# STATE OF ARKANSAS ARKANSAS GEOLOGICAL COMMISSION

NORMAN F. WILLIAMS, STATE GEOLOGIST

# WATER RESOURCES SUMMARY NUMBER 5

USE OF WATER IN ARKANSAS, 1965

By H. N. Halberg and J. W. Stephens
U. S. Geological Survey



PREPARED BY THE U. S. GEOLOGICAL SURVEY IN COOPERATION

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#### USE OF WATER IN ARKANSAS, 1965

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#### ABSTRACT

In 1965, Arkansas used an average of 2,142 mgd (million gallons per day) of ground and surface water, 35 percent more than the use in 1960. The quantity used in 1965 does not include more than 8,700 mgd used in the production of hydroelectric power. The principal categories of use are public supply, self-supplied industrial use, rural domestic and live-stock use, irrigation, fish and minnow farming, water for wildlife impoundments and fish hatcheries, and fuel-electric-power production. More than half the State's total was used for irrigation and 80 percent of the irrigation water was ground water.

Cooling water for fuel-electric-power production required 423 mgd, 20 percent of the State's total. Practically all of it was surface water. Fish and minnow farming, a rapidly expanding activity, used 179 mgd, 8 percent of the State's total.

More than half the water used was withdrawn from the ground; streams and reservoirs supplied the rest. Surface-water supplies are commonly used in the northwestern half of the State; ground-water supplies are more common in the southeastern half or Coastal Plain where the two principal underground reservoirs, the alluvium of Quaternary age, and the Sparta Sand, of Tertiary age, furnished practically all the ground water used. The deposits of Quaternary age provided most of the ground water used for irrigation; the Sparta Sand provided much of the ground water used for industry.

#### INTRODUCTION

Water is our most essential natural resource, without it we cannot live and without enough our economy would wither away. We can make no plans for expansion of our industry or agriculture unless we know if enough water is available to support these activities. This report provides water-use data for 1965 that can be used in planning for the future.

The information in this report has been collected by the U.S. Geological Survey in cooperation with the Arkansas Geological Commission. The writers express their appreciation to the many public agencies, industries, other organizations, and individuals that provided data. Especially, they thank the Arkansas Game and Fish Commission, the Arkansas State Board of Health, the Agricultural Extension Service of the University of Arkansas,

the Soil Conservation Service and other bureaus of the U.S. Department of Agriculture, the U.S. Bureau of Mines, the U.S. Fish and Wildlife Service, and the Arkansas Power & Light Company.

In this report, "use" is defined as "withdrawal of water from a source, for use."

Some of the water is returned to the source after use and is withdrawn again. It is tallied each time it is withdrawn. If the water is recirculated, it is counted only once, when it is withdrawn from the source. Part of the water withdrawn is consumed. Consumed water is water that is evaporated or transpired, incorporated into a product, or is used by humans and animals; it is not returned to a source and cannot be used again. Consumed water is not reported separately in this study. Although air conditioning is practiced extensively throughout the State, little "new" water is used in the type of equipment that must be utilized because of the humid climate. For this reason, water used for air conditioning is not reported. This report is similar to the one for 1960 by Stephens and Halberg (1961), but this report includes data on total use of water by industry and commerce (table 3) and withdrawals of ground water from each water-bearing formation (table 4).

#### WATER USE

Arkansas used an average of 2,142 mgd of ground and surface water in 1965 (fig. 1 and table 1), 35 percent more than in 1960. The quantity used in 1965 does not include 8,730 mgd used in the production of hydroelectric power. More than half (57 percent) the 1965 total was drawn from the ground. The use figure of 2,142 mgd is the equivalent of supplying 1,125 gpd (gallons per day) to each resident of the State, as compared with 883 gpd in 1960. More than half the water was used to irrigate crops, most of which are in the eastern part of the State; 82 percent of the irrigation water was well water. More water (239 mgd) was used in Arkansas County than in any other county (fig. 2 and table 2); the smallest quantity (0.5 mgd) was used in Newton County. Most of the counties in which water use increased the most since 1960 are concentrated in the east-central part of the State (fig. 3). The increases are due to greater use of water for irrigation, for fish and minnow farming, and for cooling at fuel-electric plants built since 1960.

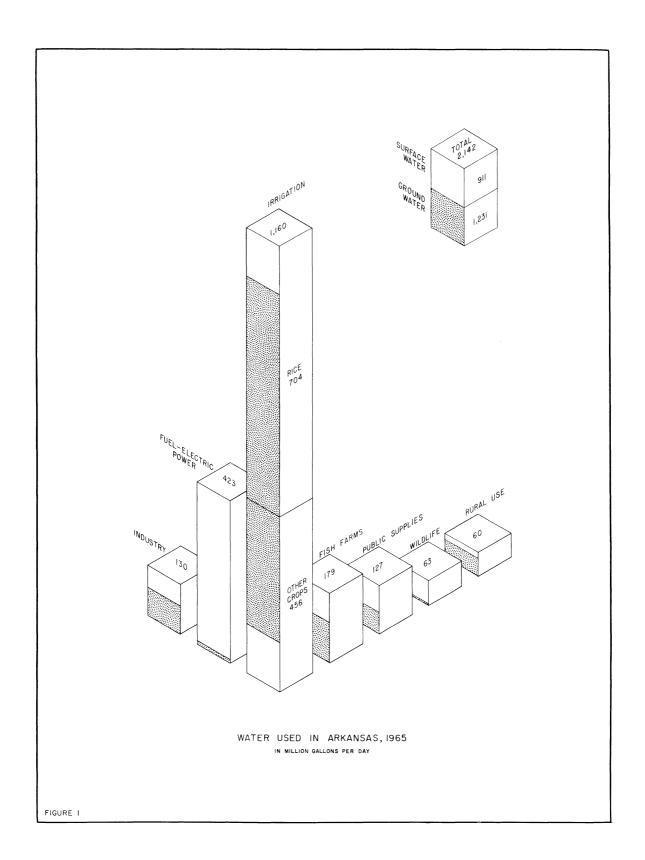


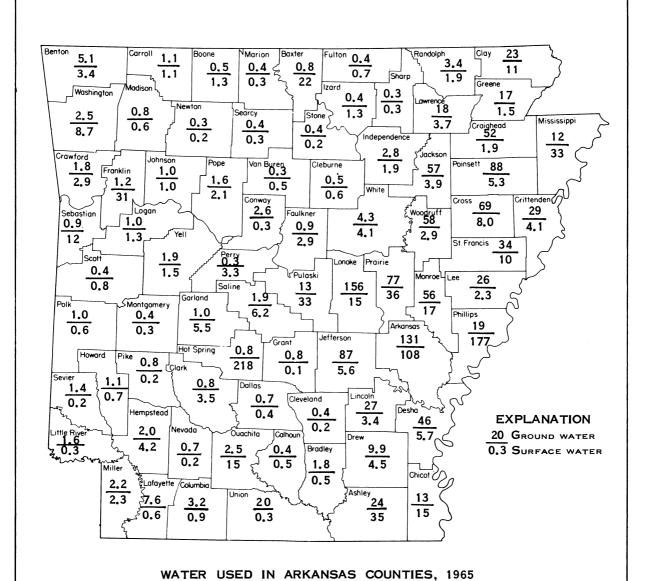
Table 1.--USE OF WATER IN ARKANSAS, 1965 (Million gallons per day)

Type of use	Wate	r used in l	965		(+) or decr	ease (-)
-01-	Ground	Surface		Ground	Surface	
	water	water	Total	water	water	Total
Public supply	54	73	127	+6	+21	+27
Self-supplied industry	74	56	130	<b>-</b> 24	+26	+2
Rural use Domestic Livestock	31 13	0 16	31 29	+3 +1	0 -4	+3 -3
Irrigation Rice Other crops	577 372	127 84	704 456	+51 +136	+16 +29	+67 +165
Fish and minnow farms	103	76	179	+60	+71	+131
Wildlife impound- ments and national fish hatcheries	1	62	63	0	+17	+17
Subtotal	1,225	494	1,719	+233	+176	+17
Fuel-electric power	6	417	423	0	+155	+155
Total	1,231	911	2,142	+233	+331	+155 +564
Hydroelectric power		8,730	8,730		+530	+530

Water use is tabulated by county, category of use, and source (table 2). The principal categories are public supply, self-supplied industrial use, use by rural households and livestock, irrigation, fish and minnow farming, water for wildlife impoundments and fish hatcheries, and fuel-electric power production. The data are given in average million gallons per day; for example, the water used to irrigate rice may have been applied in 40 or 50 days, but it is tabulated as though the water were applied at a constant rate throughout the entire year. Although the detailed data are given to the nearest 0.01 mgd, this precision was used only in order to add the figures. Most of the county totals are probably accurate within 5 percent.

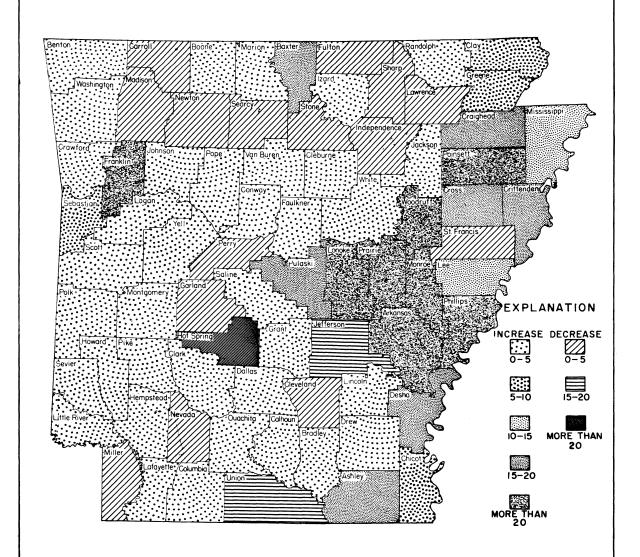
# Public Supplies

The supply systems of 302 cities, towns, and other water districts in the State, both publicly and privately owned, drew 127 mgd from their sources during 1965 (table 2). The water was distributed to about 1,100,000 people and the commercial and industrial establishments



IN MILLION GALLONS PER DAY

FIGURE 2



6

FIGURE 3

CHANGES IN WATER USE IN ARKANSAS COUNTIES, 1960 TO 1965

IN MILLION GALLONS PER DAY

				T								Wildlife impoundments and																		
	Public supply Self-supplied industry  Ground Surface Ground Surface			Rural use Domestic Livestock Ground Ground Surface				Rice	Irrig	Oth	er crops			nd minnow :	farms	Wildlif nationa	e impoundm l fish hat	ents and cheries	Fuel-	electric p	power	Co	unty Total		Rank according					
County	water	water	Total	water	water	Total	water	Ground water	Surface water	Total	Ground Water	water	Total	Ground water	Surface	Total	Ground water	Surface water	Total	Ground water	Surface Water	Total	Ground water	Surface water	Total	Ground Water	Surface water	Total	to quantity of water used	County
Arkansas Ashley Baxter	1.66 -93 -34	0	1.66 -93 -34	7.47	26.00	33.47	0.32 .53 .26	0.11	0.17 .15 .23	0.28 .26 .28	73.82	49.22	123.04	52.15 6.58	34.40 5.96	86.55 12.54	2.70	23.83	-33	0.08	0.61	0.69	0	0	0	130.84 23.63	108.23 34.75	239.07 58 38	1 12	Arkansas
Benton Boone	2.36 .02	1.47 .67	3.83 .69	.11	0	.11	.81	1.06	.84	1.90	0	0	000	-0	.03 .73	.03 .73 .01	.01	.01	1	0 0	21.59	21.64	0	000	0	.78 5.11	21.86 3.38	22.64 8.49	32 32	Ashley Baxter Benton
Bradley Calhoun	.74 .12	0	.74	.38	0,46	.38 .49	.26 .16	.06	.08	.14	0	0	0 0	0 0	.39	.39 .01	.34	0	- 34	0 0	0	0	0	0	0.	1.78	1.28	1.82 2.25	54 49	Boone Bradley
Carroll Chicot Clark	.55 .79 .20	·39 o .85	.94 .79 1.05	.02	0 0 1.60	0 .02 1.65	,29 ,38 ,38	.21 .18 .16	.68 .27 .22	.89 .45 .38	0 8.05 0	0 8.04 .86	0 16.09 .86	0 3.62 0	0 .76 .01	0 4.38	.01	.04 5.78	.05 5.78	. 0	0	0	0	000	0 0	.35 1.06 13.04	.53 1.11 14.85	.88 2.17 27.89	66 51 22	Calhoun Carroll Chicot
Clay Cleburne	.58 .02	0.24	.58 .26	0.04	0	0 .04	-53	.14	.13	.27	8.04	4.77	12.81	11.46	5.73	17.19	1.94	0	1.94	.15	.36	.51	0	0	0	-79 22.84	3.54	4.33 33.83	42 18	Clark
Cleveland Columbia	1.48	0	1.48	0 1.12	.01	.01	.26 .21 .51	.08	.16 .09 .16	.31 .17 .28	0 .	000	0 0	.01	.01	.01 .07 .14	.01	0 61	.03	0	0	0.14	0	0	0	.48	.58	1.06	63 72	Clay Cleburne Cleveland
Conway Craighead	3.08	0	1.02	.02	0	.02	.37	.23	.26	.49	0	.02	.02	.21	0	.21	.80	0 54	.80	0	0	0	0	0	0	3.23 2.65	.87 .28	4.10 2.93	43 48	Columbia Conway
Crawford Crittenden	0 2.16	1.48	1.48 2.16	.07	-59	.19 .59 .07	.52 .77	.14 .18 .10	.09	.23 .40	27.24 0 8.93	.96 0 1.58	28.20 0 10.51	20.02 1.08 16.36	.83 .51 2.32	20.85 1.59 18.68	.64 0 .30	0 .11 .17		0 0	0	0	0 31	0	0 31	52.46 1.78	1.88 2.91	54.34 4.69	13 40	Craighead Crawford
Cross Dallas	.61 .50	0	.61 .50	0	0	0	.45 .20	.17	.04	.21	51.56 0	5.73	57.29 .11	15.44 0	1.72	17.16	0.49	.55	1.04	000	0	0	0	0	0	28.69 68.72 .75	4.10 8.04 .36	32.79 76.76	19 8	Crittenden Cross
Desha Drew	.78 1.02	0	.78 1.02	0 .13	0	0 .13	.45 .39	.10	.14	.24 .28	19.42 5.35	3.21 2.29	22.63 7.64	19.58 1.72	2.39 2.10	21.97 3.82	6.01	0 0	6.01	0	0	0	0 .	0	0	46.34	5.74	52.08	61 14	Dallàs Desha
Faulkner Franklin Fulton	.02 .52 .12	1.58 .29	1.60 .81 .12	0	.03	.03	.61 .25 .20	.27 .24 .06	.40 .30 .35	.67 .54 .41	0 0	0 47	.47 0 0	.08	.32	.32 .10	0.14	0.12	.12	0	0	0	0	0 30.14	0 30.16	9.87 .90 1.25	4.55 2.89 30.78	14.42 3.79 32.03	29 44 20	Drew Faulkner Franklin
Garland Grant	.01	4.60	4.61	. 34	0	.34	.58	.12	-1.5	.27	0	0	0	0	.21	0	0	.79	.79	0	.16	.16	0	0	0	1.05	.72 5.54	1.10	62	Fulton
Greene Hempstead	1.12	0	.31 1.12 1.08	.12	0	.12	.23 .51 .42	.06 .18 .33	.07 .12 .33	.13 .30 .66	7.94	. 88	0 8.82 0	.09 4.88	.01 .54 .32	.10 5.42	.06 2.42 .21	0 0	2.42	0	0	0	0 0	0	0 0	.75 17.17	1.54	.83 18.71	50 67 27	Garland Grant Greene
Hot Spring Howard	-35	.83	.83	.08	5-57 0	5.65	.18	.15	.20	.35	Ö	.70	.70	0	•01	. 32 . 04	.12	.86	.22	0	3.57 0	3.57 0	0	209.40	209.40	2.05 .82	4.23 217.60	6.28 218.42	37 2	Hempstead Hot Spring
Independence Izard	.04	1.20	1.24	0	o .86	.86	.50	.21	.34	-55 -40	1.40	000	1.40	.65	.13 .10	.13 .75 .01	000	.29	.29	0 0	0 0	0	0 0	0	0	1.08 2.80	.74 1.93	1.82 4.73	55 39	Howard Independence
Jackson Jefferson	.87 5.40	0	.87 5.40	1.01 38.96	.01	1.01 38.97	.50 1.18	.10	.15 .14	.25 .24	33.03 27.85	·33	33.36 27.85	15.70 13.18	.13 3.29	15.83 16.47	5.72	3.33 2.14	9.05 2.36	0	0	0	0	0	0	56.93 86.89	1.29 3.94 5.58	1.67 60.87 92.47	56 11	Izard Jackson Jefferson
Johnson Lafayette Lawrence	.04 .36 .71	.57 0 .02	.61 .36	,01 ,56	0.17	.01	.29	.17	,18 .18	• 35 • 30	0 1.34	0	0 1.34	.31 2.53	.24 .20	.55 2.73	.18	0	.18	0	0	0	0	0	0	1.00	-99	1.99	52	Johnson
Lee Lincoln	.56	0	.73 .56 .29	.02	0	.02	.41 .65 .44	.05 .18 .11	.28 .12 .13	.33 .30 .24	10.91 12.57 15.17	2.73 1.24	13.64 13.81 15.17	4.78 11.57 8.34	.64 .89 3.08	5.42 12.46 11.42	1.03 0 2.19	0 .16	1.05 0 2.35	0	0	0 0	0	0	0	17.89 25.55	3.69 2.25	8.12 21.58 27.80	25 23	Lafayette Lawrence Lee
Little River Logan	.31	0 .69	.31 .73	.34 .01	0 . 04	. 34 . 05	.21	.16 .35	.23	- 39 - 76	.51	0	.51	.09	.08	.17	0	0	0	0	0	0	0	0	0	26.57	3.37	29.94	53	Lincoln Little River
Lonoke Madison	0 08	.09	.74 .09	0	0	. 0	-59 -33	.19	.28 .50	.47 •77	56.90 0	6.32	63.22 0	43.79	1.61	45.40	53.66	6.73	.10 60.39 .21	0 0	0	0	000	0	0 0 0	.96 155.87	1.26 14.94	2.22 170.81	50 4	Logan Lonoke
Marion Miller	0	1.63	1.63	.07	.11	.07	-19	.06	.28	.52	1.00	.16	1.16	.50	.12	0 .62	.03	0	.03 \	0	0	0	ő	ő	ő	.81	.61 .28	1.42	59 70	Madison Marion
Mississippi Monroe Montgomery	3.85	0	3.85 .74	2.88	0	2.88 .01	1.42	.12	.03 .05	.15 .08	2.18 20.96	.32 2.33	2.50	1.56 31.32	.11 5.12	1.67 36.44	0 2.87	0 8.10	0 0 10.97	.01	0 32.14 1.46	0 32.15 1.46	0	0	0	2.22	2.33 32.60	4.55 44.62	41 16	Miller Mississippi
Nevada	.03	0.04	.07	05	.01	,05 .01	.18	.12	.14 .16	.26 ,32	0	0	0	0	.01 .04	.01 .04	0	0.11	0 11	0	0	0 0	0	0	0	56.32 •38 •71	17.06 .30 .21	73.38 .68	9 71 65	Monroe Montgomery Nevada
Newton Ouachita Perry	.23	0 1.36 .05	0 1.59 .08	0 1.75	0 13.81	0 15.56	.24 .44 .16	.04	.23	.27	0	0	0	0	0	0	.03	0	.03	0	0	0	0	0	0	.31 2.49	.23 15.25	.54 17.74	75 28	Newton Ouachita
Phillips Pike	2.60 .36	0 .09	2.60 .45	1.19	0 .03	1.19	.71	.10 .08 .16	.12 .11 .11	.22 .19 .27	8.19 0	1.65 0 0	1.65 8.19 0	5.14 0	.15 .28	5.42 0	.41	0 0	.03 .41	0 0	0	1.34	0.72	0 176.30	0 177.02	.29 19.04	3.34 176.69	3.63 195.73	46	Perry Phillips
Poinsett Polk	1.29	0 .43	1.29	o •33	0	o -33	.75 .29	.06	.04 .16	.10	58.50	3.08	61.58	26.68	1.40	28.08	·35	.55	.90	. 0	.27	.27	0	0	0	.79 87.63	5.34	92.97	64	Pike Poinsett
Pope Prairie Pulaski	.21 .33 3.17	1.70 0 28.79	1.91 .33 31.96	.05	0	.06 0	.41 .27 .18	.29	.24	-53 -22	0 47.17	0 17.68	0 64.85	.41 20.35	0 2.18	.41 22.53	0 8.44	.16 16.39	.21 .16 24.83	.19	0	.19	0 0 0	0	0	.99 1.56 76.65	.60 2.11	1.59	57 45	Polk Pope
Randolph	0	.45	.45	-02	0 0	1.19	.32	.17	.25	.42	2.56	.45 1.12	3.01	3.01	•53 •05	3.54 .37	.92	1.65		0	0	0	2.98	Ö	2.98	12.99	36.38 32.86	113.03 45.85	5 15	Prairie Pulaski
St. Francis Saline Scott	1.42	0 1.16 .49	1.42 1.23 .49	.68 .01	0 4.88 .01	.68 4.89 .01	.70 .61 .24	.20 .10 .18	.05 .14 .22	.25 .24	24.06 0	6.01	30.07	.32 6.11 0	1.50	7.61	1.07	1.32	1.74	0	0 0	0	0 .11	0 1.25 0	0 1.36 0	3.36 33.70 1.86	1.91 10.13 6.19	5.27 43.83 8.05	38 17 35	Randolph St. Francis Saline
Searcy Sebastian	.11	0 11.23	.11	o o	.03	.03	.27	.06	.32	.38	0	0	0	0	0 13	0.13	0	0	0	. 0	0	0	0	0	ó ó	.42 .44	.85	1.27	60 69	Scott Searcy
Sevier Sharp	.95 .09	.05	.95 .14	0	0	0	.22 .16	.21 .17 .04	.28 .19 .24	.49 .36 .28	0	0	0	0 0 0	.06 .02	.06 .02	.21	0	.21 .04	0	0.	0	0	0	0	.91 1.38	11.60	12.51 1.59	30 58	Sebastian Sevier
Stone Union	.09 3.79	0	.09 3.79	.01 15.12	0.16	.01 15.28	.18 .65	.08	.19 .24 .20 .11	.28 .22	0	0	0	0	0,04	0.04	0	0 .01	.01	0 0	0	0	0	0	0	.29 .36 19.67	.29 .20 .32	.58 .56 19.99	73 74 26	Sharp Stone Union
Van Buren Washington White	0 .25	7.43	7.68	0	0 .16	0 .16	.26 .78	.06 1.15	.24	.30 1.91	0	0	0	0	.02	.02 -33	o .26	0	0 .26	0	0	0	0	0	0	.32	.49	.81	68	Van Buren
wnite Woodruff Yell	.33 .48 .74	1.99 0 .34	2.32 .48 1.08	.04 .02 .03	0 0	.07 .02 .03	.74 .34 .31	.34 .05 .38	.42 .08 .27	.76 .13 .65	1.03 31.08 0	.81 1.29 0	1.84 32.37 0	.80 21.22 .40	1.53 .10	.91 22.75 .50	1.04 4.94 0	.71	1.75 4.94	0	0	0	000	0	0	4.32 58.13	4.07 2.90	11.13 8.39 61.03	31 33 10	Washington White Woodruff
STATE TOTALS	53.71	72.87	126.58	73.88	55.80	129.68	31.32	12.54	16.46	29.00	577-15	126.94	704.09	372.20	83.86	456.06	103.51	.28 75.60	.28	0.48	-54 62.18	.54 62.66	5.94	417.09	423.03	1.86	1.53	3.39	47.	Yell
aro convert mi	llion mellone	non dour to												- W.			<u> </u>	اا		1		(4)		141107	(0.02	دا ۱۰۷۰موید	ATA-OT	2,141.54		

<sup>&</sup>lt;sup>a</sup>To convert million gallons per day to acre-feet per year, multiply by 1,120.

in the municipalities. The total includes water used for public facilities and fire fighting; it also includes leakage and wastage. About 35 percent of the water was used by commerce and industry. Supplying 127 mgd is the equivalent of furnishing 113 gpd to each resident of the municipalities.

#### Industry and Commerce

Arkansas industry and commerce used 173 mgd during 1965 (table 3), which includes water furnished by the public-supply systems and that which industry supplied itself.

Arkansas industry supplied itself with an average of 130 mgd in 1965 (table 2), a little more than in 1960. This water was used by agricultural, chemical, metal, mining, paper, petroleum, and other types of manufacturing industries; also at mines, quarries, sand and gravel pits, and oil and gas wells. This category also includes water used by hospitals, institutions, military establishments, schools, and visitors at recreation areas. Water used for recreational activities, such as boating or fishing, or for navigation is not included in the report.

#### Rural Households and Livestock

Farmers and others who furnish their own water supplies are classed as rural domestic users. In 1965 about 800,000 rural users withdrew 31 mgd from their own wells and springs (table 2). This withdrawal was computed on the basis of use of 50 gallons of water per day per capita by the 75 percent of people who have running water in their homes and on the basis of 10 gallons per day by the remaining 25 percent. The 29 mgd used to raise cattle, swine, and poultry was drawn about equally from wells, and from streams and ponds. The number of other animals in the State was so small that their total water use was too small to tabulate.

### Irrigation

More than half the water withdrawn in Arkansas in 1965 (1,160 mgd) was used to irrigate crops (table 2). Irrigation of rice accounted for 61 percent of this water; the quantity used on rice was 11 percent greater than in 1960 because of increased acreage planted. A figure of 1.8 acre-feet per acre (Engler and others, 1945, p. 23) was used to compute the quantity of water used to irrigate rice. Most of the rest of the irrigation water was applied to cotton and soybeans; the 456 mgd used on crops other than rice was 57 percent greater than the use in 1960. The quantities of irrigation water given in this report include conveyance losses, which are small (estimated to be 7 percent of the water applied).

Table 3.--INJUSTRIAL AND COMMERCIAL USE OF WATER IN ARKANSAS COUNTIES, 1965 (Million gallons per day)

			(Mı	llion gallon			<del></del>		
	public-s	ished by upply syste	ms		upplied in	dustry		inty total	
County	Ground water	Surface water	Total	Ground water	Surface water	Total	Ground water	Surface water	Total
Arkansas Ashley	0.41	0	0.41 .12	0 7.47	0 26.00	0 33.47	0.41 7.59	0 26.00	0.41 33.59
Baxter	0	0	0	.07	0	.07	.07	0	.07
Benton Boone	1.36 0	1.06	2.42	.11	0	.10 .01	1.47	1.06	2.53 .04
Bradley	.14	0	.14	.38	0	.38	.52	0	.52
Calhoun	0	0	0	.03	.46	.49	.03	.46	.49
Carroll Chicot	.27	.24	.51	.02	0	0 .02	.27	.24	.51 .02
Clark	ő	.20	.20	.05	1.60	1.65	.05	1.80	1,85
Clay	0	0	. 0	0	0	0	0	0	0 .
Cleburne Cleveland	0	0	0	.04	.01	.04	.04	0,01	.04 .01
Columbia	.61	0	.61	1.12	.03	1.15	1.73	.03	1.76
Conway	.49	0	.49	.02	0	.02	-51	0	.51
Craighead Crawford	•55 0	0.22	•55 •22	.19 0	0 •59	.19 .59	.74	0.81	.74 .81
Crittenden	.60	0	.60	.07	0.09	.07	.67	0.01	.67
Cross Dallas	0	0	0	0	0	0	0	0	0
	<b></b>	<b></b>							
Desha Drew	.46	0	.46	0 .13	0	.13	0 •59	0	o •59
Faulkner	0	.79	•79	0	0	0	0	•79	•79
Franklin Fulton	.12	0.18	.30 .02	0	0.03	.03 0	.12	.21 0	•33 •02
Garland	0	1.81	1.81	. 34	0	. 34	. 34	1.81	2.15
Grant	.10	0	.10	0 '	-0	0	.10	0	.10
Greene Hempstead	.21 .40	0	.21 .40	.12	0	.12 .01	.33 .41	0	.33 .41
Hot Spring	0	.03	.03	.08	5.57	5.65	.08	5.60	5.68
Howard	.29	.05	. 34	.27	0	.27	.56	.05	.61
Independence Izard	0	0.50	.50 0	0	.86	o .86	0	.50 .86	.50 .86
Jackson	.01	0	.01	1.01	0	1.01	1.02	0	1.02
Jefferson	.24	0	.24	38.96	.01	38.97	39.20	.01	39.21
Johnson Lafayette	0	.28	.28 0	.01 .56	0.17	.01 .73	.01 .56	.28 .17	.29 .73
Lawrence	.24	0	.24	0	0	0	.24	0	. 24
Lee Lincoln	0.23	0	.23	.02	0	.02 .03	.25	0	.25 .03
Little River	0	0	0	. 34	0	. 34	. 34	0	.34
Logan	0	.15	.15	.01	.04	.05	.01	.19	.20
Lonoke Madison	0	0	0	0	0	0	0	0	0
Marion	0	0	. 0	.07	. 0	.07	.07	. 0	.07
Miller	0	.71	.71	.08 2.88	.1,1	.19 2.88	.08 4.06	.82	.90 4.06
Mississippi Monroe	1.18	0	1.18 .25	.01	0	.01	.26	0	.26
Montgomery Nevada	0	0	0	.05	0 .01	.05 .01	05	0 .01	.05 .01
	ļ	ļ					ļ		
Newton Ouachita	0	.20	0 •20	0 1.75	0 13.81	0 15.56	0 1.75	0 14.01	0 15.76
Perry Phillips	.85	0	0 .85	0 1.19	0	0 1.19	0 2.04	0	0 2.04
Pikę	.25	0	.25	.07	.03	.10	.32	.03	•35
Poinsett	.30	0	.30	0	0	0	.30	0	.30
Polk Pope	0.11	.10	.10 .93	.33 .05	0.01	•33 •06	.33 .16	.10 .83	.43 .99
Prairie	.01	0	.01	0	0	0	.01	0	.01
Pulaski	1.81	9.01	10,82	0	1.19	1.19	1.81	10.20	12.01
Randolph St. Francis	.48	0.12	.12 .48	.02 .68	0	.02 .68	.02 1.16	.12	.14 1.16
Saline	0	.54	-54	.01	4.88	4.89	.01	5.42	5.43
Scott Searcy	0	0.36	.36 0	0	0.01	0	0	·37	· 37
Sebastian	0	7.51	7.51	0	.03	.03	0	7.54	7.54
Sevier	.57	0	.57	0	0	0	•57 0	0	.57
Sharp Stone	0	0	0	.01	0	.01	.01	0	.01
Union	.82	0	.82	15.12	.16	15.28	15.94	.16	16.10
Van Buren	0	.17	.17	0	0	0	0	.17	.17
Washington White	.15 .01	3.43 .58	3.58 .59	.04	.16 .03	.16 .07	.15 .05	3.59 .61	3.74 .66
Woodruff	.06	0 .28	.06	.02	0	.02 .03	.08	0 .28	.08 .81
Yell	.50	<b> </b>	.78	<b>_</b>	<b> </b>		•53		
STATE TOTAL	14.22	29.37	43.59	73.88	55.80	129.68	88.10	85.17	173.27

#### Fish and Minnow Farms

Raising fish for food and minnows for bait is an important and fast-growing activity, which uses large quantities of water. In 1965, 179 mgd, 8 percent of the State's total, was used for this purpose (table 2), 58 percent of which was drawn from wells. The fish and minnows are raised in large leveed ponds, most of which are in the Grand Prairie region. About 3 feet of water was applied to 33,000 acres of fish ponds during the year and about 6 feet was applied to 17,000 acres of minnow ponds.

#### Wildlife Impoundments and Fish Hatcheries

The approximately 22 mgd of surface water in this category used in Baxter and Fulton Counties is water diverted at national trout hatcheries and returned to the streams. The other 40 mgd of surface water is diverted from streams and held in impoundments for the use of migrating and wintering ducks and geese. (See table 2.)

#### Fuel-Electric Power

Most of the water used in the production of fuel-electric power is river water that is used once for cooling and then is returned to the stream. The only degradation of the water is an increase of its temperature, which is dissipated a few miles downstream. Ground water used for cooling is recirculated; hence, comparatively little is used. The total of 423 mgd (table 2) used in 1965 is 58 percent more than the 1960 figure. New plants built since 1960 at Helena and Ozark account for the increase.

#### GROUND-WATER WITHDRAWALS

To assist future studies of ground water in relation to possible depletion of the supply in the water-bearing formations, table 4 shows withdrawals from each aquifer in each county. More than 97 percent of the water was withdrawn in the Coastal Plain, practically all from alluvium of Quaternary age and the Sparta Sand, of Tertiary age. The Quaternary deposits supplied most of the ground water used for irrigation and fish farming; the Sparta Sand furnished much of the water used by industry.

Very little of the water withdrawn is returned to the ground to recharge the groundwater reservoirs. In 1965, less than 1 mgd was returned to the ground for this purpose.

# Table 4.--WITHDRAWALS OF GROUND WATER FROM AGUIFERS IN ARKANSAS, 1965 (Million gallons per day)

County	Deposits of Quaternary age	Jackson Group	Cockfield Formation	Sparta Sand	Memphis Aquifer	Cane River	Carrizo Sand	Wilcox Group	Clayton Formation	Nacatoch Sand	Ozan Formation	Tokio Formation	Woodbine Formation	Trinity Group	Rocks of Paleozoic age	County Total
Arkansas Ashley Baxter Benton Boone	113.45 22.80		0.83	17.39			The state of the s								0.78 5.11 .54	130.84 23.63 .78 5.11 .54
Bradley Calhoun Carroll Chicot	.3 <sup>1</sup> 4	0.01	.29 .18 .85	1.14											1.06	1.78 .35 1.06 13.04
Clark	.12				0.20	-		0.07		0.44	0.13				.03	.79
Cleburne Cleveland Columbia Conway	.04	. 04	.10	.26 3.03		0.06	and a sea had be assessed to the sea of the	AND		TOTAL PROPERTY AND					.48	.48 .44 3.23 2.65
Craighead Crawford Crittenden Cross Dallas	48.82 1.18 26.37 67.96		.02	.67	3.26 .07 .71	.06		.38 2.25 .05	-	MARADA PRINCIPAL DE LA CONTRACTOR DE LA			The second secon		.60	52.46 1.78 28.69 68.72 .75
Desha Drew Faulkner Franklin Fulton	45.11 8.51 .76	.12	.40	.83 1.12							-				.90 .49 .38	46.34 9.87 .90 1.25 .38
Garland Grant Greene Hempstead Hot Spring	.11 15.75 .26 .04	.06	.08	.50	.22	.02	C.02	1.20	0.02	1.12		0.67			1.05 .23	1.05 .75 17.17 2.05 .82
Howard Independence Izard Jackson Jefferson	2.17 56.87 42.01	.21	-31	44,36								.69	0.04	0.13	.22 .63 .38 .06	1.08 2.80 .38 56.93 86.89
Johnson Lafayette Lawrence Lee Lincoln	.60 4.61 17.72 25,44 25.88	.27	.02 .08	2.63 .09 .34		.32			-			The state of the s	and the state of t		.40	1.00 7.56 17.89 25.55 26.57
Little River Logan Lonoke Madison Marion	1.42 .31 155.46		-	.15	.09			.17		.20			Total and a second seco		.65 .81 .43	1.62 .96 155.87 .81 .43
Miller Mississippi Monroe Montgomery Nevada	1.71 5.19 56.08			.24		.14	.09	.14 6.83		.14		-37	Y Y	-	.38	2.22 12.02 56.32 .38 .71
Newton Ouachita Perry Phillips Pike	14.44 .42		.03	2.27 4.57		.17	.05				· ·	12			.29	.31 2.49 .29 19.04 .79
Poinsett Polk Pope Prairie Pulaski	86.18 1.02 69.90 12.78		- Commission of the Commission	6.75	.08			1.37			The state of the s	And the state of t			.99 .54	87.63 .99 1.56 76.65 12.99
Randolph St. Francis Saline Scott Searcy	3.16 32.79			.57	.76		A separate and a separate sepa	.15 .63	.23		And the state of t	COLUMN TO THE PROPERTY OF THE			.20 .43 .42 .44	3.36 33.70 1.86 .42 .44
Sebastian Sevier Sharp Stone Union	.21		.55	19.07			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		· ·		Control of the Contro	. 15		.99	.70 .07 .29 .36	.91 1.38 .29 .36 19.67
Van Buren Washington White Woodruff Yell	3.55 58.00 .47				.13			.12			Communication of the Communica	Taxania and and an and an			32 2.44 .65 1.39	.32 2.44 4.32 58.13 1.86
TOTALS: STATE Coastal Pla	1,066.65 in 1,062.86	0.71	4.00	106.21 106.21	5.52 5.52	0.82	0.16 0.16	14.18 14.18	0.25 0.25	2.36 2.36	0.13 0.13	2.00	0.04	1.12	26.58 0.22	1,230.73
Interior Highlands								-	1		L				26.36	30.15

#### SELECTED BIBLIOGRAPHY

- Arkansas-White-Red Basins Inter-Agency Committee, 1957, Development of water and land resources of the Arkansas-White-Red River basins: U.S. 85th Cong., 1st sess., S. Doc. 13.
- Engler, Kyle, Thompson, D. G., and Kazmann, R.G., 1945, Ground-water supplies for rice irrigation in the Grand Prairie region, Arkansas: Arkansas Univ. Agr. Expt. Sta. Bull. 457, 56 p.
- Guyton, W.F., 1950, Estimated use of ground water in the United States, 1945: U.S.Geol. Survey open-file rept.
- Kerns, W.H., 1964, Water: U.S. Bur. Mines Minerals Yearbook, 1963, v. 1, p. 1209-1220.
- Mack, L.E., 1963, Sources of water for industry with special reference to municipal supplies: Arkansas Indus. Devel. Comm. and Arkansas Univ., Coll. Business Adm., Indus. Research and Ext. Center, 18 p.
- MacKichan, K.A., 1951, Estimated use of water in the United States, 1950: U.S. Geol. Survey Circ. 115, 13 p.
- 1957, Estimated use of water in the United States, 1955: U.S. Geol. Survey Circ. 398, 18 p. MacKichan, K. A., and Kammerer, J. C., 1961, Estimated use of water in the United States, 1960: U.S. Geol. Survey Circ. 456, 44 p.
- McGuinness, C. L., 1951, The water situation in the United States, with special reference to ground water: U.S. Geol. Survey Circ. 114, p. 87, 94, 100, app. p. 12, 13.
- \_\_\_\_\_ 1963, The role of ground water in the national water situation: U.S. Geol. Survey Water Supply Paper 1800, p. 163-175.
- Randall, L. E., 1961, Annotated bibliography of water-use data, 1960: U.S. Geol. Survey Circ. 455.
  Stephens, J.W., and Halberg, H.N., 1961, Use of water in Arkansas, 1960: Arkansas Geol. and Conserv. Comm. Special Ground-Water Rept., 4, 8 p.
- Stroud, R. B., 1964, The mineral industry of Arkansas: U.S. Bur. Mines Minerals Yearbook, 1963, v. 3, p. 135-157.
- Thomas, H.E., 1951, The conservation of ground water: New York, McGraw-Hill, p. 49, 111, 291, 294.
- U.S. Department of Agriculture, 1955, The yearbook of agriculture, 1955, water: U.S. 84th Cong., 1st sess., H. Doc. 32, p. 252, 254, 379, 381, 383.
- U.S. Public Health Service, 1964a, Municipal water facilities communities of 25,000 population and over, as of Jan. 1, 1964: U.S. Public Health Service Pub. 661, 1964 ed., p. 8,9.
- 1964b, 1963, Inventory, municipal water facilities: U.S. Public Health Service Pub. 775 (revised), v. 7, p. 2-12.
- U.S. Bureau of the Census, 1966, Water use in manufacturing: 1963 Census of manufactures, U.S. Bur. Census Prelim. Rept. MC63(P)-6.
- 1966, Water use in manufacturing, 1964: 1963 Census of manufactures, U.S. Bur. Census Prelim. Rept. MC63(P)-10.
- 1966, 1964 United States census of agriculture, Arkansas: Prelim. Rept., U.S. Bur. Census ser. AC 64-Pl. (State and county rept.)
- Wood, N.H., 1957, Water use in Arkansas: Arkansas Univ., Coll. Business Adm., Indus. Research and Ext. Center, 17 p.
- 1959, Arkansas water resources: Arkansas Univ., Coll. Business Adm., Indus. Research and Ext. Center, p. 160-170, 172, 177.