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Public Ground-Water Supplies in Marshall County

by DOROTHY M. WOLLER, MICHAEL L. SARGENT, ROBERT D. OLSON
and ELLIS W. SANDERSON

ILLINOIS STATE WATER SURVEY
CHAMPAIGN
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PUBLIC GROUND-WATER SUPPLIES IN MARSHALL COUNTY

by Dorothy M. Woller, Michael L. Sargent,¹ Robert D. Olson, and Ellis W. Sanderson

INTRODUCTION

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

This report includes separate descriptions for 13 ground-water supplies furnishing water to nine municipalities, two mobile home parks, one water company, and one utility corporation in Marshall County. These are preceded by brief summaries of the ground-water hydrology and geology of the county and the development of ground-water sources for public use. An explanation of the format used in the descriptions is also given.

Acknowledgments. This report was prepared under the general direction of Richard G. Semonin, Chief of the Illinois State Water Survey, and John M. Shafer, Head of the Hydrology Section. John W. Brother, Jr., supervised the preparation of the illustrations. The annual pumpage information was provided from the Water Use Inventory Program. The chemical analyses, unless otherwise stated, were made by personnel of the Water Survey Chemistry Division under the supervision of Mark E. Peden. The analyses made by personnel of the Illinois Environmental Protection Agency were under the supervision of Roger Selburg. Ross D. Brower, Associate Geologist, Illinois State Geological Survey, reviewed the geological information in the manuscript. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

GROUND-WATER GEOLOGY AND HYDROLOGY

The ground-water geology and hydrology of Marshall County are described generally in Illinois State Water Survey Contract Report 208, "Groundwater Conditions and River-Aquifer Relationships along the Illinois Waterway"; Illinois State Geological Survey Circular 248, "Ground-water Geology in East-Central Illinois"; Circular 422, "Geology Related to Land Use in the Hennepin Region"; and Circular 478, "Geology along the Illinois Waterway."

The following brief discussion of geologic and hydrologic conditions in the county is based in part on these publications. More detailed information about specific

aspects of the geology in this part of the state may be obtained from the Illinois State Geological Survey and its publications. More detailed information about specific aspects of ground-water hydrology and water quality not covered here may be obtained from the Illinois State Water Survey. The Surveys are located on the campus of the University of Illinois at Urbana-Champaign.

Unconsolidated Deposits

Physiographically, Marshall County lies in the Bloomington Ridged Plain area of the Till Plains Section,

¹Illinois State Geological Survey

Central Lowland Province. Glaciation has modified the ancient surface topography that was dominated by the ancient Mississippi Valley, a major bedrock valley system occupied by the ancestral Mississippi River. In particular, the entire county was glaciated by the most recent major ice advance in Illinois, the Wisconsinan glaciation. As the glacial ice melted, the area was blanketed with the rock debris from the glacier, leaving a succession of glacial deposits or drift. In Marshall County these deposits form a series of broad morainic ridges trending roughly north-south. Broad lower lying areas of gently undulating ground moraine are located between these ridges. In addition, areas along and east of the Illinois River were subjected to major ice melt runoff as the glacial fronts retreated to the east and north. Thick outwash and alluvial materials were deposited, but the land surface in these otherwise relatively flat areas has been dissected by the more recent drainage system.

Thick deposits of wind-blown silt called loess cover the glacial deposits in the entire county, except for a small area in the northeast where bedrock is exposed and a belt 2 to 3 miles wide along the west side of the Illinois River Valley where Pennsylvanian strata are close to the surface and crop out in bluffs along streams and on hillsides. The

loess is generally thickest along the Illinois River and thins away from it. Most of the county west of the river has loess deposits that range in thickness from 8 to 12 ft. Just east (windward) of the river valley in a narrow band about 2 miles wide, the loess thickens, ranging from 12 to 15 ft or more. The loess thins gradationally eastward to about 5 ft thick along the line between Marshall and LaSalle Counties.

Thick deposits of glacial drift have accumulated in the preglacial bedrock valleys concealing much of the bedrock topography. However, the Middle Illinois Valley, a segment of the main trunk of the ancient Mississippi Valley prior to Wisconsinan glaciation and also the largest, deepest bedrock valley in the county, closely conforms to the present-day channel of the Illinois River. The Middle Illinois Valley parallels the present Illinois River Valley and extends eastward from the river's position about 6 to 8 miles. Among the units deposited there is part of the Banner Formation, the Sankoty Sand Member, which is a very important water-yielding stratum in the Prairie Aquigroup. Total drift thickness exceeds 300 ft most of the way across the county in the thalweg of the Middle Illinois Valley (figure 1).

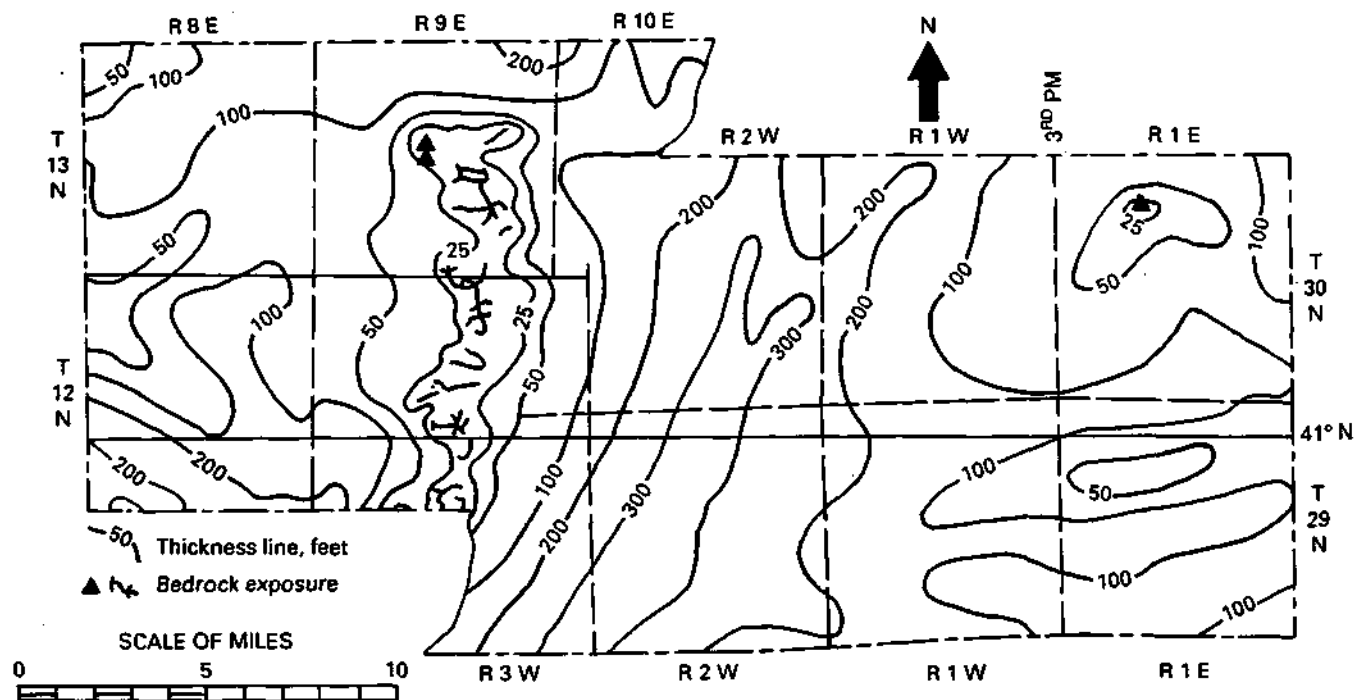


Figure 1. Thickness of glacial drift in the Marshall County area (modified from Piskin and Bergstrom, 1975, ISGS-C490)

The buried Wyoming Bedrock Valley, a tributary of the ancient Mississippi Valley, extends northwestward across the southwest corner of T12N, R8E in the southwest corner of the county. Drift thickness in the Wyoming Valley is commonly 200 ft or more in the Marshall County segment; some wells have encountered more than 300 ft of drift. The surface topography in the moraines over the Wyoming Valley shows a sag of about 100 ft.

Except for the limited outcrop areas and the buried preglacial-valley system discussed above, drift thicknesses in Marshall County range from 50 to 100 ft (figure 1). But in the area surrounding bedrock exposures, especially the belt of numerous exposures west of the Illinois River Valley, drift thicknesses are generally less than 25 ft.

Glacial deposits are dominated by tills with numerous stringers and thin discontinuous lenses of glacial outwash composed mostly of sand and gravel. All surficial deposits and most other glacial deposits in Marshall County are Wisconsinan age. In the deeper parts of bedrock valleys, there are Illinoian and pre-Illinoian age glacial deposits buried beneath Wisconsinan drift.

The most favorable areas for developing ground-water supplies from the Prairie Aquigroup (water-bearing sand and gravel deposits) are generally within the bedrock valleys where the drift is thick. In these areas, glacial meltwater frequently deposited clean sand and gravel that has since been buried beneath more recent deposits of drift or alluvium. Such deposits provide the ground-water supplies for Henry, Sparland, Lacon, LaRose, Varna, and Wenona.

The Middle Illinois Bedrock Valley contains extensive deposits of permeable sand and gravel that occur along the present Illinois River Valley and extend several miles eastward from the river. In these areas, the thickness of the sand and gravel deposits may reach or exceed 100 ft. The Sankoty Sand forms the base of the glacial deposits in this bedrock valley.

Well-pumping test results indicate that these sand and gravel deposits generally are highly permeable and can support large withdrawals of ground water. Municipal, industrial, and irrigation supplies can usually be obtained from the Sankoty Sand. Well yields may approach or exceed 500 gpm in the more favorable areas.

In the Illinois River Valley, the Sankoty Sand Member is overlain by younger glacial outwash and alluvial deposits that often contain permeable sand and gravel, but outside the river valley it is overlain by much less permeable till. Locations where shallow sand and gravel deposits occur typically coincide with areas of high ground-water recharge. The shallower sand and gravel deposits are also dependable sources of ground water in the valley where these deposits are saturated.

The Wyoming Buried Bedrock Valley contains deposits of sand and gravel that may offer potential for development of small municipal supplies. Records of domestic and farm wells in this area indicate the thickness of the sand and gravel deposits ranges from 5 to over 20 ft. However, little quantitative information concerning the yield capability of this resource is available. Substantial amounts of methane gas have been reported from many of the wells tapping these deposits.

Few significant water-bearing sand and gravel deposits are contained in the drift outside of the bedrock valley systems and the Illinois River bottomlands, particularly where the drift is less than 50 ft thick. Typically, the sand and gravel deposits encountered are discontinuous or severely limited in areal extent and are capable of yielding only enough ground water for domestic and farm supplies.

Bedrock

Upper Bedrock Aquigroup

Immediately below the glacial deposits throughout the county lie strata of the Pennsylvanian System (figure 2). These strata are hydrostratigraphically assigned to the Upper Bedrock Aquigroup and are composed mostly of shale with a few thin water-yielding beds of sandstone and fractured limestone (figure 3). Although the water-yielding potential from the Pennsylvanian formations is largely untested, they normally are not considered dependable sources of municipal ground-water supplies in Marshall County. Typically, yields from wells 100 to 300 ft deep are barely adequate for domestic and small farm supplies, and they are only used as a last resort when a suitable supply is not available from the unconsolidated deposits. Below about 300 ft, the water may become too mineralized for most uses. Currently, no public water system uses the Upper Bedrock Aquigroup for a supply. The Camp Grove Public Water System originally obtained a part of its supply from wells finished in the Pennsylvanian rocks. However, these wells have been disconnected from the system due to their low productivity (less than 10 gpm, long term).

The Pennsylvanian is thickest in the north-south band along the east end of the county where the Bond Formation is preserved (figure 2). In this band, it reaches a maximum thickness of about 600 ft in the south-central part of T29N, R1E. To the west this aquigroup thins dramatically below the Middle Illinois Bedrock Valley. Both the Bond and Modesto Formations and the upper part of the Carbondale Formation are eroded in this area.

Mississippi Valley Aquigroup

Dolomites and the overlying confining shale of the Mississippi Valley Aquigroup (Silurian and Devonian Systems, figure 3) occur directly below the Upper Bedrock Aquigroup in nearly all of Marshall County. The exception is a thin Mississippian limestone occurring directly below the Pennsylvanian in the southwestern corner of the county. However, this limestone is of little importance for public water supplies. A 10- to 15-mile-wide band of shales in the Upper Devonian Series extends from the northwest corner across the southern part of the county. In this area these relatively impermeable strata restrict flow between the Upper Bedrock and the Mississippi Valley Aquigroups.

In the remaining area of the county to the north and east, dolomites of the Silurian System and Middle Devonian Series occur directly below Pennsylvanian strata (figure 3). In this area, Pennsylvanian shales limit ground-water movement between aquifers of the Upper Bedrock and Mississippi Valley Aquigroups.

The Middle Devonian thins toward the northeast from its full thickness of 70 to 90 ft (where it is overlain by Upper Devonian) to a featheredge, beyond which it has been completely eroded. Past studies have shown that the

Middle Devonian rocks in this area contribute little if any water to wells.

Regional trends suggest that the thickness of the underlying Silurian dolomite ranges from approximately 300 ft in the south-central part, to 400 ft in the northwest, and more than 500 ft in the northeast corner of Marshall County. Actual penetrations of the Silurian are reported to range from 410 ft in Hopewell Well No. 5 to 585 ft in Varna Well No. 2. The 585-ft penetration in Varna and the 545 ft encountered in Toluca Well No. 2 probably include substantial amounts of Devonian, but they are at or near the maximum thickness of Silurian that occurs in Marshall County. The Silurian shows a trend of thickening in the northeast area, but the resultant thickness of Silurian and Middle Devonian rocks is difficult to predict because of pre-Pennsylvanian erosion.

The Silurian dolomite is an important aquifer in many northern Illinois areas where it is highly fractured and crevassed and can receive adequate recharge. However, the degree of fracturing usually is much less, and recharge is low in areas such as those found throughout Marshall County where the Silurian is overlain by Pennsylvanian or Devonian Rocks. The resulting productivity of the Silurian in these areas is typically low and water quality is poor. As an example, Camp Grove Well No. 3, the only

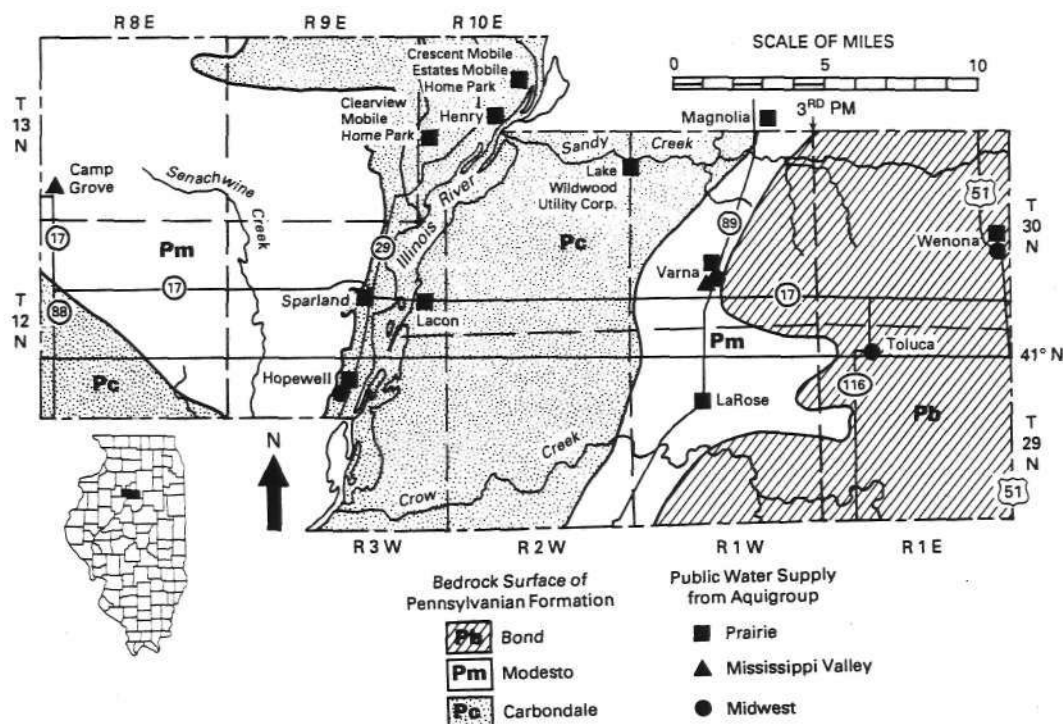


Figure 2. Locations of public ground-water supplies by producing aquigroup and geologic map of the bedrock surface in Marshall County (modified from Willman et al., 1967, Geologic Map of Illinois)

SYSTEM	SERIES	GROUP OR FORMATION	AQUIGROUP	LOG	THICKNESS (FT)	DESCRIPTION	
QUATERNARY	PLEISTOCENE		Prairie Aquigroup		0-310	Unconsolidated glacial deposits-pebbly clay (till), silt, sand and gravel Alluvial silts and sands along streams	
PENNSYLVANIAN	MISSOURIAN	Bond and Modesto	Upper Bedrock Aquigroup		200-600	Shale, sandstone, clay, limestone, and coal	
	DES MOINESIAN	Carbondale and Spoon					
DEVONIAN	UPPER	New Albany	Mississippi Valley Aquigroup		0-100	Shale, gray to black, some green; generally fissile	
	MIDDLE	Cedar Valley			0-90	Limestone, pure, fine to coarse, coarsening upward, some beds argillaceous, fossiliferous at top	
Wapsipinicon							
SILURIAN	NIAGARAN	Racine			reef	Dolomite, very pure to argillaceous, silty, cherty; reefs in upper part	
		Sugar Run			225-430	Dolomite, slightly argillaceous and silty	
		Joliet				Dolomite, very pure to shaly and shale, dolomitic; white, light gray, green, pink, maroon	
	ALEXANDRIAN	Kankakee				Dolomite, pure top 1'-2', thin green shale partings, base glauconitic	
		Elwood			50-70	Dolomite, slightly argillaceous, abundant layer white chert	
		Wilhelmi				Dolomite, gray, argillaceous and becomes dolomitic shale at base	
ORDOVICIAN	CINCINNATIAN	Maquoketa			Midwest Aquigroup		155-200
	CHAMPLAINIAN	Ottawa Supergroup	Galena	330-380			Limestone, cherty (lower part) Limestone, shale partings, speckled Limestone, cherty, sandy at base
			Platteville				
		Glenwood					
		St. Peter	120-180	Sandstone, fine and coarse grained; little dolomite; shale at top Sandstone, fine to medium grained; locally cherty red shale at base			
	CANADIAN	Shakopee		500-600			Dolomite, sandy, cherty (oolitic); sandstone
		New Richmond					Sandstone interbedded with dolomite
		Oneota					Dolomite, white to pink, coarse grained cherty (oolitic)
		Gunter					Sandstone, medium-grained, slightly dolomitic

Figure 3. Generalized column of rock stratigraphic units and aquigroups in Marshall County

public water-supply well in Marshall County finished solely in the Silurian rocks, is capable of yielding only about 20 gpm of marginal-quality water.

Midwest Aquigroup

Four public water-supply systems in Marshall County (Hopewell, Toluca, Varna, and Wenona) have wells open to the Midwest Aquigroup (Ordovician System), the deepest bedrock unit producing potable water in the county (figure 2). Their penetration into the Midwest Aquigroup ranges from 650 ft at Varna to over 700 ft at Wenona. These wells are open to dolomites of the Galena and Platteville Groups and the Glenwood-St. Peter Sandstone. No well penetrates the deeper parts of this aquigroup because water quality is thought to dramatically deteriorate with increasing depth below the St. Peter Sandstone. Instead, wells reach depths of 110 to 170 ft into the St. Peter Sandstone (total depths, 1775 to 1874 ft), always stopping before reaching the basal Kress Member, a problematic unit in many wells elsewhere. All thicknesses of units are consistent with regional trends, so no unusual geological conditions have been encountered or are expected in future well drilling.

The Maquoketa Group (figure 3) occurs at the top of the Midwest Aquigroup. It is composed mostly of shale with minor dolomites, argillaceous and silty dolomites, and dolomitic shales. These strata have characteristically low hydraulic conductivities that result in the Maquoketa acting as the confining unit at the top of the Midwest Aquigroup. The Maquoketa is present throughout the county and ranges from a minimum known thickness of 155 ft at Toluca to a known maximum thickness of 194 ft at Wenona.

The Galena and Platteville Groups (Ottawa Supergroup), which occur immediately below the Maquoketa, are also present throughout the county (figure 3). They form a thick succession of relatively pure limestones with minor shaly partings and zones, and range in penetrated thickness from 358 ft at Varna to 380 ft at Wenona.

Regional trends and deep penetrations in adjacent counties show the total thickness of the Ottawa Supergroup ranges from about 330 ft in the northwest part of the county to 380 ft along the east side. These units seldom yield much water, but wells are generally left open through them because, historically, they have not caused problems.

Below the Platteville is the Glenwood-St. Peter Sandstone, the deepest and most productive part of the Midwest Aquigroup from which water is produced in Marshall County (figure 3). The top of the Glenwood is encountered at depths of 1635 ft at Hopewell to 1759 ft at Varna. Regionally, depths will vary because of both changes in surface elevation and structural variation of the unit. Elevations on top of the Glenwood Formation, however, vary from approximately -800 ft (below sea level) in the northeast part of the county to a minimum elevation of -1100 ft in the south-central part of the east half of the county. Along the east side of the county, the elevation on top of Glenwood rises to about -1000 ft due to the LaSalle Anticline. Because none of the wells within the county completely penetrate the St. Peter, direct evidence for its full thickness is not available. Wells within the county do, however, provide minimum thickness; and nearby wells located outside the county provide projections of thickness that range from 120 to 190 ft for the county.

Most wells in Marshall County that tap the Galena and Platteville Groups and Glenwood-St. Peter Sandstone formations of the Midwest Aquigroup are pumped at rates of about 100 to 300 gpm. The specific capacities of these wells usually range from about 0.5 to 3 gpm/ft with most near the lower end of this range. Some wells with low specific capacities have been improved after shooting with explosives.

Although the water from these units is considered potable, it is only marginally so due to the high degree of mineralization. In addition, radioactivity from radium or other sources often naturally occurs in water from the St. Peter Sandstone in Marshall County. The level of radioactivity may be sufficient to warrant treatment for removal before using this water for human consumption.

GROUND-WATER DEVELOPMENT FOR PUBLIC USE

Ground water is used as a source for 13 public water supplies serving Camp Grove, Clearview Mobile Home Park, Crescent Mobile Estates Mobile Home Park, Henry,

Hopewell, Lacon, Lake Wildwood Utility Corporation, LaRose, Magnolia, Sparland, Toluca, Varna, and Wenona. The locations of these supplies are shown in figure 2.

Sand and gravel deposits in the unconsolidated materials of the Prairie Aquigroup are tapped at Clearview Mobile Home Park, Crescent Mobile Estates Mobile Home Park, Henry, Lacon, Lake Wildwood Utility Corporation, LaRose, Magnolia, Sparland, Varna (No. 3) and Wenona (No. 4) as a source of all or a portion of their water supply. There are presently 18 production and standby wells finished in this aquifer ranging in depth from 33 to 305 ft. Their reported pumping rates range from 40 to 600 gpm depending 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 1989 was estimated to be about 1,055,000 gpd. Analyses of water from these wells show that the iron content ranges from 0.0 to 7.6 mg/L, hardness from 300 to 633 mg/L, nitrates from 0.0 to 443 mg/L, sulfates from 0.0 to 385 mg/L, and total dissolved minerals from 360 to 864 mg/L. Water for Henry, Lacon, Lake Wildwood Utility Corporation Well No. 1, Sparland, and Varna is chlorinated and fluoridated. At LaRose and Magnolia, the water is aerated, filtered, chlorinated, and fluoridated. The water from Clearview Mobile Home Park, Crescent Mobile Estates Mobile Home Park, and Wenona Well No. 4 is not treated.

Deeper lying bedrock aquifer units are tapped for water supplies at Camp Grove, Hopewell, Toluca, Varna (No. 2), and Wenona (No. 5). In these wells, various combinations of the Mississippi Valley Aquigroup (Silurian System) and the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone) are open to the borehole with each contributing a portion of the water withdrawn. Water obtained from many of these bedrock aquifers in Marshall County is normally highly mineralized with one or more mineral constituents exceeding the primary or secondary standards of the U.S. Environmental Protection Agency Interim Drinking Water Regulations. Fluoride, sulfate, chloride, and the total mineral content are among the constituents that may be greater than the allowable or recommended limits. Sufficient data are not available to determine the specific aquifer unit that contributes water with the greatest concentration of each mineral.

The Mississippi Valley Aquigroup (dolomite of the Silurian System) has been tapped as the primary source of

supply at Camp Grove. A well at Varna is open to the Silurian dolomite as well as to deeper aquifer units. The Camp Grove well, open only to the Mississippi Valley Aquigroup (Silurian System), is 825 ft deep and is reportedly pumped at 21 gpm. The estimated production for Camp Grove was 7250 gpd in 1989. Analyses of water from this well indicate that the iron content ranges from a trace to 0.65 mg/L, hardness from 41 to 65 mg/L, chlorides from 630 to 700 mg/L, sodium from 670 to 730 mg/L, fluorides from 2.22 to 2.8 mg/L, and total dissolved minerals from 1785 to 1872 mg/L. Hydrogen sulfide gas was also noted in water from this well. Water for Camp Grove is aerated.

The upper part of the Midwest Aquigroup (dolomites of the Galena and Platteville Groups and the Glenwood-St. Peter Sandstone) are tapped as a source of water for Hopewell, Toluca, Varna (No. 2), and Wenona (No. 5). There are presently five production and standby wells finished in these aquifers at depths ranging from 1773 to 1870 ft, including Varna Well No. 2, which is also open to the Mississippi Valley Aquigroup (Silurian System). Their reported pumping rates range from about 150 to 300 gpm. Production in 1989 from these wells was estimated to be about 298,000 gpd. Analyses of water from these wells indicate that the iron content usually ranges from about 0.1 to 2.0 mg/L, hardness from 151 to 324 mg/L, sulfates from 158 to 400 mg/L, chlorides from 209 to 785 mg/L, sodium from 340 to 650 mg/L, fluoride from 1.2 to 3.0 mg/L, and the total dissolved minerals from 1130 to 1970 mg/L. Water from Hopewell and Toluca is chlorinated, and the water from Wenona Well No. 5 is chlorinated and filtered. The water from Varna Well No. 2 is not treated.

The total public water-supply pumpage from the aquifers in Marshall County for 1989 was about 1.4 million gallons per day (mgd). Of this total, approximately 77 percent (1,055,000 gpd) was obtained from wells tapping sand and gravel aquifers of the Prairie Aquigroup, less than 1 percent (7250 gpd) from wells finished only in the Mississippi Valley Aquigroup (Silurian System), and about 22 percent (298,000 gpd) from wells finished in the Midwest Aquigroup (dolomites of the Galena and Platteville Groups and the Glenwood-St. Peter Sandstone).

FORMAT

In this publication the descriptions of public ground-water supplies are presented in alphabetical order by facility name.

At the beginning of each description the U.S. Census of population for 1980 is given for incorporated areas. For unincorporated areas, population is estimated by the number of services or residential units and an assumed number of 3.5 persons per service.

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

The land surface elevations are estimated from U.S. Geological Survey topographic maps.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer or aquifers 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. Most of the limestones or dolomites reported by drillers yielding fresh water in Illinois are carbonate rocks, dolomitic in composition. When the bedrock aquifers tapped by a well are described, 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 well. When samples are not available for log entry, the driller's terminology is used and indicated by quotation marks. 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

est	estimated
ft	foot (feet)
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
hr	hour(s)
ID	inside diameter
in	inch(es)
Lab	laboratory
lb	pound(s)
me/L	milliequivalents per liter
mgd	million gallons per day
mg/L	milligrams per liter
min	minute(s)
No.(s)	number(s)
pc/L	picocuries per liter
pop	population
rpm	revolutions per minute
T	township
TDH	total dynamic head

CAMP GROVE

The village of Camp Grove (est. pop. 100) installed a public water supply in 1938. The water system is owned and operated by the Camp Grove Water Co. One well (No. 3) is in use. In 1951 there were 40 services, none metered; the estimated average pumpage in 1983 was 7000 gpd. In 1990 there were 50 services, 94 percent metered; the average and maximum pumpages were 5495 and 7500 gpd, respectively. The water is aerated.

WELL NO. 1, open to sandstone of the Upper Bedrock Aquigroup, (Pennsylvanian System), was completed in 1938 to a depth of 268 ft by Chris Ebert, Washington. This well has not been used for several years and has been disconnected from the system. The well is located about 0.5 block southeast of the bank building, approximately 800 ft N and 3240 ft W of the SE corner of Section 30, T13N, R8E. The land surface elevation at the well is approximately 850 ft.

The well is cased with 4-in. pipe from about 4 ft above the floor of a 7-ft deep pit to a depth of about 250 ft.

The pumping equipment presently installed is a Fairbanks Morse cylinder pump rated at 5 gpm, and powered by a 3-hp Fairbanks Morse electric motor.

WELL NO. 2, open to sandstone of the Upper Bedrock Aquigroup (Pennsylvanian System), was completed in 1953 to a depth of 265 ft by C.H. Rogers, Knoxville. This well was disconnected from the system about 1973, and the well site property was returned to the original owner. The well is located approximately 950 ft N and 3400 ft W of the SE corner of Section 30, T13N, R8E. The land surface elevation at the well is approximately 850 ft.

The well is cased with 6-in. pipe from about 15 ft above a concrete slab to an unknown depth.

WELL NO. 3, open to dolomite of the Mississippi Valley Aquigroup (Silurian System), was completed in April 1965 to a depth of 825 ft by Jerry H. Wakefield, Kewanee. The well is located approximately 650 ft N and 3050 ft W of the SE corner of Section 30, T13N, R8E. The land surface elevation at the well is approximately 850 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	14	14
Sandy brown day	16	30
Brown clay	28	58
Clay and boulders	20	78
Sandy gray clay	72	150
Sand and gravel	30	180

<i>Strom</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sandy blue clay	30	210
Blue clay, gas, sea mud	12	222
Red and brown clay coal	18	240
Black to gray shale	297	537
Sandrock	14	551
Shale	29	580
Gray sandstone	20	600
Limerock	20	620
Shale	61	681
Brown lime	10	691
Gray lime	45	736
Light gray lime	50	786
Light gray lime to white sandrock	24	810
Coarse sandrock	15	825

An 8-in. diameter hole was drilled to a depth of 572 ft, reduced to 7 in. between 572 and 735 ft, and finished 5 in. in diameter from 735 to 825 ft. The well is cased with 7-in. OD pipe from about 2 ft above land surface to a depth of 572 ft and 6-in. OD pipe from 555 ft to a depth of 735 ft.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. C006331) is for a water sample from the well collected June 22, 1977. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 3, LABORATORY NO. C006331

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.1		Silica	SiO ₂	10	
Manganese	Mn	0.00		Fluoride	F	2.5	0.13
Ammonium	NH ₄	1.7	0.09	Boron	B	1.7	
Sodium	Na	670	29.14	Cyanide	CN	0.00	
Potassium	K	7.7	0.20	Nitrate	NO ₃	0.13	0.00
Calcium	Ca	16	0.80	Chloride	Cl	650	18.33
Magnesium	Mg	6	0.49	Sulfate	SO ₄	192	3.99
				Alkalinity (as CaCO ₃)		428	836
Arsenic	As	0.000					
Barium	Ba	0.0		Hardness (as CaCO ₃)		65	1.30
Cadmium	Cd	0.00					
Chromium	Cr	0.00		Total dissolved minerals		1872	
Copper	Cu	0.01					
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.0					
Zinc	Zn	0.01		pH (as rec'd)		9.9	

A production test was conducted on October 5, 1965, by representatives of the Camp Grove Water Co., the State Water Survey, and the Wallace Engineering Co. After 23

hr of pumping at rates ranging from 22.6 to 20.8 gpm, the final drawdown was 14.5 ft from a nonpumping water level of 344.5 ft below the top of the casing. Substantial recovery was reportedly observed 1 min after pumping was stopped.

The pumping equipment presently installed is a Red Jacket submersible pump (Model No. 500T417DC) set at

462 ft, rated at 21 gpm, and powered by a 5-hp electric motor.

A 6-in. diameter test hole was constructed in February 1977 to a depth of 625 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The hole was located approximately 1110 ft N and 1715 ft E of the SW corner of Section 30, T13N, R8E.

CLEARVIEW MOBILE HOME PARK

Clearview Mobile Home Park (est. pop. 50), is located about 3 miles southwest of Henry. The water system is owned by Freda Abbott and operated by Deanna Stephens. One well is in use. In 1981 there were 57 services; the average pumpage was 6849 gpd. In 1990 there were 57 services (15 occupied), none metered; the average pumpage was 2600 gpd. The water is not treated.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in 1970 to a depth of 113 ft. The well is located west of Illinois Route 29 in the

northwest corner of the park, approximately 2250 ft N and 1350 ft E of the SW corner of Section 19, T13N, R10E. The land surface elevation at the well is approximately 512 ft.

The well is cased with 6-in. pipe from about 0.8 ft above land surface to an unknown depth.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 80 gpm, and powered by a 10-hp electric motor. The well is equipped with 97 ft of airline.

CRESCENT MOBILE ESTATES MOBILE HOME PARK

Crescent Mobile Estates Mobile Home Park (est. pop. 180), located about 0.5 mile northeast of Henry, installed a public water supply in 1965. The water system is owned by Walter Harmon and operated by Thomas Maubach. One well (No. 1) is in use and another well (No. 2) is available for emergency use. In 1990 there were 24 services, none metered; the average pumpage in 1988 was 3700 gpd. The water is not treated.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in 1965 to a depth of 80 ft by A.R. Tuttle. The well is located on a playground by the ground storage building, approximately 2450 ft N and 650 ft W of the SE corner of Section 9, TUN, R10E. The land surface elevation at the well is approximately 493 ft.

The well is cased with 8-in. pipe from about 1 ft above land surface to an unknown depth.

In 1984, this well was shock chlorinated by Norm Barger.

The pumping equipment presently installed is a Goulds submersible pump set at 60 ft, rated at 40 gpm, and powered by a 3-hp electric motor.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1967 to a depth of 80 ft by Acme Well Drilling, East Peoria. This well is available for emergency use. The well is located southeast of Well No. 1 on a playground by the ground storage building, approximately 2400 ft N and 550 ft W of the SE corner of Section 9, T13N, R10E. The land surface elevation at the well is approximately 493 ft.

WELL NO. 2, DRILLERS LOG

<i>Stratum</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sand	80	80

The well is cased with 6-in. steel pipe from about 1 ft above land surface to a depth of 74 ft followed by 6 ft of 6-in. No. 12 slot screen.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 40 gpm and powered by a 3-hp electric motor.

HENRY

The city of Henry (pop. 2740) installed a public water supply in 1902. Two wells (Nos. 4 and 5) are in use and another well (No. 3) is available for emergency use. In 1950 there were 762 services, none metered. In 1990 there were 1150 services; 2 percent metered; the average and maximum pumpages were 379,400 and 476,000 gpd, respectively. The water is fluoridated and chlorinated.

Initially, water was obtained from two wells constructed in 1902 to a depth of 40 ft each by the National Construction Co., South Bend, Indiana. These wells were abandoned and sealed prior to 1938. The wells were located 8 ft apart in the pumping station about 200 ft from the Illinois River bank in the SE quarter of Section 16, T13N, R10E. The wells were 8 in. in diameter, cased with 8-in. pipe from about 8 ft below the pump-station floor within a pit, and 8-ft Johnson strainers were placed at the bottom of each well.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was constructed in 1903 to a depth of 40 ft (reported to be 22 ft deep in 1938) by Frank Dennis. This well was abandoned in 1945 and sealed prior to 1958. The well was located about 10 ft east of the initial wells, approximately 1600 ft N and 1130 ft W of the SE corner of Section 16, T13N, R10E. The land surface elevation at the well is approximately 460 ft.

An 8-ft diameter hole was dug to a depth of 22 ft and finished 5 ft in diameter from 22 to 40 ft. The well was lined with brick laid in cement mortar to a depth of 10 ft and with open joints from 10 ft to a depth of 40 ft.

In February 1934, the well reportedly produced 500 gpm for 3 hr with a drawdown of 4 ft from a nonpumping water level of 20 ft below the well curb.

In July 1938, this well was reported to be 22 ft deep and could be pumped dry during the summer months.

A mineral analysis of a sample (Lab. No. 83957) collected July 27, 1938, showed the water to have a hardness of 399 mg/L, total dissolved minerals of 522 mg/L, a nitrate content of 32.1 mg/L, and an iron content of 0.12 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was constructed in 1928 to a depth of 40 ft and deepened in 1930 to a reported depth of 62 ft by Fred Bickerman, Henry. This well was abandoned prior to 1974. The well is located about 20 ft southeast of the pumping station, approximately 1590 ft N and 1150 ft W of the SE corner of Section 16, TON, R10E. The land surface elevation at the well is approximately 460 ft.

The well is cased with 8-in. pipe from below the well-house floor to a depth of 48 ft followed by 14 ft of No. 30 slot screen.

In July 1938, the nonpumping water level was reported to be 18 ft below land surface.

A mineral analysis of a sample (Lab. No. 108854) collected January 8, 1947, showed the water to have a hardness of 353 mg/L, total dissolved minerals of 436 mg/L, a nitrate content of 36.2 mg/L, and a trace of iron.

WELL NO. 3, finished in sand and gravel of the Prairie Aquigroup, was completed in 1936 to a depth of 62 ft by Mike Schwiderski, Henry. The well is located about 30 ft northeast of the pumping station, approximately 1925 ft N and 1080 ft W of the SE corner of Section 16, T13N, R10E. The land surface elevation at the well is approximately 460 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Hardpan	16	16
Gravel	21	37
Sand and gravel	11	48
Sand	2	50
Sand and gravel	4	54
Sand	8	62

The well is cased with 12-in. pipe from the wellhouse floor to a depth of 48 ft followed by 14 ft of No. 30 slot screen.

In July 1938, the well reportedly produced 550 gpm with a drawdown of 24 ft from a nonpumping water level of 18 ft below land surface.

The pumping equipment presently installed consists of a 40-hp, 1800 rpm U.S. electric motor (Serial No. 136323) and a 12-in., 4-stage American Well Works turbine pump (Serial No. 60199) set at 40 ft, rated at 500 gpm at about 220 ft TDH, and equipped with 40 ft of 6-in. column pipe. A 10-ft section of 8-in. suction pipe is attached to the pump intake.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B144194) of a sample collected June 17, 1975, after pumping for 2 hr at 500 gpm, showed the water to have a hardness of 389 mg/L, total dissolved minerals of 572 mg/L, a nitrate content of 352 mg/L, and an iron content of 0.0 mg/L.

WELL NO. 4, finished in sand and gravel of the Prairie Aquigroup, was completed in 1944 to a depth of 74 ft by

H.W. Packard, Washburn. The well is located about 20 ft northwest of the pumping station, approximately 1900 ft N and 1205 ft W of the SE corner of Section 16, T13N, R10E. The land surface elevation at the well is approximately 460 ft.

WELL NO. 4, SAMPLE STUDY LOG
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
QUATERNARY SYSTEM		
Pleistocene Series		
Wisconsin Stage		
Soil, sandy, gravelly, leached, dark brown	10	10
Sand, medium to coarse, gravelly, salty, slightly calcareous, oxidized, rounded, polished grains, brown	5	15
Sand and gravel, mixed lithology, oxidized yellowish-brown	25	40
Pre-Illinoian Stage		
Sankoty Sand		
Sand, medium, well-sorted, numerous rounded, polished, frosted pink grains, pink, dean	5	45
Same, medium to coarse, gravelly	15	60
Gravel, up to 3/8 in.	14	74
PENNSYLVANIAN SYSTEM		
Shale, carbonaceous, silty, dark gray; this doesn't check with other wells at same location		at 74

A 12-in. diameter hole was drilled to a depth of 74 ft. The well is cased with 12-in. pipe from about 2 ft above land surface to a depth of 60 ft followed by 14 ft of No. 30 slot Johnson screen.

Upon completion, the nonpumping water level was reported to be 18 ft.

In 1948, the well reportedly produced 500 gpm with a drawdown of 25 ft from a nonpumping water level of 30 ft.

The pumping equipment presently installed is a 10-in., 6-stage Layne & Bowler turbine pump (Serial No. 83515) set at 60 ft, rated at 500 gpm at about 245 ft TDH, and powered by a 50-hp, 1750 rpm General Electric motor (Model No. 5K6328XM500B, Serial No. CNJ309347).

WELL NO. 5, finished in sand and gravel of the Prairie Aquigroup, was completed in February 1969 to a depth of 135 ft by the J J. Miller Artesian Well Co., Brookfield. The well is located next to the water tower on Indian Town Road near Illinois Route 29, approximately 2540 ft N and 500 ft E of the SW corner of Section 9, T13N, R10E. The land surface elevation at the well is approximately 522 ft

WELL NO. 5, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Soil	3	3
Sand	54	57
Sand and gravel	6	63
Clay	1	64
Sand	31	95
Sand and gravel	39	134
Sand	11	145
Shale	2	147

A 38-in. diameter hole was drilled to a depth of 147 ft. The well is cased with 16-in. steel pipe from about 3 ft above land surface to a depth of 110 ft followed by 25 ft of 16-in. No. 60 slot Johnson screen. The annulus between the borehole and casing-screen assembly is filled with cement from 0 to 20 ft, with sand and bentonite from 20 to 102 ft, and with gravel from 102 to 147 ft.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B144195) is for a water sample from the well collected June 17, 1975, after 4 hr of pumping.

WELL NO. 5, LABORATORY NO. B144195

	<i>mg/L</i>	<i>me/L</i>	<i>mg/L</i>	<i>me/L</i>			
Iron	Fe	0.1	Silica	SiO ₂	16		
Manganese	Mn	0.05	Fluoride	F	0.2	0.01	
Ammonium	NH ₄	0.03	Boron	B	0.0		
Sodium	Na	52	2.26	Cyanide	CN	0.00	
Potassium	K	0.7	0.02	Nitrate	NO ₃	25.43	0.41
Calcium	Ca	76	3.79	Chloride	Cl	5	0.14
Magnesium	Mg	33	2.72	Sulfate	SO ₄	54	1.12
			Alkalinity (as CaCO ₃)		260	5.20	
Arsenic	As	0.000	Hardness (as CaCO ₃)		325	630	
Barium	Ba	0.1	Total dissolved minerals		422		
Cadmium	Cd	0.00	pH (as rec'd)		7.8		
Chromium	Cr	0.00	Radioactivity				
Copper	Cu	0.00	Alpha <i>pc/L</i>		0.0		
Lead	Pb	0.00	± deviation		0.0		
Mercury	Hg	0.0000	Beta <i>pc/L</i>		0.1		
Nickel	Ni	0.0	± deviation		1.6		
Selenium	Se	0.000					
Silver	Ag	0.000					
Zinc	Zn	0.0					

Upon completion, the well reportedly produced 670 gpm for 8 hr with a drawdown of 14 ft from a nonpumping water level of 70 ft below land surface.

The pumping equipment presently installed is a 10-in., 6-stage Johnston turbine pump (Serial No. GB2248) set at 104 ft, rated at 600 gpm at about 225 ft TDH, and powered by a 50-hp, 1760 rpm General Electric motor (Model No. SK6248XH4A, Serial No. DEJ416509).

A test hole (No. 1-74) was constructed in October 1974 to a depth of 115 ft by the Layne-Western Co., Aurora. It was located approximately 820 ft N and 200 ft E of the SW corner of Section 16, T13N, R10E. Upon completion, the nonpumping water level was reported to be 47 ft.

HOPEWELL

The village of Hopewell (est. pop. 350), formerly known as Watuhiyi Waterworks Co., installed a public water supply in 1975. One well (No. 5) is in use. In 1978 there were 75 services, none metered; the estimated average and maximum pumpages were 21,000 and 31,500 gpd, respectively. In 1990 there were 105 services, all metered; the average pumpage was 25,700 gpd. The water is chlorinated.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was constructed in 1975 to a depth of 23 ft. This well was abandoned and sealed in 1989. The well was located approximately 3500 ft S and 2200 ft W of the NE corner of Section 34, T12N, R9E. The land surface elevation at the well is approximately 500 ft.

WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Brown sandy clay	16	16
Coarse sand and gravel	7	23
Hard dark shale		

A 36-in. diameter hole was bored to a depth of 23 ft. The well was cased with 6-in. pipe from a few feet below land surface within an 11-ft deep pit to a depth of 11 ft and 36-in. concrete tile from 11 ft to a depth of 23 ft.

WELL NO. 2. Location and construction features are not available. This well was abandoned and sealed in 1989.

WELL NO. 3. Location and construction features are not available. This well was abandoned and sealed in 1989.

One test hole was constructed in 1976 to a depth of 42 ft by the K & K Well Drilling Co., Mokena. It was located approximately 1150 ft S and 800 ft W of the NE corner of the SE quarter of Section 34, T12N, R9E.

Ten test holes were constructed in September 1976 by the Layne-Western Co., Aurora, to depths ranging from 33 to 50 ft. They were located in the NE quarter of the SE quarter of Section 34, T12N, R9E.

WELL NO. 4, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1976 to a depth of 36.5 ft by the Layne-Western Co., Aurora. This well was abandoned and sealed in 1989. The well was located west of the Illinois River on the east side of Route 29 at the site of Test Hole 1-76, approximately 3390 ft S and 800 ft W of the NE corner of Section 34, T12N, R9E. The land surface elevation at the well is approximately 455 ft.

WELL NO. 4, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dark brown sandy soil	4	4
Brown silty clay	5	9
Brown silty clay with gravel seams	10	19
Brown fine sand to coarse gravel (loose), some coal	12	31
Fine sand to medium gravel, some silt, small clay seams	5.5	36.5
Shale below		

A 20-in. diameter hole was drilled to a depth of 36.5 ft. The well was equipped with an 8-in. diameter Baker monitor pitless adapter from 1.5 ft above land surface to a depth of 5 ft and cased with 8-in. steel pipe from about 5 ft below land surface to a depth of 193 ft followed by 17 ft of 8-in. No. 73 (0.040 in.) Layne shutter screen. The annulus between the borehole and casing-screen assembly was filled with backfill from 0 to 5 ft, with cement from 5 to 15 ft, with Chillicothe gravel from 15 to 193 ft, and with No. 2 Muscatine gravel from 193 to 363 ft.

A production test using one observation well was conducted by the driller on September 21, 1976. After 73 hr of pumping at rates of 14.4 to 15 gpm, the final drawdown was 8.25 ft from a nonpumping water level of 7.25 ft below land surface. Fifty min after pumping was stopped, the water level had recovered to 7.67 ft. On the basis of the production test data, it was estimated that this well should yield 10 to 15 gpm on a long-term basis.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B16596) is for a water sample from the well collected October 21, 1976, after 1 hr of pumping at 15 gpm.

WELL NO. 4, LABORATORY NO. B16596

		mg/L	me/L		mg/L	me/L
Iron	Fe	0.1		Silica	SiO ₂	13.4
Manganese	Mn	0.01		Fluoride	F	0.1
Ammonium	NH ₄	0.0	0.00	Boron	B	0.1
Sodium	Na	11	0.48	Cyanide	CN	0.01
Potassium	K	2.2	0.06	Nitrate	NO ₃	22
Calcium	Ca	120	5.99	Chloride	Cl	5.9
Magnesium	Mg	SO	4.12	Sulfate	SO ₄	190
				Alkalinity (as CaCO ₃)		310
Arsenic	As	0.00				620
Barium	Ba	0.1		Hardness (as CaCO ₃)	SOS	10.10
Cadmium	Cd	0.00				
Chromium	Cr	0.00		Total dissolved minerals		615
Copper	Cu	0.00				
Lead	Pb	0.00				
Mercury	Hg	0.0000				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Zinc	Zn	0.1		pH(as rec'd)		7.4

WELL NO. 5 was completed in March 1977 to a depth of 1773 ft by the Layne-Western Co., Aurora. The water-yielding unit in this well is the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located approximately 642 ft N and 2272 ft E of the SW corner of Section 27, T12N, R9E. The land surface elevation at the well is approximately 640 ft.

WELL NO 5, SUMMARY SAMPLE STUDY LOG

(furnished by the State Geological Survey)

Strata	Thickness (ft)	Depth (ft)
QUATERNARY SYSTEM		
Pleistocene Series (Samples not reliable)		
"Brown clay"	10	10
"Brown clay, trace gravel"	5	15
"Gray clay, trace coal and gray sand"	8	20
"Medium gray sand, some clay"	5	25
"Gray clay"	12	37
"Medium to medium-coarse sand, trace of fine sand, trace of clay"	13	50
"Gray clay, few sand streaks"	14	64
PENNSYLVANIAN SYSTEM (Samples not reliable)		
"Cemented sandstone"	31	95
"Gray clay, sand, some shale"	25	120
"Cemented sand and lime ledges or boulders"	40	160
Siltstone, gray, grading to sandstone, gray, silty, very fine, compact	5	165
Shale, gray; siltstone, gray	8	170

Strata	Thickness (ft)	Depth (ft)
Shale, gray	5	175
Shale, dark gray, black; trace of coal	5	180
Underclay; shale, gray	5	185
Shale, gray, sandstone, silty, gray, very fine, compact	5	190
Shale, gray, silty in part	10	200
Shale, as above; sandstone, silty, gray, very fine, compact	5	205
Shale, dark gray, slightly micaceous	15	220
Shale, as above; little shale, black	5	225
Shale, dark gray	10	235
Shale, dark gray, black	5	240
Shale, black; trace of limestone, gray, sublithographic	5	245
Shale, gray, weak; underclay	5	250
Shale, dark gray, black; underclay	10	260
Sandstone, greenish gray, very fine, angular, friable, in part very calcareous, compact	10	270
Sandstone, as above, friable; little siltstone, greenish gray	5	275
Sandstone, light gray to gray, very fine, friable, with part very calcareous, compact; siltstone, gray, in part shaly	20	295
Shale, extra silty, gray, grading to siltstone, sandy	25	320
Shale, as above; little shale, black; ironstone	5	325
Shale, gray	15	340
Shale, dark gray, black; little limestone, silty, dark brownish gray, slightly fossiliferous	5	345
Shale, black; ironstone	8	350
Shale, black	10	360
Shale, black; shale, gray	15	375
Shale, as above; clay, light gray	5	380
Shale, gray; shale, black; trace of coal	5	385
Shale, gray, dark gray, black; trace of coal	10	395
Shale, dark gray, black; little clay, light gray	20	415
Shale, very sandy, brownish gray; shale, as above	15	430
Shale, black; shale, gray, dark gray	5	435
Sandstone, gray, very fine, compact; shale, as above	15	450
Shale, gray, greenish gray, siltstone, gray (Samples not reliable)	100	550
DEVONIAN SYSTEM		
Upper Devonian Series		
New Albany Shale Group (top may be a little higher)		
Shale, dark gray	20	570
Shale, as above; shale, grayish green	5	575
Shale, dark gray, brownish tinge, spores, pyrite	50	625
Middle Devonian Series		
Cedar Valley Limestone		
Dolomite, gray, extra fine	5	630
Dolomite, calcareous, light to medium brownish gray, extra fine	8	638
Dolomite, calcareous in part, gray	12	650

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>	<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Wapsipinicon Limestone			Shale, gray, weak; shale, dark greenish gray; siltstone, gray (Samples not reliable 1135 to 1200 ft)	35	1170
limestone, light brownish gray, sublithographic	40	690	Shale, gray, weak; little shale, light greenish gray	5	1175
SILURIAN SYSTEM			Shale, gray, weak	25	1200
Niagaran Series			Shale, gray, weak; shale, dark gray, dolomite, brownish gray, very fine	5	1205
Dolomite, gray, very fine to extra fine	5	695	Dolomite, brownish gray, very fine	5	1210
Dolomite, medium light brownish gray, very fine to extra fine, slightly vesicular	15	710	Sample out of place	5	1215
Same, rather dense	5	715	Shale, gray, weak	9	1224
Dolomite, light to medium light brownish gray, very fine to extra fine, trace of chert	5	720	Dolomite, argillaceous, olive gray, extra fine	16	1240
Same, cherty	5	725	Dolomite, as above; shale, gray, greenish gray, dark gray	5	1245
Same, trace of chert	5	730	Shale, greenish gray, weak; shale, dark olive gray	10	1255
Same, medium light brownish gray	20	750	Shale, as above; little dolomite, argillaceous, gray, extra fine	5	1260
Dolomite, light brownish gray, very fine to extra fine, in part rather dense	15	765	Shale, as above	5	1265
Same, mostly extra fine	10	775	Shale, as above; little dolomite, argillaceous, olive gray, extra fine	25	1290
Same, very fine to extra fine, trace of chert	15	790	Champtainian Series		
Same, no chert	40	830	Galena Dolomite Group		
Same, mostly very fine, slightly vesicular	30	860	Dolomite, light grayish brown, very fine (No samples 1295 to 1310 ft)	50	1340
Same, very fine to extra fine	15	875	Same, very fine to fine	15	1355
Dolomite, as above; little dolomite, light gray, extra fine (No sample 885 to 890 ft)	15	890	Dolomite, light grayish brown to light brownish gray, very fine to fine	25	1380
Dolomite, as above; trace of dolomite, gray, extra fine	10	900	Same, light grayish brown	30	1410
Dolomite, light brownish gray, little tight gray, very fine, slightly vesicular in part	35	935	Dolomite, light brownish gray, fine	35	1445
Dolomite, light brownish gray, light gray, very fine to extra fine	5	940	Same, very fine to fine	45	1490
Same, slightly cherty to cherty	10	950	Guttenberg Formation		
Same, no chert	50	1000	Dolomite, brown, light brownish gray, very light gray, very fine to medium; very dark reddish gray shale partings; lower part cherty	20	1510
Dolomite, light brownish gray, to light gray, extra fine, oil-stained	15	1015	Platteville Dolomite Group (Samples not reliable)		
Dolomite, very light brownish gray, extra fine	15	1030	Dolomite, slightly cherry, light brown fine; little geode quartz	15	1525
Dolomite, light gray, extra fine, in part oil-stained	25	1055	Dolomite, light grayish brown, little dark gray, very fine	5	1530
Alexandrian Series			Dolomite, light grayish brown to light gray, very fine, trace of chert	5	1535
Dolomite, light olive gray, very fine to fine, slightly vesicular, trace of glauconite	10	1065	Same, very cherty	5	1540
Dolomite, light brownish gray to very light gray, very fine to fine, in part with trace of glauconite	25	1090	Dolomite, very cherty, grayish brown, very fine	15	1555
Dolomite, very cherty, light brownish gray, very fine to fine	5	1095	Same, very fine to extra fine	10	1565
Same, slightly cherty, slightly glauconitic	5	1100	Dolomite, as above; dolomite, grayish brown, extra fine, rather dense	5	1570
ORDOVICIAN SYSTEM			Dolomite, very cherty, grayish brown, extra fine, rather dense	5	1575
Cincinnatian Series			Dolomite, brown, very fine	5	1580
Maquoketa Shale Group			Dolomite, brown, very fine to extra fine, cherty	5	1585
Siltstone, slightly dotomitic, gray, with extra fine black specks	14	1114	Same, no chert	15	1600
Shale, gray, weak	6	1120	Dolomite, brown, extra fine, rather dense, few shale partings, in part with orange specks	5	1605
Siltstone, shaly in part, gray, shale, gray, weak	5	1125	Dolomite, brown, very fine to extra fine	15	1620
Siltstone, gray, shale, gray, weak; trace of limestone, light to dark gray, fossiliferous	5	1130	Dolomite, light grayish brown, extra fine	10	1630
Siltstone, gray	5	1135			

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dolomite, brown, extra fine Ancell Group	5	163S
St Peter Sandstone		
Sandstone, white to light buff, fine to coarse, rounded, frosted, incoherent, few grains with secondary crystal faces	95	1730
Same, very fine to coarse, friable to incoherent	35	1765
Same, friable to a little compact	5	1770
Same, in part very pyritic	5	1775

A 19.2-in. diameter hole was drilled to a depth of 174 ft, reduced to 15 in. between 174 and 1309 ft, and finished 9.9 in. in diameter from 1309 to 1773 ft. The well is cased with 16-in. steel pipe from land surface to a depth of 174 ft and 10-in. steel pipe from about 2 ft above land surface to a depth of 1309 ft (cemented in).

A production test was conducted by the driller on March 30, 1977. After 8 hr of pumping at rates ranging from 185 to 354 gpm, the final drawdown was 383 ft from a nonpumping water level of 169 ft below land surface.

A second production test was conducted by the driller on March 31, 1977. After 3.5 hr of pumping at rates ranging from 335 to 420 gpm, the maximum drawdown was 445 ft from a nonpumping water level of 169 ft below land surface.

A third production test was conducted by the driller on April 1, 1977. After 10.2 hr of pumping at rates ranging from 250 to 434 gpm, the final drawdown was 450 ft from a nonpumping water level of 169 ft below land surface.

The pumping equipment presently installed is a 20-stage Layne & Bowler pump (No. 83816) set at 550 ft, rated at 300 gpm at about 582 ft TDH, and powered by a 75-hp, 1770 rpm General Electric motor. 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. B045920) is for a water sample from the well collected May 18, 1982.

WELL NO. 5, LABORATORY NO. B045920

	<i>mg/L</i>	<i>me/L</i>	<i>mg/L</i>	<i>me/L</i>
Iron Fe	0.47		Silica SiO ₂	9.9
Manganese Mn	0.007		Fluoride F	2.00 0.10
Ammonium NH ₄	1.8	0.10	Boron B	0.86
Sodium Na	370	16.10	Cyanide CN	<0.005
Potassium K	14.9	0.38	Nitrate NO ₃	<0.4
Calcium Ca	35	1.75	Chloride Cl	209 5.89
Magnesium Mg	15.4	1.27	Sulfate SO ₄	400 8.32
Strontium Sr	137		Alkalinity (as CaCO ₃)	241 4.82
Arsenic As	<0.001		Hardness (as CaCO ₃)	152 3.04
Barium Ba	<0.005		Total dissolved minerals	1190
Beryllium Be	<0.0005			
Cadmium Cd	<0.003			
Chromium Cr	<0.005			
Cobalt Co	<0.005			
Copper Cu	<0.003			
Lead Pb	<0.005			
Mercury Hg	0.00009			
Nickel Ni	<0.003			
Selenium Se	<0.001			
Vanadium V	<0.004			
Zinc Zn	0.005		pH (as rec'd)	7.6

LACON

The city of Lacon (pop. 2135) installed a public water supply in 1893. Two wells (Nos. 1 and 3) are in use. In 1950 there were 635 services, 15 percent metered; the average and maximum pumpages were 125,000 and 200,000 gpd, respectively. In 1990 there were 880 services, 6 percent metered; the average and maximum pumpages were 331,100 and 468,000 gpd, respectively. The water is fluoridated and chlorinated.

Initially, a well, finished in sand and gravel of the Prairie Aquigroup, was constructed about 1854 to a depth of 40 ft, and deepened in 1893 to a reported depth of 60 ft. This well, formerly used by an old sugar mill and distillery,

was purchased by the city in 1893. This well was abandoned about 1950. The well was located about 200 ft from the Illinois River inside the pumping station, approximately 1000 ft N and 300 ft W of the SE corner of Section 26, T30N, R3W. Originally, an 8-ft diameter hole was dug to a depth of 40 ft. The well was walled with brick from above the pump-station floor which was about 12 ft below land surface to a depth of 40 ft. After the city purchased the well in 1893, an 8-in. diameter hole was drilled inside the 8-ft diameter hole from 40 to 60 ft. The well was then cased with 8-in. pipe from about 1 ft above the pump-station floor which was about 12 ft below land surface to an unknown depth and was equipped with a well screen.

In 1934, the nonpumping water level was reported to be 12 ft below the top of the casing.

A second well, finished in sand and gravel of the Prairie Aquigroup, was completed in 1893 to a depth of 60 ft. This well was abandoned about 1950. The well was located about 6 ft north of the mill and distillery well, approximately 1006 ft N and 300 ft W of the SE corner of Section 26, T30N, R3W. The well was cased with 8-in. pipe from about 1 ft above the pump-station floor, which was about 12 ft below land surface, to an unknown depth and was equipped with a well screen. In January 1923, the nonpumping water level was reported to be 10.6 ft below the top of the casing.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in 1931 to a depth of 39 ft (later measured at 375 ft deep) by Chris Ebert, Washington. The well is located in the pumping station in the west part of the city near the Illinois River, approximately 1150 ft N and 460 ft W of the SE corner of Section 26, T30N, R3W. The land surface elevation at the well is approximately 460 ft.

A 10-in. diameter hole was drilled to a depth of 39 ft. The well is cased with 10-in. pipe from about 0.8 ft above the pump-station floor to a depth of 27 ft followed by 12 ft of 10-in. Cook screen. In 1983, an 8-in. pipe was placed inside the 10-in. pipe.

Nonpumping water levels were reported to be 18.5 ft below the well platform in February 1934, and about 20 ft below the pump base in 1947.

The pumping equipment presently installed is a 7-stage Layne pump set at 30 ft, rated at 400 gpm at about 180 ft TDH, and powered by a 40-hp 1760 rpm Fairbanks Morse electric motor (Model No. KZKV3, Serial No. F446044).

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B031526) of a sample collected January 5, 1982, after pumping for 30 min at 500 gpm, showed the water to have a hardness of 350 mg/L, total dissolved minerals of 422 mg/L, and an iron content of <0.005 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1948 to a depth of 50 ft by the M. Ebert Co., Washington. This well is not in use because the pump reportedly breaks suction. The well is located about 20 ft southwest of Well No. 1, approximately 1132 ft N and 477 ft W of the SE corner of Section 26, T30N, R3W. The land surface elevation at the well is approximately 460 ft.

WELL NO. 2, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	2	2
Sand and gravel	35	37
Yellow clay	2	39
Sand	9	48
Coarse gravel	2	50

A 10-in. diameter hole was drilled to a depth of 50 ft. The well is cased with 10-in. black steel pipe from about 1 ft above the pump-station floor to a depth of 40 ft followed by 10 ft of 10-in. Johnson Everdur screen. The screened section from top to bottom consists of 3 ft of No. 20 slot, 5 ft of No. 25 slot, and 2 ft of No. 125 slot.

A production test using three observation wells was conducted by the State Water Survey on September 16, 1948. After 1.2 hr of pumping at rates of 400 to 225 gpm, the final drawdown was 12 ft from a nonpumping water level of 20 ft.

The pumping equipment presently installed is a submersible pump rated at 600 gpm (operated at 375 gpm), and powered by a 50-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B031527) is for a water sample from the well collected January 5, 1982, after 30 min of pumping at 250 gpm.

WELL NO. 2, LABORATORY NO. B031527

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	<0.005		Silica	SiO ₂	18	
Manganese	Mn	<0.005		Fluoride	F	0.24	0.01
Ammonium	NH ₄	<0.1		Boron	B	0.07	
Sodium	Na	12	0.52	Cyanide	CN	<0.005	
Potassium	K	2.7	0.07	Nitrate	NO ₃	15.0	0.24
Calcium	Ca	82	4.09	Chloride	Cl	14	0.39
Magnesium	Mg	35.8	Z95	Sulfate	SO ₄	37	0.77
Strontium	Sr	0.110		Alkalinity (as CaCO ₃)		308	6.16
				Hardness (as CaCO ₃)		346	6.92
Arsenic	As	<0.001		Total dissolved minerals		412	
Barium	Ba	0.102					
Beryllium	Be	<0.0005					
Cadmium	Cd	<0.003					
Chromium	Cr	<0.007					
Cobalt	Co	<0.005					
Copper	Cu	0.007					
Lead	Pb	0.00					
Mercury	Hg	<0.00005					
Nickel	Ni	<0.003					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.004					
Zinc	Zn	0.006		pH (as rec'd)		7.4	

WELL NO. 3, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1948 to a depth of 50 ft by the M. Ebert Co., Washington. The well is located about 15 ft northwest of Well No. 2, approximately 1140 ft N and 490 ft W of the SE corner of Section 26, T30N, R3W. The land surface elevation at the well is approximately 460 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	2	2
Sand and fine gravel	36	38
Yellow clay	2	40
Sand	8	48
Coarse gravel	2	50

A 10-in. diameter hole was drilled to a depth of 50 ft. The well is cased with 10-in. black steel pipe from about 12 ft above the pump-station floor to a depth of 40 ft followed by 10 ft of 10-in. Johnson Everdur screen. The screened section from top to bottom consists of 3 ft of No. 20 slot, 5 ft of No. 25 slot, and 2 ft of No. 125 slot.

A production test using two observation wells was conducted by the State Water Survey on September 14, 1948. After 1.9 hr of pumping at rates of 450 to 350 gpm, the final drawdown was 13 ft from a nonpumping water level of 19 ft.

The pumping equipment presently installed is a 10-in., 5-stage Byron Jackson vertical turbine pump (Serial No. 89973) set at 51 ft, rated at 480 gpm, and powered by a 30-hp General Electric motor (Model No. 5K6235KM500B, Serial No. BRJ223272).

LAKE WILDWOOD UTILITY CORPORATION

Lake Wildwood Utility Corporation (est. pop. 900), located about 3 miles northwest of Varna, installed a public water supply in 1968. The water system is owned and operated by Utilities, Inc. One well (No. 1) is in use and another well (No. 2) is available for emergency use. In 1972 there were 60 services, none metered; the average pumpage was 20,000 gpd. In 1989 there were 268 services, all metered; the average pumpage was 38, 100 gpd. The water from Well No. 1 is chlorinated and fluoridated.

Prior to the construction of a public water supply, two test holes, a test well, and an observation well were drilled in 1968 by the Layne-Western Co., Aurora, to depths of 308, 260, 307, and 310 ft, respectively. The first hole was located in the NW quarter of Section 17, T30N, R1W, and the rest of the holes were located in the SE quarter of Section 7, T30N, R1W.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in August 1968 to a depth of 270 ft by the J.P. Miller Artesian Well Co., Brookfield. The well is located approximately 2525 ft S and 110 ft W of the NE corner of Section 7, T30N, R1W. The land surface elevation at the well is approximately 649 ft.

A 30-in. diameter hole was drilled to a depth of 273 ft. The well is cased with 12-in. steel pipe from land surface to a depth of 240 ft followed by 30 ft of 12-in. No. 60 slot Houston stainless steel screen. The annulus between the borehole and casing-screen assembly is filled with cement

from 0 to 20 ft, with impervious Till from 20 to 210 ft, and with gravel from 210 to 273 ft.

WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay with layers of sand	165	165
Clean coarse sand	108	273

A production test was conducted by the driller on August 6, 1968. After 2.5 hr of pumping at a rate of 300 gpm, the drawdown was 6 ft from a nonpumping water level of 140 ft below land surface. Pumping was continued for 6 hr at a rate of 500 gpm with a final drawdown of 10 ft. Substantial recovery was reportedly observed 4 min after pumping was stopped.

The pumping equipment presently installed consists of a 60-hp, 1770 rpm General Electric motor (Model No. SK6257XH5A, Serial No. GDJ717524) and a 10-in., 6-stage Peerless turbine pump (Model No. LB, Serial No. 252010) set at 200 ft, rated at 500 gpm at about 300 ft TDH, and equipped with 200 ft of 6-in. column pipe.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B144197) is for a water sample from the well collected June 17, 1975, after 45 min of pumping.

WELL NO. 1, LABORATORY NO. B144197

		mg/L	me/L	mg/L	me/L
Iron	Fe	0.0		Silica	SiO ₂ 15
Manganese	Mn	0.02		Fluoride	F 0.2 0.01
Ammonium	NH ₄	0.03	0.00	Boron	B 0.0
Sodium	Na	63	0.27	Cyanide	CN 0.00
Potassium	K	0.7	0.02	Nitrate	NO ₃ 4.98 0.08
Calcium	Ca	79	3.94	Chloride	Cl 4 0.11
Magnesium	Mg	36	2.96	Sulfate	SO ₄ 59 1.23
				Alkalinity (as CaCO ₃)	292 5.84
Arsenic	As	0.000		Hardness (as CaCO ₃)	345 6.90
Barium	Ba	0.0			
Cadmium	Cd	0.00		Total dissolved minerals	407
Chromium	Cr	0.00			
Copper	Cu	0.01		pH (as rec'd)	7.8
Lead	Pb	0.00		Radioactivity	
Mercury	Hg	0.0000		Alpha pc/L	0.5
Nickel	Ni	0.0		± deviation	0.9
Selenium	Se	0.000		Beta pc/L	3.5
Silver	Ag	0.000		± deviation	1.8
Zinc	Zn	0.0			

WELL NO. 2 (formerly Test Well No. 2-68), finished in sand and gravel of the Prairie Aquigroup, was completed in March 1968 to a depth of 305 ft by the Layne-Western Co., Aurora. This well is available for emergency use. The well is located approximately 2100 ft N and 100 ft W of the SE corner of Section 7, T30N, R1W. The land surface elevation at the well is approximately 650 ft.

WELL NO. 2, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Black top soil	1	1
Brown clay with sand and gravel seams	20	21
Gray sandy clay	26	47
Brown sand	15	48.5
Gray sandy clay	10.5	59
Brown sandy clay	11	70

The village of LaRose (pop. 173) installed a public water supply in 1973. Two wells are in use. In 1976 there were 80 services, all metered; the estimated average and maximum pumpages were 10,000 and 30,000 gpd, respectively. In 1990 there were 70 services, all metered; the average pumpage was 10,000 gpd. The water is aerated, filtered, chlorinated, and fluoridated.

Prior to the installation of a public water supply, two test holes were drilled in 1972 to depths of 98 and 83 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The holes

Strata	Thickness (ft)	Depth (ft)
Brown sand and gravel	3	73
Brown sandy clay	3	76
Light brown sandy clay with sand seams	10	86
Gray sandy clay	9	95
Brown sandy clay	4	99
Fine sand to medium gravel	8.5	107.5
Brown sandy clay	75	115
Sand and gravel	3	118
Graysandy clay	37	155
Fine brown sand	20	175
Fine to medium brown sand	15	190
Fine to coarse brown sand with fine to medium gravel	90	280
Fine to coarse brown sand with fine to coarse gravel with boulders	24	304
Shale	3	307

A 9.9-in. diameter hole was drilled to a depth of 305 ft. The well is cased with 6-in. pipe from land surface to a depth of 285 ft followed by 20 ft of 6-in. ID No. 20 slot Layne & Bowler-Houston stainless steel screen. The top of the well casing is equipped with a pitless adapter.

A production test using one observation well was conducted on April 8, 1968, by representatives of the driller and the State Water Survey. After 3 hr of pumping at rates ranging from 133 to 178 gpm, the final drawdown was 11.5 ft from a nonpumping water level of 140.0 ft below land surface. Substantial recovery was reportedly observed 2 min after pumping was stopped.

The pumping equipment presently installed is a Barnes submersible turbine pump (Model No. 612) set at 260 ft, rated at 250 gpm, and powered by a 15-hp electric motor.

A partial analysis of a sample (Lab. No. 174382) collected during the initial production test, after pumping for 3 hr at rates of 133 to 178 gpm, showed the water to have a hardness of 344 mg/L, total dissolved minerals of 408 mg/L, and an iron content of 0.1 mg/L.

LAROSE

were located in the NW and SW quarters of Section 16, T29N, R1W.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in December 1972 to a depth of 47 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 0.5 mile southeast of the village, approximately 1950 ft N and 1720 ft E of the SW corner of Section 16, T29N, R1W. The land surface elevation at the well is approximately 640 ft.

WELL NO. 1, DRILLERS LOG

<i>Soma</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay, yellow	20	20
Clay, gray	11	31
Gravel (water bearing)	16	47

An 8-in. diameter hole was drilled to a depth of 47 ft. The well is cased with 8-in. black pipe from about 3 ft above land surface to a depth of 39 ft followed by 8 ft of 6-in. No. 100 slot Johnson stainless steel screen. A 6-in. pipe is attached to the top of the screen from 34 to 39 ft.

A production test using one observation well (No. 2) was conducted on January 17, 1973, by representatives of the driller, the State Water Survey, and Casler, Houser & Hutchison, Consulting Engineers. After 3 hr of pumping at rates ranging from 16S to 140 gpm, the final drawdown was 6.01 ft from a nonpumping water level of 6.85 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 8.95 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 6-in., 6-stage Layne vertical turbine pump set at 40 ft, rated at 50 gpm at about 73 ft TDH, and powered by a 3-hp, 1750 rpm U.S. electric motor (Serial No. 80565).

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A6805) of a sample collected October 3, 1977, after pumping for 2 hr at 50 gpm, showed the water to have a hardness of 319 mg/L, total dissolved minerals of 400 mg/L, and an iron content of 1.85 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1973 to a depth of 47 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 120 ft southeast of Well No. 1, approximately 1850 ft N and 1790 ft E of the SW corner of Section 16, T29N, R1W. The land surface elevation at the well is approximately 640 ft.

An 8-in. diameter hole was drilled to a depth of 47 ft. The well is cased with 8-in. black pipe from about 3 ft above land surface to a depth of 37 ft and 6-in. pipe from 34 ft to a depth of 39 ft followed by 8 ft of 6-in. No. 100 slot Johnson stainless steel screen.

WELL NO. 2, DRILLERS LOG

<i>Soma</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	20	20
Gray clay	11	31
Gravel	16	47

Upon completion, the well reportedly produced 125 gpm for 5 hr with a drawdown of 4.0 ft from a nonpumping water level of 8.5 ft below land surface.

The pumping equipment presently installed is a 6-in., 6-stage Layne vertical turbine pump set at 40 ft, rated at 50 gpm at about 73 ft TDH, and powered by a 3-hp, 1705 rpm U. S. electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B916266) is for a water sample from the well collected November 6, 1989.

WELL NO. 2, LABORATORY NO. B916266

	<i>mg/L</i>	<i>me/L</i>		<i>mg/L</i>	<i>me/L</i>	
Iron	Fe	1.042	Silica	SiO ₂	16	
Manganese	Mn	0.018	Fluoride	F	0.64	
Ammonium	NH ₄	1.8	Boron	B	0.270	
Sodium	Na	39	Cyanide	CN	<0.005	
Potassium	K	0.38	Nitrate	NO ₃	<0.4	
Calcium	Ca	70	Chloride	Cl	4.7	0.13
Magnesium	Mg	34	Sulfate	S ₀ 4	13	0.27
Strontium	Sr	0.306	Alkalinity (as CaCO ₃)		396	7.92
Aluminum	Al	<0.050	Hardness (as CaCO ₃)		305	6.10
Arsenic	As	0.006	Total dissolved minerals		414	
Barium	Ba	0.080				
Beryllium	Be	<0.0005				
Cadmium	Cd	<0.003				
Chromium	Cr	<0.005				
Cobalt	Co	<0.005				
Copper	Cu	<0.005				
Lead	Pb	<0.005				
Mercury	Hg	<0.00005				
Nickel	Ni	<0.005				
Selenium	Se	<0.001				
Silver	Ag	<0.003				
Vanadium	V	<0.005				
Zinc	Zn	<0.050	pH(as rec'd)		8.0	

MAGNOLIA

The village of Magnolia (pop. 308) installed a public water supply in 1951. Two wells (Nos. 4 and 5) are in use. Although this village is in Putnam County, the wells in use are located about one-half mile south of the village in Marshall County. In 1951 there were 50 services, none metered. In 1989 there were 65 services, none metered; the average and maximum pumpages in 1988 were 40,400 and 71,000 gpd, respectively. The water is aerated, filtered, chlorinated, and fluoridated.

WELL NO. 1, was constructed in 1951 to a depth of 222 ft by Guy Defenbaugh, Dana, and deepened in 1960 into sandstone of the Upper Bedrock Aquigroup (Pennsylvanian System) to a reported depth of 320 ft. This well was abandoned prior to 1983. The well is located in the village park about 1 block east of the business district, approximately 2000 ft S and 2000 ft E of the NW corner of Section 35, T31N, R1W, Putnam County. The land surface elevation at the well is approximately 670 ft.

The well is cased with 8-in. pipe from about 1.5 ft above the pumphouse floor to an unknown depth.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B109535) is for a water sample from the well collected April 23, 1973, after 35 min of pumping at 9 gpm. Methane gas was present in a previous sample.

WELL NO. 1, LABORATORY NO. B109535

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.42	0.02	Silica	SiO ₂	20	
Manganese	Mn	0.04	0.00	Fluoride	F	0.3	0.02
Ammonium	NH ₄	11	0.61	Boron	B	03	
Sodium	Na	78	339	Nitrate	NO ₃	0.0	0.00
Potassium	K	2.6	0.07	Chloride	Cl	9	0.25
Calcium	Ca	78	3.89	Sulfate	SO ₄	0.0	0.00
Magnesium	Mg	32	2.63	Alkalinity (as CaCO ₃)		494	9.88
Arsenic	As	0.00		Hardness (as CaCO ₃)		326	652
Barium	Ba	05					
Cadmium	Cd	0.00		Total dissolved minerals		514	
Chromium	Cr	0.00					
Copper	Cu	0.01					
Lead	Pb	0.00		pH(as rec'd)		7.7	
Mercury	Hg	0.0000		Radioactivity			
Nickel	Ni	0.0		Alpha <i>pc/L</i>		2.7	
Selenium	Se	0.00		± deviation		2.6	
Silver	Ag	0.00		Beta <i>pc/L</i>		12.0	
Zinc	Zn	0.01		± deviation		3.1	

WELL NO. 2, finished in sand and clay of the Prairie Aquigroup, was completed in September 1960 to a depth of 85 ft by the Germantown Well Drilling Co., Metamora.

This well was abandoned in December 1972. The well is located in a field several blocks north of the main part of town on the north side of Iowa St., approximately 700 ft S and 1900 ft E of the NW corner of Section 35, T31N, R1W, Putnam County. The land surface elevation at the well is approximately 665 ft.

WELL NO. 2, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	2	2
Yellow clay	17	19
Sand	11	30
Blue clay	55	85

The well is cased with 24-in. ID concrete tile from land surface to a depth of 30 ft and 18-in. ID concrete tile from 30 ft to a depth of 85 ft. The annulus between the borehole and concrete tile is filled with concrete from 0 to 10 ft and with gravel from 10 to 85 ft.

Upon completion, the well reportedly produced 30 gpm for 2 hr with a drawdown of 45 ft from a nonpumping water level of 25 ft.

Two test holes were drilled in 1962 by Charles M. Hayes, Champaign, in an attempt to develop an additional supply for the village. The first hole was drilled to a depth of 75 ft and located about 0.2 mile northwest of the village in the SE quarter of Section 27, T31N, R1W, Putnam County. The second hole, located about 400 ft southwest of the first hole, approximately 100 ft S and 1000 ft W of the NE corner of Section 34, T31N, R1W, Putnam County, was developed as a test well. It was finished in sand and gravel to a depth of 54.6 ft. A 4-in. diameter hole was drilled to a depth of 54.6 ft and cased with 4-in. pipe from land surface to a depth of 44.6 ft followed by 8 ft of 4-in. No. 25 slot and 2 ft of 4-in. No. 14 slot screen. A production test was conducted on November 5, 1962, by representatives of the State Water Survey and Farnsworth & Wylie, Consulting Engineers. After 1.5 hr of pumping at rates ranging from 25.2 to 23.8 gpm, the final drawdown was 4.26 ft from a nonpumping water level of 15.98 ft below land surface. Ten min after pumping was stopped, the water level had recovered to 17.17 ft. On the basis of the short-term test data, it was estimated that this test well would yield 30 gpm (43,200 gpd) on a long-term basis.

WELL NO. 3 (old grade school well), finished in sand and gravel of the Prairie Aquigroup, was completed in August 1940 to a depth of 1% ft by Clifford Eggers. This

well was abandoned prior to 1976. The well is located on the north side of the old grade school on Monroe St. east of Bloomington St., approximately 1000 ft S and 2500 ft E of the NW corner of Section 35, T31N, R1W, Putnam County. The land surface elevation at the well is approximately 670 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Fill and clay	10	10
Clay	20	30
Sand 30 to 32 ft	5	35
Clay	5	40
Clay and sand	5	45
Clay	5	50
Sand 50 to 53 ft; water	5	55
Clay	5	60
Clay, red, hard	5	65
Clay	20	85
Clay and sand at 86 ft	5	90
Sand, dirty, very little water	15	105
Clay, sand and gravel mixed in clay	55	160
Clay	10	170
Clay, sandy, caved badly	15	185
Clay, sand at 186 ft, dirty, water	5	190
Sand, dirty	2	192
Sand, clean and water	4	196

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B109533) is for a water sample from the well collected April 23, 1973, after 40 min of pumping at 15 gpm.

WELL NO. 3, LABORATORY NO. B109S33

	<i>mg/L</i>	<i>me/L</i>		<i>mg/L</i>	<i>me/L</i>
Iron	Fe	1.70	0.06	Silica	SiO ₂ 20
Manganese	Mn	0.05	0.00	Fluoride	F 0.3 0.02
Ammonium	NH ₄	4.4	0.24	Boron	B 0.3
Sodium	Na	42	1.83	Nitrate	NO ₃ 1.8 0.03
Potassium	K	1.9	0.05	Chloride	Cl 2.0 0.06
Calcium	Ca	80	3.99	Sulfate	SO ₄ 10 0.21
Magnesium	Mg	35	2.88	Alkalinity (as CaCO ₃)	436 8.72
Arsenic	As	0.00		Hardness (as CaCO ₃)	344 6.87
Barium	Ba	0.5			
Cadmium	Cd	0.00		Total dissolved	
Chromium	Cr	0.00		minerals	497
Copper	Cu	0.04			
Lead	Pb	0.00		pH (as rec'd)	7.7
Mercury	Hg	0.0000		Radioactivity	
Nickel	Ni	0.0		Alpha <i>pc/L</i>	1.7
Selenium	Se	0.00		± deviation	2.1
Silver	Ag	0.00		Beta <i>pc/L</i>	8.5
Zinc	Zn	0.13		± deviation	2.6

A 4-in. diameter hole was drilled to a depth of 196 ft. The well is cased with 4-in. pipe from within a 5-ft deep pit to a depth of 192 ft followed by 4 ft of No. 12 slot Johnson

screen. The top of the casing is equipped with a pitless adapter.

Upon completion, the well reportedly produced 6 gpm with a drawdown of 30 ft from a nonpumping water level of 35 ft.

This well was acidized in 1972 but the results of this work were not reported.

Prior to the construction of Well No. 4, two test holes were drilled in July 1973 by Albrecht Well Drilling, Inc., Ohio, Illinois. The first hole, drilled to a depth of 123 ft, was located on the west edge of town and the second hole, drilled to a depth of 163 ft, was located at the site of Well No. 4.

WELL NO. 4, finished in sand and gravel of the Prairie Aquigroup, was completed in November 1973 to a depth of 138 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 0.5 mile south of the village, approximately 40 ft S and 1250 ft E of the NW corner of Section 2, T30N, R1W, Marshall County. The land surface elevation at the well is approximately 660 ft.

WELL NO. 4, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	11	11
Yellow gravel	2	13
Gray clay	37	50
Dark clay	18	68
Brown clay	5	73
Gravel 1/8 in. (no water)	3	76
Brown clay	7	83
Sand and gravel (no water)	6	89
Green clay	5	94
Gray clay	6	100
Soft black clay	2	102
Gravel	2	104
Gray clay	3	107
Gravel	1	108
Gray clay	4	112
Gravel mixed small to coarse, some sand (water bearing)	26	138

An 8-in. diameter hole was drilled to a depth of 138 ft. The well is cased with 8-in. pipe from 1 ft above land surface to a depth of 128 ft followed by 10 ft of 8-in. No. 50 slot Johnson stainless steel screen. The top of the casing is equipped with a pitless adapter.

A production test was conducted by the driller on November 13, 1973. After 4 hr of pumping at rates of 100 to 112 gpm, the final drawdown was 5.02 ft from a non-pumping water level of 99.04 ft below land surface. Thirty

min after pumping was stopped, the water level had recovered to 99.60 ft. Based on a review of available information, the Water Survey reported that a long-term production rate of 100 gpm (144,000 gpd) should be possible from this well

The pumping equipment presently installed is an 8-in., 7-stage Red Jacket submersible pump (No. 1006R4-4HB) set at about 125 ft, rated at 100 gpm, and powered by a 10-hp Red Jacket electric motor.

The following mineral analysis (Lab. No. 197361) is for a water sample from the well collected November 7, 1974, after 40 min of pumping at 100 gpm.

WELL NO. 4, LABORATORY NO. 197361

		mg/L me/L		mg/L me/L	
Iron(total)	Fe	5.9	Silica	SiO ₂	17.3
Manganese	Mn	0.05	Fluoride	F	0.6
Ammonium	NH ₄	7.0	Boron	B	0.3
Sodium	Na	41.1	Nitrate	NO ₃	0.7
Potassium	K	2.0	Chloride	Cl	3
Calcium	Ca	66.0	Sulfate	SO ₄	0.0
Magnesium	Mg	33.0	Alkalinity (as	CaCO ₃)	404
Strontium	Sr	0.51			8.08
			Hardness (as	CaCO ₃)	300
Barium	Ba	0.2			6.00
Cadmium	Cd	0.00	Total dissolved		
Chromium	Cr	0.00	minerals		415
Copper	Cu	0.00			
Lead	Pb	<0.05			
Lithium	Li	0.00	Turbidity	31	
Nickel	Ni	<0.05	Color	10	
Zinc	Zn	0.04	Odor	0	

WELL NO. S, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1982 to a depth of

138 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 75 ft west of Well No. 4, approximately 40 ft S and 1175 ft E of the NW corner of Section 2, T30N, R1W, Marshall County. The land surface elevation at the well is approximately 660 ft.

WELL NO. 5, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Yellow clay	11	11
Yellow gravel	2	13
Gray clay	37	50
Dark clay	18	68
Brown clay	5	73
Gravel	3	76
Brown clay	7	83
Sandy clay	6	89
Green clay	5	94
Gray clay	11	105
Gravel	33	138

A 6-in. diameter hole was drilled to a depth of 138 ft. The well is cased with 6-in. steel pipe from land surface to a depth of 125 ft and equipped with 12 ft of 6-in. No. 60 slot telescope screen with 1 ft of nominal sized blank pipe attached to the top of the screen for a total depth of 138 ft.

Upon completion, the well reportedly produced 140 gpm for 1 hr with a drawdown of 20.0 ft from a nonpumping water level of 103.5 ft below land surface.

The pumping equipment presently installed is a Red Jacket submersible pump set at 119 ft, rated at 100 gpm, and powered by a 10-hp Red Jacket electric motor.

SPARLAND

The village of Sparland (pop. 624) installed a public water supply in 1937. Two wells (Nos. 2 and 3) are in use. In 1950 there were 110 services; the estimated average and maximum pumpages were 10,000 and 20,000 gpd, respectively. In 1990 there were 207 services, none metered; the average and maximum pumpages were 82,400 and 120,000 gpd, respectively. The water is fluoridated and chlorinated.

Prior to the construction of a public water supply, a test well was drilled in 1936 to a depth of 21 ft by Johnson & Hinkle, Bloomington. It was located approximately 1700 ft S and 2000 ft E of the NW corner of Section 14, T12N, R9E. A 6-in. diameter hole was drilled and cased with 6-in pipe to a depth of 10 ft followed by a No. 20 slot screen.

Upon completion, the nonpumping water level was reported to be 735 ft below the top of the casing.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in 1936 to a depth of 26 ft by Mike Ebert, Washington. This well was abandoned and sealed about 1966. The well was located about 0.5 block southwest of the railroad station, approximately 1690 ft S and 1990 ft E of the NW corner of Section 14, T12N, R9E. The land surface elevation at the well is approximately 460 ft.

A 10-in. diameter hole was drilled to a depth of 26 ft. The well was cased with 10-in. pipe from about 12 ft above land surface to a depth of 15 ft followed by 11 ft of 10-in. No. 40 slot Cook screen.

A production test was conducted by the State Water Survey on October 8-9, 1936. After 24 hr of pumping at rates ranging from 175 to 131 gpm, the maximum drawdown was 12 ft from a nonpumping water level of 7.3 ft below the top of the casing. Because of seasonal variations in the water level, pumping rates in excess of 100 gpm were not recommended.

A mineral analysis of a sample (Lab. No. 108853) collected January 8, 1947, after pumping for 18 hr at 168 gpm, showed the water to have a hardness of 631 mg/L, total dissolved minerals of 797 mg/L, and an iron content of 0.0 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1955 to a depth of 33 ft by the M. Ebert Co., Washington. This well is alternated with Well No. 3 every two weeks. The well is located about 17 ft east of Well No. 1, approximately 1688 ft S and 2007 ft E of the NW corner of Section 14, T12N, R9E. The land surface elevation at the well is approximately 460 ft.

The well is cased with 12-in. pipe from about 25 ft above land surface to a depth of about 28 ft followed by 5 ft of Johnson Everdur screen. The screened section consists of 1 ft of No. 125 slot followed by 4 ft of No. 150 slot.

The pumping equipment presently installed is a Red Jacket submersible pump set at about 32 ft, rated at 100 gpm, and powered by a 10-hp, 3450 rpm Red Jacket electric motor (Serial No. 3BME7359).

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B105900) of a sample collected December 4, 1973, after pumping for 30 min at 100 gpm, showed the water to have a hardness of 595 mg/L, total dissolved minerals of 807 mg/L, and an iron content of 0.00 mg/L.

WELL NO. 3, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1966 to a depth of 34 ft by the M. Ebert Co., Washington. This well is alternated with Well No. 2 every two weeks. The well is located about 20 ft southeast of Well No. 2, approximately 1705 ft S and 2020 ft E of the NW corner of Section 14, T12N, R9E. The land surface elevation at the well is approximately 460 ft.

The well is cased with 12-in. black steel pipe to a depth of 30 ft followed by 4 ft of 12-in. Cook Everdur screen. The screened section consists of 1 ft of No. 100 slot followed by 3 ft of No. 150 slot. The top of the well casing is equipped with a Baker pitless adapter.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Loam	10	10
Soft brown clay, trace gravel	6	16
Soft yellow clay	14	30
Gravel trace clay	4	34
Shale below		

Upon completion, the well reportedly produced 60 gpm for 42 hr with a drawdown of 1.1 ft from a nonpumping water level of 83 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 31.5 ft, rated at 100 gpm, and powered by a 10-hp, 3450 rpm Franklin Electric motor (Model No. 3P1026C59D, Serial No. AB755).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B01733) is for a water sample from the well collected July 12, 1977, after 30 min of pumping at 100 gpm.

WELL NO. 3, LABORATORY NO. B01733

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.0		Silica	SiO ₂	11	
Manganese	Mn	0.00		Fluoride	F	03	0.02
Ammonium	NH ₄	0.0	0.00	Boron	B	03	
Sodium	Na	24	1.04	Cyanide	CN	0.00	
Potassium	K	3.1	0.08	Nitrate	NO ₃	9.2	0.15
Calcium	Ca	120	5.99	Chloride	Cl	27	0.76
Magnesium	Mg	59	4.86	Sulfate	SO ₄	240	4.99
				Alkalinity (as CaCO ₃)		287	5.74
Arsenic	As	0.00		Hardness (as CaCO ₃)		549	10.98
Barium	Ba	0.0					
Cadmium	Cd	0.00		Total dissolved minerals		698	
Chromium	Cr	0.00					
Copper	Cu	0.01					
Lead	Pb	0.00					
Mercury	Hg	0.0001					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH(as rec'd)		12	

TOLUCA

The city of Toluca (pop. 1471) installed a public water supply in 1908. Two wells (Nos. 2 and 3) are in use. In 1950 there were 420 services; the average and maximum pumpages were 85,000 and 90,000 gpd, respectively. In 1990 there were 650 services, all metered; the average pumpage in 1989 was 168,100 gpd. The water is chlorinated.

WELL NO. 1 was completed in 1908 to a depth of 2000 ft (cleaned out in 1916 to a depth of 1904 ft and in 1948 to a depth of 1900 ft) by the J.P. Miller Artesian Well Co., Brookfield. This well was abandoned in 1952 and sealed in 1960. The water-yielding units in this well were dolomites and sandstones of the Mississippi Valley Aquigroup (Silurian System) and the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well was located on the east side of Cedar St. north of West Railroad St., approximately 240 ft N and 2300 ft E of the SW corner of Section 5, T29N, R1E. The land surface elevation at the well is approximately 695 ft.

The well was originally cased with 12-in. pipe from 1 ft above land surface to a depth of 76 ft, 10-in. pipe from 60 ft to a depth of 310 ft, 8-in. pipe from 297 ft to a depth of 592 ft, and 6-in. pipe from 587 ft to a depth of 848 ft. It was reported that the 6-in. pipe was then placed at a lower depth (not recorded) and the upper part removed. An 8-in. casing was then placed on the 6-in. pipe up to a depth of 139 ft below land surface. The hole was finished 6 in. in diameter at the bottom. In 1916, this well was cleaned out to a depth of 1904 ft by S.B. Geiger & Co., Chicago. The well was then recased with 8-in. pipe from land surface to a depth of 250 ft and 6-in. pipe from about 250 ft to a depth of 850 ft.

Nonpumping water levels were reported to be 165 ft in 1908, 135 ft below land surface in 1913, and 138 ft in 1917.

A production test was conducted by the State Water Survey on June 17, 1924. After 1 hr of pumping at a rate of 81 gpm, the drawdown was 26.2 ft from a nonpumping water level of 145.8 ft below land surface.

In January 1947, the nonpumping water level was reported to be about 150 ft below the top of the casing.

In January 1948, a bridge was found at a depth of about 1250 ft. This well was then cleaned out to a reported depth of 1900 ft by Ira French and Sons, Fairbury. On February 7, 1948, after a 25-week idle period, the nonpumping water level was reported to be 169 ft below the pumphouse floor.

A production test was conducted on February 23, 1948, by representatives of the city, the State Water Survey, and the consulting engineer. After 2 hr of pumping at rates ranging from 52 to 48.8 gpm, the drawdown was 21.6 ft from a nonpumping water level of 176.7 ft below the pump base. After a 50-min idle period, pumping was continued for 1.7 hr at rates of 111 to 105 gpm with a drawdown of 55.9 ft.

A partial analysis of a sample (Lab. No. 113564) collected February 23, 1948, after pumping for 5.9 hr at rates ranging from 50 to 110 gpm, showed the water to have a hardness of 213 mg/L, total dissolved minerals of 2277 mg/L, and an iron content of 0.5 mg/L.

WELL NO. 2 was completed in November 1951 to a depth of 1870 ft by the J.P. Miller Artesian Well Co., Brookfield. The water-yielding unit in this well is the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located on the west side of South Main St. and north of West Railroad Ave., approximately 350 ft N and 2480 ft E of the SW corner of Section 5, T29N, R1E. The land surface elevation at the well is approximately 695 ft.

WELL NO. 2, SAMPLE STUDY LOG (furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
QUATERNARY SYSTEM		
Pleistocene Series		
No sample	30	30
Gravel	20	50
Gravel; till	15	65
Gravel	35	100
PENNSYLVANIAN SYSTEM		
Shale, gray, brown, black, weak to firm; limestone, light gray	530	630
DEVONIAN SYSTEM		
Middle Devonian Series		
Dolomite	5	635
SILURIAN SYSTEM		
Niagaran Series		
Dolomite, grayish buff, white, very fine to medium; limestone, white, light gray	455	1090
Dolomite, buff, gray, pink, green, very fine to coarse	25	1115
Alexandrian Series		
Kankakee Dolomite		
Dolomite, buff, very fine to medium	25	1140
Elwood Dolomite		
Dolomite, buff, fine to medium	40	1180

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
ORDOVICIAN SYSTEM		
Cincinnatian Series		
Maquoketa Group		
Shale, grayish green, brown; weak; dolomite, light gray	155	1338
Champlainian Series		
Galena and Platteville Groups		
Dolomite buff, light brown; limestone, light to medium brown	371	1706
Ansell Group		
St Peter Sandstone		
Sandstone, white, fine to coarse, incoherent	168	1874

A 24-in. diameter hole was drilled to a depth of 94 ft, reduced to 19 in. between 94 and 617 ft, reduced to 12 in. between 617 and 1358 ft, and finished 8 in. in diameter from 1358 to 1884 ft. A concrete plug was placed from 1884 to 1870 ft. The well is cased with 20-in. pipe from land surface to a depth of 94.5 ft, 12-in. pipe from 2 ft above land surface to a depth of 593.6 ft (cemented in), 16-in. OD liner from 315 ft to a depth of 617 ft, and 8-in. pipe from 593.6 ft to a depth of 1357.1 ft (cemented in).

A production test was conducted on November 5, 1951, by representatives of the driller, the city, the State Water Survey, and the Austin Engineering Co. After 10.1 hr of intermittent pumping at rates ranging from 60 to 102 gpm, the drawdown was 174 ft from a nonpumping water level of 192 ft below the top of the casing. Twenty-three min after pumping was stopped, the water level had recovered to 205 ft. The well was then shot with three charges as follows: 209 lb of 100 percent nitroge and 12 lb of 60 percent dynamite primer between 1805 and 1791 ft; and 228 lb of 100 percent nitroge each and 14 lb of 60 percent dynamite primer each between the depths of 1790 and 1766 ft and between 1810 and 1795 ft.

A production test, using Well No. 1 as an observation well, was then conducted on December 11, 1951, by representatives of the driller, the city, the State Water Survey, and the Austin Engineering Co. After 9.6 hr of pumping at rates ranging from 150 to 420 gpm, the drawdown was 183 ft from a nonpumping water level of 184 ft below land surface. Twenty-one min after pumping was stopped, the water level had recovered to 213 ft.

The pumping equipment presently installed is an 8-in. Peerless vertical turbine pump (Serial No. 95415) set at about 420 ft, rated at 160 gpm at about 298 ft TDH, and powered by a 20-hp, 1800 rpm General Electric motor. The well is equipped with about 420 ft of airline.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B051111) of a sample collected April 21, 1981, after pumping for 7.5 hr at 120 gpm,

showed the water to have a hardness of 201 mg/L, total dissolved minerals of 1520 mg/L, and an iron content of 0.94 mg/L.

WELL NO. 3 was completed in January 1965 to a depth of 1842 ft by the J.P. Miller Artesian Well Co., Brookfield. The water-yielding unit in this well is the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located west of Cedar St. on the north side of West Third St., approximately 2557 ft S and 2090 ft E of the NW corner of Section 5, T29N, R1E. The land surface elevation at the well is approximately 688 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Red clay	12	12
Blue shale and clay	8	20
Red sand and clay some gravel	10	30
Blue hardpan	6	36
Gray shale with pea gravel	49	85
Gray clay and fine sand	10	95
Brown muddy shale	11	106
Green shaly lime	18	124
Gray and pink shale mixed	26	150
Gray shale mixed with gravel	25	175
Gray shale and lime	11	186
Coal,	2	188
Pink shale and lime	7	195
Light gray shale some lime shells	40	235
Dark brown shale	30	265
Black shale	25	290
Light gray shale	25	315
Dark lime and shale	3	318
Coal and black shale	16	334
Light gray shale	31	365
Dark shale	15	380
Coal and black slate	5	385
Light gray shale	5	390
Light gray shale and lime shells	60	450
Light gray lime	25	475
Brown shale	5	480
Light brown lime	20	500
Gray shale	15	515
Gray sandy lime	10	525
Sand	20	545
Dark shale	3	548
Gray sandy lime	9	557
Coal	2	559
Gray chalky lime	16	575
Dark brown shale	5	580
Sand	12	592
Gray lime	43	635
Lime changing to light brown	5	640
light gray lime some chalk bricks	60	700
Light gray lime	100	800
Gray lime, medium	116	916
White lime, medium	194	1110
Light gray and pink lime	25	1135
Light gray lime	25	1160
Green sandy lime	15	1175
Green shale	63	1238
Gray hard shale, dark lime fine	30	1268
White lime	12	1280

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dark gray	15	1295
Dark brown lime	20	1315
Gray chalk	20	1335
Light brown lime	40	1375
Light brown lime hard	235	1610
Brown lime	70	1680
Brown sand	3	1683
Brown silt sand	12	1695
Silt and sand brown	15	1710
St Peter sand	90	1800
White sand, medium	20	1820
Sand, hard	22	1842

A 19.2-in. diameter hole was drilled to a depth of 618 ft, reduced to 12.5 in. between 618 and 1371 ft, and finished 8 in. in diameter from 1371 to 1842 ft. The well is cased with 20-in. OD pipe from land surface to a depth of 106.5 ft, 12-in. pipe from above land surface to a depth of 613.7 ft, 16-in. OD liner from 181 ft to a depth of 617 ft, and an 8-in. pipe from 615 ft to a depth of 1371 ft (cemented in).

Upon completion, the well reportedly produced at rates ranging from 150 to 280 gpm for 22 hr with a drawdown of 198 ft from a nonpumping water level of 188 ft.

The pumping equipment presently installed is an 8-in., 15-stage Peerless turbine pump (Serial No. 311829) set at 420 ft, rated at 230 gpm at about 477 ft TDH, and

powered by a 40-hp, 1770 rpm General Electric motor (Model No. 5K6256XC502A, Serial No. EAJ 526473).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B145485) is for a water sample from the well collected June 25, 1975, after 1 hr of pumping at 240 gpm.

WELL NO. 3, LABORATORY NO. B145485

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.4		Silica	SiO ₂	10	
Manganese	Mn	0.00		Fluoride	F	14	0.07
Ammonium	NH ₄	1.8	0.01	Boron	B	0.7	
Sodium	Na	390	16.96	Cyanide	CN	0.00	
Potassium	K	14.7	0.38	Nitrate	NO ₃	0.04	0.00
Calcium	Ca	47	234	Chloride	Cl	445	12.55
Magnesium	Mg	21	1.73	Sulfate	SO ₄	220	4.58
				Alkalinity (as CaCO ₃)		240	4.80
Arsenic	As	0.000		Hardness (as CaCO ₃)		204	4.08
Barium	Ba	0.0					
Cadmium	Cd	0.00		Total dissolved			
Chromium	Cr	0.00		minerals		1325	
Copper	Cu	0.00					
Lead	Pb	0.00		pH(as rec'd)	7.9		
Mercury	Hg	0.0000		Radioactivity			
Nickel	Ni	0.0		Alpha <i>pc/L</i>	27.0		
Selenium	Se	0.000		± deviation	8.5		
Silver	Ag	0.000		Beta <i>pc/L</i>	35.2		
Zinc	Zn	0.0		± deviation	5.8		

VARNA

The village of Varna (pop. 441) installed a public water supply in 1941. One well (No. 3) is in use and another well (No. 2) is available for emergency use. In 1950 there were 125 services; the average and maximum pumpages were 20,000 and 30,000 gpd, respectively. In 1989 there were 216 services, 12 percent metered; the average and maximum pumpages were 31,500 and 50,000 gpd, respectively. The water from Well No. 3 is chlorinated and fluoridated.

Prior to the installation of a public water supply, water for the school and several families was obtained from a 6-ft diameter dug well completed to a depth of 90 ft. This well was abandoned prior to 1950 and sealed about 1954. The well was located on the west side of Walnut St. about 350 ft north of the Chicago & Alton RR tracks, approximately 350 ft N and 1900 ft W of the SE corner of Section 28, T30N, R1W.

A second well was completed in 1940 to a depth of 99 ft by Hayes & Sims, Champaign. This well was abandoned prior to 1951. The well was located in the north part of the village. The well was cased with 6-in. pipe to a depth of 94 ft followed by 5 ft of No. 50 slot Johnson silicon brass screen. A production test was conducted by the driller in April 1940. After 17 hr of pumping at rates of 15 to 12 gpm, the drawdown was 49 ft from a nonpumping water level of 45 ft below the top of the casing. In 1946, this well was acidized which reportedly improved the yield for a short time.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in 1940 to a depth of 95 ft by Hayes & Sims, Champaign. This well was abandoned in 1963 and has been sealed. The well was located on Front St., approximately 2510 ft N and 1025 ft W of the SE corner of Section 28, T30N, R1W. The land surface elevation at the well is approximately 725 ft.

The well was cased with 6-in. pipe to a depth of 90 ft followed by 5 ft of No. SO slot Johnson screen.

A production test was conducted by the driller in 1940. After 21 hr of pumping at rates of 12 to 10 gpm, the draw-down was 48 ft from a nonpumping water level of 42 ft below the top of the casing.

A mineral analysis of a sample (Lab. No. 108900) collected January 13, 1947, showed the water to have a hardness of 299 mg/L, total dissolved minerals of 532 mg/L, and an iron content of 0.7 mg/L.

WELL NO. 2 was completed in August 1949 to a depth of 1870 ft by the J.P. Miller Artesian Well Co., Brookfield. This well is available for emergency use. The water-yielding units in this well are dolomites and sandstones of the Mississippi Valley Aquigroup (Silurian System) and the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located in a small frame building adjoining the east part of the pump station, approximately 2550 ft N and 800 ft W of the SE corner of Section 28, T30N, R1W. The land surface elevation at the well is approximately 725 ft.

WELL NO. 2, SAMPLE STUDY LOG
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
QUATERNARY SYSTEM		
Pleistocene Series		
Glacial Drift		
"Soil"	4	4
"Red clay and graver	96	100
"Shale, blue" (till)	4	104
"Gravel"	2	106
PENNSYLVANIAN SYSTEM		
Shale, gray to red to green; limestone	109	215
Sandstone, partly argillaceous, gray	45	260
Shale, brown to black	55	315
Coal	5	320
Shale, gray; some limestone, gray	21	341
Coal	4	345
Shale, sandstone, siltstone, and limestone	35	380
Shale, gray to brown	155	535
Sandstone, gray, shale, gray to brown	25	560
Shale, sandy, gray to buff to green	25	585
Coal	2	587
Shale, silty, carbonaceous; sandstone	41	628
DEVONIAN SYSTEM		
Upper Devonian Series		
Shale, brown, brittle, to tough	15	643
Middle Devonian Series		
Dolomite, brown, very fine	2	645
SILURIAN SYSTEM		
Niagaran Series		
Dolomite, buff to gray, very fine to fine	20	665
Dolomite, cherty, buff; geode quartz	20	685
Dolomite, silty, cherty; some siltstone	225	910
Shale, silty, dolomitic, gray, weak	9	919
Dolomite, silty, white; some siltstone	41	960

<i>Soma</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dolomite, cherty, buff	75	1035
Dolomite, gray, some buff	130	1165
Alexandrian Series		
Kankakee Formation		
Dolomite, buff to green	30	1195
Dolomite, cherty, buff	10	1205
Edgewood Formation		
Siltstone, sandy, dolomitic; shale, gray	25	1230
ORDOVICIAN SYSTEM		
Cincinnatian Series		
Maquoketa Group		
Shale, dolomitic, gray; streaks dolomite	100	1330
Shale, dolomitic, brown; dolomite, brown	40	1370
Shale, dolomitic, grayish-brown	31	1401
Champlainian Series		
Galena Group		
Kimmiswick Subgroup		
Dolomite, buff, fine to medium	49	1450
Limestone, dolomitic, and dolomite, buff	60	1510
Dolomite, buff to brown, medium	95	1605
Decorah Subgroup		
Dolomite, cherty, buff, brown speckled	15	1620
Platteville Group		
Dolomite, cherty, buff; some limestone	45	1665
Dolomite and limestone, buff to brown	60	1725
Dolomite, buff to brown	34	1759
Ancell Group		
Glenwood-St Peter Formation		
Sandstone, white, fine to coarse, incoherent	16	1775
Same and clay, yellow	45	1820
Sandstone, white, fine to coarse, incoherent	25	1845
Sandstone, partly silty, white, fine to medium	25	1870

A 14-in. diameter hole was drilled to a depth of 132 ft, reduced to 13.2 in. between 132 and 657 ft, reduced to 8 in. between 657 and 1406 ft, and finished 6.6 in. in diameter from 1406 to 1870 ft. The well is cased with 14-in. OD pipe from land surface to a depth of 132.5 ft, 8-in. pipe from 12 ft above the wellhouse floor to a depth of 6543 ft (cemented in), and a 6-in. liner from 895.2 ft to a depth of 1406 ft.

A production test was conducted by the State Water Survey on August 6, 1949. After 7.2 hr of pumping at rates ranging from 106 to 206 gpm, the final drawdown was 37.5 ft from a nonpumping water level of 199.0 ft. Six min after pumping was stopped, the water level had recovered to 2005 ft.

The pumping equipment presently installed consists of a 30-hp, 3450 rpm electric motor and a 6-in., 6-stage Red Jacket submersible pump (Serial No. 1BNE8986) set at 300 ft, rated at 180 gpm, and equipped with 300 ft of 4-in. column pipe.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B23638) is for a water sample from the well collected November 30, 1977, after 1 hr of pumping at 140 gpm.

WELL NO. 2, LABORATORY NO. B23638

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.4		Silica	SiO ₂	11	
Manganese	Mn	0.00		Fluoride	F	2.0	0.10
Ammonium	NH ₄	1.0	0.06	Boron	B	1.2	
Sodium	Na	650	28.28	Cyanide	CN	0.00	
Potassium	K	12.7	0.32	Nitrate	NO ₃	0.0	0.00
Calcium	Ca	44	2.20	Chloride	Cl	785	22.14
Magnesium	Mg	21	1.73	Sulfate	SO ₄	200	4.16
				Alkalinity (as CaCO ₃)		308	6.16
Arsenic	As	0.00		Hardness (as CaCO ₃)		196	3.92
Barium	Ba	0.1		Total dissolved minerals		1970	
Cadmium	Cd	0.00					
Chromium	Cr	0.00					
Copper	Cu	0.01					
Lead	Pb	0.00					
Mercury	Hg	0.0002					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH (as rec'd)		8.0	

An 8-in. diameter test well was drilled in 1978 to a depth of 120 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. It was abandoned and sealed in September 1978. The test well was located in the NE quarter of the NE quarter of the SE quarter of Section 28, T30N, R1W.

WELL NO. 3, finished in sand and gravel of the Prairie Aquigroup, was completed in December 1980 to a depth of 272 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 2 miles west-northwest of the village, approximately 250 ft S and 2450 ft E of the NW corner of Section 30, T30N, R1W. The land surface elevation at the well is approximately 660 ft.

WELL NO. 3, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Top soil	5	5
Clay	25	30
Gray gravel	23	53
Clay	9	62
Gravel	20	82
Clay	24	106
Gravel	9	115
Sand	15	130
Big rock	10	140
Sand	122	262
Finer sand	10	272

A 10-in. diameter hole was drilled to a depth of 272 ft. The well is cased with 10-in. pipe from about 0.8 ft above land surface to a depth of 252 ft followed by 20 ft of 10-in. No. 40 slot Johnson stainless steel screen. The top of the casing is equipped with a Baker pitless adapter.

Upon completion, the nonpumping water level was reported to be 175 ft. The well produced 720 gpm for 1.5 hr.

The pumping equipment presently installed consists of a 60-hp Red Jacket electric motor and a Red Jacket submersible pump (Model No. 7-535-4A-1B) set at 220 ft, and equipped with 220 ft of 5-in. column pipe. The well is equipped with 214 ft of airline.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B000003) is for a water sample from the well collected December 29, 1989.

WELL NO 3, LABORATORY NO. B000003

		mg/L	me/L			mg/L	me/L
Iron	Fe	1.096		Silica	SiO ₂	17	
Manganese	Mn	0.159		Fluoride	F	0.12	
Ammonium	NH ₄	0.2	0.01	Boron	B	<0.050	
Sodium	Na	8.3	0.36	Cyanide	CN	<0.005	
Potassium	K	<0.3		Nitrate	NO ₃	<0.4	
Calcium	Ca	72	3.59	Chloride	Cl	2.6	0.07
Magnesium	Mg	33	2.72	Sulfate	SO ₄	36	0.75
Strontium	Sr	0.146		Alkalinity (as CaCO ₃)		310	6.20
Aluminum	Al	0.205		Hardness (as CaCO ₃)		312	6.24
Arsenic	As	<0.001		Total dissolved minerals		372	
Barium	Ba	0.021					
Beryllium	Be	<0.0005					
Cadmium	Cd	<0.003					
Chromium	Cr	<0.005					
Cobalt	Co	<0.005					
Copper	Cu	<0.005					
Lead	Pb	<0.005					
Mercury	Hg	<0.00005					
Nickel	Ni	<0.005					
Selenium	Se	<0.001					
Silver	Ag	<0.003					
Vanadium	V	<0.005					
Zinc	Zn	<0.050		pH (as rec'd)		8.2	

WENONA

The city of Wenona (pop. 1025) installed a public water supply in 1895. One well (No. 5) is in use and another well (No. 4) is available for emergency use. In 1950 there were 350 services, all metered; the estimated average

pumpage was 56,000 gpd. In 1988 there were 498 services, 99 percent metered; the average pumpage was 105,000 gpd. The water from Well No. 5 is chlorinated and filtered.

WELL NO. 1 was completed in 1890 to a depth of 1857 ft by the S. Swanson Co., Minneapolis, Minnesota. This well was abandoned and sealed in 1937. The water-yielding units in this well were dolomites and sandstones of the Mississippi Valley Aquigroup (Silurian System) and the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well was located in the pumping station near the main business district, approximately 1450 ft S and 900 ft W of the NE corner of Section 24, T30N, R1E. The land surface elevation at the well is approximately 690 ft.

WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Soil and yellow clay	10	10
Blue clay	46	56
Sand	10	66
Hardpan	34	100
Red clay	3	103
Soft clay, shale	3	106
Hard limestone	15	107.5
Brown shale	6	113.5
Sandstone	7	120.5
Blue shale	13	133.5
Dark clay, shale	4	137.5
Limestone	13	150.5
Gray slate	35	154
Black slate	3	157
Coal No. 10	05	157.5
Gray slate	11	168.5
Blue shale	2	170.5
Limestone (top hard)	11	181.5
Brown shale	8	189.5
Clay shale	6	195.5
Hard sandstone	2	197.5
Clay shale	4	201.5
Brown shale	2	203.5
Blue shale	6	209.5
Hard limestone	2	211.5
Blue shale	4	215.5
Clay shale, green	17	232.5
Blue shale	5	237.5
Brown shale	14	251.5
Blue sandstone	30	281.5
Gray slate	14	295.5
Dark shale	38	333.5
Coal No. 7	3	336.5
Fire clay (top good)	103	346.8
Sandy shale	8	354.8
Clay shale	18	372.8
Black shale	3	375.8
Dark shale	2	377.8
Brown shale	3	380.8
Flint-rock	4	384.8
Dark slate	4	388.8
Nodular fire clay	18	391.6
Brown shale	4	395.6
Fireclay	4.7	4003

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sandy shale	33	403.8
Soft shale	1.7	405.5
Sandstone	15.5	421
Gray slate	5.7	426.7
Dark slate with iron bands	1.5	428.2
Gray slate and sulfur	215	449.7
Black slate with fossils	4	453.7
Gray shale with fossils and plants	15.7	469.4
Black slate	33	472.9
Blue shale	6	478.9
Limestone	1.1	480
Dark soapstone	4	484
Limestone	1	485
Dark clay, shale	25	487.5
Black slate	5	492.5
Coal No. 4	1.2	493.7
Fire clay	6	499.7
Limestone	1	500.7
Dark clay, shale	2-5	503.2
Black slate	5	508.2
Coal No. 3	12	509.4
Fire clay	6.4	515.8
Limestone	2	517.8
Coal	0.3	518.1
Sandstone with sulfur	45	522.6
Dark shale	13	535.6
Hard sulfur rock	35	539.1
Black slate	45	543.6
Gray slate, shale	11.7	555.3
Coal No. 2	2.7	558
Fire clay	3.8	561.8
Sandstone	9.8	571.6
Gray slate	2	573.6
Dark shale	5	578.6
Hard rock	1.4	580
Black coal	1	581
Fire clay	5.8	586.8
Dark slate	1.8	588.6
Hard rock	1.6	590.2
Gray slate	1.5	591.7
Soapstone	4	595.7
Rock	1.3	597
Soapstone	2.7	599.7
Coal	0.9	600.6
Fire clay	5.3	605.9
Soapstone	9.6	615.5
Gray shale	14	629.5
Coal	1.1	630.6
Clay	1.5	632.1
Coal	1.2	633.3
Limestone	101	734.3
White shale	179	913.3
Limestone	139	1052.3
Shale	33	1085.3
Limestone	65	1150.3
Clay and shale	194	1344.3
No record	455.7	1800
St. Peter Sandstone	57	1857

The well was cased with 12-in. pipe from land surface to a depth of 110 ft and 9-in. pipe from 110 ft to a depth of 4% ft. Below the casing, the hole was reported to be 6 in. in diameter from 4% to 1114 ft and 4 in. from 1114 to 1857 ft.

Nonpumping water levels were reported to be 125 ft below land surface in March 1915, and 152 ft on December 19, 1916.

A production test was conducted by the State Water Survey on October 16, 1922. After 5.5 hr of pumping at a rate of about 100 gpm, the drawdown was 92 ft from a nonpumping water level of 156 ft. Full recovery was observed after pumping had been stopped for 4.8 hr.

A production test was conducted by the State Water Survey on July 29, 1927. After a 10.5-hr idle period, the well reportedly produced 98 gpm for 12 hr with a drawdown of 90.1 ft from a nonpumping water level of 160.9 ft below the top of the casing.

In May 1930, the well reportedly produced 65 gpm with a drawdown of 100 ft from a nonpumping water level of 160 ft.

On October 1, 1930, the nonpumping water level was reported to be 165 ft below land surface.

A mineral analysis of a sample (Lab. No. 75815) collected March 21, 1935, showed the water to have a hardness of 228 mg/L, total dissolved minerals of 1447 mg/L, and an iron content of 0.2 mg/L.

A test hole was constructed in 1930 to a depth of 81 ft. The hole was located about 2.5 blocks west and 15 blocks south of Well No. 1. Upon completion, it reportedly produced 20 gpm for 15 min with a drawdown of 15 ft from a nonpumping water level of 30 ft below land surface.

A second test hole was constructed in 1930 to a depth of 73 ft. The hole was located about 50 ft northeast of Well No. 1. Upon completion, when pulling the casing, a flow of water was indicated. The hole was pumped at a rate of 15 gpm with a drawdown of 8 ft from a nonpumping water level of 20 ft below land surface.

A well was dug in 1930 to a depth of 50 ft. This well caved in within a few months after it was constructed. It was located near Well No. 1 in the SE quarter of the NE quarter of Section 24, T30N, R1E.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in 1930 to a depth of 50 ft by Mike Ebert, Washington. This well was abandoned in 1939 and sealed prior to 1948. The well was located on the southwest edge of the city at Third and Spruce Sts., approximately 2100 ft S and 2280 ft E of the NW corner of Section 24, T30N, R1E. The land surface elevation at the well is approximately 680 ft.

WELL NO. 2, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Blue clay	40	40
Shale red	7	47
Sand	5	52
No record	8	60

The well was cased with 6-in. pipe to a depth of 47 ft followed by 3 ft of 6-in. perforated pipe.

Upon completion, the nonpumping water level was reported to be 28 ft below land surface.

A mineral analysis of a sample (Lab. No. 75817) collected March 21, 1935, showed the water to have a hardness of 438 mg/L, total dissolved minerals of 725 mg/L, and an iron content of 1.0 mg/L.

WELL NO. 3 was completed in 1937 to a depth of 1865 ft by Joseph Egerer, Milwaukee, Wisconsin. This well was abandoned in 1960 and sealed in 1975. The water-yielding unit in this well was the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well was located just outside the treatment plant building about 50 ft north of Well No. 1, approximately 1400 ft S and 900 ft W of the NE corner of Section 24, T30N, R1E. The land surface elevation at the well is approximately 690 ft.

WELL NO. 3, SAMPLE STUDY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
QUATERNARY SYSTEM		
Pleistocene Series		
"Till and brown mud"	50	50
"Muddy gravel"	20	70
PENNSYLVANIAN SYSTEM		
Shale, thin beds of limestone, coal, and sandstone	564	634
SILURIAN SYSTEM		
Niagaran and Alexandrian Series		
Dolomite, partly shaley	336	970
Dolomite	175	1145
Siltstone and sandstone	10	1155
ORDOVICIAN SYSTEM		
Cincinnatian Series		
Maquoketa Group		
Shale, some limestone and dolomite	170	1325
Champlainian Series		
Galena and Platteville Groups		
Limestone, few thin shale and dolomite beds	380	1705
Ancell Group		
Glenwood Formation		
Dolomite, shale and sandstone	10	1715
St Peter Sandstone	140	1855

The well was cased with 12-in. pipe from land surface to a depth of 346 ft and 8-in. pipe from about 0.5 ft above the pump-station floor to a depth of 13503 ft. Below the casing, the hole was finished 8 in. in diameter to 1865 ft.

A production test was conducted by the State Water Survey on May 11-12, 1937. After 23.7 hr of pumping at rates ranging from 30 to 24 gpm, the final drawdown was 107 ft from a nonpumping water level of 191 ft below the top of the casing.

In January 1947, the nonpumping water level was reported to be about 180 ft.

A partial analysis of a sample (Lab. No. 143000) collected March 29, 1957, showed the water to have a hardness of 256 mg/L, total dissolved minerals of 1482 mg/L, and an iron content of 33 mg/L.

Five test holes were constructed in 1947 by the Layne-Western Co., Aurora, to depths ranging from 72 to 88 ft. Three of the holes were located in the NW and SE quarters of Section 24, T30N, R1E, and the other two holes were located in the NW and NE quarters of Section 25, T30N, R1E.

A test well was constructed in February 1947 to a depth of 62 ft by the Layne-Western Co., Aurora. It was located approximately 50 ft S and 1320 ft W of the NE corner of Section 25, T30N, R1E. The test well was cased with 8-in. pipe from land surface to a depth of 45 ft and 6-in. pipe from 1 ft above land surface to a depth of 55 ft and equipped with 53 ft of 6-in. No. 30 slot Keystone screen with the bottom set at 61 ft. A production test was conducted by the State Water Survey on February 10, 1947. Pumping was started at a rate of 45 gpm but broke suction almost immediately. After the discharge valve was throttled to 25 gpm, the pumping water level was at the bottom of the pump suction 55 ft below land surface. After 25 hr of pumping, the drawdown was 43.0 ft from a nonpumping water level of 12.0 ft below land surface. Two min after pumping was stopped, the water level had recovered to 12.8 ft.

WELL NO. 4, finished in sand and gravel of the Prairie Aquigroup, was completed in October 1947 to a depth of 61.8 ft by the Layne-Western Co., Aurora. This well is available for emergency use. The well is located about 0.5 mile south of the city, approximately 33 ft S and 1300 ft W of the NE corner of Section 25, T30N, R1E. The land surface elevation at the well is approximately 695 ft.

WELL NO. 4, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	12	12
Blue clay	36	48
Sand and gravel	13.8	61.8

A 20-in. diameter hole was drilled to a depth of 53 ft and finished 17 in. in diameter from 53 to 623 ft. The well is cased with 20-in. OD pipe from about 2 ft above land surface to a depth of 53 ft and 10-in. ID pipe from 2 ft above land surface to a depth of 51.7 ft followed by 10.1 ft of 10-in. No. 6 (0.080 in.) Layne Everdur bronze shutter screen. The bottom 25 ft of screen is a 10- by 17-in. cone section. A 6-in. thick concrete plug extends from 61.8 to 623 ft. The annulus between the 20- and 10-in. casings and between the 17-in. borehole and 10-in. screen is filled with 1/8- by 3/8-in. gravel from 0 to 61.8 ft.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B34812) is for a water sample from the well collected February 28, 1977, after 1 hr of pumping at 60 gpm.

WELL NO. 4, LABORATORY NO. B34812

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	2.7		Silica	SiO ₂	14	
Manganese	Mn	0.15		Fluoride	F	0.6	0.03
Ammonium	NH ₄	0.86	0.08	Boron	B	0.8	
Sodium	Na	94	4.09	Cyanide	CN	0.01	
Potassium	K	4.7	0.12	Nitrate	NO ₃	0.0	0.00
Calcium	Ca	111	5.54	Chloride	Cl	29	0.82
Magnesium	Mg	42	3.46	Sulfate	SO ₄	350	7.28
				Alkalinity (as CaCO ₃)		272	5.44
Arsenic	As	0.00		Hardness (as CaCO ₃)		460	9.20
Barium	Ba	0.1					
Cadmium	Cd	0.00		Total dissolved minerals		851	
Chromium	Cr	0.00					
Copper	Cu	0.02					
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH(as rec'd)		7.5	

A production test using one observation well was conducted on October 9, 1947, by representatives of the driller, the State Water Survey, and the Miller Engineering Service. After 9.7 hr of pumping at rates of 98 to 95 gpm, the drawdown was 14.7 ft from a nonpumping water level of 13.0 ft below the top of the casing. One hr after pumping was stopped, the water level had recovered to 20.8 ft.

On February 19, 1953, the well reportedly produced about 25 gpm with a drawdown of 4 ft from a nonpumping water level of 28 ft. Pumping was continued for 20 min with a drawdown of 5 ft. Thirty-five min after pumping was stopped, full recovery was observed.

The pumping equipment presently installed is a 6-in., 11-stage Layne & Bowler turbine pump (No. 18841) set at 40 ft, rated at 60 gpm at about 165 ft TDH, and powered by a 5-hp, 1750 rpm U. S. electric motor (Model No. CFU, Serial No. 765607).

Nine test holes were constructed in August and November 1955 by the Layne-Western Co., Aurora, to depths ranging from 63 to 90 ft. The holes were located in Sections 24 and 25, T30N, R1E.

WELL NO. 5 was completed in March 1957 to a depth of 1837 ft by the Layne-Western Co., Aurora. The water-yielding unit in this well is the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located south of the city hall about 15 blocks southwest of the treatment plant, approximately 1800 ft S and 1000 ft W of the NE corner of Section 24, T30N, R1E. The land surface elevation at the well is approximately 690 ft.

WELL NO. 5, SAMPLE STUDY LOG
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
QUATERNARY SYSTEM		
Pleistocene Series		
Soil, clay	41	41
Gravel	16	57
Gravel, sand, day	44	101
PENNSYLVANIAN SYSTEM		
Shale, limestone, coal	529	630
Sandstone, gray and white	10	640
SILURIAN SYSTEM		
Niagaran Series		
Moccasin Springs Dolomite		
Dolomite, brown, gray, very fine grained	285	925
St Clair Dolomite		
Dolomite brown, gray, white, pink very fine to fine-grained, silty	196	1121
Alexandrian Series		
Kankakee Dolomite		
Dolomite, brownish gray		
Edgewood Dolomite		
Dolomite, brownish gray, cherry, silty	32	1153
ORDOVICIAN SYSTEM		
Cincinnatian Series		
Maquoketa Group		
Brainard Shale		
Sandstone, gray, green gray, shale greenish to gray dolomite buff; shale dark gray	107	1260

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Fort Atkinson Limestone		
Dolomite to limestone, gray fossiliferous	35	1295
Scales Shale		
Shale, dark olive gray weak	39	1334
Champlainian Series		
Galena and Platteville Groups		
Limestone, dolomite brown, gray, cherty and shaly in part	381	1715
Ancestral Group		
St Peter Sandstone		
Starved Rock Sandstone Member		
Sandstone, white, fine to coarse	75	1790
Tonti Sandstone Member		
Sandstone, white fine to medium	45	1835

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. C006274) is for a water sample from the well collected March 11, 1974, after 2 hr of pumping.

WELL NO. 5, LABORATORY NO. C006274

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.6		Silica	SiO ₂	10.5	
Manganese	Mn	0.01		Fluoride	F	1.6	0.08
Ammonium	NH ₄	1.7	0.09	Boron	B	0.9	
Sodium	Na	410	17.84	Cyanide	CN	0.03	
Potassium	K	14.0	0.36	Nitrate	NO ₃	3.9	0.06
Calcium	Ca	56	2.79	Chloride	Cl	525	14.80
Magnesium	Mg	25	2.06	Sulfate	SO ₄	174	3.62
				Alkalinity (as CaCO ₃)		252	5.04
Arsenic	As	0.00		Hardness (as CaCO ₃)		244	4.88
Barium	Ba	0.0		Total dissolved minerals			
Cadmium	Cd	0.00		1406			
Chromium	Cr	0.00		pH (as rec'd)			
Copper	Cu	0.00		83			
Lead	Pb	0.00		Radioactivity			
Mercury	Hg	0.0000		Alpha <i>pc/L</i>			
Nickel	Ni	0.0		± deviation			
Selenium	Se	0.00		55			
Silver	Ag	0.00		Beta <i>pc/L</i>			
Zinc	Zn	0.00		± deviation			
				27.8			
				62			

A 19.2-in. diameter hole was drilled to a depth of 636 ft, reduced to 15.2 in. between 636 and 1341 ft, and finished 10 in. in diameter from 1341 to 1837 ft. The well is cased with 20-in. OD steel pipe from land surface to a depth of 132 ft, 16-in. OD pipe from land surface to a depth of 636 ft, and 10-in. pipe from about 1.5 ft above land surface to a depth of 1341 ft (cemented in).

A production test was conducted on March 29, 1957, by representatives of the driller, the city, the State Water Survey, and Farnsworth & Wylie, Consulting Engineers. After 4.9 hr of pumping at rates ranging from 25 to 40 gpm, the drawdown was 185.0 ft from a nonpumping water level of 211.5 ft below land surface. Six min after pumping was stopped, the water level had recovered to 2245 ft.

This well was shot with 100 percent gel and 60 percent dynamite (detonator) as follows: 57 lb at 1825 ft, 57 lb at 1800 ft, 85 lb at 1775 ft, 100 lb at 1750 ft, and 100 lb at 1725 ft. A production test was then conducted by the driller on May 1, 1957. After 252 hr of intermittent pumping at rates ranging from 271 to 153 gpm, the maximum drawdown was 132 ft from a nonpumping water level of 213 ft.

On July 24, 1975, the well reportedly produced 159 gpm for 30 min with a drawdown of 73 ft from a nonpumping water level of 217 ft.

On August 18, 1976, after pumping at a rate of 195 gpm, the drawdown was 82 ft from a nonpumping water level of 222 ft.

In May 1989, the nonpumping water level was reported to be 228 ft.

The pumping equipment presently installed is a 7-stage Franklin submersible pump (Model No. 2366046010) set at 405 ft, rated at 128 gpm at about 405 ft TDH, and powered by a 20-hp electric motor.