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*Public Groundwater Supplies
in Pulaski County*

by DOROTHY M. WOLLER and ELLIS W. SANDERSON

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PUBLIC GROUNDWATER SUPPLIES IN PULASKI COUNTY

by Dorothy M. Woller and Ellis W. Sanderson

Introduction

This publication presents all available information on production wells used for public groundwater supplies in Pulaski County. Bulletin 60, which is divided by county into separate publications, supersedes Bulletin 40 and its Supplements 1 and 2.

The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Systems and wells described furnish water for drinking or general domestic use in: 1) incorporated municipalities; 2) unincorporated communities where 10 or more separate lots or properties are being served or are intended to be served; 3) state-owned parks and memorials; and 4) state-owned educational, charitable, or penal institutions.

This report includes separate descriptions for groundwater supplies of 6 municipalities in Pulaski County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for municipal use. An explanation of the format used in the descriptions is also given.

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Groundwater Geology

The geology of Pulaski County is described generally in Illinois State Geological Survey Circular 212, *Groundwater Geology in Southern Illinois*, and Report of Investigation 71, *Geology and Oil Possibilities of Extreme Southern Illinois - Union, Johnson, Pope, Hardin, Alexander, Pulaski, and Massac Counties*. The following brief discussion of geologic conditions in the county is taken largely from these publications. A more detailed definition of the geology in this portion of the state can be obtained from the State Geological Survey which is located on the University of Illinois campus, Urbana.

The unconsolidated materials forming the present day land surface in Pulaski County range in thickness from less than 5 ft in the uplands of the central area to about 150 ft in the Cache River Valley and more than 175 ft in the Ohio

River bottomlands at the southern tip of the county. In the bottomland areas, permeable sand and gravel deposits 80 to 150 or more feet thick are capable of yielding moderate to large quantities of water to individual wells.

Semiconsolidated deposits of gravel, sand, and silt (Tertiary and Cretaceous) are present in the county except north of the Cache River. These materials range in thickness from a featheredge near the Cache River to as much as 383 ft at Olmsted. They are a potential source for moderate to large groundwater supplies. Locally, a chert gravel or limestone rubble may be present at the consolidated bedrock surface and can be a significant source of water.

The upper consolidated bedrock units in Pulaski County are of Mississippian and Devonian age. They consist of beds of shale, siltstone, limestone (some very cherty), and sand-

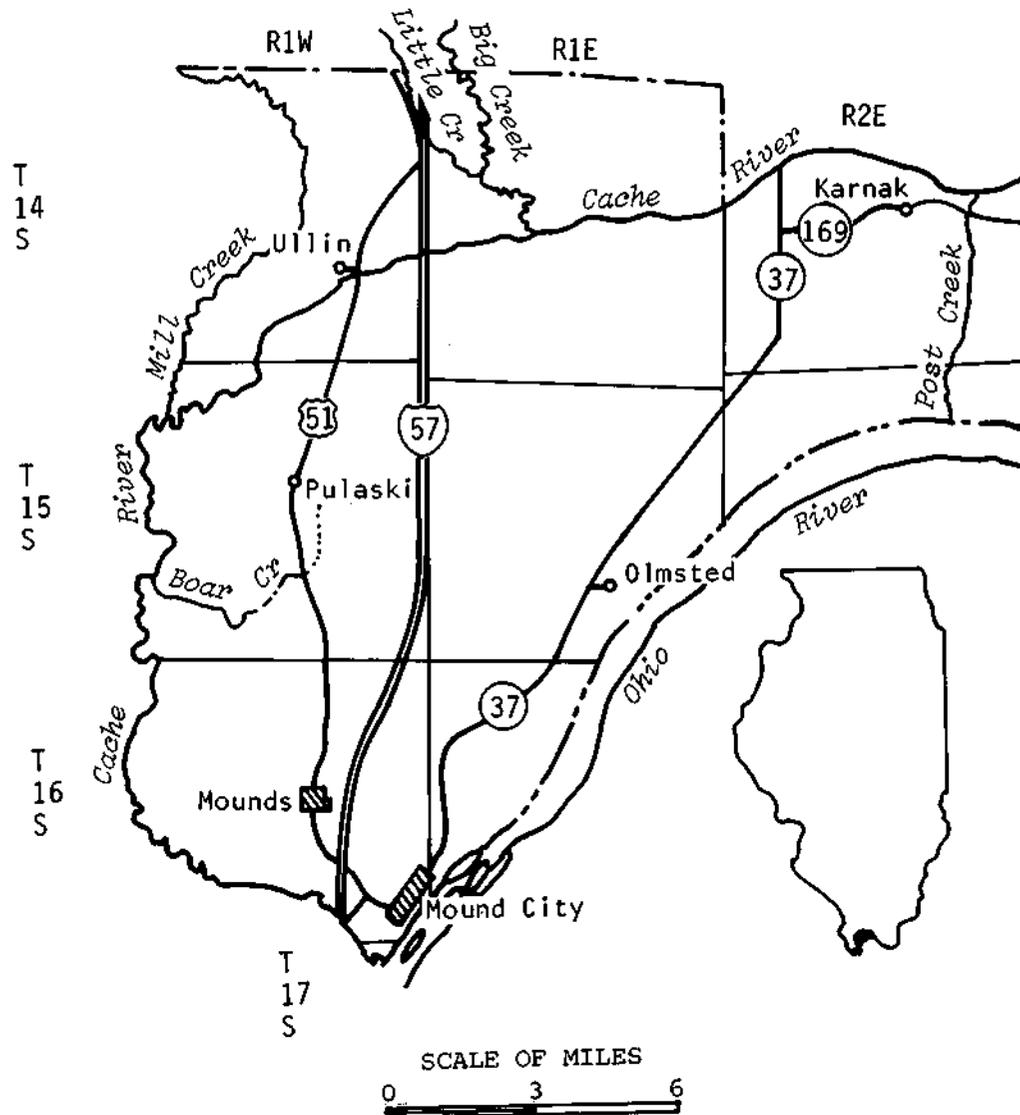


Figure 1. Location of public groundwater supplies in Pulaski County

stone that dip northeasterly at about 125 ft per mile. North-east (and some northwest) trending faults have produced small to moderate vertical displacements of these units in the northern part of the county. The Mississippian rocks range in thickness from a featheredge in the southwest part of the county, to as much as 1700 ft in the northeast. The Devonian rocks are about 1400 ft thick in the northeast part of the county, but thin southward because of erosion prior to deposition of the Cretaceous and Tertiary rocks. The creviced limestone and dolomite beds are potential sources of municipal and industrial supplies in the western and southern areas of Pulaski County where they are present at higher elevations above sea level. Downdip to the northeast the groundwater may be highly mineralized.

Groundwater Development for Municipal Use

Groundwater is used as a source of municipal water supply at Karnak, Mound City, Mounds, Olmsted, Pulaski, and Ullin. The locations of these supplies are shown in figure 1.

Unconsolidated sand and gravel deposits associated with the bottomlands of the Cache River Valley are tapped as a source of water at Karnak, Pulaski, and Ullin. There are presently 3 production wells ranging in depth from 36 to 150 ft. Their reported yields range from about 50 to 200 gpm. Ultimate yields, which are probably in excess of these amounts, depend primarily upon the type of well constructed and the permeability, thickness, and areal extent of the sand and gravel unit tapped by each well. Production from these

wells in 1977 was estimated to be about 124,400 gpd.

The analyses of water from these wells show that the iron content ranges from 1.5 to 13 mg/l and the hardness from 76 to 451 mg/l. Treatment provided for these supplies includes aeration, settling, and filtering for iron removal and chlorination. Soda ash is added at Karnak for pH adjustment. Fluoride is also added at Pulaski and Ullin.

Wells tapping the Devonian limestone in the bedrock are in use at Mound City, Mounds, and Olmsted. There are presently 4 production wells ranging in depth from 595 to 1000 ft. Their reported yields range from about 100 to 300 gpm. Production from these wells was estimated to be about 550,000 gpd in 1977.

Analyses of water from these three supply systems indicate that the iron content ranges from 0.3 to 1.9 mg/l and the hardness from about 122 to 173 mg/l. The water at Mounds and Olmsted is aerated, settled, and chlorinated and at Mound City the water is chlorinated.

Total municipal pumpage in Pulaski County for 1977 was about 674,400 gpd. Pumpage from wells tapping sand and gravel deposits was about 18 percent (124,400 gpd) of the total and the remaining 82 percent (550,000 gpd) was from wells tapping the Devonian limestone aquifer.

Format

In this publication the descriptions of public groundwater supplies are presented in alphabetical order by place name.

At the beginning of each description, the U. S. Census of population for 1970 is given for incorporated places.

The number of services and quantity of water distributed at each supply are given where available for the earliest and the latest reported values.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

When available, sample study logs prepared by the Illinois State Geological Survey are presented. When these are not

available, drillers logs are used as reported. Commonly used drillers terms such as clay, silt, or pebbly clay generally are synonymous with the glacial tills tabulated by the State Geological Survey. Similarly, limestones or dolomites reported by drillers usually are carbonate rocks which in most of Illinois are dolomitic in composition. When stating the bedrock aquifers tapped by a well, the sample study log provided by the State Geological Survey and the drillers casing record are used to determine the geohydrologic units open to the hole. If only a drillers log is available and the geohydrologic units cannot be readily determined, only the principal rock type as described by the driller is given (dolomite, sandstone, etc.).

The screen sizes given in this publication are for continuous slot-type screens unless stated otherwise. Slot sizes given indicate the width of the slot openings in thousandths of an inch. For example, a 20 slot screen has slot openings 0.020 in. wide and a 100 slot screen has slots 0.100 in. wide. Approximate equivalent slot openings for other types of screens are given in parentheses after the screen description.

ABBREVIATIONS USED

ft.....	foot (feet)
gpd.....	gallons per day
gpm.....	gallons per minute
hp.....	horsepower
hr.....	hour(s)
in.....	inch(es)
Lab.....	laboratory
lb.....	pound(s)
me/l.....	milliequivalents per liter
mg/l.....	milligrams per liter
min.....	minute(s)
No.(s).....	number(s)
OD.....	outside diameter
pc/l.....	picocuries per liter
R.....	range
rpm.....	revolutions per minute
T.....	township
TDH.....	total dynamic head

KARINAK

The village of Karnak (641) installed a public water supply in 1954. One well is in use. In 1958 there were 214 services, all metered; the average and maximum daily pumpages were 20,000 and 30,200 gpd, respectively. In 1977 there were 270 services, all metered; the average and maximum daily pumpages were 49,060 and 53,500 gpd, respectively. The water is chlorinated, aerated, settled, filtered for iron removal, and pH adjusted.

WELL NO. 1, finished in sand and gravel, was completed in June 1953 to a depth of 36 ft by the Diehl Pump & Supply Co., Louisville, Ky. The well is located inside the waterworks building on the south side of Illinois Route 169 just west of the Penn Central RR crossing, approximately 1075 ft S and 1100 ft W of the center of Section 15, T14S, R2E. The land surface elevation at the well is approximately 340 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Top soil	6	6
Muddy sand	9	15
Fine sand	16.5	31.5
Blue clay	.5	32
Medium sand and coarse gravel	4	36

A 12-in. diameter hole was drilled to a depth of 36 ft. The well is cased with 12-in. wrought iron pipe from 1.5 ft above land surface to a depth of 20.5 ft followed by 15.5 ft of 12-in. Cook silicon bronze screen. The screened section consists of 11.5 ft of No. 20 slot followed by 4 ft of No. 60 slot.

A production test using one observation well was con-

ducted on June 10, 1953, by representatives of the driller, the village, the State Water Survey, and W. W. Miller, Consulting Engineer. After 8 hr of intermittent pumping at rates ranging from 86.8 to 50 gpm, the final drawdown was 12.62 ft from a nonpumping water level of 11.20 ft below land surface.

The pumping equipment presently installed is a 6-in., 3-stage Deming vertical turbine pump (Serial No. 17315) set at 25 ft, rated at 75 gpm at about 50 ft head, and powered by a 2-hp 1800 rpm U. S. electric motor (Serial No. 2345095).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A1169) is for a water sample from the well collected July 14, 1976, after 30 min of pumping at 48 gpm.

WELL NO. 1, LABORATORY NO. A1169

		<i>mg/l</i>	<i>me/l</i>			<i>mg/l</i>	<i>me/l</i>
Iron	Fe	2.1		Silica	SiO ₂	26	
Manganese	Mn	0.27		Fluoride	F	0.1	0.00
Ammonium	NH ₄	0.1	0.01	Boron	B	0.4	
Sodium	Na	14.5	0.63	Nitrate	NO ₃	7.7	0.12
Potassium	K	1.0	0.03	Chloride	Cl	20	0.56
Calcium	Ca	18.5	0.92	Sulfate	SO ₄	80	1.04
Magnesium	Mg	8.5	0.70	Alkalinity (as CaCO ₃)		44	0.88
Arsenic	As	0.000					
Barium	Ba	0.0					
Copper	Cu	0.01					
Cadmium	Cd	0.00		Hardness (as CaCO ₃)		85	1.70
Chromium	Cr	0.01					
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Cyanide	CN	0.020		Total dissolved minerals		170	
Zinc	Zn	0.0					

MOUND CITY

The city of Mound City (1177) installed a public water supply in 1932. One well is in use. In 1951 there were 480 services, all metered; the average and maximum daily pumpages were 80,000 and 200,000 gpd, respectively. In 1975 there were 397 services, all metered; the estimated average and maximum daily pumpages were 135,000 and 240,000 gpd, respectively. The water is chlorinated.

WELL NO. 1, open to the Devonian limestone, was completed in December 1900 to a depth of 630 ft by C. O. Wilson, St. Louis, Mo. The well is located just inside the levee on the Ohio River waterfront about 70 ft north of Merritt Court and 150 ft east of Commercial Ave., approximately 200 ft

Nand 1100 ft W of the SE corner of Section 25, T16S, R1W. The land surface elevation at the well is approximately 320 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE, EOCENE, AND CRETACEOUS		
Soil	10	10
Sand and gravel	50	60
Sand, water	300	360
DEVONIAN SYSTEM		
Clear Creek Chert		
Crust of rock	20	380
Flint rock, white	250	630

The well is cased with 8-in. pipe from 0.5 in. above the floor of a pit to a depth of 450 ft.

Upon completion, the well flowed at a rate of 85,000 gpd, but in 1915 it was reported to barely flow over the top. Production tests were reported to show a maximum yield between 650,000 and 700,000 gpd.

In January 1948, the well flowed with about 5 ft of head above land surface from the tap at the well top.

The pumping equipment presently installed consists of three 8.5- by 10-in. Smith-Vaile double-acting triplex pumps, each rated at 350 gpm, and each powered by a 25-hp electric motor. Two of these pumps are operated alternately, and the other pump is operated by manual control as an emergency unit.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B04782) is for a

water sample from the well collected August 2, 1976, after 1 hr of pumping at 500 gpm.

WELL NO. 1, LABORATORY NO. B04782

		mg/l	me/l		mg/l	me/l
Iron	Fe	0.3		Silica	SiO ₂	10
Manganese	Mn	0.02		Fluoride	F	0.9
Ammonium	NH ₄	0.02	0.00	Boron	B	0.2
Sodium	Na	46	2.00	Nitrate	NO ₃	0.0
Potassium	K	5.1	0.13	Chloride	Cl	55
Calcium	Ca	33	1.65	Sulfate	SO ₄	12
Magnesium	Mg	10	0.82	Alkalinity (as CaCO ₃)		140
Arsenic	As	0.00				
Barium	Ba	0.1		Hardness (as CaCO ₃)		124
Copper	Cu	0.00				
Cadmium	Cd	0.00		Total dissolved minerals		278
Chromium	Cr	0.00				
Lead	Pb	0.00				
Mercury	Hg	0.0000				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Cyanide	CN	0.00				
Zinc	Zn	0.0		pH (as rec'd)		7.4

MOUNDS

The city of Mounds (1718) installed a public water supply in 1911. Two wells are in use. In 1949 there were 600 services, 10 percent metered; the estimated average daily pumpage was 200,000 gpd. In 1976 there were 830 services; the average and maximum daily pumpages were 338,000 and 430,000 gpd, respectively. The water is aerated, settled, and chlorinated.

WELL NO. 1 (North Well), open to the Devonian limestone, was completed in 1910 to a depth of 650 ft (reported to be 321 ft deep in 1934). The well is located on the southwest corner of the city just west of the Illinois Central RR, approximately 2470 ft S and 2300 ft W of the NE corner of Section 22, T16S, R1W. The land surface elevation at the well is approximately 320 ft.

The well is cased with 10-in. pipe to a depth of 218 ft.

In 1934, the well reportedly produced 500 gpm for 1 hr with a drawdown of 21 ft from a nonpumping water level of 47 ft.

A production test was conducted by the State Water Survey on November 11, 1963. After 2.8 hr of pumping at an undetermined rate, the drawdown was 12.61 ft from a nonpumping water level of 4.30 ft below the pump station floor. One hr after pumping was stopped, the water level had recovered to 5.83 ft.

The pumping equipment presently installed consists of a 15-hp General Electric motor, a Fairbanks-Morse Pomona turbine pump rated at 300 gpm, and has 100 ft of 6-in. column pipe. A 10-ft section of 6-in. suction pipe is attached to the pump intake.

A mineral analysis made by the Illinois Environmental

Protection Agency (Lab. No. B109592) of a sample collected April 24, 1973, after pumping for 2 hr at 300 gpm, showed the water to have a hardness of 150 mg/l, total dissolved minerals of 244 mg/l, and an iron content of 1.5 mg/l.

From 1911 to 1921, water was also obtained from another well in addition to Well No. 1. This well was originally 650 ft deep (filled to 254 ft in 1921). This well has been abandoned. The well, located south of Well No. 1, was cased with 10-in. pipe to a depth of 218 ft.

In 1911, nonpumping water levels below land surface were 15 ft in one of the wells and 19 ft in the other. In 1913, both wells flowed when not pumping, and the pumping rate from the two wells was reported to be about 1000 gpm. In March 1921, when the wells were reported to be partly filled, Well No. 1 yielded 590 gpm and the other well yielded 400 gpm.

WELL NO. 2 (South Well), open to the Devonian limestone, was completed in August 1921 to a depth of 595.5 ft by Meister Bros., Tuscola. The well is located about 300 ft south of Well No. 1, approximately 2770 ft S and 2300 ft W of the NE corner of Section 22, T16S, R1W. The land surface elevation at the well is approximately 320 ft.

A sample study log of Well No. 2 furnished by the State Geological Survey follows:

Strata	Thickness (ft)	Depth (ft)
PLEISTOCENE, EOCENE AND CRETACEOUS		
Sand and pebbles	55	55
Clay, sandy	75	130
Sand, clayey	25	155
Sand and small pebbles	7	162
Sand, shaly	28	190

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
DEVONIAN SYSTEM		
Clear Creek Chert	405	595

The well is cased with 16-in. OD pipe from land surface to a depth of 20 ft, 12-in. pipe from land surface to a depth of 57 ft, and 10-in. pipe from 17 ft to a depth of 323 ft (bottom 87 ft perforated).

During drilling, this well was shot with 14 lb of 60 percent dynamite at a depth of 542 ft.

Upon completion, the nonpumping water level was reported to be 6 ft below land surface and the well produced 600 gpm.

In January 1934, the well reportedly produced 500 gpm for 1 hr with a drawdown of 22 ft from a nonpumping water level of 14 ft.

On November 11, 1963, the nonpumping water level was 5.52 ft below the pump station floor.

The pumping equipment presently installed consists of a 7½-hp General Electric motor, a Fairbanks-Morse Pomona turbine pump rated at 300 gpm, and has 60 ft of 6-in. column pipe. A 10-ft section of 6-in. suction pipe is attached to the pump intake.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B03950) is for a water sample from the well collected July 27, 1976, after 4 hr of pumping.

WELL NO. 2, LABORATORY NO. B03950

		<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	1.1		Silica	SiO ₂	9.0
Manganese	Mn	0.06		Fluoride	F	0.7
Ammonium	NH ₄	0.27	0.02	Boron	B	0.2
Sodium	Na	41	1.78	Nitrate	NO ₃	0.0
Potassium	K	5.0	0.13	Chloride	Cl	56
Calcium	Ca	45	2.25	Sulfate	SO ₄	16
Magnesium	Mg	12	0.99	Alkalinity (as CaCO ₃)		168
Arsenic	As	0.00				
Barium	Ba	0.1		Hardness (as CaCO ₃)		162
Copper	Cu	0.00				
Cadmium	Cd	0.00		Total dissolved minerals		291
Chromium	Cr	0.00				
Lead	Pb	0.05				
Mercury	Hg	0.0000				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Cyanide	CN	0.00				
Zinc	Zn	0.0		pH (as rec'd)		7.8

OLMSTED

The village of Olmsted (453) installed a public water supply in 1941. One well is in use. In 1950 there were 156 services, 97 percent metered. In 1977 there were about 165 services; the estimated average and maximum daily pumpages were 35,000 and 40,000 gpd, respectively. The water is aerated and settled for hydrogen sulfide and iron removal, and chlorinated.

WELL NO. 1, open to the Devonian limestone, was completed in 1940 to a depth of 1000 ft by C. A. Johnson, Case Engineering Co., St. Louis, Mo. The well is located about 50 ft north of the center of the highway spur about 1200 ft east of Illinois Route 37, approximately 50 ft N and 2000 ft W of the SE corner of Section 22, T15S, R1E. The land surface elevation at the well is approximately 350 ft.

A sample study log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
No samples	20	20
Chert and pebbles	3	23
Eocene SYSTEM		
Clay, sandy and silty	57	80
CRETACEOUS SYSTEM		
Silt, sand and clay	55	135
Sand, some thin clay beds	165	300

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sand and pebbles	37	337
Clay and sand	126	463
MISSISSIPPIAN SYSTEM		
Valmeyeran Series		
Siltstone, chert, thin shale beds	204	667
Kinderhookian Series		
Shale, thin sandstone beds	203	870
DEVONIAN SYSTEM		
Clear Creek Chert, some limestone	130	1000

The well is cased with 10-in. pipe from land surface to a depth of 100 ft, 8-in. pipe from 100 ft to a depth of 250 ft, 6.8-in. pipe from 250 ft to a depth of 473 ft, and 5-in. pipe from about 0.3 ft above the pump station floor to a depth of 871 ft.

A production test was conducted by the State Water Survey on August 1-2, 1940. The nonpumping water level was reported to be 18 to 20 ft below land surface. Pumping water levels were not measured but when pumping at a rate of 38 gpm, the water was not drawn below the end of the suction pipe at a depth of 215 ft.

The pumping equipment presently installed consists of a 5-hp 3500 rpm U. S. Holloshaft electric motor, a 10-stage Jacuzzi turbine pump rated at 98 gpm at about 120 ft TDH, and has 110 ft of 3-in. column pipe.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B109503) is for a water sample from the well collected April 19, 1973, after 2 hr of pumping at about 90 gpm. Hydrogen sulfide was apparent when previous samples were collected.

WELL NO. 1, LABORATORY NO. B109503

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.57	0.02	Silica	SiO ₂	9	
Manganese	Mn	0.03	0.00	Fluoride	F	0.4	0.02
Ammonium	NH ₄	0.4	0.02	Boron	B	0.2	
Sodium	Na	36	1.57	Nitrate	NO ₃	0.0	
Potassium	K	5.0	0.13	Chloride	Cl	57	1.61
Calcium	Ca	39	1.95	Sulfate	SO ₄	18	0.37
Magnesium	Mg	11.5	0.94	Alkalinity(as CaCO ₃)		136	2.72
				Hardness (as CaCO ₃)		145	2.89
Arsenic	As	0.00		Total dissolved minerals		295	
Barium	Ba	0.3					
Copper	Cu	0.00		pH (as rec'd)		6.9	
Cadmium	Cd	0.00		Radioactivity			
Chromium	Cr	0.00		Alpha pc/l		2.6	
Lead	Pb	0.00		± deviation		1.5	
Mercury	Hg	0.0000		Beta pc/l		9.9	
Nickel	Ni	0.0		± deviation		1.9	
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.01					

PULASKI

The village of Pulaski (471) installed a public water supply in 1966. One well (No. 1A) is in use. In 1975 there were 168 services, all metered; the estimated average and maximum daily pumpages in 1974 were 17,000 and 20,000 gpd, respectively. The water is aerated, settled, filtered, softened, chlorinated, and fluoridated.

A test well, finished in sand and gravel, was completed in November 1965 to a depth of 210 ft by Claude McRaven, Jonesboro. The test well was located about 1 mile west of the village, approximately 1413 ft S and 1400 ft E of the NW corner of Section 16, T15S, R1W. The land surface elevation at the well is approximately 337 ft.

A drillers log of the test well follows:

Strata	Thickness (ft)	Depth (ft)
Black gumbo	50	50
Gumbo, some gravel	5	55
Gravel, coarse	5	60
Sand, fine	5	65
Sand, coarse	10	75
Sand, very coarse and water	5	80
Sand, very coarse and lots of water	5	85
Shale	80	165
Yellow clay	5	170
Clay and mud	5	175
Mud and boulders	5	180
Lots of mud and some gravel	5	185
Mud and gravel	5	190
Mud, gravel and boulders	5	195
Some gravel, lots of mud	5	200
Lots of mud and some gravel	5	205
Yellow clay	5	210
Solid rock, hard	8	218

A 7-in. diameter hole was drilled to a depth of 189 ft and finished 6.2 in. in diameter from 189 to 218 ft. The test well was cased with 7-in. pipe from land surface to a depth of 189 ft and equipped with 30 ft (21 ft exposed) of 6-in. No. 40 slot Johnson screen.

A production test was conducted on November 17, 1965, by representatives of the driller, the State Water Survey, and R. A. Nack & Associates, Consulting Engineers. After 20 min of pumping at rates of 45 to 40.5 gpm, the drawdown was 114.0 ft from a nonpumping water level of 12.7 ft below land surface. Eight min after pumping was stopped, the water level had recovered to 28.7 ft. On the basis of the production test data, it was estimated that this test well would yield 15 gpm (21,600 gpd) on a long-term basis.

WELL NO. 1A, finished in sand and gravel, was completed in December 1965 to a depth of 88 ft by Claude McRaven, Jonesboro. The well is located about 1 mile west of the village 12 ft south of the test well, approximately 1425 ft S and 1400 ft E of the NW corner of Section 16, T15S, R1W. The land surface elevation at the well is approximately 337 ft.

A drillers log of Well No. 1A follows:

Strata	Thickness (ft)	Depth (ft)
Gumbo	45	45
Fine sand, some gumbo	10	55
Fine sand	10	65
Fine to medium sand	5	70
Medium sand and some gravel	5	75
Coarse sand	5	80
Coarse gravel and sand	8	88

An 8-in. diameter hole was drilled to a depth of 88 ft. The well is cased with 8-in. pipe from 1.7 ft above land surface to a depth of 68 ft followed by 20 ft of 8-in. Johnson red brass screen. The screened section from top to bottom consists of 6 ft of No. 20 slot, 2 ft of No. 30 slot, 2 ft of No. 60 slot, 7 ft of No. 40 slot, and 3 ft of No. 80 slot.

A production test using one observation well was conducted on December 15, 1965, by representatives of the driller, the State Water Survey, and R. A. Nack & Associates, Consulting Engineers. After 3.2 hr of pumping at a rate of 50 gpm, the final drawdown was 11.99 ft from a nonpumping water level of 14.58 ft below land surface. Ten min after pumping was stopped, the water level had recovered to 14.72 ft. On the basis of the production test data, it was estimated that this well should yield 100 gpm (144,000 gpd) on a long-term basis.

The pumping equipment presently installed is a Johnston pump set at 56 ft, rated at 55 gpm, and powered by a 2-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A12944) is for a

water sample from the well collected December 15, 1976, after 30 min of pumping at 60 gpm.

WELL NO. 1A, LABORATORY NO. A12944

		mg/l	me/l			mg/l	me/l
Iron	Fe	12.5		Silica	SiO ₂	32	
Manganese	Mn	0.14		Fluoride	F	0.2	0.01
Ammonium	NH ₄	2.1	0.12	Boron	B	0.2	
Sodium	Na	13.0	0.57	Nitrate	NO ₃	0.0	0.00
Potassium	K	2.2	0.06	Chloride	Cl	8	0.23
Calcium	Ca	110	5.49	Sulfate	SO ₄	84	1.75
Magnesium	Mg	33.0	2.72	Alkalinity(as CaCO ₃)		370	7.40
Arsenic	As	0.02					
Barium	Ba	0.3		Hardness (as CaCO ₃)		432	8.64
Copper	Cu	0.00					
Cadmium	Cd	0.00		Total dissolved minerals		510	
Chromium	Cr	0.02					
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Cyanide	CN	0.000					
Zinc	Zn	0.00		pH (as rec'd)		7.5	

ULLIN

The village of Ullin (546) installed a public water supply in 1960. One well is in use. In 1977 there were 200 services, all metered; the average and maximum daily pumpages were 47,650 and 52,000 gpd, respectively. The water is chlorinated, aerated, settled, fluoridated, and filtered.

WELL NO. 1, finished in sand and gravel, was completed in July 1959 to a depth of 150 ft by the Layne-Western Co., Kirkwood, Mo. The well is located near the water tower, approximately 600 ft N and 1800 ft W of the SE corner of Section 23, T14S, R1W. The land surface elevation at the well is approximately 340 ft.

A drillers log of Well No. 1 follows:

Strata	Thickness (ft)	Depth (ft)
Top soil	0.5	0.5
Light brown sandy clay	8	8.5
Fine and medium fine sand	11.5	20
Fine and medium sand and layers of clay	22	42
Medium and medium fine sand, some gravel	23	65
Medium and medium fine sand and coarse sand	5	70
Medium and coarse sand, lots of fine sand	8.5	78.5
Medium and coarse sand with clay showing (some gravel)	9.5	88
Medium and coarse sand and gravel	22	110
Medium and coarse sand and gravel, some fine	5	115
Fine and medium sand, blue clay	17	132
Medium and coarse sand and gravel and some fine sand	18	150

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A5905) is for a water sample from the well collected September 13, 1976.

WELL NO. 1, LABORATORY NO. A5905

		mg/l	me/l			mg/l	me/l
Iron	Fe	4.5		Silica	SiO ₂	17	
Manganese	Mn	0.18		Fluoride	F	0.3	0.02
Ammonium	NH ₄	0.7	0.04	Boron	B	0.0	
Sodium	Na	9.5	0.41	Nitrate	NO ₃	0.88	0.01
Potassium	K	1.0	0.03	Chloride	Cl	8	0.23
Calcium	Ca	80	3.99	Sulfate	SO ₄	5	0.10
Magnesium	Mg	20.2	1.66	Alkalinity(as CaCO ₃)		280	5.60
Arsenic	As	0.020					
Barium	Ba	0.32		Hardness (as CaCO ₃)		290	5.80
Copper	Cu	0.00					
Cadmium	Cd	0.00		Total dissolved minerals		310	
Chromium	Cr	0.00					
Lead	Pb	0.00					
Mercury	Hg	0.0001					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Cyanide	CN	0.010					
Zinc	Zn	0.04		pH (as rec'd)		7.3	

A 20-in. diameter hole was drilled to a depth of 150 ft. The well is cased with 16-in. pipe from 6.3 ft above land

surface to a depth of 18 ft and 8-in. pipe from 6.3 ft above land surface to a depth of 140 ft followed by 10 ft of 8-in. No. 5 (0.105 in.) Layne shutter screen. The annulus between the bore hole and the 16-in. casing is filled with cement from 0 to 18 ft, and the annulus between the 16- and 8-in. casings and the bore hole and 8-in. casing-screen assembly is filled with gravel from 1.5 ft above land surface to a depth of 150 ft.

A production test was conducted on July 30, 1959, by representatives of the driller, the village, the State Water

Survey, and Robert Callaghan, Engineer. After 4 hr of pumping at rates of 157 to 300 gpm, the drawdown was 26.73 ft from a nonpumping water level of 9.50 ft below land surface. After pumping had been stopped for 1.8 hr, the water level was 9.59 ft.

The pumping equipment presently installed consists of a 7½-hp 1800 rpm U. S. electric motor (Serial No. 2894389), an 8-in., 4-stage Johnston vertical turbine pump rated at 200 gpm at about 110 ft TDH, and has 50 ft of 5-in. column pipe.