amounted to approximately 440 Mgal/d. About 242 Mgal/d (55 percent) of the water withdrawn was from ground water and the remaining 198 Mgal/d was from surface water.

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