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*Public Ground-Water Supplies  
in Knox County*

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

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# PUBLIC GROUND-WATER SUPPLIES IN KNOX COUNTY

by Dorothy M. Wbller, Ellis W. Sanderson, Michael L. Sargent,<sup>1</sup> and Robert D. Olson

## INTRODUCTION

This publication presents all available information on production wells used for public ground-water supplies in Knox 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 18 public ground-water supplies in Knox County. These are preceded by brief summaries of the ground-water geology and hydrology 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.

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## GROUND-WATER GEOLOGY AND HYDROLOGY

The geology of Knox County is described generally in Illinois State Geological Survey Circular 222, "Groundwater Geology in Western Illinois, North Part"; in Illinois State Geological Survey Report of Investigation 221, "Ground-Water Geology of the Rock Island, Monmouth, Galesburg, and Kewanee Area, Illinois"; and in Illinois State Water Survey and State Geological Survey Cooperative Groundwater Report 10, "Geology, Hydrology, and Water Quality of the Cambrian and Ordovician Systems in Northern Illinois." The following brief discussion of geologic conditions in the county is taken largely from these publications. For more detailed information concerning the geology in this part of the state, the reader is referred to the State Geological Survey. More detailed

information concerning the ground-water hydrology and water quality may be obtained from the Water Survey. The Surveys are located on the campus of the University of Illinois at Urbana-Champaign.

### Unconsolidated Deposits

The Prairie Aquigroup (see figure 1) is established within the unconsolidated glacial deposits which blanket Knox County, forming the present land surface. These deposits consist mostly of glacial drift but may also contain locally important deposits of loess and alluvium along the Spoon River and other streams. The drift is generally less

<sup>1</sup>Illinois State Geological Survey

SYSTEM	SERIES	GROUP OR FORMATION	HYDROSTRATIGRAPHIC UNITS AQUIGROUP	AQUIFER/ AQUITARD	LOG	THICKNESS (ft)	GENERALIZED DESCRIPTION				
QUATER-MARY	PLEISTOCENE		Prairie	Pleistocene		0 - 125	Till, gravel, sand, silt, peat, loess				
PENNSYLVANIAN	DESMOINESIAN and ATOKIAN	Carbondale	Upper Bedrock	Pennsylvanian		0 - 460	Shale, sandstone, clay, limestone, coal				
		Spoon Abbott									
MISSISSIPPIAN	VALMEYERAN	Burlington	Mississippi Valley	Burlington aquifer		0 - 140	Limestone, white to brown, very cherty, fossiliferous, dolomitic				
	KINDERHOOKIAN	New Albany		Mississippian Devonian confining unit		0 - 250	Shale, green to brown, pyritic, Sporangites, little sandstone and dolomite				
DEVONIAN	UPPER		Cedar Valley-Waspipinicon	Devonian		40 - 155	Limestone and dolomite, silty, cherty, fine gray to buff, part slightly pyritic				
	MIDDLE										
SILURIAN	NIAGARAN	Racine - Marcus	Silurian dolomite aquifer		0 - 220	Dolomite, crystalline, vesicular, white to gray, partly cherty					
	ALEXANDRIAN				20 - 80	Dolomite, dense to vesicular, silty and sandy in lower part					
ORDOVICIAN	CINCINNATIAN	Maquoketa	Midwest Bedrock	Maquoketa confining unit		80 - 210	Shale, dolomitic, green to gray, some dolomite				
	CHAMPLAINIAN	Ottawa Megagroup		Galena	Galena-Platteville unit		215 - 275	Dolomite and limestone, medium-grained, cherty in lower part			
				Platteville			60 - 100	Dolomite, fine-grained, cherty			
				Ancell Group			Glenwood - St. Peter	Ancell aquifer		140 - 210	Sandstone, medium-grained, friable, mostly white
	CANADIAN	Prairie du Chien		Shakopee	Prairie du Chien		190 - 270	Dolomite, cherty, few sandstone beds			
				New Richmond			15 - 80	Sandstone, some dolomite			
				Oneota			200 - 270	Dolomite, cherty, medium crystalline			
Gunter			0 - 10	Sandstone, dolomitic							
CAMBRIAN	ST. CROIXAN	Eminence	Middle confining unit	Eminence-Potosi		230 - 300	Dolomite, light colored, sandy, thin sandstones				
		Potosi				Dolomite, fine-grained, gray to brown, drusy quartz					
		Franconia				Franconia		160 - 230	Dolomite, sandstone and shale, glauconitic, green to red, micaceous		
		Ironton						Ironton-Galesville aquifer		110 - 200	Sandstone, fine to coarse-grained, well sorted, upper part dolomitic
		Galesville									

Figure 1. Generalized column of rock stratigraphic units and aquigroups in Knox County

than 50 ft thick, with bedrock outcrops along many of the creeks, and contains little water-bearing sand and gravel. Small domestic supplies can sometimes be obtained from large-diameter bored wells that tap thin lenses of sand and gravel present in the drift.

The most favorable prospects for developing ground-water supplies from the Prairie Aquigroup are usually in areas of thicker drift that are commonly situated along pre-glacial bedrock valleys where glacial meltwater deposited significant quantities of clean sand and gravel. About 50 to 100 ft of drift is present in buried or partially buried bedrock valleys located near Rio, west of Galesburg, and near the present Spoon River valley.

The municipal water-supply potential of these more favorable areas remains virtually unexplored in Knox County. Galesburg obtained its supply from drift wells in the Cedar Creek bottomlands until about 1920, and Williamsfield conducted exploratory work in the glacial deposits and alluvium along the Spoon River without establishing a supply. Yates City remains the only municipality with a well that receives a contribution of water (less than 100 gpm) from sand and gravel deposits in the Prairie Aquigroup. Only through an exploratory program that includes a review of well records, geophysical testing, and test drilling can sand and gravel aquifers capable of producing more than a domestic water supply be located and verified.

## **Bedrock**

Beneath the glacial drift, the upper bedrock formations consist principally of shale with thin beds of sandstone and limestone. The total sequence of sedimentary rocks in Knox County ranges in geologic age from Pennsylvanian to Cambrian (see generalized stratigraphic sequence in figure 1).

Pennsylvanian rocks underlie the Prairie Aquigroup and form the bedrock surface throughout the county except in a very small area at the southwest corner where they have been eroded, exposing the Mississippian rocks at the bedrock surface. The Pennsylvanian rocks range in thickness from a featheredge near the eroded area in the southwest corner to as much as 460 ft in the north part of the county. In a few areas, water-yielding sandstone, siltstone, and fractured shale lie near the bedrock surface and constitute an Upper Bedrock Aquigroup. This aquigroup functions hydrologically like the Prairie Aquigroup, with which it may be interconnected.

In most of Knox County the upper bedrock surface consists of tight, impermeable Pennsylvanian shale. These shales form the upper part of the Mississippi Valley

Aquigroup, which generally acts as a confining bed hydraulically separating the Prairie Aquigroup and lower parts of the Mississippi Valley Aquigroup. In some areas the shale contains intervals of water-bearing sandstone.

A few total or supplemental public water supplies in southern and western Knox County have been obtained from Pennsylvanian strata that comprise the Upper Bedrock or Mississippi Valley Aquigroups. In these isolated cases, well yields of 20 to 50 gpm have been reported, but yields barely adequate for domestic or farm supplies are more common.

The Burlington aquifer (Mississippian age) is the next-lower part of the Mississippi Valley Aquigroup in the south one-half of Knox County where it underlies the Pennsylvanian rocks, except for the small area in the southwest corner where it directly underlies the glacial drift. It lies at a depth of about 50 ft near the southwest corner to about 470 ft at the southeast corner. It ranges in thickness from a featheredge along the line of complete erosion which extends across the central part of the county to about 100 ft at Yates City and about 120 ft at Abingdon. The yield capability of the Burlington aquifer depends on the number, size, and degree of interconnection of water-filled fractures within the rock that are intersected by the well bore. Quantities of water adequate for domestic and farm use usually can be obtained from this unit and, locally, supplies for small communities may be available for development, although the water is probably quite highly mineralized in the southeast corner of the county.

The next-lower interval in the Mississippi Valley Aquigroup consists of impermeable shales of the New Albany Group (Kinderhook Series-Mississippian age and Upper Devonian Series), which extend throughout Knox County except for a small area in the northwest corner where they have been eroded. These shales underlie the Pennsylvanian rocks in the north one-half of the county and the Burlington Limestone in the south one-half, separating the Burlington aquifer both physically and hydraulically from deeper water-yielding units. Their thickness ranges from a featheredge along the erosional lineament in the northwest corner to about 100 ft in the northeast area. They are about 190 to 285 ft thick in the southern portion of the county.

In the previously noted small area where the Burlington aquifer underlies the glacial drift, it constitutes the Upper Bedrock Aquigroup, and shale of the New Albany Group becomes the upper confining unit of the Mississippi Valley Aquigroup.

The basal part of the Mississippi Valley Aquigroup consists of limestone and dolomite of the Silurian and Devonian Systems (Hunton Megagroup) that occur below

the shales of the New Albany Group, except in a small area in the northwest corner of the county where they directly underlie the Pennsylvanian rocks. They lie at depths from about 250 ft at Galesburg to about 400 ft in the northwest area to as much as 700 ft in the southeast part of the county. They range in thickness from about 140 to 170 ft in the southwest quarter to about 300 to 350 ft in eastern and northern Knox County. Water from these carbonate units is obtained from cracks and crevices in the rock that are intersected by the well bore. The degree of fracture development is reportedly greater in the upper 125 ft of these units and is generally better than in the shallower Burlington aquifer. Small to possibly moderate-sized municipal supplies (50 to 100 gpm) can often be obtained. The water is highly mineralized.

Below the Mississippi Valley Aquigroup there is a series of hydrologically related units that make up the Midwest Aquigroup. The uppermost part is the Maquoketa Group (Ordovician age), which underlies the Silurian-Devonian aquifer and consists primarily of shales that yield little or no water. It is about 80 to 210 ft thick, has very low permeability, and acts as an aquitard between the Silurian-Devonian aquifer and deeper water-yielding units.

Below the Maquoketa Group a thick sequence of rock units forms the water-yielding portion of the Midwest Aquigroup, formerly known as the Cambrian-Ordovician aquifer system. These rock units are, in downward order, dolomites of the Galena and Platteville Groups; Glenwood-St. Peter Sandstone (Anzell aquifer); Prairie du Chien Group (Shakopee, New Richmond, Oneota, and Gunter Formations); Eminence-Potosi Dolomite; Franconia Formation; and Ironton-Galesville Sandstone. Water supply wells in Knox County have not penetrated units below the Ironton-Galesville Sandstone.

The top of the Galena Group (Ordovician age) lies at depths ranging from about 700 ft at Galesburg to about 1100 ft at Yates City. The Galena and Platteville Groups have a thickness that ranges from about 275 to 375 ft. Water from these units is also obtained from cracks and crevices intersected by the well bore. Moderate quantities of water (50 to 200 gpm) usually are obtained, but the water is highly mineralized.

The Anzell aquifer, consisting of the Glenwood-St. Peter Sandstone (Ordovician age), lies below the Galena-Platteville at depths ranging from about 1075 ft in the west-central area to about 1425 ft in the southeast region near Yates City. The limited data available suggest that the aquifer is about 140 to 210 ft thick in Knox County. The Anzell is one of the more reliable aquifers in northern Illinois and is capable of yielding moderate quantities of water. The water is highly mineralized in this area.

Below the Glenwood-St. Peter lie the Prairie du Chien Group (Ordovician age), the Eminence-Potosi Dolomite (Cambrian age), and the Franconia Formation. Together they form the Middle Confining Unit in the Midwest Aquigroup, consisting of interbedded sandstones, shales, and dolomites. These units are encountered at depths from about 1225 ft in the west-central area to about 1575 ft in the southeast and have a total thickness of about 990 to 1055 ft. The shales and dolomites yield little water, but the sandy parts of these units may contribute small to moderate quantities of highly mineralized water.

The Ironton-Galesville Sandstone (Cambrian age) is the most consistently permeable and productive aquifer of the Midwest Aquigroup in northern Illinois. It is capable of yielding moderate to large quantities (several hundred gpm) of highly mineralized water in Knox County. It lies at depths of about 2200 to 2500 ft and is about 110 to 200 ft thick.

## GROUND-WATER DEVELOPMENT FOR PUBLIC USE

Ground water is used as a source for public water supplies at Abingdon, Altona, Blake Water Corporation, Central Illinois Utility Co., East Galesburg, Galesburg, Henderson, Knoxville, Maquon, Oneida, Rio, St. Augustine, Victoria, Wataga, Westport Water Mutual, Williamsfield, Windwood Water System, Inc., and Yates City. The locations of these supplies are shown in figure 2.

Sand and gravel deposits in the drift of the Prairie Aquigroup and sandstone, siltstone, and fractured shale in the upper part of the Upper Bedrock Aquigroup (Pennsylvanian System) are tapped as a partial source of water for Yates City. There is presently 1 emergency well finished in these aquifer units at a depth of 94 ft, with a reported pumping rate of 125 gpm. Analyses of water samples from the well indicate that the iron content ranges from a trace

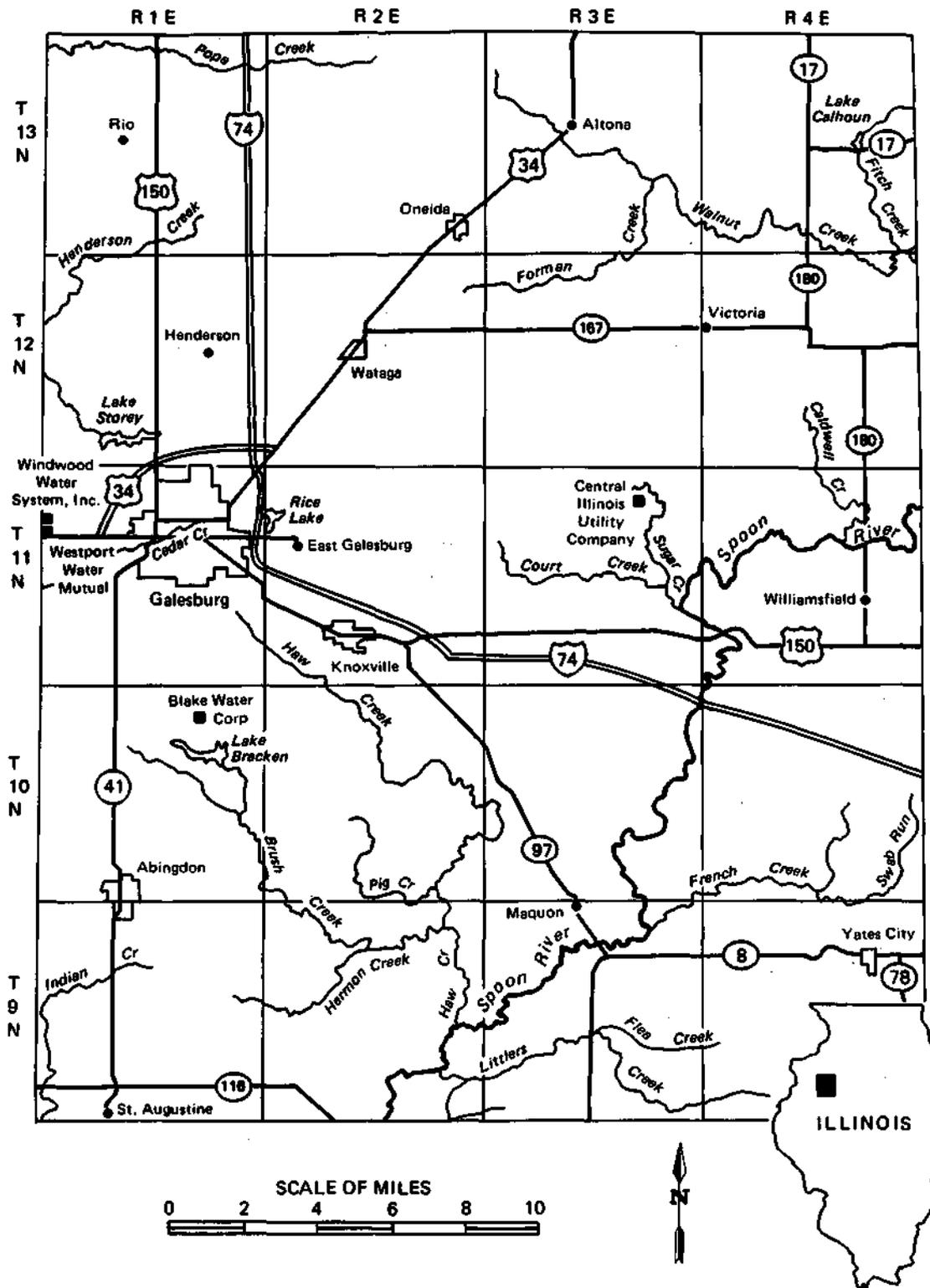


Figure 2. Locations of public ground-water supplies in Knox County

to 0.7 mg/L and the hardness from 290 to 370 mg/L. Water from this well is not treated.

The Pennsylvanian sandstone, siltstone, and fractured shale of the Upper Bedrock or Mississippi Valley Aquifers are a source of water for Westport Water Mutual and Windwood Water System, Inc., and a partial source of water for St. Augustine. There are presently 3 production wells, 87, 150 and 170 ft deep, open only to the Pennsylvanian rocks. Their pumps are reportedly rated from about 20 to 52 gpm. Production from these wells in 1986 was estimated to be about 20,200 gpd. Analyses of water from these wells indicate that the hardness ranges from 275 to 340 mg/L. The iron content of water from the 2 wells in the west-central part of the county ranges from 0.27 to 0.73 mg/L. The iron content of water from St. Augustine Well No. 2, located in the southwest corner of the county, ranges from 4.57 to 7.49 mg/L. Water from Westport Water Mutual is fluoridated; water from St. Augustine Well No. 2 is filtered; and water from the Windwood Water System, Inc., is not treated.

The Burlington aquifer of the Mississippi Valley Aquifer is used as a partial source of water for St. Augustine. There is presently 1 production well, 170 ft deep, open only to the Burlington. It is reportedly pumped at a rate of about 20 gpm. Production from this well in 1986 was estimated to be about 6100 gpd. Analyses of water samples show that the iron content ranges from 4.5 to 9.80 mg/L and the hardness from 266 to 290 mg/L. Water from St. Augustine Well No. 1 is aerated to oxidize iron, chlorinated, and filtered.

Deeper bedrock aquifers are tapped for water supplies at Abingdon, Altona, Blake Water Corporation, Central Illinois Utility Co., Galesburg, Henderson, Knoxville, Maquon, Oneida, Rio, Victoria, Wataga, Williamsfield, and Yates City. These wells are open to various combinations of aquifers in the Mississippi Valley and Midwest Aquifers (Pennsylvanian, Mississippian, Devonian, Silurian, Ordovician, and Cambrian age units), with each contributing a portion of the water withdrawn. Water obtained from many of these bedrock units in Knox County is highly mineralized, with one or more mineral constituents exceeding the primary or secondary standards of the USEPA Interim Drinking-Water Regulations. Fluoride, radium, sulfate, chloride, and total mineral content are among the constituents that may be greater than the allowable or recommended limit. Sufficient data are not available to determine the specific aquifer unit that contributes water with the greatest concentrations of each mineral constituent.

The Mississippi Valley Aquifer (Devonian and Silurian Systems) is tapped as a source at Altona, Blake

Water Corporation, Central Illinois Utility Co., Henderson, Oneida Well No. 1, Rio, Victoria, and Williamsfield. There are presently 10 production and standby wells ranging in depth from 520 to 887 ft open only to the Devonian and Silurian aquifers, including the Altona well, which is open to the Silurian aquifer and the Midwest Aquifer (Maquoketa Group). Their reported pumping rates range from 60 to 170 gpm. Production from these wells in 1986 was estimated to be about 236,750 gpd.

The wells at Maquon and Wataga are open to combinations of the Pennsylvanian, Burlington, Devonian, and Silurian aquifers. There are presently 2 production wells (one in each community), 638 and 840 ft deep, open to these units. They are reportedly pumped at rates of 62 and 140 gpm. Production from these wells in 1986 was estimated to be about 96,000 gpd.

Analyses of water from the Devonian and Silurian units individually, and in the various combinations at Maquon and Wataga, indicate that the iron content ranges from 0.0 to 1.46 mg/L, sodium from 288 to 760 mg/L, fluoride from 1.6 to 4.2 mg/L, chlorides from 68 to 570 mg/L, hardness from 21 to 112 mg/L, and total dissolved minerals from 771 to 1830 mg/L. Hydrogen sulfide gas was also noted in water from 7 wells. Water for Altona, Blake Water Corporation, Henderson, Maquon, Oneida, Victoria, Wataga, and Williamsfield is aerated to remove hydrogen sulfide, and is chlorinated; water for Central Illinois Utility Co. is chlorinated and filtered; and water for Rio is chlorinated.

Part of the Midwest Aquifer (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone) is tapped as a source of water by Knoxville Well No. 1 and Yates City Well No. 3. The wells, 1375 and 1580 ft deep, are reportedly pumped at rates of 175 and 250 gpm. Oneida Well No. 2 is open to the Galena-Platteville unit as well as the overlying Devonian and Silurian aquifers. This well is 1202 ft deep and is pumped at a rate of 150 gpm. Production in 1986 from these 3 wells was estimated to be about 167,500 gpd. Analyses of water indicate that the iron content generally ranges from 0.1 to 1.0 mg/L, sodium from 310 to 406 mg/L, fluoride from 1.0 to 3.0 mg/L, sulfates from 105 to 700 mg/L, hardness from 58 to 424 mg/L, and total dissolved minerals from 882 to 1619 mg/L. Water for Knoxville and Yates City Well No. 3 is chlorinated.

Combinations of aquifers within the Midwest Aquifer (Cambrian-Ordovician aquifer system) are tapped for water supplies at Abingdon, Galesburg, and Knoxville. There are presently 7 production or standby wells, ranging in depth from 2408 to 2586 ft, finished within the Midwest

Aquigroup (including the Florence Ave. well at Galesburg, which is also open to the Devonian aquifer). Their reported pumping rates range from 300 to 1000 gpm. Production from these wells for 1986 was estimated to be about 665,700 gpd. Analyses of water indicate that the iron content ranges from a trace to 2.0 mg/L, sodium from 267.4 to 398.1 mg/L, fluoride from 1.4 to 4.0 mg/L, chlorides from 142.8 to 230 mg/L, sulfates from 250 to 579 mg/L, hardness from 210 to 385 mg/L, and total dissolved minerals from 990 to 1575 mg/L. Water for Abingdon is chlorinated.

The total municipal pumpage in Knox County in 1986 averaged about 1,192,250 gpd. Of this total, about 33 percent (392,300 gpd) was from wells finished in the Mississippi Valley and Upper Bedrock Aquigroups (Pennsylvanian, Burlington, and the Devonian and Silurian aquifers); about 11 percent (134,250 gpd) was from wells finished in the upper water-yielding part of the Midwest Aquigroup (Galena and Platteville unit or Ancell aquifer); and about 56 percent (665,700 gpd) was from wells tapping combinations of formations within the Midwest Aquigroup (Cambrian-Ordovician aquifer system).

## FORMAT

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

At the beginning of each description the U.S. Census of population for 1980 is given for incorporated places. For unincorporated places, 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.

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 that yield 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 hydrostratigraphic units open to the well. If only a drillers log is available and the hydrostratigraphic 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. 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.

## 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)
OD.....	.....	outside diameter
pc/L.....	.....	picocuries per liter
R.....	.....	range
rpm.....	.....	revolutions per minute
T.....	.....	township
TDH.....	.....	total dynamic head
Tr.....	.....	trace

## ABINGDON

The city of Abingdon (4210) installed a public water supply in 1902. One well (No. 3) is in use and another well (No. 2) is available for emergency use. In 1950 there were 800 services, almost all metered; the average and maximum pumpages were 300,000 and 355,000 gpd, respectively. In 1986 there were 1200 services, all metered; the average pumpage was 383,600 gpd. The water is chlorinated.

WELL NO. 1 was completed in 1902 to a depth of 1355 ft (logged in 1954 at 1323 ft) by William Gray and Brothers, Chicago. This well was abandoned between 1973 and 1975 and sealed in 1987. The water-yielding unit penetrated in this well before abandonment was part of the Midwest Aquigroup (Glenwood-St. Peter Sandstone). The well was located on the west side of the Chicago, Burlington & Quincy RR south of Latimer St., approximately 1250 ft N and 2450 ft E of the SW corner of Section 33, T10N, R1E. The land surface elevation at the well is 747.5 ft.

A bore hole, 9 in. in diameter, was drilled to a depth of 600 ft and was reduced to 6 in. in diameter from 600 to 1355 ft. In 1932, 9- and 7-in. buckets were lowered and stopped at 530 ft. The well was cased with 9-in. pipe from land surface to a depth of 600 ft and 6-in. pipe from 600 ft to a depth of 1232 ft. In 1954, a geophysical log indicated that an 8-in. ID casing extended from land surface to a depth of 532 ft, a 5.5-in. casing from 532 ft to a depth of 1210 ft, and a 6-in. hole from 1210 to 1323 ft. The wall of the well was reported to be perforated between 1224 and 1322 ft.

In December 1913, the nonpumping water level was reported to be 130 ft below land surface.

In January 1920, after pumping at a rate of 130 gpm, the drawdown was 46 ft from a nonpumping water level of 170 ft below land surface.

On February 15, 1928, the nonpumping water level was reported to be 179 ft.

In 1932, J. B. Millis, Byron, checked the hole size by lowering 9- and 7-in. buckets into the well to a depth of 530 ft. The well was then measured and an obstruction was found at a depth of 585 ft. The nonpumping water level was reported to be 184 ft.

In January 1934, the well reportedly produced 104 gpm for 1 hr with a drawdown of 93 ft from a nonpumping water level of 200 ft.

Nonpumping water levels were reported to be 190 ft in 1936, and 208 ft on July 5, 1941 (Well No. 2 idle).

On February 9, 1944, after pumping at a rate of 104 gpm, the drawdown was 97 ft from a nonpumping water level of 215 ft below the pump base (Well No. 2 idle).

On October 12, 1945, the nonpumping water level was reported to be 216 ft.

In 1954, this well was shot by Halliburton. Results are not available.

In October 1954, this well was geophysically logged to a depth of 1323 ft. The nonpumping water level was reported to be 240 ft below land surface.

In November 1954, after pumping at a rate of 200 gpm, the drawdown was 223 ft from a nonpumping water level of 250 ft below land surface.

In August 1955, the well reportedly produced 200 gpm with a drawdown of 205 ft from a nonpumping water level of 245 ft below land surface.

A mineral analysis of a sample (Lab. No. 109796) collected April 2, 1947, after pumping for 5 min at 104 gpm, showed the water to have a hardness of 349 mg/L, total dissolved minerals of 1324 mg/L, and an iron content of 0.7 mg/L.

WELL NO. 2 was completed in August 1928 to a depth of 2583 ft by the Thorpe Brothers, Des Moines, Iowa. This well is available for emergency use. The water-yielding unit in this well is the Midwest Aquigroup (Cambrian-Ordovician aquifer) except for dolomites of the Galena and Platteville Groups and the Glenwood-St. Peter Sandstone. The well is located about 50 ft south of Well No. 1, approximately 1200 ft N and 2450 ft E of the SW corner of Section 33, T10N, R1E. The land surface elevation at the well is approximately 746 ft.

### WELL NO. 2, SAMPLE STUDY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
Pleistocene Series		
Dirt and clay	35	35
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale and lime	95	130
Shale	20	150
Sandstone, incoherent from 150 to 170 ft	40	190
<b>MISSISSIPPIAN SYSTEM</b>		
Valmeyeran Series		
Burlington Limestone	120	310
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS</b>		
Kinderhookian and Upper Devonian Series		

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
New Albany Group Shale	240	550
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series Cedar Valley Limestone Shaley limestone	60	610
Wapsipinicon Limestone	20	630
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series Dolomites	90	720
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series Maquoketa Group Shale and shaley dolomite	180	900
Champlainian Series Galena and Platteville Groups Dolomites	310	1210
Ancell Group Glenwood Formation Sandstone, some shale at base	100	1310
St. Peter Sandstone	100	1410
Sandstone, shale, and chert fragments	5	1415
Canadian Series Prairie du Chien Group Shakopee Dolomite Dolomite, sandstone streaks	255	1670
New Richmond Sandstone Sandstone and dolomite	60	1730
Onecota Dolomite Dolomite, some sandstone	250	1980
<b>CAMBRIAN SYSTEM</b>		
St. Croixan Series Eminence-Potosi Dolomite Dolomite	260	2240
Franconia Formation Sandstone and dolomite, thin beds of shale	230	2470
Ironton-Galesville Sandstone Sandstone, part dolomitic	110	2580
Eau Claire Formation Dolomite	2	2582

The well is cased with 16-in. OD pipe from land surface to a depth of 303 ft, 10-in. pipe from 300 ft to a depth of 1441 ft, and an 8-in. liner from 2410 ft to a depth of 2440 ft. The hole was finished 9.8 in. in diameter from 1441 ft to the bottom.

A production test was conducted by the State Water Survey on August 5, 1928. After 1 hr of pumping at rates ranging from 610 to 623 gpm, the drawdown was 17 ft from a nonpumping water level of 177 ft. Three min after pumping was stopped, full recovery was observed.

On October 10, 1928, the well reportedly produced 536 gpm for 36 hr with a drawdown of 12 ft from a nonpumping water level of 180 ft.

In 1932, after pumping at a rate of 536 gpm, the drawdown was 12 ft from a nonpumping water level of 198 ft.

In February 1934, the well reportedly produced 536 gpm for 36 hr with a drawdown of 15 ft from a nonpumping water level of 210 ft.

In July 1936, after pumping at a rate of 470 gpm, the drawdown was 10.5 ft from a nonpumping water level of 191.5 ft below the pump base.

On October 17, 1939, the nonpumping water level was reported to be 199 ft.

On July 13, 1941, the well reportedly produced 560 gpm with a drawdown of 11 ft from a nonpumping water level of 191 ft below the pump base.

Nonpumping water levels were reported to be 207 ft below the pump base on February 9, 1944, and 238 ft in 1945.

After the pump was repaired in 1946, the well reportedly produced at rates ranging from 460 to 485 gpm with a drawdown of 11 ft from a nonpumping water level of 217 ft. One min after pumping was stopped, full recovery was observed.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 500 gpm at about 270 ft TDH, and powered by a 50-hp electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B131902) of a sample collected March 26, 1975, after pumping for 1 hr at 200 gpm, showed the water to have a hardness of 321 mg/L, total dissolved minerals of 1321 mg/L, and an iron content of 0.7 mg/L.

WELL NO. 3 was completed in March 1959 to a depth of 2586 ft by the J. P. Miller Artesian Well Co., Brookfield. The water-yielding unit in this well is the Midwest Aquigroup (Cambrian-Ordovician aquifer) except for dolomites of the Galena and Platteville Groups. The well also penetrates a few feet of the Basal Bedrock Aquigroup (Eau Claire Formation), but its contribution to the yield of the well is probably negligible. The well is located approximately 1500 ft N and 1900 ft E of the SW corner of Section 33, T10N, R1E. The land surface elevation at the well is approximately 745 ft.

#### WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Drift	40	40
Gray shale	87	127
Shale and lime	37	164
Gray lime	122	286
White lime	25	311
Shale	258	569
Brown lime	167	736
Gray shale	114	850

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Brown lime	39	889
Brown shale	20	909
Brown lime	310	1219
St. Peter sand	158	1377
Gray shale	8	1385
Brown lime	105	1490
Gray lime	20	1510
Brown lime	20	1530
Red and white lime	37	1567
Gray lime	163	1730
Brown and gray lime	45	1775
Gray lime	84	1859
Brown lime	232	2091
Red lime	25	2116
Brown lime	29	2145
Red and white lime	24	2169
Brown lime	26	2195
Gray lime	26	2221
Gray shale and lime	103	2324
Sandy lime	26	2350
Gray lime	86	2436
Gray shale and lime	37	2473
Galesville sand	107	2580
Brown lime	6	2586

A 26-in. diameter hole was drilled to a depth of 200 ft, reduced to 25 in. between 200 and 1220 ft, reduced to 19 in. between 1220 and 1467 ft, and finished 15 in. in diameter from 1467 to 2586 ft. The well is cased with 26-in. OD drive pipe from land surface to a depth of 200 ft and 20-in. OD pipe from land surface to a depth of 1220 ft (cemented in).

A production test was conducted on March 17-18, 1959, by representatives of the driller and the Beling Engineering Consultants. After 25 hr of pumping at rates of 400 to 425 gpm, the drawdown was 3 ft from a nonpumping water level of 270 ft. Pumping was continued for 3.8 hr at a rate of 750 gpm with a drawdown of 20 ft. Pumping was continued for 11.7 hr at a rate of 900 gpm with a drawdown of

30 ft. Pumping was continued for 4.9 hr at a rate of 1100 gpm with a drawdown of 46 ft. After an additional 1.2 hr of pumping at a rate of 670 gpm, the final drawdown was 12 ft.

The pumping equipment presently installed is a Deming turbine pump rated at 800 gpm, and powered by a 125-hp U. S. electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B022643) is for a water sample from the well collected December 6, 1983, after 2 hr of pumping at about 850 gpm.

WELL NO. 3, LABORATORY NO. B022643

		<i>mg/L me/L</i>		<i>mg/L me/L</i>	
Iron	Fe	0.87	Silica	SiO <sub>2</sub>	10
Manganese	Mn	0.005	Fluoride	F	2.50
Ammonium	NH <sub>4</sub>	1.3	Boron	B	1.14
Sodium	Na	309	Cyanide	CN	<0.005
Potassium	K	14	Nitrate	NO <sub>3</sub>	<0.4
Calcium	Ca	73	Chloride	Cl	155 4.37
Magnesium	Mg	34.3	Sulfate	SO <sub>4</sub>	547 11.38
Strontium	Sr	3.07	Alkalinity (as CaCO <sub>3</sub> )		218 4.36
Aluminum	Al	<0.05	Hardness (as CaCO <sub>3</sub> )		330 6.60
Arsenic	As	<0.001			
Barium	Ba	0.034	0.00 Total dissolved minerals		1282
Beryllium	Be	<0.0005			
Cadmium	Cd	<0.003			
Chromium	Cr	<0.005			
Cobalt	Co	<0.005			
Copper	Cu	0.070			
Lead	Pb	0.009			
Mercury	Hg	<0.00010			
Nickel	Ni	<0.005			
Selenium	Se	<0.001			
Silver	Ag	<0.005			
Vanadium	V	<0.005			
Zinc	Zn	0.062	pH (as rec'd)		7.8

## ALTONA

The village of Altona (610) installed a public water supply in 1952. One well is in use. In 1952 there were 155 services, all metered; the average pumpage was 8000 gpd. In 1986 there were 260 services, all metered; the average pumpage was 41,400 gpd. The water is aerated to remove hydrogen sulfide and chlorinated.

WELL NO. 1 was completed in March 1951 to a depth of 808 ft by the Peerless Service Co., Orion. The water-yielding units in this well are dolomite of the Mississippi Valley Aquigroup (Silurian System) and shale of the Midwest Aquigroup (Maquoketa Group). The well is

located in the fire station east of Depot St. and south of Washington St., approximately 2200 ft N and 2500 ft W of the SE corner of Section 16, T13N, R3E. The land surface elevation at the well is approximately 755 ft.

WELL NO. 1, SAMPLE STUDY SUMMARY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Till, yellowish orange, silt, yellowish	40	40
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale, dolomitic, silty, gray, green, yellowish gray	400	440
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series		
Cedar Valley-Wapsipinicon Limestone		
Dolomite, yellowish brown; limestone, gray	45	485
Shale, brown, weak; dolomite, limestone	45	530
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Dolomite, silty, light gray to yellowish gray, fine to medium	245	775
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series		
Maquoketa Group		
Shale, dolomitic, grayish green	30	805

A 12-in. diameter hole was drilled to a depth of 528 ft and finished 8 in. in diameter from 528 to 808 ft. The well is cased with 12-in. pipe from about 1.5 ft above land surface to a depth of 160 ft and 8-in. pipe from about 1.5 ft above land surface to a depth of 528 ft (cemented in).

A production test was conducted on April 27, 1951, by representatives of the driller, the State Water Survey, and the Pappmeier Engineering Co. After 6.2 hr of pumping at rates of 66 to 135 gpm, the drawdown was 27.5 ft from a nonpumping water level of 219.0 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 219.5 ft.

In 1984, the nonpumping water level was reported to be 260ft.

The pumping equipment presently installed is a Peerless pump rated at 100 gpm, and powered by a 15-hp, 1800 rpm electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B20668) is for a water sample from the well collected November 6, 1979, after 1.5 hr of pumping at 150 gpm. Hydrogen sulfide was apparent when previous samples were collected.

WELL NO. 1, LABORATORY NO. B20668

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.024		Silica	SiO <sub>2</sub>	9.0	
Manganese	Mn	<0.002		Fluoride	F	2.50	0.13
Ammonium	NH <sub>4</sub>	2.1	0.12	Boron	B	1.1	
Sodium	Na	320	13.92	Cyanide	CN	<0.005	
Potassium	K	5.1	0.13	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	10	0.50	Chloride	Cl	122	3.44
Magnesium	Mg	4	0.33	Sulfate	SO <sub>4</sub>	46	0.96
Strontium	Sr	0.29		Alkalinity (as CaCO <sub>3</sub> )		544	10.88
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		40	0.80
Barium	Ba	0.094		Total dissolved minerals		847	
Cadmium	Cd	<0.0005					
Chromium	Cr	<0.005					
Cobalt	Co	<0.01					
Copper	Cu	0.035					
Lead	Pb	0.01					
Mercury	Hg	<0.00005					
Nickel	Ni	0.021					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Zinc	Zn	0.014		pH (as rec'd)		8.0	

## BLAKE WATER CORPORATION

Blake Water Corporation (est. 160), formerly known as Windcrest Subdivision, located about 3 miles south of Galesburg, installed a public water supply in 1960. This supply serves Hickory Knolls, Paradise Acres, and Windcrest Acres Subdivisions. One well is in use. In 1968 there were about 16 services, all metered; the average pumpage was 7500 gpd. In 1986 there were 50 services, 2 percent metered; the average pumpage was 11,400 gpd. The water is aerated and chlorinated.

WELL NO. 1 was completed in October 1960 to a depth of 520 ft by Russell Blake, Galesburg. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is located near the north end of Windcrest Subdivision on the west side of the street, approximately 1875 ft N and 930 ft E of the SW corner of Section 2, T10N, R1E. The land surface elevation at the well is approximately 750 ft.

WELL NO. 1, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Clay	30	30
Pennsylvanian-Mississippian shales	395	425
Devonian limestone	75	500
Silurian limestone	20	520

A 6-in. diameter hole was drilled to a depth of 520 ft. The well is equipped with a 6-in. diameter pitless adapter from about 2 ft above land surface to a depth of 4 ft and cased with 6-in. steel pipe from 4 ft below land surface to a depth of 427 ft.

A production test was conducted on March 8, 1968, by representatives of the driller and the State Water Survey. After 3 hr of pumping at rates ranging from 17 to 14 gpm, the final drawdown was 6.00 ft from a nonpumping water level of 250.00 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 252.50 ft. On the basis of the production test data, it was estimated that this well should yield 50 gpm (72,000 gpd) on a long-term basis.

The pumping equipment presently installed is a Jacuzzi submersible pump rated at 60 gpm, and powered by a 7-1/2-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B136290) is for a water sample from the well collected April 23, 1975, after 1 hr of pumping at 55 gpm. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 1, LABORATORY NO. B136290

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.1		Silica	SiO <sub>2</sub>	9	
Manganese	Mn	0.0		Fluoride	F	3.8	0.20
Ammonium	NH <sub>4</sub>	0.8	0.04	Boron	B	1.9	
Sodium	Na	550	23.92	Cyanide	CN	0.00	
Potassium	K	6.4	0.16	Nitrate	NO <sub>3</sub>	0.2	0.00
Calcium	Ca	7	0.35	Chloride	Cl	300	8.46
Magnesium	Mg	4	0.33	Sulfate	SO <sub>4</sub>	200	4.16
				Alkalinity (as CaCO <sub>3</sub> )		604	12.08
Arsenic	As	0.000		Hardness (as CaCO <sub>3</sub> )		34	0.68
Barium	Ba	0.0		Total dissolved minerals		1466	
Cadmium	Cd	0.00					
Chromium	Cr	0.00					
Copper	Cu	0.00					
Lead	Pb	0.00		pH (as rec'd)		8.2	
Mercury	Hg	0.0000		Radioactivity			
Nickel	Ni	0.0		Alpha pc/L		8.7	
Selenium	Se	0.000		± deviation		5.5	
Silver	Ag	0.000		Beta pc/L		9.9	
Zinc	Zn	0.0		± deviation		4.4	

CENTRAL ILLINOIS UTILITY CO.

Central Illinois Utility Co. (est. 654), formerly known as Oak Run Development, located about 2.5 miles northeast of Appleton, installed a public water supply in 1973. The water system is owned by the American Central Corporation. One well is in use. In 1974 there were 20 services, all metered; the average and maximum pumpages were 11,250 and 22,500 gpd, respectively. In 1986 there were 268 services, none metered; the average pumpage was 31,400 gpd. The water is chlorinated and filtered.

WELL NO. 1 was completed in September 1972 to a depth of 802 ft by Jerry H. Wakefield, Kewanee. The major water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquifer (Devonian and Silurian Systems). The well also penetrates shale in the upper part of the Midwest Aquifer (Maquoketa Group), but its contribution to the well is probably negligible. The well is located on Briarwood Place in the south central part of Oak Run known as Forest Ridge Subdivision, approximately 700 ft S and 2400 ft E of the NW corner of Section 11, T11N, R3E. The land surface elevation at the well is approximately 725 ft.

WELL NO. 1, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Soil - black dirt	5	5
Yellow clay	15	20
Greenish sandy clay	7	27
Bluish green sandy clay	16	43
Gray sandy clay	20	63
Sandy seamud	49	112
Brown gravelly rock	2	114
Soft gray shale	7	121
Hard gray shale	29	150
Coal	2	152
Slate	3	155
Dark shale	5	160
Light gray sandrock	25	185
Dark gray shale	5	190
Gray sandstone	40	230
Dark sandy shale	40	270
Dark gray shale	30	300
Dark gray sand	15	315
Gray shale	15	330
Black shale and coal strip	20	350
Black limey shale	5	355
Greenish shale - lime strip	5	360
Hard limey gray shale	42	402
Hard dark gray shale	7	409

Strata	Thickness (ft)	Depth (ft)
Brown lime strip	5	414
Hard gray shale	38	452
Gray hard limey shale	30	482
Gray lime	3	485
Gray shale	11	496
Gray limerock	59	555
Brown limerock	15	570
Gray hard lime	45	615
Niagara	155	770
Broken lime and shale	15	785
Gray Maquoketa shale	17	802

A 12-in. diameter hole was drilled to a depth of 526 ft and finished 8 in. in diameter from 526 to 802 ft. The well is cased with 12-in. steel pipe from about 2 ft above land surface to a depth of 126.3 ft and 8-in. steel pipe from about 3 ft above land surface to a depth of about 526 ft (cemented in).

A production test was conducted by the K & K Well Drilling Co., Mokena, on September 7-8, 1972. After 5.7 hr of pumping at a rate of 300 gpm, the drawdown was 45 ft from a nonpumping water level of 215 ft. Pumping was continued for 16.5 hr at a rate of 200 gpm with a final drawdown of 25 ft. Five min after pumping was stopped, full recovery was observed.

The pumping equipment presently installed is a Barnes submersible pump (Model No. 612-20) rated at 125 gpm, and powered by a 20-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B007092) is for a water sample from the well collected August 5, 1981, after 1 hr of pumping at 125 gpm. Hydrogen sulfide was apparent when previous samples were collected.

WELL NO. 1, LABORATORY NO. B007092

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.037		Silica	SiO <sub>2</sub>	8.4	
Manganese	Mn	<0.005		Fluoride	F	3.05	0.16
Ammonium	NH <sub>4</sub>	1.0	0.06	Boron	B	1.50	
Sodium	Na	526	22.88	Cyanide	CN	<0.005	
Potassium	K	8.2	0.21	Nitrate	NO <sub>3</sub>	0.04	0.00
Calcium	Ca	6	0.30	Chloride	Cl	320	9.02
Magnesium	Mg	2.9	0.24	Sulfate	SO <sub>4</sub>	106	2.20
Strontium	Sr	0.263		Alkalinity (as CaCO <sub>3</sub> )		587	11.74
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		24	0.48
Barium	Ba	0.074		Total dissolved minerals		1324	
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	<0.00005					
Nickel	Ni	<0.003					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.004					
Zinc	Zn	0.003		pH (as rec'd)		7.9	

## EAST GALESBURG

The village of East Galesburg (928) installed a public water supply in 1950. Finished water for this supply is obtained from the city of Galesburg (see Galesburg). In

1952 the average consumption was 10,750 gpd. In 1986 there were 313 services; the average consumption was 58,400 gpd.

## GALESBURG

The city of Galesburg (35,305) installed a public water supply in 1890. Although this city is located in Knox County, the last four wells constructed are located in Henderson County. Four wells (Collector No. 1, and Well Nos. 74-1, 74-2, and 74-3) are in use and three wells (Henderson St. Well Nos. 1 and 2, and Florence Ave. well)

are available for emergency use. Galesburg also furnishes water to the village of East Galesburg. In 1952 the average and maximum pumpages were 1,150,000 and 1,400,000 gpd, respectively. In 1986 there were 12,653 services, all metered (including East Galesburg); the average pumpage was 5,396,500 gpd. The water is chlorinated, and then

pumped to the treatment plant in Galesburg where it is fed a polyelectrolyte coagulant aid (Nalcolyte 110-A), filtered, and fluoridated.

Initially, water was obtained from a series of driven wells 70 to 80 ft deep located along the bank of Cedar Creek near the old waterworks building in the city of Galesburg. Additional wells were drilled as needed until there were about 80. In 1911, with five 8-in. wells and one 10-in. well in use, all about 70 ft deep, the nonpumping water level was reported to be 45 to 50 ft below land surface. The wells were equipped with Cook strainers about 20 ft long with 1/16-in. openings. By 1921, continuous sand problems caused abandonment of these wells.

Two wells were drilled in the same vicinity as the driven wells in January and September 1896 to depths of 1226 and 1250 ft, respectively. In 1906 another well was drilled to a depth of 775 ft in the same part of the city. Non-pumping water levels were reported to be 100 ft below land surface in 1911 and 180 ft in 1920. In 1921, it was reported that these deep wells were not being used because their operation was not economical compared to the operation of the three wells that were drilled in 1917 and 1919. These wells were abandoned prior to 1929.

1226-FT DEEP WELL, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black top soil	4	4
Blue clay	8	12
Fine sand	13	25
Sand	13	38
Coal	2	40
Coarse sand and gravel	45	85
Fire clay	5	90
Sandstone	15	105
Shale mixed with sand	27	132
Sandstone	6	138
Fire clay	4	142
Black shale	8	150
White shale	15	165
Brown shale	10	175
Soapstone	15	190
Black soapstone	10	200
Limestone and flint	15	215
Slate	15	230
Yellow shale	115	345
Limestone	80	425
White limestone	25	450
Sandstone	110	560
Shale, soapstone and limestone	90	650
Limestone	25	675
Black limestone	85	760
Trenton limestone	300	1060
St. Peter sandstone	166	1226

A large-diameter well, 9 ft in diameter, was constructed in 1914 to a depth of about 80 ft. The well was cased

with 6-ft diameter steel pipe to a depth of 60 ft followed by two concentric perforated pipes, with an 18-in. space between which was filled with gravel. This well was abandoned in 1920.

CENTRAL FIRE STATION WELL (also known as Bradley Well No. 1) was completed in December 1917 to a depth of 1252 ft by city employees. This well was abandoned prior to 1952 and has been sealed. The water-yielding unit penetrated in this well before abandonment was the Midwest Aquigroup (Glenwood-St. Peter Sandstone). The well was located at the Central Fire Station on the east side of Cherry St. south of Simmons St., approximately 500 ft S and 1280 ft W of the NE corner of Section 15, T11N, R1E, Knox County. The land surface elevation at the well is 772.78 ft.

CENTRAL FIRE STATION WELL, PARTIAL SAMPLE STUDY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
Pleistocene Series		
Till, pebbly and sandy	at	54
Sand, quartz grains, with a piece of coal	at	96
Sand and gravel	at	98
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Coal and black sandy shale	at	110
Shale, gray, with fine sand	at	215
Shale and fine sand, gray	at	260
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series		
Cedar Valley-Wapsipinicon Limestone		
Limestone, gray, shaley	5	410
Interval	5	415
Limestone, like last	5	420
Limestone, gray, with a little sand	5	425
Limestone, gray, fine grained	10	435
Limestone, light brownish gray, fine grained	25	460
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Limestone, like last, mixed with dolomite, light gray	5	465
Limestone, light to drab, crystalline	39	504
Limestone, gray	11	515
Limestone, gray, subcrystalline	5	520
Limestone, light gray, subcrystalline, partly dolomitic	5	525
Dolomite, gray	50	575
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series		
Maquoketa Group		
Dolomite, gray, with some chert	5	580
Shale, greenish gray	29	609
Shale, light gray	57	666

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Limestone, shaley, dolomitic, subcrystalline	14	680
Shale, gray	5	685
Limestone, dolomitic, subcrystalline	6	691
Limestone, gray and drab, partly dolomitic	17	708
Shale, gray, calcareous	10	718
<b>Champlainian Series</b>		
<b>Galena and Platteville Groups</b>		
Limestone, gray to drab, dolomitic, fine grained, shows HCl action	62	780
Dolomite, gray, crystalline	6	786
Limestone, gray, dolomitic, shows HCl action	206	992
Limestone, dolomitic with some chert	5	997
Limestone, dolomitic, gray	83	1080
Limestone, dolomitic, gray with some sand	10	1090
<b>Ancell Group</b>		
<b>Glenwood-St. Peter Sandstone</b>		
Sand, quartz, in clean rounded grains	10	1100
Sand, like the last with some dolomite from above	6	1106
Sand, yellowish, in rounded grains	46	1152
Sandstone with gray dolomite cement	at	1180
Sandstone, like last	5	1185
Sandstone, with gray (light) dolomitic cement	20	1205
Sandstone, with gray dolomite cement	35	1240
Sandstone, in clean rounded quartz grains	12	1252

The well was cased with 24-in. heavy steel pipe from land surface to a depth of 40 ft, 20-in. heavy steel pipe from 40 ft to a depth of 146 ft, 16-in. heavy steel pipe from 146 ft to a depth of 276 ft, 12-in. heavy steel pipe from 276 ft to a depth of 626 ft, and 10-in. wrought iron pipe from 626 ft to a depth of 1087 ft. Below the casing, the hole was 10 in. in diameter to the bottom.

The well was shot with two 200-lb charges of 100 per cent gelatin and then cleaned out.

In 1921, it was reported that after pumping at a rate of 450 gpm, the drawdown was 118 ft from a nonpumping water level of 186 ft below land surface.

A mineral analysis of a sample (Lab. No. 99153) collected February 11, 1944, after pumping for 30 min at 210 to 225 gpm, showed the water to have a hardness of 501 mg/L, total dissolved minerals of 1885 mg/L, and an iron content of 0.6 mg/L.

BROOKS ST. WELL (also known as Bradley Well No. 2) was constructed in 1919 to a depth of 1245 ft by city employees and deepened in July 1944 to a reported depth of 2450 ft by the Thorpe Well Drilling Co., Des Moines, Iowa. This well was abandoned and sealed in 1986. The water-yielding unit in this well was the Midwest Aquigroup (Cambrian-Ordovician aquifer) except for dolomites of

the Galena and Platteville Groups, and the Glenwood-St. Peter Sandstone. The well also penetrated the upper part of the Basal Bedrock Aquigroup (Eau Claire Formation), but its contribution to the well was probably negligible. The well was located at the southeast corner of Brooks St. and Churchill Ave., approximately 2325 ft S and 900 ft E of the NW corner of Section 14, T11N, R1E, Knox County. The land surface elevation at the well is 782.7 ft.

#### BROOKS ST. WELL, INTERPRETED DRILLERS LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
<b>Glacial drift</b>		
Till and clay, yellow to gray	20	20
Sand and gravel	32	52
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Shale, light gray	68	120
Shale, dark gray, calcareous	15	135
Shale, light gray, with coal	5	140
Sandstone, gray, reddish	20	160
Sandstone, calcareous, gray; shale, gray	9	169
Limestone, sandy, gray; shale, sandy	9	178
Shale, black; limestone, dark	12	190
Coal; underclay	5	195
Shale, black; limestone, black	20	215
Shale, gray to brown	35	250
Shale, sandy, gray	5	255
Sandstone, brown; little shale	15	270
<b>DEVONIAN SYSTEM</b>		
<b>Upper Devonian Series</b>		
<b>New Albany Group</b>		
Shale, gray to brown, sporangites	60	330
<b>Middle Devonian Series</b>		
<b>Cedar Valley-Wapsipinicon Limestone</b>		
Limestone, and dolomite, partly cherty	75	405
Limestone, gray, fine	60	465
<b>SILURIAN SYSTEM</b>		
<b>Niagaran and Alexandrian Series</b>		
Dolomite, gray; little shale, green	20	485
<b>ORDOVICIAN SYSTEM</b>		
<b>Cincinnatian Series</b>		
<b>Maquoketa Group</b>		
Shale, gray; dolomite, sandy	10	495
Dolomite, slightly cherty, gray	75	570
Shale, gray	5	575
Dolomite, gray	15	590
Shale, calcareous, gray	10	600
Dolomite, shaley, gray	10	610
Shale, gray to green	15	625
Dolomite, brown	5	630
Shale, calcareous, gray to brown	15	645
Dolomite, shaley, gray	10	655
<b>Cincinnatian and Champlainian Series</b>		
<b>Galena and Platteville Groups</b>		
Dolomite, gray	285	940
Dolomite, cherty, gray	25	965
Dolomite, gray	95	1060
Dolomite, sandy, gray	5	1065

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>Ancell Group</b>		
<b>Glenwood-St. Peter Sandstone</b>		
Sandstone, clean	165	1230
No record	22	1252
<b>Canadian Series</b>		
<b>Prairie du Chien Group</b>		
<b>Shakopee Dolomite</b>		
Dolomite, argillaceous in part	222	1474
<b>New Richmond Sandstone</b>		
Sandstone, cherty, dolomitic	46	1520
Dolomite, sandy, cherty; sandstone	15	1535
<b>Oneota Dolomite</b>		
Dolomite	15	1550
Dolomite, cherty, white; sandstone	5	1555
Dolomite, with interbedded sandstone	25	1580
Dolomite, cherty, white; sandstone	5	1585
Dolomite, cherty	15	1600
Dolomite, white	10	1610
Dolomite, cherty, sandy at base	55	1665
Dolomite, very cherty, white; quartz	5	1670
Dolomite, cherty, sandy	25	1695
Dolomite, buff, pink	10	1705
Dolomite, cherty, silty	30	1735
Dolomite, cherty, sandy, shaley, buff	15	1750
Chert, dolomitic, oolitic	5	1755
Dolomite, sandy, interbedded sandstone	15	1770
Dolomite, sandy, cherty (oolitic), buff	5	1775
Dolomite sandy, sandstone	18	1793
<b>CAMBRIAN SYSTEM</b>		
<b>St. Croixan Series</b>		
<b>Eminence-Potosi Dolomite</b>		
Dolomite, sandy, glauconitic	17	1810
Crevice	5	1815
Dolomite, sandy, cherty, glauconitic; quartz	5	1820
Dolomite	30	1850
Dolomite, sandy, glauconitic	20	1870
Dolomite; crevice at base	10	1880
Dolomite, gray, pink; quartz	20	1900
Dolomite; crevices	20	1920
Dolomite, glauconitic, buff; quartz	40	1960
Same; thin sandstone beds	20	1980
Dolomite, sandy, glauconitic, buff; quartz	25	2005
Dolomite	10	2015
Dolomite, sandy, glauconitic, buff, pink	40	2055
Dolomite	11	2066
<b>Franconia Formation</b>		
Dolomite, sandy, glauconitic	9	2075
Dolomite, very glauconitic and sandy; shale	90	2165
Sandstone, white, coarse, incoherent	20	2185
Dolomite, as above; shale	55	2240
<b>Ironton-Galesville Sandstone</b>		
Sandstone, dolomitic	50	2290
Sandstone, slightly dolomitic, buff	55	2345
Sandstone, buff; thin dolomite beds	50	2395
Sandstone, buff	20	2415
Sandstone	21	2436
<b>Eau Claire Formation</b>		
Sand; some green, red, and gray shale	14	2450

Originally, the well was cased with 20-in. pipe from land surface to a depth of 52 ft, 16-in. OD pipe from land surface to a depth of 360 ft (cemented in), and 15-in. OD pipe from 360 ft to a depth of 610 ft. Below the casing, the hole was finished 14 in. in diameter to a depth of 1245 ft. During deepening in 1944, the well was cased with 12-in. wrought iron pipe from land surface to a depth of 319.7 ft, 10-in. wrought iron pipe from 319.7 ft to a depth of 569.2 ft, and 8-in. drive pipe from land surface to a depth of 1259.5 ft (the top 522 ft was cut off and removed). Below the casing, the hole was finished 8 in. in diameter to the bottom. The annulus between the old 16- and the new 12-in. casings and between the old 14- and the new 10-in. casings was filled with cement grout.

A production test was conducted by the driller on March 8, 1919. After pumping at a rate of 650 gpm, the drawdown was 157 ft from a nonpumping water level of 190 ft below land surface.

In November 1943, a 1.5-in. airpipe broke causing air and water to rise outside the eductor pipe and flood the station. The Thorpe Well Drilling Co. removed the pump and the nonpumping water level was reported to be 253 ft below the top of the 16-in. casing. It was observed that at a depth of 60 ft, considerable water was entering the well through holes in the casing. The holes may have been made when the well was first constructed in order to take advantage of the water found at that depth. In 1944 the driller deepened the well to 2450 ft and installed new casings.

After the well was deepened, a production test was conducted by the State Water Survey on July 14, 1944. After 8.4 hr of pumping at rates of 512 to 519 gpm, the final drawdown was 19 ft from a nonpumping water level of 258 ft below land surface. One min after pumping was stopped, full recovery was observed.

A partial analysis of a sample (Lab. No. 105558) collected February 15, 1946, after pumping for 6.1 hr, showed the water to have a hardness of 318 mg/L, total dissolved minerals of 1352 mg/L, and an iron content of 1.6 mg/L.

HENDERSON ST. WELL NO. 1 (also known as Potsdam Well No. 1) was completed in July 1919 to a depth of 2414 ft by S. B. Geiger, Chicago. This well is available for emergency use. The water-yielding unit in this well is the Midwest Aquigroup (Cambrian-Ordovician aquifer) except for dolomites of the Galena and Platteville Groups and the Glenwood-St. Peter Sandstone. The well is located about 200 ft south of the waterworks pumping station and 550 ft west of Henderson St., approximately 540 ft S and 640 ft W of the NE corner of Section 16,

T11N, R1E, Knox County. The land surface elevation at the well is approximately 760 ft.

HENDERSON ST. WELL NO. 1, SAMPLE STUDY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
No samples	50	50
Sand, brownish gray, medium grained, calcareous below	10	60
No samples	20	80
Sand, brownish gray, fine to coarse, calcareous	5	85
No samples	10	95
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Shale, calcareous, medium gray, silty	50	145
Coal; and shale, medium gray, sandy	5	150
Shale, medium gray	20	170
No samples	20	190
Coal; and fire clay, light gray, soft	10	200
Shale, dark gray, soft	5	205
No samples	25	230
Shale, slightly calcareous, brown, sandy	5	235
No samples	10	245
<b>DEVONIAN SYSTEM</b>		
<b>Upper Devonian Series</b>		
<b>New Albany Group</b>		
Shale, light gray and brown, smooth	20	265
Shale, brown and gray, slightly gritty, with sporangites huronense fossils	55	320
<b>Middle Devonian Series</b>		
<b>Cedar Valley-Wapsipinicon Limestone</b>		
Limestone, argillaceous, light brownish gray, fossiliferous	5	325
No samples	105	430
<b>SILURIAN SYSTEM</b>		
<b>Niagaran and Alexandrian Series</b>		
Chert, white and gray, oolitic and banded, some weathered	5	435
No samples	10	445
Dolomite, light gray, powdered	5	450
<b>SILURIAN AND ORDOVICIAN SYSTEMS (Undifferentiated)</b>		
No samples	350	800
<b>ORDOVICIAN SYSTEM</b>		
<b>Champlainian Series</b>		
<b>Galena and Platteville Groups</b>		
Dolomite, brown, finely crystalline; lower 10 ft sandy	255	1055
<b>Ancestral Group</b>		
<b>Glenwood-St. Peter Sandstone</b>		
Sandstone, white, fine to medium	135	1190
Chert pebbles, white and buff, dense, oolitic, and porous; with sandstone	35	1225
Shale, green, sandy	5	1230
<b>Canadian Series</b>		
<b>Prairie du Chien Group</b>		
<b>Shakopee Dolomite</b>		

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Dolomite, gray, buff and pink, with cherty and sandy layers	205	1435
Dolomite, light brown, with whitish chert	50	1485
<b>New Richmond Sandstone</b>		
Sandstone, dolomitic, very fine to medium (New Richmond?)	15	1500
<b>Oneota Dolomite</b>		
Dolomite, cherty, light gray to white	225	1725
<b>Gunter Sandstone</b>		
Dolomite, cherty, white, sandy; with sandstone, white, fine	10	1735
<b>CAMBRIAN SYSTEM</b>		
<b>St. Croixian Series</b>		
<b>Eminence-Potosi Dolomite</b>		
Dolomite, light gray and pink, very fine grained	285	2020
Dolomite, light brownish gray, glauconitic	10	2030
<b>Franconia Formation</b>		
Sandstone, very dolomitic, gray with greenish tint, glauconitic, very fine grained	130	2160
Dolomite, sandy, gray, scattered glauconite	30	2190
Sandstone, dolomitic, gray, glauconitic, becoming coarser at bottom	25	2215
Shale, yellow green, powdered and mixed with sand	20	2235
<b>Ironton-Galesville Sandstone</b>		
Sandstone, white to yellow, fine to medium, loosely cemented	70	2305
Interval not studied	109	2414

A 26-in. diameter hole was drilled to a depth of 573 ft, reduced to 16 in. between 573 and 1225 ft, reduced to 12 in. between 1225 and 2100 ft, reduced to 11 in. between 2100 and 2175 ft, and finished 10 in. in diameter from 2175 to 2414 ft. The well is cased with 26-in. OD drive pipe from land surface to a depth of 125 ft, 22-in. OD pipe from land surface to a depth of 201.3 ft, and 16-in. OD pipe from 201.3 ft to a depth of 1225 ft.

Nonpumping water levels below the pump base plate were reported as follows: 156 ft in 1919; 205.5 ft in March 1936; 245.1 ft on October 18, 1939; and 247.5 ft on July 21, 1945.

The pumping equipment presently installed is a 12-in., 18-stage National Pump Co. vertical turbine pump set at 448 ft, rated at 1000 gpm, and powered by a 150-hp, 1160 rpm Westinghouse electric motor (No. 4649281). A 10-ft section of suction pipe is attached to the pump intake.

A mineral analysis of a sample (Lab. No. 105243) collected January 9, 1946, showed the water to have a hardness of 229 mg/L, total dissolved minerals of 1026 mg/L, and an iron content of 0.3 mg/L.

HENDERSON ST. WELL NO. 2 (also known as Potsdam Well No. 2) was completed in June 1928 to a depth of 2408 ft by the Phillips Bros., Des Moines, Iowa. This well is available for emergency use. The water-yielding unit in this well is the Midwest Aquigroup (Cambrian-Ordovician aquifer) except: dolomites of the Galena and Platteville Groups, the Glenwood-St. Peter Sandstone, and the Shakopee Dolomite. The well also penetrates the upper part of the Basal Bedrock Aquigroup (Eau Claire Formation), but its contribution to the well is probably negligible. The well is located on the west side of Henderson St. about 500 ft east of the waterworks station, approximately 390 ft S and 140 ft W of the NE corner of Section 16, T11N, R1E, Knox County. The land surface elevation at the well is 7563 ft.

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

<i>Srata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
<b>Glacial drift</b>		
Soil and till	20	20
Sand, yellow	55	75
Till, gray	10	85
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Shale, black	5	90
Coal	5	95
Shale, gray to black	135	230
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS</b>		
<b>Kinderhookian and Upper Devonian Series</b>		
New Albany Group	125	355
<b>DEVONIAN SYSTEM</b>		
<b>Middle Devonian Series</b>		
Cedar Valley-Wapsipicon Limestone	90	445
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Dolomite Series	125	570
<b>ORDOVICIAN SYSTEM</b>		
<b>Cincinnatian Series</b>		
Maquoketa Shale Group	200	770
<b>Champlainian Series</b>		
Galena and Platteville Dolomite Groups	300	1070
<b>Ancell Group</b>		
Glenwood-St. Peter Sandstone		
Sandstone	135	1205
Shale, weak	5	1210
<b>Canadian Series</b>		
<b>Prairie du Chien Group</b>		
Shakopee Dolomite	270	1480
New Richmond Sandstone	40	1520
Oneota Dolomite	255	1775
No samples	40	1815
<b>CAMBRIAN SYSTEM</b>		
<b>St. Croixian Series</b>		
Eminence-Potosi Dolomite	205	2020
<b>Franconia Formation</b>		
Dolomite, sandstone and shale	195	2215
Ironton-Galesville Sandstone	120	2335
<b>Eau Claire Formation</b>		
Some sandstone, dolomite, and shale	73	2408

The well is cased with 22-in. OD pipe from land surface to a depth of 412 ft and 14-in. OD pipe from 406 ft to a depth of 1479 ft. Below the casing, the hole was finished 12 in. in diameter to the bottom.

Upon completion, the well reportedly produced 1600 gpm with a drawdown of 57 ft from a nonpumping water level of 197 ft below the base plate.

In June 1933, after pumping at a rate of 1580 gpm, the drawdown was 39.1 ft from a nonpumping water level of 202.5 ft below the base plate.

Nonpumping water levels below the base plate were reported to be 211 ft in May 1936 and 222 ft in February 1940.

In June 1944, the well reportedly produced 1000 gpm with a drawdown of 74.3+ ft from a nonpumping water level of 230.9 ft below the base plate.

The pumping equipment presently installed is a 14-in., 10-stage National Pump Co. vertical turbine pump set at 397 ft, rated at 1000 gpm at about 390 ft TDH, and powered by a 200-hp, 1176 rpm Westinghouse electric motor (No. 154C3947). A 10-ft section of suction pipe is attached to the pump intake.

A mineral analysis of a sample (Lab. No. 105245) collected January 9, 1946, showed the water to have a hardness of 227 mg/L, total dissolved minerals of 1086 mg/L, and an iron content of 0.1 mg/L.

In May and June 1944, during a critical water shortage, the city leased an 80-ft deep well from the Western Illinois Ice Co. The well was located on the south side of the Atchison, Topeka, and Santa Fe RR Co. right of way and 500 ft west of Mam St., approximately 300 ft S and 1125 ft E of the NW corner of Section 15, T11N, R1E, Knox County. The well was reported to be 16 ft in diameter and cased with 15-ft diameter concrete pipe to a depth of 80 ft. On June 4, 1944, after pumping continuously at a rate of 400 gpm, there was very little drawdown from a nonpumping water level of 15 ft below land surface.

FLORENCE AVE. WELL was completed in June 1944 to a depth of 2473 ft by the Thorpe Well Drilling Co., Des Moines, Iowa. This well is available for emergency use. The water-yielding units in this well are limestone of the Mississippi Valley Aquigroup (Devonian System) and the Midwest Aquigroup (Cambrian-Ordovician aquifer) except for the Platteville Group and the Glenwood-St. Peter Sandstone. The well also penetrates the upper part of the Basal Bedrock Aquigroup (Eau Claire Formation). The well is located 500 ft west of Florence Ave. and 160 ft south of Walsh St., approximately 2500 ft N and 1500 ft E of the SW corner of Section 2, T11N, R1E, Knox County.

The land surface elevation at the well is approximately 786 ft.

**FLORENCE AVE. WELL, SAMPLE STUDY LOG**  
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
Pleistocene Series		
Soil, silt and till	25	25
Gravel, sand and silt	9	34
Till	41	75
Sand and gravel	7	82
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale, thin siltstone, limestone and coal beds	256	338
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS</b>		
Kinderhookian and Upper Devonian Series		
New Albany Group		
Shale, thin sandstone bed	40	378
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series		
Cedar Valley Limestone	80	458
Wapsipinicon Limestone	32	490
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Siltstone and dolomite	64	554
Dolomite	68	622
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series		
Maquoketa Group		
Shale, some dolomite	198	820
Champlainian Series		
Galena and Platteville Dolomite Groups	295	1115
Ancestral Group		
Glenwood-St. Peter Sandstone		
Sandstone, dolomite and shale	5	1120
Sandstone, incoherent	143	1263
Shale and chert	10	1273
Canadian Series		
Prairie du Chien Group		
Shakopee Dolomite, some shale and thin sandstone beds	232	1505
New Richmond Sandstone, dolomitic	80	1585
Oneota Dolomite, some thin sandstone and shale beds	267	1852
<b>CAMBRIAN SYSTEM</b>		
St. Croixan Series		
Eminence-Potosi Dolomite	231	2083
Franconia Formation, dolomite, sandstone, thin shale bed	187	2270
Ironton-Galesville Sandstone, partly dolomitic	120	2390
Eau Claire Formation, sandstone, shale, thin dolomite bed	83	2473

A 24-in. diameter hole was drilled to a depth of 410 ft, reduced to 23 in. between 410 and 843 ft, reduced to 18 in. between 843 and 1285 ft, and finished 12 in. in diameter from 1285 to 2473 ft. The well is cased with 24-in. OD pipe from land surface to a depth of 410 ft, 16-in. OD liner pipe from 477.2 ft to a depth of 843.3 ft, and 12-in. ID liner pipe from 1031.5 ft to a depth of 1285.1 ft.

The hole was dynamited in two series of shots. The first series of 9 shots (125 lb each) was spaced between depths of 2278 and 2392 ft, and the second series of 5 shots (175 lb each) was spaced between depths of 2293 and 2402 ft.

A production test was conducted on June 2-4, 1944, by representatives of the driller and the State Water Survey. After 8.9 hr of pumping at rates of 470 to 483 gpm, the drawdown was 83 ft from a nonpumping water level of 255 ft below the top of the 24-in. casing. Pumping was continued for 6.2 hr at rates ranging from 718 to 558 gpm with a maximum drawdown of 121 ft. After a 2.2-hr shutdown, pumping was resumed for 5.8 hr at rates of 773 to 700 gpm with a drawdown of 136 ft. After a 45-min shutdown, pumping was resumed for 11 hr at rates of 718 to 700 gpm with a drawdown of 140 ft. After another 5.5-hr shutdown, pumping was resumed for 10.6 hr at rates ranging from 800 to 718 gpm with a drawdown of 155 ft. After a 40-min shutdown, the well was pumped for 7.8 hr at rates ranging from 663 to 635 gpm with a final drawdown of 130 ft.

In November 1955, the nonpumping water level was reported to be 300 ft below land surface.

The pumping equipment presently installed is an 11-in., 9-stage American Well Works turbine pump (No. 68796) rated at 1000 gpm at about 466 ft head, and powered by a 150-hp, 1770 rpm U. S. electric motor (Serial No. 326809). A 20-ft section of 10-in. suction pipe is attached to the pump intake.

The following mineral analysis (Lab. No. 105246) is for a water sample from the well collected January 9, 1946, after 10 days of pumping at 650 gpm.

**FLORENCE AVE. WELL, LABORATORY NO. 105246**

		<i>mg/L me/L</i>		<i>mg/L me/L</i>	
Iron	Fe	0.5	Silica	SiO <sub>2</sub>	10.5
Manganese	Mn	0.0	Fluoride	F	3.0 0.16
Ammonium	NH <sub>4</sub>	1.3 0.07	Nitrate	NO <sub>3</sub>	1.2 0.02
Sodium	Na	382.5 16.64	Chloride	Cl	215.0 6.06
Calcium	Ca	68.1 3.40	Sulfate	SO <sub>4</sub>	558.9 11.62
Magnesium	Mg	26.2 2.16	Alkalinity (as CaCO <sub>3</sub> )		228 4.56
Turbidity	Tr		Hardness (as CaCO <sub>3</sub> )		279 5.58
Color	Tr				
Odor	0		Total dissolved		
Temp.	68.2F(reported)		minerals		1399

FOURTH ST. WELL was completed in 1950 to a depth of 2750 ft (plugged back to 2645 ft) by the Thorpe Well Drilling Co., Des Moines, Iowa. This well has not been used since 1966 and has been abandoned and capped. The water-yielding units in this well before abandonment were limestone and dolomite of the Mississippi Valley Aquifer (Devonian and Silurian Systems), the Midwest

Aquigroup (Cambrian-Ordovician aquifer) except for the Glenwood-St. Peter Sandstone, and the Basal Bedrock Aquigroup (Eau Claire Formation). Before the well was plugged back to 2645 ft, it also penetrated the lower part of the Basal Bedrock Aquigroup (Mt. Simon Sandstone). The well is located about 350 ft west and 50 ft north of the intersection of Fourth and Henderson Sts., approximately 590 ft N and 350 ft W of the SE corner of Section 16, T11N, R1E, Knox County. The land surface elevation at the well is approximately 775 ft.

FOURTH ST. WELL, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Drift	96	96
Shale	19	115
Slate and coal	2	117
Shale	57	174
Coal	2	176
Shale	48	224
Limestone, sandy	14	238
Shale	159	397
Limestone	250	647
Shale	48	695
Limestone	19	714
Shale	7	721
Limestone	78	799
Shale	6	805
Limestone	5	810
Shale	5	815
Limestone	6	821
Limestone, shale streaks	5	826
Limestone	266	1092
Sandstone (St. Peter)	135	1227
Shale	8	1235
Dolomite	128	1363
Shale	3	1366
Dolomite	699	2065
Dolomite, shale streaks	120	2185
Dolomite, hard	40	2225
Dolomite, shale streaks	30	2255
Sandstone (Galesville)	120	2375
Dolomite, hard	30	2405
Dolomite, sandy with shale streaks	60	2465
Dolomite, hard	63	2528
Shale, brown	8	2536
Dolomite, hard	6	2542
Shale, brown	9	2551
Dolomite	78	2629
Dolomite, sandy	21	2650
Sandstone (Mt. Simon)	100	2750

A 32-in. diameter hole was drilled to a depth of 471 ft, reduced to 23 in. between 471 and 1260 ft, reduced to 19 in. between 1260 and 2525 ft, reduced to 15 in. between 2525 and 2637 ft, and finished 12 in. in diameter from 2637 to 2750 ft. The well is cased with 32-in. pipe from within a concrete base that extends 0.8 ft above the pumphouse floor to a depth of 106 ft, 24-in. pipe from land surface to a depth of 471 ft (cemented in), 20-in. pipe from 621 ft to a depth of 840 ft (cemented in) and from 1078 ft to

a depth of 1260 ft, 16-in. pipe from 2382 ft to a depth of 2523 ft, and 12-in. perforated pipe from 2511 ft to a depth of 2637 ft.

A production test was conducted by the driller on September 6, 1950. After 5.8 hr of pumping at rates of 248 to 280 gpm, the drawdown was 104 ft from a nonpumping water level of 257 ft.

A production test was conducted by the driller on October 13-14, 1950. After 1.7 hr of pumping at rates of 500 to 485 gpm, the drawdown was 88.0 ft from a nonpumping water level of 259.0 ft. Pumping was continued for 55 min at a rate of 585 gpm with a drawdown of 109.0 ft. Pumping was continued for 4.2 hr at rates of 725 to 750 gpm with a drawdown of 139.5 ft. Pumping was continued for 2 hr at rates of 886 to 850 gpm with a drawdown of 166.0 ft. After an additional 12.5 hr of pumping at rates ranging from 1030 to 1134 gpm, the final drawdown was 218.5 ft.

After a permanent pump had been installed, a production test was conducted on September 20, 1951, by representatives of the city, the pump contractor, and the State Water Survey. After 4.1 hr of pumping at rates ranging from 1001 to 776 gpm, the final drawdown was 147 ft from a nonpumping water level of 271 ft.

A partial analysis of a sample (Lab. No. 147290) collected in August 1958, showed the water to have a hardness of 304 mg/L, total dissolved minerals of 1601 mg/L, and an iron content of 0.8 mg/L. Hydrogen sulfide was apparent when a previous sample was collected.

Prior to the construction of Collector Well No. 1, more than 35 test holes were drilled in 1956 and 1957 by the Layne-Western Co., Aurora, and The Ranney Co., Westerville, Ohio, in the Mississippi River valley near Oquawka in Henderson County.

COLLECTOR WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in February 1958 by The Ranney Co., Westerville, Ohio. This well was placed in service in May 1959. The collector well is located about 30.5 miles west of Galesburg south of Oquawka about 50 ft from the Mississippi River bank, approximately 750 ft S and 175 ft W of the NE corner of Section 28, T11N, R5W, Henderson County. The land surface elevation at the well is approximately 530 ft.

COLLECTOR WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Pill	6	6
Brown sandy clay	10	16
Fine sand, silt	13	29

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Fine sand, scattered gravel	10	39
Medium pea gravel, fine sand, silt	13	52
Very fine sand, silt	13	65
Medium pea gravel, fine sand, silt	33	98

The reinforced concrete caisson (13 ft ID by 16 ft OD) was constructed from about 11.2 ft above land surface to a depth of 97 ft. Nine 12-in. diameter perforated steel pipe laterals were projected radially toward the river from the collector at a depth of 90 ft below land surface. In 1980, this well was rehabilitated by developing, cleaning, flushing, and measuring the flow in seven of the laterals. Two laterals were added and two laterals were abandoned. The length of each lateral when it was installed and as shown by camera are given in the following table.

<i>Lateral</i>	<i>Length when installed (ft)</i>	<i>Camera length in 1980 (ft)</i>	<i>Remarks</i>
1	236	190	
2	168	136	
3	232	188	
4	216	180	
4A	200	-	installed 1980
5	108	91	abandoned
5A	200	-	installed 1980
6	200	155	
7	208	165	
8	200	170	
9	232	167	abandoned

In 1971, the nonpumping water level was reported to be 13 ft.

A production test using seven observation wells was conducted on February 4-8, 1958, using two pumps giving a combined rate of 5752 gpm. After 86.6 hr of pumping at a rate of 5752 gpm, the drawdown was 15.61 ft from a non-pumping water level of 13.27 ft below the top of the collector.

The pumping equipment presently installed consists of two 24-in. Byron Jackson turbine pumps (Type KXL), each rated at 5000 gpm at about 400 ft TDH, and powered by a 600-hp Westinghouse electric motor, and one Byron Jackson pump rated at 3000 gpm, and powered by a 300-hp U. S. electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B022362) is for a water sample from the well collected December 5, 1983, after 24 hr of pumping at 5000 gpm.

COLLECTOR WELL NO. 1, LABORATORY NO. B022362

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.59		Silica	SiO <sub>2</sub>	18	
Manganese	Mn	0.256		Fluoride	F	0.10	
Ammonium	NH <sub>4</sub>	<0.1		Boron	B	<0.005	
Sodium	Na	6	0.26	Cyanide	CN	<0.005	
Potassium	K	1.1	0.03	Nitrate	NO <sub>3</sub>	5.3	0.09
Calcium	Ca	58	2.89	Chloride	Cl	10	0.28
Magnesium	Mg	21.3	1.75	Sulfate	SO <sub>4</sub>	28	0.58
Strontium	Sr	0.090	0.00	Alkalinity (as CaCO <sub>3</sub> )		188	3.76
Aluminum	Al	<0.05		Hardness (as CaCO <sub>3</sub> )		233	4.66
Arsenic	As	<0.001					
Barium	Ba	0.022	0.00	Total dissolved minerals		256	
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	<0.00010					
Nickel	Ni	0.008					
Selenium	Se	0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.005					
Zinc	Zn	<0.005		pH (as rec'd)		7.7	

WELL NO. 74-1, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1975 to a depth of 101 ft by Luhr Bros., Inc., Columbia. The well is located about 550 ft southeast of Collector Well No. 1, approximately 1265 ft S and 25 ft E of the NW corner of Section 27, T11N, R5W, Henderson County. The land surface elevation at the well is approximately 530 ft.

WELL NO. 74-1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay, dark gray	10	10
Sand, silty	5	15
Sand, tan, medium	15	30
Sand, very coarse with gravel to 3/4 in.	5	35
Clay, dark gray	5	40
Sand, dark gray with pea gravel	45	85
Sand, yellow medium with trace of pea gravel	10	95
Sand, yellow very coarse with trace of pea gravel	10	105

A 34-in. diameter hole was drilled to a depth of 101 ft. The well is cased with 16-in. steel pipe from 12 ft above land surface to a depth of 74.2 ft followed by 26.8 ft (30.5 ft overall length) of 16-in. No. 50 slot Johnson stainless steel screen. The annulus between the bore hole and the casing-screen assembly is filled with concrete from 0 to 10 ft, with torpedo sand from 10 to 15.5 ft, and with No. 2 Northern gravel from 15.5 to 101 ft. For flood protection, the well is equipped with two corrugated steel pipes, 10 and 12 ft in diameter, extending from 11 ft above to 4 ft below land surface. The annulus between these two pipes is filled with concrete.

A production test using two observation wells was conducted by the driller on January 20, 1975. After 4 hr of pumping at a rate of 1500 gpm, the final drawdown was 21.21 ft from a nonpumping water level of 1030 ft below land surface. Fifteen min after pumping was stopped, the water level had recovered to 11.14 ft.

The pumping equipment presently installed is a Byron Jackson vertical turbine pump set at 75 ft, rated at 1780 gpm at about 445 ft head, and powered by a 350-hp General Electric motor (No. 6318P24).

A partial analysis of a sample (Lab. No. 197738) collected January 21, 1975, after pumping for 3.5 hr, showed the water to have a hardness of 226 mg/L, total dissolved minerals of 271 mg/L, and an iron content of 1.1 mg/L.

WELL NO. 74-2, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1975 to a depth of 97 ft by Luhr Bros., Inc., Columbia. The well is located about 275 ft south of Well No. 74-1, approximately 1540 ft S and 10 ft W of the NE corner of Section 28, T11N, R5W, Henderson County. The land surface elevation at the well is approximately 530 ft.

WELL NO. 74-2, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Blue silty clay	2	2
Fine brown sand	9	11
Fine brown sand with dirty clay	2	13
Medium fine brown sand	17	30
Gray sand with some gravel and cobbles, gray clay layer 33 to 36 ft	10	40
Dark gray sand, medium	36	76
Orange brown sand, coarse with gravel	5	81
Orange brown sand, medium coarse with gravel	5	86
Orange brown sand, very coarse with gravel	7	93
Gray sand, very coarse with heavy cobbles	12	105

A 34-in. diameter hole was drilled to a depth of 97 ft. The well is cased with 16-in. steel pipe from 12 ft above land surface to a depth of 71.7 ft followed by 25.3 ft (30.5 ft overall length) of 16-in. No. 50 slot Johnson stainless steel screen. The annulus between the bore hole and the casing-screen assembly is filled with concrete from 0 to 10 ft, with torpedo sand from 10 to 11.5 ft, and with No. 2 Northern gravel from 11.5 to 97 ft. For flood protection, the well is equipped with two corrugated steel pipes, 10 and 12 ft in diameter, extending from 11 ft above to 4 ft below land surface. The annulus between these two pipes is filled with concrete.

A production test using two observation wells was conducted by the driller on January 16, 1975. After 4 hr of pumping at a rate of 1500 gpm, the final drawdown was 12.07 ft from a nonpumping water level of 9.91 ft below

land surface. Fifteen min after pumping was stopped, the water level had recovered to 10.81 ft.

The pumping equipment presently installed is a Byron Jackson vertical turbine pump set at 75 ft, rated at 1780 gpm at about 445 ft head, and powered by a 350-hp General Electric motor (No. 6318P24).

A partial analysis of a sample (Lab. No. 197739) collected during the initial production test, after pumping for 3.5 hr, showed the water to have a hardness of 260 mg/L, total dissolved minerals of 308 mg/L, and an iron content of 0.5 mg/L.

WELL NO. 74-3, finished in sand and gravel of the Prairie Aquigroup, was completed in January 1975 to a depth of 102 ft by Luhr Bros., Inc., Columbia. The well is located about 275 ft south of Well No. 74-2, approximately 1815 ft S and 30 ft W of the NE corner of Section 28, T11N, R5W, Henderson County. The land surface elevation at the well is approximately 530 ft.

WELL NO. 74-3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Silty sand, brownish gray	15	15
Fine gray sand	5	20
Fine to medium brown sand with gravel (water bearing)	10	30
Coarse gray sand with gravel (water bearing)	25	55
Medium gray sand with gravel (water bearing)	5	60
Fine to medium gray sand, no gravel (water bearing)	10	70
Fine to medium gray sand with gravel (water bearing)	5	75
Fine gray sand	5	80
Fine to medium sand with gravel (water bearing)	10	90
Coarse sand with gravel (water bearing)	10	100
Medium coarse gray sand with very coarse gravel (water bearing)	5	105

A 34-in. diameter hole was drilled to a depth of 102 ft. The well is cased with 16-in. steel pipe from 12 ft above land surface to a depth of 74.5 ft followed by 27.5 ft (30.5 ft overall length) of 16-in. No. 50 slot Johnson stainless steel screen. The annulus between the bore hole and the casing-screen assembly is filled with concrete from 0 to 10 ft, with torpedo sand from 10 to 16.5 ft, and with No. 2 Northern gravel from 16.5 to 102 ft. For flood protection, the well is equipped with two corrugated steel pipes, 10 and 12 ft in diameter, extending from 11 ft above to 4 ft below land surface. The annulus between these two pipes is filled with concrete.

A production test using two observation wells was conducted on January 22, 1975, by representatives of the driller, the city, the State Water Survey, and Casler,

Houser & Hutchinson, Consulting Engineers. After 4 hr of pumping at rates of 1522 to 1493 gpm, the final draw-down was 12.34 ft from a nonpumping water level of 7.83 ft below land surface. Fifteen min after pumping was stopped, the water level had recovered to 8.70 ft.

The pumping equipment presently installed is a Byron Jackson vertical turbine pump set at 75 ft, rated at 1780 gpm at about 445 ft head, and powered by a 350-hp General Electric motor (No. 6318P24).

## HENDERSON

The village of Henderson (369) installed a public water supply in 1967. One well is in use. In 1971 there were 55 services, all metered; the average and maximum pumpages were 12,000 and 20,000 gpd, respectively. In 1986 there were 136 services, all metered; the average and maximum pumpages were 25,900 and 36,300 gpd, respectively. The water is aerated and chlorinated.

WELL NO. 1 was completed in August 1966 to a depth of 705 ft by Russell Blake, Galesburg. The major water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well also penetrates shale in the upper part of the Midwest Aquigroup (Maquoketa Group), but its contribution to the well is probably negligible. The well is located at the base of the elevated tank in the north part of the village, approximately 1750 ft N and 1900 ft E of the SW corner of Section 14, T12N, R1E. The land surface elevation at the well is approximately 805 ft.

WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	25	25
Soft shale	38	63
Sandstone	7	70
Shale and sandstone	120	190
Sandstone	30	220
Shale	130	350
Rock	10	360
Shale	58	418
Shale and rock	17	435
Limestone	255	690
Limestone and shale	5	695
Shale	10	705

The well is cased with 12-in. pipe from land surface to a depth of 63 ft and 8-in. pipe from 1.5 ft above land surface to a depth of 447 ft (cemented in to 65 ft). The top of the

A partial analysis of a sample (Lab. No. 197740) collected during the initial production test, after pumping for 3.5 hr at 1500 gpm, showed the water to have a hardness of 236 mg/L, total dissolved minerals of 276 mg/L, and an iron content of 0.2 mg/L.

Hydrologic analyses of the results of the production tests on Well Nos. 74-1, 2, and 3, indicated that the three-well system was capable of furnishing 8 mgd (1850 gpm per well) on a long-term basis.

well casing is equipped with a pitless adapter. Below the casing, the hole is 8 in. in diameter to the bottom.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B19366) is for a water sample from the well collected October 29, 1979, after 1 hr of pumping. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 1, LABORATORY NO. B19366

	<i>mg/L</i>	<i>me/L</i>		<i>mg/L</i>	<i>me/L</i>
Iron	Fe	<0.01	Silica	SiO <sub>2</sub>	8.3
Manganese	Mn	<0.0005	Fluoride	F	2.25 0.12
Ammonium	NH <sub>4</sub>	0.8	Boron	B	1.1
Sodium	Na	330	Cyanide	CN	<0.005
Potassium	K	5.5	Nitrate	NO <sub>3</sub>	<0.4
Calcium	Ca	6	Chloride	Cl	112 3.16
Magnesium	Mg	3	Sulfate	SO <sub>4</sub>	35 0.73
Strontium	Sr	0.24	Alkalinity (as CaCO <sub>3</sub> )		560 11.20
Arsenic	As	<0.001	Hardness (as CaCO <sub>3</sub> )		25 0.50
Barium	Ba	0.06	Total dissolved minerals		824
Beryllium	Be	<0.005			
Cadmium	Cd	0.002			
Chromium	Cr	<0.005			
Cobalt	Co	<0.004			
Copper	Cu	<0.007			
Lead	Pb	0.01			
Mercury	Hg	<0.00005			
Nickel	Ni	<0.007			
Selenium	Se	<0.001			
Silver	Ag	<0.005			
Zinc	Zn	<0.005	pH (as rec'd)		7.8

A production test was conducted on August 5, 1966, by representatives of the driller, the State Water Survey, and Weber, Hillemeier & Fischer, Consulting Engineers. After 2 hr of pumping at rates of 67.5 to 64 gpm, the draw-down was 84.5 ft from a nonpumping water level of 300.0 ft below land surface. Five min after pumping was

stopped, the water level had recovered to 305.0 ft. On the basis of the production test data, it was estimated that this well should yield 64 gpm (92,160 gpd) on a long-term basis.

The pumping equipment presently installed is a Red Jacket submersible pump operated at about 60 gpm, and powered by a 15-hp electric motor. The well is equipped with 430 ft of airline.

## KNOXVILLE

The city of Knoxville (3432) installed a public water supply in 1896. Three wells are in use. In 1950 there were 578 services, all metered; the estimated average and maximum pumpages were 90,000 and 95,000 gpd, respectively. In 1986 there were 1215 services, all metered; the average and maximum pumpages were 375,300 and 532,000 gpd, respectively. The water is chlorinated.

WELL NO. 1 was constructed in September 1895 to a depth of 1350 ft by S. Swanson, Minneapolis, Minn., and deepened in 1935 to a reported depth of 1375 ft by C. W. Varner, Dubuque, Iowa. The water-yielding unit in this well is the upper part of the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located at the southwest corner of Ann and Line Sts., approximately 2500 ft N and 2600 ft E of the SW corner of Section 28, T11N, R2E. The land surface elevation at the well is approximately 777 ft.

### WELL NO. 1, CORRELATED DRILLERS LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
Drift	20	20
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian Series</b>		
Shale	10	30
Coal	0.5	30.5
Clay and shale	106	136.5
Coal	0.5	137
<b>PENNSYLVANIAN, MISSISSIPPIAN, AND DEVONIAN SYSTEMS</b>		
<b>Atokan, Kinderhookian, and Upper Devonian Series</b>		
Shale	348	485
<b>DEVONIAN AND SILURIAN SYSTEMS</b>		
<b>Middle Devonian, Niagaran and Alexandrian Series</b>		
Limestone	188	673
<b>ORDOVICIAN SYSTEM</b>		
<b>Cincinnatian Series</b>		
<b>Maquoketa Group</b>		
Brainard Shale		
Shale	92	765
<b>Ft. Atkinson Limestone</b>		
Limestone	70	835

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>Scales Shale</b>		
Shale	39	874
<b>Champlainian Series</b>		
<b>Galena and Platteville Groups</b>		
Limestone	306	1180
<b>Ancell Group</b>		
<b>Glenwood-St. Peter Sandstone</b>		
Sandstone	170	1350
No record	25	1375

The well was originally cased with 8-in. pipe from 1 ft above land surface to a depth of 468 ft and 6-in. pipe from 468 ft to a depth of 1056 ft. Below the casing, the hole was finished 6 in. in diameter to the bottom. In 1935, the 6-in. pipe was removed and the well was drilled 6 in. in diameter from 1350 to 1375 ft. After cleaning, a 6-in. wrought iron pipe was placed from 3 ft above the wellhouse floor to a depth of 1056 ft.

Upon completion, the well reportedly produced 150 gpm for 32 hr with a drawdown of about 70 ft from a non-pumping water level of 140 ft.

On November 10, 1920, the nonpumping water level was reported to be 187 ft.

In September 1934, after pumping at a rate of 160 gpm, the drawdown was about 100 ft from a nonpumping water level of about 200 ft.

In 1935, C. W. Varner removed the 6-in. casing and deepened the well. The well was then shot with 40 lb of explosives at 1340 ft and 60 lb at 1280 ft, cleaned, and new casing installed. The nonpumping water level was then reported to be 202 ft.

In 1956, the nonpumping water level was reported to be 279 ft.

In September 1978, the well reportedly produced 130 gpm with a drawdown of 66 ft from a nonpumping water level of 296 ft.

In 1983, the nonpumping water level was reported to be 335 ft.

On February 4, 1985, the well reportedly produced about 175 gpm for 30 min with a drawdown of 60 ft from a nonpumping water level of 320 ft.

The pumping equipment presently installed is a Burks submersible pump set at 451 ft below the top of the casing, operated at 175 gpm, and powered by a 25-hp Franklin electric motor. The well is equipped with 451 ft of airline.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B022820) is for a water sample from the well collected December 7, 1983, after 13 hr of pumping at 150 gpm.

WELL NO. 1, LABORATORY NO. B022820

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.25		Silica	SiO <sub>2</sub>	9.5	
Manganese	Mn	<0.005		Fluoride	F	2.10	
Ammonium	NH <sub>4</sub>	1.5	0.09	Boron	B	1.09	
Sodium	Na	315	13.70	Cyanide	CN	<0.005	
Potassium	K	14	0.36	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	60	2.99	Chloride	Cl	165	4.65
Magnesium	Mg	28.9	2.38	Sulfate	SO <sub>4</sub>	455	9.46
Strontium	Sr	2.95	0.07	Alkalinity (as CaCO <sub>3</sub> )		240	4.80
Aluminum	Al	<0.05		Hardness (as CaCO <sub>3</sub> )		267	5.52
Arsenic	As	<0.001					
Barium	Ba	0.035	0.00	Total dissolved		1193	
Beryllium	Be	<0.0005		minerals			
Cadmium	Cd	<0.003					
Chromium	Cr	<0.005					
Cobalt	Co	<0.005					
Copper	Cu	<0.005					
Lead	Pb	<0.005					
Mercury	Hg	<0.00010					
Nickel	Ni	<0.005					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.005					
Zinc	Zn	0.032		pH (as rec'd)	7.8		

WELL NO. 2, open to the Midwest Aquigroup (Cambrian-Ordovician aquifer), was completed in January 1935 to a depth of 2498 ft by C. W. Varner, Dubuque, Iowa. The well is located about 89 ft west of Well No. 1, approximately 2500 ft N and 2511 ft E of the SW corner of Section 28, T11N, R2E. The land surface elevation at the well is 777.8 ft.

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

Strata	Thickness (ft)	Depth (ft)
<b>QUATERNARY SYSTEM</b>		
Pleistocene Series		
Glacial till	20	20
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale, some sandstone, limestone and coal	240	260

Strata	Thickness (ft)	Depth (ft)
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS</b>		
Kinderhook and Upper Devonian Series		
New Albany Group		
Shale	200	460
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series		
Cedar Valley Limestone		
Limestone, shaley	70	530
Wapsipinicon Limestone	20	550
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Dolomite, shale at base	15	565
Dolomite	115	680
Dolomite and shale	25	705
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series		
Maquoketa Group		
Shale and dolomite	180	885
Champlainian Series		
Galena and Platteville Groups		
Dolomites	315	1200
Ancestral Group		
Glenwood Formation		
Sandstone and dolomite	20	1220
Sandstone	80	1300
Shale and dolomite	5	1305
St. Peter Sandstone		
Sandstone	85	1390
Sandstone, shale, and chert fragments	10	1400
Canadian Series		
Prairie du Chien Group		
Shakopee Dolomite		
Dolomite, thin beds of sandstone and shale	225	1625
New Richmond Sandstone		
Dolomite and sandstone, thin shales	75	1700
Oneota Dolomite	240	1940
<b>CAMBRIAN SYSTEM</b>		
St. Croixian Series		
Eminence-Potosi Dolomite	290	2230
Franconia Formation		
Sandstone and dolomite, some shale	170	2400
Ironton-Galesville Sandstone		
Sandstone, part dolomitic	95	2495

A 15-in. diameter hole was drilled to a depth of 480 ft, reduced to 10 in. between 480 and 900 ft, reduced to 8 in. between 900 and 1485 ft, and finished 6 in. in diameter from 1485 to 2498 ft. The well is cased with 16-in. OD drive pipe from land surface to a depth of 90 ft, 10-in. pipe from 1 ft above land surface to a depth of 480 ft (cemented in from 0 to 90 ft), 8-in. pipe from 459 ft to a depth of 900 ft, and a 6.2-in. liner from 1383 ft to a depth of 1485 ft.

During drilling, a production test was conducted by the State Water Survey on November 16, 1934, at a depth of 1376 ft. After 4.5 hr of pumping at a rate of 92 gpm, the drawdown was 76 ft from a nonpumping water level of 224 ft below land surface.

A production test was conducted by the State Water Survey on January 30, 1935, at the final depth. After pumping at a rate of 232 gpm, the drawdown was 16.5 ft from a nonpumping water level of 214.0 ft below the top of the casing. Pumping was continued at a rate of 300 gpm with a drawdown of 24.0 ft.

On February 8, 1944, after pumping for 30 min at a rate of 240 gpm, the drawdown was 18.5 ft from a nonpumping water level of 257.5 ft. Fifteen min after pumping was stopped, the water level had recovered to 259.5 ft.

In 1956, the well reportedly produced about 200 gpm for 1 hr with a drawdown of 25 ft from a nonpumping water level of 280 ft.

On February 4, 1985, after 30 min of pumping at a rate of about 300 gpm, the drawdown was 35 ft from a nonpumping water level of 320 ft.

The pumping equipment presently installed is a Sumo submersible pump set at 440 ft below the top of the casing, rated at 450 gpm, and powered by a 60-hp Franklin electric motor. The well is equipped with 440 ft of airline.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B022826) of a sample collected December 7, 1983, after pumping for 12 hr at 300 gpm, showed the water to have a hardness of 227 mg/L, total dissolved minerals of 1113 mg/L, and an iron content of 0.16 mg/L.

WELL NO. 3 was completed in March 1960 to a depth of 2525 ft by the Varner Well and Pump Co., Dubuque, Iowa. The water-yielding unit in this well is the Midwest Aquigroup (Cambrian-Ordovician aquifer). The well also penetrates a few feet of the Basal Bedrock Aquigroup (Eau Claire Formation), but its contribution to the well is probably negligible. The well is located about 130 ft southwest of Well No. 1 on Line St., approximately 2400 ft N and 2550 ft E of the SW corner of Section 28, T11N, R2E. The land surface elevation at the well is approximately 778 ft.

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
No record	5	5
Yellow clay	10	15
Blue, green, black clay - some gravel	16	31
Shale and coal, dark gray and black	4	35
Shale, blue - gray - some rock	4	39
Shale	13	52
Gray shale	23	75
Sandy shale	20	95
Sandstone	5	100
Sandstone and shale	15	115
Sandstone and rock	5	120
Hard sandstone, shale and dark rock	5	125

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black shale	7	132
Black shale and gray slate	8	140
Light and dark gray shale	8	148
Coal and shale	3	151
Green shale and some lime	3	154
Light gray shale and sand	11	165
Gray shale, light and dark	15	180
Sandstone and lime	1	181
Limestone - breaks bit	2	183
Gray sandstone	2	185
Sandstone and gray shale	1	186
Lime and shale - breaks bit	2	188
Black - gray shale	7	195
White fine clay	3	198
Lime and shale	3	201
Gray shale	3	204
Hard black rock - breaks bit	13	217
Dark gray shale	15	232
Gray shale and rock	4	236
Blue shale	1	237
Gray shale - caves	13	250
Dark blue shale - caves	2	252
Gray and blue shale - caves	8	260
Gray shale - caves	16	276
Green shale	3	279
Gray shale	7	286
Multicolored shale	5	291
Shale	12	303
Blue shale - caves	47	350
Brown shale	16	366
Gray shale	9	375
Gray and brown shale	9	384
Brown and green shale	3	387
Brown shale	6	393
Gray shale	13	406
Brown and green shale	9	415
Brown and gray shale	24	439
Gray shale	23	462
Shale and lime	3	465
Gray shale - caves bad	3	468
Lime and shale - caves	2	470
Lime - caves	49	519
Lime and shale	39	558
Lime	120	678
Lime and shale	7	685
Shale	6	691
Lime and shale	6	697
Shale	6	703
Lime and shale	24	727
Blue shale	40	767
Blue shale and gray lime and dolomite	5	772
Lime and dolomite - hard	22	794
Lime and shale	3	797
Lime	13	810
Blue shale	5	815
Lime	2	817
Lime and shale	73	890
Lime - gray	61	951
Lime	83	1034
Lime and shale	4	1038
Lime	18	1056
Lime and shale	20	1076
Lime - hard	109	1185
Sand	15	1200
Sand and shale	4	1204
Sand	11	1215
Sand and shale	4	1219
Sand	14	1233

Strata	Thickness (ft)	Depth (ft)
Sand and dolomite	2	1235
Sand	40	1275
Sand and shale	31	1306
Sand	96	1402
Blue shale - sticks to tools	9	1411
Gray shale	12	1423
Sandy shale	7	1430
Lime - hard	2	1432
Lime and shale - shale sticky - caves	5	1437
Green and gray shale - caves	14	1451
Lime and shale	1	1452
Shale with gravel	8	1460
Lime and shale	2	1462
Gray shale	4	1466
Lime and shale	3	1469
Shale	5	1474
Lime	3	1477
Shale	2	1479
Lime and shale - hard	6	1485
Shale	8	1493
Lime and shale - caves	10	1503
Gray lime and red rock	7	1510
Lime	130	1640
Lime and gray shale	6	1646
Lime	5	1651
Lime and sand	6	1657
Lime - hard	254	1911
Lime, sand and dolomite	5	1916
Brown lime	5	1921
Lime and some sand	4	1925
Lime	44	1969
Lime and sand	4	1973
Lime	20	1993
Lime and sand	33	2026
Lime	79	2105
Lime and sand	12	2117
Lime	91	2208
Lime and shale	58	2266
Blue - green shale	6	2272
Lime and shale	21	2293
Lime and shale, some sand	14	2307
Sand and shale	5	2312
Lime and shale	28	2340
Gray and brown lime	6	2346
Lime and shale	26	2372
Lime	3	2375
Lime and shale	17	2392
Sand and shale	22	2414
White sand	63	2477
Lime and sand	7	2484
Green shale	2	2486
Sand	18	2504
Sand and dolomite	7	2511
Sand	8	2519
Lime	6	2525

A 30-in. diameter hole was drilled to a depth of 91 ft, reduced to 3.2 in. between 91 and 541 ft, reduced to 19 in. between 541 and 900 ft, reduced to 15 in. between 900 and

1503 ft, and finished 12 in. in diameter from 1503 to 2525 ft. The well is cased with 26-in. pipe from land surface to a depth of 91 ft, 20-in. pipe from 1 ft above land surface to a depth of 541 ft (cemented in), 16-in. pipe from 520 ft to a depth of 900 ft, and a 12-in. liner from 1387.4 ft to a depth of 1503 ft.

A production test using one observation well (No. 2) was conducted by the State Water Survey on March 29, 1960. After 5.2 hr of pumping at rates ranging from 408 to 556 gpm, the final drawdown was 140 ft from a nonpumping water level of 278 ft below the top of the casing. Eight min after pumping was stopped, full recovery was observed. During this test, Well No. 1 was pumping continuously.

On February 4, 1985, the well reportedly produced about 450 gpm for 30 min with a drawdown of 35 ft from a nonpumping water level of 320 ft.

The pumping equipment presently installed is a Sumo submersible pump set at 454 ft below the top of the casing, rated at 450 gpm, and powered by a 60-hp Franklin electric motor. The well is equipped with 454 ft of airline.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B20947) is for a water sample from the well collected November 6, 1979, after 30 min of pumping at 350 gpm.

WELL NO. 3, LABORATORY NO. B20947

		mg/L	me/L		mg/L	me/L
Iron	Fe	0.38		Silica	SiO <sub>2</sub>	9.0
Manganese	Mn	0.004		Fluoride	F	2.21 0.12
Ammonium	NH <sub>4</sub>	1.3	0.07	Boron	B	1.0
Sodium	Na	302	13.14	Cyanide	CN	<0.005
Potassium	K	13	0.33	Nitrate	NO <sub>3</sub>	<0.4
Calcium	Ca	54	2.70	Chloride	Cl	183 5.16
Magnesium	Mg	24	1.98	Sulfate	SO <sub>4</sub>	400 8.32
Strontium	Sr	2.95		Alkalinity (as CaCO <sub>3</sub> )		259 5.18
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		240 4.80
Barium	Ba	0.05		Total dissolved minerals		1138
Cadmium	Cd	<0.0005				
Chromium	Cr	<0.005				
Cobalt	Co	<0.005				
Copper	Cu	<0.006				
Lead	Pb	0.02				
Mercury	Hg	<0.00005				
Nickel	Ni	<0.005				
Selenium	Se	<0.001				
Silver	Ag	<0.005				
Zinc	Zn	<0.006		pH (as rec'd)		7.7

## MAQUON

The village of Maquon (350) installed a public water supply in 1955. One well is in use. In 1955 there were 93 services; the average and maximum pumpages were 13,000 and 15,000 gpd, respectively. In 1986 there were 167 services, all metered; the average pumpage was 30,000 gpd. The water is aerated for hydrogen sulfide removal and chlorinated.

WELL NO. 1 was completed in October 1952 to a depth of 638 ft by Russell Blake, Galesburg. The water-yielding unit in this well is the Mississippi Valley Aquifer (Burlington Limestone, limestone of the Devonian System, and dolomite of the Silurian System). The well is located south of the center of the village, approximately 1100 ft S and 2200 ft W of the NE corner of Section 4, T9N, R3E. The land surface elevation at the well is approximately 625 ft.

WELL NO. 1, CORRELATED DRILLERS LOG  
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
Yellow clay, with sand	56	56
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moines and Atokan Series</b>		
Shale, with coal	106	162
<b>MISSISSIPPIAN SYSTEM</b>		
<b>Valmeyeran Series</b>		
Burlington Limestone	78	240
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS (undifferentiated)</b>		
<b>Kinderhookian and Upper Devonian Series</b>		
<b>New Albany Group</b>		
Shale	250	490
<b>DEVONIAN AND SILURIAN SYSTEMS</b>		
Limestone and dolomite	148	638

A 12-in. diameter hole was drilled to a depth of 169 ft, reduced to 8 in. between 169 and 498 ft, and finished 6 in. in diameter from 498 to 638 ft. The well is cased with 12-in. pipe from about 1.7 ft above the pumphouse floor to a depth of 56 ft, 8-in. ID pipe from about 1.7 ft above land surface to a depth of 169 ft (cemented in), and a 6-in. ID wrought iron liner from 242 ft to a depth of 498 ft.

A production test was conducted on October 13, 1952, by representatives of the driller, the village, the State

Water Survey, and the Pappmeier Engineering Co. After 38 min of pumping at rates ranging from 40 to 66 gpm, the drawdown was 3.0 ft from a nonpumping water level of 125.5 ft below the top of the casing. Pumping was continued for 2.1 hr at rates of 74 to 72 gpm with a drawdown of 5.2 ft. Pumping was continued for 2 hr at a rate of 100 gpm with a drawdown of 8.8 ft. After an additional 1.2 hr of pumping at rates ranging from 120 to 150 gpm, the final drawdown was 15.3 ft. Twenty-nine min after pumping was stopped, the water level had recovered to 126.0 ft.

In 1953, the nonpumping water level was reported to be 130.5 ft.

In 1954, the well reportedly produced 117 gpm for 4 hr with a drawdown of 11.0 ft from a nonpumping water level of 132.5 ft.

In 1958, the nonpumping water level was reported to be 141 ft.

The pumping equipment presently installed is a submersible pump rated at 62 gpm, and powered by a 10-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B19072) is for a water sample from the well collected October 28, 1979, after 2 hr of pumping at 100 gpm.

WELL NO. 1, LABORATORY NO. B19072

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	<0.005		Silica	SiO <sub>2</sub>	8.4	
Manganese	Mn	0.0057		Fluoride	F	3.12	0.16
Ammonium	NH <sub>4</sub>	1.2	0.07	Boron	B	1.8	
Sodium	Na	700	30.45	Cyanide	CN	<0.005	
Potassium	K	8.7	0.22	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	10	0.50	Chloride	Cl	500	14.10
Magnesium	Mg	5	0.41	Sulfate	SO <sub>4</sub>	220	4.58
Strontium	Sr	0.49		Alkalinity (as CaCO <sub>3</sub> )		630	12.60
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		45	0.90
Barium	Ba	0.09		Total dissolved minerals		1830	
Beryllium	Be	<0.005					
Cadmium	Cd	0.003					
Chromium	Cr	<0.005					
Cobalt	Co	0.009					
Copper	Cu	0.02					
Lead	Pb	0.03					
Mercury	Hg	0.00102					
Nickel	Ni	0.02					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Zinc	Zn	<0.003		pH (as rec'd)		7.9	

## ONEIDA

The city of Oneida (765) installed a public water supply in 1947. Two wells are in use. In 1950 there were 170 services, all metered; the estimated average pumpage was 15,000 gpd. In 1986 there were 315 services, all metered; the average pumpage was 66,500 gpd. The water is aerated to remove hydrogen sulfide and chlorinated.

WELL NO. 1 was completed in November 1945 to a depth of 840 ft (reported to be 832 ft deep in 1947) by Ellis Jones, Burlington, Iowa. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is located at the southeast corner of Young American and Sage Sts., approximately 1500 ft S and 1860 ft E of the NW corner of Section 36, T13N, R2E. The land surface elevation at the well is approximately 815 ft.

### WELL NO. 1, SAMPLE STUDY LOG (furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
Pleistocene Series		
Glacial drift	37	37
Sand and gravel	2	39
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale and sandstone, some limestone and coal	411	450
<b>DEVONIAN SYSTEM</b>		
Upper Devonian Series		
New Albany Group		
Shale	55	505
Middle Devonian Series		
Cedar Valley Limestone		
Dolomite and limestone	76	581
Wapsipicon Limestone	15	596
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Dolomites	242	838
<b>ORDOVICIAN SYSTEM</b>		
Cincinnatian Series		
Maquoketa Group		
Lime, shaley	2	840

A 12-in. diameter hole was drilled to a depth of 79.3 ft, reduced to 10 in. between 79.3 and 526 ft, and finished 8 in. in diameter from 526 to 840 ft. The well is cased with 12-in. ID drive pipe from land surface to a depth of 39.4 ft, 10-in. ID pipe from land surface to a depth of 79.3 ft (cemented in), and 8-in. ID pipe from 1 ft above land surface to a depth of 526 ft.

A production test was conducted on November 9, 1945, by representatives of the driller, the State Water Survey, and the Miller Engineering Service. After 3.2 hr of intermittent pumping at rates ranging from 48 to 50.5 gpm, the

drawdown was 5.5 ft from a nonpumping water level of 277.5 ft. Seventeen min after pumping was stopped, the water level had recovered to 277.8 ft.

The pumping equipment presently installed is a Red Jacket submersible pump (Model No. 6A1257A) rated at 100 gpm, and powered by a 20-hp, 3450 rpm electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B22467) is for a water sample from the well collected November 26, 1979, after 1.5 hr of pumping at 120 gpm. Hydrogen sulfide was apparent when previous samples were collected.

### WELL NO. 1, LABORATORY NO. B22467

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.26		Silica	SiO <sub>2</sub>	8.8	
Manganese	Mn	0.003		Fluoride	F	2.20	0.12
Ammonium	NH <sub>4</sub>	0.8	0.04	Boron	B	1.1	
Sodium	Na	320	13.92	Cyanide	CN	<0.005	
Potassium	K	5.5	0.14	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	9	0.45	Chloride	Cl	112	3.16
Magnesium	Mg	4	0.33	Sulfate	SO <sub>4</sub>	43	0.89
Strontium	Sr	0.278		Alkalinity (as CaCO <sub>3</sub> )		554	11.08
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		41	0.82
Barium	Ba	0.06		Total dissolved minerals		842	
Cadmium	Cd	0.001					
Chromium	Cr	<0.005					
Cobalt	Co	<0.005					
Copper	Cu	<0.005					
Lead	Pb	0.01					
Mercury	Hg	<0.00005					
Nickel	Ni	<0.005					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Zinc	Zn	0.052		pH (as rec'd)		7.9	

WELL NO. 2 was completed in April 1970 to a depth of 1202 ft by the Mid-Continent Drilling Co., Normal. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems) and the upper part of the Midwest Aquigroup (Galena and Platteville Groups). The well is located southeast of Well No. 1, approximately 1650 ft S and 1900 ft E of the NW corner of Section 36, T13N, R2E. The land surface elevation at the well is approximately 815 ft.

A 15-in. diameter hole was drilled to a depth of 80 ft, reduced to 12 in. between 80 and 526 ft, reduced to 8 in. between 526 and 1002 ft, and finished 6 in. in diameter from 1002 to 1202 ft. The well is cased with 14-in. steel pipe from land surface to a depth of 66 ft, 8-in. steel pipe from about 2 ft above land surface to a depth of 521 ft

(cemented in), and a 6-in. steel liner from 815 ft to a depth of 1002 ft. The top of the casing is equipped with a pitless adapter.

WELL NO. 2, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Black top soil	5	5
Yellow clay	10	15
Yellow-brown clay, some gravel	10	25
Clay and gravel, mostly gravel No. 6-8 buckshot size	10	35
Sand and gravel	5	40
Black coal	5	45
White limestone, very hard	4	49
White limestone, green and gray shale	11	60
Gray and green shale	20	80
Gray shale, medium soft	37	117
Coal and shale	6	123
Gray and firm shale	12	135
Limestone and gray shale	65	200
Black and gray shale, soft	20	220
Gray shale, limestone and some coal	5	225
Hard, gray shale, with limestone streaks	15	240
Soft shale, limestone	20	260
Shale and limestone	31	291
Shale and limestone, some coal in sample	4	295
Coal and shale, mostly coal	15	310
Shale and limestone, shale dominant	20	330
Shale and limestone, gray shale mostly	90	420
Limestone with shale	30	450
Limestone and shale	18	468
Shale, with limestone	22	490
Shale	11	501
Limestone	59	560
Hard, dense limestone	37	597
Limestone	237	834
Shaley limestone	8	842
Shale	88	930
Shale, with limestone streaks	12	942
Limestone	198	1140
Sandy limestone	62	1202

A production test was conducted by the Layne-Western Co., Aurora, on April 8, 1970. After 12 hr of pumping at rates ranging from 200 to 360 gpm, the final drawdown was 24 ft from a nonpumping water level of 320 ft.

The pumping equipment presently installed is a submersible pump rated at 150 gpm, and powered by an electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B133022) is for a water sample from the well collected April 2, 1975, after 1 hr of pumping.

WELL NO. 2, LABORATORY NO. B133022

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.2		Silica	SiO <sub>2</sub>	9	
Manganese	Mn	0.0		Fluoride	F	2.1	0.11
Ammonium	NH <sub>4</sub>	1.2	0.07	Boron	B	1.1	
Sodium	Na	325	14.14	Cyanide	CN	0.00	
Potassium	K	8.3	0.21	Nitrate	NO <sub>3</sub>	0.1	0.00
Calcium	Ca	25	1.25	Chloride	Cl	130	3.67
Magnesium	Mg	11	0.90	Sulfate	SO <sub>4</sub>	210	4.37
				Alkalinity (as CaCO <sub>3</sub> )		404	8.08
Arsenic	As	0.000		Hardness (as CaCO <sub>3</sub> )		108	2.16
Barium	Ba	0.1		Total dissolved minerals		938	
Cadmium	Cd	0.001		pH (as rec'd)		8.3	
Chromium	Cr	0.00		Radioactivity			
Copper	Cu	0.00		Alpha pc/L		19.0	
Lead	Pb	0.00		± deviation		7.3	
Mercury	Hg	0.0000		Beta pc/L		20.4	
Nickel	Ni	0.0		± deviation		4.9	
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0					

RIO

The village of Rio (282) installed a public water supply in 1958. One well (No. 1) is in use and another well (No. 2) is available for emergency use. In 1959 there were 45 services, 7 metered. In 1986 there were 107 services, all metered; the average and maximum pumpages were 25,700 and 29,000 gpd, respectively. The water is chlorinated.

WELL NO. 1 was completed in December 1958 to a depth of 675 ft by the Peerless Service Co., Orion. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is located about 55 ft south of the elevated storage tank on Bruner St., approximately 193

ft N and 207 ft W of the SE corner of Section 17, T13N, R1E. The land surface elevation at the well is approximately 780 ft.

WELL NO. 1, SAMPLE STUDY LOG

(furnished by the State Geological Survey)

Strata	Thickness (ft)	Depth (ft)
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
Clay, yellow	20	20
Clay, gray	15	35
Sand, coarse	5	40
Clay, gray	10	50

Strata	Thickness (ft)	Depth (ft)
Till, sandy, buffish-gray	5	55
<b>PENNSYLVANIAN SYSTEM</b>		
Des Moinesian and Atokan Series		
Shale, grayish-brown, weak	50	105
Shale, black, weak	15	120
Coal	6	126
Underclay, light buff, weak	4	130
Shale, calcareous, light grayish buff, weak	25	155
Coal	4	159
Underclay, weak	6	165
Sandstone, light buff, very fine; shale, black, buff	45	210
Shale, brownish-gray, weak	34	244
Coal	1	245
<b>PENNSYLVANIAN AND/OR DEVONIAN SYSTEM</b>		
Shale, gray to brown, weak to brittle	120	365
Sandstone, calcareous, grayish-buff, fine, medium to coarse	15	380
Shale, light gray to dark gray, weak; little sandstone	45	425
<b>DEVONIAN SYSTEM</b>		
Middle Devonian Series		
Cedar Valley Limestone		
Limestone, very silty, grayish-buff	25	450
Wapsipinicon Limestone		
Limestone, white to light buff	15	465
<b>SILURIAN SYSTEM</b>		
Niagaran and Alexandrian Series		
Dolomite, slightly silty, light grayish-buff to grayish-buff, finely crystalline	85	550
Gray lime	10	560
Dolomite, light buff to light grayish white	60	620
Gray lime	20	640
Dolomite, slightly silty, grayish-buff	15	655
No record	20	675

An 8-in. diameter hole was drilled to a depth of 675 ft. The well is equipped with a monitor pitless adapter from about 2 ft above land surface to a depth of 4 ft and cased with 8-in. steel pipe to a depth of 422 ft.

A production test was conducted on December 8, 1958, by representatives of the driller, the village, the State Water Survey, and the Pappmeier Engineering Co. After 2.1 hr of pumping at a rate of 62 gpm, the drawdown was 9.0 ft from a nonpumping water level of 257.0 ft. Four min after pumping was stopped, the water level had recovered to 258.4 ft.

On January 3, 1978, the well reportedly produced about 122 gpm for 30 min with a drawdown of 14 ft from a non-pumping water level of 222 ft.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 100 gpm, and powered by a 20-hp, 3450 rpm electric motor (Serial No. 3619 DKD).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B136293) is for a water sample from the well collected April 23, 1975, after 1 hr of pumping at 90 gpm.

WELL NO. 1, LABORATORY NO. B136293

	mg/L	me/L		mg/L	me/L
Iron	Fe	0.0	Silica	SiO <sub>2</sub>	9
Manganese	Mn	0.0	Fluoride	F	2.0 0.10
Ammonium	NH <sub>4</sub>	0.6	Boron	B	1.2
Sodium	Na	300	Cyanide	CN	0.00
Potassium	K	4.7	Nitrate	NO <sub>3</sub>	0.1 0.00
Calcium	Ca	8	Chloride	Cl	77 2.17
Magnesium	Mg	4	Sulfate	SO <sub>4</sub>	68 1.41
			Alkalinity (as CaCO <sub>3</sub> )		500 10.00
Arsenic	As	0.000	Hardness (as CaCO <sub>3</sub> )		36 0.72
Barium	Ba	0.1	Total dissolved minerals		798
Cadmium	Cd	0.00			
Chromium	Cr	0.00	pH (as rec'd)		8.2
Copper	Cu	0.00	Radioactivity		
Lead	Pb	0.00	Alpha pc/L		3.1
Mercury	Hg	0.0000	± deviation		2.5
Nickel	Ni	0.0	Beta pc/L		6.2
Selenium	Se	0.00	± deviation		3.0
Silver	Ag	0.000			
Zinc	Zn	0.0			

WELL NO. 2 was completed in May 1979 to a depth of 675 ft by the Test Drilling Service Co., Maryland Heights, Mo. This well is available for emergency use. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is located on Bruner St. about 20 ft west of the elevated storage tank and 70 ft north of Well No. 1, approximately 263 ft N and 212 ft W of the SE corner of Section 17, T13N, R1E. The land surface elevation at the well is approximately 780 ft.

WELL NO. 2, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Till	80	80
Shale, dark gray	20	100
Shale, dark gray, interbedded with carbonaceous shale lenses	23	123
Coal	2	125
Shale, silty, greenish gray	25	150
Shale, silty, greenish gray, interbedded with carbonaceous shale lenses	10	160
Shaley siltstone, light gray	50	210
Carbonaceous shale, dark gray to black	21	231
Limestone, gray	1	232
Coal	7	239
Underclay, light gray	5	244

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Shaley limestone, light gray	6	250
Clayey shale, dark gray, soft	40	290
Shale, gray	3	293
Sandy shale, dark gray	7	300
Shale, silty, gray	50	350
Sandstone, fine to medium grain, interbedded with gray shale	40	390
Shale, dark gray	20	410
Sandstone, light gray to light brown, fine to medium grain	2	412
Shale, dark gray	6	418
Limestone, gray to brownish gray	1	419
Shale, gray (Pennsylvanian-Devonian contact)	6	425
Limestone, light gray	10	435
Limestone, dark brownish gray, <1 percent white chert	15	450
Dolomite, light brown, <1 percent white chert	65	515
Limestone, light gray, finely crystalline, <1 percent white chert	10	525
Sandy dolomite, light brown, finely crystalline	50	575
Limestone, light gray, dull to finely crystalline	45	620
Silty dolomite, light brown, dull to finely		

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
crystalline, <1 percent white chert	53	673
Shale, bluish green	2	675

A 13.4-in. diameter hole was drilled to a depth of 85 ft, reduced to 12.2 in. between 85 and 435 ft, and finished 8 in. in diameter from 435 to 675 ft. The well is equipped with a Baker monitor pitless adapter from about 2 ft above land surface to a depth of 4 ft and cased with 13.4-in. surface pipe from land surface to a depth of 85 ft and 8-in. steel pipe from land surface to a depth of 435 ft (cemented in).

Upon completion, the well reportedly produced 200 gpm for 10 hr with a drawdown of 54 ft from a nonpumping water level of 300 ft below land surface.

The pumping equipment presently installed is a Red Jacket submersible pump set at 400 ft, rated at 120 gpm at about 460 ft TDH, and powered by a 20-hp Red Jacket electric motor.

## ST. AUGUSTINE

The village of St. Augustine (204) installed a public water supply in 1962. Two wells are in use. In 1968 there were about 50 services; the estimated average pumpage was 4500 gpd. In 1986 there were 70 services, none metered; the average pumpage was 12,200 gpd. The water from Well No. 1 is aerated to oxidize iron, chlorinated, and filtered; water from Well No. 2 is filtered.

WELL NO. 1, presently open to limestone of the Mississippi Valley Aquigroup (Burlington Limestone), was constructed in April 1960 to a depth of 160 ft and deepened in 1960 to a reported depth of 595 ft (filled in to 170 ft) by Russell Blake, Galesburg. The well is located on the west side of the pumphouse at the east edge of the village, approximately 1620 ft N and 75 ft W of the SE corner of Section 32, T9N, R1E. The land surface elevation at the well is approximately 658 ft.

### WELL NO. 1, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	2	2
Yellow clay	28	30
Blue clay	85	115
Sand	5	120

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
White clay	5	125
Soft limestone	10	135
Limestone	25	160
Soft limestone	10	170
Kinderhook shale	255	425
Devonian limestone	70	495
Limestone	20	515
Silurian dolomite	47	562
Gray shale (Maquoketa)	33	595

Originally, an 8-in. diameter hole was drilled to a depth of 127 ft and finished 6 in. in diameter from 127 to 160 ft. The well was originally cased with 8-in. pipe from land surface to a depth of 127 ft. After deepening, the hole was reported to be 8 in. in diameter to a depth of 425 ft and 6 in. from 425 to 595 ft. The well was then cased with 8-in. pipe from land surface to a depth of 135 ft and 6-in. pipe from land surface to a depth of 425 ft. After the well was filled in, the 8-in. diameter casing extended from about 2 ft above land surface to a reported depth of 127 ft.

Before deepening, a production test was conducted on April 29, 1960, by representatives of the driller, the village, the State Water Survey, and the Pappmeier Engineering Co. After 4.4 hr of pumping at rates of 21 to 24 gpm, the

drawdown was 21.9 ft from a nonpumping water level of 65.7 ft below land surface. One hr after pumping was stopped, the water level had recovered to 71.7 ft.

In 1960, when this well was initially drilled, it could not produce 20 gpm with continuous pumping. The well was then deepened but the results were unsuccessful so the well was filled up to a depth of 170 ft. A production test was then conducted from June 4 to July 14, 1960, by representatives of the village and the Pappmeier Engineering Co. From 3:15 pm on June 4 to 8:00 am on June 11, the well was pumped at rates ranging from 30 to 10 gpm with a maximum drawdown of 45.0 ft from a nonpumping water level of 70.0 ft. The pump was then idle from 8:00 am on June 11 to 10:30 am on June 15, when the nonpumping water level was reported to be 73.0 ft. Pumping was then continued to 7:00 pm on July 1 at rates ranging from 15 to 9.2 gpm with a final drawdown of 14.5 ft. The pump was then idle to 9:00 am on July 14, when the water level had recovered to 70.0 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 150 ft, rated at 20 gpm, and powered by a 1-hp Red Jacket electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B01048) of a sample collected July 7, 1975, after pumping for 1 hr at 20 gpm, showed the water to have a hardness of 266 mg/L, total dissolved minerals of 401 mg/L, and an iron content of 6.9 mg/L.

A well, located about 1150 ft west-southwest of Well No. 1, was completed in 1960 to a depth of 153 ft. This well was then abandoned after it was tested for 3 hr with a capacity of only 1.5 gpm.

WELL NO. 2, open to sandstone of the Upper Bedrock Aquigroup (Pennsylvanian System), was completed in

September 1971 to a depth of 87 ft by Howard Springer, Galesburg. The well is located on lots 5 and 6 on the west side of the village, approximately 1146 ft N and 2760 ft W of the SE corner of Section 32, T9N, R1E. The land surface elevation at the well is approximately 640 ft.

An 8-in. diameter hole was drilled to a depth of 87 ft. The well is cased with 8-in. pipe from about 1.5 ft above land surface to a depth of 65 ft.

The pumping equipment presently installed is a Red Jacket pump set at 65 ft, rated at 20 gpm, and powered by a 3-hp Red Jacket electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B132789) is for a water sample from the well collected March 1, 1975, after 1 hr of pumping at 20 gpm.

WELL NO. 2, LABORATORY NO. B132789

		mg/L	me/L			mg/L	me/L
<b>Iron</b>	<b>Fe</b>	6.6		<b>Silica</b>	<b>SiO<sub>2</sub></b>	12	
<b>Manganese</b>	<b>Mn</b>	0.1		<b>Fluoride</b>	<b>F</b>	0.7	0.04
<b>Ammonium</b>	<b>NH<sub>4</sub></b>	3.9	0.22	<b>Boron</b>	<b>B</b>	0.2	
<b>Sodium</b>	<b>Na</b>	58	2.52	<b>Cyanide</b>	<b>CN</b>	0.00	
<b>Potassium</b>	<b>K</b>	2.7	0.07	<b>Nitrate</b>	<b>NO<sub>3</sub></b>	0.0	0.00
<b>Calcium</b>	<b>Ca</b>	64	3.19	<b>Chloride</b>	<b>Cl</b>	2	0.06
<b>Magnesium</b>	<b>Mg</b>	28	2.30	<b>Sulfate</b>	<b>SO<sub>4</sub></b>	5	0.10
				<b>Alkalinity (as CaCO<sub>3</sub>)</b>		434	8.68
				<b>Hardness (as CaCO<sub>3</sub>)</b>		275	5.50
<b>Arsenic</b>	<b>As</b>	0.04		<b>Total dissolved minerals</b>		426	
<b>Barium</b>	<b>Ba</b>	0.2		<b>pH (as rec'd)</b>		7.7	
<b>Cadmium</b>	<b>Cd</b>	0.000		<b>Radioactivity</b>			
<b>Chromium</b>	<b>Cr</b>	0.00		<b>Alpha pc/L</b>		0.8	
<b>Copper</b>	<b>Cu</b>	0.00		<b>± deviation</b>		1.8	
<b>Lead</b>	<b>Pb</b>	0.00		<b>Beta pc/L</b>		4.1	
<b>Mercury</b>	<b>Hg</b>	0.0000		<b>± deviation</b>		2.0	
<b>Nickel</b>	<b>Ni</b>	0.0					
<b>Selenium</b>	<b>Se</b>	0.00					
<b>Silver</b>	<b>Ag</b>	0.00					
<b>Zinc</b>	<b>Zn</b>	0.4					

VICTORIA

The village of Victoria (389) installed a public water supply in 1950. One well is in use. In 1951 there were 120 services, 98 percent metered; the estimated average and maximum pumpages were 7000 and 11,000 gpd, respectively. In 1986 there were 211 services, all metered; the average pumpage was 20,700 gpd. The water is aerated for hydrogen sulfide removal and chlorinated.

WELL NO. 1 was completed in April 1950 to a depth of 860 ft by the Peerless Service Co., Orion. The water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is located about 0.2 mile west of the

center of the village, approximately 150 ft S and 1100 ft W of the NE corner of Section 13, T12N, R3E. The land surface elevation at the well is approximately 830 ft.

WELL NO. 1, SAMPLE STUDY SUMMARY LOG

(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
<b>Soil, brownish-black</b>	5	5

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Silt, loess, light brown	20	25
Till, light brown	5	30
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moines and Atoka Series</b>		
Shale, silty, gray, with thin beds of limestone and sandstone	80	110
Sandstone, silty, gray	25	135
Shale, silty, gray with thin beds of limestone and sandstone, sandstone at base	393	528
<b>DEVONIAN SYSTEM</b>		
<b>Upper Devonian Series</b>		
Shale, silty, brown	67	595
<b>Middle Devonian Series</b>		
<b>Cedar Valley Limestone</b>		
Limestone, dolomitic, silty, brown to gray	62	657
<b>Wapsipicon Limestone</b>		
Limestone, dolomitic, very fine, buff	28	685
<b>SILURIAN SYSTEM</b>		
<b>Niagaran and Alexandrian Series</b>		
Dolomite, light gray, cherty	175	860

A 15-in. diameter hole was drilled to a depth of 192 ft, reduced to 12 in. between 192 and 370 ft, reduced to 10 in. between 370 and 600 ft, and finished 8 in. in diameter from 600 to 860 ft. The well is cased with 12-in. steel pipe from about 3 ft above land surface to a depth of 192 ft, 10-in. steel pipe from 180 ft to a depth of 370 ft, and 8-in. steel pipe from 360 ft to a depth of 600 ft.

A production test was conducted on April 24, 1950, by representatives of the driller, the village, the State Water Survey, and the Pappmeier Engineering Co. After 5.2 hr of pumping at rates ranging from 110 to 107 gpm, the drawdown was 14 ft from a nonpumping water level of 312 ft below land surface. Four min after pumping was stopped, the water level had recovered to 314 ft.

The village of Wataga (996) installed a public water supply in 1955. One well is in use. In 1957 there were 140 services; the average and maximum pumpages were 13,500 and 15,000 gpd, respectively. In 1986 there were 362 services, all metered; the average pumpage was 66,000 gpd. The water is aerated for hydrogen sulfide removal and chlorinated.

WELL NO. 1 was completed in November 1954 to a depth of 840 ft by the Peerless Service Co., Orion. The

The pumping equipment presently installed consists of a 15-hp, 1500 rpm U. S. electric motor and a 6-in., 12-stage Peerless turbine pump rated at 100 gpm at about 400 ft TDH, and equipped with 420 ft of 4-in. column pipe. A 20-ft section of 4-in. suction pipe is attached to the pump intake. The well is equipped with 423 ft of airline.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B028690) is for a water sample from the well collected December 8, 1981, after 1 hr of pumping at 90 gpm. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 1, LABORATORY NO. B028690

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.40		Silica	SiO <sub>2</sub>	9.1	
Manganese	Mn	<0.005		Fluoride	F	2.00	0.10
Ammonium	NH <sub>4</sub>	1.1	0.06	Boron	B	1.31	
Sodium	Na	600	26.10	Cyanide	CN	<0.005	
Potassium	K	11	0.28	Nitrate	NO <sub>3</sub>	0.8	0.01
Calcium	Ca	15	0.75	Chloride	Cl	450	12.69
Magnesium	Mg	7.6	0.62	Sulfate	SO <sub>4</sub>	125	2.60
Strontium	Sr	0.51		Alkalinity (as CaCO <sub>3</sub> )		584	11.68
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		59	1.18
Barium	Ba	0.129		Total dissolved minerals		1560	
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	<0.00005					
Nickel	Ni	<0.003					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.004					
Zinc	Zn	<0.002		pH (as rec'd)		7.8	

## WATAGA

major water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well is also open to part of the Pennsylvanian System and to shale in the upper part of the Midwest Aquigroup (Maquoketa Group), but its contribution to the well is probably negligible. The well is located at 121 North Main St. near the center of the village about one block southeast of U. S. Route 34, approximately 3300 ft S and 2200 ft E of the NW corner of Section 16, T12N, R2E. The land surface elevation at the well is approximately 830 ft.

WELL NO. 1, SAMPLE STUDY SUMMARY LOG  
(furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
No samples	5	5
Silt, light brown	5	10
Till, gray and brown, noncalcareous	20	30
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Shale and siltstone, gray with beds of coal and sandstone	455	485
<b>DEVONIAN SYSTEM</b>		
<b>Upper Devonian Series</b>		
<b>New Albany Group</b>		
Shale and siltstone, brownish gray, micaceous, sporangites	75	560
<b>Middle Devonian Series</b>		
Cedar Valley Limestone	35	595
Wapsipicon Limestone		
Limestone, light gray, fine to lithographic	25	620
<b>SILURIAN SYSTEM</b>		
<b>Niagaran and Alexandrian Series</b>		
Dolomite, light buff to white, gray in lower part, fine	55	675
Dolomite, light gray to white	30	705
Dolomite, gray to buff, fine, sandy	125	830
<b>ORDOVICIAN SYSTEM</b>		
<b>Cincinnatian Series</b>		
<b>Maquoketa Group</b>		
Shale, gray, soft, silty	10	840

A 12-in. diameter hole was drilled to a depth of 139.5 ft, reduced to 10 in. between 139.5 and 364 ft, and finished 8 in. in diameter from 364 to 840 ft. The well is cased with 12-in. pipe from about 1 ft above land surface to a depth of 139.5 ft, 10-in. liner from 229 ft to a depth of 364 ft, and 8-in. liner from 364 ft to a depth of 580 ft.

A production test was conducted on December 13, 1954, by representatives of the driller, the State Water

Survey, and the Austin Engineering Co. After 4 hr of pumping at rates ranging from 137 to 107 gpm, the draw-down was 36 ft from a nonpumping water level of 323 ft below land surface. Nine min after pumping was stopped, the water level had recovered to 321 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 440 ft, rated at 140 gpm, and powered by a 20-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B012223) is for a water sample from the well collected September 19, 1983, after 10 min of pumping at 150 gpm.

WELL NO. 1, LABORATORY NO. B012223

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.12		Silica	SiO <sub>2</sub>	9.0	
Manganese	Mn	<0.005		Fluoride	F	2.25	0.12
Ammonium	NH <sub>4</sub>	0.7	0.04	Boron	B	1.17	
Sodium	Na	389	16.92	Cyanide	CN	<0.005	
Potassium	K	7.4	0.19	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	7	0.35	Chloride	Cl	200	5.64
Magnesium	Mg	3.8	0.31	Sulfate	SO <sub>4</sub>	60	1.25
Sr		0.279		Alkalinity (as CaCO <sub>3</sub> )		560	11.20
Arsenic	As	<0.001		Hardness (as CaCO <sub>3</sub> )		24	0.48
Barium	Ba	0.023		Total dissolved minerals		1007	
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	<0.00010					
Nickel	Ni	<0.005					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.004					
Zinc	Zn	<0.002		pH (as rec'd)		8.2	

WESTPORT WATER MUTUAL

Westport Water Mutual (est. 90), located about 2.2 miles west of Galesburg, installed a public water supply in 1963. The water system is owned and operated by the Westport Homeowners Mutual Water Supply. One well is in use. This supply is also cross connected with the Windwood Water System, Inc. In 1969 there were 23 services; the average pumpage was 3300 gpd. In 1986 there were 24 services, all metered; the average and maximum pumpages

were 4500 and 6430 gpd, respectively. The water is chlorinated and fluoridated.

WELL NO. 1, open to sandstone and shale of the Mississippi Valley Aquigroup (Pennsylvanian System), was completed in May 1963 to a depth of 150 ft by Russell Blake, Galesburg. The well is located at the west edge of the subdivision along the public road, approximately 255 ft

N and 60 ft E of the SW corner of Section 7, T11N, R1E. The land surface elevation at the well is approximately 760 ft.

**WELL NO. 1, DRILLERS LOG**

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	25	25
Sand very fine	40	65
Blue clay and sand	20	85
Broken coal	3	88
Shale with streaks of gravel and rocks	62	150

A 6-in. diameter hole was drilled to a depth of 150 ft. The well is cased with 6-in. pipe from about 1.7 ft above land surface to a depth of 92.5 ft and a 5-in. slotted liner from 87 ft to a depth of 150 ft. The top of the well casing is equipped with a pitless adapter.

A production test was conducted on May 9, 1968, by representatives of the subdivision, the State Water Survey, and Kenneth E. Schrader & Associates, Consulting Engineers. After 2 hr of pumping at rates ranging from 19 to 22 gpm, the final drawdown was 7.14 ft from a non-pumping water level of 25.28 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 27.27 ft. On the basis of the production test data, it was estimated that this well should yield 55 gpm (79,200 gpd) on a long-term basis.

The pumping equipment presently installed is a Jacuzzi submersible pump rated at 30 gpm, and powered by a 2-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B022426) is for a water sample from the well collected December 5, 1983, after 30 min of pumping at 32 gpm.

**WELL NO. 1, LABORATORY NO. B022426**

		<i>mg/L</i>	<i>me/L</i>			<i>mg/L</i>	<i>me/L</i>
Iron	Fe	0.56		Silica	SiO <sub>2</sub>	20	
Manganese	Mn	0.010		Fluoride	F	0.25	
Ammonium	NH <sub>4</sub>	1.3	0.07	Boron	B	0.27	
Sodium	Na	33	1.44	Cyanide	CN	<0.005	
Potassium	K	3.8	0.10	Nitrate	NO <sub>3</sub>	<0.4	
Calcium	Ca	66	3.29	Chloride	Cl	8.5	0.24
Magnesium	Mg	29.7	2.44	Sulfate	SO <sub>4</sub>	44	0.92
Strontium	Sr	0.78	0.02	Alkalinity (as CaCO <sub>3</sub> )		314	6.28
Aluminum	Al	0.09		Hardness (as CaCO <sub>3</sub> )		297	5.94
Arsenic	As	<0.001		Total dissolved minerals		406	
Barium	Ba	0.115					
Beryllium	Be	<0.0005					
Cadmium	Cd	0.005					
Chromium	Cr	<0.010					
Cobalt	Cu	0.009					
Copper	Cu	<0.005					
Lead	Pb	0.005					
Mercury	Hg	<0.00010					
Nickel	Ni	0.017					
Selenium	Se	<0.001					
Silver	Ag	<0.005					
Vanadium	V	<0.005					
Zinc	Zn	0.020		pH (as rec'd)		7.4	

**WILLIAMSFIELD**

The village of Williamsfield (585) installed a public water supply in 1940. Two wells (Nos. 2 and 3) are in use. In 1952 there were 170 services; the average and maximum pumpages in 1949 were 17,000 and 20,000 gpd, respectively. In 1986 there were 285 services, all metered; the average and maximum pumpages were 47,000 and 66,000 gpd, respectively. The water is aerated for hydrogen sulfide removal and chlorinated.

Prior to the construction of a public water supply, 32 test holes and 4 test wells were completed in the valley flat and along the alluvial terraces on the south side of the Spoon River near Illinois Route 180.

WELL NO. 1 was completed in July 1939 to a depth of 19.1 ft by the Sewell Well Co., St. Louis, Mo. This well was abandoned prior to July 1971 and sealed in 1982. The water-yielding units in this well were sand and gravel of the Prairie Aquigroup. The well also penetrated sandstone in the upper part of the Upper Bedrock Aquigroup (Pennsylvanian System), but its contribution to the well was probably negligible. The well was located in the floodplain of the Spoon River, about 1 mile north of the village on the east side of Route 180, approximately 1150 ft S and 2750 ft E of the NW corner of Section 14, T11N, R4E. The land surface elevation at the well is approximately 600 ft.

WELL NO. 1, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Black soil	1.2	1.2
Subsoil and clay	7.3	8.5
Sand and clay	1	9.5
Gravel	4.5	14
Clay	1	15
Sandstone	3.3	18.3
Shale	0.8	19.1

A 10-ft wide square hole was dug to a depth of 19.1 ft. The bottom of a 1-ft thick concrete slab was placed at a depth of 19.1 ft. An 8-in. thick circular brick wall, 6 ft in diameter, was placed from the top of the slab to a height of 10.8 ft (7.3 ft below land surface). The top 2.7 ft of brick was laid in mortar. The annulus between the brick wall and the sides of the hole was filled with washed gravel from the top of the concrete slab to a height of 9.5 ft, and a 1.3-ft layer of clay was placed on top of the gravel. The remainder of the backfill record is not available.

A production test was conducted by the State Water Survey on July 6-7, 1939. After 28.1 hr of intermittent pumping at rates ranging from 22.8 to 15.0 gpm, the maximum drawdown was 10.00 ft from a nonpumping water level of 0.75 ft above the top of the brick wall (7.3 ft below land surface). The water level recovered to 2.50 ft below the top of the brick wall after pumping had been stopped for 3.9 hr.

A mineral analysis of a sample (Lab. No. 109848) collected April 7, 1947, showed the water to have a hardness of 398 mg/L, total dissolved minerals of 479 mg/L, and an iron content of 0.1 mg/L.

WELL NO. 2 was completed in September 1946 to a depth of 887 ft (reported to be bridged at 670 ft in 1946) by the Varner Well and Pump Co., Dubuque, Iowa. The major water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well also penetrates shale in the upper part of the Midwest Aquigroup (Maquoketa Group), but its contribution to the well is probably negligible. The well is located at the northwest corner of Gale St. and Chicago Ave., approximately 2240 ft N and 1650 ft E of the SW corner of Section 23, T11N, R4E. The land surface elevation at the well is approximately 705 ft.

WELL NO. 2, SAMPLE STUDY LOG

(furnished by the State Geological Survey)

Strata	Thickness (ft)	Depth (ft)
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
Soil, loess, clay and glacial till	35	35

Strata	Thickness (ft)	Depth (ft)
Sand and granule gravel, clayey	5	40
Till	30	70
Sand and granule gravel, silty	11	81
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Shale, limestone, siltstone and compact sandstone	299	380
<b>MISSISSIPPIAN SYSTEM</b>		
<b>Valmeyeran Series</b>		
Burlington Limestone		
Chert	4	384
<b>MISSISSIPPIAN AND DEVONIAN SYSTEMS (Undifferentiated)</b>		
<b>Kinderhookian and Upper Devonian Series</b>		
<b>New Albany Group</b>		
Shale	191	575
<b>DEVONIAN SYSTEM</b>		
<b>Middle Devonian Series</b>		
<b>Cedar Valley Limestone, some dolomite at top</b>	70	645
Wapsipinicon Limestone	25	670
<b>SILURIAN SYSTEM</b>		
<b>Niagaran and Alexandrian Series</b>		
Dolomite	205	875
<b>ORDOVICIAN SYSTEM</b>		
<b>Cincinnatian Series</b>		
<b>Maquoketa Group</b>		
Shale and limestone	12	887

A 12-in. diameter hole was drilled to a depth of 595 ft and finished 8 in. in diameter from 595 to 887 ft. The well is cased with 12-in. ID pipe from about 0.9 ft above land surface to a depth of 98.5 ft and 8-in. ID pipe from about 0.9 ft above land surface to a depth of 595 ft (cemented in).

Production tests were attempted by the State Water Survey on September 19 and 21, 1946. After 2.4 hr of pumping on September 19 at rates of 150 to 165 gpm, pumping was terminated because of mechanical failure in the engine. On September 21, the well reportedly produced 230 to 220 gpm for 5.7 hr and 315 gpm for 12 hr. Pumping was again terminated because of mechanical trouble, but during the test the pump did not break suction. Water levels could not be observed during these tests because of a broken airline. On September 24, after the pump was removed, the nonpumping water level was reported to be 186.5 ft below the top of the casing. The well was then reported to be bridged or filled in at 670 ft.

On December 4, 1958, the well reportedly produced 140 gpm with a drawdown of 8 ft from a nonpumping water level of 212 ft.

The pumping equipment presently installed is a Goulds submersible pump (Model No. 100H15-8, Serial No. 227BA) rated at about 125 gpm, and powered by a 15-hp Marathon electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B46989) of a sample collected May 19, 1977, after pumping for 30 min, showed the water to have a hardness of 34 mg/L, total dissolved minerals of 1680 mg/L, and an iron content of 0.7 mg/L.

WELL NO. 3 was completed in March 1970 to a depth of 880 ft by the Layne-Western Co., Aurora. The major water-yielding units in this well are limestone and dolomite of the Mississippi Valley Aquigroup (Devonian and Silurian Systems). The well also penetrates shale in the upper part of the Midwest Aquigroup (Maquoketa Group), but its contribution to the well is probably negligible. The well is located north-northwest of Well No. 2, approximately 2280 ft N and 1630 ft E of the SW corner of Section 23, T11N, R4E. The land surface elevation at the well is approximately 705 ft.

WELL NO. 3, DRILLERS LOG

Strata	Thickness (ft)	Depth (ft)
Black top soil	5	5
Soft yellow clay	15	20
Soft yellow clay, gravelly	15	35
Gray clay, gravelly	36	71
Gravel, fine to coarse	11	82
Soft gray shale	20	102
Lime and shale, very hard, chert	5	107
Gray shale	12	119
Gray shale and sandy shale, medium hard	61	180
Gray shale and hard limestone	15	195
Shale and coal	10	205
Gray shale - limestone	15	220
Sandstone	5	225
Hard limestone and shale	35	260
Limestone and shale, buff dolomite	30	290
Coal with sandstone and very soft gray shale	10	300
Limestone and shale	50	350
Brown limestone, some shale	30	380
Gray shale with some limestone	10	390
Shale with limestone streaks	118	508
Cherty limestone	5	513
Limestone and shale	15	528
Shale	47	575
Shale and limestone, dolomite very soft	25	600
Buff to dark brown limestone, very hard	75	675
White limestone, hard, brittle	25	700
Limestone and some very soft green shale	80	780
Limestone and chert, black and gray, very hard, some green shale	50	830
Buff limestone and green shale, hard	25	855
White limestone and soft green shale	5	860
Green shale, some black	10	870
Shale	10	880

A 15-in. diameter hole was drilled to a depth of 92 ft, reduced to 12 in. between 92 and 600 ft, and finished 8 in. in diameter from 600 to 880 ft. The well is cased with 12-in. steel pipe from land surface to a depth of 92 ft and 8-in. steel pipe from about 2 ft above land surface to a depth of 596.5 ft (cemented in).

A production test was conducted by the driller on March 6, 1970. After 5.2 hr of pumping at rates ranging from 219 to 151 gpm, the drawdown was 14 ft from a non-pumping water level of 218 ft below land surface. Pumping was continued for 30 min at a rate of 400+ gpm with a final drawdown of 36 ft. Five min after pumping was stopped, full recovery was observed. During this test, Well No. 2 was pumping intermittently.

The pumping equipment presently installed is a Sumo submersible pump set at 300 ft, rated at 150 gpm, and powered by a 15-hp General Electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B132464) is for a water sample from the well collected March 31, 1975, after 30 min of pumping at 60 gpm. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 3, LABORATORY NO. B132464

		mg/L	me/L			mg/L	me/L
Iron	Fe	0.2		Silica	SiO <sub>2</sub>	10	
Manganese	Mn	0.0		Fluoride	F	3.0	0.16
Ammonium	NH <sub>4</sub>	1.1	0.06	Boron	B	1.8	
Sodium	Na	700	30.45	Cyanide	CN	0.00	
Potassium	K	7.0	0.18	Nitrate	NO <sub>3</sub>	0.0	0.00
Calcium	Ca	8	0.40	Chloride	Cl	570	16.07
Magnesium	Mg	4	0.33	Sulfate	SO <sub>4</sub>	160	3.33
				Alkalinity (as CaCO <sub>3</sub> )		581	11.62
Arsenic	As	0.000		Hardness (as CaCO <sub>3</sub> )		36	0.72
Barium	Ba	0.0		Total dissolved minerals		1790	
Cadmium	Cd	0.002					
Chromium	Cr	0.00		pH (as rec'd)		8.3	
Copper	Cu	0.00		Radioactivity			
Lead	Pb	0.00		Alpha pc/L		3.4	
Mercury	Hg	0.0000		± deviation		5.6	
Nickel	Ni	0.0		Beta pc/L		16.2	
Selenium	Se	0.00		± deviation		6.1	
Silver	Ag	0.00					
Zinc	Zn	0.0					

## WINDWOOD WATER SYSTEM, INC.

Windwood Water System, Inc. (est. 175), formerly known as Westport Subdivision Section III, located about 2.2 miles west of Galesburg, installed a public water supply in 1974. One well is in use. This supply is also cross connected with the Westport Water Mutual. In 1986 there were 50 services, 49 metered; the average pumpage in 1985 was 9600 gpd. The water is not treated.

WELL NO. 1, open to sandstone and shale of the Mississippi Valley Aquigroup (Pennsylvanian System), was completed in 1974 to a depth of 170 ft. The well is located near the intersection of Sycamore Bend and Westport Road, approximately 1458 ft N and 651 ft E of the SW corner of Section 7, T11N, R1E. The land surface elevation at the well is approximately 762 ft.

The well is cased with 8-in. steel pipe from about 1 ft above land surface to an unknown depth. The top of the well casing is equipped with a pitless adapter.

The pumping equipment presently installed is an Aeromotor submersible pump (Serial No. SE30-300) set at about 145 ft, rated at 52 gpm, and powered by a 3-hp, 3450 rpm electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B142329) is for a water sample from the well collected June 4, 1975, after 1 hr of pumping at 52 gpm.

### WELL NO. 1, LABORATORY NO. B142329

		<i>mg/L me/L</i>				<i>mg/L me/L</i>	
<b>Iron</b>	<b>Fe</b>	<b>0.3</b>		<b>Silica</b>	<b>SiO<sub>2</sub></b>	<b>22</b>	
<b>Manganese</b>	<b>Mn</b>	<b>0.0</b>		<b>Fluoride</b>	<b>F</b>	<b>0.3</b>	<b>0.02</b>
<b>Ammonium</b>	<b>NH<sub>4</sub></b>	<b>1.5</b>	<b>0.08</b>	<b>Boron</b>	<b>B</b>	<b>0.2</b>	
<b>Sodium</b>	<b>Na</b>	<b>54</b>	<b>2.35</b>	<b>Cyanide</b>	<b>CN</b>	<b>0.00</b>	
<b>Potassium</b>	<b>K</b>	<b>2.0</b>	<b>0.05</b>	<b>Nitrate</b>	<b>NO<sub>3</sub></b>	<b>0.57</b>	<b>0.01</b>
<b>Calcium</b>	<b>Ca</b>	<b>72</b>	<b>3.59</b>	<b>Chloride</b>	<b>Cl</b>	<b>3</b>	<b>0.08</b>
<b>Magnesium</b>	<b>Mg</b>	<b>29</b>	<b>2.39</b>	<b>Sulfate</b>	<b>SO<sub>4</sub></b>	<b>7</b>	<b>0.15</b>
				<b>Alkalinity (as CaCO<sub>3</sub>)</b>		<b>420</b>	<b>8.40</b>
<b>Arsenic</b>	<b>As</b>	<b>0.00</b>		<b>Hardness (as CaCO<sub>3</sub>)</b>		<b>299</b>	<b>5.98</b>
<b>Barium</b>	<b>Ba</b>	<b>0.2</b>					
<b>Cadmium</b>	<b>Cd</b>	<b>0.00</b>		<b>Total dissolved minerals</b>		<b>471</b>	
<b>Chromium</b>	<b>Cr</b>	<b>0.00</b>					
<b>Copper</b>	<b>Cu</b>	<b>0.00</b>					
<b>Lead</b>	<b>Pb</b>	<b>0.00</b>		<b>pH (as rec'd)</b>	<b>7.5</b>		
<b>Mercury</b>	<b>Hg</b>	<b>0.0000</b>		<b>Radioactivity</b>			
<b>Nickel</b>	<b>Ni</b>	<b>0.0</b>		<b>Alpha <i>pc/L</i></b>	<b>2.0</b>		
<b>Selenium</b>	<b>Se</b>	<b>0.00</b>		<b>± deviation</b>	<b>1.5</b>		
<b>Silver</b>	<b>Ag</b>	<b>0.000</b>		<b>Beta <i>pc/L</i></b>	<b>4.4</b>		
<b>Zinc</b>	<b>Zn</b>	<b>0.1</b>		<b>± deviation</b>	<b>1.8</b>		

## YATES CITY

The village of Yates City (860) installed a public water supply in 1942. One well (No. 3) is in use and another well (No. 1) is available for emergency use. In 1952 there were 197 services, 182 metered. In 1986 there were 360 services, all metered; the average pumpage was 41,100 gpd. The water from Well No. 3 is chlorinated.

WELL NO. 1 was completed in July 1940 to a depth of 94 ft by C. W. Varner, Dubuque, Iowa. This well is available for emergency use. The water-yielding units in this well are sand and gravel of the Prairie Aquigroup and sandstone, siltstone, and shale in the upper part of the Upper Bedrock Aquigroup (Pennsylvanian System). The well is located about 1 mile east of the village on the north side of Illinois Route 8, approximately 2600 ft S and 200 ft W of the NE corner of Section 12, T9N, R4E. The land surface elevation at the well is approximately 680 ft.

### TEST HOLE NO. 1, SAMPLE STUDY LOG

(site of Well No. 1 - furnished by the State Geological Survey)

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
<b>QUATERNARY SYSTEM</b>		
<b>Pleistocene Series</b>		
Loess and glacial till	55	55
Sand and granule gravel, silty	15	70
Sand, yellow, clean	5	75
Sand and granule gravel, silty	10	85
<b>PENNSYLVANIAN SYSTEM</b>		
<b>Des Moinesian and Atokan Series</b>		
Siltstone and shale	10	95
Sandstone, shaley, brown	5	100

An 8-in. diameter hole was drilled to a depth of 94 ft. The well is cased with 8-in. pipe from land surface to a depth of 76.2 ft and equipped with 20 ft (21 ft overall length) of 8-in. Johnson welded brass screen. The screen

section from top to bottom consists of 2 ft of No. 24 slot, 5 ft of No. 44 slot, 10 ft of No. 34 slot, and 3 ft of No. 70 slot.

A production test using one observation well was conducted by the State Water Survey on July 30, 1940. After 5 hr of pumping at a rate of 100 gpm, the drawdown was 2.0 ft from a nonpumping water level of 66.1 ft below land surface. Ten min after pumping was stopped, the water level had recovered to 66.3 ft.

In 1944, the well reportedly produced 100 gpm with a drawdown of 2 ft from a nonpumping water level of 68 ft.

In 1957, after pumping at a rate of 100 gpm, the drawdown was 2 ft from a nonpumping water level of 76 ft.

Nonpumping water levels were reported to be 68 ft in 1960, and 75 ft in 1961.

In 1963, the well reportedly produced 70 gpm with a drawdown of 4.4 ft from a nonpumping water level of 73.6 ft.

The pumping equipment presently installed consists of a 7-1/2-hp Fairbanks Morse electric motor and a 6-in., 10-stage Fairbanks Morse turbine pump (No. 10294) rated at 125 gpm at about 133 ft TDH, and equipped with 60 ft of 5-in. column pipe. A 10-ft section of suction pipe is attached to the pump intake. The well is reportedly equipped with 70 ft of airline.

A partial analysis of a sample (Lab. No. 158551) collected September 11, 1962, showed the water to have a hardness of 370 mg/L, total dissolved minerals of 416 mg/L, and an iron content of 0.1 mg/L.

WELL NO. 2 was completed in August 1940 to a depth of 92 ft by C. W. Varner, Dubuque, Iowa. It was constructed as a test well and has never been equipped with a permanent pump. The water-yielding units in this well are sand and gravel of the Prairie Aquigroup. The well also penetrates sandstone and shale in the upper part of the Upper Bedrock Aquigroup (Pennsylvanian System), but its contribution to the well is probably negligible. The well is located about 10 ft northwest of Well No. 1, approximately 2593 ft S and 207 ft W of the NE corner of Section 12, T9N, R4E. 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>
Drift	86	86
Shale	4	90
Shale and "fine gravel"	7	97
Shale	3	100

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
"Gravel" and shale	7	107
Shale	3	110

The well is cased with 6-in. pipe from about 1.8 ft above land surface to a depth of 74 ft and equipped with 20 ft of 6-in. screen. The screen section from top to bottom consists of 2 ft of No. 24 slot, 5 ft of No. 44 slot, 10 ft of No. 34 slot, and 3 ft of No. 70 slot.

WELL NO.3 was completed in April 1964 to a depth of 1580 ft by the J. P. Miller Artesian Well Co., Brookfield. The water-yielding units in this well are the upper part of the Midwest Aquigroup (Galena and Platteville Groups and the Glenwood-St. Peter Sandstone). The well is located near the collecting reservoir, approximately 2514 ft S and 2200 ft E of the NW corner of Section 11, T9N, R4E. The land surface elevation at the well is approximately 675 ft.

The following mineral analysis (Lab. No. 211943) is for a water sample collected from the reservoir at Well No. 3 on August 30, 1979.

WELL NO. 3, LABORATORY NO. 211943

	<i>mg/L</i>	<i>me/L</i>		<i>mg/L</i>	<i>me/L</i>	
Iron(total) Fe	0.6		Silica	SiO <sub>2</sub>	11.5	
Manganese Mn	0.03		Fluoride	F	2.6	
Ammonium NH <sub>4</sub>	1.4	0.08	Boron	B	1.1	
Sodium Na	378	16.44	Nitrate	NO <sub>3</sub>	0.2	0.00
Potassium K	15.6	0.40	Chloride	Cl	200	5.64
Calcium Ca	80.4	4.01	Sulfate	SO <sub>4</sub>	641.8	13.35
Magnesium Mg	33.4	2.75	Alkalinity (as CaCO <sub>3</sub> )		220	4.40
Strontium Sr	3.46	0.08	Hardness (as CaCO <sub>3</sub> )		338	6.76
Barium Ba	<0.1		Total dissolved minerals		1534	
Cadmium Cd	0.00					
Chromium Cr	0.00					
Copper Cu	0.02					
Lead Pb	<0.05					
Lithium Li	0.25		Turbidity		6	
Nickel Ni	0.03		Color		0	
Silver Ag	0.00		Odor		0	
Zinc Zn	0.01		Temp.(reported)		76F	

WELL NO. 3, DRILLERS LOG

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Drift	60	60
Shale	250	310
Limestone	100	410
Shale	290	700
Limestone	310	1010
Shale	80	1090
Limestone	345	1435
Sandstone	140	1575
Shale	5	1580

An 11-in. diameter hole was drilled to a depth of 512 ft, reduced to 9.8 in. between 512 and 640 ft, reduced to 8.8 in. between 640 and 1114 ft, and finished 6 in. in diameter from 1114 to 1580 ft. The well is cased with 12-in. pipe from land surface to a depth of 60 ft, 8-in. pipe from land surface to a depth of 602 ft (cemented in), and a 6-in. pipe from 602 ft to a depth of 1114 ft (cemented in).

Upon completion, the well reportedly produced 165 gpm for 4 hr with a drawdown of 113 ft from a nonpumping water level of 172 ft below the top of the casing.

The pumping equipment presently installed is a submersible pump set at about 400 ft, rated at about 250 gpm, and powered by a 40-hp electric motor.