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*Public Groundwater Supplies  
in Kendall County*

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# PUBLIC GROUNDWATER SUPPLIES IN KENDALL COUNTY

by Dorothy M. Woller and James P. Gibb

## Introduction

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

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

This report includes separate descriptions for groundwater supplies of 4 municipalities, 3 subdivisions, and 1 state park in Kendall County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for municipal use. An explanation of the format used in the descriptions is also given.

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## Geology

The geology of Kendall County is described generally in Illinois State Geological Survey Circular 198, *Groundwater Possibilities in Northeastern Illinois*, and in Illinois State Water Survey and State Geological Survey Cooperative Ground-Water Report 1, *Ground-Water Resources of the Chicago Region, Illinois*. The following brief discussion of geologic conditions in the county is taken largely from these publications. For a more detailed definition of the geology in this portion of the state, the reader is referred to the State Geological Survey which is located on the University of Illinois campus, Urbana.

The glacial drift deposits in Kendall County vary in thickness from less than 1 ft along the Fox River, where

bedrock is exposed, to more than 200 ft in a 1- to 2-mile wide strip located from 1 to 3 miles south and east of the Fox River valley. Shallow outwash deposits of water-bearing sand and gravel occur locally along the Fox River and its tributaries and are potential sources for municipal water supplies. In the remainder of the county sand and gravel deposits, where present, normally lie at the bedrock surface and usually are not tapped as a source for groundwater.

Beneath the glacial deposits, the upper bedrock formations consist mainly of beds of dolomite (a limestone-like rock), shale, and sandstone which dip slightly southeasterly at about 10 ft per mile. The bedrock formations in Kendall

| SYSTEM       | SERIES       | GROUP OR FORMATION | AQUIFER            | LOG             | THICKNESS (FT)   | DESCRIPTION   |  |
|--------------|--------------|--------------------|--------------------|-----------------|------------------|---|--|
| QUATERNARY   | PLEISTOCENE  |                    | Sands and Gravels  |                 | 0-200±           | Unconsolidated glacial deposits-pebbly clay (till), silt, sand and gravel<br>Alluvial silts and sands along streams   |  |
|              |              |                    |                    |                 | Fissure Fillings | Shale, sandy, brown to black  |  |
| DEVONIAN     | NIAGARAN     | Racine             | Silurian           |                 | 0-120            | Dolomite, very pure to highly argillaceous, silty, cherty; reefs in upper part<br>Dolomite, shaly, and shale, dolomitic; maroon, green, pink  |  |
|              |              | Sugar Run          |                    |                 |                  |   |  |
| SILURIAN     | ALEXANDRIAN  | Kankakee           |                    |                 | 0-120            | Dolomite, glauc.; thin grn. shale partings<br>Dolomite, cherty, slightly argillaceous<br>Dolomite, argillaceous, and dolomitic shale  |  |
|              |              | Elwood             |                    |                 |                  |   |  |
| ORDOVICIAN   | CINCINNATIAN | Maquoketa          |                    |                 | 0-12             | Shale, red; oolites (Neda)  |  |
|              |              |                    |                    |                 | 0-160            | Shale, silty, dolomitic, greenish gray, weak (Upper unit)<br>Dolomite and limestone, white, light gray, interbedded shale (Middle unit)<br>Shale, dolomitic, brown, gray (Lower unit) |  |
|              | CHAMPLAINIAN | Galena             | Galena-Platteville |                 |                  | 0-220   | Dolomite, and/or limestone, cherty (Lower part)<br>Dolomite, shale partings, speckled  |
|              |              |                    |                    |                 |                  | 0-150   | Dolomite and/or limestone, cherty, sandy at base   |
|              |              | Glenwood           | Glenwood-St. Peter |                 |                  | 0-375   | Sandstone, fine and coarse grained; little dolomite; shale at top<br>Sandstone, fine to medium grained; locally cherty red shale at base   |
|              |              |                    |                    |                 |                  | 0-260   | Dolomite, sandy, cherty (oolitic); sandstone<br>Sandstone interbedded with dolomite<br>Dolomite, white to pink, coarse grained cherty (oolitic)<br>Sandstone, medium-grained, slightly dolomitic |
|              | CANADIAN     | Shakopee           | Prairie du Chien   |                 |                  | 80-90   | Dolomite, light colored, sandy, thin sandstones  |
|              |              |                    |                    |                 |                  | 150-160   | Dolomite, fine-grained, gray to brown, drusy quartz  |
|              | CAMBRIAN     | CROIXAN            | Eminence           | Eminence-Potosi |                  | 80-125  | Dolomite, sandstone and shale, glauconitic, green to red, micaceous  |
|              |              |                    |                    |                 |                  | 200   | Sandstone, fine to coarse grained, well sorted; upper part dolomitic   |
| Potosi       |              |                    | Franconia          |                 |                  | (395-410)   | Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic   |
|              |              |                    |                    |                 |                  | 400   |  |
| Ironton      |              |                    | Ironton-Galesville |                 |                  | 2,000±  | Sandstone, coarse grained, white, red in lower half; lenses of shale and siltstone, red, micaceous   |
|              |              |                    |                    |                 |                  |   |  |
| Eau Claire   |              |                    |                    |                 |                  |   |  |
|              |              |                    |                    |                 |                  |   |  |
| PRE-CAMBRIAN |              |                    |                    |                 |                  | Granitic rocks  |  |

Figure 1. Generalized column of rock stratigraphic units and aquifers in Kendall County  
(Modified from Illinois State Water Survey and State Geological Survey Cooperative Ground-Water Report 2)

County range in age from Silurian to Precambrian (see generalized stratigraphic sequence in figure 1).

The bedrock stratigraphy of Kendall County (see figure 2) is complicated by the presence of the Sandwich Fault Zone which extends southeastward from Sandwich (De Kalb County) into Will County. In Kendall County this zone strikes northwest-southeast with the south side up-thrown as much as 50 ft in the western portion of the county. There also are minor faults paralleling or at angles to the major fault zone trend.

In the northeast and eastern part of the county, the uppermost bedrock is of Silurian age and consists primarily of dolomite (see figure 2). This is part of the geohydrologic unit commonly referred to as the shallow dolomite aquifer throughout northeastern Illinois. These rocks are encountered at depths from about 500 to 200 ft and range in thickness from a featheredge along the west, where they have been eroded and the underlying Maquoketa Group is exposed, to more than 100 ft in the northeast corner of the county. The yield capability of the Silurian rocks depends primarily upon the number, size, and degree of interconnection of water-filled cracks and crevices that are penetrated by a well bore. In some areas the Silurian rocks directly underlie permeable deposits of water-bearing sand and gravel. Under such geohydrologic conditions, formation of solution cracks and crevices and free exchange of water from the glacial drift to the bedrock are maximized, thereby enhancing the yield capability of the Silurian aquifer.

The Maquoketa Group of Ordovician age is composed primarily of nonwater-bearing shales that separate the Silurian aquifer from deeper lying water-bearing units. These shales lie at depths from about 50 ft near the center of the county to about 250 ft in the northeast corner of the county. They range in thickness from less than 1 ft along their western edge where they have been eroded away exposing the underlying Galena and Platteville Dolomite Groups to more than 150 ft in the northeast corner of the county. The Maquoketa rocks generally are not considered as a source for large municipal water supplies. However, locally, small subdivision and domestic supplies are obtained from minor systems of cracks and crevices in the more dolomitic parts of these rocks.

Below the Maquoketa Group occurs a thick sequence of hydrologically connected rocks that is referred to as the Cambrian-Ordovician aquifer in Kendall County. It consists in downward order of the Galena and Platteville Dolomite Groups, Glenwood-St. Peter Sandstone, Prairie du Chien Group, Eminence-Potosi Dolomite, Franconia Formation, and Ironton-Galesville Sandstone.

The Galena-Platteville (Ordovician age) is exposed beneath the drift in an area approximately 6 miles wide running from the northwestern corner of the county south-

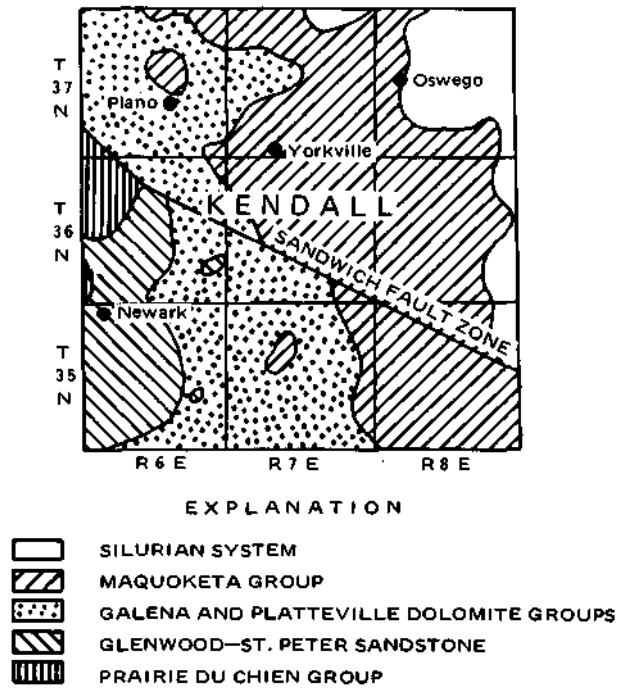


Figure 2. Areal geology of the bedrock surface (Modified from *Geologic Map of Illinois*, Willman and others, 1967)

eastward to the central part of the southern county line (see figure 2). The top of this dolomite lies at depths from less than 100 ft in the Fox River valley in southwestern Kendall County to over 300 ft in the northeast corner of the county. It varies in thickness from less than 50 ft along the western boundary of the county to about 300 and 370 ft in the southeast and northeast corners of the county, respectively. Water from this dolomite is obtained from cracks and crevices, and where it lies directly beneath permeable sand and gravel deposits, its yield potential is enhanced.

The Glenwood-St. Peter Sandstone lies below the Galena-Platteville. This sandstone is encountered at depths from about 100 ft in the southwest portion of the county to approximately 800 ft in the northeast corner. It ranges in thickness from about 0 to 375 ft. It is estimated that the Galena-Platteville and the Glenwood-St. Peter produce 15 percent of the total potential yield from the Cambrian-Ordovician aquifer.

Below the Glenwood-St. Peter lie the Prairie du Chien Group, Eminence-Potosi Dolomite, and Franconia Formation which consist of interbedded sandstones, shales, and dolomites. These units are encountered at depths from about 300 ft in the southwest to about 1000 ft in the northeast and have total thicknesses varying from about 300 to 600 ft. The shales and dolomites yield little water, but the sandy parts of these units contribute small to moderate quantities of water to wells where they are not cased

off by liners. It is estimated that these units produce 35 percent of the total yield from the Cambrian-Ordovician aquifer. However, wells tapping only these units are seldom constructed.

The Ironton-Galesville Sandstone (Cambrian age) is the most consistently permeable and productive unit of the Cambrian-Ordovician aquifer in northeastern Illinois. In Kendall County it lies at depths of about 1000 ft in the southwest to about 1600 ft in the northeast and has a relatively uniform thickness of 200 ft. It is estimated that it produces 50 percent of the total Cambrian-Ordovician aquifer yield.

### Groundwater Development for Municipal Use

Unconsolidated sand and gravel associated with shallow local deposits are tapped for municipal water supplies for all wells at the city of Piano, located in the northwestern part of the county, and for one of the wells at the village of Yorkville, located in the center of the north half of the county. There are currently six wells tapping these aquifers to depths ranging from 18 to 42 ft. Their reported yields range from 150 to 430 gpm depending primarily upon the type of well and the permeability, thickness, and areal extent of the sand and gravel unit tapped by each well. Estimated production from municipal wells finished in sand and gravel aquifers of the county was about 950,000 gpd in 1972. Past and recent analyses of water from these wells indicate that the iron content ranges from a trace to 0.7 mg/l and the hardness from 339 to 425 mg/l. Water for Piano is fluoridated. Water from all wells at Yorkville is chlorinated; fluoridation is not required because of the natural fluoride content.

The underlying bedrock units are tapped for water supplies at Marina Village Subdivision and Oswego, located in the northeastern part of the county; at Hollis Park Subdivision, Fox Lawn Subdivision, and Silver Springs State Park in the northwestern part of the county; at Newark in the southwest part of the county; and at Yorkville. In these wells various combinations of water-bearing units in the shallow dolomite and Cambrian-Ordovician aquifers may be open to the hole with each contributing a portion of the water withdrawn.

At Marina Village Subdivision, the Maquoketa rocks have been tapped as the primary source of supply. Well No. 1 is 187 ft deep and the reported yield upon completion was 115 gpm. The estimated production of this well was 35,000 gpd in 1972. Past and recent analyses of water from this well indicate that the iron content of water ranges from 0.05 to 0.2 mg/l and the hardness from 224 to 280 mg/l. The water is chlorinated and fluoridated.

Below the Ironton-Galesville Sandstone lies the Eau Claire Formation. The upper and middle parts of the Eau Claire are composed primarily of nonwater-bearing shales that separate the Cambrian-Ordovician aquifer from deeper water-bearing units. The Elmhurst Sandstone Member at the base of the Eau Claire Formation and the deeper lying Mt. Simon Sandstone are hydrologically connected and form the Elmhurst-Mt. Simon aquifer, the deepest fresh water aquifer in northern Illinois. However, in Kendall County, this aquifer lies at depths from 1400 to 1800 ft and, except for the extreme northern part, generally produces water that is too mineralized (salty) for most uses.

Dolomite of the Galena-Platteville (the uppermost part of the Cambrian-Ordovician aquifer) is tapped as the primary source of supply for Hollis Park Subdivision and Silver Springs State Park. The Hollis Park Subdivision well is 200 ft deep and the reported yield upon completion was 575 gpm. The Silver Springs State Park well is 120 ft deep and reportedly yielded 10 gpm upon completion. These are both new systems and no recorded pumpage is available. An analysis of water from the Hollis Park Subdivision well indicates that the iron content is 0.17 mg/l and the hardness 357 mg/l. The water is chlorinated and fluoridated. Silver Springs State Park water is not treated.

The Glenwood-St. Peter Sandstone (the middle part of Cambrian-Ordovician aquifer) is tapped as the primary source of supply for Fox Lawn Subdivision and for the village of Newark. The Fox Lawn Subdivision well is 715 ft deep and Newark's wells are 287 and 336 ft deep. Upon completion, the three wells reportedly were capable of yielding from 150 to 280 gpm. Estimated production from these wells in 1972 was about 57,000 gpd. Past and recent analyses of water from these wells indicate that the iron content ranges from 0.1 to 2.6 mg/l and the hardness from 272 to 370 mg/l. Water for Fox Lawn Subdivision is not treated. Water for Newark is chlorinated, aerated, settled, fluoridated, and filtered.

Oswego Wells No. 1 and 2 and Marina Village Well No. 2 penetrate the Glenwood-St. Peter Sandstone and are also open to the overlying Galena-Platteville. These wells are 669, 720, and 700 ft deep, respectively, and are reportedly capable of yielding 100 to 200 gpm. Analyses of water from these wells indicate that the iron content ranges from 0.0 to 1.1 mg/l and the hardness from about 240 to 280 mg/l. Water from all wells at Oswego is chlorinated and treated with polyphosphate. The natural fluoride content of water from all wells satisfies present standards.

Wells tapping all of the Cambrian-Ordovician aquifer

with the exception of the Galena-Platteville are also used for water supply at Oswego (Wells No. 3 and 4) and Yorkville (Well No. 3). These wells range in depth from 1335 to 1396 ft. Their reported yields range from about 535 to 1280 gpm. Analyses of water from these wells indicate that the iron content normally is 0.0 mg/l and the hardness ranges from 225 to 268 mg/l.

Throughout most of northeastern Illinois the deep sandstone aquifers have been overdeveloped resulting in marked declines in the water levels of these aquifers. However, the pumpage from these formations in Kendall County has not

been excessive to date. Moderate water level declines due to nearby pumping centers at Aurora (Kane County) and Joliet (Will County) have been experienced (from 0 to 10 feet per year for the period 1966-1971).

Total municipal supply pumpage in Kendall County for 1972-1973 was about 1,427,400 gallons each day. Estimated pumpage from municipal wells finished in sand and gravel aquifers was about 63 percent of this total (900,000 gpd); in the Maquoketa Group about 3 percent (42,000 gpd); and in various combinations of units in the Cambrian-Ordovician aquifer about 34 percent (485,400 gpd).

## Format

In this publication the descriptions of public ground-water supplies are presented in alphabetical order by place name as follows: Fox Lawn Subdivision, Hollis Park Subdivision, Marina Village Subdivision, Newark, Oswego, Piano, Silver Springs State Park, and Yorkville.

At the beginning of each description the U. S. Census of population for 1970 is given for incorporated places. For unincorporated places, the population is estimated on the basis of the number of services or residential units and an assumed number of 3.5 persons per service.

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

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer 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. Similarly, limestones or dolomites reported by drillers usually are carbonate rocks which in most of Illinois are dolomitic in composition. When stating the bedrock aquifers tapped by a well, the sample study log by the State Geological Survey and the casing record are used to determine the aquifer units open to the hole. If only a drillers log is available and the aquifer units cannot be determined readily, the principal rock type usually is given (i.e., dolomite).

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

## Abbreviations Used

|      |       |                    |        |       |                            |
|------|-------|--------------------|--------|-------|----------------------------|
| est. | ..... | estimated          | me/l   | ..... | milliequivalents per liter |
| ft   | ..... | foot (feet)        | mg/l   | ..... | milligrams per liter       |
| gal  | ..... | gallon(s)          | min    | ..... | minute(s)                  |
| gpd  | ..... | gallons per day    | No.(s) | ..... | number(s)                  |
| gpm  | ..... | gallons per minute | OD     | ..... | outside diameter           |
| HCl  | ..... | hydrochloric acid  | pc/l   | ..... | picocuries per liter       |
| hp   | ..... | horsepower         | qt     | ..... | quart(s)                   |
| hr   | ..... | hour(s)            | R      | ..... | range                      |
| ID   | ..... | inside diameter    | rpm    | ..... | revolutions per minute     |
| in.  | ..... | inch(es)           | T      | ..... | township                   |
| Lab. | ..... | laboratory         | TDH    | ..... | total dynamic head         |
| lb   | ..... | pound(s)           | Tr     | ..... | trace                      |

## FOX LAWN SUBDIVISION

Fox Lawn Subdivision (est. 130), located 1 mile southwest of Yorkville, installed a public water supply in 1968. The water system is owned and operated by the Fox Lawn Utility Co., Inc. One well is in use. In 1972 there were 32 services, all metered; the average daily pumpage was 6000 gpd. The water is not treated.

WELL NO. 1, open to the Glenwood-St. Peter Sandstone, was completed in August 1966 to a depth of 715 ft by the Wehling Well Works, Beecher. The well is located approximately 1300 ft S and 50 ft W of the NE corner of Section 6, T36N, R7E. The land surface elevation at the well is approximately 665 ft.

A drillers log of Well No. 1 follows:

| <i>Strata</i>                        | <i>Thickness<br/>(ft)</i> | <i>Depth<br/>(ft)</i> |
|--------------------------------------|---------------------------|-----------------------|
| Drift                                | 94                        | 94                    |
| Maquoketa shale                      | 67                        | 161                   |
| Galena-Platteville dolomite and lime | 341                       | 502                   |
| Glenwood-St. Peter sandstone         | 213                       | 715                   |

A 16-in. diameter hole was drilled to a depth of 95 ft, reduced to 15.2 in. between 95 and 162 ft, reduced to 12 in. between 162 and 511 ft, and finished 8 in. in diameter from 511 to 715 ft. The well is cased with 16-in. OD drive pipe from land surface to a depth of 95 ft, 12-in. ID liner pipe from 89 to 162 ft, and 8-in. pipe from 1.5 ft above land surface within a pitless adapter to a depth of 511 ft (cemented in).

## HOLLIS PARK SUBDIVISION

Hollis Park Subdivision (est. 8), located 3 miles southwest of Piano, installed a public water supply in 1972. The water system is owned and operated by the Valley Water Co. One well is in use. In 1973 only 2 metered services were connected to the system; a total of 42 lots in this subdivision will be connected to the system in the future. The water is chlorinated and fluoridated.

WELL NO. 1, open to the Galena-Platteville, was completed in January 1972 to a depth of 200 ft by the K & K Well Drilling Co., Mokena. The well is located about 200. ft S of Frazier Road at the rear of Lot 1, approximately 1200 ft N and 2800 ft W of the SE corner of Section 19, T37N, R6E. The land surface elevation at the well is approximately 662 ft.

A drillers log of Well No. 1 follows:

| <i>Strata</i>  | <i>Thickness<br/>(ft)</i> | <i>Depth<br/>(ft)</i> |
|----------------|---------------------------|-----------------------|
| Overburden     | 84                        | 84                    |
| Rock formation | 116                       | 200                   |

An 8-in. diameter hole was drilled to a depth of 200 ft. The well is cased with 8-in. pipe from 1.2 ft above land surface to a depth of 84 ft.

A production test was conducted by the driller on January 18, 1972. After 3.2 hr of pumping at a rate of 560 gpm, the drawdown was 32 ft from a nonpumping water

A production test was conducted by the driller on August 25, 1966. After 1.4 hr of pumping at a rate of 150 gpm, the drawdown was 156 ft from a nonpumping water level of 133 ft below land surface.

On February 2, 1972, the nonpumping water level was reported to be 148.6 ft below land surface.

The pumping equipment presently installed is a Goulds submersible pump powered by a 5-hp electric motor.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01544) is for a water sample from the well collected September 15, 1971.

### WELL NO. 1, LABORATORY NO. 01544

|           | <i>mg/l</i>     | <i>me/l</i> |      | <i>mg/l</i>                        | <i>me/l</i>             |
|-----------|-----------------|-------------|------|------------------------------------|-------------------------|
| Iron      | Fe              | 0.2         | 0.01 | Silica                             | SiO <sub>2</sub> 8.5    |
| Manganese | Mn              | 0.0         |      | Fluoride                           | F 0.65 0.03             |
| Ammonium  | NH <sub>4</sub> | 0.8         | 0.04 | Nitrate                            | NO <sub>3</sub> 0.0     |
| Sodium    | Na              | 22          | 0.96 | Chloride                           | Cl 7.1 0.20             |
| Potassium | K               | 13          | 0.33 | Sulfate                            | SO <sub>4</sub> 32 0.67 |
| Calcium   | Ca              | 63          | 3.24 | Alkalinity (as CaCO <sub>3</sub> ) | 294 5.88                |
| Magnesium | Mg              | 30          | 2.47 | Hardness (as CaCO <sub>3</sub> )   | 276                     |
| Barium    | Ba              | 0.15        |      | Total dissolved minerals           | 330                     |
| Copper    | Cu              | 0.0         |      | pH (as rec'd)                      | 7.4                     |
| Cadmium   | Cd              | 0.00        |      | Radioactivity                      |                         |
| Chromium  | Cr              | 0.0         |      | Alpha <i>pc/l</i>                  | 7                       |
| Lead      | Pb              | 0.00        |      | ± deviation                        | 2                       |
| Mercury   | Hg              | <0.0005     |      | Beta <i>pc/l</i>                   | 8                       |
| Nickel    | Ni              | 0.0         |      | ± deviation                        | 2                       |
| Silver    | Ag              | 0.0         |      |                                    |                         |
| Zinc      | Zn              | 0.09        |      |                                    |                         |

level of 24 ft below land surface. Another test on January 19, 1972, indicated that the well produced 575 gpm for 2.5 hr with a drawdown of 40 ft from a nonpumping water level of 20 ft below land surface.

The pumping equipment presently installed is a Red Jacket submersible pump set at 90 ft, rated at 125 gpm, and powered by a 5-hp Red Jacket electric motor.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. B103988) is for a water sample from the well collected November 9, 1972, after 30 min of pumping at 90 gpm.

### WELL NO. 1, LABORATORY NO. B103988

|           | <i>mg/l</i>     | <i>me/l</i> |      | <i>mg/l</i>                        | <i>me/l</i>             |
|-----------|-----------------|-------------|------|------------------------------------|-------------------------|
| Iron      | Fe              | 0.17        | 0.01 | Silica                             | SiO <sub>2</sub> 11     |
| Manganese | Mn              | 0.03        | 0.00 | Fluoride                           | F 0.5 0.03              |
| Ammonium  | NH <sub>4</sub> | 0.8         | 0.04 | Boron                              | B 0.2                   |
| Sodium    | Na              | 8           | 0.35 | Nitrate                            | NO <sub>3</sub> 0.0     |
| Potassium | K               | 3.8         | 0.10 | Chloride                           | Cl 2 0.06               |
| Calcium   | Ca              | 87          | 4.34 | Sulfate                            | SO <sub>4</sub> 30 0.62 |
| Magnesium | Mg              | 34          | 2.80 | Alkalinity (as CaCO <sub>3</sub> ) | 324 6.48                |
| Arsenic   | As              | 0.00        |      | Hardness (as CaCO <sub>3</sub> )   | 357                     |
| Barium    | Ba              | 1.1         |      | Total dissolved minerals           | 342                     |
| Copper    | Cu              | 0.01        |      | pH (as rec'd)                      | 7.8                     |
| Cadmium   | Cd              | 0.00        |      | Radioactivity                      |                         |
| Chromium  | Cr              | 0.00        |      | Alpha <i>pc/l</i>                  | 9.2                     |
| Lead      | Pb              | 0.00        |      | ± deviation                        | 3.2                     |
| Mercury   | Hg              | 0.0000      |      | Beta <i>pc/l</i>                   | 9.7                     |
| Nickel    | Ni              | 0.0         |      | ± deviation                        | 2.1                     |
| Selenium  | Se              | 0.00        |      |                                    |                         |
| Silver    | Ag              | 0.00        |      |                                    |                         |
| Zinc      | Zn              | 0.00        |      |                                    |                         |

## MARINA VILLAGE SUBDIVISION

Marina Village Subdivision (est. 800), located 1 mile north of Oswego, installed a public water supply in 1963. The water system is owned and operated by the Valley Water Co. Two wells are in use. In 1973 there were 127 services, all metered; the estimated average and maximum daily pumpages were 42,000 and 84,000 gpd, respectively. The water is chlorinated and fluoridated.

WELL NO. 1, open to the shales and dolomite of the Maquoketa Group, was completed in April 1963 to a depth of 187 ft by the Layne-Western Co., Aurora. The well is located on the east side of Route 31 across from the subdivision, approximately 650 ft S and 700 ft E of the NW corner of Section 8, T37N, R8E. The land surface elevation at the well is approximately 642 ft.

A drillers log of Well No. 1 follows:

| Strata                               | Thickness<br>(ft) | Depth<br>(ft) |
|--------------------------------------|-------------------|---------------|
| Top soil                             | 1                 | 1             |
| Brown silty clay with boulders       | 11                | 12            |
| Gray silty clay                      | 9                 | 21            |
| Brown sand and gravel with clay      | 18                | 39            |
| Green limestone and broken shale     | 6                 | 45            |
| Red and purple shaley limestone      | 13                | 58            |
| Hard gray shale                      | 50                | 108           |
| Gray and brown lime                  | 6                 | 114           |
| Hard brown and gray shaley limestone | 7                 | 121           |
| Hard brown and gray shale            | 8                 | 129           |
| Soft gray shale                      | 55                | 184           |
| Soft green shale                     | 1                 | 185           |
| Brown limestone                      | 2                 | 187           |

An 11-in. diameter hole was drilled to a depth of 53 ft and finished 7.9 in. in diameter from 53 to 187 ft. The well is cased with 8-in. standard steel pipe from 1.4 ft above the pumphouse floor to a depth of 53 ft.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01601) is for a water sample from the well collected September 16, 1971, after 5 min of pumping at 100 gpm.

WELL NO. 1, LABORATORY NO. 01601

|           |                 | mg/l     | me/l |                                    |                  | mg/l | me/l |
|-----------|-----------------|----------|------|------------------------------------|------------------|------|------|
| Iron      | Fe              | 0.05     | 0.00 | Silica                             | SiO <sub>2</sub> | 16   |      |
| Manganese | Mn              | 0.0      |      | Fluoride                           | F                | 0.45 | 0.02 |
| Ammonium  | NH <sub>4</sub> | 0.8      | 0.05 | Nitrate                            | NO <sub>3</sub>  | 0    |      |
| Sodium    | Na              | 99       | 4.31 | Chloride                           | Cl               | 17   | 0.48 |
| Potassium | K               | 9.0      | 0.23 | Sulfate                            | SO <sub>4</sub>  | 150  | 3.12 |
| Calcium   | Ca              | 58.4     | 2.91 | Alkalinity (as CaCO <sub>3</sub> ) |                  | 320  | 6.40 |
| Magnesium | Mg              | 33.0     | 2.71 | Hardness (as CaCO <sub>3</sub> )   |                  | 280  |      |
| Barium    | Ba              | 0.0      |      | Total dissolved minerals           |                  | 550  |      |
| Copper    | Cu              | 0.0      |      | pH (as rec'd)                      |                  | 7.5  |      |
| Cadmium   | Cd              | 0.00     |      | Radioactivity                      |                  |      |      |
| Chromium  | Cr              | 0.0      |      | Alpha pc/l                         |                  | 2    |      |
| Lead      | Pb              | 0.00     |      | ± deviation                        |                  | 1    |      |
| Mercury   | Hg              | < 0.0005 |      | Beta pc/l                          |                  | 7    |      |
| Nickel    | Ni              | 0.0      |      | ± deviation                        |                  | 3    |      |
| Silver    | Ag              | 0.0      |      |                                    |                  |      |      |
| Zinc      | Zn              | 0.0      |      |                                    |                  |      |      |

A production test was conducted by the driller on April 9, 1963. After 6 hr of pumping at a rate of 115 gpm, the drawdown was 117 ft from a nonpumping water level of 19 ft below land surface.

The pumping equipment presently installed is a 6-in., 4-stage Layne and Bowler submersible pump (No. 47266) set at 105 ft, rated at 100 gpm at about 205 ft TDH, and powered by a 7 1/2-hp 3600 rpm U. S. electric motor.

WELL NO. 2, open to the Galena-Platteville and the Glenwood-St. Peter Sandstone, was completed in August 1972 to a depth of 700 ft by the K & K Well Drilling Co., Mokena. The well is located at the west end of Marlin Drive, approximately 650 ft S and 100 ft W of the NE corner of Section 7, T37N, R8E. The land surface elevation at the well is approximately 647 ft.

A drillers log of Well No. 2 follows:

| Strata         | Thickness<br>(ft) | Depth<br>(ft) |
|----------------|-------------------|---------------|
| Overburden     | 56                | 56            |
| Broken shale   | 124               | 180           |
| Shale          | 60                | 240           |
| Rock formation | 300               | 540           |
| Sandstone      | 158               | 698           |
| Shale          | 2                 | 700           |

An 8-in. diameter hole was drilled to a depth of 280 ft and finished 6 in. in diameter from 280 to 700 ft. The well is cased with 8-in. black pipe from land surface to a depth of 56 ft and a 6-in. liner pipe was set from 140 ft to a depth of 280 ft.

Upon completion, the well reportedly produced 196 gpm for 4 hr with a drawdown of 335 ft from a nonpumping water level of 14 ft below land surface.

The pumping equipment presently installed is a Reda submersible pump (No. 5-32289) set at 350 ft, rated at 200 gpm, and powered by a 40-hp electric motor (No. 5-23273).

The following mineral analysis made by the Environmental Protection Agency (Lab. No. B109804) is for a water sample from the well collected April 23, 1973, after 0.6 hr of pumping at 200 gpm.

WELL NO. 2, LABORATORY NO. B109804

|           |                 | mg/l   | me/l |                                    |                  | mg/l | me/l |
|-----------|-----------------|--------|------|------------------------------------|------------------|------|------|
| Iron      | Fe              | 1.1    | 0.04 | Silica                             | SiO <sub>2</sub> | 13   |      |
| Manganese | Mn              | 0.02   | 0.00 | Fluoride                           | F                | 0.8  | 0.04 |
| Ammonium  | NH <sub>4</sub> | 0.0    |      | Boron                              | B                | 0.7  |      |
| Sodium    | Na              | 122    | 5.31 | Nitrate                            | NO <sub>3</sub>  | 0.0  |      |
| Potassium | K               | 6.10   | 0.16 | Chloride                           | Cl               | 34   | 0.96 |
| Calcium   | Ca              | 62     | 3.09 | Sulfate                            | SO <sub>4</sub>  | 120  | 2.50 |
| Magnesium | Mg              | 31     | 2.55 | Alkalinity (as CaCO <sub>3</sub> ) |                  | 360  | 7.20 |
| Arsenic   | As              | 0.00   |      | Hardness (as CaCO <sub>3</sub> )   |                  | 282  | 5.64 |
| Barium    | Ba              | 0.0    |      | Total dissolved minerals           |                  | 506  |      |
| Copper    | Cu              | 0.01   |      | pH (as rec'd)                      |                  | 8.0  |      |
| Cadmium   | Cd              | 0.00   |      | Radioactivity                      |                  |      |      |
| Chromium  | Cr              | 0.00   |      | Alpha pc/l                         |                  | 0.0  |      |
| Lead      | Pb              | 0.00   |      | ± deviation                        |                  | 1.8  |      |
| Mercury   | Hg              | 0.0000 |      | Beta pc/l                          |                  | 13.9 |      |
| Nickel    | Ni              | 0.0    |      | ± deviation                        |                  | 3.2  |      |
| Selenium  | Se              | 0.00   |      |                                    |                  |      |      |
| Silver    | Ag              | 0.00   |      |                                    |                  |      |      |
| Zinc      | Zn              | 0.29   |      |                                    |                  |      |      |



## NEWARK

The village of Newark (590) installed a public water supply in 1965. One well (No. 2) is in use. In 1965 there were 128 services, all metered; the average daily pumpage was 14,700 gpd. In 1972 there were 224 services, all metered; the estimated average daily pumpage was 52,000 gpd. The water is chlorinated, aerated, settled, fluoridated, and filtered.

WELL NO. 1, finished in sandstone, was completed in 1893 to a depth of 170 ft. This well was abandoned and filled with concrete in 1967. The well was located at the northeast corner of the intersection of Front and Jackson Sts., approximately 2250 ft S and 550 ft W of the NE corner of Section 6, T35N, R6E. The land surface elevation at the well site is approximately 665 ft.

WELL NO. 2, open to the Glenwood-St. Peter Sandstone, was completed in August 1964 to a depth of 287 ft by the Layne-Western Co., Aurora. The well is located about 50 ft N and 350 ft W of the intersection of Johnson St. and Lions Ave., approximately 1950 ft S and 1300 ft W of the NE corner of Section 6, T35N, R6E. The land surface elevation at the well is approximately 657 ft.

A drillers log of Well No. 2 follows:

| Strata                       | Thickness<br>(ft) | Depth<br>(ft) |
|------------------------------|-------------------|---------------|
| Black top soil               | 1.5               | 1.5           |
| Brown clay                   | 23                | 24.5          |
| Sand -- medium gravel        | 16.5              | 41            |
| Soft gray clay and silt      | 7.5               | 48.5          |
| Fine to medium sand          | 15.5              | 64            |
| Sandy clay                   | 9                 | 73            |
| Sand and gravel              | 12                | 85            |
| Silt and clay                | 5                 | 90            |
| Gravel                       | 2.5               | 92.5          |
| Lime                         | 2.5               | 95            |
| Brown sand                   | 3                 | 98            |
| Gray clay                    | 9                 | 107           |
| Lime                         | 11                | 118           |
| Brown sand                   | 4                 | 122           |
| Gray sand and clay, gravelly | 32                | 154           |
| Gray clay, lime, coal        | 5                 | 159           |
| Lime                         | 2                 | 161           |
| Sandstone                    | 11                | 172           |
| Lime                         | 7                 | 179           |
| Soft gray shale              | 5                 | 184           |
| White sandstone              | 85.5              | 269.5         |
| White lime and sandstone     | 6.5               | 276           |
| Brown lime                   | 7                 | 283           |
| Gray lime                    | 4                 | 287           |

An 8-in. diameter hole was drilled to a depth of 287 ft. The well is cased with 8-in. pipe from 2 ft above land surface to a depth of 185 ft.

A production test was conducted on August 3, 1964, by representatives of the driller, the State Water Survey, and Caldwell-Rhoads Co., Consulting Engineers. After 2.5 hr of pumping at a rate of 157 gpm, the drawdown was 57.0 ft from a nonpumping water level of 75.2 ft below land surface. Five min after pumping was stopped, the water level had recovered to 75.7 ft. On the basis of the production test data, it was estimated that this well would yield 150 gpm (215,000 gpd) on a long-term basis.

On September 29, 1970, the nonpumping water level was reported to be 80 ft.

On January 6, 1972, the well reportedly produced 122 gpm for 15 min with a drawdown of 42 ft from a nonpumping water level of 80 ft.

The pumping equipment presently installed is a Layne turbine pump set at 185 ft, rated at 100 gpm at about 200 ft head, and powered by a 7 1/2-hp 1750 rpm General Electric motor.

The following mineral analysis (Lab. No. 193498) is for a water sample from the well collected September 25, 1973, after 15 min of pumping at 100 gpm.

WELL NO. 2, LABORATORY NO. 193498

|           | mg/l            | me/l  |                                    | mg/l                       | me/l |      |
|-----------|-----------------|-------|------------------------------------|----------------------------|------|------|
| Iron      | Fe              | 0.4   | Phosphate                          | PO <sub>4</sub>            | 0.0  |      |
| Manganese | Mn              | 0.09  | (unfiltered)                       |                            |      |      |
| Ammonium  | NH <sub>4</sub> | 0.6   | Silica                             | SiO <sub>2</sub>           | 14.7 |      |
| Sodium    | Na              | 25.3  | Fluoride                           | F                          | 0.4  |      |
| Potassium | K               | 1.5   | Boron                              | B                          | 0.4  |      |
| Calcium   | Ca              | 74.0  | Nitrate                            | NO <sub>3</sub>            | 0.5  | 0.01 |
| Magnesium | Mg              | 35.4  | Chloride                           | Cl                         | 1    | 0.03 |
| Strontium | Sr              | 0.51  | Sulfate                            | SO <sub>4</sub>            | 78.8 | 1.64 |
| Barium    | Ba              | <0.1  | Alkalinity (as CaCO <sub>3</sub> ) | 308                        | 6.16 |      |
| Copper    | Cu              | 0.00  | Hardness (as CaCO <sub>3</sub> )   | 330                        | 6.60 |      |
| Cadmium   | Cd              | 0.00  | Total dissolved                    |                            |      |      |
| Chromium  | Cr              | 0.00  | minerals                           | 436                        |      |      |
| Lead      | Pb              | <0.05 | Turbidity                          | Tr                         |      |      |
| Lithium   | Li              | 0.00  | Color                              | 0                          |      |      |
| Nickel    | Ni              | <0.05 | Odor                               | H <sub>2</sub> S (at well) |      |      |
| Zinc      | Zn              | 0.03  | Temp. (reported)                   | 52.0 F                     |      |      |

WELL NO. 3, open to the Glenwood-St. Peter Sandstone, was completed in June 1973 to a depth of 336 ft by the Layne-Western Co., Aurora. This well will be put in service as soon as a permanent pump is installed. The well is located on the southeast corner of the village, approximately 420 ft N and 1621 ft E of the SW corner of Section 5, T35N, R6E. The land surface elevation at the well is approximately 690 ft.

A drillers log of Well No. 3 follows:

| Strata   | Thickness<br>(ft) | Depth<br>(ft) |
|--|-------------------|---------------|
| Black soil                                     | 1                 | 1             |
| Brown clay                                     | 11                | 12            |
| Gray clay                                      | 6                 | 18            |
| Gray clay, trace of gravel                     | 2                 | 20            |
| Gray clay, few boulders, trace of gravel       | 69                | 89            |
| Hard pinkish clay, few boulders                | 18                | 107           |
| Dirty sand                                     | 2                 | 109           |
| Hard gray clay, few boulders                   | 19                | 128           |
| Lime or boulder                                | 12                | 140           |
| Hard gray clay                                 | 5                 | 145           |
| Dirty sand                                     | 5                 | 150           |
| Hard gray clay                                 | 7                 | 157           |
| Lime and shale                                 | 23                | 180           |
| Clay hard                                      | 10                | 190           |
| Sandstone, white and brown                     | 9                 | 199           |
| Lime   | 5                 | 204           |
| Sandstone, fine and hard                       | 33                | 237           |
| No circulation                                 | 5                 | 242           |
| Partial circulation, sandstone and lime lenses | 54                | 296           |
| Sandstone and lime                             | 16                | 312           |
| Sandstone, softer                              | 14                | 326           |
| Lime   | 10                | 336           |

A 17-in. diameter hole was drilled to a depth of 20 ft, reduced to 15 in. between 20 and 212 ft, and finished 10 in. in diameter from 212 to 336 ft. The well is cased with 16-in. pipe from land surface to a depth of 20 ft and 10-in. pipe from land surface to a depth of 211 ft (cemented in).

A production test was conducted by the driller on June 27, 1973. After 8 hr of pumping at rates of 275 to 284 gpm, the final drawdown was 22 ft from a nonpumping

water level of 80 ft below land surface. Additional development work was conducted on the well following the production test.

A partial analysis of a sample (Lab. No. 192565) collected during the initial production test, after pumping for 7.5 hr at 284 gpm, showed the water to have a hardness of 370 mg/l, total dissolved minerals of 590 mg/l, and an iron content of 0.5 mg/l.

## OSWEGO

The village of Oswego (1862) installed a public water supply in 1895. Two wells (Nos. 3 and 4) are in use. In 1951 there were 339 services, all metered; the estimated average daily pumpage was 48,000 gpd. In 1972 there were 760 services, all metered; the estimated average and maximum daily pumpages were 191,000 and 369,000 gpd, respectively. The water is chlorinated and treated with polyphosphate to keep iron in solution. The natural fluoride concentration in the water is adequate to satisfy state requirements for this ingredient.

The initial supply was obtained from a dug well about 12 or 14 ft in diameter and 18 ft deep located in the southwest portion of the village. The well penetrated 5 ft of drift and 13 ft of limestone. The nonpumping water level on September 10, 1917, was reportedly 11 to 12 ft below land surface; after several hr of pumping the water level was 16 ft below land surface. With time, a marked reduction in well yield forced the village to obtain water from a spring formerly used by a creamery. The well was abandoned about 1921 and has been filled.

WELL NO. 1, open to the Galena-Platteville and the Glenwood-St. Peter Sandstone, was completed in 1921 to a depth of 680 ft by C. B. Palmer, Aurora. In December 1953, the measured depth was reported to be 669 ft. This well has not been used since 1963 because of low yield. The well is located in a pit at the Village Hall, 100 ft S of Washington St. and 21 ft W of Main St., approximately 1600 ft N and 750 ft E of the SW corner of Section 17, T37N, R8E. The land surface elevation at the well is approximately 633 ft.

A drillers log of Well No. 1 follows:

| <i>Strata</i>              | <i>Thickness<br/>(ft)</i> | <i>Depth<br/>(ft)</i> |
|----------------------------|---------------------------|-----------------------|
| Clay and gravel            | 12                        | 12                    |
| Niagaran limestone         | 43                        | 55                    |
| Cincinnati shale           | 115                       | 170                   |
| Galena limestone           | 340                       | 510                   |
| St. Peter sandstone        | 166                       | 676                   |
| Prairie du Chien limestone | 4                         | 680                   |

An 8-in. diameter hole was drilled to a depth of 200 ft and finished 6 in. in diameter from 200 to 680 ft. The well was originally cased with 8-in. pipe to a depth of 14 ft. In 1932, the well was recased with 100 ft of 6-in. pipe.

On October 25, 1924, the well reportedly produced 100

gpm with a nonpumping water level of 40 ft below land surface.

On October 8, 1947, the nonpumping water level was reported to be 105 ft below the pump base after a 17-hr idle period.

This well was acidized with 1000 gal HCl on December 8, 1953. After the acidizing, the well produced at a rate of 100 gpm with a drawdown of 37 ft from a nonpumping water level of 143 ft below land surface.

In February 1954, the well reportedly produced 125 gpm with a drawdown of 63 ft from a nonpumping water level of 143 ft below land surface.

In October 1958, the nonpumping water level was reported to be 227 ft.

The pumping equipment presently installed consists of a 15-hp U. S. electric motor, a 6-in., 20-stage American Well Works turbine pump (No. 72034) set at 240 ft, rated at 100 gpm at about 270 ft head, and 240 ft of 4-in. column pipe. A 10-ft section of 4-in. suction pipe is attached to the pump intake. The pump base is 6 ft below land surface. The well is equipped with 240 ft of airline.

A partial analysis of a sample (Lab. No. 103017) collected April 10, 1945, showed the water to have a hardness of 239 mg/l, total dissolved minerals of 479 mg/l, and an iron content of 0.7 mg/l.

WELL NO. 2, open to the Galena-Platteville and the Glenwood-St. Peter Sandstone, was constructed in March 1932 to a depth of 720 ft by B. L. Palmer & Sons, Aurora, and deepened in September 1950 to a depth of 728 ft by the Layne-Western Co., Aurora. This well has not been in use since 1966 and repair work in 1969 proved unsatisfactory. The well is located in the southwest corner of the triangular block at the intersection of Washington and Van Buren Sts., approximately 950 ft N and 1550 ft E of the SW corner of Section 17, T37N, R8E. The land surface elevation at the well is 653.9 ft.

A 12-in. diameter hole was drilled to a depth of 24 ft, reduced to 10.5 in. between 24 and 192 ft, and finished 6 in. in diameter from 192 to 720 ft. The well was cased with 12-in. pipe from land surface to a depth of 24 ft and 8-in. pipe from land surface to a depth of 192 ft.

Upon completion, the well reportedly produced 100

gpm with a drawdown of 85 ft from a nonpumping water level of 90 ft below the top of the casing.

In 1939, the 8-in. pipe was replaced by B. L. Palmer & Sons. Some of the original casing was reused. The non-pumping water level was reported to be 90 ft.

On October 8, 1947, the well reportedly produced 100 gpm for 30 min from a nonpumping water level of 105 ft below the pump base. The pumping water level was below the airline.

In September 1950, this well was repaired by Layne-Western Co., Aurora. The hole in the rock below the 8-in. pipe was reamed out from 6 in. to 8 in. in diameter. After deepening to 728 ft, two shot charges of 50 lb each were set off at depths of 718 and 711 ft. About 3 cubic yards of sand was cleaned out. After rehabilitation, the nonpumping water level was 150 ft below land surface. The village reported little increase in production.

The pump was lowered in September 1954 by Layne-Western Co., Aurora. The airline was then measured at 240 ft and in a production test on September 20, 1954, after 4 hr of pumping at a rate of 88 gpm, the drawdown was 37 ft from a nonpumping water level of 166 ft below land surface.

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

| <i>Strata</i>                            | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|--|-----------------------|-------------------|
| <b>PLEISTOCENE SYSTEM</b>                |                       |                   |
| "Glacial drift, clay, and coarse gravel" | 24                    | 24                |
| <b>SILURIAN SYSTEM</b>                   |                       |                   |
| Alexandrian Series                       |                       |                   |
| "Limestone"                              | 21                    | 45                |
| <b>ORDOVICIAN SYSTEM</b>                 |                       |                   |
| Maquoketa Group                          |                       |                   |
| "Shale"                                  | 137                   | 182               |
| Limestone and shale                      | 10                    | 192               |
| Galena-Platteville Groups                |                       |                   |
| Limestone and dolomite                   | 353                   | 545               |
| St. Peter Sandstone                      | 175                   | 720               |
| No record                                | 8                     | 728               |

The pumping equipment presently installed is a Byron Jackson submersible pump set at 450 ft, rated at 100 gpm at about 430 ft head, and powered by a 15-hp Byron Jackson electric motor.

A mineral analysis of a sample (Lab. No. 112162) collected October 8, 1947, after pumping for 30 min at 100 gpm, showed the water to have a hardness of 238 mg/l, total dissolved minerals of 472 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 3, open to the Cambrian-Ordovician aquifer except for the Galena-Platteville, was completed in October 1957 to a depth of 1378 ft by the Layne-Western Co., Aurora. The well is located at the intersection of Madison and Douglas Sts., approximately 75 ft S and 650 ft E of the NW corner of Section 20, T37N, R8E. The land surface elevation at the well is approximately 640 ft.

A 26-in. diameter hole was drilled to a depth of 32 ft, reduced to 25 in. between 32 and 520 ft, reduced to 19.2 in. between 520 and 789 ft, and finished 15.2 in. in diam-

eter from 789 to 1378 ft. The well is cased with 26-in. steel pipe from 0.6 ft above the pump station floor to a depth of 32 ft, 20-in. steel pipe from 0.6 ft above the pump station floor to a depth of 520 ft (cemented in), and 15.2 in. slotted steel liner from 709 to 789 ft. The well was shot with 150 lb of 100 percent gelatin at each of the following depths: 1350, 1313, 1280, and 1240 ft.

A summary sample study log of Well No. 3 furnished by the State Geological Survey follows:

| <i>Strata</i>  | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|--|-----------------------|-------------------|
| <b>PLEISTOCENE SERIES</b>  |                       |                   |
| Soil, slightly sandy, black  | 3                     | 3                 |
| Till, slightly sandy, buff   | 4                     | 7                 |
| Sand and gravel; a little till, brownish buff  | 8                     | 15                |
| Sand and gravel, clean, brownish buff  | 15                    | 30                |
| <b>ORDOVICIAN SYSTEM</b>   |                       |                   |
| Cincinnatian Series  |                       |                   |
| Maquoketa Group  |                       |                   |
| Limestone, clayey, green, gray, fine to very fine, crystalline, partly granular  | 20                    | 50                |
| Limestone, slightly cherty, gray, fine to very fine, granular, shale partings; little siltstone  | 65                    | 115               |
| Shale, calcareous, very clayey, brown, weak; little siltstone  | 45                    | 160               |
| Champlainian Series  |                       |                   |
| Galena Group   |                       |                   |
| Limestone, slightly sandy, partly cherty, partly slightly argillaceous, chalky, weak, buff, white, fine to very fine, crystalline                    | 205                   | 365               |
| Dolomite, partly very calcareous, white, buff, fine to medium crystalline  | 55                    | 420               |
| Platteville Group  |                       |                   |
| Limestone, gray, buff, very fine to fine, crystalline, little black mottled  | 65                    | 485               |
| Dolomite, buff, gray, fine to very fine, crystalline, some visible porosity  | 25                    | 510               |
| Ancell Group   |                       |                   |
| Glenwood-St. Peter Sandstone   |                       |                   |
| Sandstone, dolomitic, white, buff, medium to incoherent, friable   | 65                    | 575               |
| Sandstone, partly clayey, white, medium, fine to medium, incoherent, partly friable  | 150                   | 725               |
| Sandstone, very clayey, very cherty, dolomitic, white, buff, medium to coarse, incoherent, friable; shale, green, red, brown, tough; little dolomite | 50                    | 775               |
| Prairie du Chien Group   |                       |                   |
| Oneota Dolomite  |                       |                   |
| Dolomite, cherty, slightly sandy, white, buff, fine to medium, crystalline; little sandstone at base   | 185                   | 960               |
| <b>CAMBRIAN SYSTEM</b>   |                       |                   |
| St. Croixan Series   |                       |                   |
| Eminence-Potosi Dolomite   |                       |                   |
| Glaucinitic, dolomitic, glauconitic, buff, brown, gray, fine to very fine, granular to crystalline, basal 45 ft extremely pyritic                    | 130                   | 1090              |
| Franconia Formation  |                       |                   |
| Sandstone, glauconitic, dolomitic, gray, fine to medium, compact to incoherent   | 90                    | 1180              |
| Ironton Sandstone  |                       |                   |
| Sandstone, dolomitic, buff, medium, fine, incoherent, compact  | 95                    | 1275              |
| Galesville Sandstone   |                       |                   |
| Sandstone, white, fine, little medium, incoherent  | 95                    | 1370              |
| Eau Claire Formation   |                       |                   |
| Sandstone, dolomitic, gray, buff, fine to very fine, compact, extremely pyritic; shale, sandy, green, brittle  | 2                     | 1372              |

A mineral analysis of a sample made by the Environmental Protection Agency (Lab. No. 00817) collected August 10, 1971, after pumping for 35 min at 1000 gpm, showed the water to have a hardness of 230 mg/l, total dissolved minerals of 472 mg/l, and an iron content of 0.0 mg/l.

A production test was conducted by the driller on October 25-26, 1957. During the first 20.3 hr the pumping rate ranged from 1033 to less than 633 gpm. After an additional 10 hr of pumping at a constant rate of 1227 gpm, the final drawdown was 149 ft from a nonpumping water level of 189 ft below land surface. One hr after pumping was stopped, the water level had recovered to 261 ft.

In July 1958, the nonpumping water level was reported to be 250 ft from the top of the casing.

On January 11, 1972, the well reportedly produced 1000 gpm for about 20 min with a drawdown of 63 ft from a nonpumping water level of 335 ft.

The pumping equipment presently installed is a 200-hp Byron Jackson electric motor, a 12-in., 9-stage Byron Jackson submersible pump (Serial No. 344372) set at 500 ft, rated at 1000 gpm at about 550 ft head, and 489 ft of 8-in. column pipe. The well is equipped with 500 ft of airline.

WELL NO. 4, open to the Cambrian-Ordovician aquifer except for the Galena-Platteville, was completed in April 1964 to a depth of 1396 ft by the Layne-Western Co., Aurora. The well is located at the intersection of Routes 34 and 71, approximately 2500 ft S and 750 ft W of the NE corner of Section 17, T37N, R8E. The land surface elevation at the well is approximately 658 ft.

A driller's log of Well No. 4 follows:

| <i>Strata</i>                   | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|---------------------------------|-----------------------|-------------------|
| Black soil                      | 1                     | 1                 |
| Clay                            | 3                     | 4                 |
| Gray limestone                  | 21                    | 25                |
| Brown limestone                 | 20                    | 45                |
| Gray limestone                  | 115                   | 160               |
| Shale with limestone shells     | 10                    | 170               |
| Gray shale                      | 35                    | 205               |
| Gray limestone                  | 60                    | 265               |
| Brown limestone                 | 20                    | 285               |
| Gray limestone                  | 50                    | 335               |
| Brown limestone                 | 50                    | 385               |
| Gray limestone                  | 169                   | 554               |
| White sandstone                 | 146                   | 700               |
| White limestone                 | 5                     | 705               |
| Gray limestone and shale        | 5                     | 710               |
| Brown limestone                 | 3                     | 713               |
| White shale                     | 2                     | 715               |
| Brown limestone and shale       | 10                    | 725               |
| White sandstone                 | 25                    | 750               |
| Gray limestone                  | 60                    | 810               |
| Reddish brown limestone         | 10                    | 820               |
| Brown limestone                 | 15                    | 835               |
| Gray and white limestone        | 79                    | 914               |
| Red rock and green shale        | 2                     | 916               |
| Gray limestone                  | 14                    | 930               |
| Gray sandstone                  | 10                    | 940               |
| Sandstone with limestone shells | 10                    | 950               |
| Hard sandy limestone            | 15                    | 965               |
| Brown limestone                 | 15                    | 980               |
| White sandstone                 | 12                    | 992               |

| <i>Strata (continued)</i>                | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|--|-----------------------|-------------------|
| Gray limestone                           | 23                    | 1015              |
| Brown limestone                          | 45                    | 1060              |
| Red, brown, and yellow limestone         | 15                    | 1075              |
| Brown limestone                          | 18                    | 1093              |
| Gray shale                               | 1                     | 1094              |
| Gray limestone                           | 36                    | 1130              |
| Gray limestone with shale streaks        | 13                    | 1143              |
| Sandy shale                              | 4                     | 1147              |
| Limestone                                | 3                     | 1150              |
| Gray sandstone                           | 5                     | 1155              |
| Shale with limestone shells              | 5                     | 1160              |
| Sandstone                                | 5                     | 1165              |
| Gray limestone                           | 5                     | 1170              |
| Limestone shells and green sandy shale   | 10                    | 1180              |
| Gray limestone                           | 7                     | 1187              |
| Sandy limestone                          | 3                     | 1190              |
| Gray limestone                           | 25                    | 1215              |
| Sandy limestone                          | 20                    | 1235              |
| Hard gray sandstone                      | 25                    | 1260              |
| Medium sandstone with hard streaks       | 10                    | 1270              |
| Medium white sandstone                   | 20                    | 1290              |
| Hard white sandstone                     | 25                    | 1315              |
| Medium white sandstone with hard streaks | 10                    | 1325              |
| Soft white sandstone                     | 51                    | 1376              |
| Medium white sandstone                   | 12                    | 1388              |
| Green shale                              | 8                     | 1396              |

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 00818) is for a water sample from the well collected August 10, 1971, after 35 min of pumping at 940 gpm.

WELL NO. 4, LABORATORY NO. 00818

|           | <i>mg/l</i>     | <i>me/l</i> |                                    | <i>mg/l</i>      | <i>me/l</i> |
|-----------|-----------------|-------------|------------------------------------|------------------|-------------|
| Iron      | Fe              | 0.0         | Silica                             | SiO <sub>2</sub> | 7           |
| Manganese | Mn              | 0.0         | Fluoride                           | F                | 1.5 0.08    |
| Ammonium  | NH <sub>4</sub> | 1.3 0.07    | Nitrate                            | NO <sub>3</sub>  | 0.0         |
| Sodium    | Na              | 84 3.65     | Chloride                           | Cl               | 23 0.65     |
| Potassium | K               | 8 0.20      | Sulfate                            | SO <sub>4</sub>  | 115 2.39    |
| Calcium   | Ca              | 52 2.60     | Alkalinity (as CaCO <sub>3</sub> ) | 270              | 5.40        |
| Magnesium | Mg              | 25 2.06     | Hardness (as CaCO <sub>3</sub> )   | 225              |             |
| Barium    | Ba              | 0.0         | Total dissolved minerals           | 493              |             |
| Copper    | Cu              | 0.0         | pH (as rec'd)                      | 7.5              |             |
| Cadmium   | Cd              | 0.00        | Radioactivity                      |                  |             |
| Chromium  | Cr              | 0.0         | Alpha <i>pc/l</i>                  | 17               |             |
| Lead      | Pb              | 0.00        | ± deviation                        | 4                |             |
| Mercury   | Hg              | <0.0005     | Beta <i>pc/l</i>                   | 23               |             |
| Nickel    | Ni              | 0.0         | ± deviation                        | 4                |             |
| Silver    | Ag              | 0.0         |                                    |                  |             |
| Zinc      | Zn              | 0.0         |                                    |                  |             |

A production test was conducted by the driller on April 24, 1964. After 12 hr of pumping at rates of 533 to 776 gpm, the final drawdown was 173 ft from a nonpumping water level of 264 ft below land surface. The water level recovered to 281 ft 1.3 hr after pumping stopped. The well was shot after this test as follows: 50 qt 100 percent gelatin 1361-1370 ft, 50 qt gel 1346-1355 ft, 50 qt gel 1331-1340 ft, and 50 qt liquid nitroglycerine 1267-1280 ft.

After shooting, a second production test was conducted by the driller on May 7, 1964. The well reportedly was pumped at rates ranging from 569 to 1078 gpm for 12 hr with a final drawdown of 160 ft from a nonpumping water level of 264 ft below land surface. One hr after pumping was stopped, the water level had recovered to 374 ft below land surface.

On May 19, 1964, the driller reported that the well pro-

duced from 967 to 1280 gpm for 12 hr with a final draw-down of 140 ft from a nonpumping water level of 280 ft.

On January 11, 1972, the well reportedly produced 975 gpm for about 20 min with a drawdown of 70 ft from a nonpumping water level of 345 ft.

A 26-in. diameter hole was drilled to a depth of 9 ft, reduced to 25 in. between 9 and 564 ft, and finished 19 in. in diameter from 564 to 1396 ft. The well is

cased with 26-in. pipe from land surface to a depth of 9 ft and 20-in. pipe from 1.8 ft above land surface to a depth of 560 ft (cemented in).

The pumping equipment presently installed is a Byron Jackson oil-lubricated submersible turbine pump (Serial No. 718325) set at 560 ft, rated at 1000 gpm at about 560 ft head, and powered by a 200-hp 1750 rpm Byron Jackson electric motor. The well has a 560-ft airline.

## PLANO

The city of Plano (4664) installed a public water supply in 1891. Five wells are in use. In 1949 there were 640 services, all metered; the average daily pumpage was 350,000 gpd. In 1972 there were 1463 services; the estimated average daily pumpage was 900,000 gpd. The water is fluoridated.

WELL NO. 1, finished in sand and gravel, was dug in 1891 to a depth of 14 ft, deepened in 1916 to 16.5 ft, and completed in 1947 to a depth of 18 ft. The well is located in the eastern part of the city at the main pumping station, approximately 2000 ft N and 10 ft E of the SW corner of Section 23, T37N, R6E. The land surface elevation at the well is approximately 600 ft.

A drillers log of Well No. 1 follows:

| <i>Strata</i>   | <i>Thickness<br/>(ft)</i> | <i>Depth<br/>(ft)</i> |
|-----------------|---------------------------|-----------------------|
| Loam            | 4                         | 4                     |
| Sand and gravel | 6                         | 10                    |
| Gravel          | 6                         | 16                    |
| No record       | 2                         | 18                    |

The well diameter is 12 ft to a depth of 14 ft; the diameter below this depth is unknown. It was walled with boulders during the original excavation and later lined with a concrete wall.

In September 1917, the nonpumping water level was reported to be 6 ft below land surface. Long continued pumping at this time resulted in a drawdown of a little more than 4 ft. However, no change of water levels was reported on May 5, 1928, with two centrifugal pumps operating at a combined rate of 240 gpm.

On July 22, 1946, the well reportedly produced 320 gpm when pumping continuously with a drawdown of 7.7 ft from a nonpumping water level of 6.0 ft below land surface.

The pumping equipment presently installed is an 8-in., 10-stage Aurora turbine pump rated at 350 gpm at about 220 ft TDH and powered by a 25-hp 1800 rpm U. S. electric motor.

A mineral analysis made by the Environmental Protection Agency (Lab. No. 00730) of a sample collected August 2, 1971, showed the water to have a hardness of 406 mg/l, total dissolved minerals of 467 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in July 1946 to a depth of 40 ft by the Layne-Western Co., Aurora. The well is located in Big Rock Creek Park, approximately 2000 ft N and 500 ft E of the SW corner of Section 23, T37N, R6E. The land surface elevation at the well is approximately 600 ft.

A drillers log of Well No. 2 follows:

| <i>Strata</i>           | <i>Thickness<br/>(ft)</i> | <i>Depth<br/>(ft)</i> |
|-------------------------|---------------------------|-----------------------|
| Sand and gravel, yellow | 30                        | 30                    |
| Sand, fine, yellow      | 4                         | 34                    |
| Sand and gravel, gray   | 6                         | 40                    |

A 42-in. diameter hole was drilled to a depth of 40 ft. The well is cased with 38-in. ID outer pipe from 7.5 ft above land surface to a depth of 30 ft and a 26-in. OD inner pipe from 7.5 ft above land surface to a depth of 30 ft followed by 5 ft of 26-in. OD No. 6 (0.080 in.) Layne Type D stainless steel shutter screen and 5 ft of 26-in. ID by 38-in. OD concrete screen. The annulus between the 26- and 38-in. casings is filled with selected washed gravel (1/4 to 3/8 in. size) from 0 to 40 ft.

A production test was conducted on July 22, 1946, by representatives of the city, the driller, and the State Water Survey. After 7 hr of pumping at rates from 305 to 325 gpm, the maximum drawdown was 14.8 ft from a nonpumping water level of approximately 6.0 ft below land surface. After an additional hr of pumping at rates of 375 to 380 gpm, the final drawdown was 17 ft. Thirteen min after pumping was stopped, the water level had recovered to about 6.2 ft.

The pumping equipment presently installed consists of a 10-hp U. S. electric motor, an 8-in., 2-stage Aurora water-lubricated turbine pump (No. 30384) set at 30 ft, rated 300 gpm at about 65 ft TDH, and 30 ft of 6-in. column pipe. A 10-ft section of 6-in. suction pipe is attached to the pump intake. The well is equipped with 30 ft of airline.

A mineral analysis made by the Environmental Protection Agency (Lab. No. 00704) of a sample collected August 2, 1971, showed the water to have a hardness of 376 mg/l, total dissolved minerals of 440 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 3, finished in sand and gravel, was completed in May 1960 to a depth of 39.5 ft by the Layne-Western Co., Aurora. The well is located about 500 ft E of the main pumping station at the foot of Main St., about midway between Wells No. 1 and 2, approximately 2000 ft N and 150 ft E of the SW corner of Section 23, T37N, R6E. The land surface elevation at the well is approximately 600 ft.

A drillers log of Well No. 3 follows:

| <i>Strata</i>                                      | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|--|-----------------------|-------------------|
| Top soil   | 3                     | 3                 |
| Gray clay  | 2.5                   | 5.5               |
| Dirty coarse gravel and boulders                   | 9.5                   | 15                |
| Clean coarse sand and gravel                       | 2                     | 17                |
| Fine sand to medium coarse gravel                  | 8                     | 25                |
| Fine to medium gravel, some sand and coarse gravel | 7                     | 32                |
| Fine to medium gravel                              | 7.5                   | 39.5              |

A 56-in. diameter hole was drilled to a depth of 10 ft and finished 38 in. in diameter from 10 to 39.5 ft. The well is cased with 52-in. steel pipe from 8 ft above land surface to a depth of 10 ft, 38-in. steel pipe from 8 ft above land surface to a depth of 29 ft, and 26-in. steel pipe from 9.5 ft above land surface to a depth of 29 ft followed by 10 ft of 26-in. No. 6 (0.080 in.) Layne stainless steel shutter screen. The annulus between the 52- and 38-in. casings is filled with cement from land surface to a depth of 10 ft and the annulus between the 38-in. pipe and hole and the 26-in. pipe and screen is filled with gravel from 10 to 39.5 ft.

A production test was conducted by the driller on May 11, 1960. After 8 hr of pumping at a rate of 354 gpm, the drawdown was 8.17 ft from a nonpumping water level of 5.00 ft. Five min after pumping was stopped, the water level had recovered to 5.50 ft.

The pumping equipment presently installed is a Layne and Bowler oil-lubricated turbine pump set at 30 ft, rated at 350 gpm at about 40 ft head, and powered by a 10-hp 1750 rpm Westinghouse electric motor.

A mineral analysis made by the Environmental Protection Agency (Lab. No. 00731) of a sample collected August 2, 1971, showed the water to have a hardness of 385 mg/l, total dissolved minerals of 395 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 4, finished in sand and gravel, was completed in June 1966 to a depth of 36.5 ft by the Layne-Western Co., Aurora. The well is located about 265 ft SW from Well No. 3 in Big Rock Creek Park near the main pumping station on Main St., approximately 1755 ft N and 60 ft E of the SW corner of Section 23, T37N, R6E. The land surface elevation at the well is approximately 600 ft.

A 48-in. diameter hole was drilled to a depth of 10 ft, reduced to 42 in. between 10 and 20 ft, and finished 38 in. in diameter from 20 to 36.5 ft. The well is cased with

38-in. pipe from 0.8 ft above land surface to a depth of 26.5 ft and a 26-in. steel pipe from 1.2 ft above land surface to a depth of 26.5 ft followed by 10 ft of 26-in. No. 6 (0.080 in.) Layne stainless steel shutter screen. The annulus between the 38- and 26-in. casings is filled with cement from 1 ft above land surface to a depth of 9 ft followed by 7 tons of No. 3 Muscatine gravel from 9 to 36.5 ft. The annular opening between the 48- and 42-in. holes and 38-in. casing was backfilled with bentonite and sand from land surface to a depth of 20 ft. The well is protected from flooding by 10 ft of 14-in. pipe encased in a 28-in. square concrete column mounted on top of the well.

A drillers log of Well No. 4 follows:

| <i>Strata</i>                             | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|---|-----------------------|-------------------|
| Black top soil                            | 2                     | 2                 |
| Sandy soil                                | 4                     | 6                 |
| Sand, gravel, and boulders                | 20                    | 26                |
| Fine to coarse sand                       | 2                     | 28                |
| Fine to coarse sand, gravel, and boulders | 8.5                   | 36.5              |
| Yellow clay below                         |                       |                   |

A production test was conducted by the driller on June 23, 1966. After 8 hr of pumping at a rate of 412 gpm, the drawdown was 12.8 ft from a nonpumping water level of 5.6 ft below land surface.

The pumping equipment presently installed is a Byron Jackson oil-lubricated turbine pump rated at 500 gpm at about 206 ft head and powered by a 4-hp 1800 rpm U. S. electric motor. The pump discharges through a pitless adapter at a depth of 5 ft below land surface.

A mineral analysis made by the Environmental Protection Agency (Lab. No. 00732) of a sample collected August 2, 1971, showed the water to have a hardness of 404 mg/l, total dissolved minerals of 440 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 5, finished in sand and gravel, was completed in June 1966 to a depth of 40.7 ft by the Layne-Western Co., Aurora. The well is located about 325 ft SW of Well No. 2 on East Main St. in Big Rock Creek Park, approximately 1695 ft N and 330 ft E of the SW corner of Section 23, T37N, R6E. The land surface elevation at the well is approximately 600 ft.

A drillers log of Well No. 5 follows:

| <i>Strata</i>                           | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|---|-----------------------|-------------------|
| Black dirt                              | 2                     | 2                 |
| Sandy soil                              | 2                     | 4                 |
| Gravel and boulders                     | 6                     | 10                |
| Sand and gravel, yellow                 | 15                    | 25                |
| Clean fine to coarse sand, gravel, gray | 15.7                  | 40.7              |
| Clay below                              |                       |                   |

A 48-in. diameter hole was drilled to a depth of 10 ft, reduced to 42 in. between 10 and 20 ft, and finished 38 in. in diameter from 20 to 40.7 ft. The well is cased with 38-in. pipe from 4 ft above land surface to a depth of 30.7 ft and a 26-in. steel pipe from 1 ft above land surface to a depth of 30.7 ft followed by 10 ft of 26-in. No. 6 (0.080

in.) Layne stainless steel shutter screen. The annulus between the 38-in. and 26-in. casings is filled with ready mix cement from land surface to a depth of 10 ft followed by 7 tons of No. 3 Muscatine gravel between the casings, screen, and hole from 10 ft to a depth of 40.7 ft. The annular opening between the 48- and 42-in. holes and 38-in. casing was backfilled with bentonite and sand from land surface to a depth of 20 ft. The well is protected from flooding by 12 ft of 16-in. pipe encased in a 28-in. square concrete column mounted on top of the well.

A production test was conducted by the driller on July 1, 1966. After 8 hr of pumping at rates of 421 to 430 gpm, the final drawdown was 12.0 ft from a non-pumping water level of 3.8 ft below land surface. One min after pumping was stopped, the water level had recovered to 4.7 ft.

The pumping equipment presently installed is a Byron Jackson oil-lubricated turbine pump rated at 1000 gpm at about 204 ft head and powered by a 75-hp 1800 rpm U. S.

electric motor. The pump discharges through a pitless adapter at a depth of 5 ft below land surface.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 00733) is for a water sample from the well collected August 2, 1971.

**WELL NO. 5, LABORATORY NO. 00733**

|           |                 | <i>mg/l</i> | <i>me/l</i> |                                    |                  | <i>mg/l</i> | <i>me/l</i> |
|-----------|-----------------|-------------|-------------|------------------------------------|------------------|-------------|-------------|
| Iron      | Fe              | 0.0         |             | Silica                             | SiO <sub>2</sub> | 15          |             |
| Manganese | Mn              | 0.0         |             | Fluoride                           | F                | 0.1         | 0.01        |
| Ammonium  | NH <sub>4</sub> | 0.1         | 0.01        | Boron                              | B                | 0.0         |             |
| Sodium    | Na              | 6.4         | 0.28        | Nitrate                            | NO <sub>3</sub>  | 8.4         | 0.14        |
| Potassium | K               | 1.0         | 0.03        | Chloride                           | Cl               | 9           | 0.25        |
| Calcium   | Ca              | 93          | 4.63        | Sulfate                            | SO <sub>4</sub>  | 65          | 1.35        |
| Magnesium | Mg              | 36          | 2.96        | Alkalinity (as CaCO <sub>3</sub> ) |                  | 228         | 5.76        |
| Barium    | Ba              | 0.0         |             | Hardness (as CaCO <sub>3</sub> )   |                  | 376         |             |
| Copper    | Cu              | 0.0         |             | Total dissolved                    |                  |             |             |
| Cadmium   | Cd              | 0.00        |             | minerals                           |                  | 400         |             |
| Chromium  | Cr              | 0.0         |             | pH (as rec'd)                      |                  | 7.3         |             |
| Lead      | Pb              | 0.00        |             | Radioactivity                      |                  |             |             |
| Mercury   | Hg              | <0.0005     |             | Alpha <i>pc/l</i>                  |                  | 0           |             |
| Nickel    | Ni              | 0.0         |             | ± deviation                        |                  | 1           |             |
| Silver    | Ag              | 0.0         |             | Beta <i>pc/l</i>                   |                  | 3           |             |
| Zinc      | Zn              | 0.0         |             | ± deviation                        |                  | 2           |             |

## SILVER SPRINGS STATE PARK

Silver Springs State Park, located 2 miles south of Piano, installed a public water supply in 1973. Ten wells are in use. The average pumpage during the summer months is estimated to be about 500 gpd. The water is not treated.

Nine wells in existence when the park property was purchased are being used to serve primitive campgrounds, the ranger's residence, and the park office. These wells are all 4 in. in diameter and reportedly range in depth from 100 to 150 ft. No casing depths, water levels, or production data are available.

PARK WELL NO. 1, open to the Galena-Platteville, was completed in April 1973 to a depth of 120 ft by the K & K Well Drilling Co., Mokena. The well is located beside the parking lot at the park entrance, approximately 300 ft S and 1600 ft W of the NE corner of Section 3, T36N, R6E. The land surface elevation at the well is approximately 628 ft.

A drillers log of Park Well No. 1 follows:

| <i>Strata</i> | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|---------------|-----------------------|-------------------|
| Black dirt    | 5                     | 5                 |
| Gravel        | 25                    | 30                |
| Clay          | 20                    | 50                |
| Gravel        | 11                    | 61                |
| Limestone     | 59                    | 120               |

A 6-in. diameter hole was drilled to a depth of 120 ft. The well is cased with 6-in. black pipe from land surface to a depth of 61 ft. The top of the well casing is equipped with a pitless adapter.

Upon completion, the well reportedly produced 10 gpm for 4 hr with a drawdown of 39 ft from a nonpumping water level of 44 ft below land surface.

The pumping equipment presently installed is a Red Jacket submersible pump (Model No. 75W1-12BC-2) set at 84 ft, rated at 10 gpm, and powered by a 3/4-hp Red Jacket electric motor.

## YORKVILLE

The village of Yorkville (2094) installed a public water supply in 1886. One well (No. 3) is in use and another well (No. 2) is available for emergency use. In 1949 there were 205 services, 200 of which were metered; the estimated

average and maximum daily pumpages were 85,000 and 95,000 gpd, respectively. In 1972 there were 621 metered services, plus the library, fire barn, and police station; the average daily pumpage was 236,400 gpd. The water is

chlorinated. The natural fluoride concentration in the water is adequate to satisfy state requirements for this ingredient.

The initial water supply was obtained from springs located on a hillside about 0.5 mile south of town, approximately 2400 ft N and 1400 ft E of the SW corner of Section 4, T36N, R7E. Water was collected by lines of tile laid about 3 ft below land surface and discharged into a collecting reservoir located at the site of the springs. From here it flowed through a 6-in. pipeline to the village distribution system. In 1909 another collecting reservoir was built beside the old one and water was pumped to a storage reservoir located on the hillside about 700 ft SW at 40 ft higher elevation. In 1917 it was estimated that the springs furnished 24,000 gpd. In 1928 about one-half of the public water supply was obtained from the springs. From April 4 to August 18, 1946, when the village well (No. 1) was out of service, the springs were the only source of supply but were unable to meet all demands during the latter part of August because of a prolonged drought. The use of spring water was discontinued in 1954 and the spring pumping station abandoned.

WELL NO. 1, open to the Galena-Platteville and the Glenwood-St. Peter, was completed in 1923 to a depth of 590 ft by B. L. Palmer & Sons, Aurora. This well was cleaned out in 1946 by Ray Feuerborn, Batavia, and then shot at 2 levels in the St. Peter Sandstone. This well was taken out of service in 1964 and was sealed in January 1970 by the Layne-Western Co., Aurora. The well is located about 155 ft W of Bridge St. and 150 ft S of Hydraulic Ave., approximately 2000 ft S and 200 ft W of the NE corner of Section 32, T37N, R7E. The land surface elevation at the well is approximately 584 ft.

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

| <i>Strata</i>   | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|---|-----------------------|-------------------|
| <b>PLEISTOCENE SYSTEM</b>   |                       |                   |
| Glacial Drift   | 10                    | 10                |
| <b>ORDOVICIAN SYSTEM</b>  |                       |                   |
| Maquoketa Group   |                       |                   |
| Shale, blue, little water   | 70                    | 80                |
| Galena-Platteville Groups   |                       |                   |
| Limestone, some water, small flow with gradual increase in last 75 ft       | 330                   | 410               |
| St. Peter Sandstone   |                       |                   |
| Sandstone, flow gradually increases all through formation except last 15 ft | 180                   | 590               |

A 10-in. diameter hole was drilled to a depth of 12 ft, reduced to 8 in. between 12 and 420 ft, and finished 6 in. in diameter from 420 to 590 ft. The well is cased with 10-in. pipe from 0.2 ft above the pumphouse floor to a depth of 12 ft and 8-in. pipe from 0.2 ft above the pumphouse floor to a depth of 80 ft. The annular space around the 8-in. casing was cement grouted.

Upon completion, the well reportedly flowed at a rate of about 18 gpm. Free flow reportedly ceased in March 1938. The distance to water below the pump base measured 10 ft on April 5, 1946, after the well had been idle one day and

was the same on August 17, 1946, after the well had been rehabilitated. On October 9, 1947, after 3.5 hr of pumping at 150 gpm, the pumping water level was 92 ft below the pump base.

On October 18, 1966, the nonpumping water level was reported to be 88 ft.

A mineral analysis of a sample (Lab. No. 112158) collected October 9, 1947, after pumping for 3.5 hr at 150 gpm, showed the water to have a hardness of 263 mg/l, total dissolved minerals of 339 mg/l, and an iron content of 0.2 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in May 1954 to a depth of 42 ft by the Layne-Western Co., Aurora. This well is available for emergency use. The well is located about 0.5 mile south of town near the old spring pumping station, approximately 2000 ft N and 1500 ft E of the SW corner of Section 4, T36N, R7E. The land surface elevation at the well is approximately 670 ft.

A drillers log of Well No. 2 follows:

| <i>Strata</i>  | <i>Thickness (ft)</i> | <i>Depth (ft)</i> |
|--|-----------------------|-------------------|
| Top soil   | 3                     | 3                 |
| Fine to coarse brown sand  | 5                     | 8                 |
| Medium to coarse rust colored gravel, boulders (rusty limestone flakes)                          | 9                     | 17                |
| Fine to coarse (rusty) sand, sharp and tight   | 4                     | 21                |
| Coarse gravel and limestone flakes, fairly loose   | 7                     | 28                |
| Limestone layer or boulder   | 1.5                   | 29.5              |
| Sandy gravel coarse and loose, grayish and black fine sand                                       | 0.5                   | 30                |
| Sandy gravel coarse and loose (blue clay streaks)  | 3                     | 33                |
| Coarse gravel (flakes rust colored limestone), flakes white colored limestone, thin streaks clay | 12                    | 45                |
| Grayish-blue clay (soft)   | 31                    | 76                |

A 38-in. diameter hole was drilled to a depth of 42 ft. The well is cased with 38-in. OD No. 3 gage ARMCO iron pipe from 2.5 ft above land surface to a depth of 17.5 ft, 12-in. pipe from 3 ft above land surface to a depth of 18 ft, 12-in. screen from 18 to 28 ft, 12-in. pipe from 28 to 37 ft, and finished with 12-in. screen from 37 to 42 ft. The screened sections are both No. 5 (0.105 in.) Layne stainless steel shutter screens. The annulus between the 38-in. casing and hole and the 12-in. casing and screens was filled with 1/4 to 3/8 in. gravel from 0 to 42 ft.

A production test using one observation well was conducted on May 24-25, 1954, by representatives of the driller, the State Water Survey, and the Walter E. Deuchler Co., Consulting Engineers. After 16 hr of pumping at a rate of 203 gpm, the drawdown was 17.70 ft from a nonpumping water level of 0.37 ft above land surface. Ten min after pumping was stopped, the water level had recovered to 5.83 ft below land surface.

Monthly nonpumping water levels for the period July 1956 to July 1957 ranged from 18 to 28 ft.

On March 10, 1958, the well reportedly produced 165 gpm for 5 min with a drawdown of 3 ft from a nonpumping water level of 21 ft below the pump base.



On January 2, 1971, after pumping at a rate of 150 gpm, the drawdown was 6 ft from a nonpumping water level of 14 ft.

The pumping equipment presently installed consists of a 10-hp 1800 rpm U. S. electric motor (Serial No. 2332421), an 8-in., 4-stage Layne water-lubricated turbine pump (Serial No. 27881), 3.7 ft length, set at 30 ft, rated at 240 gpm at about 100 ft TDH, and 30 ft of 5-in. column pipe. A 7-ft section of 6-in. suction pipe is attached to the pump intake. The well is equipped with 32 ft of airline.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01590) is for a water sample from the well collected September 14, 1971, after 30 min of pumping at 190 gpm.

WELL NO. 2, LABORATORY NO. 01590

|           |                 | mg/l    | me/l |                                    |                  | mg/l | me/l |
|-----------|-----------------|---------|------|------------------------------------|------------------|------|------|
| Iron      | Fe              | 0.0     |      | Silica                             | SiO <sub>2</sub> | 12.5 |      |
| Manganese | Mn              | 0.0     |      | Fluoride                           | F                | 0.15 | 0.01 |
| Ammonium  | NH <sub>4</sub> | 0.0     |      | Nitrate                            | NO <sub>3</sub>  | 13.2 | 0.21 |
| Sodium    | Na              | 7.0     | 0.30 | Chloride                           | Cl               | 18   | 0.51 |
| Potassium | K               | 1.6     | 0.04 | Sulfate                            | SO <sub>4</sub>  | 106  | 2.20 |
| Calcium   | Ca              | 92.8    | 4.63 | Alkalinity (as CaCO <sub>3</sub> ) |                  | 292  | 5.84 |
| Magnesium | Mg              | 49.4    | 4.06 | Hardness (as CaCO <sub>3</sub> )   |                  | 425  |      |
| Barium    | Ba              | 0.0     |      | Total dissolved minerals           |                  | 480  |      |
| Copper    | Cu              | 0.0     |      | pH (as rec'd)                      |                  | 7.4  |      |
| Cadmium   | Cd              | 0.00    |      | Radioactivity                      |                  |      |      |
| Chromium  | Cr              | 0.0     |      | Alpha pc/l                         |                  | 2    |      |
| Lead      | Pb              | 0.00    |      | ± deviation                        |                  | 1    |      |
| Mercury   | Hg              | <0.0005 |      | Beta pc/l                          |                  | 1    |      |
| Nickel    | Ni              | 0.0     |      | ± deviation                        |                  | 2    |      |
| Silver    | Ag              | 0.0     |      |                                    |                  |      |      |
| Zinc      | Zn              | 0.0     |      |                                    |                  |      |      |

WELL NO. 3, open to the Cambrian-Ordovician aquifer except for the Galena-Platteville, was completed in May 1960 to a depth of 1335 ft by the Layne-Western Co., Aurora. The well is located in the main pumping station in an alley 0.5 block west of Bridge St. and just north of Van Emmon St., approximately 2160 ft S and 160 ft W of the NE corner of Section 32, T37N, R7E. The land surface elevation at the well is approximately 584 ft.

The following mineral analysis made by the Environmental Protection Agency (Lab. No. 01592) is for a water sample from the well collected September 14, 1971, after 10 min of pumping at 890 gpm. Hydrogen sulfide was apparent on a previous analysis.

WELL NO. 3, LABORATORY NO. 01592

|           |                 | mg/l    | me/l |                                    |                  | mg/l | me/l |
|-----------|-----------------|---------|------|------------------------------------|------------------|------|------|
| Iron      | Fe              | 0.0     |      | Silica                             | SiO <sub>2</sub> | 8.0  |      |
| Manganese | Mn              | 0.0     |      | Fluoride                           | F                | 0.8  | 0.04 |
| Ammonium  | NH <sub>4</sub> | 0.7     | 0.04 | Nitrate                            | NO <sub>3</sub>  | 0.9  | 0.01 |
| Sodium    | Na              | 26      | 1.13 | Chloride                           | Cl               | 9    | 0.25 |
| Potassium | K               | 12      | 0.31 | Sulfate                            | SO <sub>4</sub>  | 45   | 0.94 |
| Calcium   | Ca              | 62      | 3.09 | Alkalinity (as CaCO <sub>3</sub> ) |                  | 280  | 5.60 |
| Magnesium | Mg              | 29      | 2.38 | Hardness (as CaCO <sub>3</sub> )   |                  | 268  |      |
| Barium    | Ba              | 0.0     |      | Total dissolved minerals           |                  | 350  |      |
| Copper    | Cu              | 0.0     |      | pH (as rec'd)                      |                  | 7.1  |      |
| Cadmium   | Cd              | 0.00    |      | Radioactivity                      |                  |      |      |
| Chromium  | Cr              | 0.0     |      | Alpha pc/l                         |                  | 8    |      |
| Lead      | Pb              | 0.00    |      | ± deviation                        |                  | 2    |      |
| Mercury   | Hg              | <0.0005 |      | Beta pc/l                          |                  | 23   |      |
| Nickel    | Ni              | 0.0     |      | ± deviation                        |                  | 4    |      |
| Silver    | Ag              | 0.0     |      |                                    |                  |      |      |
| Zinc      | Zn              | 0.0     |      |                                    |                  |      |      |

The pumping equipment presently installed is a 10-in., 9-stage Layne submersible pump (Serial No. 41793) rated at 800 gpm at about 300 ft TDH. It is powered by a 100-

hp 1800 rpm U. S. electric motor (Serial No. 1270623) and has 332 ft of 8-in. column pipe. The well is equipped with 332 ft of airline.

A drillers log of Well No. 3 follows:

| Strata                       | Thickness (ft) | Depth (ft) |
|------------------------------|----------------|------------|
| Clay                         | 16.8           | 16.8       |
| Lime                         | 11.2           | 28         |
| Shale                        | 7              | 35         |
| Lime and shale streaks       | 5              | 40         |
| Shale                        | 40             | 80         |
| Lime                         | 70             | 150        |
| Lime, hard                   | 30             | 180        |
| Lime, medium                 | 10             | 190        |
| Lime, hard                   | 65             | 225        |
| Lime brown, hard             | 75             | 330        |
| Lime and shale, hard         | 15             | 345        |
| Brown lime, hard             | 35             | 380        |
| Brown lime, medium           | 35             | 415        |
| Lime and sand, medium        | 5              | 420        |
| Sand white, medium           | 35             | 455        |
| Sand white, soft             | 135            | 590        |
| Sand gray, medium            | 143            | 733        |
| Shale                        | 2              | 735        |
| Lime and shale               | 15             | 750        |
| White sand, medium           | 15             | 765        |
| White sand and shale, medium | 5              | 770        |
| Shale with lime streaks      | 20             | 790        |
| Lime                         | 5              | 795        |
| Shale with lime streaks      | 15             | 810        |
| Lime                         | 20             | 830        |
| Lime, hard                   | 15             | 845        |
| Lime, medium                 | 10             | 855        |
| Lime, hard                   | 80             | 935        |
| No cuttings                  | 10             | 945        |
| Lime and sand, hard          | 10             | 955        |
| Lime                         | 5              | 960        |
| Lime, hard                   | 5              | 965        |
| Gray and brown lime, hard    | 15             | 980        |
| Lime, hard                   | 69             | 1049       |
| Sandy lime and shale         | 11             | 1060       |
| Lime and shale               | 20             | 1080       |
| Sandy lime and shale         | 10             | 1090       |
| Shale                        | 15             | 1105       |
| Lime and shale               | 25             | 1130       |
| Lime                         | 5              | 1135       |
| Lime, hard                   | 5              | 1140       |
| Sandy lime                   | 2              | 1142       |
| Lime, hard                   | 8              | 1150       |
| Sandy lime                   | 10             | 1160       |
| Sand                         | 10             | 1170       |
| Lime, hard                   | 10             | 1180       |
| Sandy lime                   | 20             | 1200       |
| Sand                         | 10             | 1210       |
| Lime                         | 5              | 1215       |
| Sand                         | 110            | 1325       |
| Hard sand                    | 8              | 1333       |
| Shale                        | 2              | 1335       |

A 20-in. diameter hole was drilled to a depth of 14 ft, reduced to 19.2 in between 14 and 430 ft, reduced to 15.2 in. between 430 and 811 ft, and finished 12 in. in diameter from 811 to 1335 ft. The well is cased with 2-in. pipe from 0.3 ft above the pump station floor to a depth of 14 ft, 16-in. OD pipe from 0.3 ft above the pump station floor to a depth of 430 ft (cemented in), and 12-in. ID perforated liner pipe from 723 to 811 ft.

A production test was conducted by the driller on June 3, 1960. After 7 hr of pumping at rates of 674 to 892 gpm, the final drawdown was 168 ft from a nonpumping water level of 83 ft below the top of the casing.

On January 10, 1972, the well reportedly produced 900 gpm for 2 hr with a drawdown of 120 ft from a nonpumping water level of 174 ft.