:RATIVE GROUND-WATER REPORT 2
llinois 1962

STATE WATER SURVEY STATE GEOLOGICAL SURVEY

# GROUND-WATER RESOURCES OF DUPAGE COUNTY, ILLINOIS

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STATE OF ILLINOIS DEPARTMENT OF REGISTRATION AND EDUCATION

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**COOPERATIVE GROUND-WATER REPORT 2**

URBANA, ILLINOIS 1962

STATE OF ILLINOIS — OTTO KERNER, *Governor*

DEPARTMENT OP REGISTRATION AND EDUCATION — WILLIAM SYLVESTER WHITE, *Director*



STATE WATER SURVEY
WILLIAM C. ACKERMANN, *Chief*

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# GROUND-WATER RESOURCES OF DUPAGE COUNTY, ILLINOIS

**ARTHUR J. ZEIZEL, WILLIAM C. WALTON,
ROBERT T. SASMAN, and THOMAS A. PRICKETT**

## ABSTRACT

A rapidly increasing development of ground-water resources in DuPage County, Illinois, has resulted from the municipal and industrial growth in the Chicago metropolitan region. Evaluation of the ground-water resources of DuPage County provides a basis for their development and management.

Ground-water supplies are withdrawn from four principal geohydrologic units: 1) glacial drift aquifers, 2) Silurian dolomite aquifer, 3) Cambrian-Ordovician aquifer, and 4) the Mt. Simon aquifer. The glacial drift and Silurian dolomite aquifers receive recharge chiefly from precipitation that falls within the county limits. Relatively impermeable shales of the Maquoketa Formation separate these aquifers from the deeper Cambrian-Ordovician aquifer. Eecharge to the Cambrian-Ordovician aquifer occurs in the areas of Kane, McHenry, Kendall, Boone, and DeKalb Counties where the Maquoketa Formation is appreciably dolomitic, relatively thin, or absent. The water moves southeastward from these recharge areas through the aquifer toward a deep cone of depression centered near Summit in Cook County.

The total potential yield of the glacial drift and Silurian dolomite aquifers is calculated to be 41 million gallons per day (mgd); the calculated potential yield of the Silurian dolomite aquifer (38 mgd) is limited by recharge. Full development of the underlying Silurian dolomite aquifer is assumed in estimating the potential yield of the glacial drift aquifers (3 mgd), and the yield of the glacial drift aquifers is considered as supplemental to the yield of the Silurian dolomite aquifer. Practical sustained yields of the deeper Cambrian-Ordovician and Mt. Simon aquifers are calculated to be 4.3 mgd and 2.1 mgd respectively.

Water levels in wells in the Cambrian-Ordovician aquifer in some areas have declined as much as 635 feet since 1864, and the average decline over the county during the 96-year period (1864 to 1960) was about 480 feet. Total withdrawals from the Cambrian-Ordovician and Mt. Simon aquifers in 1960 (8.8 mgd) exceeded the calculated total practical sustained yield of these aquifers (6.4 mgd).

The Silurian dolomite aquifer is the most heavily developed source of ground water in DuPage County and yielded 68 percent of the 29.3 mgd pumped from all aquifers in 1960. The calculated practical sustained yield of this aquifer (35 mgd) exceeded total withdrawals in 1960 and nonpumping water levels were not critical in any pumping center in the county. Extrapolation of pumpage graphs shows that the practical sustained yields of some pumping centers will be exceeded within 2 to 5 years and the practical sustained yields of all pumping centers will be exceeded by 1985. Extrapolation of the pumpage growth curve for the county shows that total ground-water withdrawals from wells will exceed the potential yield of the Silurian dolomite aquifer by about 1977.

## INTRODUCTION

### PURPOSE AND SCOPE

This report presents a quantitative evaluation of the ground-water resources of DuPage County, Illinois, and was prepared cooperatively by the Illinois State Geological Survey and the Illinois State Water Survey. The geohydrologic characteristics of the ground-water reservoir beneath the county are given along with an analysis of past, present, and probable future development of the ground-water resources. Special attention is given to the Silurian dolomite aquifer and the associated glacial drift aquifers because of their potential as sources of ground water. The importance of these aquifers is emphasized by the rapidly increasing demands for water supply and the widespread continuing decline of water levels in the deeper Cambrian-Ordovician aquifer. The maps, data, and interpretations presented provide a basis for water-resource planning and a guide to the development and conservation of ground water in the county.

Detailed study in DuPage County was begun in 1957 as part of a research program of the State Geological Survey on geologic factors controlling ground water in the Silurian dolomite aquifer in northeastern Illinois. The need for an evaluation of the ground-water resources of DuPage County was recognized in 1959 and cooperative investigation by the State Geological Survey and the State Water Survey was initiated. The State Water Survey collected data on water levels, pumpage, mineral quality of water, and well tests. Well logs, drilling samples, geophysical logs, and other geologic information were provided by the State Geological Survey.

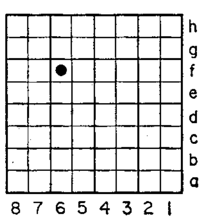
### PREVIOUS REPORTS

General information on the ground-water resources of DuPage County is included in reports on: *The Artesian Waters in Northeastern Illinois* (Anderson, 1919), *The Groundwater Possibilities in Northeastern Illinois* (Bergstrom et al., 1955), and *Preliminary Report on Ground-Water Resources of the Chicago Region, Illinois* (Suter et al., 1959). Other published and unpublished reports which contain information on the water resources and the geology of the county are listed in the Selected References at the end of this report.

### WELL NUMBERING SYSTEM

The well numbering system used in this report is based on the location of the well and on the system of rectangular surveys of the U. S. Government for identification.

The well number has five parts: county abbreviation, township, range, section, and coordinates (number and letter) that give location within the section. Sections are divided into one-eighth mile squares with each square containing 10 acres. A normal section of one square mile contains eight rows of eighth-mile squares: an odd-size section has more or fewer rows. Squares are numbered from east to west and lettered from south to north starting at the southeast corner as illustrated:




DuPage County
T39N, R9E,
sec. 30

The well number of the well shown is DUP 39N9E-30.6f. When more than one well is in a 10-acre square they are identified by arabic numbers after the lower case letter in the well number.

### ACKNOWLEDGMENTS

The basic geologic and hydrologic data upon which this report depends were provided through the cooperation of many county, municipal, and industrial officials, engineers, water-well contractors, and well owners. Special thanks are due Orville L. Meyer, former Chief Engineer of the DuPage County Health Department, for the many valuable logs of water wells made available during the investigation.

The U. S. Geological Survey supplied logs, hydrographs of wells, and pumping test data from Argonne National Laboratory and arranged for the loan of the deep-well current meter used in the geophysical investigation. The Illinois Division of Waterways installed and furnished data from stream gages.

The geological and geophysical studies incorporated in this report were conducted by the State Geological Survey. Discussion of the units below the Maquoketa Formation has been modified for DuPage County from Cooperative Ground-Water Report 1 (Suter et al., 1959). The hydrologic and water chemistry studies were made by the State Water Survey.

Arthur J. Zeizel, of the State Geological Survey, was responsible for the processing and analysis of the geologic and geophysical data and assisted in geohydrologic interpretations. The authors of the State Water Survey participated in the following manner: William C. Walton supervised computation and analysis of the hydrologic and chemical data and assisted in geohydrologic interpretations; Robert T. Sasman collected, processed, and analyzed water level and pumpage data; Thomas A. Prickett processed and aided in the analysis of basic hydrologic data, made most of the hydrologic computations, and assisted in geohydrologic interpretations.

Many present and former members of both agencies have assisted in the preparation of the report and in the collection and processing of data. Among these are George B. Maxe'y, James E. Hackett, Robert E. Bergstrom, Grover H. Emrich, Francis Wobber, Lowell A. Reed, and Richard Cannon of the staff of the Geological Survey and Harmon F. Smith, Jacob S. Randall, Richard J. Schicht, George E. Reitz, William H. Baker, Sandor Csallany, Robert R. Russell, and W J Wood of the Engineering staff of the State Water Survey.

The chemical analyses of water from wells were made by the Chemistry Section of the Water Survey. Sections on climate and statistical analysis of geologic controls were prepared, in large part, by Stanley A. Changnon and James C. Neill, respectively, both of the Water Survey.

## GEOGRAPHY

### LOCATION AND GENERAL FEATURES

DuPage County is in the northeastern part of Illinois (fig. 1). It is about 18 miles square, has an area of 331 square miles, and includes all of townships 38 to 40 north, ranges 9 to 11 east, and part of township 37 north, range 11 east (figs. 2 and 3). It is bounded on the north and east by Cook County, which contains the city of Chicago, on the south by Will County, and on the west by Kane County. Quadrangle topographic maps, published by the U. S. Geological Survey, cover the area (pl. 1, *in pocket).*

In 1950 about 60 percent of the land in DuPage

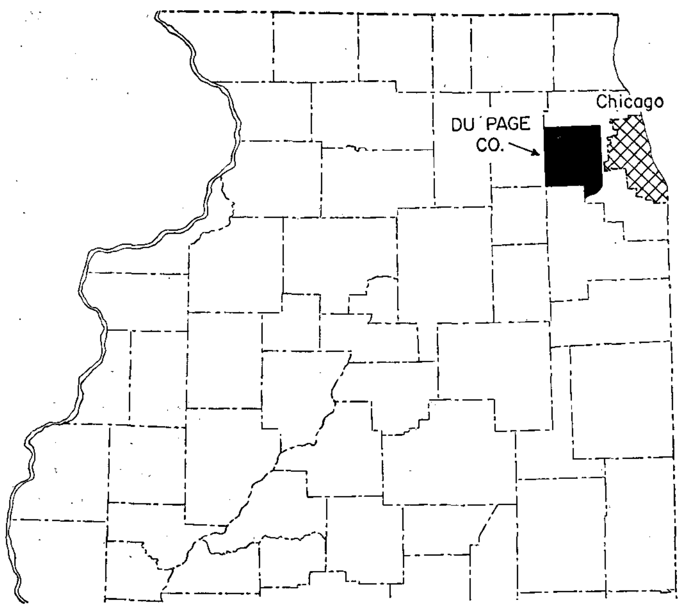



**Fig. 1. Location of DuPage County.**

County was in farms; however, expansion in suburban development from the city of Chicago has resulted in rapid municipal and industrial growth. The principal communities are along the east-west lines of the Chicago and Northwestern and the Chicago, Burlington, and Quincy Railroads. Wheaton, with a population of about 24,000, is the county seat. Argonne National Laboratory encompasses about five square miles in the southeastern part of the county.

All the communities in DuPage County obtain their water supplies from ground water. Water required by the industries for processing and cooling and water for rural and residential use is also obtained from wells.

## Topography and Drainage

DuPage County lies in the Great Lake and Till Plains sections of the Central Lowland Province, a glaciated lowland that extends from the Appalachian Plateau on the east to the Great Plains of Kansas, Nebraska, and the Dakotas on the west. All of the county is in the Wheaton morainal country subdivision of the Great Lake section except the southwestern part, which is in the Bloomington ridged plain subdivision of the Till Plains section (Leighton et al., 1948, p. 18). The county is characterized by low, broad, glacial moraines with numerous swamps and undrained areas. The numerous undrained areas in the moderately dissected upland are characteristic of young, poorly-integrated drainage systems in glaciated regions. Bedrock is exposed and affects surface features only locally.

The west and east branches of the DuPage River and Salt Creek flow generally south. The Des Plaines River is the southeastern county boundary and flows southwest. The valleys of the two branches of the DuPage River and Salt Creek originated during deposition of glacial materials and have not been significantly modified since. In a few places the rivers transect high morainal ridges; for example, the West Branch of the DuPage River west of Winfield. The southern reaches of the Bast Branch of the DuPage River in DuPage County are above a bedrock valley that has been partially filled.

The Des Plaines River flows in a valley formed by dissection of a bedrock divide by an earlier river. The floor and the lower slopes of the valley walls are cut in bedrock. This valley was an outlet channel Of glacial Lake Chicago and later carried discharge from other glacially ponded waters in the Superior, Huron, Brie, and Michigan basins (Bretz, 1955, p. 33). The natural drainage of the Des Plaines River has been altered by man by construction of the Illinois and Michigan Canal and the Chicago Sanitary and Ship Canal.

In most places, relief in the upland is less than 50 feet. Relief is greater along major valleys bordered by morainal deposits and often reaches a maximum of about 90 feet. The upland surface rises gradually toward the northwest and attains an elevation of about 830 feet near the northwest corner of the county. The lowest elevation is 585 feet in the Des Plaines River Valley, thereby giving a maximum relief of about 245 feet.

## Climate

Precipitation, evapotranspiration, and temperature are the climatic factors directly related to the availability, storage, movement, and withdrawal of ground water. Temperature influences evapotranspiration and infiltration and also affects the rate and distribution of ground-water withdrawal.

The climate of DuPage County is a humid continental type with cold, moderately dry winters and warm to hot, wet summers. Some minor effects on the climate are produced by Lake Michigan, but these are generally minimal, especially in regard to the temperature. The lake does affect the weather conditions sufficiently to produce approximately 1 to 1.5 inches of the average annual precipitation of 34.2 inches that occurs in the county.

Sixty percent of the average annual precipitation occurs during the warmer half-year, April-September. About 40 percent of the average annual precipitation comes from thunderstorms and about 10 percent is derived from snowfall. Normally June is the wettest month and February the driest month. The average annual and monthly precipitation values for DuPage County are shown in table 1. Observations of water levels in DuPage County indicate that, in general, recharge from precipitation to the ground-water reservoir

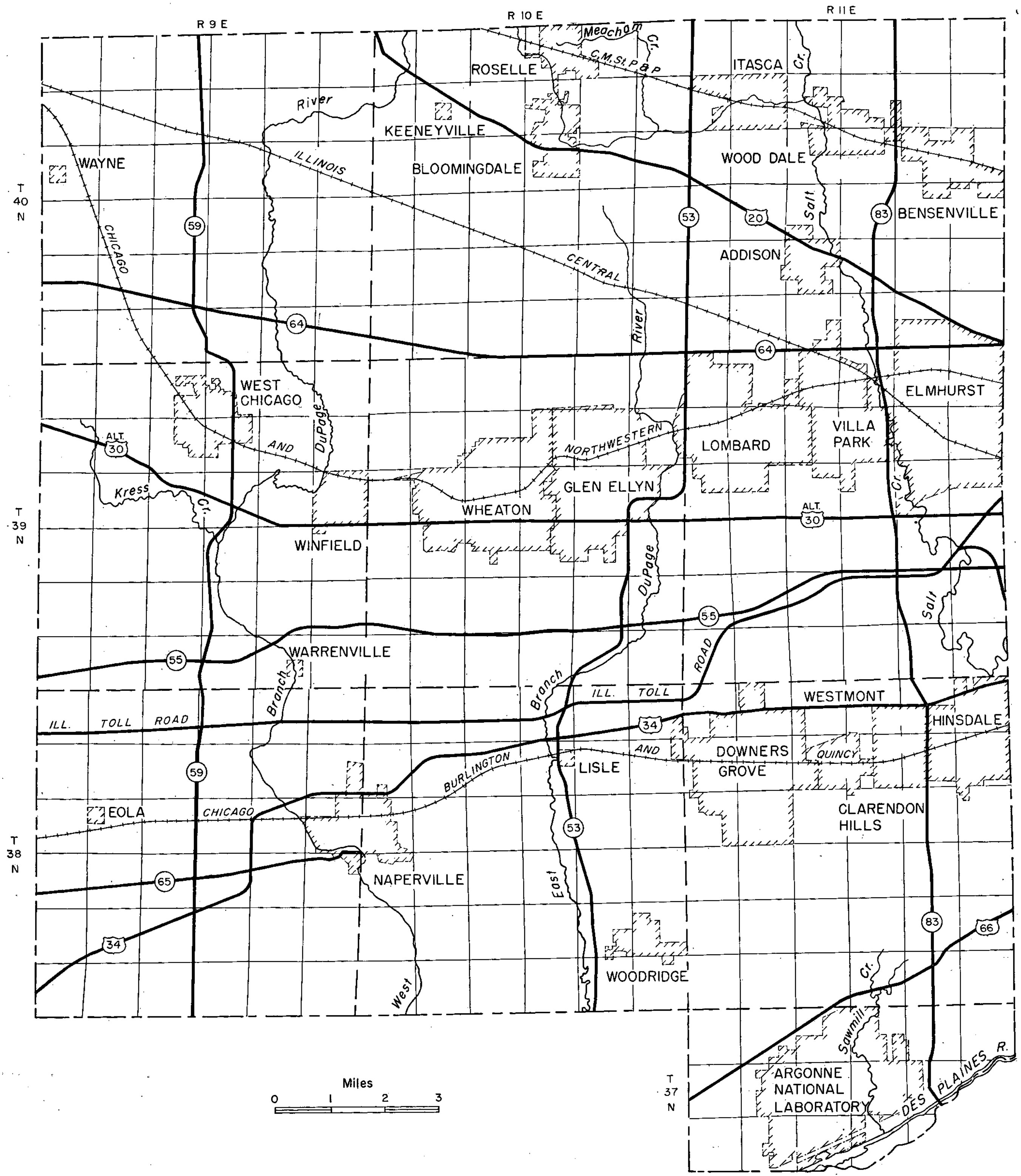



Fig. 2. Principal geographic features of DuPage County.

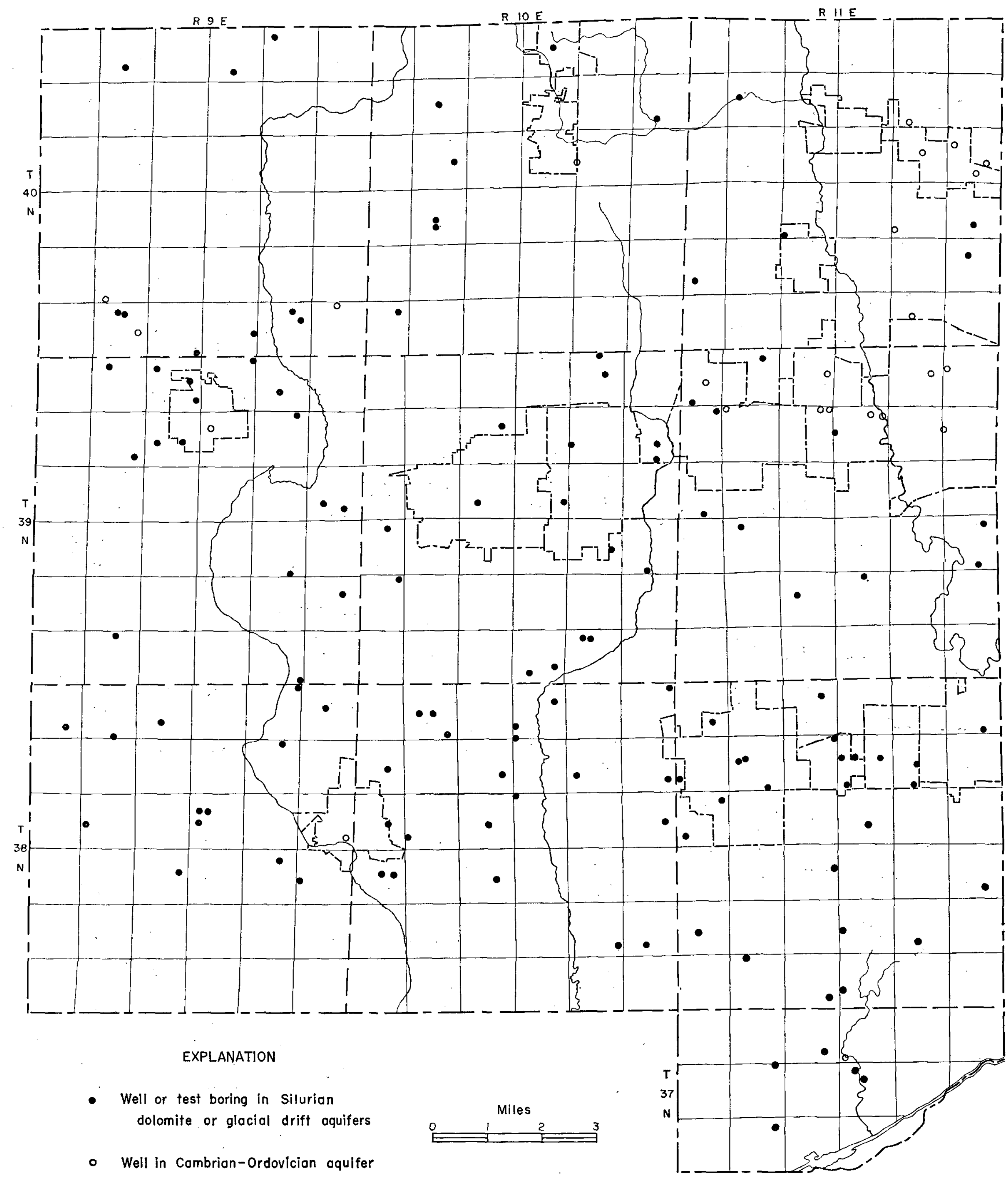



**Fig. 3. Location of selected wells and test borings.**

**Table 1. Monthly and Annual Climatic Data (based on 1936-1960 period)**

| Month | Mean temperature (°F) | Average precipitation (in) | Greatest precipitation amount (in) | Greatest precipitation year | Least precipitation amount (in) | Least precipitation year | Average snowfall (in) |
|---|---|---|---|---|---|---|---|
| January | 25.0 | 1.8 | 5.55 | 1960 | 0.29 | 1956 | 7.9 |
| February | 26.1 | 1.7 | 3.22 | 1957 | 0.14 | 1952 | 6.2 |
| March | 36.2 | 2.9 | 7.23 | 1948 | 0.38 | 1958 | 5.0 |
| April | 48.2 | 3.3 | 9.42 | 1946 | 0.93 | 1942 | 1.4 |
| May | 59.2 | 3.8 | 6.97 | 1945 | 1.09 | i950 | 0.1 |
| June | 69.3 | 4.6 | 10.65 | 1939 | 1.10 | 1956 | 0 |
| July | 74.0 | 3.2 | 8.00 | 1957 | 0.11 | 1946 | 0 |
| August | 72.3 | 3.1 | 6.38 | 1937 | 0.55 | 1953 | 0 |
| September | 64.1 | 3.0 | 10.27 | 1936 | 0.26 | 1940 | T |
| October | 53.2 | 2.8 | 10.87. | 1954 | 0.18 | 1952 | 0.1 |
| November | 38.5 | 2.1 | 3.56 | 1945 | 0.60 | 1939 | 3.6 |
| December | 27.3 | 1.9 | 4.32 | , 1936 | T | 1943 | 7.9 |
| Annual | 49.6 | 34.2 | 45.58 | 1954 | 23.44 | 1956 | 32.2 |

is greatest in the spring, that is, after the ground thaws and before vigorous plant growth begins.

On the average, 120 days per year have measurable precipitation. Daily precipitation equaling or exceeding 0.25 inch can be expected on 40 days per year on the average. The average monthly and annual snowfall values for the county are shown in table 1. In December and January, the months of greatest average snowfall, approximately 45 percent of the average monthly precipitation is derived from snowfall.

The length of the growing season also influences recharge because plants intercept most of the water soaking into the soil zone during this period. The growing season for the Chicago region ranges from 160 to 170 days. Dates of beginning and end of the growing season (the period between killing frosts) most commonly occur in late April or early May and in October, respectively.

As shown in table 1 there is a wide variation in mean temperature throughout the year. July on the average is the warmest month and January normally is the coldest month. There are no significant variations in the mean monthly and annual temperatures within the county. On the average, 90 days per year have daily mean temperatures below freezing. Temperatures equal to or greater than 90 degrees occur 25 days per year on the average. During the period of frequent and persistent daily temperatures below freezing, little or no recharge to the ground-water reservoir occurs because the ground is frozen and relatively impermeable.

## POPULATION

Figures released by the U. S. Bureau of the Census show that during the interval 1950 to 1960 the population of DuPage County increased from 154,599 to 313,459. These figures represent a gain of 102.8 percent and a rate of increase of 15,886 persons per year. This rate of population growth shows a marked increase when contrasted to the 5,112 persons per year rate of increase during the previous 10 years (fig. 4).

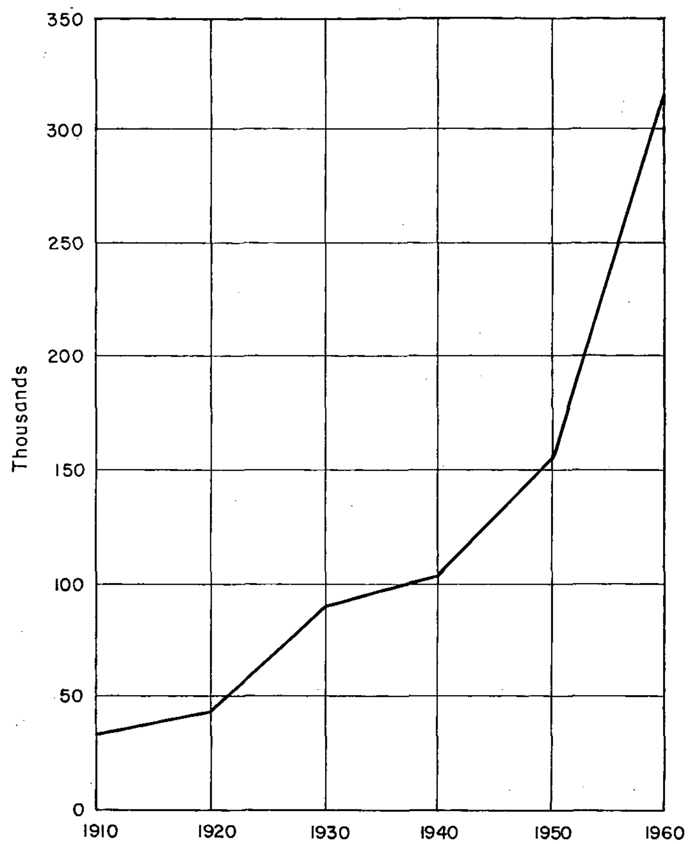



Fig. 4. Growth of population in DuPage County.

As would be expected because of the proximity of DuPage County to the city of Chicago, urban population during 1950 to 1960 increased considerably over rural population (127.9 versus 22.7 percent), and today 85.5 percent of the total population of the county is in urban areas.

Demand for water supplies and pumpage rates closely follow these trends (compare figs. 4 and 27), and the distribution of the population in the county influences ground-water use. Thus, urban development results in areas of concentrated pumpage. The population of the townships in DuPage County is given in table 2.

## ECONOMY

The quantity and quality of the ground-water supplies of DuPage County have been, up to the present, adequate to meet the demands of what was formerly largely an agricultural economy.

Favorable soil, topography, annual rainfall, temperature range, and length of growing season have resulted in the production of a wide variety of crops. Crops

**Table 2. Population of DuPage County by Township**

| Township | Population 1940 | 1950 | 1960 |
|---|---|---|---|
| Addison | 9,905 | 17,778 | 41,808 |
| Bloomingdale | 2,480 | 3,867 | 14,924 |
| Downers Grove | 25,607 | 36,264 | 66,664 |
| Lisle | 7,756 | 11,237 | 20,982 |
| Milton | 16,824 | 25,604 | 51,361 |
| Naperville | 3,616 | 4,861 | 8,218 |
| Wayne | 1,274 | 2,065 | 3,077 |
| Winfleld | 6,857 | 9,561 | 16,437 |
| York | 29,161 | 43,362 | 89,988 |
| Total | 103,480 | 154,599 | 313,459 |

grown are chiefly feed crops for the dairy and livestock farms. The metropolitan area of Chicago creates the demand for dairy products, fresh vegetables, flowers, plants, and eggs.

A shift in the economy from agriculture to manufacturing has been taking place as the suburban areas grow. This shift is evident by comparison of the statistics available from the U. S. Census of Manufacturers (1954, 1958) and the U. S. Census of Agriculture (1950, 1959).

The number of farms and the percentage of the land in farms have decreased rapidly since 1950. The 776 farms in 1959 represent a decrease of 54 percent. In this nine-year period, the percentage of land in farms has decreased 12.3 percent to 48.3 percent. Elimination and incorporation of the smaller, marginal farms is shown by the increase in the average size of farms (131.0 acres in 1959 versus 90.0 in 1950). Dairy farms predominate in DuPage County and in 1950 they made up about 18 percent of the farms. Livestock and cash grain farms ranked second and third. Farm water supplies are obtained from ground water. Only five acres were irrigated in 1959 in contrast to 63 acres in 1950.

The number of business establishments increased by 38 percent (226 to 312) in the four-year period from 1954 to 1958. During this time the number of employees increased 41 percent to 7809 with the total payroll ($36,880,000) representing an increase in payroll of $14,644,000. Of the 16 major manufacturing groups in the county in 1954, the food and kindred products group ranked first followed closely by fabricated metal products and machinery, except electrical. The estimated amount ($70,920,000) added to the county's economy by manufacturers in 1958 was a $24,393,000 gain over the 1954 value.

Mineral production in DuPage County includes sand, gravel, and stone. Numerous sand and gravel pits are operated throughout the county, and these materials find great use in highway construction as well as in general building construction. The two largest sand and gravel plants are operated by the Elmhurst-Chicago Stone Company at Warrenville and at Barbers Corners, a few miles south of Woodridge. The only active rock quarry in DuPage County is operated by the Elmhurst-Chicago Stone Company in Elmhurst. This is one of the major quarries in the Chicago metropolitan area. Its crushed rock is used extensively as a sub-base for road and highway construction, as ballast for railroad track systems, and as a source of agricultural limestone.

## GEOLOGY

### GENERAL RELATIONS

The rocks of Paleozoic age in DuPage County rest unconformably on the basement rocks of Precambrian age. The general sequence, lithologie character, water-yielding properties, structure, and distribution of these rocks are shown in the stratigraphic column (fig. 5), cross section of the bedrock (fig. 6), and the areal geologic map of the bedrock surface (fig. 7). The Paleozoic bedrock consists of about 3500 feet of consolidated, stratified, sedimentary rocks of Cambrian, Ordovician, and Silurian age. The summary of the sample study of a deep well (DUP 40N11E-13.5b; Appendix B) illustrates the character of the bedrock formations. These formations dip gradually to the east and southeast at about 10 feet per mile and have been folded into a series of gentle anticlines and synclines.

Almost all of the bedrock immediately beneath the glacial drift belongs to the Silurian System (fig. 7) and is part of the Niagara Cuesta which extends northward around Lakes Michigan and Huron, and then eastward through New York state. Between the bedrock and the overlying glacial deposits is a major unconformity marked by a well-developed drainage system eroded into the bedrock surface (pl. 1).

During the Pleistocene Epoch, DuPage County was overrun by several advances of continental glaciers which, upon recession, left unconsolidated deposits that almost completely cover the bedrock (fig. 8) and reach a maximum thickness of slightly more than 200 feet (fig. 9).

### BEDROCK STRATIGRAPHY

#### PRECAMBRIAN

No wells are known to reach Precambrian rocks in DuPage County. The information obtained from wells in the surrounding area and from estimates of thickness of the Mt. Simon Sandstone suggests that these rooks are granite and related crystallines and would be encountered in drilling at depths ranging from 3000 to 4000 feet.

| SYSTEM | SERIES | GROUP OR FORMATION | GEOHYDROLOGIC UNITS | Aquifer | LOG | THICKNESS (FT) | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| QUATERNARY | PLEISTOCENE | | Glacial drift aquifers | | | 0-200± | Unconsolidated glacial deposits-pebbly clay (till), silt, sand and gravel<br>*Alluvial silts and sands along streams* |
| DEVONIAN | | | | | | Fissure Fillings | Shale, sandy, brown to black |
| SILURIAN | NIAGARAN | Racine<br>Waukesha<br>Joliet | Niagaran aquifer | Silurian dol. aquifer | | 0-170 | Dolomite, very pure to highly argillaceous, *silty, cherty; reefs in upper part*<br>Dolomite, shaly, and shale, dolomitic; maroon, green, pink |
| SILURIAN | ALEXANDRIAN | Kankakee<br>Edgewood | Alexandrian aquifer | Silurian dol. aquifer | | 0-90 | Dolomite, *glauc.; thin grn. shale partings*<br>Dolomite, argillaceous, silty and/or sandy, cherty |
| ORDOVICIAN | CINCINNATIAN | Neda | Confining beds of the Maquoketa Formation | | | 0-20 | Shale, red; oolites |
| ORDOVICIAN | CINCINNATIAN | Maquoketa | Confining beds of the Maquoketa Formation | | | 85-230 | 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) |
| ORDOVICIAN | MOHAWKIAN | Galena<br>Decorah<br>Platteville | Galena-Platteville | Cambrian-Ordovician aquifer | | 300-350 | Dolomite, and/or limestone, cherty<br>Dolomite, shale partings, speckled<br>Dolomite and/or limestone, cherty, sandy at base |
| ORDOVICIAN | MOHAWKIAN | Glenwood | Glenwood-St. Peter | Cambrian-Ordovician aquifer | | 200-375 | Sandstone, fine and coarse grained; little dolomite; shale at top<br>Sandstone, fine to medium grained; locally cherty red shale at base |
| ORDOVICIAN | CHAZYAN | St. Peter | Glenwood-St. Peter | Cambrian-Ordovician aquifer | | | |
| ORDOVICIAN | PRAIRIE DU CHIEN | Shakopee<br>New Richmond<br>Oneota | Prairie du Chien | Cambrian-Ordovician aquifer | | 0-200 | Dolomite, sandy, cherty (oolitic); sandstone<br>Sandstone interbedded with dolomite<br>*Dolomite, white to pink, coarse grained* cherty (oolitic), sandy at base |
| CAMBRIAN | CROIXAN | Trempealeau | Trempealeau | Cambrian-Ordovician aquifer | | 80-190 | Dolomite, white, fine grained; geodic quartz; sandy at base |
| CAMBRIAN | CROIXAN | Franconia | Franconia | Cambrian-Ordovician aquifer | | 70-100 | Dolomite, sandstone and shale, glauconitic, green to red, micaceous |
| CAMBRIAN | CROIXAN | Ironton | Ironton-Galesville | Cambrian-Ordovician aquifer | | 175-200 | Sandstone, fine to coarse grained, well sorted; upper part dolomitic |
| CAMBRIAN | CROIXAN | Galesville | Ironton-Galesville | Cambrian-Ordovician aquifer | | | |
| CAMBRIAN | CROIXAN | Eau Claire | Confining beds of the Eau Claire Formation (upper and middle beds) | | | 300-400 | Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic |
| CAMBRIAN | CROIXAN | Eau Claire<br>Mt. Simon | Eau Claire (lower beds) and Mt. Simon Formations | Mt. Simon aquifer | | 2,000± | Sandstone, coarse grained, white, red in lower half; lenses of shale and siltstone, red, micaceous |
| | | | | | | | Precambrian |

**Fig. 5. Stratigraphic section, geohydrologic units, water-yielding properties of the rocks, and**

| DRILLING AND CASING CONDITIONS | WATER YIELDING PROPERTIES | CHEMICAL QUALITY OF WATER | WATER TEMPERATURE |
|---|---|---|---|
| Boulders, heaving sand locally; sand and gravel wells usually require screens and development; casing required in wells into bedrock | Sand and gravel, permeable<br>Some wells yield more than 1000 gpm; specific capacities range from 1.0 to 40.7 gpm/ft, av. 13.8 gpm/ft | Hardness from 387 to 596 ppm, av. 485 | 46° min.<br>52° av.<br>54° max. |
| Upper part usually weathered and broken; extent of crevicing varies widely<br>Chert layers slow drilling rate | Niagaran aquifer more productive than Alexandrian aquifer<br>Basal units of Niagaran aquifer locally may retard recharge<br>Specific capacities from 0.5 to 530 gpm/ft<br>Coefficient of transmissibility averages 114,000 gpm/ft | Variable hardness < 200 to >1000 ppm<br>Iron > 0.5 ppm in 60% of analyses | 49° min.<br>52° av.<br>59° max. |
| Shale requires casing<br>Dolomite units creviced | | | |
| Top of Galena usually selected for hole reduction and seating of casing | Development and yields of crevices are small | Regionally hardness < 100 ppm<br>$H_2S$ often present<br>High alkalinity > 350 ppm | 54° to 55° |
| Lower cherty shales cave and usually are cased<br>Friable sand may slough | Small to moderate quantities of water<br>Coefficient of transmissibility probably about 15% of that of Cambrian-Ordovician aquifer | Water similar in quality or slightly harder than that in Ironton-Galesville Sandstone | 53° to 56° |
| Crevices encountered locally in the dolomite, especially in Trempealeau<br>Casing not required | Crevices in dolomite and sandstone generally yield small to moderate quantities of water; Trempealeau locally well creviced and partly responsible for exceptionally high yields of several deep wells<br>Coefficient of transmissibility probably averages about 30% of that of total Cambrian-Ordovician aquifer | | |
| Amount of cementation variable<br>Lower parts more friable<br>Sometimes sloughs | Most productive unit of Cambrian-Ordovician aquifer<br>Coefficient of transmissibility probably averages about 50% of that of total Cambrian-Ordovician aquifer | Iron usually < 0.4 ppm<br>Hardness av. 200 ppm | 55° to 58° |
| Casing usually not necessary; locally weak shales may require casing | Shales, generally not water-yielding; act as a confining bed between Ironton-Galesville and Mt. Simon | | |
| Casing not required | Moderate amounts of water; permeability between that of Glenwood-St. Peter and Ironton-Galesville | Hardness from 247 to 544 ppm, av. 352<br>Chlorides increase at rate of 400 ppm each additional 25' depth below elevation -1275' | 66° at elev. -1300', increasing 1° with each additional 100' depth |
| crystalline rocks | | | |

**character of ground water (modified for DuPage County from figure 17, Suter et al., 1959).**

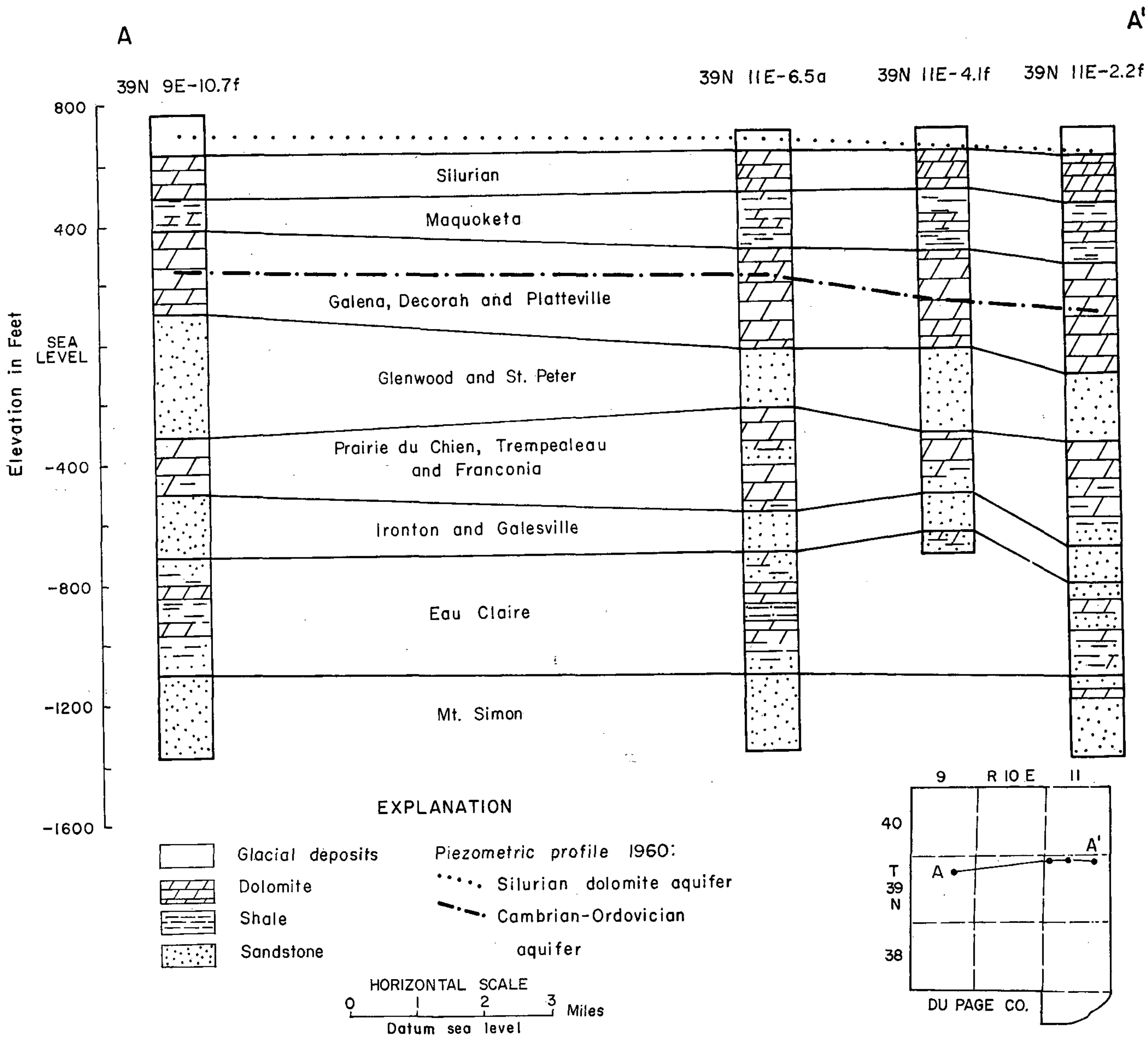



**Fig. 6. Cross section of the bedrock with piezometric profiles added.**

CAMBRIAN

Rocks of Cambrian age consist chiefly of sandstone with some shale and dolomite and are known to reach a maximum thickness of approximately 2500 feet in some parts of northeastern Illinois. Most of the shale and dolomite formations occur in the upper 800 feet. No wells penetrate the entire thickness of rocks of Cambrian age in DuPage County.

The following rock units comprise the Cambrian section, from the bottom up: Mt. Simon Sandstone, Eau Claire Formation, Galesville Sandstone, Ironton Sandstone, Franconia Formation, and the Trempealeau Dolomite.

The Mt. Simon Sandstone is a pink, yellow, and white, fine- to coarse-grained, incoherent to friable sandstone. Locally it is arkosic and contains red and green shale beds near the base. Lenses of shale and siltstone occur at some places. The deepest water well on record in DuPage County, the Chicago, Milwaukee, St. Paul, and Pacific Railroad Well No. 1 (DUP 40N11E-13.3c) was drilled to a total depth of 2290 feet and penetrated 470 feet into the Mt. Simon Sandstone. Records are available of 11 wells in DuPage County that enter the Mt. Simon Sandstone but do not penetrate it completely.

Twenty-four of the wells for which records are available penetrate the Eau Claire Formation in DuPage County, including the 11 wells that enter the underlying Mt. Simon Sandstone. The 13 wells which end

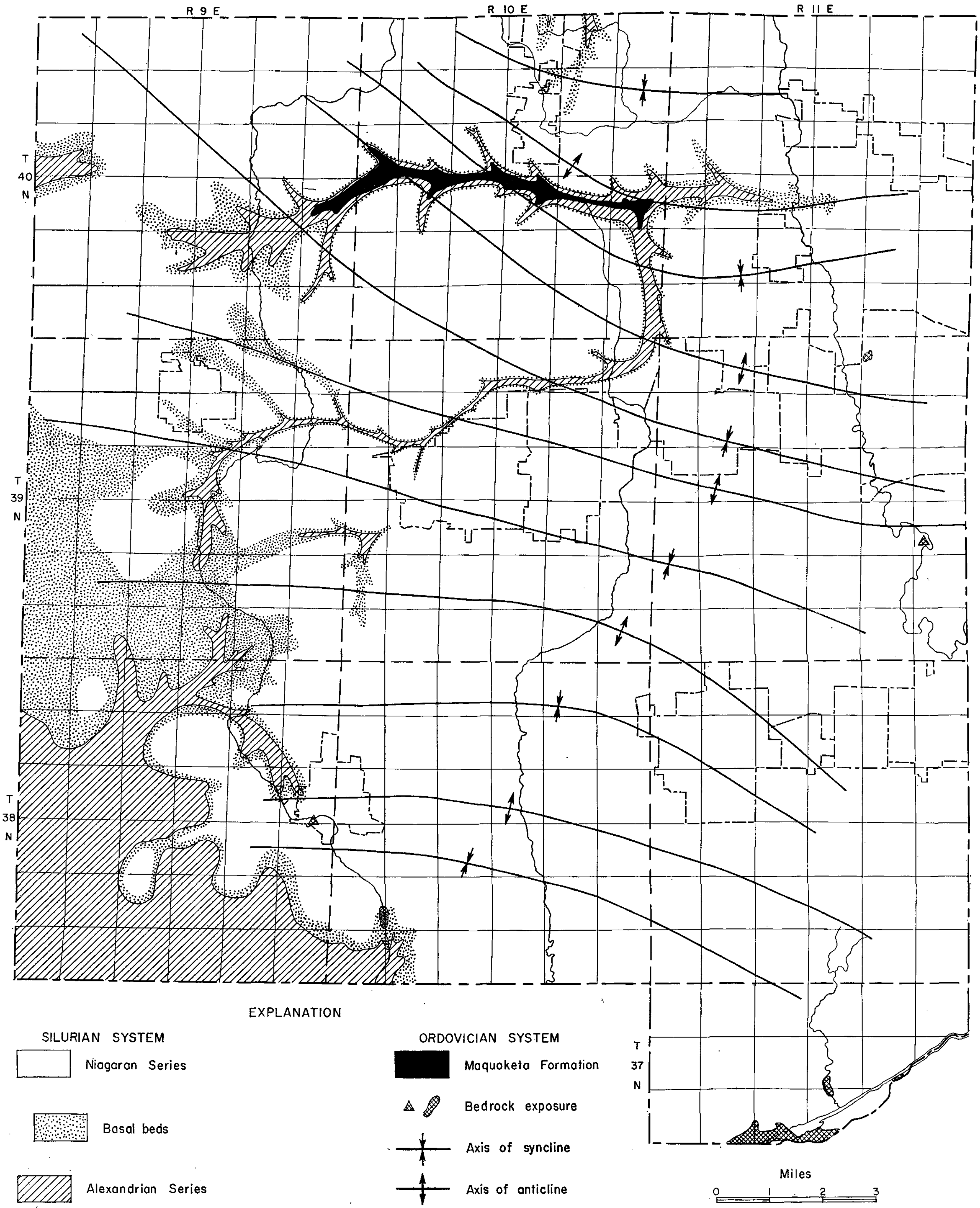



**Fig. 7. Areal geology of the bedrock surface.**

in the Eau Claire Formation penetrate from 4 to 54 feet. The lower sandstone of the Eau Claire Formation is incoherent, dolomitic, and contains glauconite. The middle and upper parts of the Eau Claire Formation consist chiefly of green to gray shale, dolomitic sandstone, and sandy brown dolomite. The thickness of the middle and upper parts of the formation (Suter et al., 1959, p. 19) determined from the well records, ranges from about 245 to 420 feet. Elevation of the top of the Eau Claire Formation ranges from about 550 feet below sea level along the northwestern part of the county to about 900 feet below sea level along the southeastern border. The top of the Eau Claire Formation is reached in drilling at depths of 1350 to 1500 feet.

The Galesville Sandstone consists of white to light gray, fine- to medium-grained, well sorted, incoherent sandstone that overlies the Eau Claire Formation. Strata of the Ironton Sandstone that occur immediately above the Galesville Sandstone are similar in lithology and are made up of fine- to very coarse-grained, variegated, commonly dolomitic sandstone interbedded with dolomite beds. A thin, dolomitic, coarsely glauconitic medium- to coarse-grained sandstone unit locally is present in the upper part of the Ironton Sandstone. The Ironton and Galesville Sandstones are not differentiated in most of the records of studies of drill samples from wells, and the interval is designated the Ironton-Galesville Sandstone. The combined thickness of the Ironton and Galesville Sandstones beneath DuPage County ranges from about 175 to 200 feet. The depth to the top of these sandstones ranges from about 1150 in the northwestern part of the county to about 1300 feet in the southeastern part.

The Franconia Formation is made up chiefly of interbedded sandstone, shale, and dolomite which contain an abundance of glauconite. A characteristic greenish tint often is given to sandstone and shale by the glauconite particles. The sandstone beds are pink, buff, and greenish gray, fine-grained, dolomitic, and compact. The shales are red and green, sandy, silty, and weak (cave and slake easily). Commonly the sandstone grades to sandy dolomite. Thickness of the Franconia Formation is 70 to 100 feet.

The Trempealeau Dolomite is buff to gray, very finely crystalline, and dense. Commonly the dolomite is sandy and glauconitic at or near the base of the formation. Thickness of the Trempealeau Dolomite beneath DuPage County is 80 to 190 feet. The erosional unconformity which separates the Cambrian and Ordovician rocks occurs at the top of the Trempealeau Dolomite.

### ORDOVICIAN

Rocks of Ordovician age in DuPage County consist of, from the bottom up, the Prairie du Chien Series, the St. Peter Sandstone, the Glenwood Formation, the Platteville, Decorah, and Galena Formations, the Maquoketa Formation, and the Neda Formation. The Prairie du Chien Series is made up of three formations: the Oneota Dolomite, the New Richmond Sandstone, and the Shakopee Dolomite. This series consists almost completely of white to light gray to pink, fine to coarsely crystalline, cherty (oolitic) dolomite with lenses of sandstone. Beneath DuPage County, these rocks thin northward from about 200 feet to a featheredge.

The St. Peter Sandstone is a white to light gray and buff, fine- to coarse-grained, locally silty and argillaceous, friable sandstone. A large percentage of the quartz grains is well rounded and frosted. A basal zone that has rapid changes in lithology and thickness occurs where the St. Peter Sandstone is exceptionally thick. This basal section may consist of fine- to coarse-grained, pink to reddish brown sandstone with varying amounts of shale, chert, and dolomite fragments. The shale is commonly red or green, sandy, and weak.

Thickness maps of the St. Peter and overlying Glenwood Sandstones suggest that in places the sandstones were deposited in channels. In these areas, thicknesses of greater than 400 feet can be found. The Glenwood Formation has been recognized in many of the wells in DuPage County and is a fine- and coarse-grained sandstone which contains lenses of dolomite and shale. The dolomite is light gray, buff, and green and is argillaceous, silty, or sandy. The shale lenses are green and sandy, and range from plastic to tough. Thickness of the Glenwood Formation ranges from 3 to 80 feet and averages 31 feet. The top of the Glenwood is reached in drilling at depths of about 700 to 750 feet.

The Platteville, Decorah, and Galena Formations are similar in lithology and are made up of dolomite and limestone beds. The Platteville Dolomite is commonly argillaceous, cherty in the upper half, buff to gray, very fine to finely crystalline, and mottled. Near the contact with the underlying Glenwood Sandstone the dolomite of the Platteville Formation is sandy. The Decorah Formation overlies the Platteville Dolomite and is a fine to medium crystalline, speckled (red and black) dolomite with thin gray to red shale partings. The Galena Dolomite is a fine to medium crystalline, buff to brown dolomite, cherty in the lower half, and includes scattered thin shale beds. The combined thickness of these dolomites is very uniform and ranges from about 300 to 350 feet.

The Maquoketa Formation is made up chiefly of an olive gray to brown, weak, silty, dolomitic shale which contains beds of light gray to brown dolomite. In northeastern Illinois, three units have been recognized in the Maquoketa Formation (Suter et al., 1959, p. 33). From bottom to top the units are:

*Lower Unit*—Shale, silty, brown to very dark gray-brown, weak to brittle. Depauperate zone sometimes occurs which contains small phosphatic fossils. Thickness is about 50 to 100 feet.

*Middle Unit*—Dolomite, some shale and limestone, light gray to light brownish gray, a few pink and green grains, fine to coarsely crystalline, fossil fragments common. Thickness ranges from less than 50 feet in eastern DuPage County to 50 to 100 feet in the western part.

*Upper Unit*—Shale, dolomitic, silty, olive gray, greenish gray, weak. Some dolomite, silty, light gray to dark green, contains black speckled chert. Some fossil fragments (chiefly Bryozoa). Generally 50 to 100 feet thick.

The character of the Maquoketa Formation is shown in the sample study log of the deep well DUP 40N11E-13.5b (Appendix B).

The base of the Maquoketa Formation is well marked by a change from shale to the buff-colored dolomite of the Galena Formation. Delineation of the upper erosional surface is sometimes difficult where the upper strata of the Maquoketa contain dolomite and are overlain by lithologically similar strata in the lower part of the Bdgewood Formation. The upper surface is easily distinguished where the Kankakee or Edgewood Dolomites overlie the shales of the Maquoketa Formation or where the Neda Formation occurs. Much of the lower part of the rocks of Silurian age consists of white to light brown, cherty, and glauconitic dolomite which contrasts markedly with the darker color, black speckling, and the presence of black-speckled chert in the dolomite of the Maquoketa Formation.

The Neda Formation consists of a shale which is dolomitic, silty, hematitic, red (sometimes a green, yellow, and purple mixture), and contains goethite oolites. Silty, argillaceous, pink and green dolomite is often present. The pre-Silurian erosion has resulted in very patchy occurrence of the Neda Formation in DuPage County, and where this formation occurs the entire Maquoketa section is present. Only 10 of the 74 wells studied penetrated the Neda Formation. Commonly, where the Neda Formation occurs, the overlying Edgewood Formation of the Alexandrian Series is thin. Locally, Kankakee Dolomite lies directly upon the Neda Formation. The boundary between rocks of Ordovician and Silurian age is easily determined where the colorful shale of the Neda Formation is overlain by the dolomite of the Alexandrian Series. The thickness of the Neda Formation, where present, ranges from 5 to 15 feet.

## SILURIAN

Rocks of Silurian age in DuPage County include the Alexandrian Series overlain by the Niagaran Series. These rocks form essentially all of the bedrock surface beneath the glacial drift and the few bedrock outcrops in the county (fig. 7).

### *Alexandrian Series*

The Alexandrian Series is composed chiefly of dolomite which decreases in clastic content from the base of the series upward. Shale and very argillaceous dolomite beds occur near the base of the series and grade to a relatively pure dolomite near the top.

Erosional thinning of the Alexandrian Series has occurred where the rocks form the surface of the bedrock. Approximate original depositional thicknesses are present throughout most of the county where these rocks are overlain by the Niagaran Series.

Two formations make up the Alexandrian Series, the Edgewood below and the Kankakee above. The Edgewood Formation is a gray to brownish gray, argillaceous, cherty dolomite which contains coarse silt and fine sand and shale partings toward the base. The Kankakee Formation is a white to light brown to light gray, relatively clean, locally glauconitic dolomite which contains thin green shale partings. It is difficult to distinguish the upper Edgewood Formation from the overlying Kankakee Formation by study of cuttings from water wells. The two formations are not differentiated for this study. The character of the Alexandrian rocks is shown in the study of reference wells DUP 38N11E-30.5d and DUP 39NllE-4.1e (Appendix B).

The lithologic changes which mark the boundary between the Alexandrian Series and the Maquoketa or Neda Formations have been described. The contact between the Alexandrian and Niagaran Series is a smooth bedding surface which can be seen in the Elmhurst quarry and in outcrops along the Des Plaines and Kankakee Valleys in Will County. In DuPage County, the basal beds of the Niagaran Series are red, green, and greenish gray, shaly dolomite and shale. The abrupt change in color and lithologic character between these beds and the Kankakee Dolomite of the Alexandrian Series is easily discernible.

### *Niagaran Series*

The rocks of the Niagaran Series have been subdivided into the Joliet, Waukesha, and Racine Formations. These formations range from clean dolomite to highly silty, argillaceous, and cherty dolomite with some thin shale beds, and contain reefs locally. Reefs and associated strata are most characteristic of the Racine Formation but may occur stratigraphically as low as the Joliet Formation (Willman, 1949, p. 26).

Regionally, these formations have been defined in outcrop chiefly on differences in the lithologic character of the dolomite. The formations are conformable and have contacts that are transitional between clean carbonates and very silty and argillaceous carbonates. For this report, these lithologically similar formations were not differentiated by study of drill samples from wells because of the transitional nature of the contacts and. because of the presence of reef and reef-like deposits.

The lower beds of the Joliet Formation, however, are characterized by their pink or red color and distinctive lithology and are easily recognizable in samples of drill cuttings.

A zone of dolomitic shale about 12 inches thick differentiates these basal beds of the Niagaran Series into three distinct units. From bottom to top, these units are: a shaly dolomite, a dolomitic shale, and a shaly silty dolomite. The presence of the middle shale is usually difficult to determine by study of well cuttings because it tends to be washed away during drilling. The character of these beds is shown in the sample study log of the Villa Park City Well No. 7 (DUP 39N11E-4.1e; Appendix B).

The red shaly dolomite of the basal beds of the Niagaran Series contrasts markedly with the underlying light brown to light gray, relatively clean dolomite of the Kankakee Formation, and the contact between the Niagaran and the underlying Alexandrian Series is easily distinguished in surface and subsurface studies.

Erosion has been active upon the upper surface of the rocks of Niagaran Series and considerable thinning has resulted, particularly where deep valleys have been carved into the dolomite bedrock. This erosional thinning prevents accurate determination of the original thickness of the Niagaran Series in DuPage County. The upper eroded surface of the dolomite of the Niagaran Series is highly creviced. Black shale has been found in crevices in the dolomite of the Niagaran Series in the Elmhurst quarry and locally throughout the region. Fossils in this material are middle and late Devonian in age (Alden, 1902, p. 93-94). Unconsolidated glacial materials of Pleistocene age overlie the dolomite of Niagaran age in most of the county.

## Bedrock Structure

DuPage County is on the northeastern flank of the Kankakee Arch, an asymmetrical anticline which trends about S 40°E and plunges to the southeast (Willman and Payne, 1942, p. 184). The Kankakee Arch connects the Cincinnati and Wisconsin Arches and separates the Michigan and Illinois basins. The bedrock formations in DuPage County dip to the east and southeast at about 10 feet per mile. Gentle folds are well defined by all stratigraphic horizons and pitch with the dip. The axes of these folds in the dolomite of Silurian age are shown on the areal geologic map of the bedrock surface (fig. 7).

Jointing in the dolomite of Silurian age is well exposed in quarries and, where measured, indicates two major systems of joints that trend about N 50°E and N 47°W. The northeastern trend of the dolomite joints is at right angles to the trend of the Kankakee Arch and the second joint trend makes an angle of about 7° with the trend of the arch.

More data are necessary before precise relationships can be established between joint development and regional and local structures. Table 3 lists the data collected for this study on trends of joint systems in the dolomite of Silurian age.

**Table 3. Trend of Joint Systems**

| 1/4 | 1/4 | 1/4 | Sec. | Twp. | Range | NE trend | NW trend |
|---|---|---|---|---|---|---|---|
| SW | NW | SW | 16 | 37N | HE | N 40° E | N 63° W |
| SE | SW | 8E | 13 | 38N | 9E | N 43° E | N 56° W |
| 8E | NW | NE | 30 | 38N | 10E | N 60° E | N 35° W |
| S | SW | NW | 2 | 39N | HE | N 54° E | N 44° W |
| SW | NW | SE | 17 | 39N | 12E | N 60° E | N 36° W |
| NW | SE | NE | 17 | 39N | 12E | N 48° E | N 38° W |
| NE | NW | SE | 17 | 39N | 12E | N 48° E | N 57° W |
| Average | | | | | | N 50° E | N 47° W |

## History of the Bedrock

Numerous transgressions and regressions of shallow seas across northeastern Illinois are recorded by the sedimentary bedrock formations in DuPage County. A gradual wearing down of the surrounding exposed rock masses by erosional processes, deposition of the sands and muds into the sea, and later consolidation formed sandstone and shales. When the seas were clearer, the carbonate from which the limestone and dolomite rocks were formed was deposited. The periods of sediment deposition and consolidation were interrupted by episodes of uplift and deformation during which the exposed rocks underwent weathering and erosion. Perhaps the major period of uplift and erosion occurred after the deposition of the rocks of Prairie du Chien age. This uplift resulted in the formation of the Kankakee Arch (Ekblaw, 1938, p. 1428). The erosion during this major uplift was extensive and rocks as deep as the Franconia Formation were cut into and removed. It was on this irregular surface that the St. Peter Sandstone was deposited and a major unconformity within the bedrock sequence was formed.

Conditions of deposition of the Maquoketa Formation favored accumulations of mud and silt with minor amounts of calcareous material. Sometime during the middle of this interval the seas cleared with a decrease in the amount of clastic materials and an increase in the amount of the calcareous material deposited.

The shallow sea in which the Alexandrian sediments were deposited transgressed a highly uneven Maquoketa surface and reworked the upper part of the shale depositing it with the carbonate. Clastic material was concentrated in the deeper parts of the sea and particularly in channels which had been cut into the Maquoketa surface (Buschbach, 1959, p. 85). With time, the sea became deeper, cleaner, and more quiet. Clastic deposition decreased and then essentially ceased.

Environmental conditions during the time of the deposition of the Joliet and Waukesha Formations of the Niagaran Series fluctuated from those which cause continuous deposition of relatively clean carbonates to those which cause deposition of very silty and argillaceous carbonates. The recognition of individual units in the Joliet Formation from outcrop to outcrop throughout most of the region and the great similarity of insoluble residues of these units show widespread uniformity of depositional conditions (Workman, 1949). In contrast, during the time of deposition of the Racine Formation, reef building was more widespread and caused highly variable and complex sedimentation conditions locally.

Unknown thicknesses of sediments were deposited on the dolomite of Silurian age in shallow, continental seas which invaded the county during Devonian and perhaps even Mississippian and Pennsylvanian times. Major periods of structural disturbance which formed the gentle folds in the bedrock and emergence of the land took place in late Silurian time and near the end of the Mississippian period (Willman and Payne, 1942, p. 195). The sediments which were deposited on the dolomite of Silurian age may have been removed during the late-Mississippian-pre-Pennsylvanian erosional interval or during the long period of time between the Pennsylvanian and the Pleistocene. The only evidence of transgression of the seas over the county after Silurian time is limited to the small quantities of shale of Devonian age found in some of the openings near the upper surface of the dolomite of Silurian age.

The geologic record of the time between the Pennsylvanian and the Pleistocene in this region is poorly known. After withdrawal of the Paleozoic long period of weathering and erosion produced a surface of low relief upon the dolomite. Advances of the ice sheets during the Pleistocene scoured the surface of the dolomite and covered it with thick deposits of unconsolidated material.

## Bedrock Topography

The bedrock topography map of DuPage County (pl. 1) was compiled almost entirely from about 1250 records of water wells and test borings because of the few outcrops of bedrock and the thick glacial drift cover. This map agrees in general with an earlier interpretation presented by Horberg (1950, pl. 1, sheet 1).

The bedrock surface is principally a broad, gently rolling upland, part of the Central Illinois Peneplain (Horberg, 1950, p. 95), which extends over northeastern and central Illinois. The development of the peneplain began some time after the Pennsylvanian Period and was terminated by Pleistocene glaciation.

Regionally, because of the presence of less resistant shales above and below it and because of its gentle eastward dip, the Silurian dolomite became a cuesta. The ridge of the cuesta became a major divide for drainage, so that many streams drained westward. The eastward-draining bedrock valleys trend approximately parallel to the dip of the bedrock but diverge slightly to the northeast. They have been interpreted as tributaries of a valley cut into the soft Devonian shales to the east (Horberg, 1950, p. 28).

The bedrock surface in DuPage County slopes from about 700 feet above mean sea level in the northwest to about 640 feet in the southeast and to about 580 feet in the northeast. Some small isolated hills in the bedrock surface in the eastern part of the county may reflect relatively resistant reef structures.

The valleys in the bedrock surface are generally about one-half to one mile wide and about 80 feet deep and for the most part are filled completely with glacial drift. The tributary valleys which were cut back into the rock uplands have steep slopes and are commonly narrow. Major joint systems appear to have locally influenced the trend of the valleys. Most of the valleys were created by preglacial erosion, but some are related to glacial events.

Only two present-day river valleys overlie bedrock valleys in DuPage County. The southern reaches of the East Branch of DuPage River flow in a broad lowland which partly overlies a buried bedrock valley. Where the West Branch of DuPage River leaves the county, it overlies the head of a buried bedrock valley. Des Plaines River, along the southeastern boundary of the county, flows in an outlet valley of Glacial Lake Chicago cut down to an elevation of about 585 feet above mean sea level, across the bedrock drainage divide.

## Unconsolidated Deposits

### Glacial Drift

Almost all unconsolidated glacial deposits in DuPage County were deposited by ice of the Lake Michigan glacial lobe of Wisconsinan age, the most recent Pleistocene glacial stage. The recent classification of the Wisconsinan stage by Frye and Willman (1960) is as follows:

| STAGE | SUBSTAGE | MORPHOSTRATIGRAPHIC UNITS |
|---|---|---|
| Wisconsinan (glacial) | Valderan (glacial) | |
| | Twocreekan (ice retreatal) | |
| | Woodfordian (glacial) | Tinley moraine |
| | | Valparaiso moraines |
| | | Palatine moraine |
| | | Roselle moraine |
| | | Keeneyville moraine |
| | | Minooka moraine |
| | Farmdalian (ice retreatal) | |
| | Altonian (glacial) | |

A map of the surficial geology is presented in figure 8. Surficial geologic maps of parts of DuPage County have been published by Trowbridge (1912, pl. 2), Fisher 1925, pl. 1), Fryxell (1927, pl. 1), Bretz (1955, supplement to Bulletin 65), and Ekblaw (in Suter et al., 1959, fig. 5). Some of the revisions of the earlier mapping of the Wheaton Quadrangle, in progress by Block, have been included in the surficial geologic map in figure 8.

*Topography*

Although glacial drift materials may range widely in composition, they have characteristic land forms generally independent of the underlying bedrock surface. The most prominent and abundant land form in DuPage County is glacial moraine, an accumulation of drift deposited by the glacial ice. It is differentiated into end moraine, which is more or less an undulatory ridge-like deposit of glacial drift built along the border of a glacier; and ground moraine, which comprises areas of low relief behind the end moraine and was deposited as the glacier melted back.

Many of the end moraines in DuPage County are distinct and easily traceable topographic features and are named generally from a town built upon them. The same names are applied to the areas of ground moraine respectively associated with the end moraines.

*Composition*

The glacial drift in DuPage County consists almost entirely of three types of materials: till, glaciofluvial deposits, and glaciolacustrine deposits. At some places, these deposits grade into one another.

*Till* generally consists of a heterogeneous mixture of particles of all sizes. Till ranges from very compact (often called "hardpan" by drillers) to loose and friable. The heterogeneity of till results from direct deposition by glacial ice without any significant sorting action by water. The tills in DuPage County range from a dense clayey till almost completely lacking coarse fragments to a gravelly, sandy till closely associated with water-worked materials. Most of the tills of the Minooka, Valparaiso, and Tinley Moraines (fig. 8) have a high clay content and a scarcity of pebbles and coarser fragments. The study of the split-spoon samples from a test boring in the "West Chicago end moraine northeast of Naperville shows the character of the clayey tills (DUP 38N10E-5.6d; Appendix B). The till which forms most of the West Chicago end moraine contains abundant quantities of sand and gravel and is closely associated with water-laid materials northwest of West Chicago. The description of some of the drill cuttings of a well near West Chicago shows the coarse-textured material which frequently occurs in this till (DUP 39N9E-3.1h; Appendix B).

A coarse-textured glacial drift occurs widely under the Valparaiso drift in southeastern DuPage County. It closely resembles the Lemont drift, which is a complex of silty till and water-laid silt, gravel, and sand occurring beneath Valparaiso drift throughout much of the upland area bordering the Des Plaines Valley (Horberg and Potter, 1955, p. 9 and 17). A study of split-spoon samples from a test boring shows the nature of occurrence and character of this coarse-textured glacial drift (DUP 39N11E-28.6e; Appendix B).

*Glaciofluvial deposits* consist of material deposited by glacial melt-waters and exhibit a distinct sorting of constituent particles. These deposits may range from clay to gravel and frequently show sharp changes in texture. Types of glaciofluvial deposits which occur locally on land surfaces in DuPage County are kames, kame terraces, and eskers. More widespread deposits of glaciofluvial materials are found in the form of valley-train along the major drainages and as outwash-plain bordering the West Chicago end moraine (fig. 8). Glaciofluvial deposits commonly are interbedded with till and are represented by extensive buried sheets of outwash sand and gravel. Glaciofluvial deposits frequently are lenticular, discontinuous, and erratic in nature. Where the end moraines contain large quantities of coarse-textured glaciofluvial material they have a rough, irregular topography. The prominent topographic expression of the West Chicago end moraine as compared with the others in the county reflects in part the coarseness of its composition. The nature of occurrence and character of the interbedded sands and gravels are shown in the study of split-spoon samples from a boring near the western boundary of the county (DUP 38N9E-6.2b; Appendix B).

*Glaciolacustrine deposits* in DuPage County consist chiefly of laminated silt and clay which were deposited in pro-glacial lakes. Coarser textured materials may have been deposited along the shorelines of the lakes. Laminated silts of glaciolacustrine origin mainly are found in the depressional areas of the Minooka ground moraine in the southwestern part of the county. The character of these laminated silts is shown in a study of split-spoon samples (DUP 38N9E-4.5c; Appendix B).

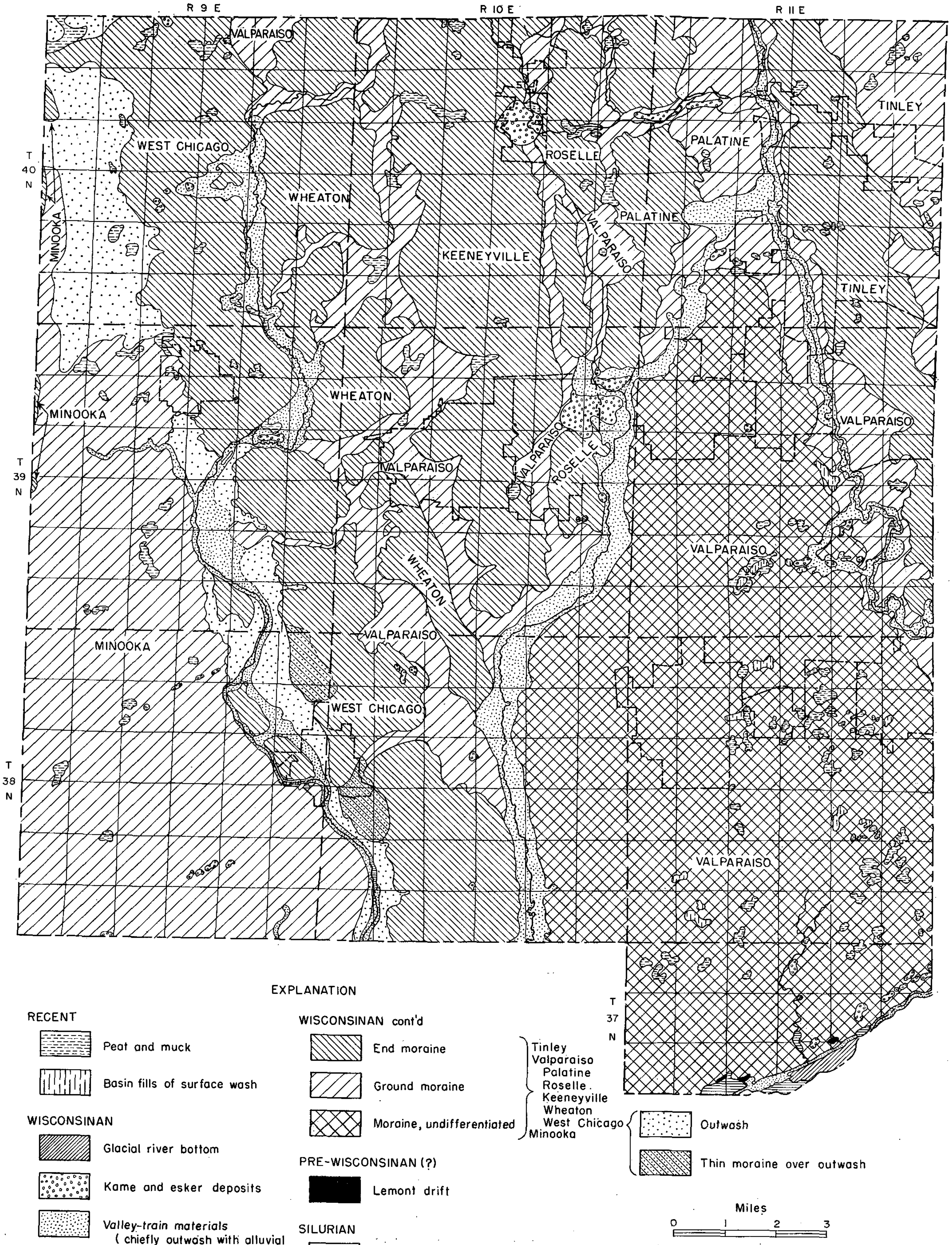



**Fig. 8. Surficial geology.**

### Recent Deposits

Peat and muck are being formed at the present time in many of the low basins in the poorly-drained morainal areas in the county. Surface wash is depositing silts and clays in the natural depressions. The rivers and streams are reworking the glacial deposits and are forming alluvial deposits.

The soils being developed from the unconsolidated materials in DuPage County are chiefly silt loams. The soil types mapped in DuPage County (Hopkins et al., 1917) have since been grouped on the basis of parent materials and surface color and included in a colored map of *Parent Material and Surface Color of Soils in Northeastern Illinois* prepared by the University of Illinois Agricultural Experiment Station, 1957. The soils included in each group on this map occur in close geographic association over relatively wide areas, were developed in similar parent material and under a cover of similar vegetation, have approximately the same number and sequence of horizons but differ in oxidation or drainage profile, and form in general a soil catena (Wascher et al., 1960, p. 92-93).

### Thickness

The unconsolidated deposits have a maximum thickness of slightly more than 200 feet (fig. 9). The deposits attaining a thickness generally greater than 100 feet occur in a zone extending from the north-central part of the county southward through Wheaton and Glen Ellyn and southeastward through Downers Grove and Argonne National Laboratory (figs. 9 and 2). Areas less than 50 feet thick occur for the most part in the southwestern part of the county, locally in the eastern tier of townships, and along the southern reaches of the East Branch of the DuPage River.

Areas of thicker unconsolidated deposits correspond with bedrock valleys (fig. 9 and pl. 1) and with areas of high land-surface topography formed by end moraines. Greatest thicknesses occur where end moraines lie over bedrock valleys such as in the north-central part of the county and in the vicinity of Clarendon Hills.

The unconsolidated deposits are generally thinner in the low areas between end moraines. The thinnest deposits are located where ground moraine occurs above high bedrock. This condition is common in the southwestern part of the county.

### History

The surficial materials of Pleistocene age and the subsurface relationships established by study of well cuttings and drillers' logs record a complex series of glacial events in DuPage County.

Evidence of pre-Illinoian or early Illinoian glacial activity has not been found in DuPage County. As the ice withdrew behind the crest of the Niagara Cuesta in late Illinoian time, ponding and slackwater deposition took place (Horberg and Potter, 1955, p. 18). The Lemont drift may represent the readvance of the late Illinoian (Horberg and Potter, 1955, p. 18) or early Wisconsinan (Frye and Willman, 1960, p. 6) ice up the backslope of the Niagara Cuesta. Horberg and Potter believe that the coarse texture of this drift represents incorporation of the water-laid deposits into the fluctuating ice front. Exposures of Lemont drift are limited to a few scattered localities along the Des Plaines Valley (fig. 8) but Lemont drift may occur beneath the surficial drift in much of the upland area in the southeastern part of the county. Discharge of the ponded meltwater, after the retreat of the ice which deposited the Lemont drift, cut across the bedrock divide and formed the Des Plaines Valley (Horberg and Potter, 1955, p. 19).

All the moraines in the county are of Woodfordian age. The Minooka Moraine differs from the earlier Marseilles Moraine chiefly by a notable change in alignment and seems to indicate a significant withdrawal and readvance of the ice (Prye and Willman, 1960, p. 8). Extensive deposits of outwash sands and gravels associated with the retreat of the earlier Marseilles ice were overridden by the Minooka and Valparaiso ice north of Elgin (Suter et al., 1959, p. 39). Some of these gravels may extend back beneath the Minooka and Valparaiso tills in DuPage County. Deposits of glaciolacustrine silts on Minooka ground moraine in the southwestern part of the county are evidence of ponding.

Minor fluctuations of the Valparaiso ice are recorded by the north-south-trending end moraines which cover all but the southeastern part of the county. The clayey Valparaiso tills may have been deposited as a thin cover over thick silty Lemont drift in the southeastern part of the county (Bretz, 1955, p. 106). It is here that the well-defined north-south Valparaiso end moraines become less distinct and apparently swing eastward. The complexity of the surface topography in this area may result in part from the configuration of the underlying Lemont drift (Bretz, 1955, p. 71). This complexity prevents differentiation of the Valparaiso end moraines in this area.

During the building of the most prominent of the Valparaiso end moraines, the "West Chicago end moraine, a fairly extensive outwash plain was deposited. West Chicago outwash occurs beyond the border of the West Chicago end moraine in much of the county and as a valley-train along the West Branch of the DuPage River. Local overriding of this deposit by the ice is shown northwest and southeast of Naperville where a

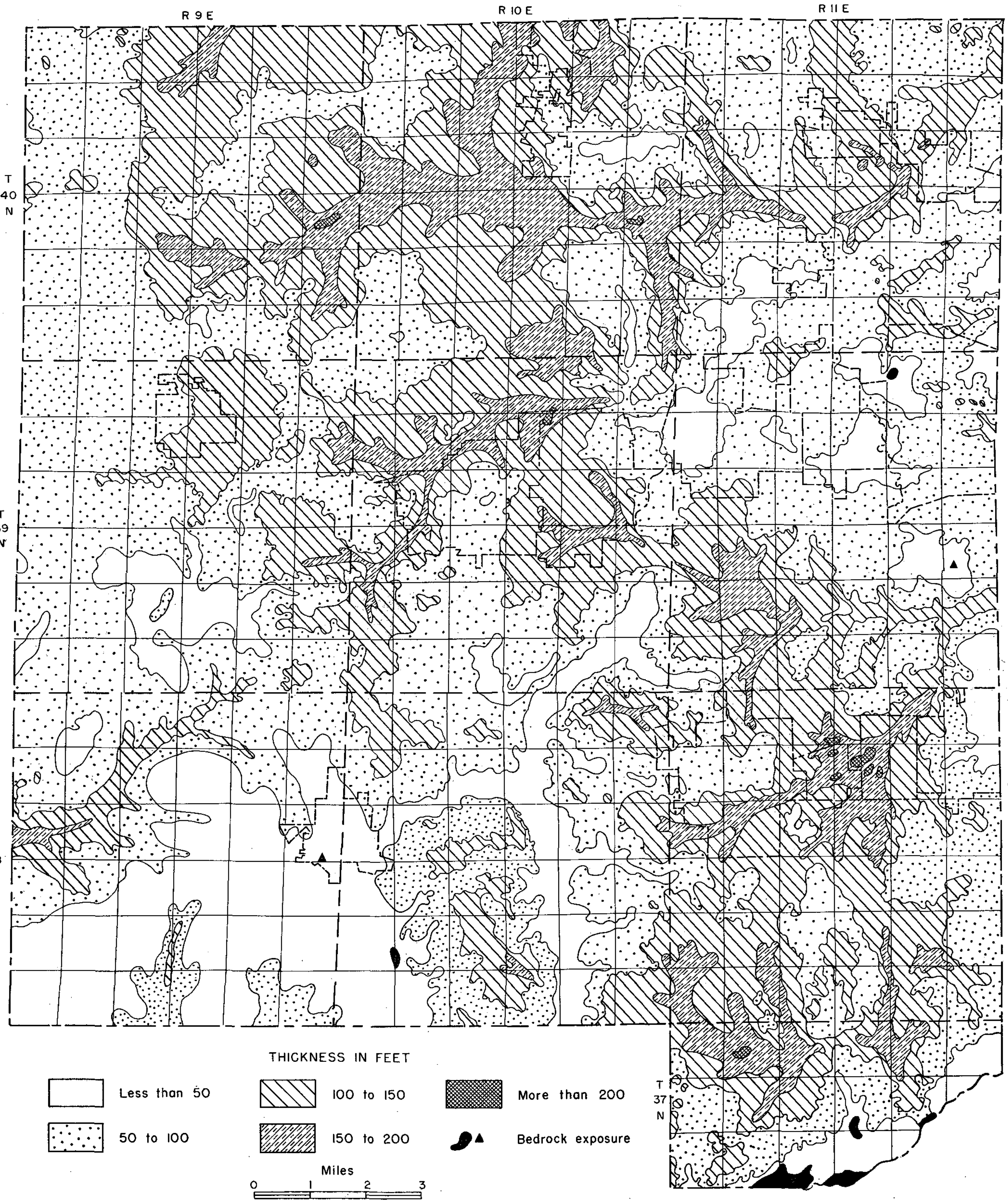



**Fig. 9. Thickness of unconsolidated deposits.**

thin cover of West Chicago till is found over West Chicago outwash (figs. 8 and 12 BB').

After building the narrow end moraines and depositing considerable quantities of outwash materials along what is now the Bast Branch of the DuPage River, the Valparaiso ice retreated from the county. Readvance of the ice up the backslope of the Valparaiso Moraine resulted in construction of the Tinley Moraine in the northeastern corner of the county. The Tinley end moraine is relatively slender and extends as a ridge parallel to the lake basin to the east. Withdrawal of the ice from the position of the Tinley end moraine initiated Glacial Lake Chicago and ended major glacial activity in DuPage County. The Des Plaines Valley, however, from time to time continued to act as an outlet for Glacial Lake Chicago.

## RELATIONSHIP OF GEOLOGY TO GROUND WATER

A large reservoir of ground water occurs in the saturated earth materials beneath the land surface in DuPage County. Variations in the lithologic character, distribution, and structure of the earth materials control the occurrence, source, movement, and availability of ground water. A sound and detailed knowledge of the geology is necessary for a basic understanding and interpretation of ground-water conditions.

Aquifers are lithologic units or combinations of such units that have an appreciably greater transmissivity than adjacent units and that store and transmit water that is recoverable in usable quantities. The aquifers in DuPage County consist of sand and gravel, sandstones, and creviced limestones and dolomites.

Geohydrologic units are geologic units which act hydraulically more or less as a distinct hydraulic system. On the basis of character and origin of the deposit, stratigraphic position, water-bearing properties, and use, six principal geohydrologic units are recognized in the earth materials beneath DuPage County. From top to bottom, these geohydrologic units are: 1) glacial drift aquifers, 2) Silurian dolomite aquifer, 3) confining beds of the Maquoketa Formation, 4) Cambrian-Ordovician aquifer, 5) confining beds of the Eau Claire Formation, and 6) the Mt. Simon aquifer. The glacial drift and Silurian dolomite aquifers are hydraulically separated from the Cambrian-Ordovician aquifer by the relatively impermeable shales of the Maquoketa Formation. The Cambrian-Ordovician aquifer is separated from the deeper Mt. Simon aquifer by the impermeable beds of the Eau Claire Formation.

### Glacial Drift Aquifers

The glacial drift aquifers are the saturated, relatively clean, coarse-textured deposits of sand and gravel which occur erratically throughout the glacial drift. The clayey tills within the county are commonly too fine-grained and poorly sorted to have sufficient permeability to be considered as aquifers. The silty tills that are often closely associated with coarse-textured material may be moderately permeable. Small lenses of sand and gravel in the till provide limited quantities of water to large-diameter dug wells.

Where deposits of sand and gravel are penetrated during the drilling of a well, they generally are by-passed in favor of completion in the underlying dolomite. Traditionally, this procedure has been followed because of the relative ease of well completion and development in the dolomite and because of the common belief that rock wells are more reliable and desirable. Wells drilled in the glacial sand and gravel aquifers, particularly in areas where thick deposits are available and where the underlying Silurian dolomite aquifer is limited in its yield, may produce greater yields of ground water of better quality and lower temperature than the bedrock aquifers.

The occurrence of glacial drift aquifers is extremely irregular, and their character and distribution range widely. The geology of the unconsolidated deposits provides a basis for the general determination and delineation of these aquifers, and small diameter test holes may be drilled to locate and evaluate the glacial drift aquifers more precisely.

Three categories of glacial drift aquifers are recognized in DuPage County on the basis of their mode of occurrence: 1) surficial, 2) interbedded, and 3) basal.

*Surficial glacial drift aquifers* occur just below land surface and are made up chiefly of relatively coarse-grained glacial outwash deposits (sand or larger). These deposits commonly are well sorted and have wide ranges and abrupt changes in grain size laterally and vertically. The changes in texture and sorting which characterize these materials cause inconsistencies in their water-yielding properties. Permeability is often high but varies widely with the coarser-textured, clean deposits of sand and gravel having the higher permeabilities.

Surficial deposits of coarse-textured sand and gravel which appear to be sufficiently thick and extensive for development as sources of ground water occur chiefly in the outwash materials concentrated as valley-train along the East Branch and West Branch of DuPage River and as an outwash plain in front of the West Chicago end moraine. The study of split-spoon samples from a test hole along the East Branch of DuPage

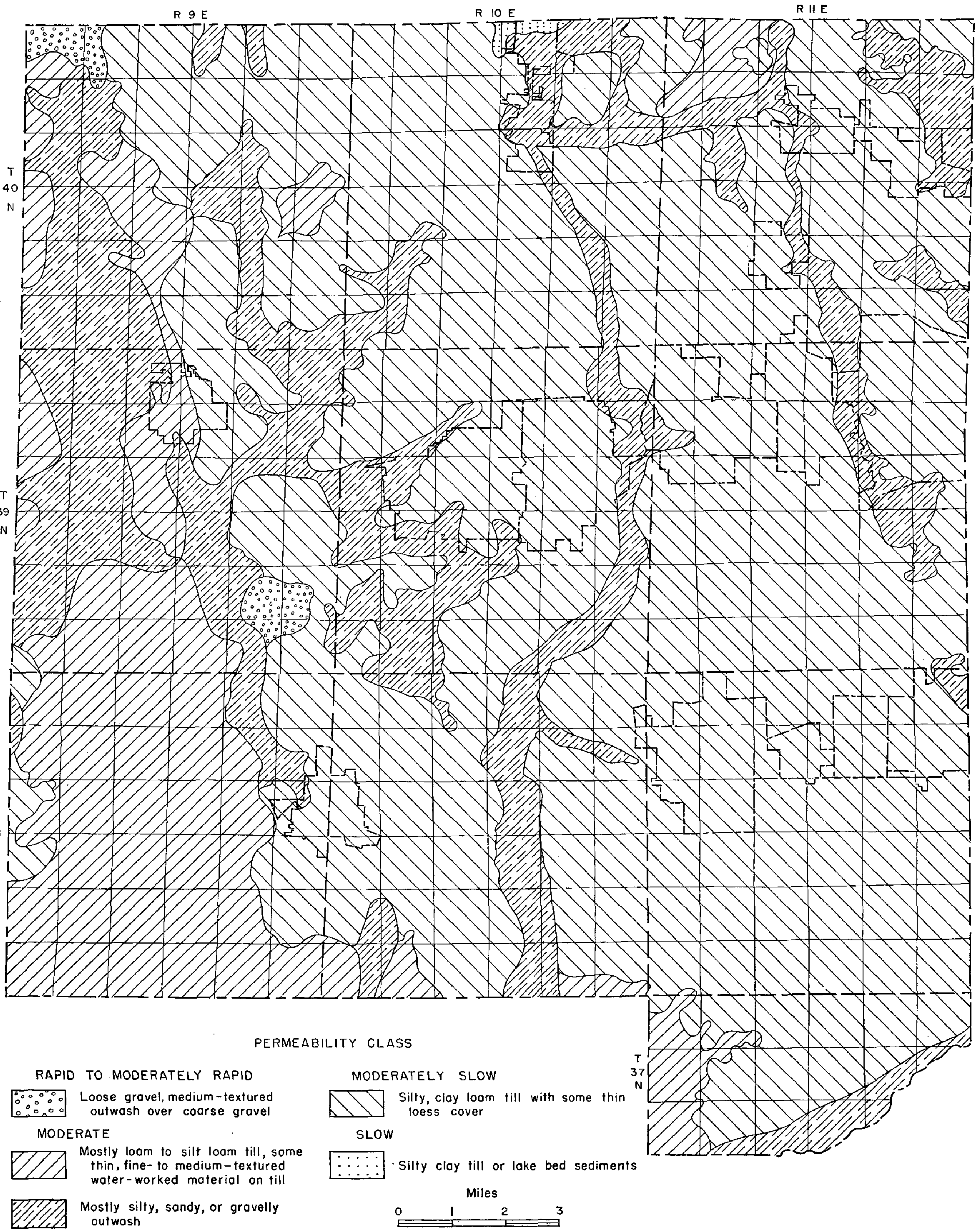



**Fig. 10. Permeability of soils and nature of soil substrata.**

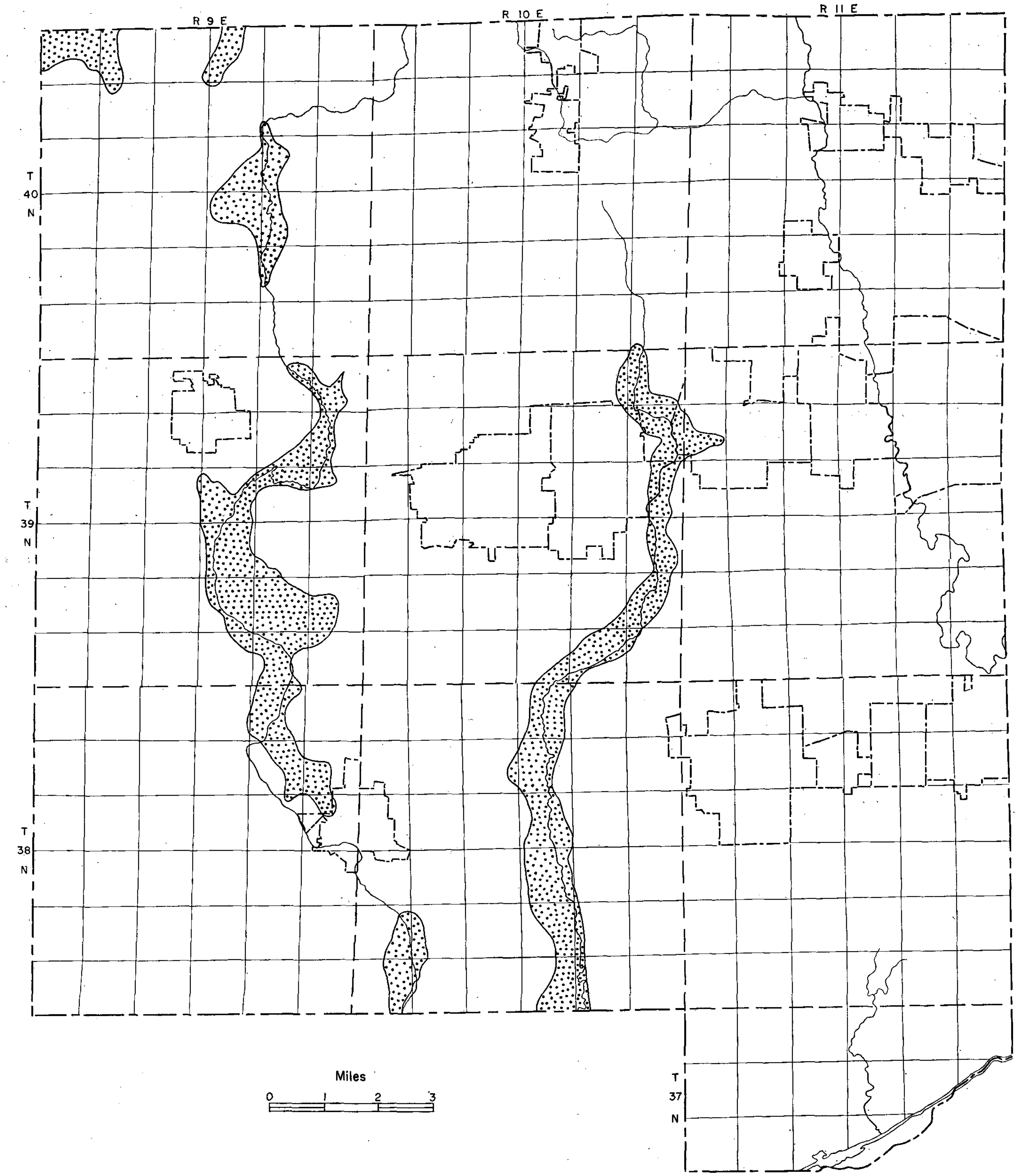



Fig. 11. Distribution of surficial glacial drift aquifers.

River shows the general character of these outwash materials (DUP 38N10E-3.2f; Appendix B).

A map of the permeability of soils and the nature of soil substrata (fig. 10) was constructed from the map of Parent Material and Surface Color of Soils in Northeastern Illinois prepared by the University of Illinois Agricultural Experiment Station (1957), and from data on permeability available in soil type descriptions published by the Department of Agronomy at the University of Illinois. The designation of permeability given to a soil type refers to the least permeable horizon in the soil profile and is based upon empirical data. In most instances, the least permeable horizon is the substrata (any material below the subsoil which is agriculturally significant).

Table 4 presents the rate of penetration of water under a one-inch head into a moist soil.

**Table 4. Rate of Penetration of Water into Soils by Permeability Class**

| *Permeability class* | | | | | | |
|---|---|---|---|---|---|---|
| Very slow | Slow | Moderately slow | Moderate | Moderately rapid | Rapid | Very rapid |
| *Hate of penetration, inches per hour* | | | | | | |
| Less than 0.05 | 0.05 to 0.2 | 0.2 to 0.8 | 0.8 to 2.5 | 2.5 to 5.0 | 5.0 to 10.0. | More than 10.0 |

Correlation of the maps of surficial geology (fig. 8) and permeability of soils and nature of substrata (fig. 10) with data obtained from studies of samples from test borings and from well and drillers' logs on the character and thickness of material provides the basis for delineation of surficial glacial drift aquifers favorable for development of moderate to large ground-water supplies (fig. 11).

*Interbedded glacial drift aquifers* are deposits of sand and gravel which occur either as sheet-like deposits or as lenticular and discontinuous deposits erratically distributed throughout the glacial drift. Commonly, they are separated from the surficial and basal glacial drift aquifers by deposits of glacial till. The general character of the sand and gravel deposits which make up these interbedded deposits is shown by the study of samples from well DUP 40N9E-33.1a (Appendix B).

Cross sections of the glacial deposits (fig. 12) based on sample studies and drillers' logs show that interbedded deposits of sand and gravel are numerous in the West Chicago and older end moraines but are limited in the younger end moraines to the east. The principal interbedded sand and gravel deposit in the western part of DuPage County is the extensive, fairly continuous West Chicago outwash (fig. 12 BB'). The deposits interbedded with the tills of the West Chicago and earlier end moraines are believed to represent extensive buried sheets of outwash deposits. The interbedded de-

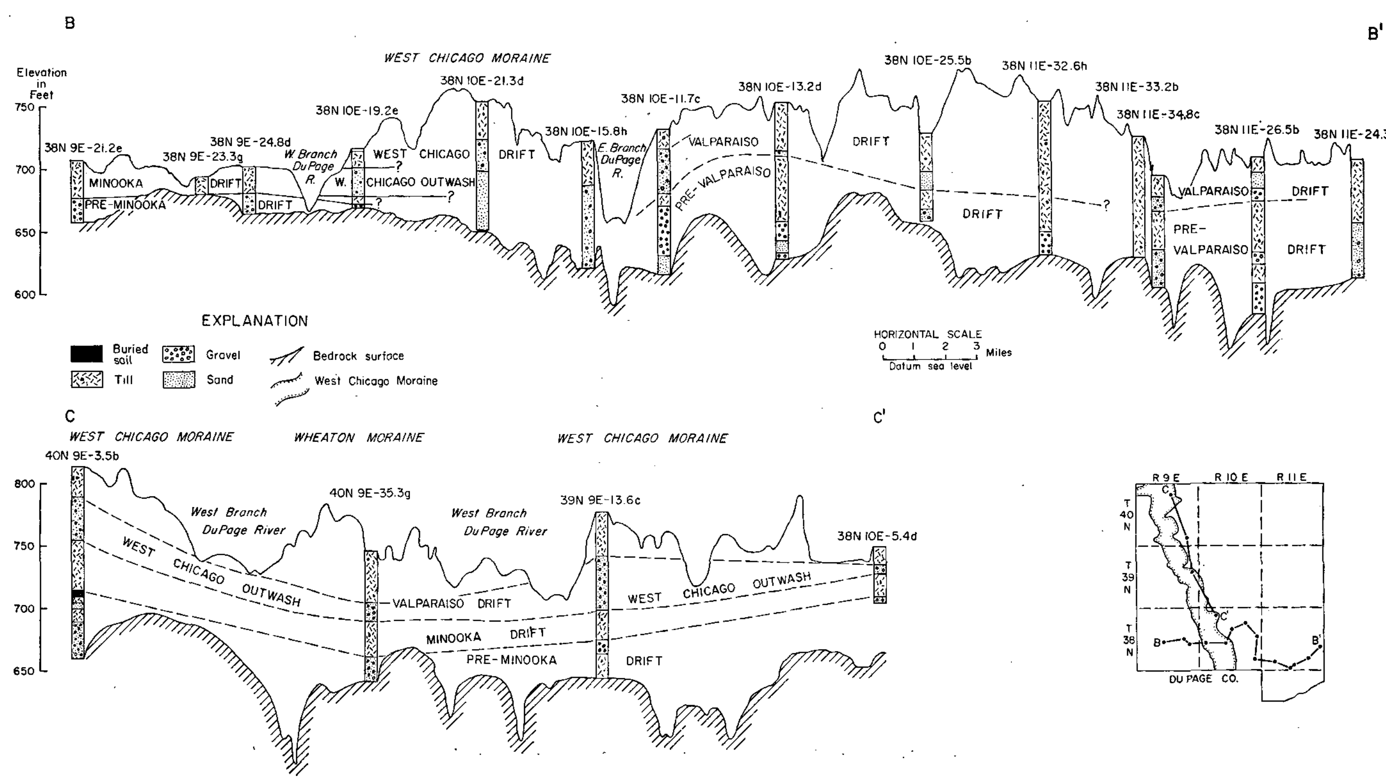



**Fig. 12. Cross sections of glacial deposits.**

posits of sand and gravel in the later drifts are more lenticular, discontinuous, and erratically distributed.

The scarcity of subsurface data prohibits detailed mapping of individual interbedded deposits of sand and gravel. The occurrence and distribution of these deposits are incorporated in the map of total thickness of sand and gravel in glacial drift, based upon moving averages (fig. 14).

*Basal glacial drift aquifers* are the sand and gravel deposits at the base of the glacial drift directly above the dolomite in DuPage County. These deposits are commonly coarse-grained and have relatively high permeabilities. A study of samples of drill cuttings from a water well shows the general character of the basal glacial drift aquifers (DUP 38N10E-12.2b; Appendix B).

The extreme ranges in the thickness of basal sand and gravel deposits which commonly occur within short distances, and the unequal distribution of well control make impractical the construction of a map of the thickness and distribution of the basal sand and gravel deposits. A map based upon moving averages (Pelletier, 1958, p. 1036) shows the general distribution of basal sand and gravel deposits in the county (fig. 13). In general, greater thicknesses of basal sand and gravel deposits occur in areas of thicker glacial drift (compare figs. 9 and 13). The basal sand and gravel deposits probably exceed 60 feet in thickness in the north-central part of the county.

Throughout much of Illinois concentration and greater thickness of sand and gravel often result from the channeling of glacial melt-waters in bedrock valleys.

The data in table 5 show that the percentage of wells which penetrate basal sand and gravel in DuPage County is slightly smaller in bedrock valleys than in bedrock uplands. Even though the average thickness of basal sand and gravel per penetrating well is slightly greater in bedrock valleys, no significant relationship is found between the occurrence and thickness of basal sand and gravel deposits and bedrock topography in the county.

**Table 5. Occurrence and Thickness of Basal Sand and Gravel**

| | Bedrock upland | Bedrock valley |
|---|---|---|
| Total number of wells | 328 | 407. |
| Number of wells which record basal sand and gravel | 256 | 299 |
| Percentage of wells which record basal sand and gravel | 78 | 73 |
| Total thickness in feet of basal sand and gravel deposits recorded by wells | 6933 | 9634 |
| Average thickness in feet of basal sand and gravel deposits per well | 27 | 32 |

DISTRIBUTION

The map of total thickness of sand and gravel deposits in glacial drift, based on moving averages (fig. 14) includes all sand and gravel deposits regardless of mode of occurrence and continuity. Total thickness of sand and gravel greater than 60 feet occurs in the north-central part of the county, the area of thicker glacial drift.

The distribution of glacial drift aquifers in DuPage County is shown in figure 15. Throughout most of the county these aquifers are scattered in occurrence, range from 20 to 40 feet in thickness, and vary widely in extent and permeability. Glacial drift aquifers which locally exceed 40 feet in thickness are concentrated in the north-central part of the county. Locally in the southwestern, southeastern, and eastern parts of the county, glacial drift aquifers are generally thin or absent.

The limitations of the geologic and hydrologic data permit only generalized interpretations of the character, occurrence, and distribution of the glacial drift aquifers. Additional data are necessary before the glacial drift aquifers in DuPage County can be better defined and their potential as sources of ground water more precisely evaluated.

## SILURIAN DOLOMITE AQUIFER

The Silurian dolomite aquifer is made up of the rocks of the Niagaran and Alexandrian Series of Silurian age. It occurs directly beneath the glacial drift throughout all of DuPage County with the exception of a narrow strip in the north-central part of the county where a deep bedrock valley has been cut through this dolomite into the Maquoketa Formation (fig. 7). Depths to the top of the Silurian dolomite aquifer vary widely within short distances and can be estimated generally from the map of thickness of the overlying unconsolidated deposits (fig. 9), or by use of the bedrock topography map and appropriate topographic maps (pl. 1). The configuration of the upper surface of the Silurian dolomite aquifer is shown by the map of bedrock topography at a contour interval of 20 feet (pl. 1). The thickness of the Silurian dolomite aquifer in the relatively unpopulated western half of the county ranges from 50 to 100 feet (fig. 16). It thickens to the east and southeast and is 150 to 200 feet thick in the southeastern part of the county. Thicknesses of greater than 200 feet occur in the Downers Grove-Hinsdale area where the Silurian dolomite aquifer is heavily developed for industrial and municipal supply. A maximum thickness of 252 feet is reported in the Clarendon Hills City Well No. 4 (DUP 38N11E-11.5d). Thicknesses of less than 50 feet are limited to the northwestern and south-

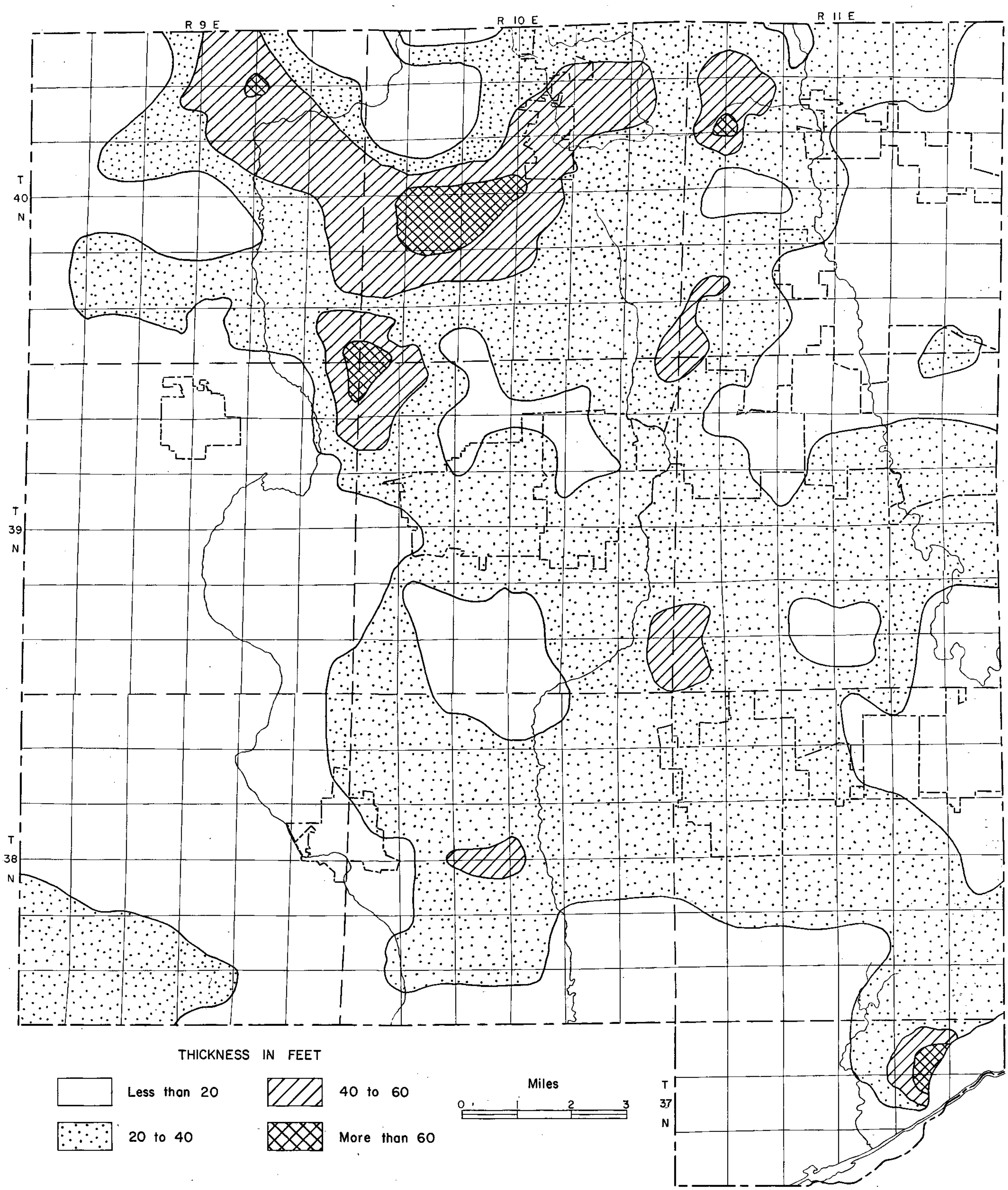



**Fig. 13. Thickness of basal sand and gravel deposits, based on moving averages.**

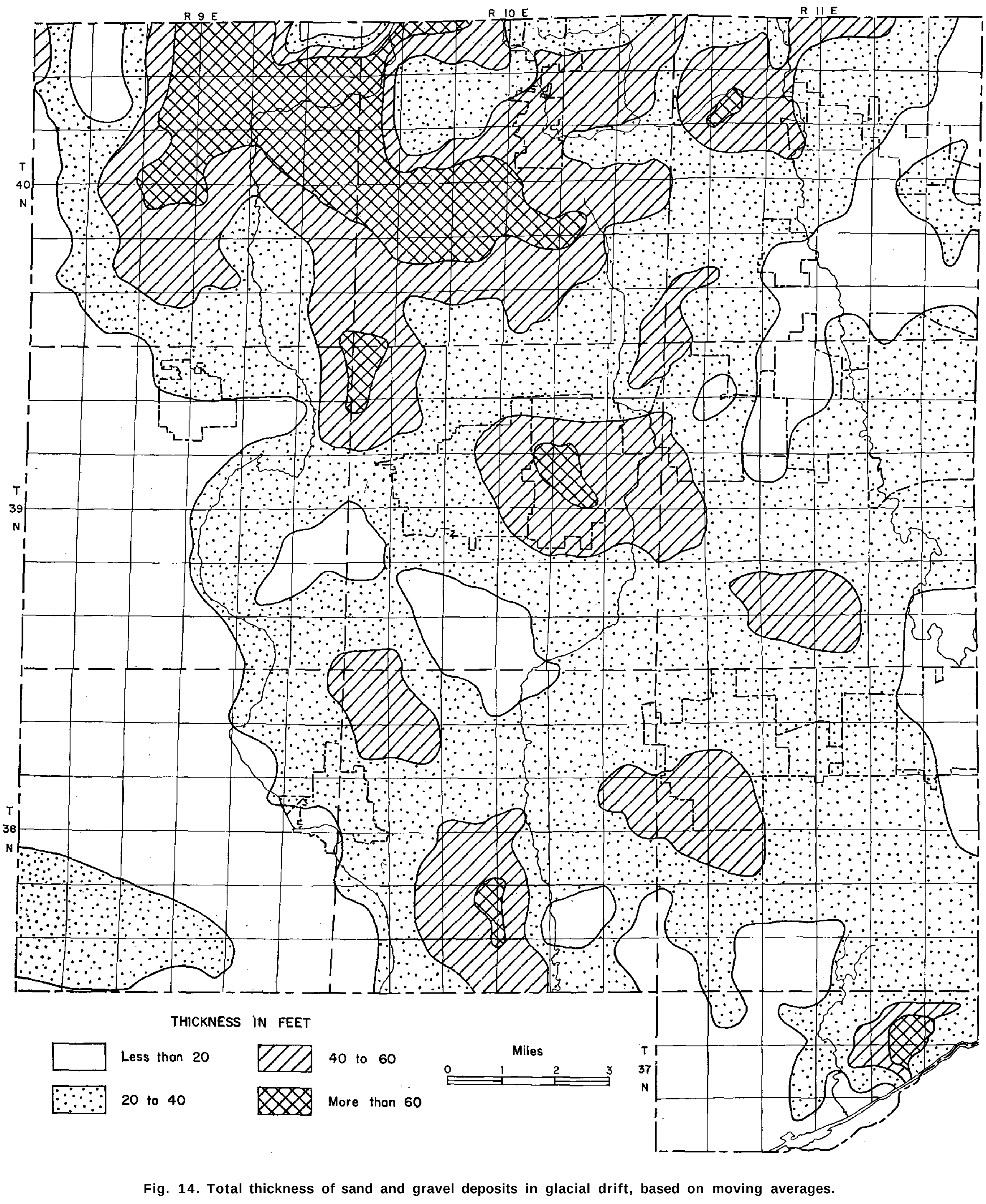



Fig. 14. Total thickness of sand and gravel deposits in glacial drift, based on moving averages.

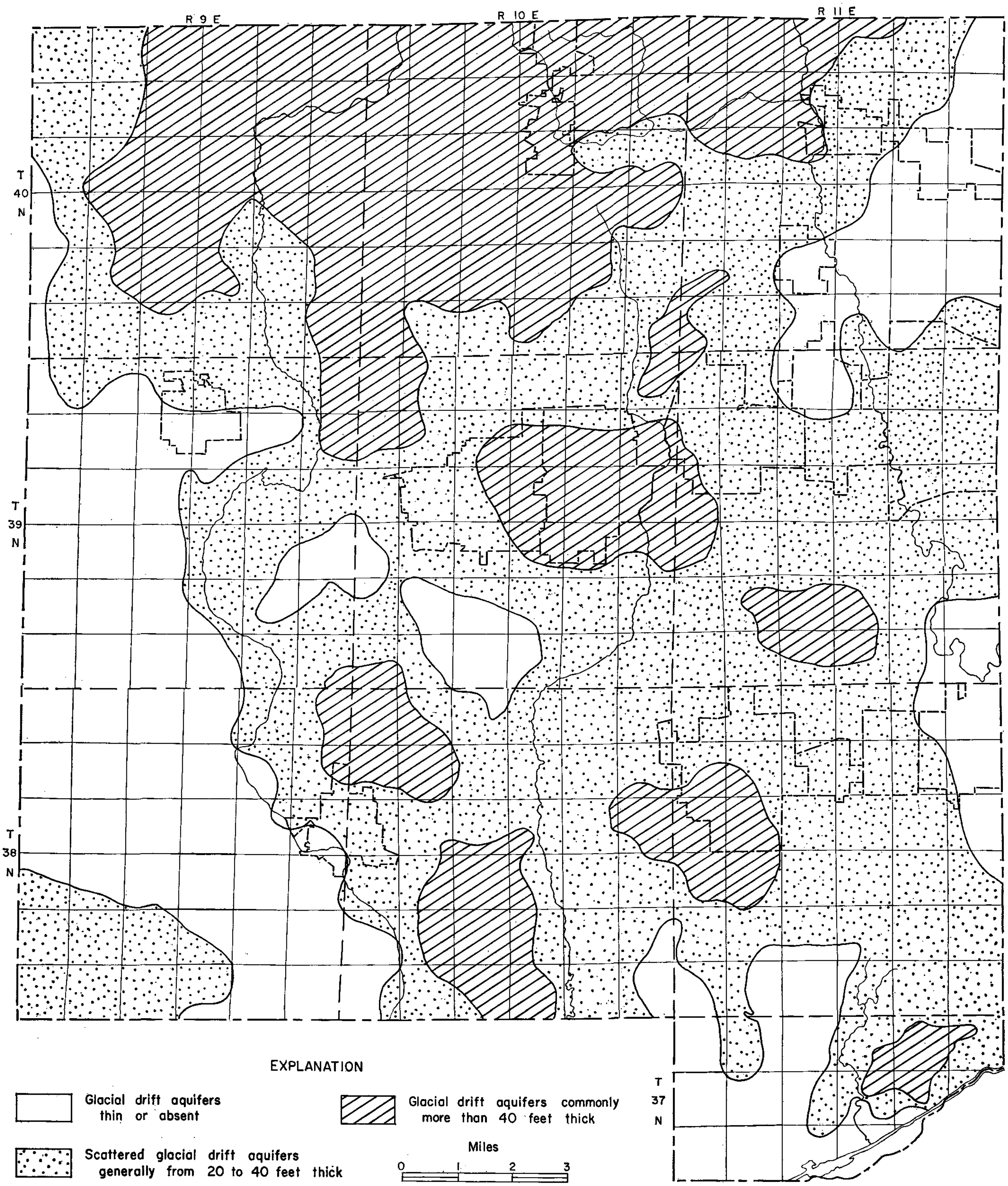



**Fig. 15. Distribution of glacial drift aquifers.**

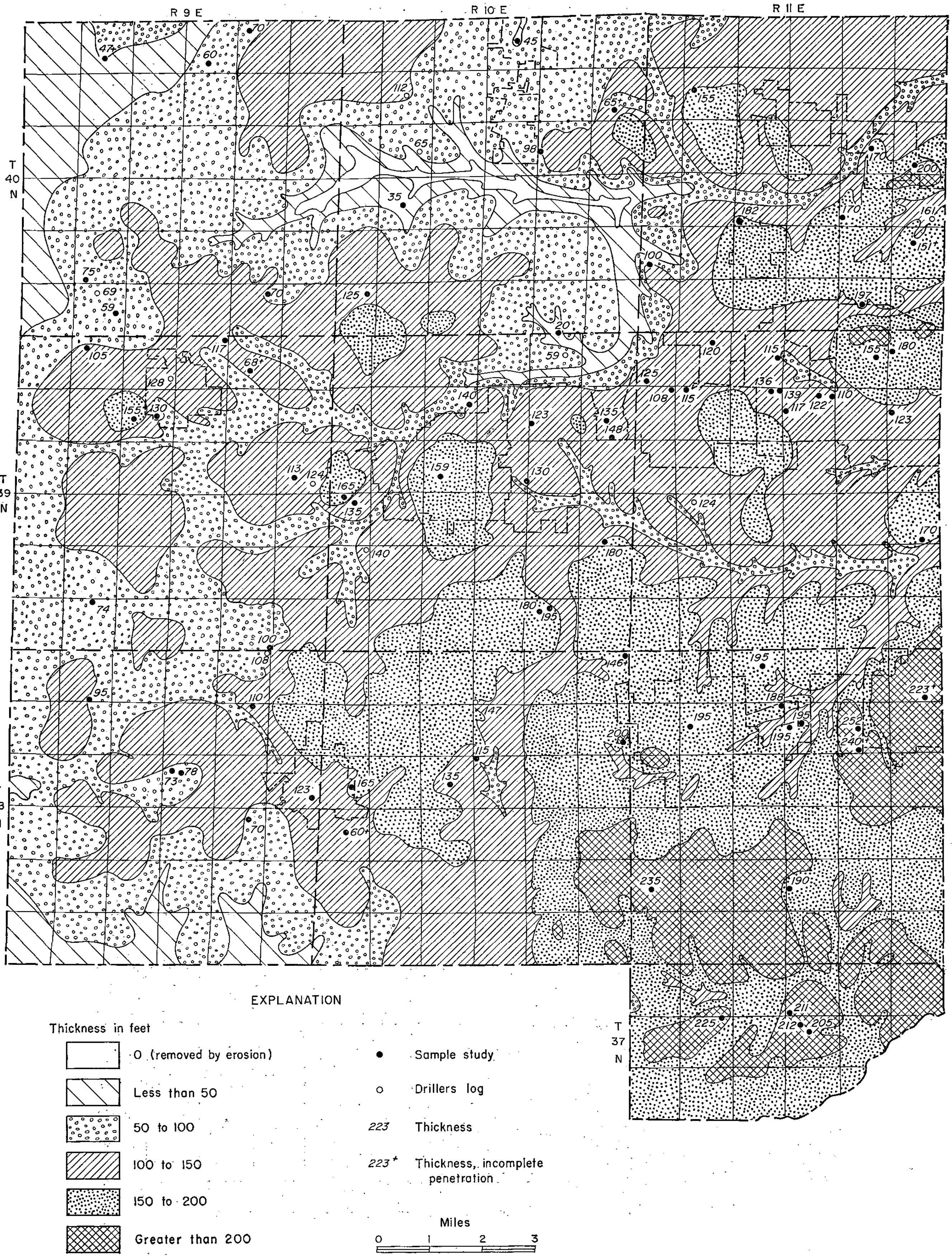



Fig. 16. Thickness of Silurian dolomite aquifer.

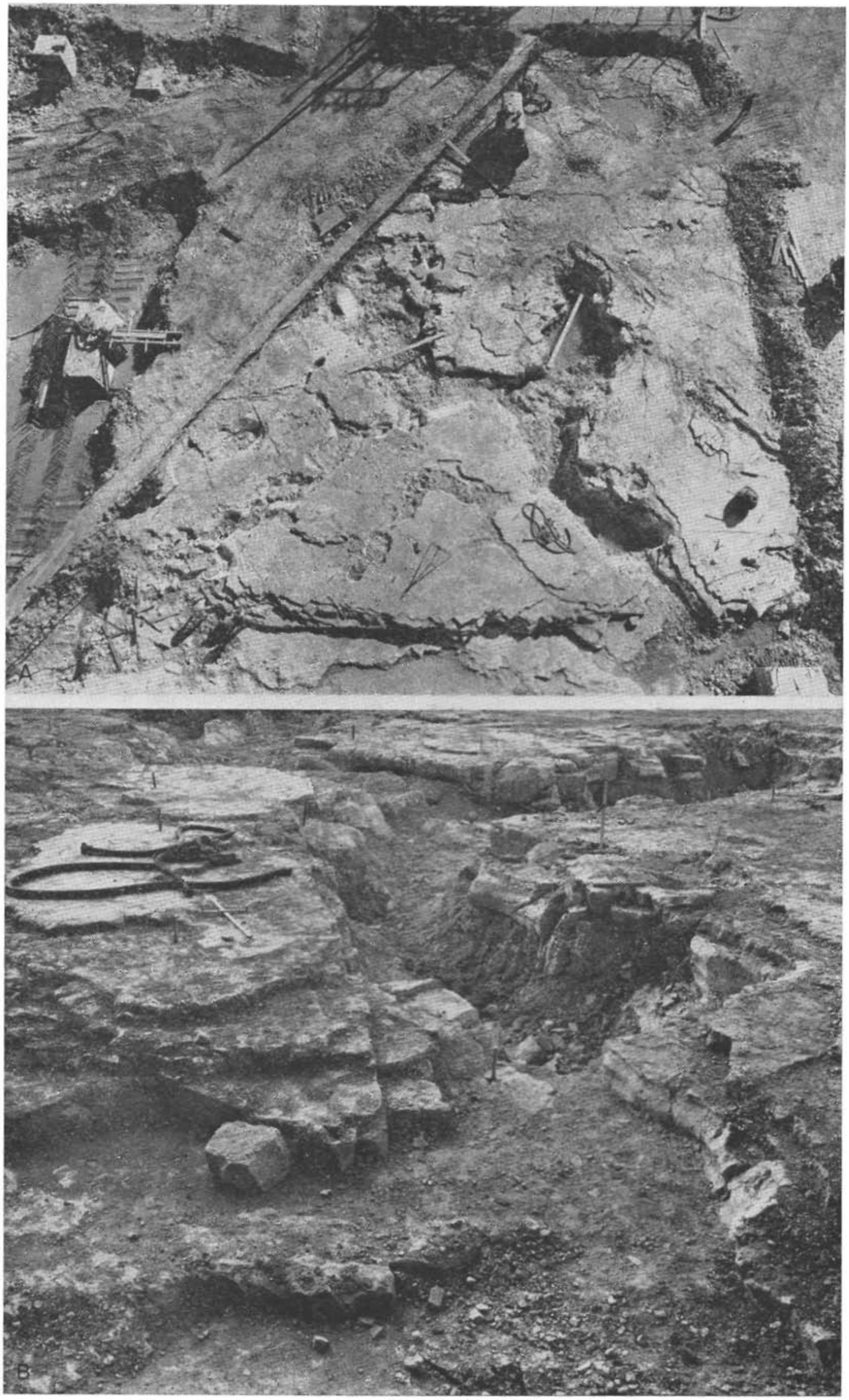


Fig. 17. Aerial and ground views of joint-controlled solution cavities in the Silurian dolomite aquifer (photographs courtesy of the Commonwealth Edison Company).

western part and along the bedrock valley in the north-central part of the county.

### Water-bearing Properties

Ground water in the Silurian dolomite aquifer is stored in openings in the dolomite and moves through a complex network of interconnected openings. Most of the openings in the dolomite are secondary in origin and were formed after the deposition and consolidation of the rocks. The influence of primary openings upon ground water in the Silurian dolomite aquifer is considered negligible. The most numerous types of secondary openings are joints and fractures which were produced in the dense and brittle dolomite by deformational forces and later enlarged by solution. The total void space represented by these features is, however, relatively small compared with the total volume of the rock.

Observations of the joints, fractures, and solution cavities in quarries, outcrops, and tunnels throughout the region provide an insight as to their character in the Silurian dolomite aquifer beneath the glacial drift in DuPage County. Many of the joints appear tight but many are fairly wide, and joints up to 12 inches in width have been measured locally (personal communication, Don U. Deere). No regularity of spacing of joints and fractures is obvious in the quarries and outcrops studied throughout the region. The density and distribution of joints and fractures in the Silurian dolomite aquifer in DuPage County cannot be determined quantitatively because of the glacial drift cover.

Enlargement of joints, fractures, and bedding planes by solution has taken place. Some openings enlarged by solution are filled with dense clay or shale; however, most do not contain fill material and are open to ground-water movement. At places, widening by solution occurs where joints and fractures intersect shale or shaly dolomite beds. Smaller horizontal solution openings exist along bedding planes particularly above shale or shaly zones.

In a few exposures in the region, exceptionally large joint-controlled cavities occur. The solution cavities illustrated in figure 17 were uncovered during excavation for foundation construction along the Des Plaines River near the southern border of DuPage County. Some of these clay-filled cavities reach 30 feet in width and extend to depths of 125 feet.

Exposures of the dolomite show that, in general, enlargement of the joints and fractures by weathering and solution has been greater in the upper part of the rock. Many of the openings narrow with depth and thin to fine cracks or disappear. Locally, the relatively impermeable shales of the Maquoketa Formation are the lower limit of solution enlargement. The zone of solution-enlarged openings in the upper part of the Silurian dolomite aquifer is thought to be related to a zone of increased solution near a fluctuating water table when the dolomite was at land surface in the geologic past. Solution enlargement probably was facilitated by the higher concentrations of carbon dioxide and organic acids contained in the percolating water.

The upper part of the Silurian dolomite aquifer is believed to be a zone of relatively high permeability and a major water-yielding interval. Many drillers in DuPage County report that the upper part of the dolomite is a reliable water-yielding zone and that it is the most productive part of the aquifer. The reliability of this zone is also indicated by plotting number of wells versus depth of penetration into the dolomite for 655 wells drilled in DuPage County (fig. 18). This figure shows that 78 percent of the wells are completed in the upper 60 feet of the dolomite. The greatest number, 221, penetrate only 20 to 40 feet into the rock.

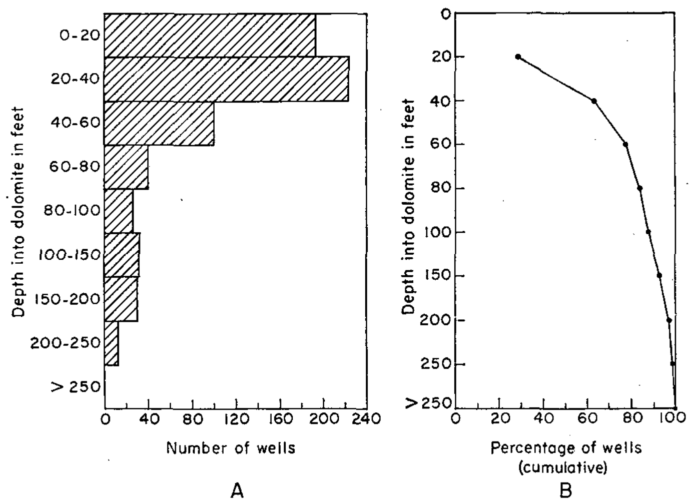



**Fig. 18. Number (A) and cumulative percentage (B) of wells versus depth of penetration into Silurian dolomite aquifer.**

An analysis of temperature and flow-velocity logs obtained from 10 selected wells shows a significant water-yielding zone in the upper part of the Silurian dolomite aquifer and some additional zones at greater depths. When correlated with information obtained from well drillers on depths to probable crevice and water-yielding zones and study of samples of the drill cuttings, fairly reliable determinations of the location of permeable zones in the Silurian dolomite aquifer were possible. Even though temperature and flow-velocity logs can be used to locate the water-yielding zones in wells, more refined techniques of geophysical logging are necessary to define these zones more precisely and to provide information on the type of openings in the dolomite. Additional geologic, geophysical, and hydrologic data likewise are necessary to evaluate more fully the water-yielding zone in the upper part of the Silurian dolomite aquifer.

The capacity of the Silurian dolomite aquifer to transmit ground water is influenced strongly by the size, number, and interconnection of the joints, fractures, and solution cavities. Extensive development and interconnection of these openings are indicated by the reliability of the dolomite as a source of ground water, by the high yields of wells drilled into the dolomite, and by the relatively uniform piezometric surface of the water in the dolomite. The effect of pumping wells upon water levels in observation wells at considerable distances also indicates a widely interconnected network of openings in the Silurian dolomite aquifer.

With unlimited recharge, the quantity of water which can be produced from a well depends chiefly upon the number and size of the water-yielding openings intersected during drilling of the well. The probability that a well may penetrate the Silurian dolomite aquifer completely without hitting any openings always exists, and some element of chance is always involved in the search for water. However, few "dry" holes have been reported in DuPage County and this supports the opinion that joints and fractures are open, abundant, and interconnected.

The frequency analysis of specific capacities of wells versus deepest stratigraphic unit reached by the wells (p. 59-60) shows that basic differences in productivity occur between the rocks of the Niagaran Series, the Alexandrian Series, and the Maquoketa Formation where these units overlie each other. Unfortunately, little data are available where the Alexandrian Series or the Maquoketa Formation occurs directly below the glacial drift; therefore, the water-yielding character of either of these as a separate unit is difficult to evaluate.

On the basis of the frequency analysis, two distinct aquifer units are recognized within the Silurian dolomite aquifer in DuPage County: 1) the Niagaran aquifer, and 2) the Alexandrian aquifer. The weathered zone with solution-enlarged openings in the upper part of the dolomite is developed in both of these units where they directly underlie the glacial drift.

### NIAGARAN AQUIFER

The Niagaran aquifer consists of the rocks of the Niagaran Series of Silurian age and forms most of the bedrock surface in DuPage County. This aquifer reaches a maximum thickness of 175 feet in the southeastern part of the county (fig. 19). Thicknesses of 100 to 150 feet are common throughout much of the eastern one-third of the county. The Niagaran aquifer thins rapidly to less than 50 feet in most of the western one-third of the county and has been removed completely by erosion in the southwestern part and along the major bedrock valley in north-central DuPage County.

The Niagaran aquifer is the most heavily developed part of the Silurian dolomite aquifer, and most wells terminate in these rocks. Lithologic and structural changes in the Niagaran aquifer cause a lack of uniformity in its water-bearing properties.

The weathered zone with solution-enlarged openings in the upper part of the Silurian dolomite aquifer is most extensively developed in the dolomite of the Niagaran aquifer because of the widespread occurrence of this aquifer at the bedrock surface throughout most of the county. On the basis of the geologic evidence, this zone with solution-enlarged openings is believed to be a zone of relatively high permeability within the aquifer that influences well yields considerably. Available well production data are inadequate to establish quantitatively the effect of this zone upon well yields in the Niagaran aquifer.

Major lithologic and structural changes in the character of the Niagaran aquifer are associated with reefs. Reef cores are made of relatively clean dolomite, and steep dips are present in the flanking beds. Statistical analysis of well yields versus thickness of reef penetrated by a well suggests that well yields are related to thickness of reef-bearing strata penetrated (see Statistical Analysis of Geologic Controls, p. 41). In order to establish more firmly the relationship of reefs to well yields, the distribution of reefs in the Niagaran aquifer must be known. The presence of dolomitized reefs in the dolomite of the Niagaran aquifer is difficult to determine by commonly used methods of subsurface investigation but can be inferred from studies of samples of well cuttings. Examination of a series of gravity profiles run above the reef at Thornton reveals the presence of a negative gravity anomaly and suggests that detailed gravity surveys may be used to locate and delineate these reefs (personal communication, L. D. McGinnis).

#### *Basal Unit*

The shaly basal beds of the Niagaran Series form a distinct unit within the Niagaran aquifer where they retard recharge to the underlying aquifer and in these areas can be designated as the basal unit of the Niagaran aquifer. These basal beds are present throughout most of DuPage County with the exception of the southwestern part (fig. 20A). A maximum thickness of 35 feet occurs in the southeastern part (fig. 20B).

Hydrologic analysis of the West Chicago pumping cone shows that recharge to the Silurian dolomite aquifer in this area is restricted compared with other areas in the county. The lower recharge rate may have resulted from the limiting effect of the shaly basal beds

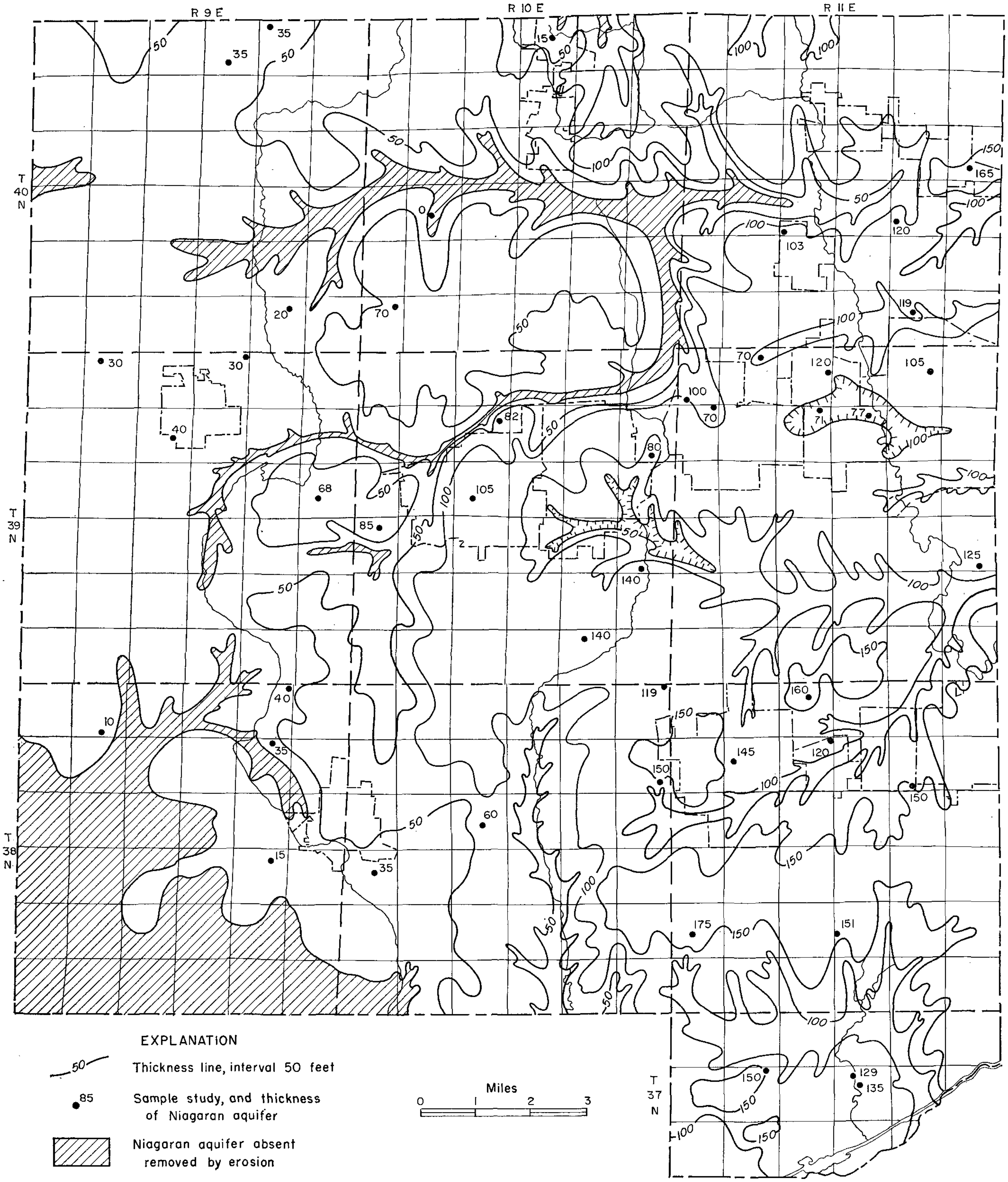



**Fig. 19. Thickness of Niagaran aquifer.**

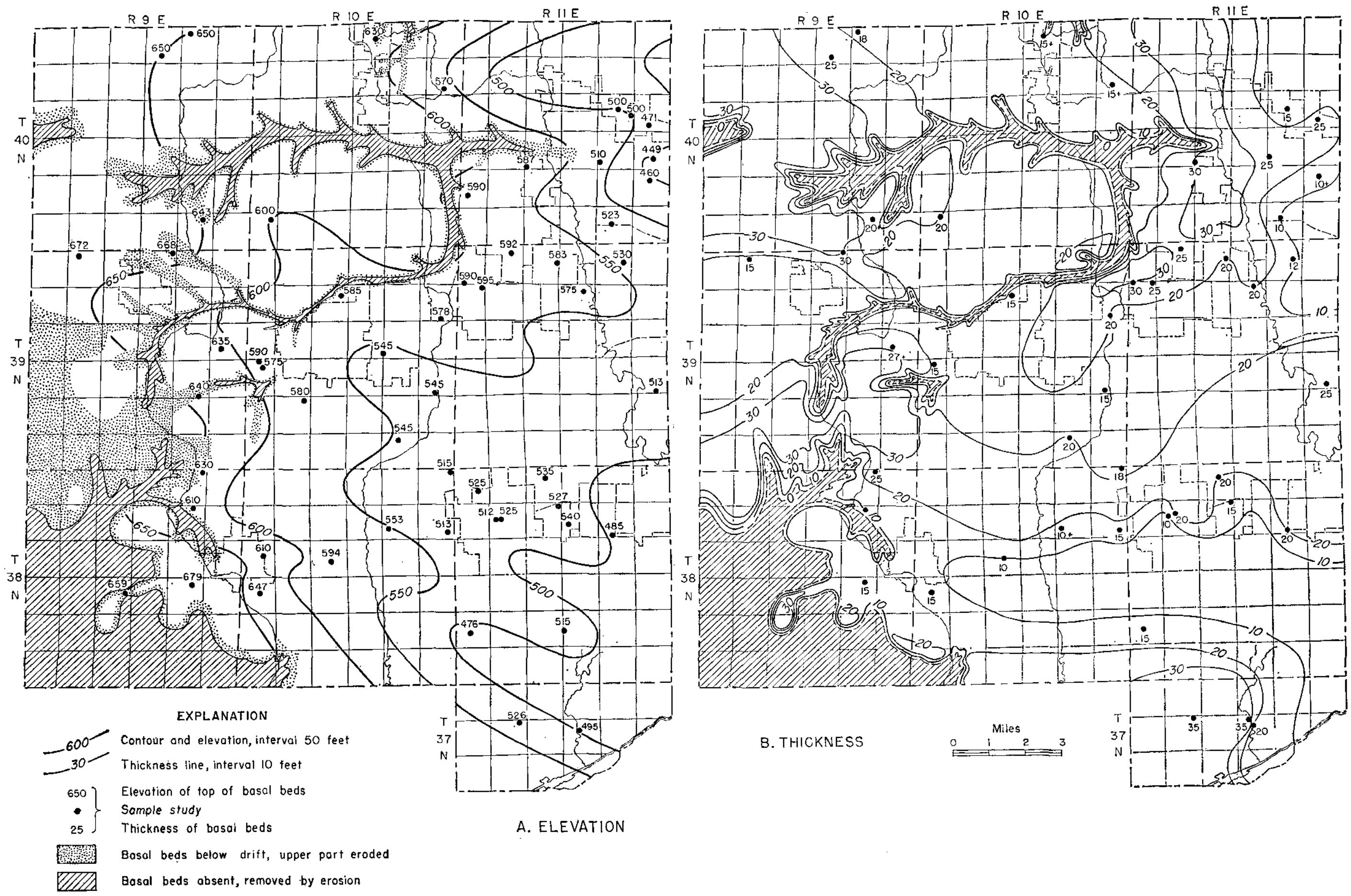



**Fig. 20. Top elevation (A) and thickness (B) of the basal beds of the Niagaran Series.**

of the Niagaran Series upon the development of a zone with solution-enlarged (hence permeable) openings in the upper part of the dolomite in the past. In the area encompassed by the West Chicago pumping cone, therefore, and in areas in the county where geohydrologic conditions are similar, the basal beds of the Niagaran Series may act hydraulically as a distinct unit (the basal unit of the Niagaran aquifer) and may retard recharge to the underlying aquifer. Data necessary to establish the geohydrologic character of the basal beds of the Niagaran Series and their hydraulic influence in the Silurian dolomite aquifer are not available throughout most of the county.

### Alexandrian Aquifer

The Alexandrian aquifer includes all the rocks of the Alexandrian Series of Silurian age and is present in most of DuPage County (fig. 21A). The Alexandrian aquifer directly underlies the Niagaran aquifer throughout most of the county, and many of the wells withdraw ground water from both of these units. In the southwestern part of the county, however, the Alexandrian aquifer constitutes the entire thickness of the Silurian dolomite aquifer.

The thickness of the Alexandrian aquifer, as reported in 49 wells, averages 57 feet and reaches a maximum of about 90 feet locally in the county (fig. 21B). Thicknesses in excess of 80 feet occur locally in the eastern third of the county where the Alexandrian aquifer is overlain by thick dolomite of the Niagaran aquifer. Fortunately, however, greater thicknesses of the Alexandrian aquifer also occur southwest of West Chicago where the overlying Niagaran aquifer is very thin. The importance of the Alexandrian aquifer perhaps is greatest in southwestern DuPage County where it is the only unit of the Silurian dolomite aquifer available for development. This area is now one of the least populated parts of the county and present development of the Alexandrian aquifer as a source of ground water is limited.

### Statistical Analysis of Geologic Controls

Analysis of the complex system of geologic variables, such as the lithologic, structural, and topographic char-

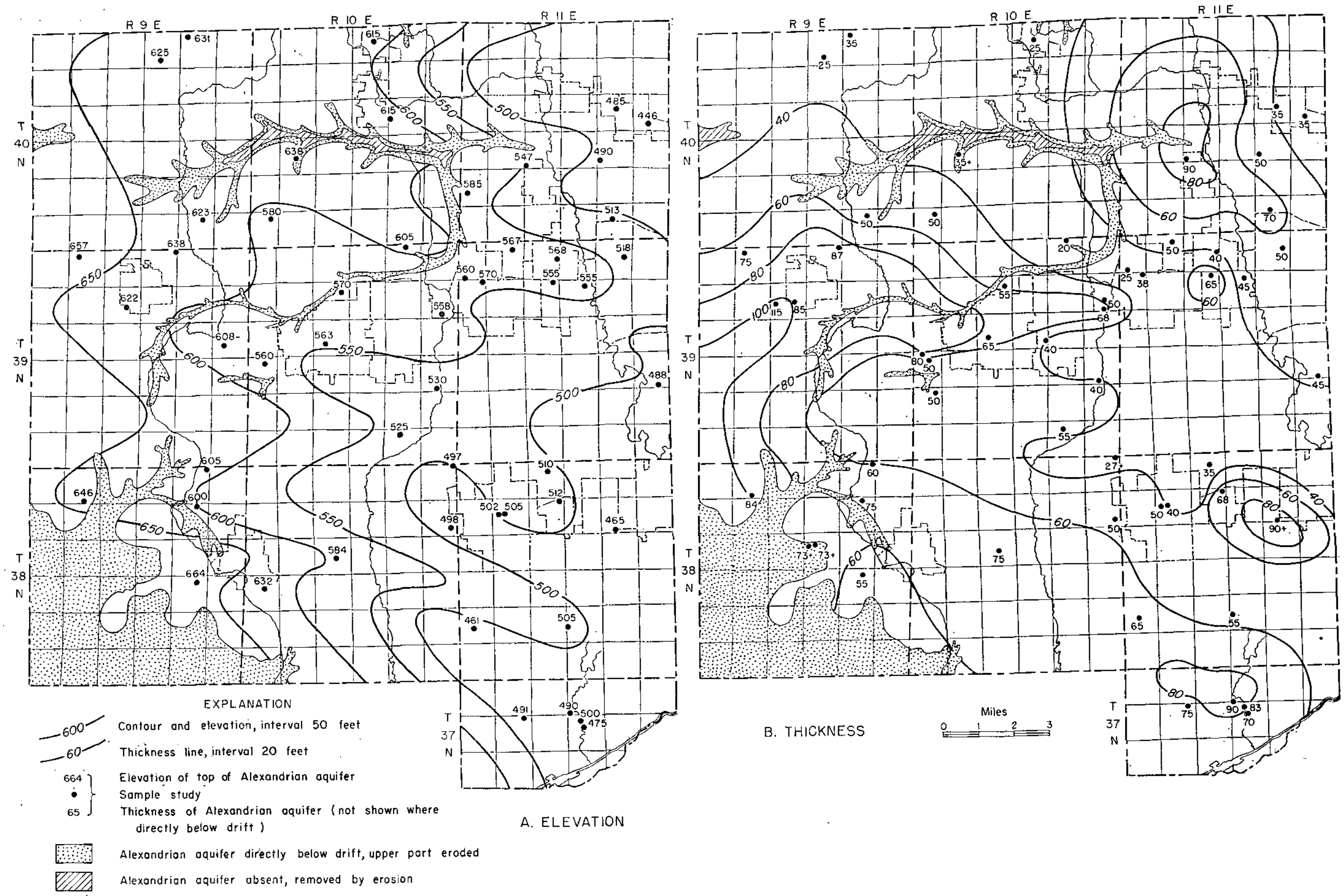



**Fig. 21. Top elevation (A) and thickness (B) of the Alexandrian aquifer.**

acter of the Silurian dolomite aquifer and its relationship to well yields, was made by a quantitative method of statistical analysis. Selection of the geologic factors analyzed was based upon their surmised relationships to ground-water production, which resulted from the study of the aquifer in DuPage County, and upon established or suggested relationships to ground-water or petroleum production in other carbonate terranes throughout the country. The probable influence of the character of the immediately overlying unconsolidated material upon well yields in the Silurian dolomite aquifer was also evaluated because of the local hydraulic interconnection of the dolomite and glacial drift.

Correlation and regression analyses (Snedecor, 1950) were made, with assistance from the University of Illinois automatic electronic digital computer, to determine if significant relationships exist between the specific capacities of wells and several geologic controls. Wells were grouped into the 13 categories in table 6. The specific capacities of wells in each category, expressed in six forms, were studied in relation to the seven geologic controls in table 6.

Simple linear correlation coefficients were computed for well categories 1 and 3 versus geologic controls *1, 2, 3, 4,* and *7.* Specific capacity in this case was expressed in forms *a, b, c,* and *d.* The same procedure was followed for well category 2 with one exception: geologic control *5* was included. For well categories 4 through 12, the correlations were computed for specific capacity forms *a* through *f* versus the seven geologic controls with two exceptions: control *7* was not applicable in well categories 4 and 5. In the case of well category 13, the correlations were determined for specific capacity forms *a* and *b* versus the thickness of reef penetrated by wells.

The simple correlation analyses provided a total of 432 separate linear correlation coefficients for well categories and geologic controls. The "variance-ratio" test described by Snedecor (1950) was used to establish the probability level of significance for these relationships. Standard deviations of specific capacities were compared with corresponding standard errors of estimate. Differences in these two standards were expressed as a percent of the standard deviation to provide a measure of practical significance of relationships.

**Table 6. Well Categories, Geologic Controls, and Specific Capacity Forms**

Well categories

1 The deepest unit penetrated by the well is the Niagaran
2 The deepest unit penetrated by the well is the Alexandrian
3 The well terminates above the. basal beds of the Niagaran Series
4 The glacial deposits penetrated by the well immediately above bedrock are predominately tight till
5 The glacial deposits penetrated by the well immediately above bedrock are predominately loose till
6 The well is in a bedrock valley and anticline
7 The well is in a bedrock upland and syncline
8 The well is in a bedrock upland and anticline
9 The well is in a bedrock valley and syncline .
10 The glacial deposits penetrated by the well immediately above bedrock are predominately sand and gravel
11 The deepest unit penetrated by the well is the Maquoketa Formation
12 The well terminates below the basal beds of the Niagaran Series
13 Drilling-cuttings samples indicate well encountered a reef

Geologic controls

*1* Thickness of glacial drift at well site
*2* Thickness of units penetrated by well
*3* Thickness of Silurian age dolomite at well site
*4* Thickness of Niagaran unit penetrated by well
*5* Thickness of Alexandrian unit penetrated by well
*6* Thickness of Maquoketa Formation penetrated by well
*7* Thickness of basal sand and gravel deposits at well site

Specific capacity forms

*a* gpm/ft, adjusted
*b* gpm/ft, actual
c gpm/ft per foot of penetration, adjusted
*d* gpm/ft per foot of penetration, actual
*e* gpm/ft per foot of Silurian age dolomite penetration, adjusted
*f* gpm/ft per foot of Silurian age dolomite penetration, actual

A number of multiple correlation relationships were computed following the study of simple correlations. The geologic controls having the best correlation with well categories were used in the multiple relationships. The following multiple relationships were determined for well category 1 using: specific capacity form *a* versus geologic controls *2* and *3; 2* and *4 ; 3* and *4; 2, 3,* and *4;* specific capacity form *b* versus geologic controls *1* and *2; 1* and *3 ; 1* and *4*; *2* and *3; 2* and *4; 3* and *4; 1, 2,* and *3*; *1, 2,* and *4; 1, 3,* and *4; 2, 3,* and *4 ; 1, 2, 3,* and *4;* and specific capacity form *d* versus geologic controls *2* and *4.*

In the case of well category 2 each of the specific capacity forms *a, b, c,* and *d* were expressed in a multiple relationship with geologic controls *1* and 7. The multiple relationships were determined for well category 3 using specific capacity form *a* versus geologic controls *2* and *3;* and specific capacity form *b* versus geologic controls *1* and *2*; *1* and *3*; *2* and *3*; *1, 2,* and *7.*

Multiple correlations were computed for all possible combinations of two or three geologic controls *1, 2, 3, 4, 5,* and *6* with specific capacity forms *a* and *b* of well category 4. The same procedure was followed for specific capacity forms c and *d* using geologic controls *2, 3, 4, 5,* and *6,* and for specific capacity form / using geologic controls *2, 5,* and *6.* Multiple relationships for other well categories were not determined because the simple correlations were very low.

Variance-ratio tests of significance were performed to provide information for judging whether the multiple correlations were significantly better than the simple correlations. Standard errors of estimate for simple correlations were compared with standard errors of estimates for multiple correlations to provide a practical basis for accepting or rejecting statistically significant multiple correlations.

The "analysis of variance" technique described by Snedecor (1950) was employed to test for differences between the average specific capacities of well categories. This method terminates with a variance-ratio test of significance which provides a basis for judging whether differences in average specific capacity are statistically significant.

Statistical analysis indicates that significant correlations exist between specific capacities, adjusted and unadjusted, of wells and 1) the total thickness of Silurian age dolomite at well site, 2) thickness of Niagaran unit penetrated by a well, and 3) thickness of reef penetrated by a well. Of equal, if not greater, importance is the fact that many of the geologic factors selected do not have relationships with well yields that are statistically significant. The statistical analysis, therefore, has pointed out those geologic factors which should be rejected and those which should be subjected to further study.

The correlation between thickness of the dolomite of Silurian age at the well site and well yields is expectable and stresses the importance of the map of the thickness of the Silurian dolomite aquifer (fig. 16) in the exploration for water supplies in the county. The relationship between thickness of the Niagaran Series penetrated by a well and well yield accents the need for knowledge of the distribution (fig. 7) and thickness (fig. 19) of the Niagaran aquifer. The necessity for additional information on the effect of reefs upon well yields and the distribution of reefs within the Silurian dolomite aquifer is made evident by the correlation of thickness of reef penetrated by a well and well yield.

The statistical analysis of geologic factors influencing well yields in the Silurian dolomite aquifer and the investigation of the water-bearing properties of the dolomite reveal a highly complex aquifer system in which the effect of an array of geohydrologic variables must be evaluated. The methods of statistical analysis used in this study established significant relationships which, when used with a knowledge of the geohydrologic properties of the dolomite and the information obtained by hydrologic analysis, provide a basis for quantitative evaluation of the Silurian dolomite aquifer.

### Confining Beds of the Maquoketa Formation

The relatively impermeable shales of the Maquoketa Formation act as a partial barrier to the downward movement of ground water from the Silurian dolomite aquifer into the deeper Cambrian-Ordovician aquifer. Rocks of the Maquoketa Formation occur throughout the county. The upper surface of the Maquoketa Formation is an erosional surface of relatively high relief (fig. 22A) and depths to this surface are difficult to predict accurately. This marked relief causes thickness of the Maquoketa Formation to vary widely within short distances. Thickness of the Maquoketa Formation as determined from sample studies ranges from 85 to 227 feet and averages about 175 feet (fig. 22B).

The effectiveness of the Maquoketa Formation as a barrier depends mainly upon the general character, thickness, and distribution of the upper, middle, and lower units which are shown in generalized form in figure 23. The high proportion of shale in the basal unit indicates that this is the least permeable of the units. Ground water from the dolomite beds of the middle and upper units locally supplements the supply available from the dolomite of Silurian age.

The shales in the Maquoketa Formation frequently swell and cave, and commonly are cased in wells which are drilled to the deeper aquifers.

### Cambrian-Ordovician Aquifer

The Cambrian-Ordovician aquifer (Suter et al., 1959) includes, from the top down, the following geologic units: Galena, Decorah, and Platteville Dolomites, Glenwood Formation, St. Peter Sandstone, Prairie du Chien Series, Trempealeau Dolomite, Franconia Formation, Ironton Sandstone, and the Galesville Sandstone. These formations function as an interconnected hydraulic system and occur everywhere in DuPage County.

The Galena, Decorah, and Platteville Dolomites are considered in this report as one unit, the Galena-Platteville Dolomite. Small quantities of water are obtained from the joints, fractures, and solution cavities in the Galena-Platteville Dolomite. The casings of wells drilled to the deeper aquifers commonly are seated in the Galena-Platteville Dolomite.

The Glenwood Formation and St. Peter Sandstone, designated the Glenwood-St. Peter Sandstone, dip from

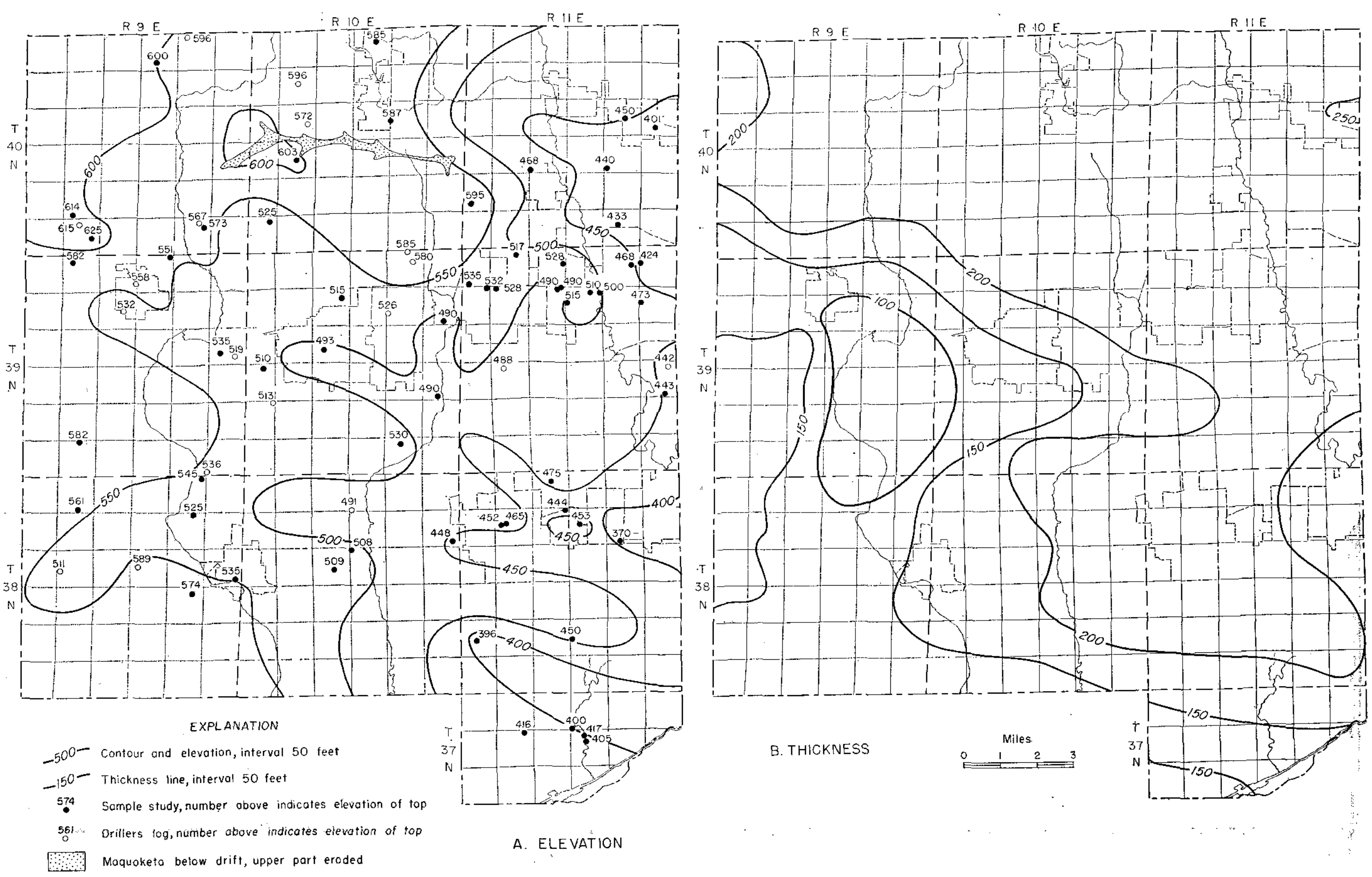



**Fig. 22. Top elevation (A) and thickness (B) of the Maquoketa Formation (thickness modified from fig. 26, Suter et al., 1959).**

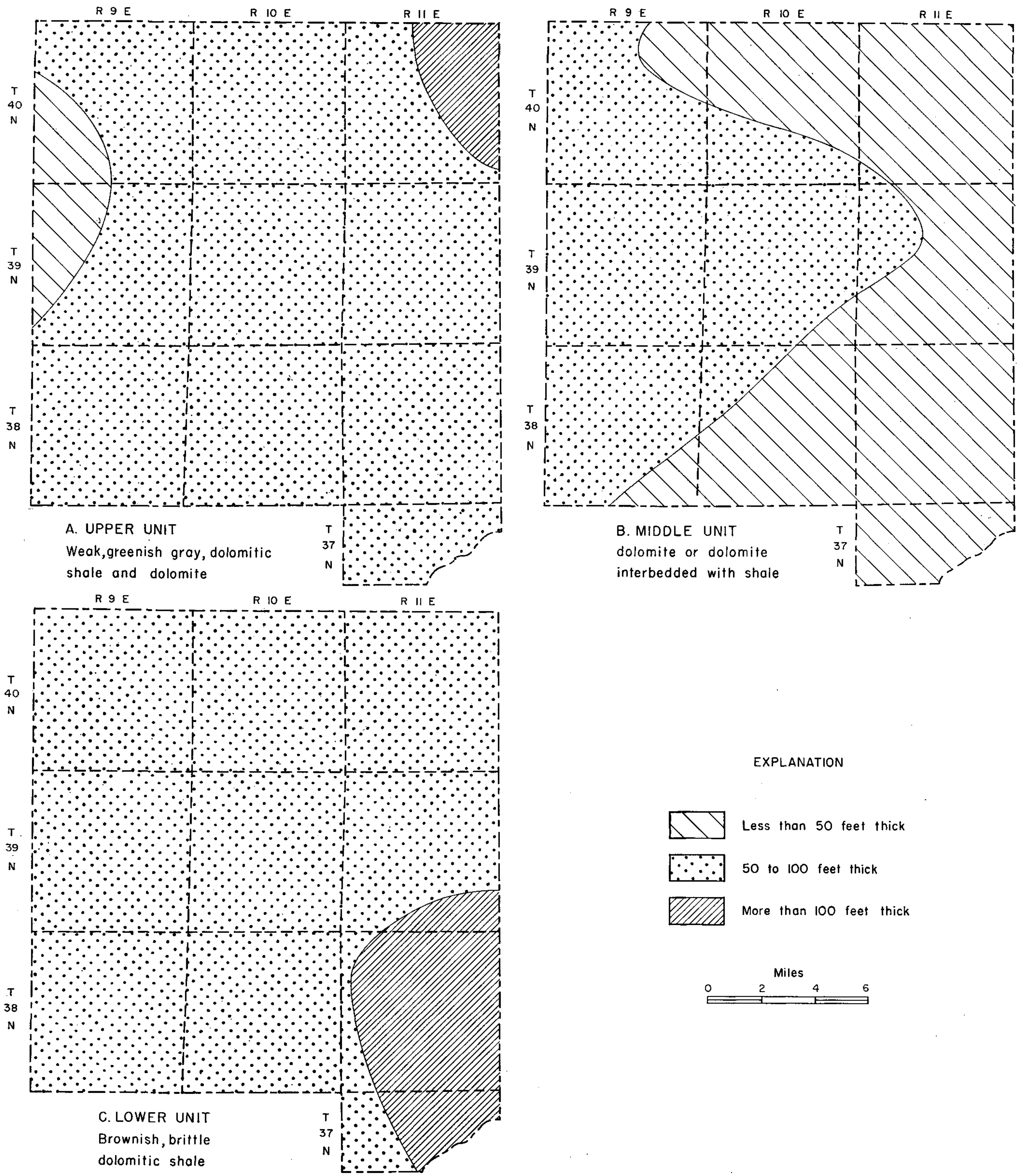



**Fig. 23. Lithologic character and thickness of the upper (A), middle (B), and lower (C) units of the Maquoketa Formation (modified from fig. 25, Surer et al., 1959).**

the northwest to the southeast at a rate of about 10 feet to the mile (fig. 24A). Reported thickness of the Glenwood-St. Peter Sandstone beneath DuPage County is commonly about 200 feet. Locally, however, as much as 450 feet of the sandstone is found (fig. 24B). Only five of the wells in DuPage County for which records are available are completed in the Glenwood-St. Peter Sandstone ; however, this formation contributes water to wells which penetrate into the deeper Ironton-Galesville Sandstone and Mt. Simon aquifer.

monly, the lower shale or rubble zone is cased off with a liner.

Sandstones and creviced dolomite in the Prairie du Chien Series, the creviced Trempealeau Dolomite, and the sandy parts of the Franconia Formation are commonly uncased and contribute ground water to wells drilled into the Ironton-Galesville Sandstone. Substantial percentages of the total yield of the Cambrian-Ordovician aquifer are contributed by these units as calculated recently by Walton and Csallany (1962).

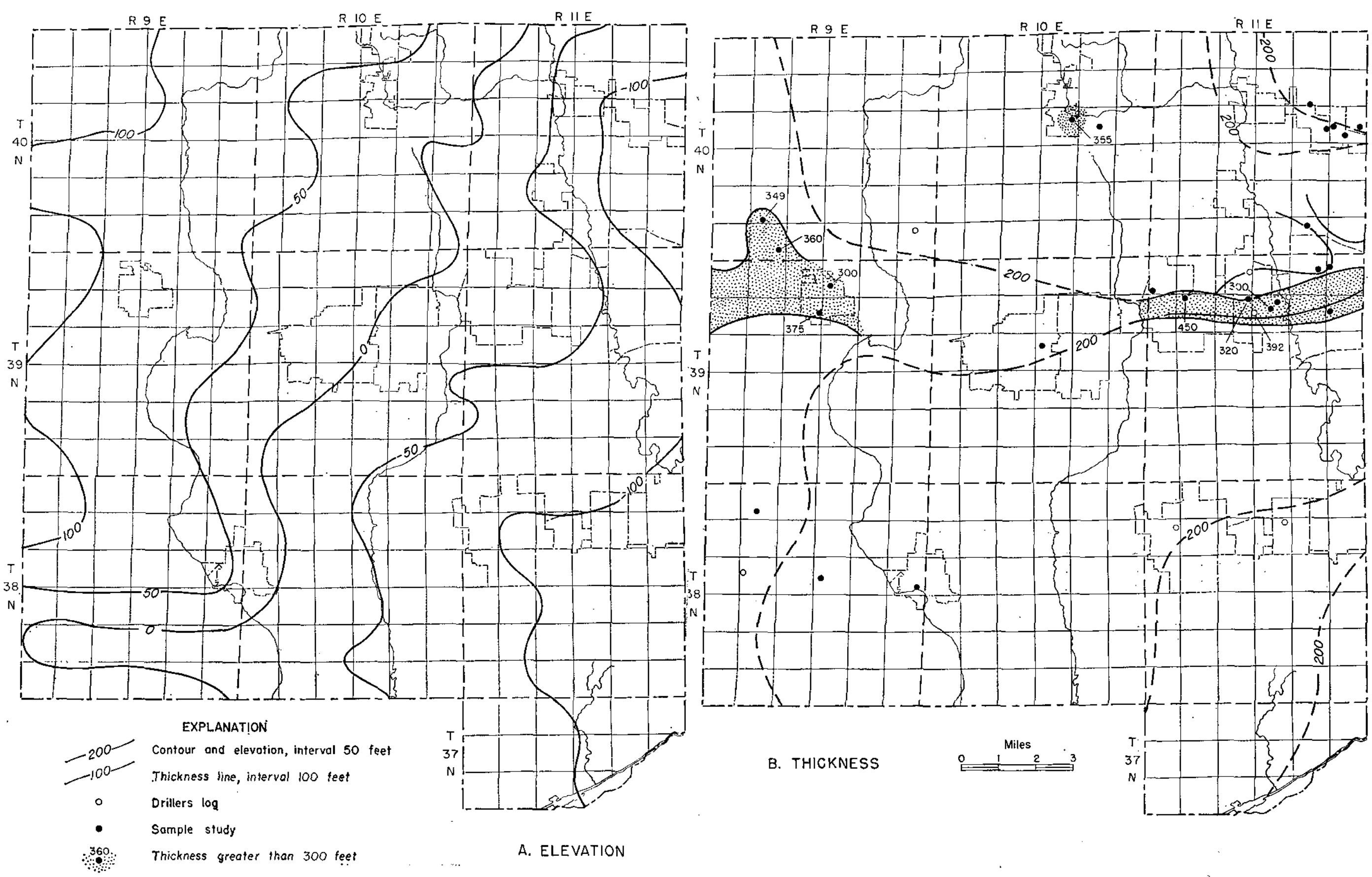



**Fig. 24. Top elevation (A) and thickness (B) of the Glenwood-St. Peter Sandstone (modified from fig. 22, Suter et al., 1959).**

The water-yielding capacity of the Glenwood-St. Peter Sandstone varies with changes in texture, cementation, and thickness. Regionally, the 60 to 80 feet of sandstone which occurs 35 to 200 feet below the top of the formation generally provides most of the water from the Glenwood-St. Peter Sandstone. Unproductive parts are the upper shaly, dolomitic sandstone and the basal shale and conglomerate zone. The drilling and construction of wells in the Glenwood-St. Peter Sandstone is, at places, hindered by the sloughing off of friable sands and the caving of the lower shale or rubble zone. Com-

The Ironton-Galesville Sandstone is consistently permeable and is one of the chief bedrock aquifers in DuPage County. Clean, friable, permeable zones occur chiefly in the lower 20 to 85 feet of the sandstone throughout the region, and may be present also in the upper dolomitic part. The principal water-yielding zone is the lower part of the Ironton-Galesville Sandstone (Suter et al., 1959, p. 41).

Records are available for 25 of the deep, high-capacity industrial and municipal wells in the county which penetrate the Ironton-Galesville Sandstone. The reliability and consistently high yields of this aquifer are the principal reasons for its large development in spite of the high costs of well construction and maintenance. This aquifer has a gentle dip to the southeast of about 10 feet per mile (fig. 25A) and a relatively consistent thickness of about 175 to 200 feet in DuPage County (fig. 25B).

Commonly, drilling a short distance below the base of the Ironton-Galesville Sandstone is advisable in order to take full advantage of the favorable water-yielding zone in the lower part of the aquifer and to insure that caving in the well will not shut off the lower productive section (Suter et al., 1959, p. 41). Caving and sand-pumping problems in the Ironton-Galesville Sandstone are associated with the incoherent zones of sand.

### CONFINING BEDS OF THE EAU CLAIRE FORMATION

The shale, dolomitic sandstone, and dolomite which make up the middle and upper parts of the Eau Claire Formation retard ground-water movement between the Cambrian-Ordovician aquifer and the deeper Mt. Simon aquifer. These beds prevent the more highly mineralized waters of the Mt. Simon aquifer from moving into the Ironton-Galesville Sandstone and also are effective in maintaining the head relationships between the two aquifer systems.

### MT. SIMON AQUIFER

The Mt. Simon aquifer consists of the sandstones of the Mt. Simon Formation and the lower Eau Claire Formation, and is the deepest source of ground water used by wells in DuPage County. Lenses of clean, well-sorted, friable sandstone in the Mt. Simon aquifer yield moderate quantities of water. These lenses are irregularly distributed and are interbedded with micaceous shale and siltstones of low permeability. The top of the Mt. Simon aquifer is reached in drilling in DuPage County at depths of about 1700 to 2000 feet below land surface and the unit dips to the southeast at about 10 feet per mile (fig. 26); Total thickness of the Mt. Simon aquifer is estimated to be about 2000 feet. Regionally, ground water in the Mt. Simon aquifer commonly is too salty for most uses at an elevation of 1300 feet or more below sea level (Suter et al., 1959, p. 41).

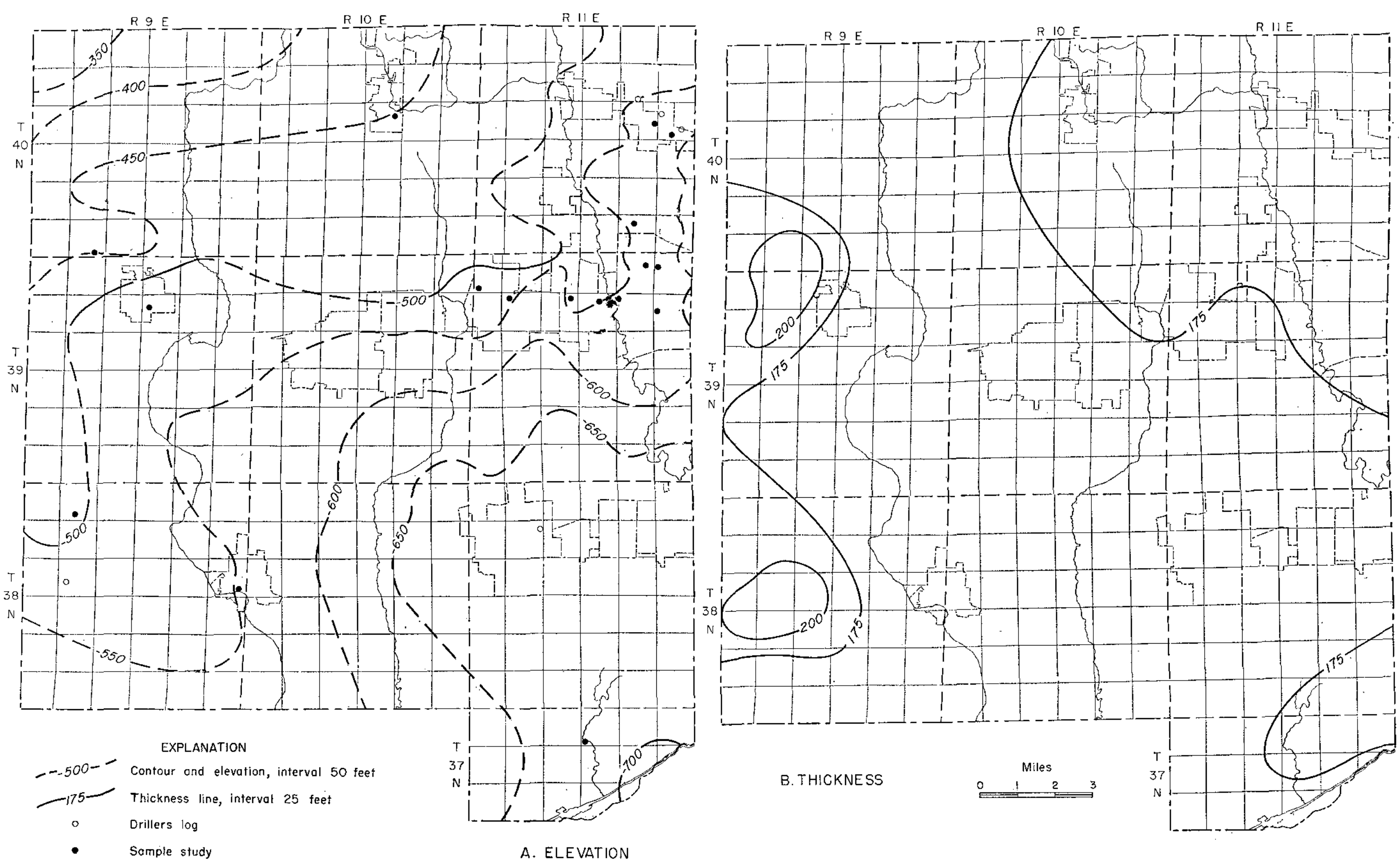



**Fig. 25. Top elevation (A) and thickness (B) of the Ironton-Galesville Sandstone (modified from fig. 21, Suter et al., 1959).**

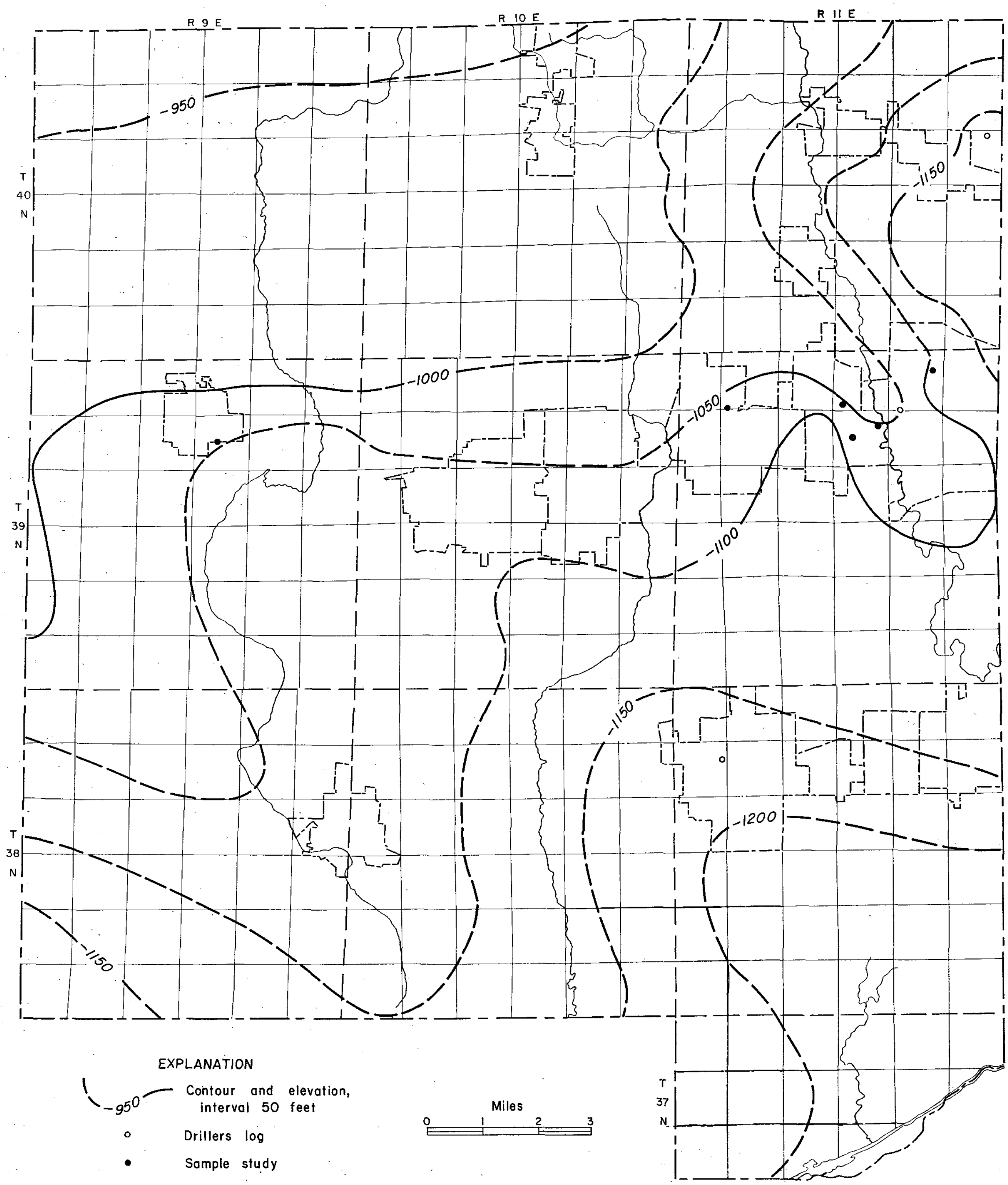



Fig. 26. Elevation of the top of the Mr. Simon aquifer (modified from fig. 19, Surer et al., 1959).

Total pumpage from wells has increased steadily at an accelerating rate since the first wells were drilled in 1890 as shown in figure 27. During the 70-year period, .890 to 1960, total pumpage increased from 841,000 gallons per day (gpd) to 29.3 million gallons per day (mgd) at an average rate of about 410,000 gpd per year. Pumpage increased very rapidly at an average rate of 1,300,000 gpd per year during the period 1950 to 1960.

Data in table 7 indicate that of the total water pumped from wells in 1960, 68 percent was derived from the Silurian dolomite aquifer, 30 percent was derived from the Cambrian-Ordovician and Mt. Simon aquifers, and 2 percent was derived from the glacial drift aquifers. In 1960 withdrawals for public water-supply systems amounted to about 68 percent of the total pumpage; industrial pumpage was 19 percent of the total; and domestic pumpage was about 13 percent of the total.

**Table 7. Distribution of Pumpage from Wells in 1960, Subdivided by Source and Use**

| Use | Pumpage from glacial drift aquifers *(mgd)* | Pumpage from Silurian dolomite aquifer *(mgd)* | Pumpage from Cambrian-Ordovician and Mt. Simon aquifers *(mgd)* | Total pumpage *(mgd)* |
|---|---|---|---|---|
| Public | 0.13 | 12.06 | 7.80 | 19.99 |
| Industrial | .02 | 4.58 | 1.00 | 5.60 |
| Domestic | .38 | 3.38 | ...... | 3.76 |
| Total | .52 | 20.02 | 8.80 | 29.34 |

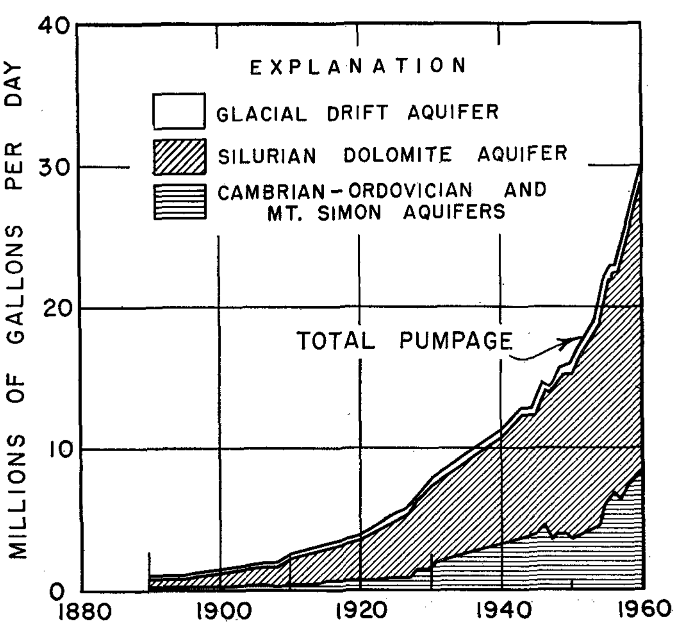



Fig. 27. Pumpage from wells, 1890-1960.

Records of pumpage are fairly complete for the period 1942 to 1960; very few records of pumpage are available for years prior to 1942. The graphs in figure 27 were constructed by piecing together fragments of information on pumpage found in published reports and in the files of the State Water Survey; by making evaluations based on the number of wells, their reported yields, and their time of construction; and by taking into consideration population growth and per capita consumption.

Downward movement of water through the Maquoketa Formation is appreciable under the influence of large differentials in head between shallow deposits and the Cambrian-Ordovician aquifer. Leakage through the Maquoketa Formation within DuPage County was about 1.05 mgd in 1960.

Many deep wells are either uncased or faultily cased in the Mt. Simon and Silurian dolomite aquifers as well as in the Cambrian-Ordovician aquifer. Thus, a large portion of the water pumped from deep wells is obtained from aquifers above and below the Cambrian-Ordovician aquifer. It is estimated that of the 9.0 mgd pumped from deep wells in 1960, 4.9 mgd came from the Cambrian-Ordovician aquifer, 0.2 mgd came from the Silurian dolomite aquifer, and 3.9 mgd came from the Mt. Simon aquifer. The 0.2 mgd obtained from the Silurian dolomite aquifer through deep wells is included in the total pumpage from the Silurian dolomite aquifer in table 7.

Pumpage data are classified in this report according to three main categories: 1) *public,* including municipal, subdivisions, and institutional; 2) *industrial,* including commercial, industrial, golf courses, irrigation, and cemeteries; and 3) *domestic,* including rural farm and rural non-farm.

Most water-supply systems furnish water for several types of use. For example, a public supply commonly includes water used for drinking and other domestic uses, manufacturing processes, and lawn sprinkling. Industrial supplies may also be used in part for drinking and other domestic uses. No attempt has been made to determine the various uses of water within categories. Any water pumped by a municipality is called a public supply, regardless of the use of water.

Municipal and subdivision pumpage data show a gradual change with seasons: the average winter use is about three-fourths of the average summer use. Pumpage from industrial wells generally is more uniform, unless large air-conditioning installations are used, the industry is seasonal, or a change in operation occurs as a result of strikes or vacation shut-downs. The use of water for irrigation is seasonal and varies from year to year depending upon climatic conditions.

The reliability of pumpage data varies greatly. Municipal pumpage nearly always is metered in cities and large villages, but many small villages and subdivisions operate without meters. Only a few of the larger industries meter their supplies. Pumpage data for municipalities and some of the larger industries are systematically recorded. Pumpage from farm wells and individual residential wells is estimated on the basis of detailed use surveys made in a few selected parts of the county considered typical.

### Discharge From Wells in Glacial Drift Aquifers

Total pumpage from the glacial drift aquifers was about 0.5 mgd in 1960. More than 70 percent of the pumpage was for domestic use. It is estimated that 10 percent of the rural farm and private residences obtain water from the glacial drift aquifers. In 1960, the city of Wheaton was the only municipality obtaining water from the glacial drift aquifers, and one of its wells is open to both the glacial drift and Silurian dolomite aquifers. For limited periods since 1925, two other municipalities obtained all or part of their water supply from wells finished in the glacial drift aquifers. Public pumpage was 0.13 mgd in 1960, or about 25 percent of the total pumpage from the glacial drift aquifers.

Industrial pumpage is limited to two wells. Both of these wells, drilled after 1956, provide only small amounts of water although their potential yield may be considerably greater. Pumpage for industrial supplies was 0.02 mgd in 1960, or about 5 percent of the total pumpage from the glacial drift aquifers.

### Discharge from Wells in Silurian Dolomite Aquifer

#### Public Supplies

The first public water supplies were developed in 1890 at Hinsdale and Wheaton and had an estimated total pumpage of 180,000 gpd. Public pumpage increased steadily at an accelerating rate, as shown in figure 28, and in 1960 was 12.06 mgd or about 60 percent of the water pumped from the Silurian dolomite aquifer. Pumpage for public supplies has increased at about the same rate as the urban population. Public pumpage in 1960 was about 3.7 times that in 1930 and urban population in 1960 was about 3.1 times that in 1930. The slight leveling off and decreases in public pumpage during the early and mid-1940's were due to restricted expansion of water-supply systems during World War II. In 1960, there were 50 public water supplies obtaining water from the Silurian dolomite aquifer.

Municipal pumpage amounted to approximately 93

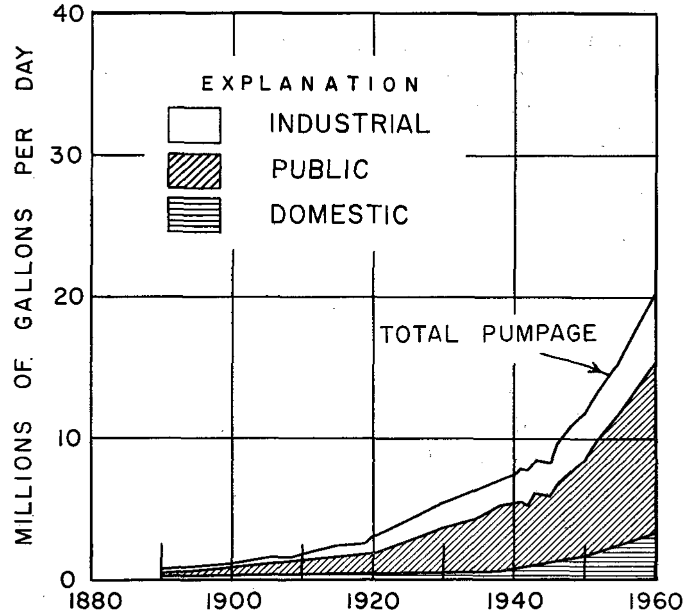



**Fig. 28. Pumpage from wells in Silurian dolomite aquifer, 1890-1960.**

percent of the public pumpage and was 11.2 mgd in 1960. The remaining 7 percent was nearly evenly distributed between subdivision and institutions. All of the municipalities in the county except one obtained all or part of their water supply from wells in the Silurian dolomite aquifer.

Although the first subdivision water supply was developed in 1924, total pumpage for subdivisions averaged less than 100,000 gpd until 1950. More rapid increases in subdivision pumpage since 1950 reflect the population expansion from concentrated urban areas of Chicago. Subdivision pumpage in 1960 was about 420,000 gpd.

Most of the institutional pumpage is for public and parochial schools outside areas served by municipal or subdivision water supply systems. A number of motels and restaurants also pump water from the Silurian dolomite aquifer. In 1960, institutional pumpage averaged about 480,000 gpd. Since 1940 institutional pumpage has increased 2½ times.

#### Industrial Supplies

The first record of an industrial well in the Silurian dolomite aquifer is for a well drilled in 1893 at the Downers Grove Golf Club. A deep railroad well drilled at West Chicago in 1890 was uncased in and obtained water from the Silurian dolomite aquifer. The original excavation at the rock quarry in Elmhurst started prior to 1880, and it is assumed that water has been withdrawn from the quarry since that time. Industrial pumpage has increased very slowly in comparison with public pumpage, as shown in figure 28, and in 1960 was 4.6 mgd or about 23 percent of the water pumped from the Silurian dolomite aquifer.

Data on industrial supplies were obtained from 110 plants. Only a few of the industrial plants meter their pumpage. In many cases pumpage was estimated from the number of hours the pump operates and the pump capacity.

### Domestic Supplies

Domestic pumpage, including rural farm and rural non-farm use, was estimated by considering rural population as reported by the U. S. Bureau of the Census and per capita use. Based on a survey of selected rural areas within the Chicago region (see Suter et al., 1959) the per capita use averages about 50 gpd in DuPage County. A survey of domestic wells in a 22-square-mile area southwest of Downers Grove and well log data in the files of the State Geological Survey indicate that on the average about 10 percent of the total domestic pumpage is from the glacial drift aquifers and 90 percent is from the Silurian dolomite aquifer.

Domestic pumpage increased at a rather slow rate that averaged about 20,000 gpd per year prior to 1940 as shown in figure 28. During and after World War II the rate of increase accelerated and averaged about 130,000 gpd per year during the period 1940 to 1960. Total domestic pumpage in 1960 was 3.4 mgd or 17 percent of the water withdrawn from the Silurian dolomite aquifer. Water for domestic use comes from small wells of low capacity that are widely distributed throughout the county.

### Distribution and Density of Pumpage

The pumpage from the Silurian dolomite aquifer is grouped into 12 centers of pumping based upon areas of concentration of use. The location of these centers and the distribution of pumpage in 1960 are shown in figure 29 and table 8, respectively. The greatest quantities of water were withdrawn from wells in pumping centers 5, 7, and 8 which include municipal areas of large population that, except for Lombard, rely entirely on shallow dolomite wells. Pumping center 6, a fourth area of large population, relies primarily on pumpage from deep sandstone wells.

**Table 8. Distribution of Pumpage from Wells in the Silurian Dolomite Aquifer in 1960, Subdivided by Use**

| Pumping center | Public pumpage (mgd) | Industrial pumpage (mgd) | Domestic pumpage (mgd) | Total pumpage (mgd) |
|---|---|---|---|---|
| 1 (Addison) | 0.55 | 0.18 | 0.28 | 1.01 |
| 2 (Itasca) | .20 | .11 | .09 | .40 |
| 3 (Roselle) | .28 | .06 | .22 | .56 |
| 4 (West Chicago) | .57 | .77 | .53 | 1.87 |
| 5 (Wheaton-Glen Ellyn-Lombard) | 4.05 | .22 | .53 | 4,80 |
| 6 (Elmhurst-Villa Park) | .51 | 1.30 | .21 | 2.02 |
| 7 (Westmont-Clarendon Hills-Hinsdale) | 3.36 | .52 | .31 | 4.19 |
| 8 (Downers Grove) | 1.94 | .07 | .08 | 2.09 |
| 9 (Lisle) | .36 | .10 | .32 | .78 |
| 10 (Warrenville) | .12 | .16 | .17 | .45 |
| 11 (Naperville-Eola) | .11 | .13 | .37 | .61 |
| 12 (Argonne) | .01 | .96 | .27 | 1.24 |
| Total | 12.06 | 4.58 | 3.38 | 20.02 |

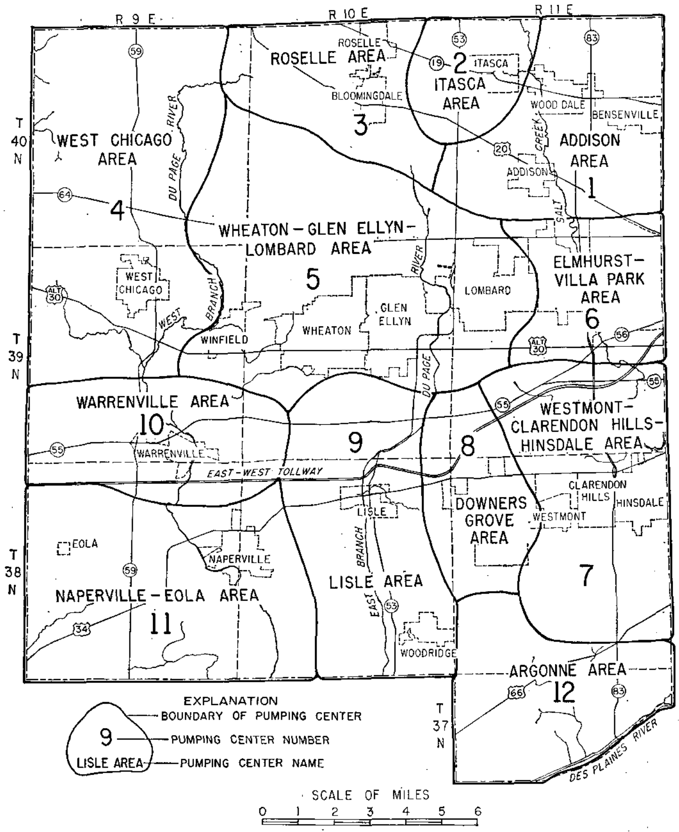



**Fig. 29. Location of Silurian dolomite aquifer pumping centers.**

In 1910, pumpage from the Silurian dolomite aquifer was largely concentrated in four pumping centers, 4, 5, 6, and 7. Except for the withdrawal of water from the quarry at Elmhurst, early pumpage was from wells in urban centers along railroads leading into Chicago. Withdrawals in pumping center 5 in 1960 were more than 15 times the pumpage in 1910. In all pumping centers except 4, 6, and 11 pumpage in 1960 was more than 10 times the pumpage in 1910. Pumpage from 1890 to 1960 in each of the pumping centers in the Silurian dolomite aquifer in figure 29 is shown in figures 30-33.

Pumpage from the Silurian dolomite aquifer was distributed to the townships within the county, and the average pumpage per square mile (density of pumpage) for each township was computed. Total pumpage and density of pumpage for each township is given in table 9.

The township having the highest density of pumpage is Downers Grove in which are located the municipal

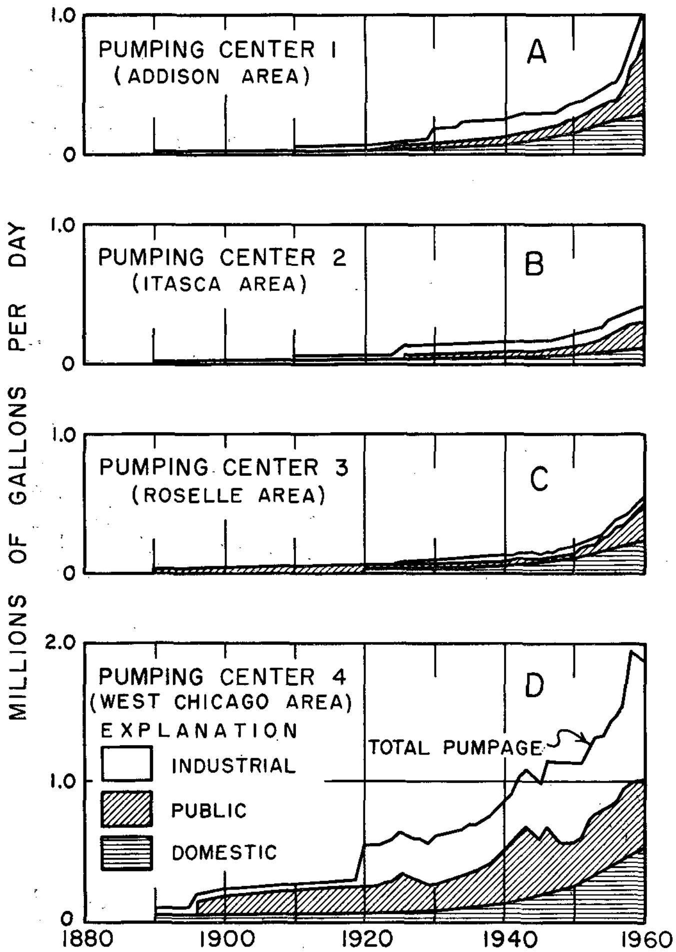



**Fig. 30. Pumpage from wells in Silurian dolomite aquifer in pumping centers 1-4, 1890-1960.**

wells for Clarendon Hills, Downers Grove, Hinsdale, and Westmont. The density is also high in Milton Township in central DuPage County. The township having the lowest density is Naperville in the south-western part of the county.

**Table 9. Geographic Distribution and Density of Pumpage from Wells in Silurian Dolomite Aquifer in 1960**

| Location | Total pumpage (mgd) | Density of pumpage (gpd/sq mi) |
|---|---|---|
| Addison (T40N,R11E) | 1.34 | 39,000 |
| Bloomingdale (T40N.R10E) | 0.92 | 27,000 |
| Wayne (T40N,R9E) | 0.87 | 24,000 |
| York (T39N,R11E) | 2.97 | 86,000 |
| Milton (T39N,R10E) | 3.98 | 115,000 |
| Winfield (T39N,R9E) | 1.52 | 42,000 |
| Downers Grove (T38-37N,R11E) | 6.86 | 140,000 |
| Lisle (T38N.R10E) | 0.98 | 27,000 |
| Naperville. (T38N,R9E) | 0.58 | 16,000 |
| Total | 20.02 | |

## Future Pumpage

Extrapolation of past pumpage records indicates that total pumpage from the Silurian dolomite aquifer may more than double by 1980. The graphs in figure 28 were extrapolated to the year 1980 taking into consideration past rates of growth of pumpage. It is estimated that total pumpage in 1980 will be in the order of magnitude of 45 mgd. Withdrawals for public supplies will probably amount to 28 mgd; industrial pumpage will probably amount to 10 mgd; and domestic pumpage will probably total about 7 mgd. Pumpage increases will probably be great in the Wheaton-Glen Ellyn-Lombard, Westmont-Clarendon Hills-Hinsdale, Downers Grove, West Chicago, Addison, Roselle, and Lisle areas.

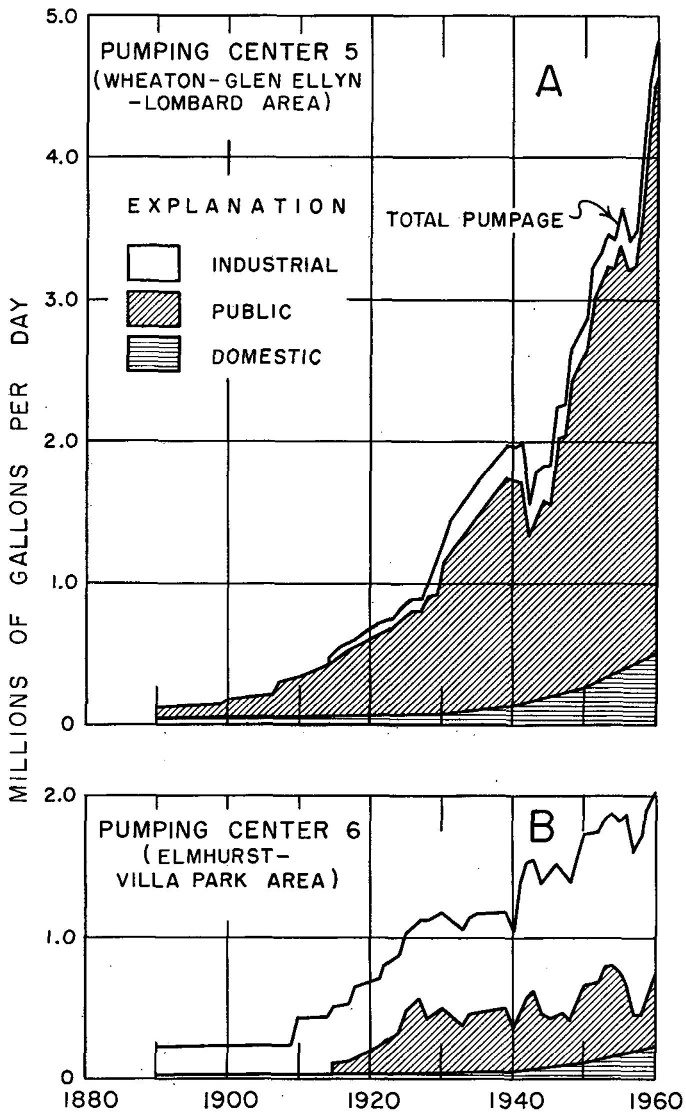



**Fig. 31. Pumpage from wells in Silurian dolomite aquifer in pumping centers 5 and 6, 1890-1960.**

## Leakage Through Maquoketa Formation

In 1960, the piezometric surface of the Cambrian-Ordovician aquifer (see fig. 72, p. 75) was several hundred feet below the water table in DuPage County, and downward movement of water through the Maquoketa Formation was appreciable under the influence of large differentials in head between shallow deposits and the Cambrian-Ordovician aquifer. The quantity of leakage through the Maquoketa Formation can be computed from the following form of Darcy's law:

$$Q_c = (P'/m')\ \Delta h\ A_c \qquad (1)$$

where:

$Q_c$ = leakage through Maquoketa Formation, in gpd

P' = vertical permeability of Maquoketa Formation, in gallons per day per square foot (gpd/sq ft)

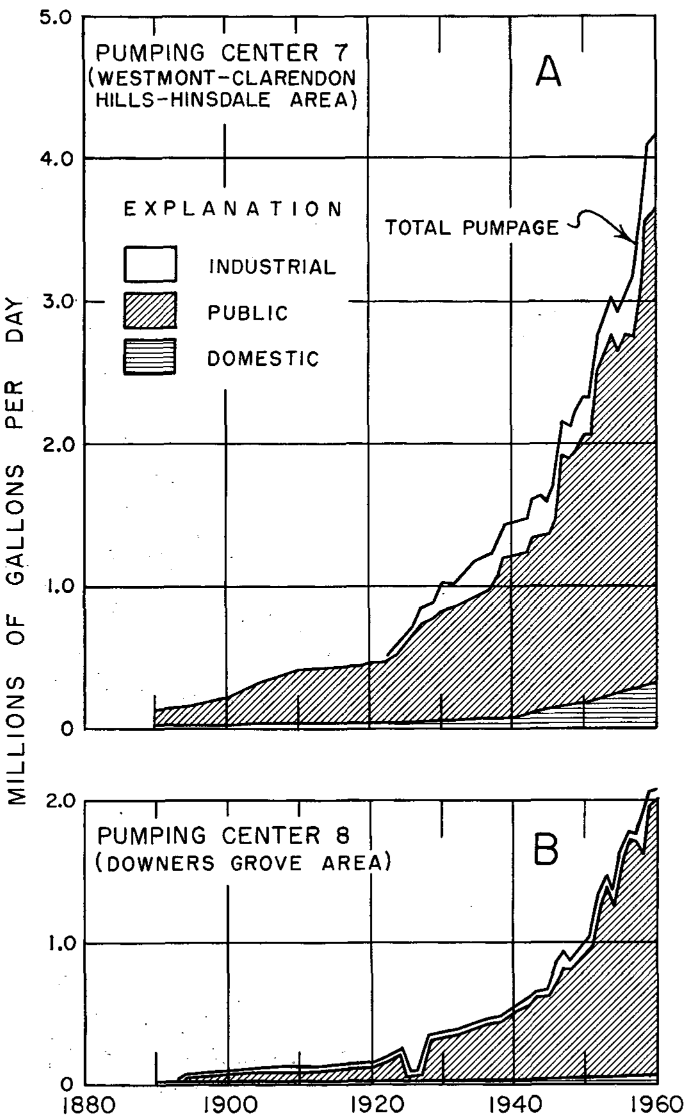



Fig. 32. Pumpage from wells in Silurian dolomite aquifer in pumping centers 7 and 8, 1890-1960.

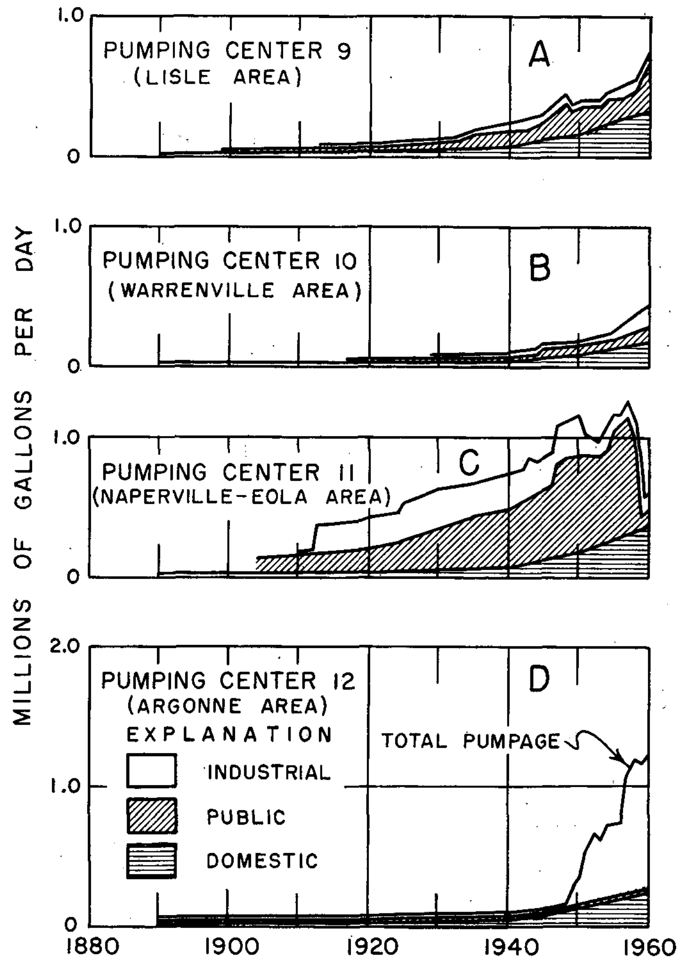



Fig. 33. Pumpage from wells in Silurian dolomite aquifer in pumping centers 9-12, 1890-1960.

$m'$ = thickness of Maquoketa Formation, in feet

$A_c$ = area of Maquoketa Formation through which leakage occurs, in square feet

$\Delta h$ = difference between the head in the Cambrian-Ordovician aquifer and the head in shallow deposits, in feet

Based on data given by Walton (1960), the average vertical permeability of the Maquoketa Formation in DuPage County is estimated to be about 0.00005 gpd/sq ft. The area of Maquoketa Formation through which leakage occurs in DuPage County is 331 square miles or $9.27 \times 10^9$ square feet. The average $\Delta h$ was determined to be about 400 feet by comparing the piezometric surface maps of water in the Silurian dolomite aquifer (see fig. 52, p. 61) and in the Cambrian-Ordovician aquifer (see fig. 72, p. 75). The average thickness of the Maquoketa Formation is about 175 feet. Substitution of these data in equation 1 indicates that the leakage through the Maquoketa Formation within DuPage County was 1.05 mgd in 1960. Leakage through the

Maquoketa Formation is withdrawal of ground water from the Silurian dolomite aquifer in addition to pumpage.

### Discharge from Wells in Cambrian-Ordovician and Mt. Simon Aquifers

The first deep sandstone wells penetrating the Cambrian-Ordovician and Mt. Simon aquifers were constructed in 1890 for the village of Hinsdale and the Chicago and Northwestern Railroad at "West Chicago. Records indicate that these wells were not tightly sealed through shallow deposits and, therefore, obtained water from both the Silurian dolomite aquifer and the deeper aquifers. Pumpage from deep sandstone wells in 1890 is estimated to have averaged 110,000 gpd. As shown in figure 34, except for short periods, pumpage from the Cambrian-Ordovician and Mt. Simon aquifers increased steadily to 8.8 mgd in 1960.

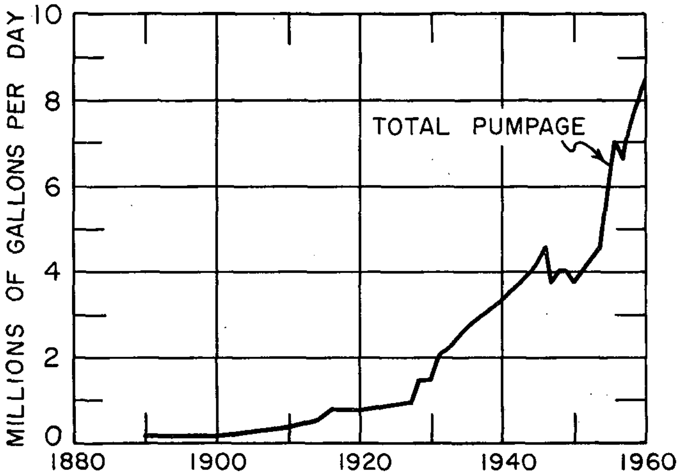



**Fig. 34. Pumpage from Cambrian-Ordovician and Mr. Simon aquifers, 1890-1960.**

During the period 1928 to 1931, the rate of increase in pumpage accelerated as deep sandstone wells owned by Lombard and Villa Park were placed in operation. Pumpage reduced from 4.7 mgd in 1946 to 4.0 mgd in 1947 and did not increase appreciably until 1954. During the period 1946 to 1954, there was a rapid conversion to diesel locomotives by railroads thereby reducing their demands for water. Pumpage increased from 4.6 mgd in 1954 to 8.8 mgd in 1960 at an average annual rate of 0.7 mgd.

In 1960, six municipalities, one subdivision, one institution, and six industries obtained all or parts of their supply from the Cambrian-Ordovician and Mt. Simon aquifers. Pumpage for public supplies averaged 7.8 mgd or 89 percent of the total pumpage from deep sandstone wells; industrial pumpage was about 1.0 mgd or 11 percent of the total. Most of the pumpage was from wells in Elmhurst-Villa Park-Lombard area. About 1.0 mgd was withdrawn from a deep sandstone well at Naperville in 1960.

Several deep sandstone wells in DuPage County are either uncased or faultily cased in the Silurian dolomite aquifer and allow leakage. The artesian pressure of the Cambrian-Ordovician aquifer is lower than that in the Silurian dolomite aquifer. Ground water, therefore, moves downward from the Silurian dolomite aquifer through wells that allow leakage. On the basis of data in Cooperative Report 1 (1959, p. 62), it is estimated that of the 9.0 mgd pumped from deep sandstone wells in 1960, 0.2 mgd came from the Silurian dolomite aquifer. Leakage through wells has decreased during the past several years as a result of recasing old wells and more thoroughly sealing new wells to depths below the Silurian dolomite aquifer.

## HYDROLOGY OF AQUIFERS

Emphasis in this report is placed on the hydrology of the Silurian dolomite aquifer. Little is known concerning the hydrology of the glacial drift aquifers and conclusions reached are inferred mostly from data in Cooperative Report 1. The hydrology of the Cambrian-Ordovician aquifer is described in detail by Suter et al. (1959), Walton (1960), and Walton and Csallany (1962); a summary of published information is presented herein.

### Silurian Dolomite Aquifer

#### Hydraulic Properties

The hydraulic properties of aquifers are expressed mathematically by the coefficients of transmissibility *T*, or permeability *P*, and storage *S*. The significant hydraulic property of a confining bed is the vertical permeability *P'*.

The capacity of a formation to transmit ground water is expressed by the coefficient of transmissibility, which is defined as the rate of flow of water in gallons per day, through a vertical strip of the aquifer one foot wide and extending the full saturated thickness under a hydraulic gradient of 100 percent (one foot per foot) at the prevailing temperature of the ground water. The coefficient of permeability is defined as the rate of flow of water in gallons per day, through a cross-sectional area of one square foot of the aquifer under a hydraulic gradient of one foot per foot at the prevailing temperature of the ground water. The relation of the coefficients of transmissibility and permeability is shown in the equation $T = Pm$, where $m$ is the saturated thickness of the aquifer.

The storage properties of an aquifer are expressed by the coefficient of storage, which is defined as the volume of water in cubic feet released from or taken into storage per square foot of surface area of the aquifer per foot change in the component of head normal to that surface.

The capacity of a confining bed to transmit ground water is expressed by its vertical permeability, which is defined as the rate of flow of water in gallons per day, through a horizontal cross-sectional area of one square foot of the confining bed under a hydraulic gradient of one foot per foot at the prevailing temperature of the ground water.

The hydraulic properties of a leaky artesian aquifer and its confining bed are often determined by means of pumping tests, wherein the effect of pumping a well at a known constant rate is measured in the pumped well and at observation wells penetrating the aquifer. Graphs of drawdown versus time after pumping started, and/or of drawdown versus distance from the pumped well, are used to solve equations which express the relation between the coefficients of transmissibility and storage of the aquifer and the vertical permeability of the confining bed, and the lowering of water levels in the vicinity of a pumped well.

The data collected during pumping tests can be analyzed by means of the leaky artesian formula (Hantush and Jacob, 1955) which can be expressed by the following relation:

$$s = (114.6Q/T) \int_u^\infty (1/u) \ \exp \ (-u - r^2/4B^2u)\,du$$

$$s = (114.6Q/T) \ W(u,r/B) \qquad (2)$$

or, evaluating the integral,

$$s = (114.6Q/T) \ 2K_o(r/B) - I_o(r/B) \left[ -Ei\left( -\frac{r^2}{4B^2u} \right) \right] + \left[ \exp\left( -\frac{r^2}{4B^2u} \right) \right] \Big\{ 0.5772 + \ln u + [-Ei(-u)] - u + u \ [I_o(r/B) - 1]/\frac{r^2}{4B^2} - u^2 \sum_{n=1}^{\infty} \sum_{m=1}^{n} \frac{(-1)^{n+m}(n-m+1)\,!}{(n+2)\,!^2} \left( \frac{r^2}{4B^2} \right)^m u^{n-m} \Big\}$$

where:

$$u = 2693r^2S/Tt \qquad (3)$$

and

$$r/B = r/\sqrt{T/(P'/m')} \qquad (4)$$

$K_o(r/B)$ = modified Bessel function of the second kind and zero order

$I_o(r/B)$ = modified Bessel function of the first kind and zero order

$s$ = drawdown in observation well, in ft

$r$ = distance from pumped well to observation well, in ft

$Q$ = discharge, in gpm

$t$ = time after pumping started, in min

$T$ = coefficient of transmissibility, in gpd/ft

$S$ = coefficient of storage of aquifer

$P'$ = coefficient of vertical permeability of confining bed, in gpd/sq ft

$m'$ = thickness of confining bed through which leakage occurs, in ft

One of the assumptions upon which the leaky artesian formula is based is that the aquifer is homogeneous and isotropic. A cursory consideration of the heterogeneous and anisotropic nature of the water-yielding openings of the Silurian dolomite aquifer leads to the conclusion that meaningful values for hydraulic properties cannot be determined with the leaky artesian formula. However, apparent departures from the ideal porous media may not be of serious significance except in the immediate vicinity of a pumped well.

The high yields of many wells and the conformable piezometric surface of the Silurian dolomite aquifer suggest that the dolomite contains numerous interconnected fractures and crevices. Such a network of openings can give a resultant regional effect equivalent to a radially homogeneous aquifer. Because the water flows in fractures and crevices that bring the water directly or by complex interconnection into wells, the flow system assumes at least some of the characteristics of a linear channel in the immediate vicinity of a pumped well where the flow departs from laminar. Thus, the leaky artesian formula may describe drawdown on an areal basis with reasonable accuracy but does not completely describe the drawdown in a pumped well.

## Pumping Tests

Controlled pumping tests have been conducted by the State Water Survey in the Wheaton area (test 1) and by the U. S. Geological Survey in the Argonne area (test 2) to determine the hydraulic properties of the Silurian dolomite aquifer and its confining beds. The data for these tests are as follows:

*Test 1, Wheaton area*

*A* pumping test was made by the State Water Survey on May 2 and 3, 1960. Wells (fig. 35) located within the corporate limits of the city of Wheaton in T39N,R10E were used. The generalized graphic logs of the wells are given in figure 36. The effects of pumping well DUP 39N10E-16.6cl were measured in the pumped well and in observation well DUP 39N10E-16.6c. Pumping was started at 6:00 p.m. on May 2 and was continued for a period of 24 hours at a constant rate of 830 gpm until 6:00 p.m. on May 3. The closest center of uncontrolled pumping was well 39N10E-15.1b, about 8200 feet east of the pumped well.

Drawdowns in the pumped and observation wells were determined by comparing the extrapolated graphs of water levels measured before pumping started with the graphs of water

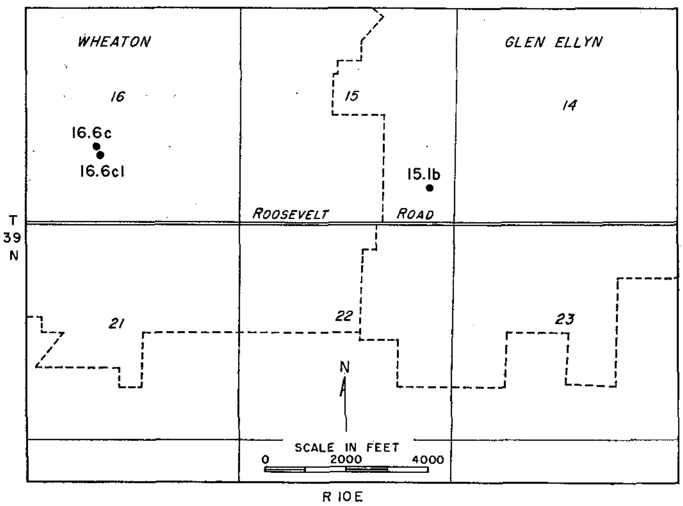



Fig. 35. Location of wells used in pumping test 1.

levels measured during pumping (see fig. 37). Observed drawdowns were adjusted for interference from well 39N10E-15.1b. Adjusted drawdowns in the pumped well were plotted against time on semilogarithmie paper, and adjusted drawdowns in the observation well were plotted against time on logarithmie paper. The time-drawdown field data graph for the observation well is given as an example in figure 38.

As pumping started water levels declined at an initial rate influenced only by the hydraulic properties of the aquifer. After about 15 minutes of pumping, the time-rate of drawdown decreased as vertical leakage became measurable. After about 55 minutes of pumping, water levels were appreciably affected by the operation of the pump in well 39N10E-15.1b as shown in figure 37.

*Test 2, Argonne area*

A pumping test was made by the U. S. Geological Survey, Ground Water Branch, during the period of August 22 to 24, 1955. Wells (fig. 39) located within the property limits of Argonne National Laboratories in T37N,R11E were used. The generalized graphic logs of the wells are given in figure 40.

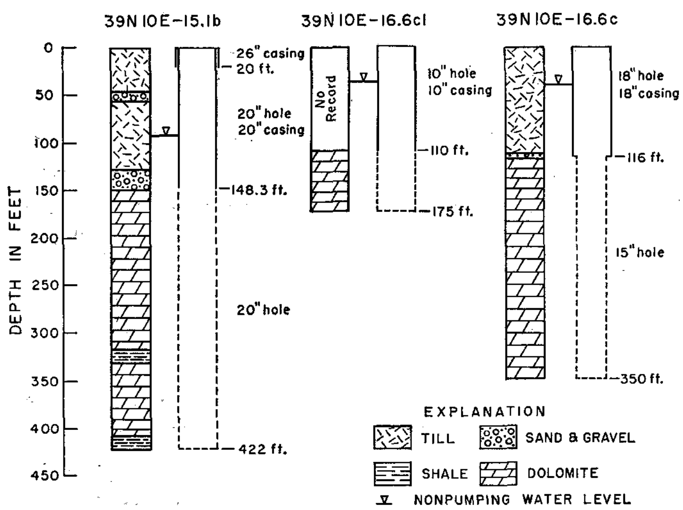



Fig. 36. Generalized graphic logs of wells used in pumping test 1.

Three wells were operated during the test as shown in figure 41. The pumps in wells DUP 37N11E-10.5f, DUP 37N11E-10.6g, and DUP 37N11E-3.8a2 were started at 8:04 a.m., **8:11** a.m., and 9:37 a.m., respectively, on August 22. It is impossible to isolate the effect of any one pumping well; therefore, the drawdown data cannot be used to determine the hydraulic properties of the aquifer. During the period 9:31 a.m. to 10:16 a.m. on August 23, the pumpage from well DUP 37N11E-3.8a2 was gradually reduced from 920 to 500 gpm.

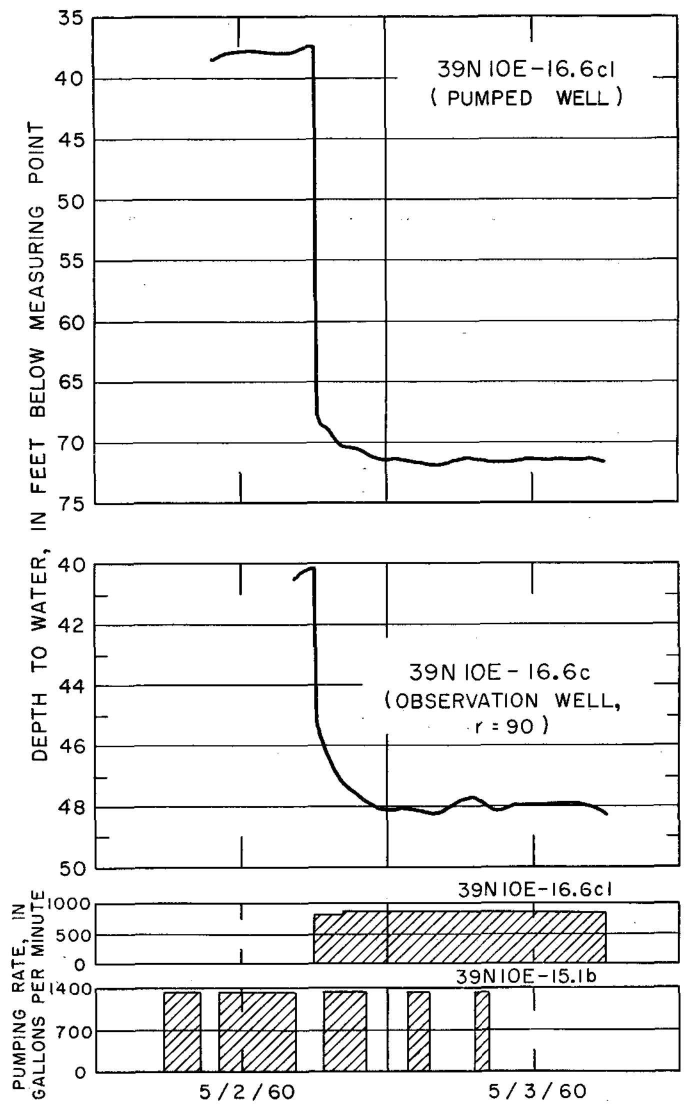



Fig. 37. Water levels and pumpage during pumping test 1.

Because the pumpage reduction was gradual and the pumping rate was not held constant, the recovery data cannot be analyzed.

At 10:00 a.m. on August 23 the pump in well **DUP** 37N11E-10.6g was shut off. Soon afterwards, at 10:25 a.m., pumpage from well 10.5f was gradually increased from 356 to 419 gpm. Pumpage changes occurred in two wells; therefore, data collected during this period are not suitable for analysis.

On August 24 at 10:00 a.m. the pump in well DUP 37N11E-3.8a2 was shut off. Recoveries in observation wells DUP 37N11E-

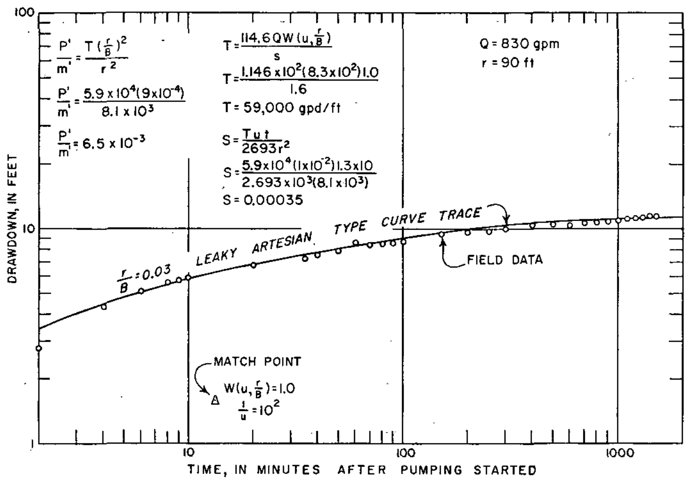



**Fig. 38. Time-drawdown graph for well 16.6c, pumping test 1.**

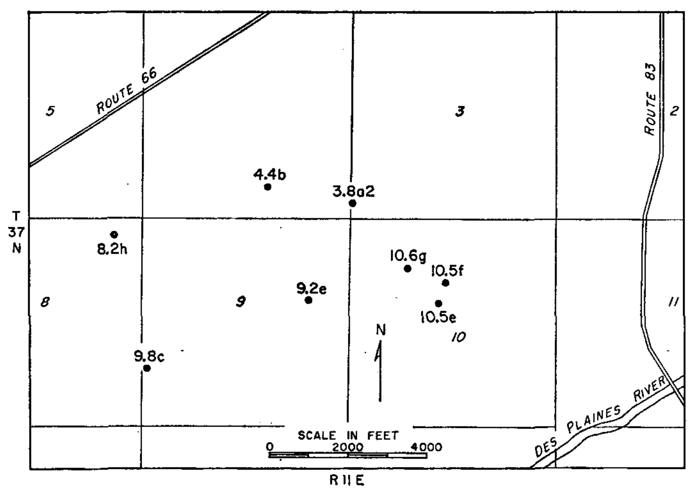



**Fig. 39. Location of wells used in pumping test 2.**

9.2e, DTJP 37N11E-4.4b, and DTJP 37N11E-10.5e due to reduction of pumpage in well DTJP 37N11E-3.8a2 were plotted on logarithmic paper as shown in figure 42.

Unfortunately the observation wells penetrate only the upper few feet of the dolomite, whereas, as shown in figure 40, well DTJP 37N11E-3.8a2 penetrates more than 200 feet of dolomite.

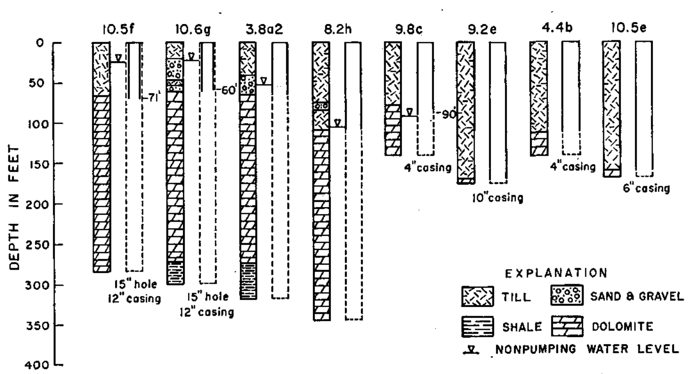



**Fig. 40. Generalized graphic logs of wells used in pumping test 2.**

In addition, the piezometric surface is in both glacial deposits and in dolomite. Thus, the cone of depression expanded into materials having different storage properties during its growth. Because the depth of penetration varies from well to well and the coefficient of storage varied within the cone of depression, the recovery data are equivocal and, as might be expected, the time-drawdown graphs in figure 42 deviate markedly from theory. The hydraulic properties cannot be computed from recovery data.

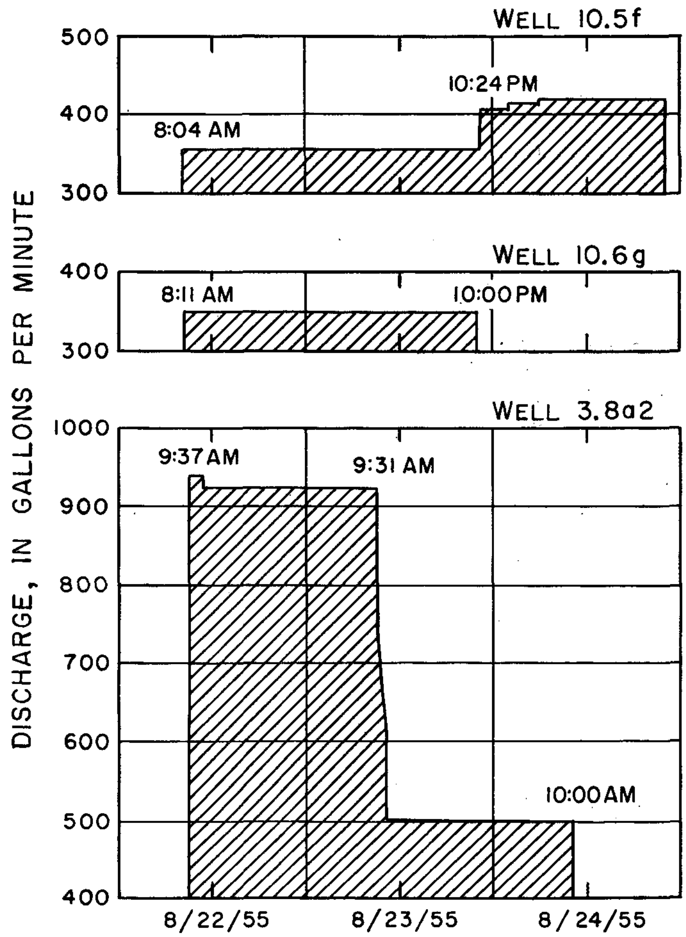



**Fig. 41. Pumping conditions during pumping test 2.**

The analysis of the interference data for the Wheaton test suggests that the fractures and crevices in the dolomite are interconnected for large distances. A straight line was matched to the time-drawdown graph for the pumped well. The straight-line method described by Cooper and Jacob (1946) and the slope of the time-drawndown graph were used to compute a coefficient of transmissibility of 63,000 gpd/ft. The coefficient of storage cannot be determined from available data because water levels in the pumped well are affected by'well loss.

The time-drawdown field data graph for the observation well was superposed on the family of nonsteady-state leaky artesian type curves (Walton, 1960). By in-

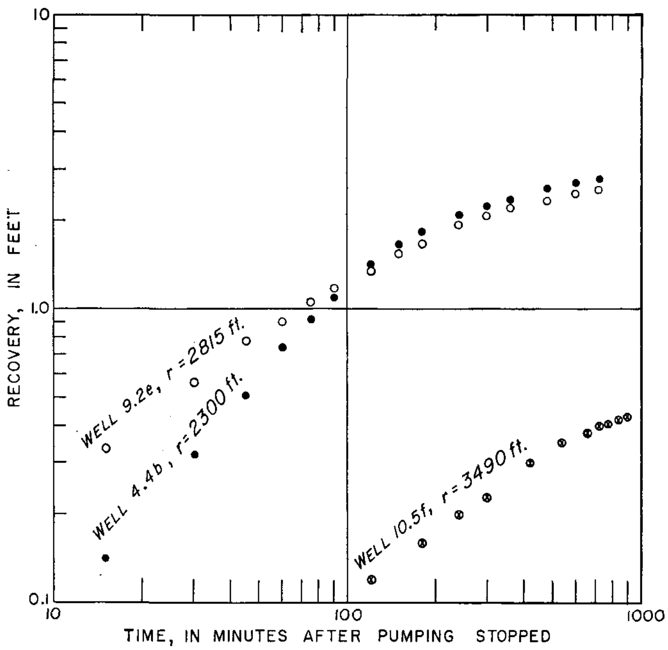



Fig. 42. Time-recovery graphs for wells 9.2e, 4.4b, and 10.5f, pumping test 2.

terpolation, an *(r/B)* = 0.03 type curve was selected as analogous to the time-drawdown field data curve. Equations 2, 3, and 4 were used to compute coefficients of transmissibility and storage of the aquifer, and the leakage coefficient, $P'/m'$ (Hantush, 1956), of the confining bed. Computations are given in figure 38. The average coefficients of transmissibility, storage, and leakage computed from the test results are 61,000 gpd/ft, 0.00035, and $6.5 \times 10^{-3}$ gpd/cu ft, respectively.

The exact nature and thickness of the confining bed are not known. It is certain, however, that leakage greatly affects the cone of depression created by pumping this well in the Silurian dolomite aquifer.

The drawdown and recovery data obtained during the Argonne test cannot be used to determine the hydraulic properties of the aquifer for reasons given above. By trial and error, it is found that the recoveries in wells DUP 37N11E-9.2e and DUP 37N11E-4.4b (fig. 39) at the end of 700 minutes could be duplicated by using the following properties: $T$ = 44,000 gpd/ft, $S = 9.0 \times 10^{-5}$, and $P'/m' = 1.0 \times 10^{-3}$ gpd/cu ft.

Measurable recovery, about 0.4 foot, was observed in observation well DUP 37N11B-10.5e which is 3490 feet from the pumped well (fig. 39), suggesting that the openings in the Silurian dolomite aquifer are interconnected over considerable distances. It is not unreasonable to believe that if the depth of penetration of all wells was the same, the leaky artesian formula would describe drawdown and recovery on an areal basis with reasonable accuracy.

*Specific Capacity Data*

The yield of a well may be given in terms of its specific capacity, which is commonly expressed as the yield in gallons per minute per foot of drawdown (gpm/ft) for a stated pumping period and rate. The theoretical specific capacity $Q/s$ of a well can be written as

$$Q/s = T/[114.6\ W(u,r/B)] \qquad (5)$$

The specific capacity is influenced (see equations 2, 3, and 4) by the hydraulic properties of the aquifer and confining bed, the thickness of the confining bed, the radius of the well, and the pumping period. From equation 5 the theoretical specific capacity of a well is directly proportional to $T$ and inversely proportional to log $T$. The relationship between the theoretical specific capacity of a well and the coefficient of transmissibility is shown in figure 43. A pumping period of 8 hours, a

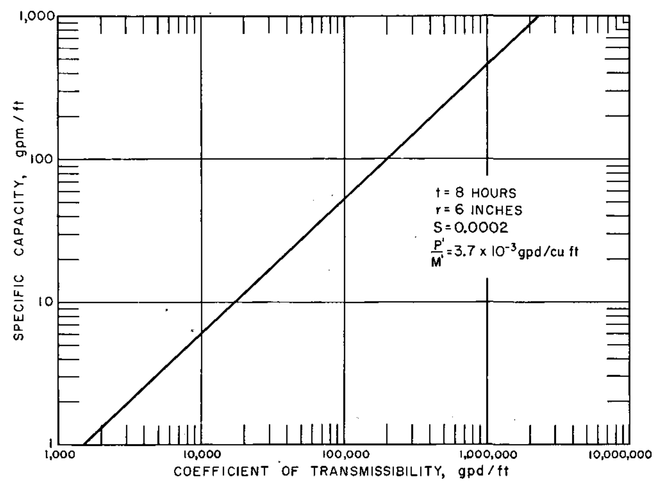



Fig. 43. Theoretical relation between specific capacity and the coefficient of transmissibility.

radius of 6 inches, a storage coefficient of 0.0002, and a leakage coefficient of $3.7 \times 10^{-3}$ gpd/cu ft were assumed in constructing the graph. These values, based on aquifer tests and specific capacity data, are considered to be average for the county.

The theoretical specific capacity considers only the head loss (aquifer loss) due to the laminar flow of water in the aquifer towards the well and ignores the head loss (well loss) resulting from the turbulent flow of water in the immediate vicinity of the well, through the well wall, and in the well bore. The specific capacities of Silurian dolomite aquifer wells in DuPage County decrease with an increase in the pumping rate, indicating that well loss is appreciable. Taking both aquifer and well losses into consideration, the actual specific capacity $Q/s_a$ is given by the following equation:

$$Q/s_a = Q/(s + s_w) \quad (6)$$

where:

$s$ = aquifer loss described by equation 2

$s_w$ = well loss

Well loss may be represented approximately by the following equation (Jacob, 1946):

$$s_w = CQ^2 \quad (7)$$

where:

$C$ = empirical well loss in $sec^2/ft^5$

$Q$ = rate of pumping in cubic feet per second (cfs)

The value of $C$ may be computed from the data collected during a "step-drawdown" test, in which the well is operated during three successive periods of equal duration at constant fractions of full capacity, by using one or both of the following equations (see Jacob, 1946) : For steps 1 and 2

$$C = \frac{(\Delta s_2/\Delta Q_2) - (\Delta s_1/\Delta Q_1)}{\Delta Q_1 + \Delta Q_2} \quad (8)$$

For steps 3 and 4

$$C = \frac{(\Delta s_3/\Delta Q_3) - (\Delta s_2/\Delta Q_2)}{\Delta Q_2 + \Delta Q_3} \quad (9)$$

The *As* terms represent increments of drawdown produced by each increase (ΔQ) in the rate of pumping. The dimensions of Δs and Δ$Q$ are feet and cubic feet per second respectively.

If step-drawdown test data are available the well-loss constant and the well loss can be estimated. The aquifer loss is then computed by subtracting the well loss from the observed drawdown. The coefficient of transmissibility of the Silurian dolomite aquifer may be estimated with the graph in figure 43 and the theoretical specific capacity based on the aquifer loss.

Step-drawdown test data are available for several wells in DuPage County. Data for the tests made on nine selected wells are presented graphically in figures 44-47. Analysis of available data indicates that the well-loss constant $C$ is a function of 1) the specific capacity and therefore the hydraulic properties of the dolomite, and 2) the position of the pumping level in relation to the top of the Silurian dolomite aquifer. High values of $C$ are computed for wells having low specific capacities and low values of $C$ are computed for wells having high

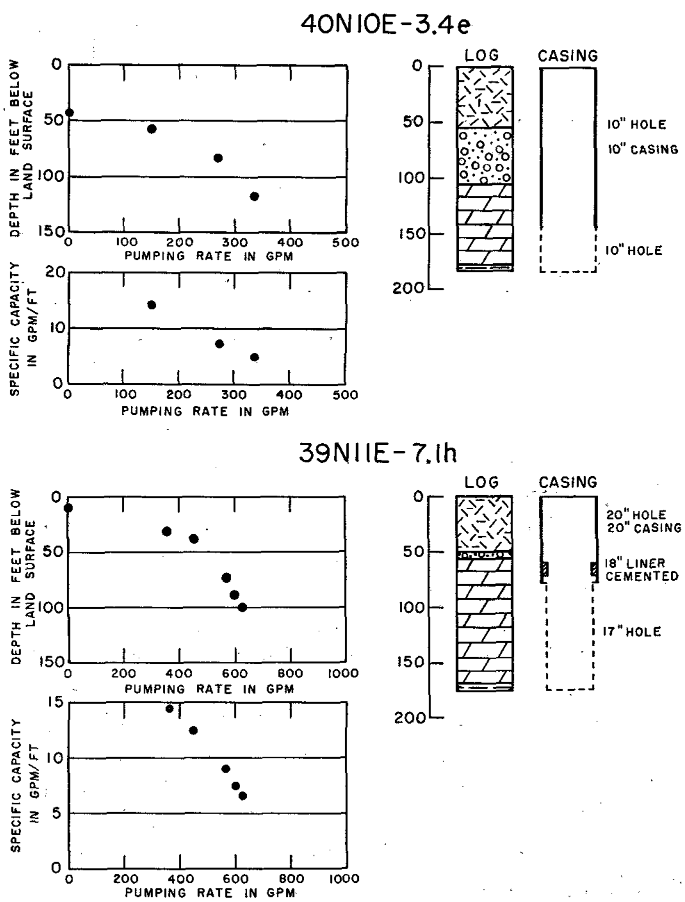



**Fig. 44. Step-drawdown test data and construction features of wells 40N10E-3.4e and 39N11E-7.1h.**

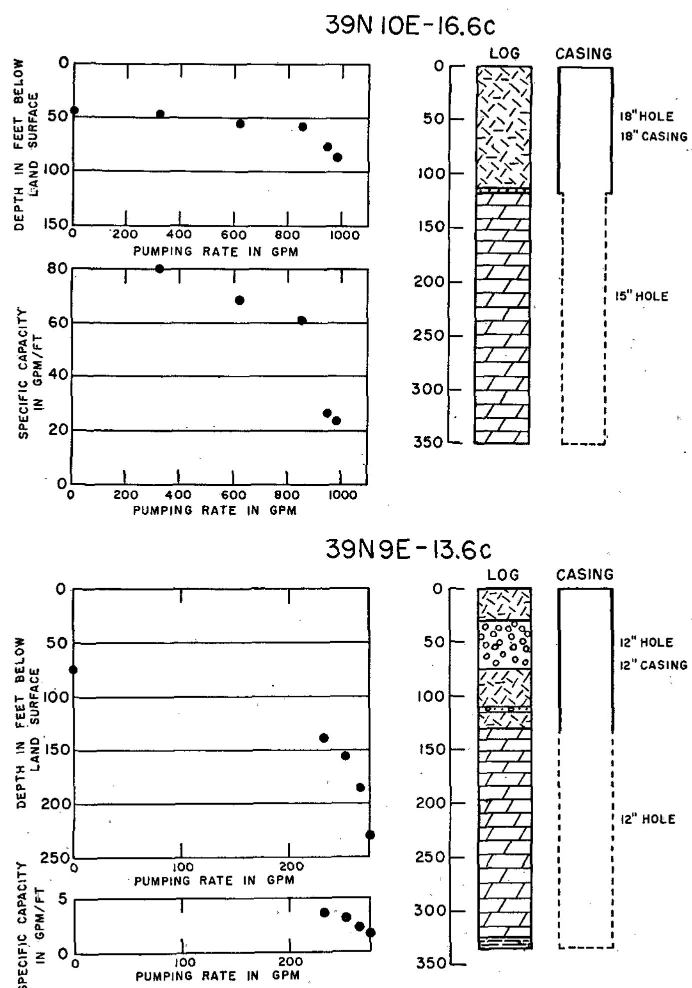



**Fig. 45. Step-drawdown test data and construction features of wells 39N10E-16.6c and 39N9E-13.6c.**

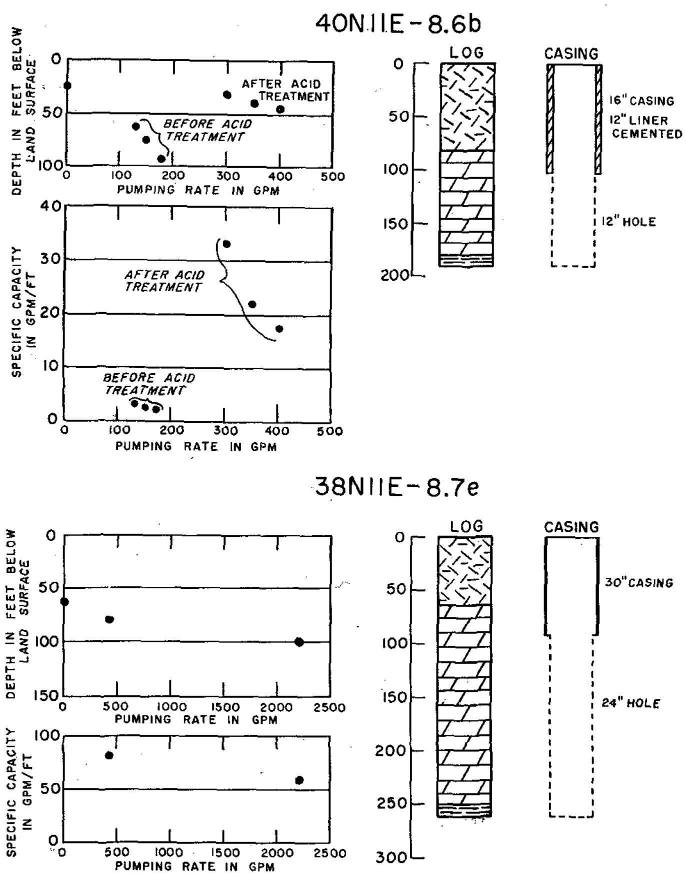



**Fig. 46. Step-drawdown test data and construction features of wells 40N11E-8.6b and 38NUE-8.7e.**

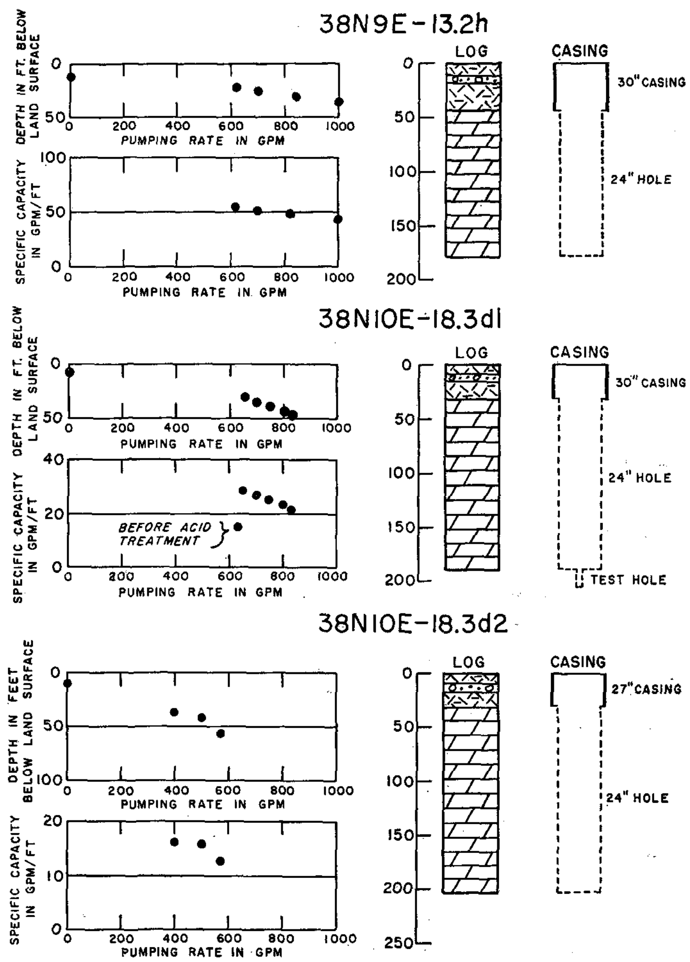



**Fig. 47. Step-drawdown test data and construction features of wells 38N9E-13.2h, 38N10E-18.3d1, and 38N10E-18.3d2.**

specific capacities. Apparently turbulence and therefore well loss increases as the coefficient of transmissibility of the aquifer decreases. The coefficient of transmissibility becomes smaller with a decrease in the size and/or number of interconnected openings in the dolomite.

The well-loss constant increases greatly when water levels are lowered below the top of the Silurian dolomite aquifer. As the pumping level declines below the top of the aquifer, maximum contribution from openings in the upper part of the dolomite above the pumping level is attained and future increases in pumpage are obtained from the openings below the pumping level. A greater burden is placed upon lower openings and well loss is greatly increased.

Graphs were prepared showing the relations between actual specific capacity and the well-loss constant for the two cases, when the pumping level is above the top of the aquifer (fig. 48) and when the pumping level is below the top of the aquifer (fig. 49).

Available specific capacity data are given in Appendix C. Most of these data were collected during well-production tests made by personnel of the State Water Survey. "Well-loss constants were estimated for each well based on actual specific capacities, water-level data, and figures 48 and 49. "Well losses were calculated with estimated well-loss constants and equation 7 and were subtracted from observed drawdowns to determine aquifer losses. Theoretical specific capacities were then computed for a pumping period of 8 hours and a radius of 6 inches based on aquifer losses and equation 2. Theoretical specific capacities and the graph of the theoretical relationship between specific capacity and the coefficient of transmissibility (fig. 43) were used to estimate the average coefficient of transmissibility of the Silurian dolomite aquifer within the cones of depression of production wells.

Estimated coefficients of transmissibilities are given in Appendix C. No great accuracy is implied for the estimated coefficients of transmissibilities because they are based on an average coefficient of storage and vertical permeability and on estimated well-loss constants. In addition, geohydrologic boundaries were not considered in the analysis of specific capacity data. The data in Appendix C can only be considered rough approxima-

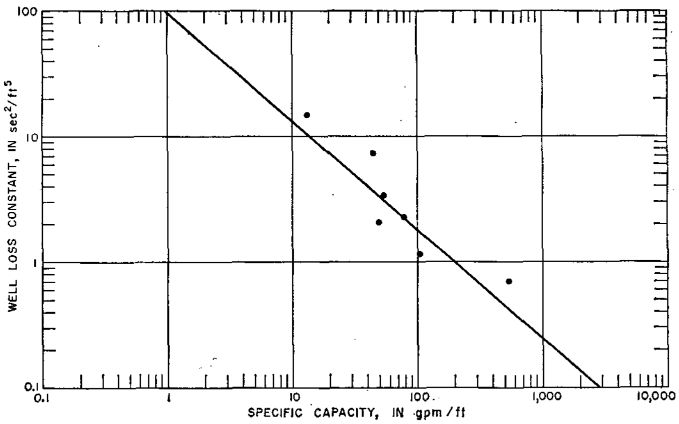



**Fig. 48. Well-loss constant versus specific capacity, pumping levels are above the top of the Silurian dolomite aquifer.**

tions of this hydraulic property of the dolomite. However, the coefficient of transmissibility estimated from specific capacity data for wells at Wheaton agree closely with the coefficient of transmissibility computed from pumping test data, indicating that the estimated coefficients of transmissibility are meaningful.

Actual specific capacities and specific capacities adjusted for well loss and to a common pumping period and radius (Appendix C) were divided by depths of penetration to obtain actual and adjusted specific capacities per foot of penetration.

Many wells penetrate only rocks of the Niagaran (N) Series; some wells penetrate rocks of both the Niagaran and Alexandrian (A) Series; other wells penetrate rocks of both the Niagaran and Alexandrian Series and the Maquoketa (M) Formation. The total depth of penetration of wells and the depth of penetration of wells into each unit were determined by studies of well logs and samples of drill cuttings and are given in Appendix C.

Wells were segregated into three categories, N, N + A, and N + A + M, depending upon the units penetrated by the wells. Specific capacities per foot of penetration for wells in each of the three categories were tabulated in order of magnitude, and frequencies were computed by the Kimball (1946) method. Values of specific capacity per foot of penetration were then plotted against percent of wells on logarithmic probability paper as shown in figure 50.

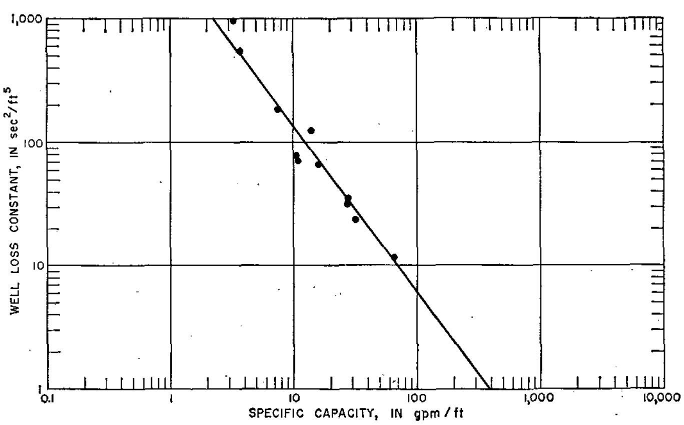



**Fig. 49. Well-loss constant versus specific capacity, pumping levels are below the top of the Silurian dolomite aquifer.**

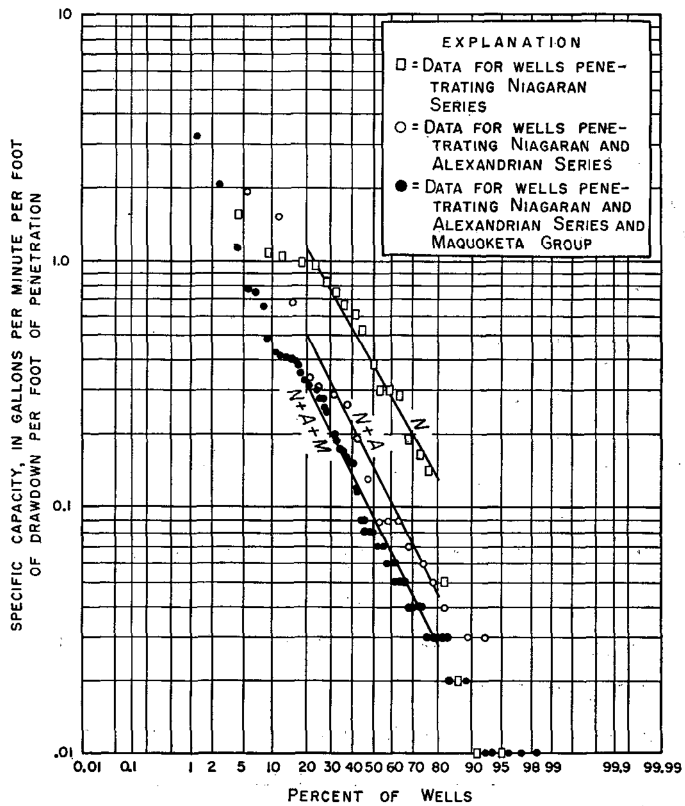



**Fig. 50. Specific capacity frequency graphs for dolomite wells.**

Specific capacities per foot of penetration decrease as the number of units penetrated increase indicating that where they overlie one another the Niagaran and Alexandrian Series are more productive than the Maquoketa Formation, and the Niagaran Series is more productive than the Alexandrian Series. Sufficient data are not available to evaluate variations of specific capacities per foot of penetration within each of the units.

The unit frequency graphs in figure 51 were constructed with figure 50 by the process of subtraction taking into consideration uneven distribution of wells in the three categories. The slope of a unit frequency graph varies with the inconsistency of production, a steeper line indicating a larger range in productivity. Figure 51 indicates that the Maquoketa Formation is much less consistent in production than both the Niagaran and Alexandrian Series and the productivity of the Alex-

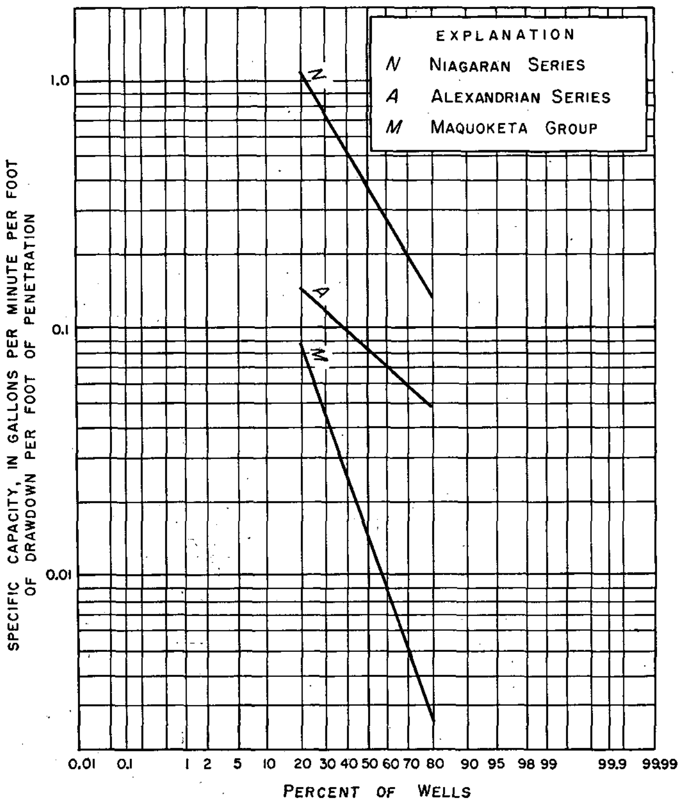



**Fig. 51. Specific capacity frequency graphs for the units penetrated by wells.**

andrian Series is more consistent than the productivity of the other units.

PIEZOMETRIC SURFACE

In order to determine areas of recharge and discharge and directions of ground-water movement in the Silurian dolomite aquifer, a piezometric surface map was made (fig. 52). Data on nonpumping levels in Appendix D were used to prepare the map. A piezometric surface is an imaginary surface to which water will rise in artesian wells. Lines of equal elevation representing lines of equal pressure on the piezometric surface are called isopiestic lines. The direction of ground-water movement is at right angles to isopiestic lines.

The piezometric surface map in figure 52 is a composite of water levels, and no distinction is made between ground water under artesian or water-table conditions. The piezometric surface map represents the elevation to which water will rise in a well completed in the Silurian dolomite aquifer and does not usually coincide with the position of the water table in shallow glacial drift deposits.

As shown by figure 52, ground water in DuPage County moves in all directions from uplands toward streams and toward well fields. In areas unaffected by heavy pumping, the piezometric surface conforms generally to the configuration of the land surface. The relief of the piezometric surface is much less than the relief of the land surface except in the immediate vicinity of well fields.

Valleys in the piezometric surface correspond with most of the West Branch DuPage River valley and the lower and upper reaches of East Branch DuPage River. The flow of these streams between periods of precipitation is maintained by ground-water runoff. Pumping in the Glen Ellyn, Lisle, Clarendon Hills, Hinsdale, and Elmhurst areas has probably reduced natural discharge of ground water to East Branch and to Salt Creek. In some areas along East Branch and Salt Creek the piezometric surface is below the water surfaces of the streams and small amounts of surface water probably percolate through the stream bed and eventually into the Silurian dolomite aquifer.

Heavy concentrated pumpage from wells has produced cones of depression in many parts of the county. The piezometric surface map shows well-defined cones of depression around the communities of Downers Grove, West Chicago, Lisle, and Glen Ellyn. A pronounced ground-water trough extends through Hinsdale, Clarendon Hills, and Westmont and a deep, local cone of depression is centered at the stone quarry in Elmhurst. Pumpage within the Argonne National Laboratory has distorted contours on the piezometric surface, and small, local cones of depression occur around numerous areas of pumping in the county.

Flow lines, paths followed by particles of water as they move through the aquifer in the direction of decreasing head, were drawn at right angles to the piezometric surface contours. The areas of influence of production wells in the county were outlined as shown in figure 53 by analysis of flow lines. In 1960 about 47 percent of the piezometric surface in DuPage County was influenced by withdrawals from wells in the Silurian dolomite aquifer.

The glacial drift overlying the dolomite permits vertical movement of ground water from the water table to the dolomite. Vertical movement and therefore recharge to the dolomite occurs in areas where the piezometric surface is below the water table. A study of the piezometric surface of the Silurian dolomite aquifer (fig. 52), the areas influenced by withdrawal from wells in the Silurian dolomite aquifer (fig. 53), and water-level data for shallow water-table wells indicate that recharge is occurring in most, if not all, upland areas and some lowland areas within the county.

The average slope of the piezometric surface in areas unaffected by pumpage is about 5 feet per mile. Gradients are steeper and exceed 20 feet per mile near and within cones of depression.

The general pattern of flow of water in the dolomite

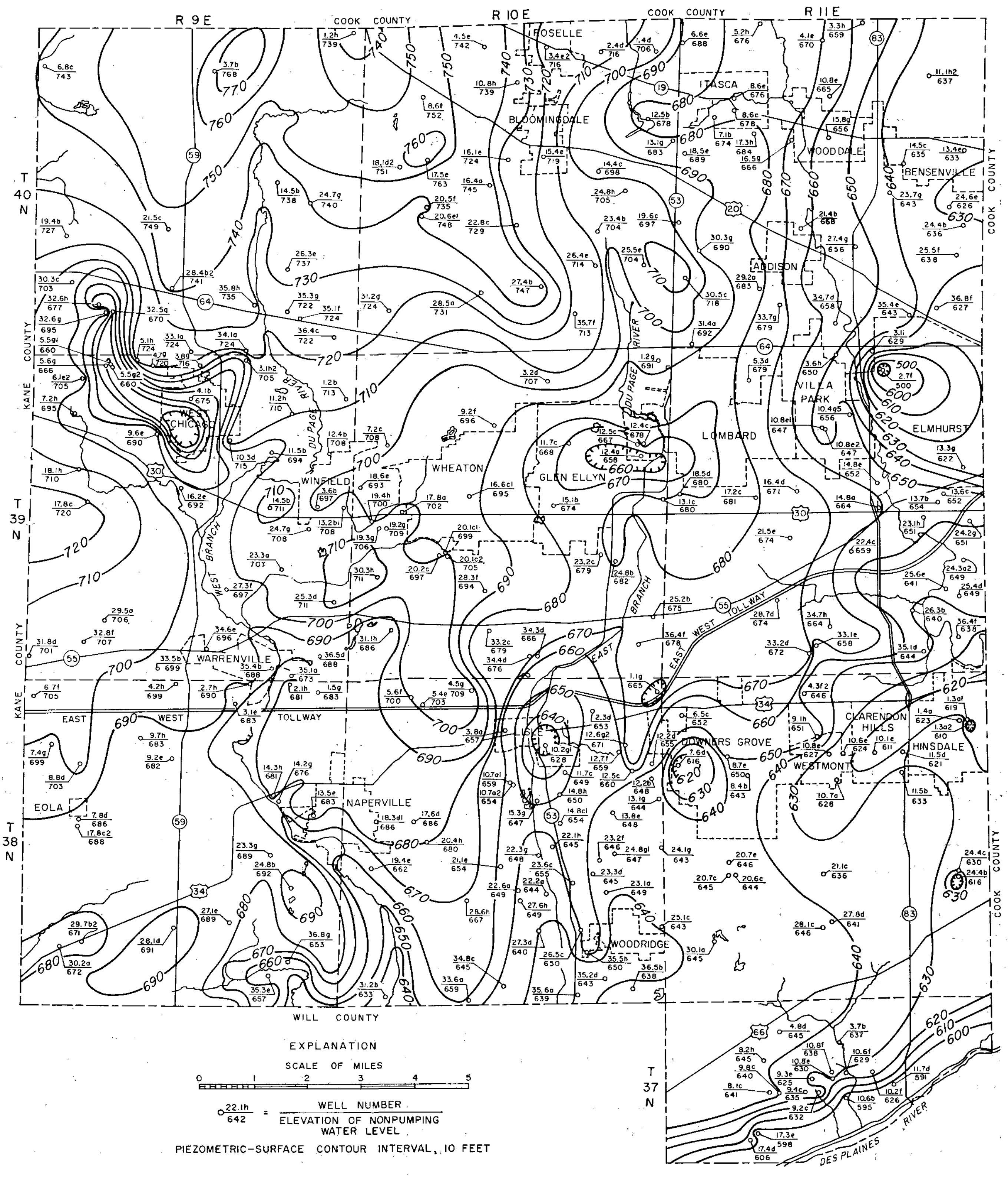



**Fig. 52. Piezometric surface of Silurian dolomite aquifer, August 1960.**

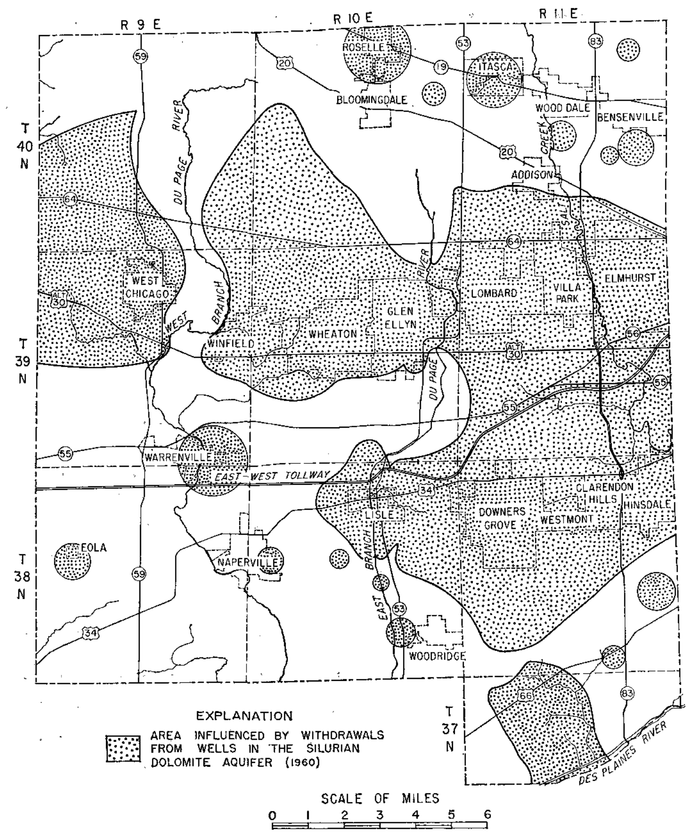



**Fig. 53. Areas influenced by withdrawals from wells in the Silurian dolomite aquifer.**

in 1960 was slow movement from all directions toward the deep cones of depression centered in the West Chicago, Lisle, Downers Grove-Westmont-Clarendon Hills-Hinsdale, and Wheaton-Glen Ellyn-Lombard areas, toward the Bast and West Branches of DuPage River, Salt Creek, and the Des Plaines River.

## WATER LEVELS

As illustrated by the hydrograph for well 39N11B-24.2g in figure 54, water levels in the Silurian dolomite aquifer generally recede in late spring, summer, and early fall when discharge by ground-water runoff to streams and by pumping from wells is greater than recharge from precipitation. Water levels begin to recover in wells late in the fall, when pumping rates are reduced and conditions are favorable for the infiltration of rainfall, first to replenish the glacial drift and later to percolate to the Silurian dolomite aquifer. The rise of water levels is especially pronounced in the wet spring months, when the ground-water reservoir receives most of its annual recharge. Maximum and minimum annual water levels are recorded at different times of the year depending primarily upon climatic and pumping conditions.

According to the hydrographs in figure 55, water levels in dolomite wells fairly remote from pumping centers have a seasonal fluctuation ranging from 2 to 8 feet and averaging 5 feet. The hydrographs of dolomite wells in pumping centers shown in figures 56-59 indicate that in heavily pumped areas seasonal fluctuations may range from 3 to 15 feet in response to changes in pumping rates. The location of observation wells is shown in figure 60.

The first record of a water level in the Silurian dolomite aquifer is for a well at Lombard and was collected in 1907. Water-level data obtained mostly from State

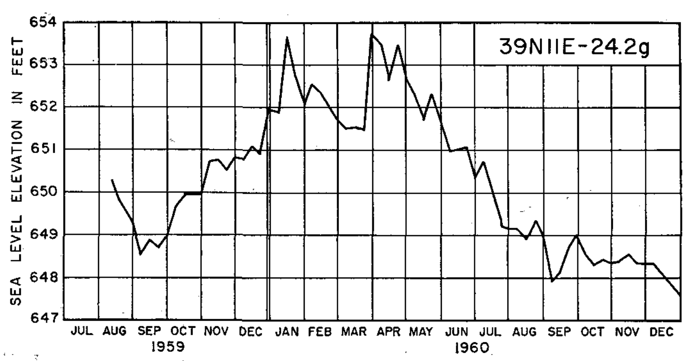



**Fig. 54. Water levels in well 39N11E-24.2g, 1959-1960.**

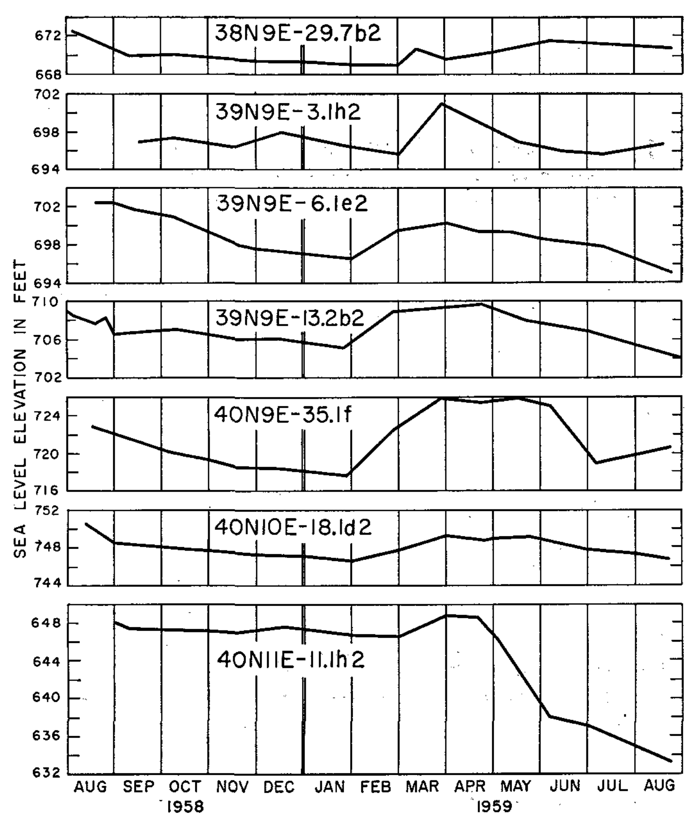



**Fig. 55. Water levels in wells in the Silurian dolomite aquifer, 1958-1959.**

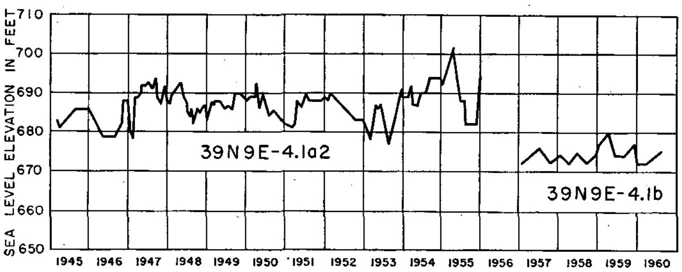



**Fig. 56. Hydrographs of water levels in wells in the Silurian dolomite aquifer in the West Chicago area, 1945-1960.**

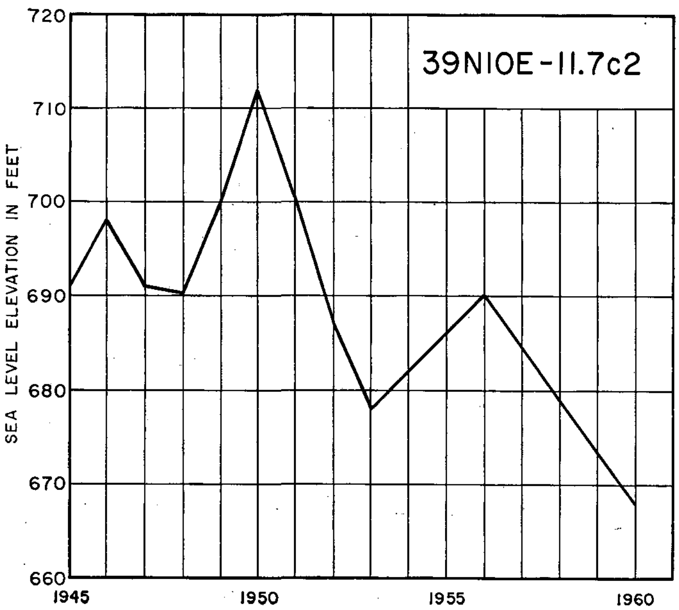



**Fig. 57. Hydrograph of water levels in a well in the Silurian dolomite aquifer in the Wheaton-Glen Ellyn-Lombard pumping center, 1945-1960.**

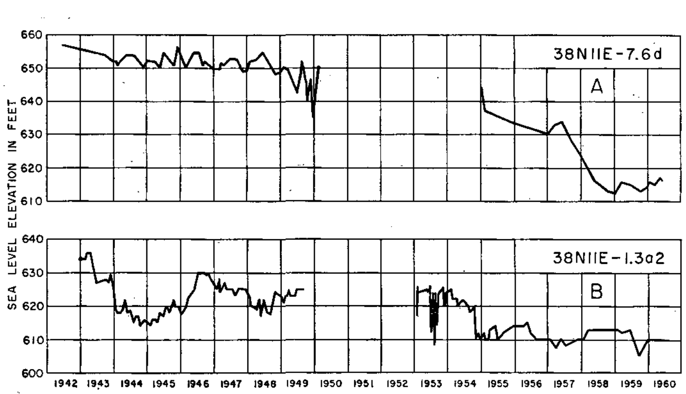



**Fig. 58. Hydrographs of water levels in wells in the Silurian dolomite aquifer in the Downers Grove area (A) and Hinsdale area (B), 1942-1960.**

Water Survey Bulletin 40 (1950) for the period 1907 through 1939 prior to heavy well development are summarized in table 10. A comparison of estimated early

**Table 10. Water Levels in Wells in the Silurian Dolomite Aquifer for the Period 1907-1939 and for 1960**

| Location of well | Depth of well (ft) | Water level elevation (ft) early | Water level elevation (ft) 1960 | Date of measurement of early water level | Water level decline (ft) |
|---|---|---|---|---|---|
| Eoselle | 182 | 733 | 716 | 1926 | 17 |
| Itasca | 184 | 684 | 676 | 1936 | 8 |
| Villa Park | 251 | 662 | 647 | 1925 | 15 |
| Lombard | 84 | 689 | 680 | 1907 | 9 |
| Glen Ellyn | 310 | 719 | 668 | 1916 | 51 |
| Wheaton | 175 | 717 | 695 | 1917 | 22 |
| Winfield | 200 | 714 | 697 | 1939 | 17 |
| West Chicago | 322 | 710 | 675 | 1915 | 35 |
| Lisle | 231 | 663 | 628 | 1926 | 35 |
| Downers Grove | 250 | 656 | 616 | 1928 | 40 |
| Westmont | 313 | 652 | 624 | 1926 | 28 |
| Clarendon Hills | 250 | 635 | 611 | 1932 | 24 |
| Hinsdale | 209 | 649 | 610 | 1924 | 39 |

water levels and the water levels measured in 1960 (table 10) indicates that the artesian pressure of the Silurian dolomite aquifer has lowered more than 10 feet in most of the pumping centers in response to heavy pumping. Water-level declines range from 8 feet at

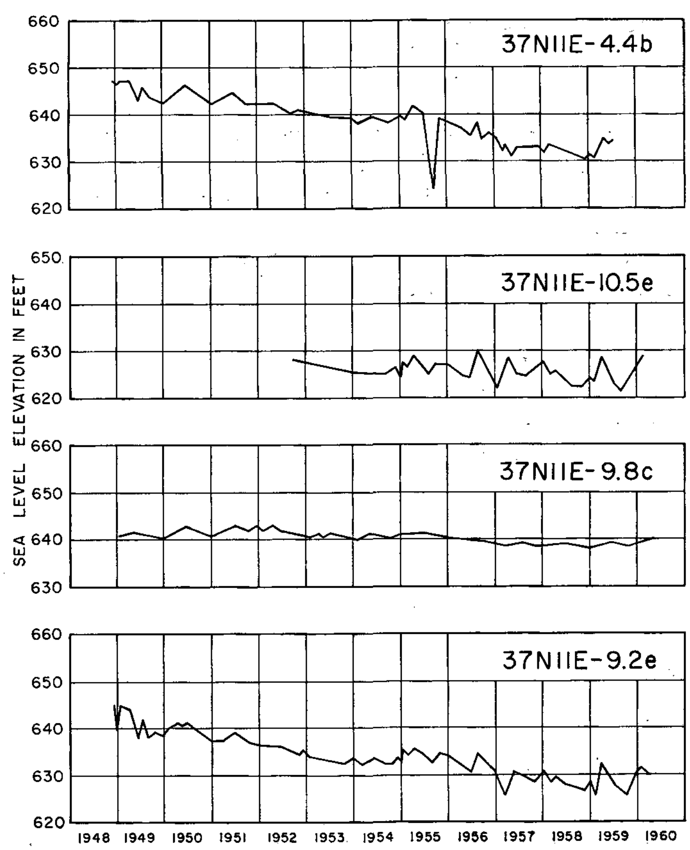



**Fig. 59. Hydrographs of water levels in wells in the Silurian dolomite aquifer in the Argonne area, 1948-1960.**

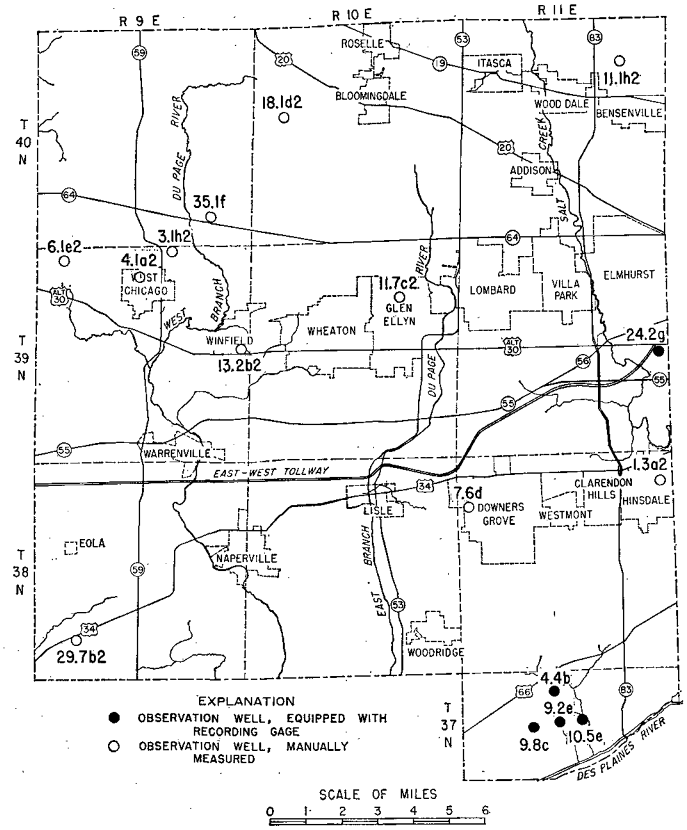



**Fig. 60. Location of selected observation wells in the Silurian dolomite aquifer.**

Itasca to 51 feet at Glen Ellyn and average about 26 feet.

Water levels in several dolomite wells have been measured periodically since 1942. Hydrographs for dolomite wells in the West Chicago, Glen Bllyn, Downers Grove, Hinsdale, and Argonne areas are given in figures 56-59. All the wells except those in the Argonne area are municipal wells and are near centers of heavy pumpage. The data in figure 59 were obtained by the U. S. Geological Survey during their study of ground-water conditions at the Argonne National Laboratory.

As the result of heavy pumping, the nonpumping water levels in dolomite wells declined from an elevation of 656 feet in 1942 to about 616 feet in 1960 at Downers Grove. The average rate of decline in this 18-year period was 2.2 feet per year and the total decline during the same period was 40 feet.

Water levels in dolomite wells at Hinsdale declined from an elevation of 635 feet in 1942 to about 610 feet in 1960. The total decline and average rate of decline in this 18-year period were 25 feet and 1.4 feet per year, respectively.

According to figure 56, water levels at West Chicago declined from an elevation of 685 feet in 1945 to about 675 feet in 1960. The average rate of decline in this 15-year period was about 0.7 foot per year and the total decline was 10 feet.

The hydrograph of well 39N10E-11.7c2 in figure 57 shows that water levels in dolomite wells at Glen Ellyn declined from an elevation of 691 feet in 1945 to 668 feet in 1960. The total decline and average rate of decline during this 15-year period were 23 feet and 1.5 feet per year, respectively.

According to the hydrographs for wells 37NllB-4.4b and 37NllE-9.2e in figure 59, water levels at Argonne declined from an average elevation of 645 feet in 1949 to 631 feet in 1960. The average rate of decline in this 11-year period was 1.3 feet per year and the total decline was 14 feet.

## Recharge

Recharge to the Silurian dolomite aquifer is derived chiefly from vertical leakage through the glacial drift. The glacial drift is in turn recharged from precipitation. The rate of recharge to the Silurian dolomite aquifer can be estimated with a piezometric map and past records of pumpage and water levels.

Areas of influence of production wells in area 1 (West Chicago), area 2 (Wheaton-Glen Ellyn-Lombard), area 3 (Downers Grove-Westmont-Clarendon Hills-Hins-

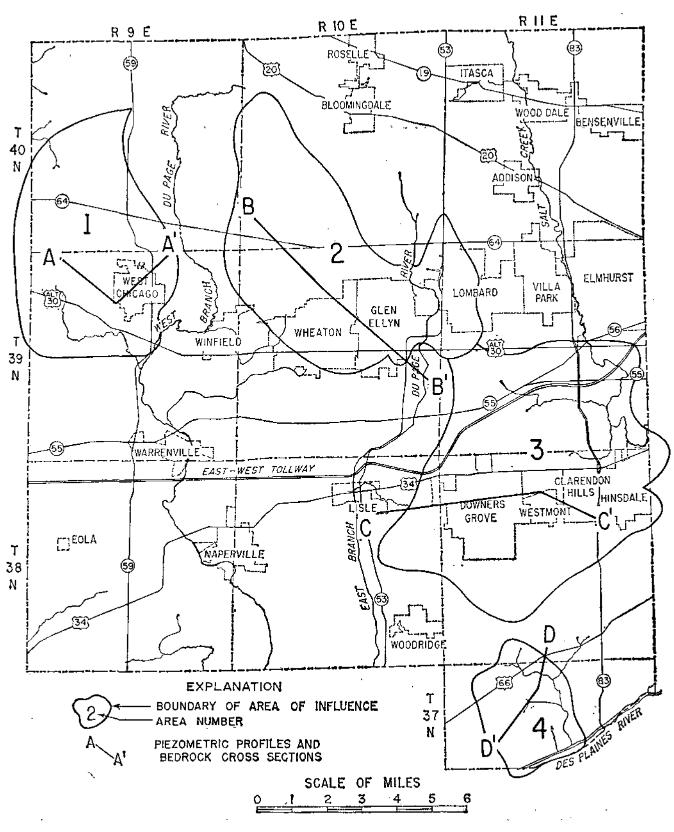



**Fig. 61. Selected areas influenced by withdrawals from wells in the Silurian dolomite aquifer.**

dale), and area 4 (Argonne National Laboratory), as shown in figure 61, were delineated with the piezometric surface map (fig. 52).

Comparisons of pumpage and water-level graphs for the areas of influence indicate that in general water-level declines are directly proportional to pumping rates. The water levels in the dolomite vary greatly from place to place within the areas and from time to time mostly because of the shifting of pumpage from well to well and variations in total well field pumpage; however, at no location is there any apparent continuous decline that cannot be explained by pumpage increases. Thus, within a relatively short time after each increase in pumpage, recharge from vertical leakage through the glacial drift increased in proportion to pumpage because vertical hydraulic gradients became greater and areas of influence expanded. Therefore, recharge to the Silurian dolomite aquifer within any particular area of influence is equal to the total pumpage from dolomite wells in the area of influence.

Measured areas of influence, pumpage data, and recharge rates computed as the quotient of pumpage and area are given in table 11. Recharge rates calculated for the areas of influence are approximately the same with the exception of area 1 where the recharge rate is approximately one-half the rate computed for the other three areas.

**Table 11. Rates of Recharge to the Silurian Dolomite Aquifer**

| Area number | 1960 pumpage (mgd) | Area (sq mi) | Recharge rate (gpd/sq mi) |
|---|---|---|---|
| 1 | 1.8 | 28.0 | 64,000 |
| 2 | 4.5 | 32.5 | 138,000 |
| 3 | 6.3 | 46.2 | 136,000 |
| 4 | 1.2 | 7.6 | 158,000 |

Detailed investigations of the geohydrologic characteristics of the areas of influence were carried out to determine the cause of the lower recharge rate in area 1. Land surface topography within the areas of influence is, in general, quite similar. Studies of the character and distribution of the unconsolidated materials revealed no appreciable gross lithologic differences within the four areas of influence, and the glacial materials would not be expected to cause major differences in recharge to the Silurian dolomite aquifer.

The piezometric profiles of the Silurian dolomite aquifer in the cross sections of the areas of influence (fig. 62) show that the piezometric surface of the water in the aquifer is more than 50 feet below ground surface throughout most of the areas. Analysis of the piezometric surface of the Silurian dolomite aquifer and data on the position of the water table in the glacial drift show that average vertical hydraulic gradients do

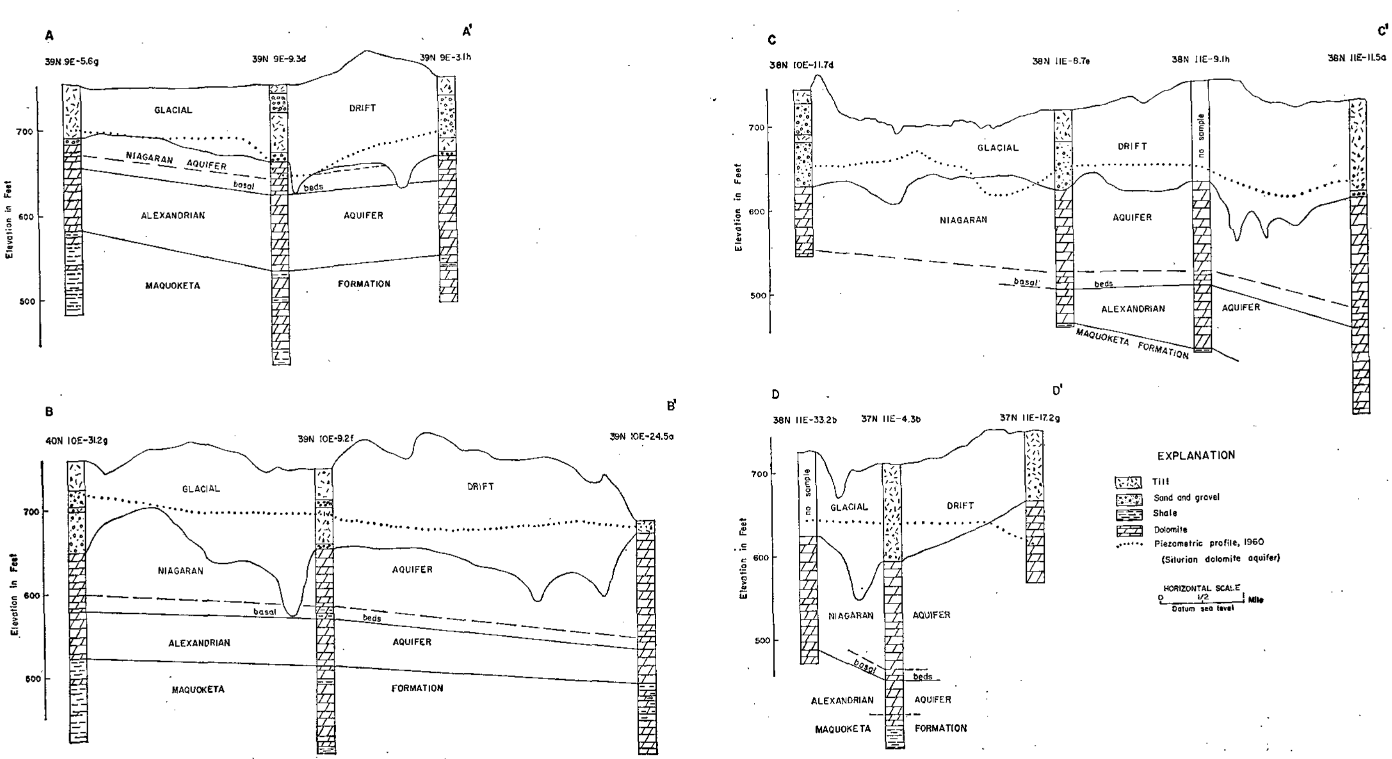



**Fig. 62. Cross sections of the Silurian dolomite aquifer in the (A) West Chicago area, (B) Wheaton-Glen Ellyn-Lombard area, (C) Downers Grove-Hinsdale area, and (D) Argonne area.**

not differ appreciably between the areas. The lower recharge rate in the "West Chicago area cannot be explained on the basis of the presence of a smaller hydraulic gradient between the glacial drift and the Silurian dolomite aquifer in the West Chicago area.

The character of the upper part of the Silurian dolomite aquifer in the West Chicago area is considerably different than in the other three areas. As is shown by the map of the areal geology of the bedrock surface (fig. 7) and the cross sections of the areas of influence (fig. 62) much of the upper part of the Silurian dolomite aquifer in the West Chicago area is made up of the basal beds of the Niagaran Series. Most of the strata of the Niagaran Series above these beds have been removed by erosion in the West Chicago area but are present and are relatively thick in the other three areas. The basal beds of the Niagaran Series in the other three areas are encountered at considerable depths.

The dense, shaly dolomite and shale of the basal beds of the Niagaran Series may have restricted development of a weathered zone with solution-enlarged openings in the upper part of the dolomite and thereby restricted development of the permeability necessary for recharge to the underlying Alexandrian aquifer.

Other areas in DuPage County where recharge is probably low, or about the same as in the West Chicago area, are delineated by assuming that recharge to the Silurian dolomite aquifer is limited east of the Niagaran-Alexandrian contact where rocks of the Niagaran aquifer are less than 50 feet thick. In these areas, the shaly basal beds of the Niagaran Series occur in the upper part of the aquifer. The recharge rate is probably also low in areas where water is obtained from the Maquoketa Formation because permeable dolomite beds of the formation are interbedded with and often overlain by beds of shale and dolomitic shale with a very low permeability.

Areas where recharge is about the same as in areas 2, 3, and 4 are delineated by assuming that recharge is high west of the Niagaran-Alexandrian contact in the rocks of the Alexandrian aquifer and east of the Niagaran-Alexandrian contact where rocks of the Niagaran aquifer are more than 25 feet thick.

Estimated recharge rates for the Silurian dolomite aquifer based upon these recharge rates, the geologic map of the bedrock surface (fig. 7), and the thickness of the Niagaran aquifer (fig. 19) are shown on the map in figure 63. It is probable that recharge to the Silurian dolomite aquifer averages about 60,000 gpd/sq mi in parts of the western one-third of the county and averages about 140,000 gpd/sq mi in large areas of the eastern two-thirds of the county.

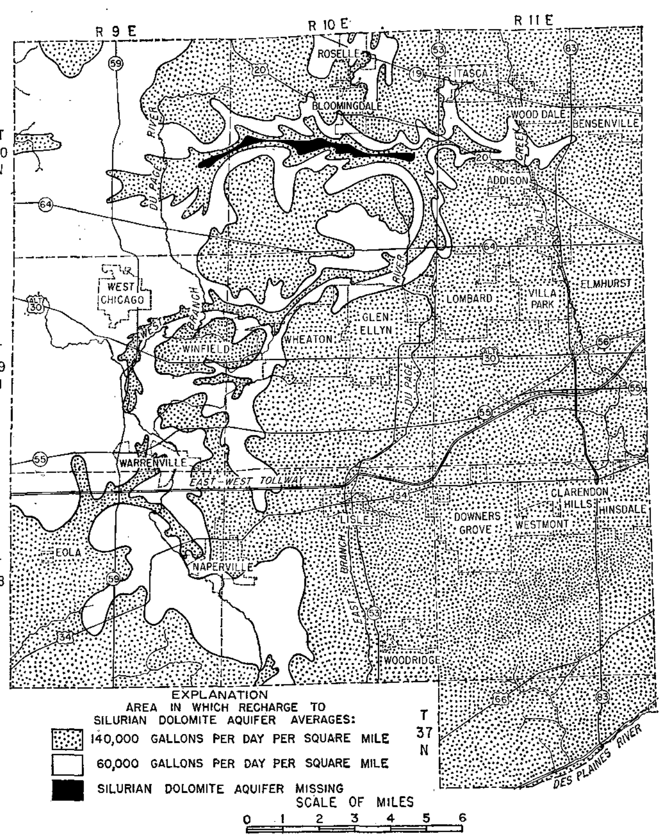



**Fig. 63. Estimated recharge rates for the Silurian dolomite aquifer.**

## PROBABLE YIELDS OF WELLS

Because the productivity of the Silurian dolomite aquifer is inconsistent it is impossible to predict with a high degree of accuracy the yield of a well before drilling at any location. Probable specific capacities of wells in figure 64 were estimated as the product of the specific capacity per foot of penetration measured in 50 percent of the existing wells (fig. 51) and unit thicknesses (figs. 19-21). Specific capacities equal to or less than 10 gpm/ft can be expected in large areas in the southwestern and north-central parts of the county where the Niagaran aquifer is thin or absent. Specific capacities equal to or less than 20 gpm/ft can be expected in areas in the western part of the county where the Niagaran aquifer is of moderate thickness and does not exceed 50 feet in thickness. Specific capacities equal to or less than 80 gpm/ft can be expected in large areas in the eastern two-thirds of the county where the total thickness of the units of the Silurian dolomite aquifer commonly exceeds 100 feet.

Probable specific capacities were in turn multiplied by available drawdowns, based on water-level data in figure 52 and thickness maps of the units, to estimate the probable yields of wells which completely penetrate the total thickness of the Silurian dolomite aquifer. Pumping levels were limited to depths below the top of the Silurian dolomite aquifer equal to one-half the

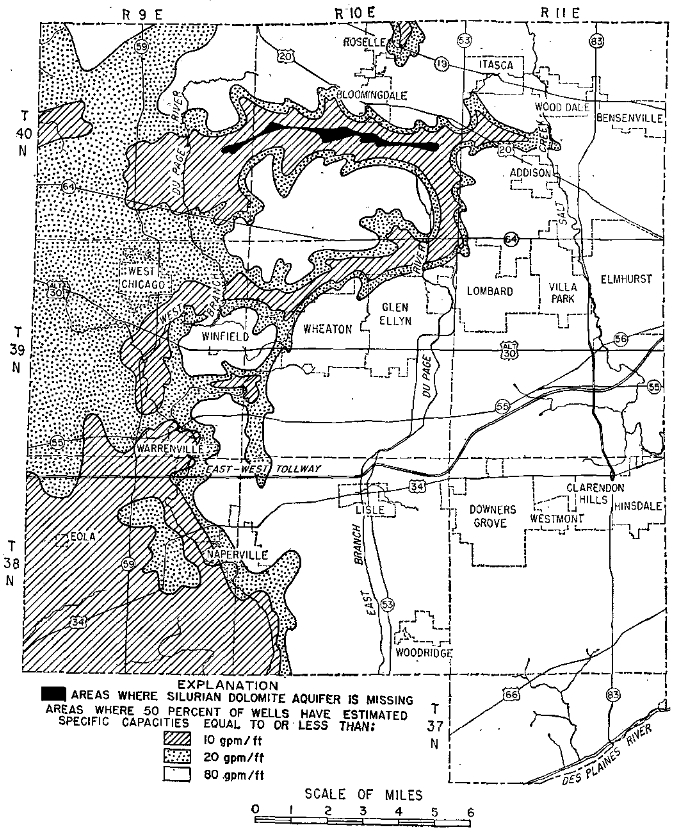



**Fig. 64. Estimated specific capacities of wells in the Silurian dolomite aquifer.**

thickness of the aquifer in areas where the Niagaran aquifer exceeds 25 feet in thickness, or one-quarter the thickness of the aquifer where the Niagaran aquifer is missing or is less than 25 feet thick, or 100 feet whichever was smaller in any particular case.

The probable range of yields of wells in the Silurian dolomite aquifer is shown in fignre 65. It is possible to drill what is essentially a dry hole at any location; however, based on data for 50 percent of existing wells' the chances of obtaining a well with a yield of 250 gpm or more are good in all areas except areas in the north-central part of the county where the Silurian dolomite aquifer is missing and the Maquoketa Formation immediately underlies the glacial drift. The chances of obtaining a well with a yield of 500 gpm or more are good in most areas in the eastern two-thirds of the county. Thus, the yield of the Silurian dolomite aquifer is probably high enough to support heavy industrial or municipal well development in all but a small part of the county.

## Potential Yield

Because the Silurian dolomite aquifer is thick, fairly deeply buried, and on a regional basis has high to moderate permeabilities and great extent, areas of influence of production wells can extend for considerable distances and available water resources can be developed with a reasonably small number of wells, and well fields. According to figure 53, there are large areas not influenced by present pumpage where heavy well development is possible, suggesting that the potential yield of the Silurian dolomite aquifer is much greater than present withdrawals. The potential yield is here defined as the maximum amount of ground water that can be developed from a reasonable number of wells and well fields without creating critical water levels or exceeding recharge.

Areas influenced by pumping include sites where the Silurian dolomite aquifer yields very little water to individual wells. In addition, the piezometric surface map in figure 52 is regular in appearance and could be favorably compared to piezometric surface maps for uniform sand and gravel or sandstone aquifers. These facts indicate that the inconsistency of the Silurian dolomite aquifer has little effect on the regional response of the aquifer to pumping and should not seriously deter the full development of available ground-water resources.

Well field specific capacity data (table 12) indicate that large quantities of water can be obtained from the

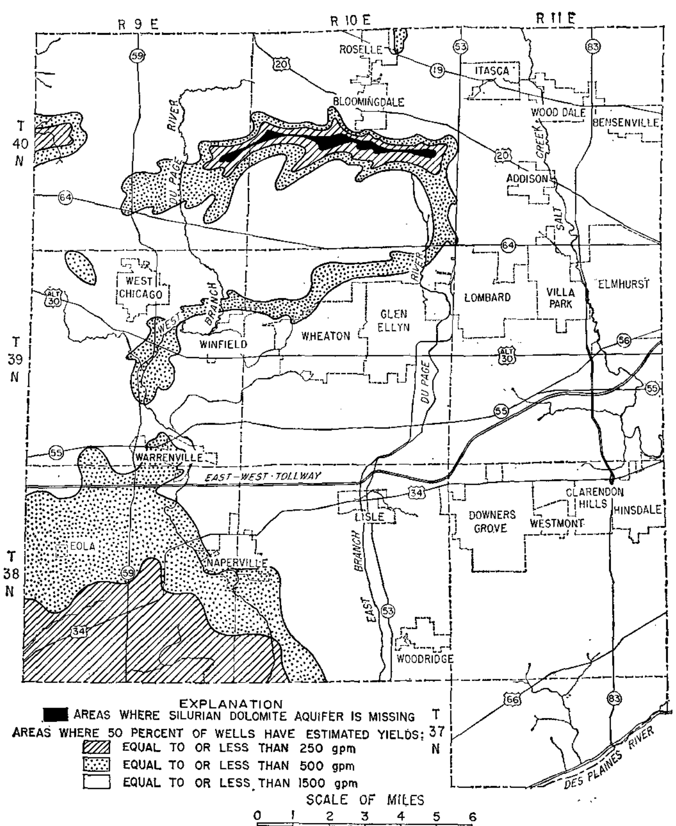



**Fig. 65. Estimated yields of wells in the Silurian dolomite aquifer.**

Table 12. Data on the Response of the Silurian Dolomite Aquifer to Heavy Pumping

| Well number | Owner | Nonpumping water level elevation: early | Nonpumping water level elevation: recent | Date of measurement: early | Date of measurement: recent | Decline in water level elevation (ft) | 1960 pumping rate (gpd) | Specific capacity (gpd/ft) |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 37N11E-10.5f | Argonne National Lab. | 648 | 612 | 1948 | 6/60 | 36 | 951,000 | 26,000 |
| 38N11E-7.6d | Village of Downers Grove | 656 | 616 | 1928 | 7/60 | 40 | 1,901,000 | 48,000 |
| 39N9E-4.1a | City of West Chicago | 710 | 675 | 1915 | 7/60 | 35 | 512,000 | 15,000 |
| 39N10E-11.7e | Village of Glen Ellyn | 719 | 668 | 1916 | 6/60 | 51 | 1,268,000 | 25,000 |
| 39N10E-16.6cl | City of Wheaton | 717 | 695 | 1917 | 6/60 | 22 | 2,000,000 | 91,000 |
| 39NllE-8.7h | Village of Lombard | 689 | 680 | 1907 | 7/60 | 9 | 317,000 | 35,000 |
| 39N11E-10.8e2 | Village of Villa Park | 662 | 647 | 1925 | 7/60 | 15 | 265,000 | 18,000 |
| 40NllE-8.6e | Village of Itasca | 684 | 676 | 1936 | 1960 | 8 | 189,000 | 24,000 |

Silurian dolomite aquifer. Specific capacities exceed 20,000 gpd/ft of drawdown in most places where data are available and the Silurian dolomite aquifer yields more than 40,000 gpd/ft in some heavily pumped areas.

Data on the response of the Silurian dolomite aquifer to heavy pumping and on yields of existing production wells indicate that the potential yield of the Silurian dolomite aquifer is limited by recharge. The potential yield of the Silurian dolomite aquifer in DuPage County is estimated to be about 38 mgd based on the recharge rates in figure 63. Artificial recharge was not considered in the computation of potential yield.

### Practical Sustained Yield of Existing Pumping Centers

In 1960 large parts of DuPage County were influenced by pumping from the Silurian dolomite aquifer. Many pumping centers are so closely spaced that individual cones of depression overlap and there is competition between pumping centers for areas unaffected by pumping. Interference between pumping centers affects values of discharge and drawdown in individual wells. This situation is particularly apparent in parts of the county from Lisle east through Hinsdale and from Winfield east through Elmhurst. Room for future expansion of areas of influence is limited.

The nonpumping water levels in wells in parts of the West Chicago, Glen Ellyn, Downers Grove, Clarendon Hills, Hinsdale, and Argonne areas were below the top of the Silurian dolomite aquifer in 1960. The yields of production wells will continually decrease as more of the aquifer is dewatered. Declines in yield will probably become critical after one-half of the Niagaran aquifer is dewatered at places where the thickness of these rocks exceeds 25 feet and after one-quarter of the Alexandrian aquifer is dewatered at place where the Niagaran aquifer is missing or is less than 25 feet thick. Therefore, available drawdown in pumping centers is limited.

In 1960 nonpumping water levels were not critical in any pumping center and there were areas unaffected by pumping. Thus, the practical sustained yield of existing pumping centers exceeds total withdrawals in 1960. The practical sustained yield is here defined as the rate at which ground water can be continuously withdrawn from wells in existing pumping centers without lowering water levels to critical stages and without exceeding recharge.

Drawdowns available for future increases in pumpage were estimated for pumping centers from the unit thicknesses and the piezometric surface map of the Silurian dolomite aquifer (figs. 19, 21, and 52). It was assumed that critical water levels will result if more than one-half of the Niagaran aquifer is dewatered at places where the thickness of these rocks exceeds 25 feet and after one-quarter of the Alexandrian aquifer is dewatered at places where the Niagaran aquifer is missing or is less than 25 feet thick. The amounts of water that can be withdrawn from pumping centers in addition to withdrawals in 1960 without creating critical water-level conditions were estimated as the products of available drawdowns and the well field specific capacities given in table 12. Estimated additional withdrawals were added to pumping rates in 1960 to obtain total allowable withdrawals.

The areas of influence necessary for a balance between total allowable withdrawals and recharge were estimated with the recharge rates in figure 63 and were sketched on a map of DuPage County using the areas influenced by withdrawals in the Silurian dolomite aquifer (fig. 53) as a guide. In some cases it was found that areas of influence needed for balance were unreasonably large and • needs were greater than that available from the areas unaffected by pumping in 1960, indicating that the practical sustained yield is limited not by critical water levels but by recharge. In these cases the practical sustained yields were estimated as the products of available areas unaffected by pumping within the county in 1960 and recharge rates in figure 63. In the other cases the sum of the estimated additional withdrawals based on critical water levels and total withdrawals in 1960 are the practical sustained yields. Estimated practical sustained yields of pumping centers are given in table 13. Artificial recharge was not considered in the computation of practical sustained yield.

Table 13. Estimated Practical Sustained Yields of Pumping Centers

| Pumping center | 1960 pumping rate *(mgd)* | Additional possible withdrawal *(mgd)* | Practical sustained yield *(mgd)* | Tear after which practical sustained yield may be exceeded |
|---|---|---|---|---|
| Downers Grove-Clarendon Hills-Hinsdale area | 6.3 | 1.5 | 7.8 | 1964 |
| Argonne area | 1.2 | 1.0 | 2.2 | 1967 |
| Elmhurst-Villa Park area | 2.0 | 0.5 | 2.5 | 1971 |
| Addison area | 1.0 | 1.5 | 2.5 | 1970 |
| Itasca area | 0.4 | 1.6 | 2.0 | 1985 |
| Eoselle area | 0.6 | 0.5 | 1.1 | 1966 |
| Wheaton-Glen Ellyn-Lombard area | 4.8 | 1.9 | 6.7 | 1970 |
| Lisle area | 0.8 | 1.8 | 2.6 | 1975 |
| West Chicago area | 1.9 | 0.8 | 2.7 | 1971 |
| Warrenville area | 0.4 | 1.6 | 2.0 | 1979 |
| Naperville-Eola area | 0.6 | 2.0 | 2.6 | 1985 |
| Total | 20.0 | 14.7 | 34.7 | |

The total practical sustained yield (about 35 mgd) is about 92 percent of the potential yield (38 mgd) of the Silurian dolomite aquifer. Thus, nearly all of the potential yield of Silurian dolomite aquifer can be developed with scattered production wells in existing pumping centers. About 3 mgd is beyond the reach of existing pumping centers mostly in areas in the northwestern and southwestern parts of the county.

Dates after which withdrawals in existing pumping centers are likely to exceed the practical sustained yields were estimated by extrapolating pumpage graphs in figures 30-33. No great accuracy is inferred for the estimated dates in table 13; they are given only to aid future water planning. If pumpage continues to grow in the future as it has in the past 10 years, the practical sustained yields of several pumping centers will probably be exceeded within 2 to 5 years and the practical sustained yields of all pumping centers will be exceeded by 1985. A reasonable extrapolation of the pumpage growth curve in figure 28 suggests that total groundwater withdrawals from wells in the Silurian dolomite aquifer in DuPage County will exceed the potential yield of the Silurian dolomite aquifer by about 1977.

## Glacial Drift Aquifers

Glacial drift aquifers in large areas of the county are in hydraulic connection with the Silurian dolomite aquifer. Pumping from basal sand and gravel aquifers in areas where recharge to the Silurian dolomite aquifer is not retarded by the shaly basal beds of the Niagaran Series will reduce recharge to, and therefore the potential yield of, the Silurian dolomite aquifer. In these areas most of the sand and gravel aquifers complement the Silurian dolomite aquifer, thus mutually supplying each other's lack. The total potential yield of these aquifers is equal to the potential yield of the Silurian dolomite aquifer and the presence of the glacial drift aquifers only serves to make development of available ground water resources less difficult.

In areas where recharge to the Silurian dolomite aquifer is retarded, the basal and interbedded sand and gravel deposits supplement the Silurian dolomite aquifer. The potential yield of the glacial drift aquifers is in addition to the potential yield of the Silurian dolomite aquifer and is limited to the difference between the recharge rates of the Silurian dolomite and glacial drift aquifers.

In areas where fairly extensive sand and gravel deposits occur at shallow depths these deposits also supplement the Silurian dolomite aquifer.

The map in figure 66 was prepared by assuming that the glacial drift aquifers supplement the Silurian dolomite aquifer in areas where basal sand and gravel deposits exceed 20 feet in thickness and the shaly dolo-

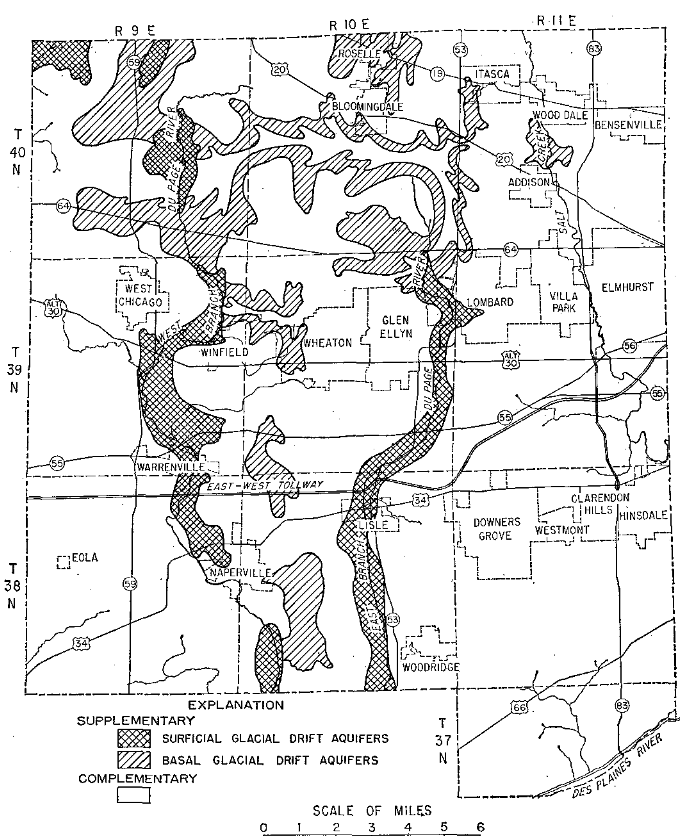



**Fig. 66. Relationship of glacial drift aquifers to dolomite aquifers.**

mite beds retard recharge and where surfieial glacial drift aquifers occur. Throughout the rest of the county, the glacial drift aquifers complement the Silurian dolomite aquifer. The potential yield of the glacial drift aquifers supplements the potential yield of the Silurian dolomite aquifer in large areas in the western one-third of the county.

### Specific Capacity Data

Available specific capacity data for wells in the glacial drift aquifers are summarized in table 14. Specific capacities range from 1.0 to 40.7 gpm/ft. Data in table 14 and in Cooperative Report 1 suggest that the yield of sand and gravel aquifers is probably high enough to support heavy industrial or municipal well development in many areas in the county.

Table 14. Specific Capacity **Data for Wells in the Glacial Drift Aquifers**

| Location and owner | Depth of well (ft) | Diam. of casing (in) | Screen length (ft) | Screen diam. (in) | Date of test | Non-pumping level (ft) | Pumping rate (gpm) | Draw-down (ft) | Specific capacity (gpm/ft) |
|---|---|---|---|---|---|---|---|---|---|
| Bloomingdale, Medinah Country Club | 68 | 8 | 15 | 16 | 1956 | 14 | 1100 | 27 | 40.7 |
| Elmhurst, Standard Oil Company | 218 | 8 | | | 1958 | 25 | 60 | 62 | 1.0 |
| Lemont, State Geological Survey | 75 | 10 | 14 | 7 | 1943 | 19.5 | 273 | 24.8 | 11.0 |
| Lombard, York Center Community Co-op | 81 | 6 | 10 | 6 | 1960 | 37 | 150 | 5.5 | 2.7 |

### Water Levels

Relatively few wells completed in the glacial drift aquifers were available for water-level measurements. Monthly measurements (fig. 67) were taken over a period of one year in several wells scattered throughout the county. The water levels in a shallow dug well west of Naperville were continuously measured with a recorder during 1959 and 1960. A hydrograph for the well is shown in figure 68.

Hydrographs of the water levels in the glacial drift wells show a pattern of seasonal fluctuation similar to the hydrographs of water levels of wells completed in the Silurian dolomite aquifer. Most of the water levels in glacial drift wells are affected to a greater degree by precipitation than are water levels in Silurian dolomite wells. Year end water levels vary from year to year chiefly because of climatic conditions. The water level is well 38N9E-22.3f was about 4 feet lower in December 1960 than it was in December 1959 largely because precipitation during the late fall months of 1960 was below normal and precipitation during the late fall months of 1959 was near normal. The hydrographs indicate no general or permanent decline in water levels.

### Reoharge

Recharge to basal sand and gravel deposits is assumed to be approximately equal to the rate of recharge (140,000 gpd/sq mi) to the underlying Silurian dolomite aquifer in areas where shaly dolomite beds do not retard the vertical movement of water. The rate of recharge to the fairly extensive surfieial sand and gravel aquifers was estimated on the basis of stream flow studies in DuPage County and sand and gravel aquifer studies in other parts of Illinois.

#### *Stream Flow Analysis*

Ground-water runoff to streams in the two drainage basins shown in figure 69 was estimated with stream flow hydrograph separation methods outlined by Linsley, Kohler, and Paulhus (1958). Daily mean stream flow data published by the U. S. Geological Sur-

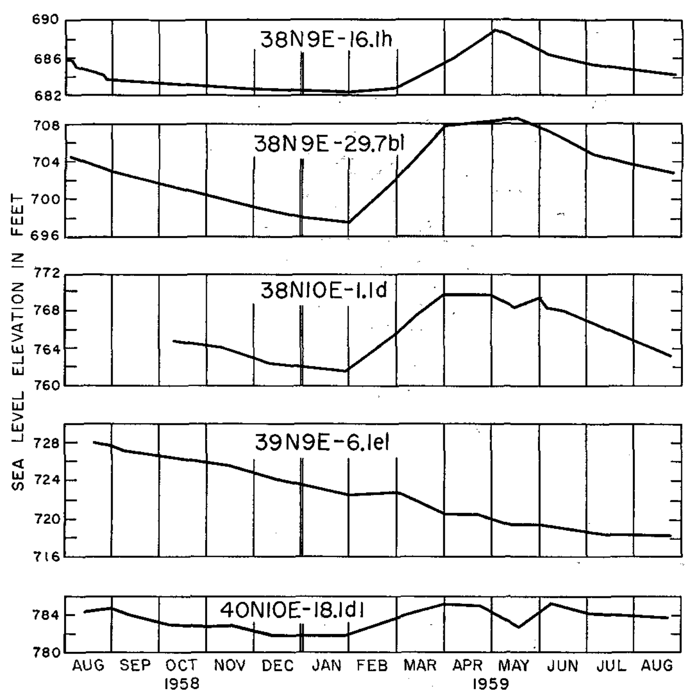



**Fig. 67. Water levels in wells in the glacial drift aquifers, 1958-1959.**

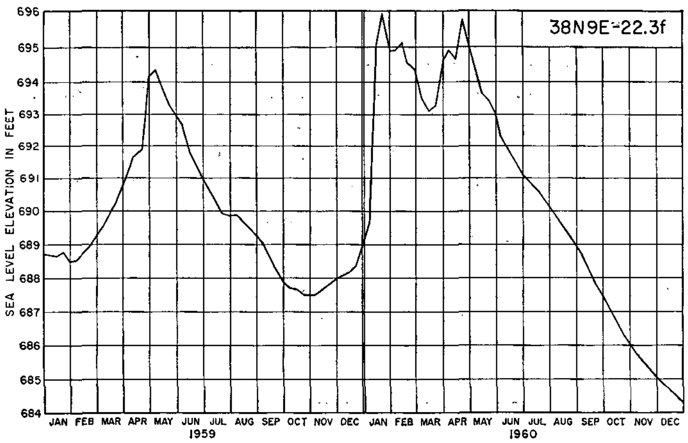



**Fig. 68. Water levels in well 38N9E-22.3f, 1959-1960.**

vey for two stream gaging stations, Salt Creek at Western Springs and DuPage Eiver at Troy, were investigated.

Records for the 10-year period 1948 through 1957 for the two gaging stations were analyzed to determine how ground-water runoff varies from year to year with climatic conditions. Daily ground-water runoff was plotted beneath stream flow hydrographs and lines were drawn connecting points to describe ground-water hydrographs as illustrated in figure 70. The shaded

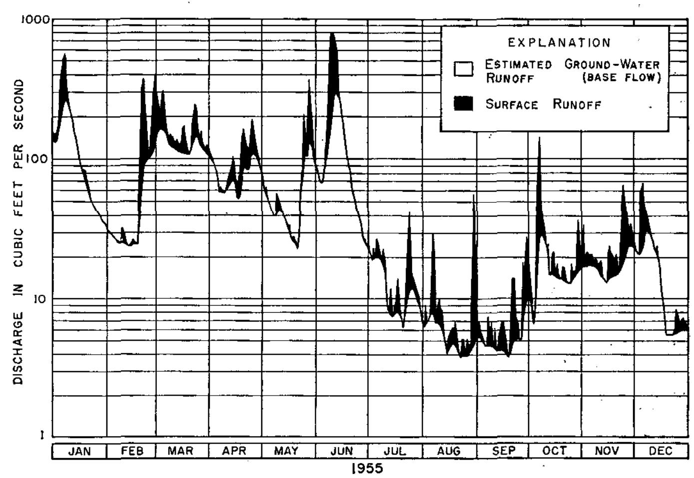



**Fig. 70. Stream flow at Western Springs gaging station, Salt Creek drainage basin, 1955.**

areas between stream flow and ground-water runoff hydrographs represent surface runoff. Annual ground-water and surface runoff for the period 1948 to 1957, expressed in inches of water over the DuPage River and Salt Creek basin, are given in table 15.

Ground-water runoff ranged from 9.45 to 2.90 inches

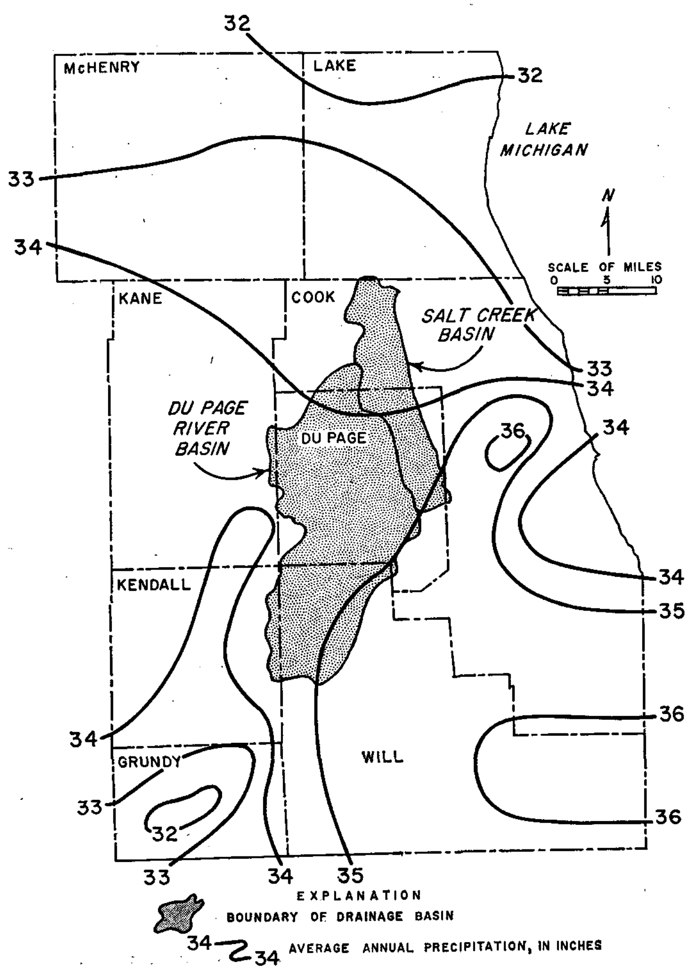



**Fig. 69. Special study drainage basins in the Chicago region.**

**Table 15. Estimated Annual Ground-Water and Surface Runoff from DuPage River and Salt Creek Drainage Basins**

| Calendar year | Ground-water runoff (*in*) | Surface runoff (*in*) | Total stream flow (*in*) |
|---|---|---|---|
| | *DuPage River basin* | | |
| 1948 | 5.46 | 4.07 | 9.53 |
| 1949 | 4.31 | 2.79 | 7.10 |
| 1950 | 8.34 | 4.28 | 12.62 |
| 1951 | 9.45 | 4.05 | 13.50 |
| 1952 | 6.72 | 2.94 | 9.66 |
| 1953 | 3.90 | 1.71 | 5.61 |
| 1954 | 7.64 | 5.99 | 13.63 |
| 1955 | 7.71 | 2.85 | 10.56 |
| 1956 | 2.90 | 1.23 | 4.13 |
| 1957 | 5.42 | 2.54 | 7.96 |
| | *Salt Creek basin* | | |
| 1948 | 4.97 | 5.01 | 9.98 |
| 1949 | 3.20 | 3.81 | 7.01 |
| 1950 | 7.94 | 4.37 | 12.31 |
| 1951 | 8.96 | 5.19 | 14.15 |
| 1952 | 7.89 | 3.52 | 11.41 |
| 1953 | 2.75 | 1.21 | 3.96 |
| 1954 | 6.90 | 4.84 | 11.74 |
| 1955 | 5.81 | 3.14 | 8.95 |
| 1956 | 2.95 | 1.78 | 4.73 |
| 1957 | 7.30 | 4.07 | 11.37 |

in the DuPage River basin and from 8.96 to 2.75 inches in the Salt Creek basin. Differences in maximum and minimum annual ground-water runoff from the two basins are small. Ground-water runoff during the period 1948 to 1957 averaged about 66 percent of stream flow from the Salt Creek basin. Maximum, minimum, and near average ground-water runoff occurred during the years 1951, 1956, and 1948 respectively. Precipitation was 5.15 inches above normal in 1951, 12.04 inches below normal in 1956, and near normal in 1948.

Data in table 15 indicate that the years 1951, 1956, and 1948 are best for studies to determine how geohydrologic and climatic conditions affect ground-water runoff and, therefore, ground-water recharge.

Some of the discharge from the basins heretofore labeled ground-water runoff is sewage. Sewage is water from shallow aquifers, the Cambrian-Ordovician and Mt. Simon aquifers, and surface sources. Water pumped from shallow aquifers was diverted from stream flow and under natural conditions would have reached the streams as ground-water runoff. Thus, water pumped from shallow aquifers within a drainage basin and discharged as sewage within the same drainage basin may be considered ground-water runoff. However, water obtained from the Cambrian-Ordovician and Mt. Simon aquifers would not under natural conditions reach streams because these aquifers are not in hydraulic connection with the surface streams. It is necessary to subtract sewage derived from the Cambrian-Ordovician and Mt. Simon aquifers and surface sources from observed ground-water runoff to determine actual ground-water runoff from shallow aquifers. Annual ground-water runoff from the two basins adjusted for sewage is given in table 16.

**Table 16. Annual Ground-Water Runoff Adjusted for Sewage from DuPage River and Salt Creek Drainage Basins**

| Drainage basin | Calendar year | Ground-water runoff *(in)* | Deep aquifer and surface source sewage *(in)* | Ground-water runoff adjusted for sewage *(in)* |
|---|---|---|---|---|
| Salt Creek | 1948 | 4.97 | 0.25 | 4.72 |
| Salt Creek | 1951 | 8.96 | 0.36 | 8.60 |
| Salt Creek | 1956 | 2.95 | 0.69 | 2.26 |
| DuPage Eiver | 1948 | 5.46 | 0.02 | 5.44 |
| DuPage Eiver | 1951 | 9.45 | 0.02 | 9.43 |
| DuPage Eiver | 1956 | 2.90 | 0.04 | 2.86 |

Many factors influence ground-water runoff. The characteristics of soils, land use, position of the water table, and amount and distribution of precipitation are but a few of the more important factors. Taking into consideration that stream flow measurements are accurate within 5 to 10 percent, and estimates of ground-water runoff are probably accurate within 10 percent, the apparent differences in ground-water runoff from basin to basin less than 15 percent of average ground-water runoff may not be real.

Not all ground-water runoff can be diverted into cones of influence because even under heavy pumping conditions there is lateral as well as vertical movement of ground water in the glacial deposits and recharge to the water table is unevenly distributed throughout the year. Studies of the character of the unconsolidated material shows that the gross lithologic character of the materials in the DuPage River and Salt Creek basins are similar. It is probable that the average ground-water runoff from areas 2, 3, and 4 under natural conditions was about the same as from Salt Creek basin and was about 5.19 inches. The average rate of recharge to the Silurian dolomite aquifer and therefore to sand and gravel deposits near the base of the glacial drift in areas 2, 3, and 4 was computed to be 140,000 gpd/sq mi or about 3.0 inches. Based on the quotient of rate of recharge and ground-water runoff, it is estimated that about 58 percent of ground-water runoff can be diverted into cones of influence to recharge production wells in deeply buried glacial drift aquifers.

Surficial sand and gravel deposits occur within each of the two basins and locally increase ground-water runoff; however, on a regional basis, these deposits have very little influence on average ground-water runoff because less permeable deposits predominate. Based upon recent studies at Taylorville (Walker and Walton, 1961), stream flow studies in central Illinois (Schicht and Walton, 1961) and in northeastern Illinois, and the above 58 percent factor, the average rate of recharge to the surficial sand and gravel aquifers was estimated to be about 4.7 inches or 230,000 gpd/sq mi.

Figure 71 is a map showing estimated recharge rates for the glacial drift aquifers. Except in small areas where surficial sand and gravel deposits occur it is probable that recharge to the glacial drift aquifers averages about 140,000 gpd/sq mi.

## Potential Yield

The potential yield of the glacial drift aquifers was estimated (from figs. 66 and 71) to be about 3 mgd. The assumption was made that conditions are favorable for development of well fields and available ground-water resources in about 50 percent of areas where glacial drift aquifers supplement the Silurian dolomite aquifer.

The potential yield of the glacial drift aquifers was estimated by assuming full development of the Silurian dolomite aquifer and supplemental development of glacial drift aquifers. In many areas full development of glacial drift aquifers and supplemental development of the Silurian dolomite aquifer may be advantageous.

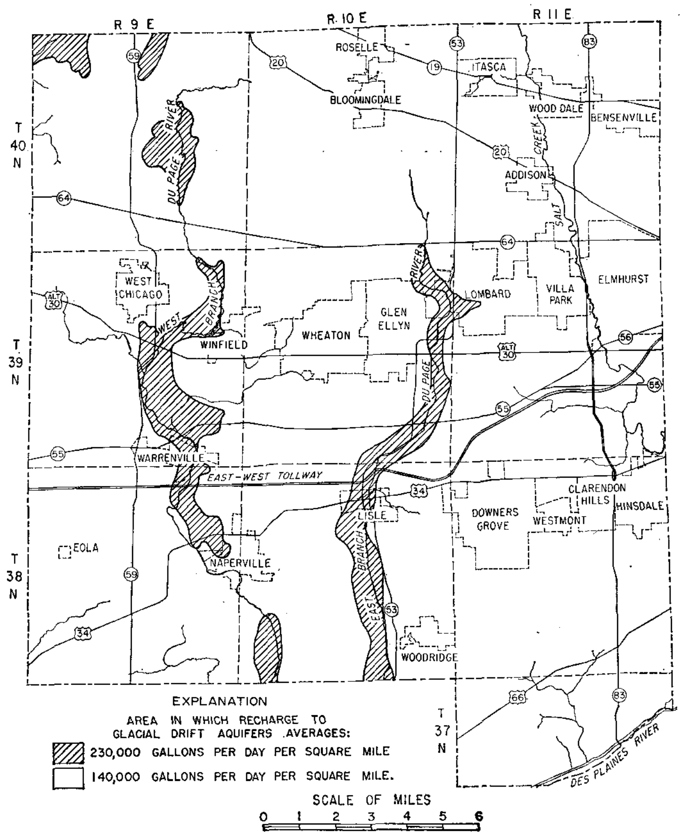



**Fig. 71. Estimated recharge rates for the glacial drift aquifers.**

Thus, it is possible to obtain more water from the glacial drift aquifers than computed and correspondingly less water from the Silurian dolomite aquifer. The potential yield of the glacial drift aquifer (3 mgd) greatly exceeds withdrawals from drift wells (0.52 mgd) in 1960.

### CAMBRIAN-ORDOVICIAN AND MT. SIMON AQUIFERS

Available data indicate that on a regional basis the entire sequence of strata, from the top of the Galena-Platteville Dolomite to the top of the shale beds of the Eau Claire Formation, behaves hydraulically as one aquifer (Cambrian-Ordovician aquifer) in northeastern Illinois. Shale beds of the Maquoketa Formation above the Galena-Platteville Dolomite greatly retard the vertical movement of ground water and confine the water in the Cambrian-Ordovician aquifer under leaky artesian conditions. The Cambrian-Ordovician aquifer receives water from overlying glacial deposits mostly in areas of Kane, McHenry, Kendall, Boone, and DeKalb Counties where the Galena-Platteville Dolomite is the uppermost bedrock formation below the glacial deposits. This is west of the border of the Maquoketa Formation in areas averaging about 15 miles west of DuPage County. Recharge of the glacial deposits occurs from precipitation that falls locally.

The Mt. Simon Sandstone and lower sandstones of the Eau Claire Formation are hydrologically interconnected. Shale of the middle and upper beds of the Eau Claire Formation greatly retards the vertical movement of water and confines the water in the Mt. Simon aquifer under leaky artesian conditions. There are significant differences in hydrostatic head between the Mt. Simon and Cambrian-Ordovician aquifers. Based on drillers' reports, the hydrostatic head in the Mt. Simon aquifer was about 50 feet higher than the hydrostatic head in the Cambrian-Ordovician aquifer in 1960 in many parts of the county.

### HYDRAULIC PROPERTIES

During the period 1943 to 1954, seven pumping tests were made in DuPage County to determine the hydraulic properties of the Cambrian-Ordovician aquifer. A summary of the coefficients of transmissibility obtained from the various pumping tests is given in table 17. Coefficients of transmissibility range from

**Table 17. Coefficients of Transmissibility of the Cambrian-Ordovician Aquifer**

| Well owner | Depth of well *(ft)* | Date of test | Pumping rate *(gpm)* | Coefficient of transmissibility *(gpd/ft)* |
|---|---|---|---|---|
| Village of Bensenville | 1445 | 1954 | 230 | 17,800 |
| City of Elmhurst | 1480 | 1944 | 625 | 18,000 |
| City of Elmhurst. | 1480 | 1944 | 920 | 14,700 |
| City of Elmhurst | 1502 | 1943 | 950 | 18,300 |
| City of Elmhurst | 1400 | 1948 | 620 | 18,200 |
| Village of Lombard | 2062 | 1954 | 1200 | 22,000 |
| Wander Company | 1987 | 1954 | 2390 | 17,600 |

14,700 to 22,000 gpd/ft and average 18,000 gpd/ft. The average coefficient of storage is estimated to be about 0.00035 based on data in Cooperative Report 1.

The coefficient of transmissibility is fairly uniform throughout large areas in the county and decreases to the southeast.

#### *Specific Capacity Data*

During the period 1927 to 1960, well-production tests were made by the State Water Survey on 34 deep sandstone wells in the county. The results of the tests are summarized in table 18. The lengths of tests range from 1 hour to 24 hours and average about 9 hours. Pumping rates range from 70 to 2310 gpm and average about 910 gpm. Diameters of inner casings range from 6 to 20 inches and the average diameter of inner casings is about 12 inches.

Specific capacities exceeding 10 gpm/ft are mostly for wells penetrating both the Cambrian-Ordovician and Mt. Simon aquifers or for wells which were shot prior to the well-production test. The average specific capacity

**Table 18. Specific Capacity Data for Wells in the Cambrian-Ordovician and Mt. Simon Aquifers**

| Well number | Owner | Units or aquifers contributing to yield of well | Diam. of inner casing *(in)* | Date of test | Length of test *(hr)* | Pumping rate *(gpm)* | Observed specific capacity *(gpm/ft)* | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 40NllE-35.5e | City of Elmhurst | C-O* | 20 | 1953 | 8 | 570 | 21.9 | City Well No. 6, shot |
| 40NllE-35.5e | City of Elmhurst | C-O | 20 | 1953 | 8 | 1270 | 15.3 | City Well No. 6, shot |
| 40NllE-31.7a | Village of Lombard | C-O | 20 | 1856 | 24 | 1025 | 9.8 | Village Well No. 5 |
| 40N11E-14.1d | Village of Bensenville | C-O | 16 | 1954 | 24 | 1050 | 14.0 | Village Well No. 3, shot |
| 40N11E-13.8el | Village of Bensenville | C-O | 6 | 1934 | 8 | 147 | 6.1 | Village Well No. 1 |
| 40NllE-13-.8el | Village of Bensenville | C-O | 6 | 1947 | 2 | 225 | 2.7 | Village Well No. 1 |
| 40N11E-13.8e2 | Village of Bensenville | C-O | 10 | 1934 | 10 | 400 | 11.7 | Village Well No. 2 |
| 40N11E-13.8e2 | Village of Bensenville | C-O | 10 | 1950 | 1 | 630 | 9.3 | |
| 40N11E-13.5b | C.M.St.P.&P.R.R, | C-O | 16 | 1950 | 1 | 400 | 14.3 | Well No. 6 |
| 40N11E-13.5b | C.M.St.P.&P.R.R. | C-O | 16 | 1950 | 1 | 600 | 12.5 | Well No. 6 |
| 40N11E-13.5b | C.M.St.P.&P.R.R. | C-O | 16 | 1950 | 1 | 725 | 10.4 | Well No. 6 |
| 39N11E-12.8e | City of Elmhurst | C-O | 12 | 1941 | .... | 990 | 9.7 | City Well No. 5 |
| 39N11E-12.8d | City of Elmhurst | 0-O | 12 | 1956 | .... | 1000 | 7.0 | City Well No. 5 |
| 39N11E-10.4g | Wander Company | C-O,MS | 12 | 1945 | 8 | 1100 | 13.3 | Well No. 7 |
| 39N11E-10.3gl | Wander Company | C-O,MS | 12 | 1933 | 1 | 1513 | 11.6 | Well No. 9 |
| 39N11E-10.3gl | Wander Company | C-O,MS | 12 | 1933 | 1 | 2310 | 10.8 | Well No. 9 |
| 39N11E-10.3gl | Wander Company | C-O.MS | 12 | 1944 | .... | 1900 | 9.7 | Well No. 9 |
| 39N11E-10.3g2 | Wander Company | C-O.MS | 16 | 1946 | 24 | 1160 | 8.7 | Well No. 11 |
| 39'N11E-10.1h | City of Elmhurst | C-O,MS | 14 | 1953 | .... | 1000 | 12.8 | City Well No. 4 |
| 39N11E-10.1h | City of Elmhurst | C-O,MS | 14 | 1956 | .... | 700 | 10.9 | City Well No. 4 |
| 39N11E-9.1h | Village of Villa Park | C-O,MS | .... | 1947 | 3 | 625 | 8.1 | Village Well No. 2 |
| 39N11E-8.7h | Village of Lombard | C-O,M8 | 10 | 1948 | 1 | 102 | 7.9 | Village Well No. 2 |
| 39N11E-8.7h | Village of Lombard | C-O,MS | 10 | 1948 | 1 | 198 | 6.8 | Village Well No. 2 |
| 39N11E-8.7h | Village of Lombard | C-O,MS | 10 | 1948 | 1 | 337 | 5.7 | Village Well No. 2 |
| 39N11E-6.7a | Village of Lombard | C-O,MS | 20 | 1954 | 22 | 1000 | 13.2 | Village Well No. 6 |
| 39N11E-6.5a | Village of Lombard | C-O,MS | 20 | 1954 | 10 | 1005 | 14.7 | Village Well No. 4, shot |
| 39N11E-4.1a | Village of Villa Park | C-O | 16 | 1956 | 24 | 842 | 7.5 | Village Well No. 7 |
| 39N11E-1.8gl | City of Elmhurst | C-O | 10 | 1944 | 2 | 625 | 11.2 | City Well No. 1 |
| 39N11E-1.8gl | City of Elmhurst | C-O | 10 | 1956 | .... | 700 | 4.4 | City Well No. 1 |
| 39N11E-1.8g2 | City of Elmhurst | C-O.MS | 8 | 1956 | .... | 1100 | 11.0 | City Well No. 2 |
| 39N9E-15.7h | City of West Chicago | C-O | .... | 1960 | 1 | 950 | 7.6 | Well No. 4 |
| 39N9E-15.7h | City of West Chicago | C-O | .... | 1960 | 3 | 530 | 13.9 | Well No. 4, shot |
| 38N11E-10.2f | Village of Clarendon Hills | G-P,G-SP | 6 | 1927 | 24 | 70 | 0.8 | |
| 38N9E-13.2b3 | City of Naperville | C-O | 20 | 1958 | 24 | 1070 | 7.1 | City Well No. 7 |

* See Appendix A for abbreviations.

of wells penetrating the Cambrian-Ordovician aquifer and not shot is about 9.7 gpm/ft. The average specific capacity of wells penetrating both the Cambrian-Ordovician and Mt. Simon aquifers is about 11.4 gpm/ft.

Step-drawdown tests were made on three deep sandstone wells in the county. Computed values of well-loss constants are given below:

| Well number | | Average *G* ($sec^2/ft^5$) |
|---|---|---|
| DUP | 40N11E-13.5b | 10 |
| DUP | 40N11E-35.5e | 6 |
| DUP | 39N11E-10.3g | 1 |

### *Yields of Individual Bedrock Units*

Most deep sandstone wells tap several bedrock units, and are multiunit wells. The specific capacity of a multiunit well is the numerical sum of the specific capacities of the individual units. The yields of individual units were evaluated by Walton and Csallany (1962).

In DuPage County, the Galena-Platteville Dolomite generally yields very little or no water to wells. The average specific capacity of a well penetrating the Galena-Platteville Dolomite and 200 feet of the Glenwood-St. Peter Sandstone is about 1.0 gpm/ft for a pumping period of 8 hours. The specific capacity increases with thickness of the Glenwood-St.Peter Sandstone but is not directly proportional to thickness. The specific capacity for a thickness of 300 feet is about 1.6 gpm/ft.

The combined yield of the Prairie du Chien Series, Trempealeau Dolomite, and Pranconia Formation to a well averages about 2.9 gpm/ft.

The average specific capacity of wells in the Ironton-Galesville Sandstone, 3.2 gpm/ft, is about three times the average specific capacity of wells in the Glenwood-St. Peter Sandstone. The Ironton-Galesville Sandstone is considered the best bedrock aquifer in Illinois because of its consistently high yield. Prom data given by Walton and Csallany (1962), the average permeability of the Ironton-Galesville Sandstone is twice that of the Mt. Simon aquifer.

The average specific capacity prior to shooting a well penetrating all units of the Cambrian-Ordovician aquifer is about 7.1 gpm/ft in areas where the Glenwood-St. Peter Sandstone is 200 feet thick. The average specific capacity prior to shooting a well penetrating 350 feet of the Mt. Simon aquifer and open to all units of the Cambrian-Ordovician aquifer is 10.4 gpm/ft.

PIEZOMETRIC SURFACE.

The water levels in 240 deep sandstone wells in northeastern Illinois were measured during the last week in October and the first week in November, 1960. Data for wells in DuPage County are given in table 19. A piezometric surf ace map for the Cambrian-Ordovician aquifer in northeastern Illinois based on data collected in 1960 was presented in State Water Survey Circular 83, and the piezometric surface for DuPage County in figure 72 was prepared from the regional map.

**Table 19. Water Levels in Deep Sandstone Wells in 1960**

| Well number | Owner | Depth of well *(ft)* | Surface elevation | Depth to water *(ft)* | Water level elevation | Date of measurement 1960 |
|---|---|---|---|---|---|---|
| DUP— | | | | | | |
| 40N11E-13.4b | C.M.St.P.& P. E.E. | 1378 | 671 | 510 | 161 | 11/3 |
| 40N11E-13.8el | Village of Bensenville | 1445 | 670 | 520 | 150 | 10/4 |
| 40N11E-14.4e | Village of Bensenville | 1445 | 670 | 514 | 156 | 10/4 |
| 40NllE-31.5b | Village of Lombard | 1793 | 738 | 528 | 210 | 11/9 |
| 40N11E-35.5e | City of Elmhurst | 1476 | 703 | 594 | 109 | 11/22 |
| 40N10E-14.81 | Suncrest Highlands Sewage & Water Co. | 1395 | 750 | 466 | 284 | 5/2 |
| 39N11E-2.2f | City of Elmhurst | 1502 | 690 | 590 | 100 | 7/29 |
| 39NllE-9.1h | Village of Villa Park | 1475 | 695 | 558 | 137 | 10/24 |
| 39N11E-9.2h | Village of Villa Park | 2125 | 699 | 560 | 139 | 6/6 |
| 39N11E-10.1h | City of Elmhurst | 1360 | 669 | 574 | 95 | 10/24 |
| 39N11E-10.4g6 | Ovaltine Pood Products | 1999 | 675 | 552 | 123 | 9/30 |
| 39N11E-12.8d | City of Elmhurst | 1480 | 677 | 564 | 113 | 6/24 |
| 39N10E-1.4d | Public Service Co. of Northern Illinois - | 1464 | 740 | 512 | 228 | 10/24 |
| 39N9E-15.7h | City of West Chicago | 1465 | 746 | 412 | 334 | 10/24 |
| 38N9E-13.2b3 | City of Naperville | 1445 | 680 | 430. | 250 | 9/12 |
| 37N11E-3.8al | Argonne National Lab. | 1595 | 673 | 493 | 180 | 11/15 |

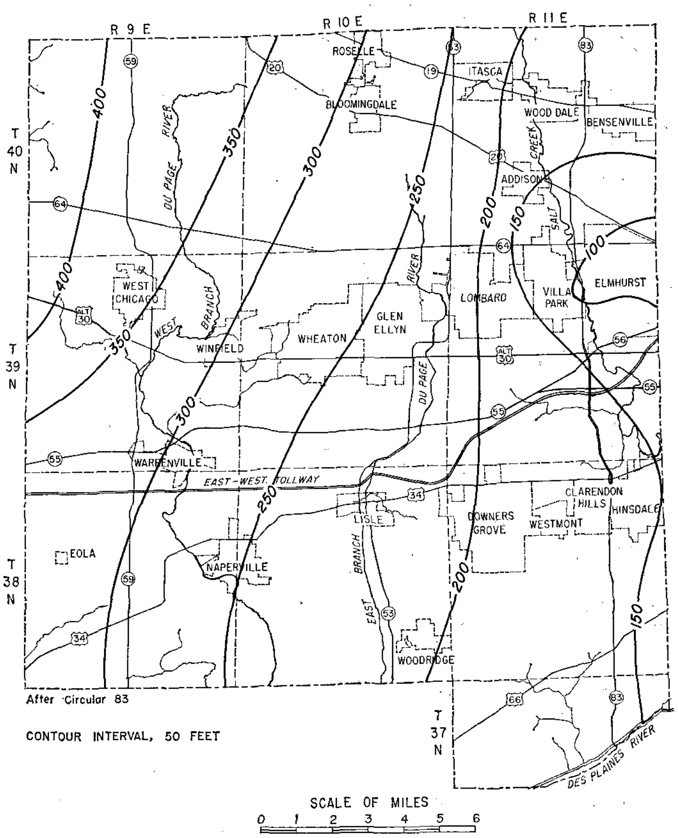



**Fig. 72. Elevation of piezometric surface of Cambrian-Ordovician aquifer, October 1960.**

The general pattern of flow of water in the Cambrian-Ordovician aquifer beneath DuPage County in 1960 was slow movement from northwest to southeast toward the deep cone of depression centered west of Chicago at Summit. Some of the water flowing toward Chicago is intercepted by pumping centers in the Elmhurst, Villa Park, West Chicago, Naperville, and Argonne areas.

The piezometric surface declines from an average elevation of 430 feet in the northwestern corner of the county to an elevation of about 95 feet east of Elmhurst. The average hydraulic gradient across the county is 19 feet per mile. The piezometric surface was below the top of the Galena-Platteville Dolomite in the deepest parts of the cones of depression at Elmhurst.

WATER LEVELS

Data in Cooperative Report 1 indicate that the average elevation of water levels in deep sandstone wells in

DuPage County was about 730 feet in 1864 prior to heavy well development. By 1960 the artesian pressure had dropped in response to withdrawals of water to elevations of about 334 feet at West Chicago and 95 feet at Elmhurst. In a period of 96 years, water levels at Elmhurst declined about 635 feet or at a rate of about 6.6 feet per year. The total decline and average rate of decline in artesian pressure at West Chicago, 1864 to 1960, were 396 feet and 4.1 feet per year, respectively.

Figure 73 shows the decline of water levels in the Cambrian-Ordovician aquifer, 1864 to 1960. The lines

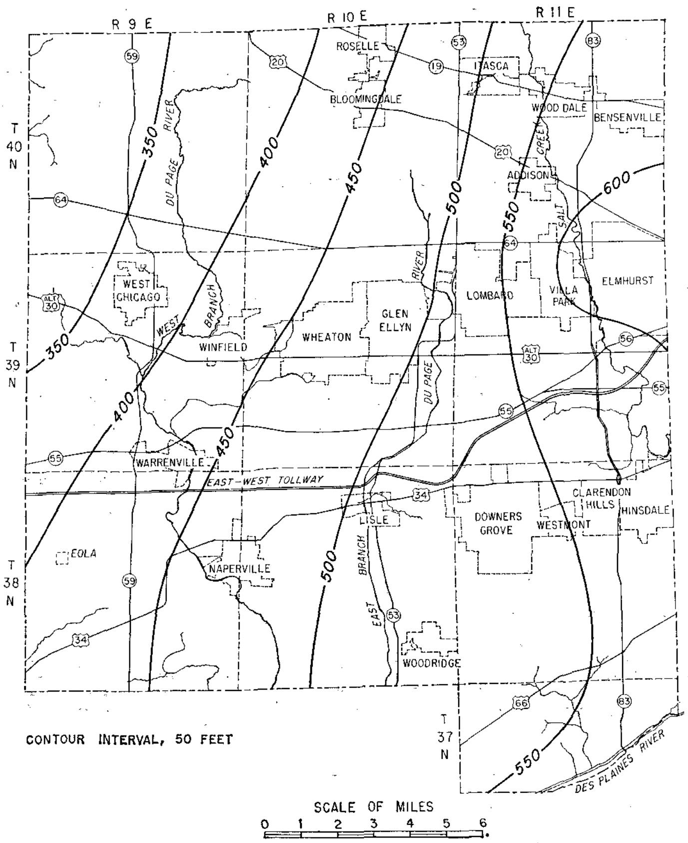



Fig. 73. Decline of artesian pressure in Cambrian-Ordovician aquifer, 1864-1960.

representing decline closely conform in most areas to the 1960 piezometric surface contours. The greatest declines, amounting to more than 600 feet have occurred in the Elmhurst area. The decline has been least in the northwest corner of the county. The average decline over the county was about 480 feet.

Examples of long-term fluctuations in water levels are shown in figure 74. Hydrographs of observation wells in the Cambrian-Ordovician aquifer show a steady decline of water levels largely as a result of the continued increase of withdrawals by municipalities, industries, institutions, and commercial establishments.

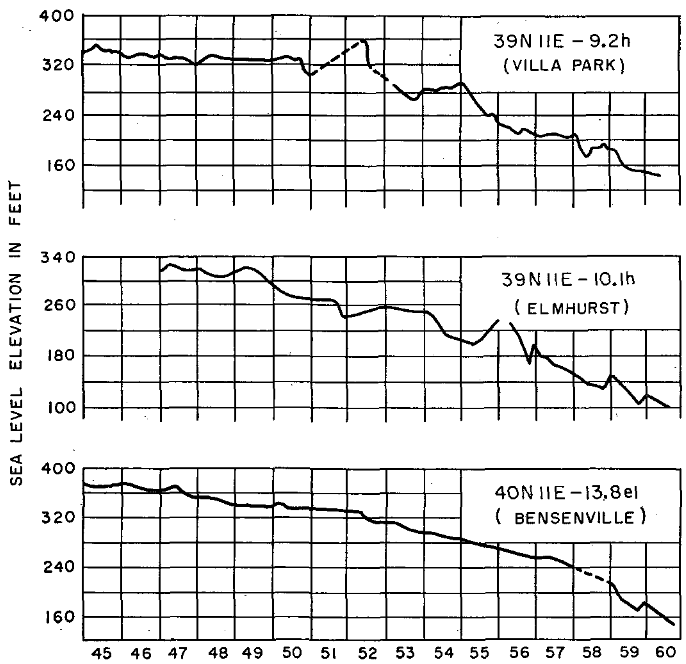



Fig. 74. Water levels in deep sandstone wells at Villa Park, Elmhurst, and Bensenville, 1945-1960.

From 1947 through 1960, the average annual decline in water levels ranged from 15.7 feet in the Elmhurst area to 13.2 feet in the Villa Park area. Total decline in artesian pressure, 1947 through 1960, was about 230 feet at Bensenville and Elmhurst and 180 feet at Villa Park. The average decline in the Elmhurst area, October 1958 to October 1959, was about 41 feet; the average decline, October 1959 to October 1960, was about 12 feet.

### PRACTICAL SUSTAINED YIELD

Factors affecting the practical sustained yield of the Cambrian-Ordovician aquifer in the Chicago region were discussed in detail in Cooperative Report 1. The practical sustained yield is largely limited by the rate at which water can move from recharge areas eastward through the aquifer to pumping centers, and is defined as the maximum amount of water that can be withdrawn without eventually dewatering the Ironton-Galesville Sandstone.

In Cooperative Report 1 it was estimated that the practical sustained yield of the Cambrian-Ordovician aquifer is about 46 mgd. The practical sustained yield of the Cambrian-Ordovician aquifer was allotted to counties in the Chicago region according to the distribution of pumpage from deep sandstone wells in 1960. The practical sustained yield of the Cambrian-Ordovician aquifer in DuPage County was computed to be 4.3 mgd based on pumpage data.

In 1960 about 15 mgd were withdrawn from the Mt. Simon aquifer in the Chicago region. Very little is known about the practical sustained yield of the Mt. Simon aquifer, however, available geohydrologic data suggest that it is reasonable to assume that the practical sustained yield does not greatly exceed present pumpage and is about 15 mgd. The practical sustained yield of the Mt. Simon aquifer was allotted to counties in the Chicago region according to the distribution of wells open in the Mt. Simon aquifer. Based on well construction data and Cooperative Report 1, the practical sustained yield of the Mt. Simon aquifer in DuPage County was computed to be about 2.1 mgd. Total withdrawals from the Cambrian-Ordovician and Mt. Simon aquifers in 1960 (8.8 mgd) exceeds the estimated practical sustained yield of the aquifers (6.4 mgd).

## WATER QUALITY

The chemical character and temperature of the ground water in DuPage County is known from the analyses of water from 106 wells. The results of the analyses are given in tables 20-22. The constituents listed in the tables are given in ionic form in parts per million (ppm).

Information collected oil the temperature of ground water is also presented in the tables. The temperature of water in 60 wells was measured at the same time as samples of water were collected.

Ground water in DuPage County varies in quality between the different aquifers and also within individual

**Table 20. Chemical Analyses of Water from Wells in the Glacial Drift Aquifer**

**(Chemical constituents in parts per million)**

| Well number | Owner | Depth (*ft*) | Date of collection | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium and Potassium (Na+K) | Alkalinity | Sulfate ($SO_4$) | Ohio-ride (Cl) | Nitrate ($NO_3$) | Hardness as ($CaCO_3$) | Dissolved solids |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | |
| 37N11E- | Argonne National Lab. | 15 | 11/2/48 | 13.1 | 10.8 | .... | 56.6 | 99.7 | 38.4 | 524 | 80.2 | 19.0 | 0.6 | 557 | 667 |
| 38N10E-1.8a | K. A. Offerman | 77 | 7/14/36 | 11.0 | 0.4 | 0 | 101.1 | 47.2 | 22.8 | 306 | 151.5 | 21.0 | 2.8 | 446 | 545 |
| 38N10E-15.6h | Snake Hill Spring Inn | 38 | 9/3/36 | 10.0 | 0 | 0 | 82.4 | 43.9 | 1.2 | 272 | 98.0 | 5.0 | 0.7 | 387 | 413 |
| 39N11E-24.2a | American Can Co. | 62 | 2/24/59 | ....... | 0.6 | 0.1 | .... | .... | .... | 368 | .... | 38.0 | 1.6 | 596 | 790 |
| 39N11E-20.1h | York Center Community Co-op | 81 | 2/8/60 | ...... | 1.8 | .... | .... | .... | .... | 344 | .... | 13.0 | 0.9 | 480 | 576 |
| 40N10E-12.5d | Medinah Country Club | 68 | 6/25/56 | ...... | 2.5 | .... | .... | .... | .... | 332 | .... | 9.0 | .... | 444 | 482 |

**Table 21. Chemical Analyses of Water from Wells in the Silurian Dolomite Aquifer**

**(Chemical constituents in parts per million)**

| Well number | Owner | Depth (*ft*) | Date of collection | Silica ($SiO_2$) | Iron (*Fe*) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium and Potassium (Na+K) | Alka- Unity | Sulfate (SO*) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Hardness as ($CaCO_3$) | Dissolved solids | Temperature (*°F*) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | | | |
| 37N11E-8.2h | Argonne National Lab. | 345 | 9/3/48 | ...... | 0.4 | .... | 105.7 | 52.1 | 22.8 | 380 | 131.0 | 0.6 | .... | 3.6 | 481 | 548 | 52 |
| 37N11B-9.1c | Slovak Catholic Charitable Assoc. | 240 | 12/16/47 | ...... | 1.3 | .... | 88.5 | 49.7 | 9.9 | 416 | 25.1 | 3.0 | .... | | 428 | 453 | ..... |
| 37N11B-9.8a | Argonne National Lab. | 160 | 8/17/48 | ...... | 1.8 | .... | 103.8 | 60.0 | 14:5 | 444 | 84.7 | 3.0 | .... | 1.9 | 510 | 548 | ..... |
| 37N11B-10.7d | Freund Estate | 143 | 12/16/47 | ...... | 9.0 | .... | 86.5 | 45.8 | 8.1 | 364 | 54.3 | 1.0 | .... | | 407 | 435 | ..... |
| 37N11B-10.7e | Freund Estate | 182 | 12/16/47 | ...... | 7.8 | .... | 104.2 | 60.8 | 16.6 | 476 | 66.4 | 1.0 | .... | | 514 | 559 | 53.0 |
| 37N11E-10.5f1 | Argonne National Lab. | 310 | 11/2/48 | 29.0 | 1.9 | .... | 92.5 | 47.6 | 5.7 | 404 | 24.1 | 4.0 | .... | 0.7 | 425 | 451 | 55.4 |
| 37N11B-10.5f2 | Argonne National Lab. | 284 | 9/16/48 | ...... | 0.2 | .... | 94.4 | 45.3 | 20.0 | 356 | 98.9 | 4.0 | .... | 1.9 | 425 | 471 | 52.0 |
| 37N11E-10.6f | Freund Estate | 158 | 12/16/47 | ...... | 3.1 | .... | 92.8 | 52.3 | 7.8 | 416 | 45.0 | 1.0 | .... | | 450 | 474 | 51.0 |
| 37NllB-10.6g | Argonne National Lab. | 300 | 8/27/48 | ...... | 1.0 | .... | 98.2 | 45.3 | 15.0 | 364 | 92.4 | 3.0 | .... | 0.1 | 434 | 477 | 52.0 |
| 37N11E-10 | Freund Estate | 202 | 12/16/47 | ...... | 1.0 | .... | 100.0 | 58.3 | 15.2 | 456 | 61.5 | 2.0 | .... | | 493 | 523 | 49.0 |
| 38N9E-13.2c | City of Naperville | 178 | 4/18/31 | 14.0 | 5.0 | 0 | 97.5 | 49.3 | 0.5 | 306 | 127.3 | 6.0 | .... | 1.5 | 446 | 504 | .... |
| 38N9B-23.3g. | Lawn Meadow Water Co. | 210 | 6/14/58 | 16.1 | 1.5 | 0.1 | 86.9 | 41.9 | 1.0 | 288 | 88.0 | 8.0 | 0.1 | 0.6 | 390 | 450 | 50.8 |
| 38N10E-3.8a | Ill. Municipal Water Co. | 233 | 12/16/59 | 15.4 | 1.1 | Tr | 97.7 | 47.1 | 12.0 | 336 | 111.9 | 8.0 | 0.3 | 0.9 | 438 | 491 | .... |
| 38N10E-11.7c | Oakview Subdiv. | 200 | 4/4/58 | 16.0 | 0.3 | 0 | 115.6 | 60.3 | 12.0 | 284 | 234.5 | 24.0 | 0.1 | 0.5 | 537 | 646 | *51.0* |
| 38N10B-12.2d | Arthur T. McIntosh Co. | 143 | 6/9/47 | 19.4 | 0.2 | 0.1 | 97.6 | 42.2 | 4.1 | 284 | 127,5 | 7.0 | 0.2 | 0.5 | 418 | 471 | 50.3 |
| 38N10E-13.8h | Maple Hill Improvement Assoc. | 158 | 11/26/60 | 10.4 | 7.4 | 0 | 101.0 | 48.0 | 21.0 | 292 | 147.7 | 30.0 | 0.1 | 9.1 | 450 | 574 | 51.0 |
| 38N10E-15.8hl | Benedictine Sisters of the Sacred Heart | 300 | 7/29/36 | 9.0 | 0.2 | 0 | 64.0 | 29.8 | 58.4 | 300 | 88.0 | 12.0 | .... | 3.4 | 283 | 433 | .... |
| 38N10E-16.4d | St. Procopius College | 245 | 8/9/35 | 11.0 | 1.0 | 0 | 77.6 | 40:1 | 7.6 | 284 | 80.6 | 5.0 | | 0.9 | 359 | 411 | .... |
| 38N10E-18.3dl | City of Naperville | 189.5 | 6/4/47 | 17.3 | 0.2 | 0 | 101.2 | 49.2 | 4.1 | 286 | 160.9 | 7.0 | 0.1 | 0.5 | 455 | 518 | 51.5 |
| 38N10E-18.3d2 | City of Naperville | 202 | 11/16/37 | 16.0 | Tr | 0 | 70.4 | 45.0 | 2.3 | 252 | 103.0 | 3.0 | | 2.8 | 392 | 405 | .... |
| 38N11E-1.3al | Village of Hinsdale | 271 | 6/2/47 | 24.4 | 1.6 | 0 | 136.9 | 39.7 | 20.7 | 352 | 181.2 | 6.0 | 0.1 | 3.3 | 506 | 631 | 59.0 |
| 38N11E-1.3a2 | Village of Hinsdale | 210 | 6/2/47 | 25.6 | Tr | 0 | 141.4 | 41.9 | 25.1 | 356 | 194.0 | 8.0 | 0.2 | 13.5 | 526 | 678 | 52.1 |
| 38N11E-6.4c | Village of Downers Grove | 300 | 1/7/57 | 13.0 | 0.8 | Tr | 90.3 | 35.3 | 9.0 | 272 | 105.5 | 7.0 | 0.2 | 0.1 | 371 | 421 | ...... |

### Table 21 (Continued)

| Well number | Owner | Depth (ft) | Date of collection | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium and Potassium (Na+K) | Alkalinity | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Hardness as ($CaCO_3$) | Dissolved solids | Temperature (°F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | | | |
| 38N11E-7.6d | Village of Downers Grove | 250 | 6/3/47 | 17.9 | 0.5 | 0 | 105.1 | 48.4 | 2.5 | 280 | 154.5 | 17.0 | 0 | 3.5 | 462 | 526 | 49.2 |
| 38N11E-8.4b | Village of Downers Grove | 291 | 6/3/47 | 18.5 | Tr | .... | 122.2 | 54.2 | 10.0 | 340 | 189.1 | 9.0 | .... | 0.6 | 528 | 621 | 51.1 |
| 38N11E-8.7e | Village of Downers Grove | 262 | 12/10/51 | 16.7 | 0.3 | 0.1 | 125.7 | 51.1 | 12.7 | 336 | 196.2 | 9.0 | 0.2 | 0.4 | 525 | 630 | ...... |
| 38N11E-9.8e | Village of Westmont | 316 | 1/27/55 | ...... | 0.1 | .... | 125.7 | 40.3 | 29.0 | 348 | 182.3 | 4.0 | 0.1 | .... | 480 | 620 | ...... |
| 38N11E-10.7a | Village of Westmont | 302 | 7/14/36 | 13.0 | 0.8 | 0 | 141.7 | 36.2 | 29.9 | 372 | 180.4 | 6.0 | .... | 2.2 | 504 | 640 | ...... |
| 38N11E-10.2c | Village of Clarendon Hills | 250 | 5/19/47 | 23.4 | 1.5 | 0 | 145.2 | 46.3 | 25.8 | 380 | 215.4 | 5.0 | 0.3 | 0.7 | 554 | 687 | 51.5 |
| 38N11E-10.6e | Black Hawk Heights Subdiv. | 295 | 6/11/53 | 20.3 | 2.7 | 0.1 | 142.4 | 39.4 | 25.0 | 352 | 206.5 | 3.0 | 0.3 | 2.6 | 518 | 696 | 53.0 |
| 38N11E-10.8e | Village of Westmont | 313 | 1/25/58 | 20.8 | 29.0 | 0.7 | 129.0 | 30.4 | 47.0 | 360 | 177.1 | 3.0 | 0.4 | 2.8 | 448 | 628 | ...... |
| 38N11E-11.5a | Village of Clarendon Hills | 354 | 9/27/45 | 15.0 | 1.7 | 0 | 127.5 | 31.7 | 21.2 | 336 | 149.7 | 3.0 | .... | 1.5 | 449 | 576 | 51.2 |
| 38N11E-12.3a1 | Village of Hinsdale | 273 | 11/16/37 | 17.0 | 0.8 | 0 | 135.0 | 21.5 | 3.0 | 240 | 177.0 | 3.0 | .... | 4.9 | 426 | 542 | ...... |
| 38N11E-12.3a2 | Village of Hinsdale | 210 | 11/16/37 | 16.0 | 0.2 | 0 | 73.4 | 54.3 | 6.2 | 242 | 163.5 | 4.0 | .... | 2.8 | 407 | 516 | ...... |
| 38N11E-16.1f | Austin Acres Subdiv. | 300 | 9/14/59 | 16.3 | 2.9 | Tr | 118.3 | 40.7 | 24.0 | 340 | 155.9 | 8.0 | 0.4 | 1.5 | 463 | 579 | 53.8 |
| 38N11E-35.6c | Tri-State Village | 200 | 5/5/58 | 19.6 | 1.8 | Tr | 98.0 | 38.5 | 25.0 | 316 | 132.1 | 3.0 | 0.4 | 4.0 | 404 | 526 | 51.0 |
| 39N9E-4.4a | City of West Chicago | 322 | 6/26/47 | 17.3 | 1.4 | 0 | 105.4 | 54.4 | 20.2 | 312 | 158.0 | 38.0 | 0.5 | 1.0 | 487 | 600 | 51.6 |
| 39N9E-4.2b | City of West Chicago | 310 | 6/25/50 | 19.3 | 0.1 | 0 | 83.9 | 38.9 | 12.0 | 296 | 88.0 | 4.0 | 0.6 | 2.8 | 370 | 415 | 50.5 |
| 39N9E-13.4b | Winfield Sanitarium | 198 | 6/12/39 | 20.5 | 0.2 | 0 | 85.6 | 46.8 | 5.1 | 318 | 89.2 | 4.0 | .... | 2.1 | 407 | 472 | ...... |
| 39N9E-13.6c1 | Village of Winfield | 335 | 10/17/58 | 17.0 | 0.5 | 0 | 98.0 | 53.8 | 16.0 | 326 | 157.2 | 7.0 | 0.3 | 1.4 | 466 | 580 | 51.0 |
| 39N9E-16.6c | City of Wheaton | 336 | 10/3/46 | 7.9 | 11.4 | 0.1 | 81.2 | 41.8 | 17.0 | 300 | 101.6 | 5.0 | 0.1 | 0.2 | 375 | 447 | 51.5 |
| 39N10E-9.6c1 | City of Wheaton | 341 | 9/16/59 | 13.5 | 1.1 | 0.1 | 102.9 | 43.7 | 20.0 | 288 | 164.8 | 14.0 | 0.2 | 0.6 | 437 | 528 | 51.6 |
| 39N10E-10.3b1 | Jefferson Ice Plant | 114 | 6/3/31 | 18.0 | 1.8 | 0 | 97.0 | 51.3 | 8.7 | 354 | 100.3 | 10.0 | .... | 0 | 453 | 504 | ...... |
| 39N10E-10.3b2 | Jefferson Ice Plant | 134 | 6/3/31 | 16.0 | 0.8 | 0 | 67.0 | 36.8 | 20.9 | 290 | 68.7 | 4.0 | .... | 0.2 | 319 | 378 | ...... |
| 39N10E-10.4c | Hathbun Farm Products Co. | 138 | 2/23/44 | ...... | 2.1 | .... | 59.7 | 45.0 | 22.8 | 274 | 99.1 | 5.0 | .... | 2.2 | 337 | 392 | 51.5 |
| 39N10E-11.7c1 | Village of Glen Ellyn | 310 | 1/16/24 | 20.8 | 0.8 | 0 | 26.6 | 29.2 | 76.7 | 254 | 80.6 | 5.0 | .... | 1.8 | ...... | 421 | ...... |
| 39N10E-11.7c2 | Village of Glen Ellyn | 352 | 6/16/47 | 17.4 | 0.5 | 0 | 65.3 | 30.6 | 57.0 | 276 | 121.8 | 8.0 | .... | 1.0 | 290 | 471 | 51.8 |
| 39N10E-11.8c | Village of Glen Ellyn | 422 | 12/3/41 | 13.0 | 0.7 | 0 | 54.5 | 31.8 | 29.2 | 266 | 109.6 | 6.0 | .... | 2.0 | 320 | 435 | ...... |
| 39N10E-11.3e | Park Commissioners | 325 | 10/21/36 | 9.0 | 1.6 | 0 | 72.4 | 3.5 | 294.0 | 458 | 197.8 | 13.0 | .... | 1.6 | 44 | 823 | ...... |
| 39N10E-12.4a | Glen Oak Country Club | 202 | 7/11/39 | 15.0 | 1.3 | 0 | 109.0 | 50.4 | 6.2 | 334 | 123.0 | 14.0 | .... | 1.5 | 468 | 859 | ...... |
| 39N10E-12.4c | Glen Oak Country Club | 212 | 7/11/39 | 17.0 | 1.9 | 0 | 107.5 | 52.8 | 19.1 | 318 | 160.0 | 21.0 | .... | 1.7 | 474 | 571 | ...... |
| 39N10E-15.8c | Village of Glen Ellyn | 422 | 4/18/58 | 16.3 | 0.5 | Tr | 103.4 | 35.3 | 52.0 | 264 | 117.7 | 5.0 | 0.7 | 1.4 | 282 | 456 | 51.5 |
| 39N10E-25.4a | W. R. Johnson | 160 | 8/1/38 | 14.5 | 3.4 | 0 | 102.2 | 48.1 | 13.6 | 360 | 113.0 | 3.0 | .... | 1.3 | 453 | 530 | ...... |
| 39N10E-35.6g | Valley View Subdiv. | 290 | 6/12/58 | 16.9 | 0.9 | Tr | 72.4 | 33.2 | 32.0 | 304 | 73.7 | 3.0 | 0.3 | 2.9 | 318 | 408 | 51.4 |
| 39N11E-1.3d | Wendland & Keimel Co. | 209 | 3/2/33 | 9.0 | 0.7 | 0 | 96.3 | 48.9 | 17.5 | 322 | 140.0 | 9.0 | .... | 1.1 | 442 | 517 | ...... |
| 39N11E-2.5e | Elmhurst Ice Co. | 218 | 3/2/33 | 8.0 | 0.4 | 0 | 179.6 | 83.5 | 24.6 | 358 | 408.0 | 42.0 | .... | 4.1 | 793 | 993 | ...... |
| *39N11E-5.3g* | *Midland Enterprises* | *209* | *3/6/54* | ...... | *0.3* | .... | *109.0* | *38.0* | *22.8* | *344* | *123.8* | *4.0* | .... | .... | *428* | *542* | ...... |
| 39N11E-7.1h1 | Village of Lombard | 175 | 4/17/48 | ...... | 2.8 | .... | 107.5 | 52.1 | 8.1 | 336 | 144.0 | 6.0 | .... | 1.3 | 486 | 507 | 52.7 |
| 39N11E-7.1h2 | Village of Lombard | 175 | 6/7/48 | 20.7 | 1.3 | Tr | 103.4 | 47.6 | 8.5 | 340 | 122.4 | 5.0 | 0.2 | 0.1 | 455 | 510 | 52.0 |
| 39N11E-8.7h | Village of Lombard | 84 | 5/23/47 | 23.2 | 2.1 | 0.2 | 112.8 | 52.9 | 3.0 | 324 | 166.8 | 6.0 | 0.3 | 1.0 | 500 | 587 | 51.8 |
| 39N11E-10.8d1 | Village of Villa Park | 251 | 5/21/47 | 21.4 | 1.3 | 0 | 102.3 | 43.9 | 6.0 | 352 | 85.8 | 5.0 | 0.2 | 2.1 | 437 | 478 | 53.0 |
| 39N11E-20.1g | Midwest-York Water Co. | 241 | 3/18/58 | 16.7 | 4.6 | Tr | 124.5 | 49.4 | 13.0 | 356 | 167.4 | 8.0 | 0.1 | 1.4 | 514 | 622 | ...... |
| 40N9E-34.1b | Crippled Children's Home | 220 | 11/9/39 | 20.5 | 1.2 | 0 | 76.2 | 52.6 | 6.7 | 354 | 54.8 | 6.0 | .... | 2.6 | 407 | 450 | ...... |
| 40N10E-3.4e1 | Village of Roselle | 182 | 5/29/47 | 24.6 | 0.5 | 0 | 68.3 | 37.9 | 25.3 | 212 | 162.7 | 1.0 | 0.5 | 0.6 | 327 | 441 | 51.1 |
| *40N10E-3.4e2* | *Village of Roselle* | *183* | *12/4/59* | *19.0* | *0.7* | *Tr* | *66.2* | *35.4* | *39.0* | *228* | *154.9* | *4.0* | *0.4* | *2.3* | *311* | *447* | *51.5* |
| 40N10E-12.5b | Medinah Country Club | 145 | 3/29/35 | 10.0 | 0.8 | 0 | 75.6 | 41.2 | 15.0 | 276 | 115.2 | 0 | .... | 0.8 | 358 | 447 | 52.0 |
| 40N10E-26.5d | North Glen Ellyn Utility Co. | 353 | 4/23/60 | 18.2 | 0.6 | 0 | 69.0 | 29.3 | 34.0 | 240 | 119.9 | 2.0 | 0.5 | 0.8 | 293 | 433 | ...... |
| 40N11E-8.4f | Village of Itasca | 200 | 5/16/47 | 21.4 | 0.6 | 0 | 79.9 | 41.2 | 27.8 | 208 | 211.3 | 2.0 | 0.4 | 0.8 | 370 | 527 | 52.0 |
| 40N11E-8.8f | Village of Itasca | 184 | 5/16/47 | 21.8 | 0.2 | 0 | 69.3 | 38.7 | 31.3 | 200 | 189.7 | 3.0 | 0.4 | 0.7 | 333 | 593 | 52.2 |
| 40N11E-11.8b | G. C. Chambers | 150 | 3/5/34 | 7.0 | 2.4 | 0 | 246.6 | 165.0 | 132.3 | 48 | 1457.2 | 11.0 | .... | 2.7 | 1295 | 2157 | ...... |
| 40N11E-15.7g | Martha E. Ruehr | 122 | 7/5/38 | 10.0 | 0.8 | 0 | 25.3 | 31.9 | 46.2 | 136 | 148.2 | 3.0 | .... | 1.1 | 194 | 383 | ...... |
| 40N11E-28.7b | Village of Addison | 182 | 1/16/34 | 11.0 | 0.5 | 0 | 76.7 | 40.8 | 24.4 | 334 | 68.7 | 5.0 | .... | 0.9 | 350 | 421 | ...... |
| 40N11E-28.3a1 | Village of Addison | 200 | 4/28/58 | 16.0 | 1.1 | Tr | 98.0 | 44.3 | 22.0 | 344 | 112.1 | 10.0 | 0.3 | 0.8 | 427 | 525 | 51.0 |
| 40N11E-28.3a2 | Village of Addison | 221 | 1/12/61 | ...... | 0.7 | .... | 88.8 | 44.4 | ...... | 340 | ........ | 3.0 | 0.3 | 1.6 | 404 | 450 | 51.5 |
| 40N11E-28.2f | H. Housermann | 108 | 3/5/34 | 13.0 | 1.0 | 0 | 102.8 | 50.6 | 17.7 | 352 | 126.3 | 12.0 | .... | 4.9 | 466 | 545 | ...... |
| 40N11E-28.4f1 | Village of Addison | 155 | 5/16/47 | 24.0 | 1.4 | Tr | 108.8 | 56.7 | 18.2 | 326 | 200.1 | 6.0 | 0.2 | 1.0 | 505 | 625 | 52.2 |
| 40N11E-28.4f2 | Village of Addison | 115 | 1/12/61 | ...... | 1.3 | .... | 98.2 | 47.8 | ...... | 328 | ........ | 3.0 | 0.3 | 2.0 | 442 | 515 | 51.8 |
| 40N11E-33.7f | Village of Addison | 250 | 4/28/58 | 18.0 | 1.1 | Tr | 94.4 | 44.9 | 12.0 | 332 | 106.6 | 3.0 | 0.3 | 0.5 | 421 | 495 | 51.2 |
| 40N11E-36.5d | Emrdy Howard Water Co. | 270 | 4/21/58 | 16.7 | 1.4 | Tr | 87.9 | 51.5 | 36.0 | 368 | 130.4 | 4.0 | 0.3 | 1.4 | 432 | 579 | 52.2 |

aquifers at different geographical locations. The quality of water obtained from any well depends not only on the geological formations penetrated during drilling, but. also on the geographical location, the relative productivity of the various formations contributing water to the wells, the artesian pressure of the various formations, and often on the rate of pumping as well as the idle period and time of pumping prior to collection of the sample. In some areas, open and unplugged wells may permit water from one aquifer to migrate to another aquifer.

### Glacial Drift Aquifers

Waters from the glacial drift aquifers are similar in mineral content to waters from the Silurian dolomite aquifer. The chemical analyses of water from six glacial

**Table 22. Chemical Analyses of Water from Deep Sandstone Wells (Chemical constituents in parts per million)**

| Well number | Owner | Depth (*ft*) | Date of collection | Silica ($SiO_2$) | Iron (Fe) | Manganese (Mn) | Calcium (Ca) | Magnesium (Mg) | Sodium and Potassium (Na+K) | Alkalinity | Sulfate ($SO_4$) | Chloride (Cl) | Fluoride (F) | Nitrate ($NO_3$) | Hardness (as CaOOs) | Dissolved solids | Temperature (*°F*) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | | | |
| 38N9E-13.2b | City of Naperville | 1445 | 9/9/60 | 7.2 | Tr | 0 | 67.4 | 24.9 | 66.0 | 276 | 109.2 | 17.0 | 1.1 | 3.7 | 271 | 452 | 57.5 |
| 38N10E-16.3d | St. Procopius College | 1208 | 7/25/35 | 7.0 | 0.5 | 0 | 76.8 | 39.0 | 8.3 | 286 | 73.6 | 5.0 | ...... | 1.2 | 353 | 380 | ...... |
| 38N11E-10.8c | Village of Westmont | 890 | 1/13/25 | 16.1 | 1.6 | 0 | 145.2 | 22.1 | 34.8 | 360 | 192.0 | 9.0 | ...... | 1.1 | ...... | 627 | ...... |
| 39N9E-4.1a | City of West Chicago | 875 | 5/28/47 | 19.2 | 0.7 | 0 | 86.4 | 45.5 | 16.3 | 296 | 111.5 | 20.0 | 0.5 | 0.3 | 403 | 478 | 51.2 |
| 39N9E-10.7f | C.&N.W.R.R. | 2083 | 11/22/30 | 14.0 | 0.2 | 0 | 79.8 | 44.0 | 4.4 | 302 | 79.0 | 4.0 | ...... | 1.2 | 380 | 419 | ...... |
| 39N11E-2.2f | City of Elmhurst | 1502 | 6/25/43 | 12.0 | 3.4 | Tr | 135.4 | 88.2 | 35.0 | 359 | 274.0 | 12.0 | ...... | 0.8 | 577 | 755 | 54.6 |
| 39N11E-4.1d | Village of Villa Park | 1419 | 4/22/58 | 7.6 | 0.2 | 0 | 80.3 | 38.5 | 95.0 | 272 | 238.6 | 33.0 | 0.6 | 1.3 | 360 | 665 | 55.4 |
| 39N11E-8.7h | Village of Lombard | 2028 | 5/23/47 | 12.3 | 0.3 | 0 | 61.3 | 17.1 | 71.1 | 272 | 70.1 | 24.0 | 1.8 | 1.2 | 224 | 439 | 61.0 |
| 39N11E-9.1h | Village of Villa Park | 2123 | 5/22/47 | 13.0 | 0.4 | 0 | 60.5 | 17.7 | 132.5 | 304 | 66.2 | 99.0 | 2.6 | 0.5 | 224 | 577 | 62.5 |
| 39N11E-10.3g | Wander Company | 1920 | 8/15/46 | 12.0 | 0.8 | 0 | 69.8 | 17.7 | 67.6 | 280 | 68.3 | 28.0 | ...... | 6.6 | 247 | 452 | 60.0 |
| 39N11E-10.4c | Wander Company | 2000 | 9/19/35 | 11.0 | 15.0 | 0 | 130.5 | 53.5 | 51.5 | 344 | 237.2 | 47.0 | ...... | 1.5 | 544 | 780 | ...... |
| 39N11E-10.4g | Wander Company | 1900 | 4/8/36 | 8.0 | Tr | 0 | 62.1 | 20.2 | 58.8 | 242 | 79.6 | 30.0 | ...... | 0.9 | 238 | 433 | ...... |
| 39N11E-12.8d | City of Elmhurst | 1485 | 2/9/43 | 16.0 | Tr | 0 | 61.0 | 22.0 | 43.2 | 230 | 80.2 | 15.0 | ...... | 3.6 | 243 | 380 | 59.5 |
| 39NllE-27.8b | Butterfield Country Club | 657 | 2/24/43 | 16.0 | 3.0 | 0 | 109.3 | 50.8 | 6.4 | 352 | 131.2 | 4.0 | ...... | 2.9 | 482 | 554 | 51.5 |
| 40N9E-36.6g | Mark Morton | 922 | 7/1/36 | 12.0 | 0.8 | 0 | 85.0 | 32.9 | 20.7 | 204 | 123.7 | 5.0 | ...... | 3.1 | 298 | 382 | ...... |
| 40N10E-15.7d | Suncrest Highlands | 1395 | -5/1/58 | 7.4 | 0.1 | Tr | 64.7 | 29.5 | 60.0 | 308 | 82.9 | 14.0 | 1.3 | 1.9 | 284 | 439. | 53.3 |
| 40N11E-7.1f | Village of Itasca | 800 | 12/15/26 | 24.0 | 0.2 | 0 | 69.1 | 37.7 | 45.3 | 220 | 182.1 | 3.0 | ...... | 1.5 | 327 | 491 | ...... |
| 40N11E-13.5b | O.M.St.P.&P. R.R. | 1461 | 1/4/50 | 12.8 | 0.5 | 0 | 80.4 | 25.7 | 50.1 | 236 | 147.7 | 18.0 | 0.8 | 1.5 | 306 | 476 | 58.9 |
| 40N11E-13.6c | O.M.St.P.&P. R.R. | 2248 | 6/13/46 | 13.3 | 0.2 | Tr | 48.1 | 9.5 | 210.9 | 228 | 77.3 | 218.0 | ...... | 0.4 | 159 | 722 | 65.5 |
| 40N11E-13.8el | Village of Bensenville | 1445 | 11/19/46 | 12.4 | 0.7 | Tr | 73.3 | 21.8 | 36.1 | 244 | 90.3 | 10.0 | 1.0 | 1.7 | 274 | 400 | 59.5 |
| 40N11E-13.8e2 | Village of Bensenville | 1442 | 5/15/47 | 11.7 | 0.4 | 0 | 71.4 | 17.9 | 44.9 | 272 | 57.4 | 13.0 | 1.2 | 0.7 | 252 | 378 | 60.0 |

drift wells in table 20 show iron contents ranging from 0 to 10.8 ppm with a median of 2.7 ppm. Waters from four of the six wells contain more than 0.6 ppm iron. The chloride content ranges from 5 to 38 ppm and averages 17.5 ppm. Of the six samples, four show chloride contents above 9 ppm.

The hardness ranges from 387 to 596 ppm and averages 485 ppm. The sulfate content ranges from 80 to 152 ppm with a median of 113 ppm.

Data in Cooperative Report 1 suggest that waters from the glacial drift aquifers have temperatures ranging from 46° to 54°F.

## SILURIAN DOLOMITE AQUIFER

The hardness of waters from the Silurian dolomite aquifer ranges from 194 to 1295 ppm and averages 436 ppm. Waters of less than 300 ppm hardness are found in small areas along the western edge and in north-central parts of the county as shown in figure 75. Two small areas of exceptionally hard water, more than 1000 ppm, are indicated. Water with a hardness exceeding 500 ppm are concentrated mostly in areas in the eastern part of the county. Water from the Silurian dolomite aquifer has a greater hardness than water from the Cambrian-Ordovician aquifer in most areas in the county. The pH ranges from 6.2 to 7.6 and averages 7.1.

About 60 percent of 79 samples in table 21 contained more than 0.5 ppm iron. The iron content ranges from a trace to 29.0 ppm and averages 1.9 ppm. The chloride content ranges, from 0 to 38 ppm with a median of 7.2 ppm. Water from the Silurian dolomite aquifer has an almost uniform concentration of 0.3 fluoride.

Waters from the Silurian dolomite aquifer contain more sulfates than waters from the Cambrian-

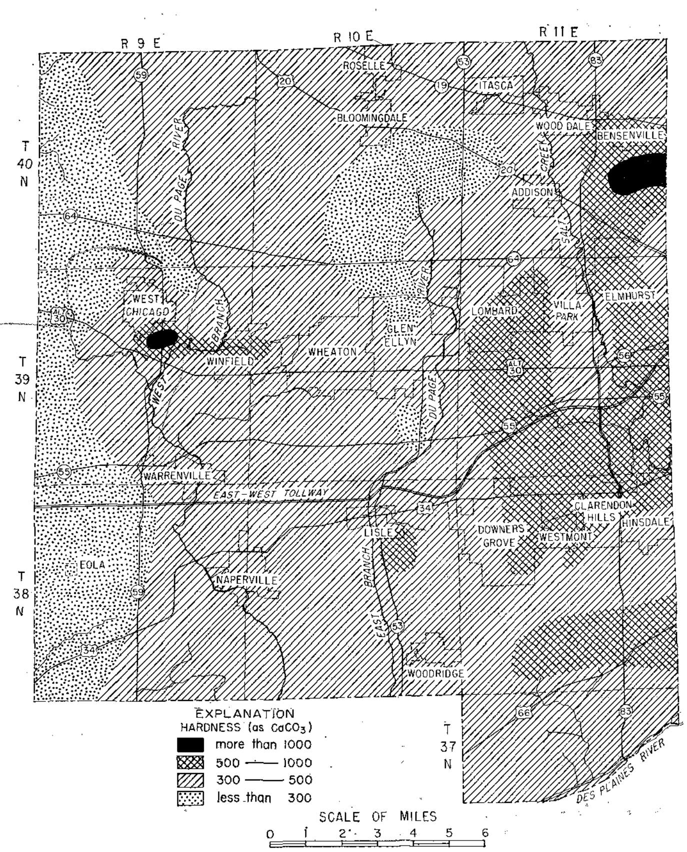



Fig. 75. Hardness of water from the Silurian dolomite aquifer.

Ordovician aquifer. The sulfate content ranges from 24. to 1457 ppm and averages 132 ppm. Waters of less than 100 ppm sulfate are found in large areas in the eastern one-third of the county as shown in figure 76.

The temperature of the water from Silurian dolomite wells ranged from 49° to 59°F and averaged about 52°F.

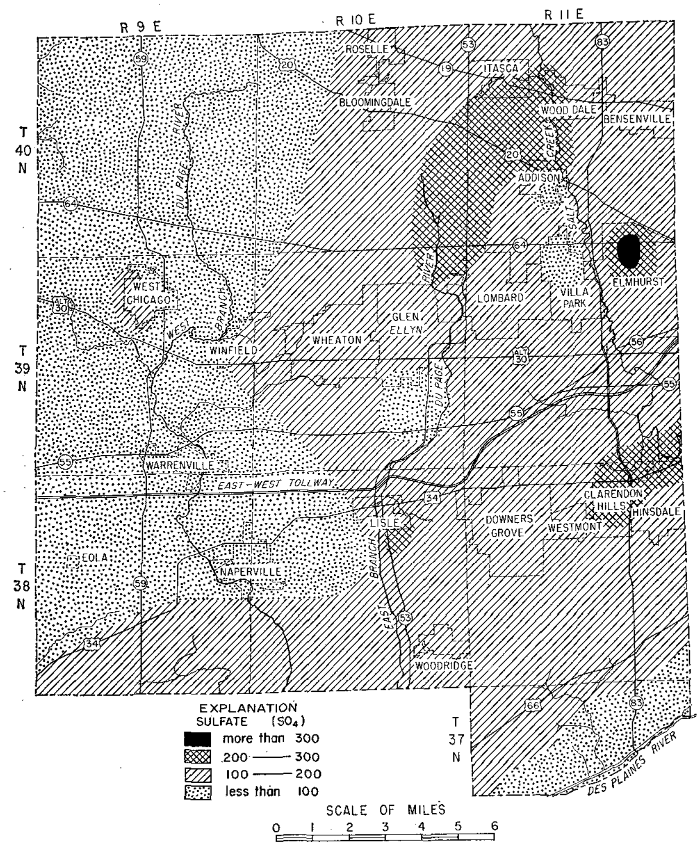



**Fig. 76. Sulfate content of water from the Silurian dolomite aquifer.**

The character and thickness of the unconsolidated glacial drift in part influence the probability of pollution and contamination of the ground water in the underlying Silurian dolomite aquifer. Ground water in the dolomite moves freely through the open network of joints and fractures, and little or no nitration takes place. Once pollution or contamination reaches the dolomite it may travel widely. Filtration of the water which percolates into the dolomite is accomplished best by slowly permeable, clayey glacial till. Coarse-textured materials overlying the dolomite are less effective but do have some filtering action.

The Illinois Department of Public Health recommends that, in closely populated areas, 50 feet of glacial drift must overlie the dolomite if private water supplies are to be used without chlorination. At least 100 feet of glacial drift cover must be present where municipal supplies are obtained. In sparsely populated minimum thickness of 30 feet of clayey till between the lowest point of the source of pollution and top of the dolomite is necessary before drilling of a well or installation of leaching types of private waste-disposal facilities is recommended.

The map of the thickness of the unconsolidated deposits (fig. 9) shows some areas with less than 50 feet of cover above the dolomite. The largest such area is in the southwestern part of the county. Most of these areas are beneath ground moraine or valley-train. In these areas where the materials are moderate to highly permeable, greater thickness of cover may be necessary to filter the water effectively.

## Cambrian-Obdovician and Mt. Simon Aquifers

The quality of waters from deep sandstone wells is influenced by the proportions of water entering the wells from the various units contributing water to the wells. Waters from the Glenwood-St. Peter and Ironton-Galesville Sandstones are in general of similar mineral quality. The St. Peter Sandstone tends to have a chloride content and hardness higher than water from the Ironton-Galesville Sandstone. Waters from the Glenwood-St. Peter and Ironton-Galesville Sandstones usually have low iron content (0.2 to 0.4 ppm) and an almost uniform concentration of 1.0 ppm fluoride. Regionally the Galena-Platteville Dolomite is characterized by high alkalinity (about 350 ppm), low hardness (less than 100 ppm), absence of sulfates, and usually sufficient hydrogen sulfide to be detected by its odor. Water entering deep sandstone wells from the

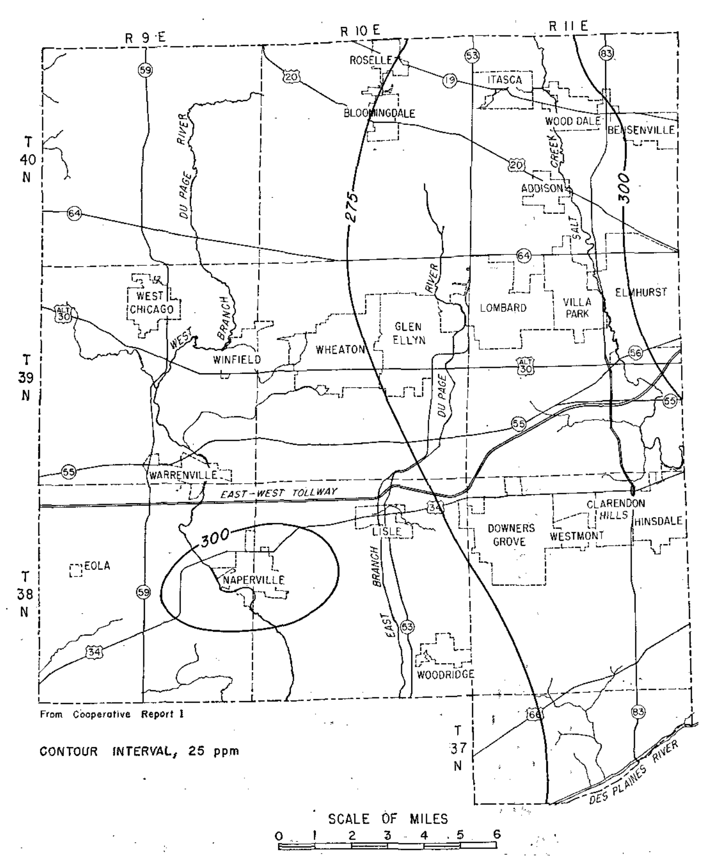



**Fig. 77. Hardness of water from the Cambrian-Orddvician aquifer.**

Silurian dolomite aquifer tends to increase the iron content and hardness of water from these wells. The primary characteristic of the quality of water from the Mt. Simon aquifer is its rapid increase in chloride concentration with increasing penetration below an elevation of —1275 feet. The rate of increase in chloride concentration with increasing depth in the aquifer approaches 400 ppm per additional 25 feet of penetration. The average hardness of water from the Mt. Simon Sandstone is less than the average hardness of water from the Cambrian-Ordovician aquifer.

As shown in figure 77, the hardness of water from the Cambrian-Ordovician aquifer increases to the east from between 260 and 275 ppm in the western part of the county to between 300 and 350 ppm in the eastern part of the county. The data in table 22 indicate that hardness of water from deep sandstone wells ranges from 159 to 577 ppm and averages 322 ppm. The chloride content ranges from 3 to 218 ppm and averages 30 ppm. The chemical analyses of water in table 22 show iron contents ranging from a trace to 15 ppm with a median of 1.6 ppm. The pH averages 7.2.

The average sulfate content of waters from the Cambrian-Ordovician aquifer increases rapidly from less than 50 ppm in the northwestern corner of the county to more than 100 ppm in the eastern part of the county as shown in figure 78. Data in table 22 show that the sulfate content of a water from deep sandstone wells ranges from 57 to 274 ppm and averages 122 ppm.

Data in Cooperative Report 1 indicate that waters from the Ironton-Galesville Sandstone range in temperature from about 55°F in the western part of the county to about 58°F in the eastern part of the county. Waters from the Glenwood-St. Peter Sandstone are generally about two degrees lower in temperature than waters from the Ironton-Galesville Sandstone. Water from the Mt. Simon aquifer appears to increase in temperature by about one degree per 100 feet of additional depth from 66°F at an elevation of 1300 feet.

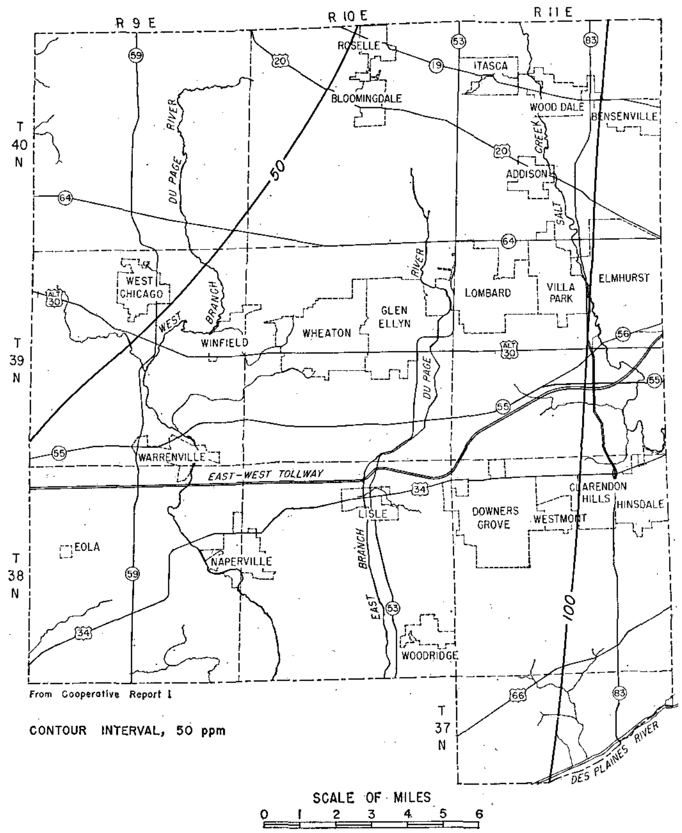



**Fig. 78. Sulfate content of water from the Cambrian-Ordovician aquifer.**

The temperature of water from deep sandstone wells is influenced by the proportions of water entering the wells from the units contributing water to the well. Temperatures in table 22 range from 51.2° to 65.5°P and average 58°F.

## WELL CONSTRUCTION, DEVELOPMENT, AND REHABILITATION

### Construction Features of Wells and Pumps

Most wells in DuPage County are drilled by the cable tool method. Wells in the Silurian dolomite aquifer with capacities exceeding 100 gpm range in depth from 75 to 422 feet and have an average depth of about 250 feet. The wells are usually eased through the unconsolidated deposits to bedrock; several wells have perforated pipe sections or commercial screens opposite sand and gravel beds above bedrock. Casing diameters range from 4 to 38 inches and commonly exceed 16 inches. Bore hole diameters are generally smaller at the bottom than at the top and finished 8 to 24 inches at the bottom. Generalized graphic logs of typical wells in the Silurian dolomite aquifer are given in figure 79A. Details of construction features of selected wells are given in table 23.

Only a few high capacity wells are developed in the glacial drift aquifer. A well at the Medinah Country Club in sec. 12, T40N, R10E is 68 feet deep and has 52 feet 8 inches of 16-inch casing and 15 feet of 16-inch screen. The specific capacity of the well for a pumping rate of 1100 gpm and a pumping period of 24 hours was 41 gpm/ft.

Wells in service in 1960 in the Cambrian-Ordovician and Mt. Simon aquifers range in depth from 1419 to 2219 feet. Wells in the Cambrian-Ordovician aquifer have an average depth of 1450 feet; wells penetrating both the Cambrian-Ordovician and Mt. Simon aquifers have an average depth of 2010 feet. The diameters of bore holes are smaller at the bottom than at the top, commonly ranging from 16 to 30 inches at the top and finished 8 to 12 inches at the bottom. Outer casing diameters generally range from 18 to 30 inches, and inner casings and liners have diameters ranging from 10 to 16 inches. Wells commonly are uncased through many of the formations penetrated, as most of the bedrock encountered does not cave or swell. A drive pipe extends through the unconsolidated deposits to bedrock. The Silurian dolomite aquifer and the Maquoketa Formation are usually cased off. In numerous wells some of the lower units give trouble through caving and these are protected with liners. The lower shales and conglomerates of the Glenwood-St. Peter Sandstone and the weak shales of the upper and middle beds of the Eau Claire Formation often require casing. Occasionally some or all of the Prairie du Chien, Trempealeau, and Franconia rocks are cased off. Generalized graphic logs of typical wells are given in figure 79B. Details of construction features of selected wells are given in table 24.

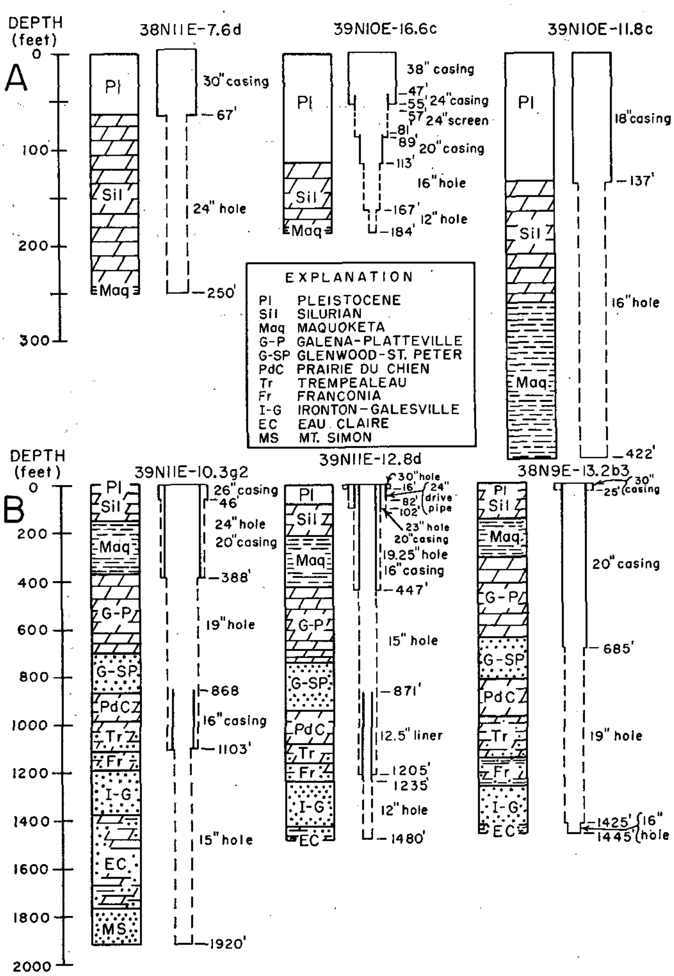



Fig. 79. Construction features of selected wells in Silurian dolomite aquifer (A) and Cambrian-Ordovician and Mt. Simon aquifers (B).

**Table 23. Construction Features of Selected Wells in the Silurian Dolomite Aquifer**

| | Bore hole record | | Casing record | |
|---|---|---|---|---|
| Depth (ft) | depth (ft) | diam. (in) | depth (ft) | diam. (in) |
| 209 | 0-42 | 12 | 0-42 | 8 |
| | 42-209 | 8 | | |
| 271 | 0-57 | 20 | 0-57 | 20 |
| | 57-271 | 19 | | |
| 231 | 0-231 | 12 | 0-44 | 12 |
| | | | 188-231 | 10 |
| 115 | 0-115 | 6 | 0-90 | 6 |
| 85 | 0-85 | 4 | 0-60 | 4 |
| 175 | 0-62 | 20 | 0-62 | 20 |
| | 62-73 | 18 | 58-73 | 18 |
| | 73-175 | 17 | | |
| 310 | 0-310 | 8 | 0-115 | 8 |
| 352 | 0-235 | 12 | 0-16 | 12 |
| | 235-352 | 10 | | |
| 422 | 0-136 | 18 | 0-136 | 18 |
| | 136-422 | 16 | | |
| 354 | 0-354 | 12 | 0-127 | 12 |
| 240 | 0-240 | 10 | 0-83 | 10 |
| 250 | 0-67 | 30 | 0-67 | 30 |
| | 67-250 | 24 | | |
| 291 | 0-118 | 30 | 0-118 | 30 |
| | 118-291 | 24 | | |
| 178 | 0-44 | 30 | 0-44 | 30 |
| | 44-178 | 24 | | |
| 190 | 0-32 | 30 | 0-32 | 30 |
| | 32-190 | 24 | | |
| 202 | 0-30 | 27 | 0-30 | 27 |
| | 30-202 | 24 | | |
| 285 | 0-285 | 8 | 0-58 | 8 |
| 200 | 0-200 | 12 | 0-76 | 12 |
| 313 | 0-120 | 16 | 0-120 | 16 |
| | 120-313 | 15 | | |
| 322 | 0-89 | 12 | 0-89 | 12 |
| | 89-322 | 8 | | |
| 350 | 0-116 | 19 | 0-116 | 19 |
| | 116-350 | 15 | | |

Pumps in wells in the Silurian dolomite aquifer with capacities equal to or greater than 100 gpm are powered by 10 to 100 horsepower electric motors. Pump bowls range in diameter from 7 to 15 inches and have lengths ranging from 3.0 to 10 feet. The number of bowl stages ranges from 2 to 15. Column pipes have lengths ranging from 24 to 220 feet and diameters ranging from 5 to 10 inches. Suction pipes have lengths ranging from 10 to 50 feet and diameters ranging from 4 to 10 inches. Over-all lengths of pumps range from 27 to 234 feet and average 145 feet. Details of selected pump installations are given in table 25.

Pumps in wells in the Cambrian-Ordovician and Mt. Simon aquifers in 1960 were powered by 50 to 400 horsepower electric motors. Pump bowls range in diameter from 6 to 15 inches and have lengths ranging from 8.9 to 19.9 feet. The number of bowl stages ranges from 8 to 30. Column pipes have lengths ranging from 550 to 810 feet and diameters ranging from 5 to 12 inches, Suction pipes have lengths ranging from 10 to 32 feet

**Table 24. Construction Features of Selected Wells in the Cambrian-Ordovician and Mt. Simon Aquifers**

| | Bore hole record | | Casing record | |
|---|---|---|---|---|
| Depth (ft) | depth (ft) | diam. (in) | depth (ft) | diam. (in) |
| 2077 | 0-450 | 18 | 0-79 | 18 |
| | 450-1110 | 12 | 226-455 | 16 |
| | 1110-2077 | 10 | 947-1110 | 10 |
| 1502 | 0-79 | 24 | 0-79 | 24 |
| | 79-460 | 18 | 0-89 | 20 |
| | 460-1260 | 15 | 0-460 | 16 |
| | 1260-1502 | 12 | 744-1260 | 13 |
| 1480 | 0-16 | 30 | 0-82 | 24 |
| | 16-82 | 24 | 0-102 | 20 |
| | 82-102 | 23 | 0-446 | 16 |
| | 102-446 | 19 | 871-1235 | 12 |
| | 446-1205 | 15 | | |
| | 1205-1480 | 12 | | |
| 2028 | 0-67 | 19 | 0-67 | 18 |
| | 67-264 | 17 | 0-264 | 15 |
| | 264-1100 | 14 | 245-500 | 12 |
| | 1100-1175 | 12 | 1059-1100 | 12 |
| | 1175-2000 | 10 | 1077-1175 | 10 |
| 1912 | 0-76 | 22 | 0-445 | 20 |
| | 76-445 | 20 | | |
| | 445-1095 | 15 | | |
| | 1095-1165 | 12 | | |
| | 1165-1912 | 10 | | |
| 1445 | 0-334 | 12 | 0-114 | 12 |
| | 334-1060 | 8 | 218-334 | 10 |
| | 1060-1445 | 6 | 328-785 | 8 |
| | | | 1060-1163 | 7 |
| | | | 1163-1269 | 6 |

and diameters ranging from 5 to 10 inches. Over-all lengths of pumps range from 570 to 840 feet and average 694 feet. Details of selected pump installations are given in table 26.

## Acid Treatment of Wells in Dolomite

Acid treatment has been used successfully to develop newly constructed dolomite wells and to rehabilitate old wells. Several wells have been treated with inhibited 15 percent hydrochloric acid in quantities ranging from 600 to 3000 gallons. Treatment is usually performed with the pump and discharge column removed from the well. Acid is introduced through a temporary line extending to a position near the bottom of the well. The solution is allowed to stand under pressure for periods ranging from 30 minutes to 4 days. The pump is reinstalled and the spent acid is removed from the well during pumping periods ranging from 3 to 8 hours.

Well-production tests were made on a few wells before and after acid treatment. The results of the tests are summarized in table 27. There is an extremely wide range (0 to 935 percent) in improvement. Most of the improvements over 100 percent were recorded for rehabilitated wells; improvements generally less than 40 percent were reported for newly constructed wells. In two of the cases where no improvement was observed the acid was allowed to stand for only an hour or less. The results of acid treatment on two wells are shown graphically in figures 46 and 47.

When wells are operated at high rates of pumping the pressure of the water in the Silurian dolomite aquifer

**Table 25. Description of Pumps in Selected Wells In the Silurian Dolomite Aquifer**

| | | Pump bowls | | | Column pipe | | Suction pipe | | |
|---|---|---|---|---|---|---|---|---|---|
| Horse-power | Rated capacity/head (gpm) (ft) | length (ft) | diam. (in) | Number of bowl stages | length (ft) | diam. (in) | length (ft) | diam. (in) | Over-all length (ft) |
| 30 | 350/230 | 4.4 | 10 | 5 | 70 | 6 | 10 | 6 | 84 |
| 15 | 170/240 | 7.3 | 7 | 15 | 120 | 5 | 10 | 5 | 137 |
| 15 | 100/290 | 6.8 | 8 | 13 | 170 | 5 | ...... | ...... | 177 |
| 15 | 133/33 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | 75 |
| 20 | 500/127 | 5.6 | 8 | 9 | 130 | 5 | 10 | 5 | 146 |
| 25 | 500/127 | 5.6 | 8 | 9 | 130 | 5 | 10 | 5 | 146 |
| 40 | 900/125 | 5.8 | 10 | 7 | 112 | 7 | 30 | 6 | 148 |
| 50 | 1000/126 | 5.5 | 14 | 5 | 108 | 10 | 10 | 8 | 123 |
| 75 | 1500/150 | 5.0 | 12 | 4 | 150 | 10 | 10 | 10 | 165 |
| 50 | 750/160 | 8.5 | 12 | 9 | 159 | 8 | 20 | 8 | 188 |
| 60 | 750/205 | 3.9 | 12 | 3 | 220 | 8 | 10 | 8 | 234 |
| 15 | 400/90 | 4.4 | 8 | 5 | 60 | 5 | 10 | 5 | 74 |
| 20 | 200/260 | 3.5 | 7 | 5 | 140 | 5 | 10 | 5 | 154 |
| 25 | 250/200 | 4.5 | 10 | 5 | 140 | 6 | ...... | ...... | 145 |
| 25 | 230/180 | 4.0 | 10 | 4 | 130 | 6 | 30 | 6 | 164 |
| 10 | 400/30 | 3.0 | 12 | 2 | 24 | 8 | ...... | ...... | 27 |
| 40 | 400/210 | 10 | 12 | 8 | 50 | 8 | 20 | 8 | 80 |
| 60 | 600/170 | 7.8 | 15 | 10 | 79 | 8 | 20 | 6 | 97 |
| 25 | 400/165 | 4.5 | 10 | 5 | 160 | 8 | 15 | 8 | 180 |
| 100 | 840/250 | 6.0 | 14 | 7 | 88 | 10 | 10 | 10 | 104 |
| 50 | 1040/170 | 4.5 | 15 | 4 | 139 | 10 | 20 | 10 | 164 |
| 50 | 600/205 | 6.2 | 15 | 8 | 119 | 10 | 20 | 6 | 145 |
| 25 | 250/280 | 6.5 | 10 | 8 | 160 | 6 | 30 | 6 | 197 |
| 20 | 300/130 | 3.3 | 8 | 4 | 147 | 6 | 13 | 6 | 163 |
| 30 | 300/230 | 5.3 | 8 | 8 | 150 | 6 | 50 | 6 | 205 |
| 60 | 1000/144 | 4.5 | 15 | 4 | 125 | 5 | 35 | 10 | 205 |
| 60 | 1000/144 | 4.5 | 15 | 4 | 160 | 12 | 35 | 10 | 200 |

**Table 26. Description of Pumps in Selected Wells in the Cambrian-Ordovician and Mt. Simon Aquifers**

| Horse-power | Rated capacity/head (gpm) (ft) | Pump bowls length (ft) | Pump bowls diam. (in) | Number of bowl stages | Column pipe length (ft) | Column pipe diam. (in) | Suction pipe length (ft) | Suction pipe diam. (in) | Over-all length (ft) |
|---|---|---|---|---|---|---|---|---|---|
| 50 | 136/590 | 12.7 | 6 | 30 | 590 | 5 | 20 | 5 | 623 |
| 75 | 325/575 | ...... | 6 | 10 | 602 | 5 | ...... | ...... | ...... |
| 100 | 450/615 | 10.7 | 10 | 16 | 610 | 8 | 10 | 8 | 631 |
| 125 | 665/549 | 10.7 | 10 | 16 | 600 | 8 | 10 | 8 | 621 |
| 125 | 440/515 | 10.0 | 10 | 14 | 550 | 8 | 10 | 10 | 570 |
| 150 | 600/703 | 15.2 | 12 | 17 | 680 | 8 | 10 | 8 | 705 |
| 200 | 800/670 | 12.6 | 12 | 12 | 660 | 8 | 32 | 8 | 705 |
| 200 | 900/618 | 12.6 | 12 | 12 | 660 | 8 | 20 | 8 | 693 |
| 200 | 800/700 | 19.9 | 12 | 23 | 680 | 8 | 10 | 8 | 710 |
| 200 | 900/715 | 12.7 | 12 | 11 | 650 | 8 | ...... | ...... | 672 |
| 250 | 800/785 | 14.4 | 12 | 14 | 780 | 10 | 20 | 10 | 814 |
| 250 | 1000/650 | 8.9 | 14 | 8 | 650 | 10 | 10 | 10 | 669 |
| 250 | 1250/660 | 10.5 | 12 | 11 | 660 | 10 | 10 | 8 | 680 |
| 250 | 1000/640 | 12.7 | 12 | 11 | 650 | 8 | ...... | ...... | 673 |
| 300 | 1200/710 | 9.7 | 14 | 10 | 690 | 10 | 24 | 10 | 724 |
| 300 | 1025/680 | 11.3 | 12 | 12 | 680 | 10 | 20 | 8 | 711 |
| 300 | 1000/885 | 18.7 | 15 | 18 | 699 | 8 | 30 | 10 | 748 |
| 300 | 1000/770 | 13.8 | 12 | 13 | 620 | 8 | ...... | ...... | 644 |
| 350 | 1400/720 | 9.8 | 14 | 9 | 810 | 10 | 20 | 10 | 840 |
| 350 | 1400/720 | 9.8 | 14 | 9 | 780 | 10 | 20 | 10 | 810 |
| 250 | 1000/644 | 15.5 | 15 | 15 | 620 | 10 | 30 | 10 | 666 |
| 400 | 1200/740 | 15 | 15 | 14 | 609 | 12 | 31 | 10 | 655 |

is greatly reduced, carbon dioxide is liberated, and the water is unable to hold in solution its load of mineral salts. Consequently calcium carbonate is precipitated in the openings of the well wall and the permeability of the well wall is greatly reduced. This clogging is particularly noticeable in wells with pumping levels below the top of the aquifer. The yields of clogged wells can often be restored to their original value by acid treatment.

During the construction of many dolomite wells some very fine drill cuttings invariably infiltrate a short distance into the water-yielding openings of the aquifer and reduce the permeability of the well wall. A newly completed well is often less than 100 percent efficient because of this partial clogging of openings. The yield of a newly completed well can therefore be increased by removing, by acid treatment, the fine materials which have migrated into the formation.

Acid introduced into a dolomite well tends to flow into, and widen, fractures leading into the well bore. Also the acid reacts with drill cuttings in openings and the dolomite of the well wall. The effect of the reaction with the dolomite of the well wall is to increase the radius of the well bore. Large increases in the radius of a well bore result in comparatively small increases in specific capacity of the well because the specific

**Table 27. Results of Acid Treatment of Wells in the Silurian Dolomite Aquifer**

| Well number | Owner | Depth (ft) | Diam. of well (in) | Quantity of acid used (gal) | Length acid left in well (hr) | Date of acid treatment | Before acid treatment pumping rate (gpm) | Before acid treatment specific capacity (gpm/ft) | After acid treatment pumping rate (gym) | After acid treatment specific capacity (gpm/ft) | Percent improvement in specific capacity | Remarks (R = rehabilitated; N = new) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | |
| 38N9E-13.2h | City of Naperville | 178 | 24 | ...... | 336 | 12/43 | 250 | 4.2 | 1000 | 43.5 | 935 | Well No. 4, R |
| 38N10E-18.3d1 | City of Naperville | 190 | 24 | 3000 | 24 | 4/42 | 390 | 3.7 | 825 | 20.0 | 441 | Well No. 5, R |
| 38N10E-18.3d2 | City of Naperville | 202 | 24 | 1000 | ½ | 2/47 | 285 | 1.7 | 285 | 1.7 | none | Well No. 6, R |
| 38N10E-18.3d2 | City of Naperville | 202 | 24 | 3000 | 96 | 3/48 | 285 | 1.7 | 570 | 12.5 | 635 | Well No. 6, R |
| 39N9E-4.2b | City of West Chicago | 310 | 24 | 3000 | .... | 4/56 | 375 | 3.3 | 800 | 10.0 | 203 | Well No. 3, R |
| 39N10E-12.4c | Glen Oak Country Club | 212 | 16 | 600 | .... | 3/57 | 311 | 2.2 | 450 | 6.3 | 187 | Well No. 2, N |
| 39N11E-4.1f | Village of Villa Park | 235 | 12 | 1500 | 1 | 11/59 | 175 | 1.8 | 200 | 1.8 | none | Well No. 5, R |
| 39N11E-10.8e2 | Village of Villa Park | 285 | 8 | 1500 | .... | 4/48 | 200 | 3.4 | 369 | 4.5 | 33 | Well No. 3, R |
| 39N11E-13.3g | City of Elmhurst | 290 | 8 | 3000 | .... | 7/59 | 335 | 3.9 | 300 | 5.4 | 39 | Well No. 7, N |
| 40N10E-3.4f | Village of Eoselle | 182 | 10 | 1000 | 24 | 3/55 | 140 | 2.3 | 170 | 7.7 | 235 | Well No. 1, R |
| 40NllE-8.5fl | Village of Itasca | 181 | 20 | 1000 | .... | 7/59 | 75 | 0.7 | 50 | 0.4 | none | Well No. 6, N |
| 40NllE-8.6b | Village of Itasca | 190 | 12 | 1000 | 20 | 4/59 | 156 | 1.2 | 250 | 3.8 | 216 | Well No. 5, N |
| 40NllE-8.6b | Village of Itasca | 190 | 12 | 2000 | 72 | 5/60 | 250 | 3.8 | 400 | 6.3 | 66 | Well No. 5, N |

capacity varies with the logarithm of $1/r^2$. Computations made with equations 2, 3, and 4 indicate that a 30-inch diameter well has a specific capacity about 8 percent more than that of a 16-inch diameter well. Several thousand gallons of acid cannot dissolve in a day enough bulk dolomite to substantially increase the radius of the well bore. Thus, large increases in the yield of a dolomite well cannot be attributed to well bore enlargement. However, the acid will penetrate considerable distances along the fractures and will widen them and increase their permeability. In addition, the acid will dissolve drill cuttings in openings and increase the permeability of the well wall.

The effect of treatment will vary according to the permeability of the well wall before treatment. A tight dolomite with narrow openings will respond differently than one with openings of appreciable width. Furthermore, a formation that has been partially clogged during drilling will respond differently than one which has not been clogged.

According to Muskat (1946), acid treatment will be relatively effective if the dolomite has extended fractures or is partially clogged near the well bore. Increases up to about 50 percent for wells of initially moderate or high capacity may be explained on the assumption that the width of water-yielding openings of a small radial zone about the well bore have been increased and/or that drilling cuttings partially clogging the well wall have been removed. Moderate increases, 50 to 500 percent, may be explained on the assumption that there are extended fractures in the dolomite which are penetrated and widened by the acid and/or that mild clogging was the principal factor in determining the initial yield of the well. Wells of initially low capacity often react best to acid treatment. Increases larger than 500 percent can only be explained on the. assumption that there are extended fractures in the dolomite which are penetrated and widened by the acid and/or that there was initially a condition of almost complete clogging of the well wall.

### Shooting Wells in Sandstone to Increase Yields

Successful use of explosives to develop newly constructed deep sandstone wells or to rehabilitate old wells has been made in the county. Shooting is normally accomplished with liquid or solidified nitroglycerine. Shots of approximately 100 to 600 pounds of 80 to 100 percent nitroglycerine are usually exploded opposite the most permeable zones of a formation. Shots are often exploded opposite the lower 80 feet of the Ironton-Galesville Sandstone and occasionally opposite the middle 80 feet of the St. Peter Sandstone. Shots are commonly spaced vertically 20 feet apart. The explosions loosen a few cubic feet to several hundred cubic yards of rock that have to be bailed out of the well.

According to Walton and Csallany (1962), the yields of newly constructed deep sandstone wells are increased by shooting because 1) the hole diameters of well bores opposite zones which have been shot are enlarged, and 2) fine drill cuttings and mud deposited in the well wall during construction are removed. Expected average increases in the yields of newly completed wells uncased in the various units or aquifers are listed below.

| Units or aquifers uncased in well | Average increase in specific capacity due to shooting, in percent |
|---|---|
| Galena-Platteville, Glenwood-St. Peter | 38 |
| Cambrian-Ordovician | 22 |
| Ironton-Galesville | 30 |
| Cambrian-Ordovician, Mt. Simon | 25 |

## SUMMARY

DuPage County is one of the areas in northeastern Illinois experiencing rapid municipal and industrial growth as development of the suburban area of the city of Chicago expands westward. An increase of 102.8 percent in the population of DuPage County during the interval between 1950 and 1960 has been concentrated in the urban areas, and in 1960 these areas contained about 85 percent of the population. A shift in the economy from agriculture to manufacturing is taking place and farms are becoming fewer while business and manufacturing establishments are rapidly increasing in number. To date, ground-water supplies have been adequate to meet the demands of this great expansion; however, problems in water supply are anticipated. Evaluation of the ground-water resources of DuPage County provides a basis for their efficient development and management.

The rocks which form the ground-water reservoir are grouped into geohydrologic units including the principal aquifer units: 1) glacial drift aquifers; 2) Silurian dolomite aquifer; 3) Cambrian-Ordovician aquifer, of which the Ironton-Galesville Sandstone is the most productive unit; and 4) the Mt. Simon aquifer, consisting of the Mt. Simon Sandstone and the lower sandstone of the Eau Claire Formation.

Glacial drift aquifers are made up of deposits of sand and gravel which occur erratically throughout the unconsolidated glacial drift which overlies the bedrock. Three general groupings of glacial drift aquifers are recognized on the basis of their mode of occurrence:

1) surficial, 2) interbedded, and 3) basal. The surficial glacial drift aquifers occur just below land surface, the interbedded aquifers are separated from the surficial and basal aquifers by deposits of till, and the basal aquifers occur at the base of the drift directly above the dolomite.

The Silurian dolomite aquifer is the most heavily developed source of ground water in the bedrock and is considered in most detail in this report. This aquifer includes rocks of the Niagaran and Alexandrian Series and occurs immediately below the unconsolidated material throughout most of the county. Thickness of the Silurian dolomite aquifer reaches a maximum of about 250 feet. Joints, fractures, and solution cavities influence strongly the occurrence, movement, and availability of ground water in the Silurian dolomite aquifer. The weathered zone with solution-enlarged openings in the upper part of the dolomite directly beneath the bedrock surface is believed to be a major water-yielding zone.

Large ranges in the yields of wells in the Silurian dolomite aquifer suggest that major differences exist in its water-yielding properties. Many aspects of the lithologic, structural, and topographic character of the dolomite influence its capacity to yield water. Statistical analysis establishes significant relationships between specific capacity of wells and 1) thickness of the Silurian dolomite aquifer at the well site, 2) thickness of the Niagaran Series penetrated by the well, and 3) thickness of reef penetrated by the well.

On the basis of a frequency analysis of specific capacities of wells versus deepest stratigraphic unit penetrated by wells, two units of geohydrologic significance are recognized within the Silurian dolomite aquifer: 1) the Niagaran aquifer, and 2) the Alexandrian aquifer. The weathered zone with solution-enlarged openings in the upper part of the dolomite occurs in each of these aquifers where they directly underlie the glacial drift. Locally, the shaly basal beds of the Niagaran Series restrict recharge to the underlying dolomite and are considered as a separate unit (the basal unit of the Niagaran aquifer).

The glacial drift and Silurian dolomite aquifers are connected hydrologically and are separated from the Cambrian-Ordovician aquifer by the shales of the Maquoketa Formation. The relatively impermeable parts of the Eau Claire Formation hydrologically separate the Cambrian-Ordovician aquifer from the underlying Mt. Simon aquifer.

Total pumpage from wells has increased steadily at an accelerating rate since the first wells were drilled in 1890. During the 70-year period, 1890 to 1960, total pumpage from all aquifers increased from 841,000 gpd to 29.3 mgd at an average rate of increase of about 410,000 gpd per year. Of the total water pumped from wells in 1960, 68 percent was derived from the Silurian dolomite aquifer, 30 percent from the Cambrian-Ordovician and Mt. Simon aquifers, and 2 percent from the glacial drift aquifers.

A comparison of Silurian dolomite aquifer water-level hydrographs and pumpage graphs indicates that in general water-level decline is directly proportional to pumpage and suggests that recharge balances discharge.

Controlled pumping tests were made in two areas in DuPage County to determine the hydraulic properties of the Silurian dolomite aquifer and its confining beds. The average coefficient of storage and the leakage coefficient were calculated to be about 0.0002 and $3.7 \times 10^{-3}$ gpd/cu ft, respectively. The coefficient of transmissibility varies considerably due to the variable thickness of the dolomite aquifer; however, based upon 115 well production tests the regional average coefficient of transmissibility is about 100,000 gpd/ft.

Specific capacity frequency graph analysis for dolomite units penetrated by wells indicates that the Niagaran and Alexandrian Series are more productive than the Maquoketa Formation, and the Niagaran Series is more productive than the Alexandrian Series. The productivity of the Alexandrian Series is the most consistent and that of the Maquoketa Formation is the least consistent.

Data on the response of the Silurian dolomite aquifer to heavy pumping and data on yields of existing production wells indicate that the potential yield of the Silurian dolomite aquifer is limited by recharge. Calculated recharge rates are based upon measured areas of influence and pumpage data. The potential yield of the Silurian dolomite aquifer is estimated to be about 38 mgd based on the recharge rates.

In 1960, nonpumping water levels were not critical in any pumping center and there were areas in the county unaffected by pumping. The practical sustained yield of existing pumping centers exceeded total withdrawals in 1960. The practical sustained yield of the Silurian dolomite aquifer is computed to be about 35 mgd based upon critical water-level and rate of recharge data. Thus, nearly all the potential yield of the Silurian dolomite aquifer can be developed with scattered production wells in existing pumping centers. About 3 mgd is beyond existing pumping centers mostly in areas in the northwestern and southwestern parts of the county.

Extrapolation of pumpage growth curves of pumping centers shows that the practical sustained yields of several pumping centers will probably be exceeded within 2 to 5 years and the practical sustained yields of all pumping centers will be exceeded by 1985. An extrapolation of the pumpage growth curve for the county suggests that the total withdrawals from wells in the

Silurian dolomite aquifer will exceed the potential yield by about 1977.

Pull development of the Silurian dolomite aquifer was assumed in estimating its potential and practical sustained yields, thus the glacial drift may be considered as supplementing the Silurian dolomite aquifer yield.

Hydrographs of the water levels in the glacial drift wells show a pattern of seasonal fluctuation similar to, but affected to a greater degree than, the hydrographs of water levels of wells completed in the Silurian dolomite aquifer. The hydrographs indicate no general or permanent decline in water levels.

The potential yield of the glacial drift aquifers is estimated to be about 3 mgd based upon studies of stream flow data, recharge rates of the Silurian dolomite aquifer, where applicable, and by assuming full development of the Silurian dolomite aquifer and supplemental development of the glacial drift aquifers. In many areas, full development of glacial drift aquifers and supplemental development of the Silurian dolomite aquifer may be advantageous. Thus, it is possible to obtain more water from the glacial drift aquifers than computed and correspondingly less water from the Silurian dolomite aquifer. The potential yield of the glacial drift aquifers (3 mgd) greatly exceeds withdrawal from drift wells (0.52 mgd) in 1960.

During the period 1943 to 1954, seven pumping tests were made in DuPage County to determine the hydraulic properties of the Cambrian-Ordovician aquifer. Coefficients of transmissibility range from 14,700 to 22,000 gpd/ft and average 18,000 gpd/ft. The average coefficient of storage is estimated to be about 0.00035 based on data in Cooperative Report 1.

The general pattern of flow of water in the Cambrian-Ordovician aquifer beneath DuPage County in 1960 was slow movement from northwest to southeast toward the deep cone of depression centered west of Chicago at Summit. The piezometric surface declines from an average elevation of 430 feet in the northwestern corner of the county to an elevation of about 95 feet east of Elmhurst.

Data in Cooperative Report 1 indicate that the average elevation of water levels in deep sandstone wells in DuPage County was about 730 feet in 1864 prior to heavy well development. By 1960, the artesian pressure had dropped in response to withdrawals of w.ater to elevations of about 334 feet at West Chicago and 95 feet at Elmhurst. In a period of 96 years, water levels at Elmhurst declined about 635 feet or at a rate of about 6.6 feet per year. The total decline and average rate of decline in artesian pressure at West Chicago, 1864 to 1960, were 396 feet and 4.1 feet per year, respectively.

Factors affecting the practical sustained yield of the Cambrian-Ordovician aquifer in the Chicago region are discussed in detail in Cooperative Report 1. The practical sustained yield of the Cambrian-Ordovician aquifer in DuPage County was computed to be about 4.3 mgd based on pumpage data.

Based on well construction data and Cooperative Report 1, the practical sustained yield of the Mt. Simon aquifer in DuPage County was computed to be about 2.1 mgd. Total withdrawals from the Cambrian-Ordovician and Mt. Simon aquifers in 1960 (8.8 mgd) exceeded the practical sustained yield of these aquifers (6.4 mgd).

Temperatures in the glacial drift aquifers range from 46° to 54°F. The hardness averages 485 ppm. The temperature of water in the Silurian dolomite aquifer ranges from 49° to 59°P and averages about 52°P. Hardness ranges from 194 to 1295 ppm and averages 436 ppm. Water with hardness exceeding 500 ppm is concentrated mostly in the eastern parts of the county.

The temperature of water from the Cambrian-Ordovician aquifer ranges from about 53° to about 58°F. The hardness ranges from less than 100 ppm to slightly more than 500 ppm.

Water from the Mt. Simon aquifer appears to increase in temperature by about one degree per 100 feet of additional depth below a depth of 2000 feet where the temperature is 66°F. The primary characteristic of the quality of water from the Mt. Simon aquifer is the rapid increase in chloride concentration with depth. At depths below 2000 feet, water from the Mt. Simon aquifer is too highly mineralized for most purposes.

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# APPENDIX A

## SELECTED WELL RECORDS

Wells listed below can be identified by the well numbering system described on page 8.

Abbreviations used in this table are:

DUP = DuPage County
SS = State Geological Survey sample set number
DL = Driller's Log
TB = Test Boring
P = Public Supply

I = Industrial Supply
E = Rural (non irrigation) Supply
Dr = Drift
Sil = Silurian
Maq = Maquoketa
C-O = Cambrian-Ordovician

G-P = Galena-Platteville
G-SP = Glenwood-St. Peter
Tr = Trempealeau
EC = Eau Claire
MS = Mt. Simon
Dol = Dolomite

| Well number | Owner *(well designation)* | Year drilled | Surface elevation *(ft above sea-level)* | Depth *(ft)* | Deepest formation reached | Main aquifer | Type of record | Use |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 37N11E-3.8al | Argonne National Lab. #1A | 1950 | 675 | 1595 | EC | C-O | SS 19957 DL | I |
| 37N11E-4.3b | Argonne National Lab. #4 | 1959 | 710 | 340 | Maq | Sil Dol | SS 33160 DL | I |
| 37N11E-8,2h | Argonne National Lab. #5 | 1948 | 751 | 345 | Maq | Sil Dol | SS 18447 DL | I |
| 37N11E-10.5f | Argonne National Lab. #1 | 1948 | 675 | 284 | Maq | Sil Dol | SS 18445 DL | I |
| 37N11E-10.6g | Argonne National Lab. #2 | 1948 | 663 | 330 | Maq | Sil Dol | SS 18445 DL | I |
| 37N11E-17.2g | Argonne National Lab. #4 | 1955 | 748 | 181 | Sil | Sil Dol | SS 26122 DL | I |
| 38N9E-1.5e | Northern Ill. Toll Ed #5A | 1959 | 730 | 41.5 | Dr | ........ | SS 321000 ...... | TB |
| 38N9E-2,lh | Elmhurst-Chicago Stone Go. #1 | 1957 | 690 | 265 | Sil | Sil Dol | SS 30711 DL | I |
| 38N9E-4.5e | Northern Ill. Toll Rd #8B | 1959 | 710 | 66.5 | Dr | ........ | SS 32347 ...... | T |
| 38N9E-5.4a | Commonwealth Edison #111 | 1958 | 741 | 200 | Maq | Sil Dol | SS 33536 ...... | I |
| 38N9E-6.2b | Northern Ill. Toll Rd #2B | 1958 | 732 | 61.5 | Dr | ........ | SS 32348 ...... | TB |
| 38N9E-11.3h | E. W. Glassner #1 | 1940 | 700 | 265 | Maq | Sil Dol | SS 7074 DL | E |
| 38N9E-13.2b3 | Naperville City Well#7 | 1958 | 680 | 1445 | EC | C-O | SS 30726 DL | P |
| 38N9E-15.6f | Concrete Products Inc. | 1959 | 702 | 141 | Sil | Sil Dol | SS 34783 DL | E |
| 38N9E-15.7d | Pioneer Publishing Co. | 1961 | 704 | 1000 | Tr | G-SP/Tr | SS 41237 ...... | I |
| 38N9E-15.7f | Concrete Products Co. #1 | 1959 | 702 | 128 | Sil | Sil Dol | SS 34782 ...... | I |
| 38N9E-17.8c2 | Warren Petroleum Co. #2 | 1953 | 717 | 282 | Maq | Sil Dol | .......... DL | I |
| 38N9E-21.2e | Harry Gregory | 1949 | 709 | 70 | Sil | Sil Dol | SS 19822 DL | E |
| 38N9E-23.3g | Lawn Meadow Water Co. | 1956 | 659 | 210 | Maq | Sil Dol | SS 33417 DL | P |
| 38N9E-24.8d | W. M.Bender #1 | 1959 | 700 | 100 | Sil | Sil Dol | .......... DL | E |
| 38N10E-l.lg | Morton Arboretum Drug Plant | 1945 | 720 | 250 | Maq | Sil Dol | SS 15341 DL | I |
| 38N10E-3.2>f | Northern Ill. Toll Rd #2 | 1958 | 678 | 35 | Dr | ........ | SS 31685 ...... | TB |
| 38N10E-3.8a | Ill. Municipal Water Co. #2 | 1959 | 723 | 233 | Maq | Sil Dol | DL | P |
| 38N10E-3.8b | Richard Schmoker | 1941 | 712 | 124 | Sil | Sil Dol | SS 6713 DL | E |
| 38N10E-5.2a | J. B. Slifer | 1944 | 760 | 123 | Sil | Sil Dol | SS 11826 DL | R |
| 38N10E-5.4d | Northern Ill. Toll Rd #5B | 1959 | 780 | 42 | Dr | Sil Dol | SS 32102 ...... | TB |
| 38N10E-5.6d | Northern Ill. Toll Rd #3 | 1958 | 768 | 31.5 | Dr | ........ | SS 31836 ...... | TB |
| 38N10E-7.3e | Peter Du Hai | 1941 | 738 | 97 | Sil | Sil Dol | SS 6712 DL | R |
| 38N10E-9.2c . | Harrison & Grace E. | 1943 | 700 | 93 | Sil | Sil Dol | SS 10210 DL | R |
| 38N10E-11.7e | Oakview Subdivision #1 | 1957 | 743 | 200 | Sil | Sil Dol | SS 27990 DL | P |
| 38N10E-12,2b | Belmont Highwood | 1954 | 738 | 295 | Maq | Sil Dol | SS 23830 ...... | P |
| 38N10E-13.2d | Eietz Construction Co. #22 | 1959 | 754 | 165 | Sil | Sil Dol | .......... DL | R |
| 38N10E-15.8h2 | Sacred Heart Academy #2 | 1937 | 720 | 237 | Maq | Sil Dol | SS 2202 DL | P |
| 38N10E-16.4d | St. Procopius College #2 | 1935 | 734 | 245 | Maq | Sil Dol | SS 1689 ...... | P |
| 38N10E-17.8b | John Henry | 1950 | 743 | 338 | Maq | Sil Dol | SS 20299 DL | R |
| 38N10E-18.3d2 | Naperville City #6 | 1937 | 688 | 202 | Maq | Sil Dol | SS 2173 DL | P |
| 38N10E-19.3e3 | E. J. Laky | 1942 | 710 | 107 | Sil | Sil Dol | SS 8679 DL | R |
| 38N10E-19.4e | Harry Hoyle | 1939 | 712 | 105 | Sil | Sil Dol | SS 3958 DL | R |
| 38N10E-21.3d | George Moss | 1959 | 755 | 104 | Sil | Sil Dol | .......... DL | R |
| 38.N10E-25.5b | Surety Builders Woodridge #3 | 1958 | 738 | 70 | Sil | Sil Dol | SS .......... DL | TB |
| 38N10E-26.1b | Surety Builders Woodridge #2 | 1958 | 740 | 75 | Sil | Sil Dol | .......... DL | TB |
| 38N11E-1.3al | Hinsdale City Well #2 | 1924 | 690 | 268 | Maq | Sil Dol | SS 766 DL | P |
| 38N11E-4.4f2 | Liberty Park #2 | 1956 | 745 | 275 | Maq | Sil Dol | SS 26960 DL | P |
| 38N11E-6.4c | New Downers Grove Village | | 755 | 300 | Sil | Sil Dol | SS 26464 ...... | .. |
| 38NllE-7.8b | Wm. Sehaffner | 1944 | 710 | 100 | Sil | Sil Dol | SS 11581 DL | R |

| Well number | Owner (*well designation*) | Tear drilled | Surface elevation (*ft above sea level*) | Depth (*ft*) | Deepest formation reached | Main aquifer | Type of record | | | Use |
|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | |
| 38N11E-8.7e | Tivoli Theater | 1941 | 720 | 264 | Maq | Sil Dol | SS | 6714 | DL | I |
| 38N11E-8.7e | Village of Downers Grove | 1951 | 715 | 268 | Maq | Sil Dol | SS | 20945 | ...... | P |
| 38N11E-9.1h | Westmont City Well #2 | 1926 | 752 | 313 | Maq | Sil Dol | SS | 560 | DL | P |
| 38N11E-10.1e | Clarendon Hills Well #2 | 1932 | 730 | 250 | Maq | Sil Dol | SS | 1231 | ...... | P |
| 38N11E-10.6e | Blackhawks Heights Water Supply | 1953 | 740 | 285 | Maq | Sil Dol | SS | 23251 | DL | P |
| 38N11E-10.7a | Westmont City Well #3 | 1935 | 760 | 302 | Maq | Sil Dol | SS | 1687 | DL | P |
| 38N11E-10.8e | "Village of Westmont #4 | 1958 | 755 | 313 | Maq | Sil Dol | SS | 30748 | DL | P |
| 38N11E-11.5b | Clarendon Hills #3 | 1945 | 710 | 354 | Maq | Sil Dol | SS | 12835 | DL | P |
| 38N11E-11.5d | Clarendon Hills #4 | 1956 | 760 | 370 | Maq | Sil Dol | SS | 26358 | DL | P |
| 38N11E-15.3e | E. H. Hurd | 1943 | 730 | 160 | Sil | Sil Dol | SS | 10032 | DL | E |
| 38N11E-18.2g | James Delany | 1943 | 730 | 142 | Sil | Sil Dol | SS | 10151 | DL | E |
| 38N11E-21.1e | Clarendon Hills Cemetery | 1935 | 767 | 202 | Sil | Sil Dol | SS | 1694 | DL | I |
| 38N11E-24.3b | Int'l Harvester #1 | 1956 | 718 | 290 | Maq | Sil Dol | SS | 28040 | DL | I |
| 38N11E-26.5b | H. F. Zitzka | 1959 | 710 | 165 | Sil | Sil Dol | | ...... | DL | E |
| 38N11E-27.8d | Brookhaven Manor #1 | 1957 | 755 | 310 | Maq | Sil Dol | SS | 32256 | DL | P |
| 38N11E-30.5d | Maple Crest Lake Country Club | 1958 | 781 | 395 | Maq | Sil Dol | SS | 31003 | DL | I |
| 38N11E-32.6h2 | John Firelli #5 | 1957 | 755 | 165 | Sil | Sil Dol | | ...... | DL | E |
| 38N11E-33.2b2 | Cass School District | 1958 | 725 | 250 | Maq | Sil Dol | SS | 31359 | DL | P |
| 38N11E-34.8c | Frank Fulkenalyer | 1946 | 705 | 90 | Sil | Sil Dol | SS | 14453 | DL | E |
| 39N9E-2.5e | J. V. Bauer | 1942 | 765 | 163 | Sil | Sil Dol | | ...... | DL | E |
| 39N9E-3.1h2 | Campbell Soup Co. #4 | 1947 | 763 | 248 | Maq | Sil Dol | SS | 16579 | DL | I |
| 39N9E-4.1b | City of W. Chicago #3 | 1950 | 768 | 310 | Maq | SilDol | | ...... | DL | P |
| 39N9E-4.2e | A. Scola | 1943 | 760 | 111 | Sil | Sil Dol | SS | 9886 | DL | E |
| 39N9E-4.7f | L. G. Carbary | 1943 | 760 | 108 | Sil | Sil Dol | SS | 9881 | DL | E |
| 39N9E-5.6g | Western Electric Co. #3 | 1958 | 752 | 268 | Maq | Sil Dol | SS | 31052 | DL | I |
| 39N9E-8.2b | Harry Glasshagel | 1942 | 750 | 105 | Sil | Sil Dol | SS | 7707 | ...... | E |
| 39N9E-9.3d | Lindsay Chemical Co. | 1953 | 750 | 332 | Maq | Sil Dol | SS | 24589 | DL | I |
| 39N9E-9.7d | George Ball Inc. | 1958 | 750 | 350 | Maq | SilDol | SS | 31318 | DL | I |
| 39N9E-10.7f | Chicago Northwestern E.E. | 1924 | 760 | 2082 | MS | C-O/MS | SS | 401 | DL | I |
| 39N9E-11.2h | Byron Spiers | 1942 | 740 | 115 | Sil | Sil Dol | SS | 9882 | DL | E |
| 39N9E-13.2bl | Wheaton Park Manor | 1955 | 768 | 268 | Maq | SilDol | | ...... | DL | P |
| 39N9E-13.6c | Village of Winfield #2 | 1957 | 778 | 335 | Maq | Sil Dol | SS | 27666 | DL | P |
| 39N9E-23.3a | E. G. Davidson | 1942 | 750 | 143 | Sil | Sil Dol | SS | 7705 | ...... | E |
| 39N9E-25.3f | Berniee Aeheson | 1947 | 750 | 130 | Sil | Sil Dol | | ...... | DL | E |
| 39N9E-32.4h | Franklin White | 1941 | 745 | 161 | Sil | Sil Dol | SS | 6711 | DL | E |
| 39N9E-35.1a | Elmhurst-Chieago Stone Co. | 1957 | 709 | 274 | Maq | Sil Dol | SS | 30710 | DL | I |
| 39N10E-2.3e | Eoy Spalding School | 1957 | 720 | 160 | Sil | Sil Dol | | ...... | DL | P |
| 39N10E-2.4h | Bennet Construction Co. | 1946 | 742 | 350 | Maq | Sil Dol | SS | 14736 | ...... | P |
| 39N10E-9.2f | City of Wheaton #5 | 1954 | 750 | 341 | Maq | Sil Dol | SS | 24881 | DL | P |
| 39N10E-11.7e | Glen-Ellyn Village #2 | 1922 | 760 | 352 | Maq | Sil Dol | SS | 1048 | ...... | P |
| 39N10E-12.4c | Glen Oak Country Club #3 | 1957 | 700 | 212 | Maq | Sil Dol | SS | 28036 | ...... | I |
| 39N10E-12.5a | Glen Oak Country Club | 1929 | 688 | 202 | Maq | Sil Dol | SS | 856 | DL | I |
| 39N10E-15.1bl | Glen Ellyn Village Well | 1954 | 770 | 415 | Maq | Sil Dol | SS | 24581 | ...... | P |
| 39N10E-16.6c3 | Wheaton City Well #4 | 1946 | 753 | 350 | Maq | Sil Dol | SS | 15659 | ...... | P |
| 39N10E-19.4g | St. Francis High School #1 | 1957 | 772 | 252 | Maq | Sil Dol | SS | 30226 | DL | P |
| 39N10E-23.2d | Frederic Babcock | 1942 | 760 | 130 | Sil | Sil Dol | SS | 11104 | DL | R |
| 39N10E-24.5a | Glen Ellyn Sewage Disp. | 1931 | 685 | 269 | Maq | SilDol | SS | 1206 | DL | I |
| 39N10E-30.1h | Arrow Head Subdivision #1 | 1959 | 740 | 335 | Maq | Sil Dol | SS | 34398 | ...... | P |
| 39N10E-35.6g | Valley View Subdivision #1 | 1957 | 750 | 290 | Maq | Sil Dol | SS | 28457 | DL | P |
| 39N10E-34.3d | Morton Arboretum #1 | 1956 | 748 | 250 | Sil | Sil Dol | SS | 26396 | DL | |
| 39N11E-1.8f | Elmhurst City Well #1 | 1915 | 678 | 1480 | EC | C-O | SS | 4229 | DL | P |
| 39N11E-2.2f | Elmhurst City Well #3 | 1926 | 690 | 2077 | MS | C-O | | ...... | DL | P |
| 39N11E-4.1f | Village of Villa Park #7 | 1958 | 704 | 1420 | EC | C-O | SS | 30860 | DL | P |
| 39N11E-5.3g | Lombard Heights | 1954 | 722 | 210 | Maq | Sil Dol | SS | 24247 | DL | P |
| 39N11E-6.3a | Village of Lombard #4 | 1953 | 700 | 2062 | MS | C-O/MS | SS | 23911 | DL | P |
| 39'N11E-7.2h | Village of Lombard #3 | 1949 | 693 | 175 | Maq | Sil Dol | SS | 19637 | ...... | P |
| 39N11E-8.8h2 | Village of Lombard #2 | 1926 | 696 | 2038 | MS | C-O/MS | SS | 627 | DL | P |
| 39N11E-9.1h | Villa Park Village Well #1 | 1928 | 699 | 2125 | MS | C-O/MS | | ...... | DL | P |
| 39N11E-9.2h | Villa Park Village Well #2 | 1931 | 700 | 2110 | MS | C-O/MS | SS | 905 | ...... | P |
| 39N11E-10.1h | Elmhurst City Well #4 | 1928 | 665 | 2205 | MS | C-O/MS | | ...... | DL | P |
| 39N11E-10.3g3 | Wander Company #11 | 1933 | 668 | 1920 | MS | C-O/MS | SS | 15336 | ...... | I |
| 39N11E-10.8e2 | Villa Park Well #4 | 1923 | 702 | 220 | Maq | Sil Dol | SS | 128 | ...... | P |
| 39N11E-12,8d | Elmhurst City Well #5 | 1940 | 675 | 1480 | EC | C-O | SS | 6059 | DL | P |
| 39N11E-18.3a | Cambell | 1957 | 720 | 147 | Sil | Sil Dol | SS | 32037 | ...... | E |
| 39N11E-20.6g | Midwest York Co. | 1954 | 725 | 241 | Sil | Sil Dol | | ...... | DL | P |

| Well number | Owner (well desiffnation) | Year drilled | Surface elevation (ft above sea level) | Depth (ft) | Deep-est for-mation reached | Main aquifer | Type of record | Use |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 39N11E-24.2g | J. Harris Jones | 1957 | 690 | 350 | Maq | Sil Dol | ...... DL | |
| 39N11E-24.3a | American Can Co. #2 | 1959 | 682 | 245 | Maq | Sil Dol | SS 34076 ...... | I |
| 39N11E-27.5h | Ill. Toll Highway | 1957 | 692 | 238 | Sil | Sil Dol | SS 30676 DL | I |
| 39N11E-28.6e | Northern Ill. Toll Rd #3 | 1958 | 717 | 36.5 | Dr | ...... | SS 31568 ...... | |
| 40N9E-2.7g | Village of Bartlett #1 | 1943 | 786 | 43*0 | GP | G-P Dol | SS 10076 ...... | I |
| 40N9E-3.5b | Golden Valley Homes #1 | 1959 | 815 | 392 | Maq | Sil Dol | SS 34610 DL | P |
| 40N9E-5.5e | Leonard Ellis | 1947 | 775 | 163 | Sil | Sil Dol | SS 17687 DL | R |
| 40N9E-29.7a | Howard Aircraft Corp. | 1942 | 753 | 1006 | G-SP | G-SP | SS 9843 DL | I |
| 40N9E-32.2d | Elgin-Joliet-Eastern R.R. | 1931 | 755 | 1038 | EC | C-O | SS 1169 DL | I |
| 40N9E-32.5g | Kawneer Products #2 | 1959 | 755 | 270 | Maq | Sil Dol | ...... DL | I |
| 40N9E-33.1a | Guy Ross | ........ | 755 | 150 | Sil | Sil Dol | SS 7704 ...... | R |
| 40N9E-34.1d | Campbell Soup Co. | 1946 | 730 | 255 | Sil | Sil Dol | SS 26580 DL | I |
| 40N9E-35.3'g | Sidwell Studio | 1959 | 748 | 190 | Maq | Sil Dol | SS 33309 DL | I |
| 40N9E-36.2h | Mark Morton #1 | 1930 | 790 | 912 | G-SP | G-SP | SS 100336 DL | R |
| 40'N10E-3.4e2 | City of Roselle #2 | 1954 | 770 | 183 | Maq | Sil Dol | SS 24958 ...... | |
| 40N10E-8.5e | Ernest Huntington | 1959 | 783 | 182 | Maq | Sil Dol | ...... DL | R |
| 40N10E-14.8d2 | Suncrest Highlands | 1956 | 722 | 1395 | EC | C-O | ...... DL | P |
| 40N10E-17.3d | Roger Seddor | 1957 | 802 | 235 | Maq | Sil Dol | ...... DL | R |
| 40N10E-20.5d | Cloverdale Cement Plant #2 | 1958 | 767 | 320 | Maq | Sil Dol | SS 31466 DL | I |
| 40N10E-31.2g | Durable Construction Co. | 1958 | 760 | 335 | Maq | Sil Dol | SS 31476 DL | I |
| 40N11E-8.7e | Village of Itasca #4 | 1951 | 690 | 233 | Maq | SilDol | SS 21782 DL | P |
| 40N11E-11.6a | Village of Bensenville #4 | 1961 | 685 | 1494 | EC | C-O | SS 41071 DL | P |
| 40N11E-13.3c | C.M.St.P. & P. R.R. #1 | 1912 | 665 | 2290 | MS | C-O/MS | ...... DL | I |
| 40N11E-13.4b | C.M.St.P. & P. R.R. #6 | 1950 | 672 | 1461 | EC | C-O | SS 20203 DL | I |
| 40N11E-13.8e2 | Village of Bensenville #2 | 1929 | 672 | 1442 | EC | C-O | SS 956 DL | P |
| 40N11E-14.4e | Village of Bensenville #3 | 1956 | 677 | 1445 | EC | C-O | SS 25024...... | P |
| 40N11E-21.8a | Evangelical Lutheran Orphanage | 1938 . | 690 | 301 | Sil | Sil Dol | SS 2855 DL | P |
| 40N11E-23.4d | White Pines Golf Club | 1950 | 687 | 625 | G-P | G-P Dol | SS 20544 ...... | I |
| 40N11E-24.4b | River Forest Country Club | 1959 | 665 | 219 | Sil | Sil Dol | SS 34078 DL | I |
| 40N11E-25.5f | Highlands Country Club #1 | 1959 | 680 | 231 | Sil | Sil Dol | SS 33412 DL | P |
| 40N11E-35.5e | City of Elmhurst #6 | 1954 | 700 | 1476 | EC | C-O | SS 24957 ...... | P |

# APPENDIX B

## REFERENCE WELLS AND TEST BORINGS

Well DUP 38N9E-4.5e

Northern Illinois Toll Road Boring. Drilled 1958 by Soils Testing Service. Total depth 66.5 feet. Elevation 710 feet estimated from topographic map. Illinois State Geological Survey Sample Set 32347. Studied by A. J. Zeizel.

| Pleistocene Series | Depth (ft) |
|---|---|
| Silt, yellowish brown, clayey oxidized, noncalcareous | 1.0 to 2.5 |
| Silt, yellowish brown, oxidized, slightly calcareous, *Tasmanites* | 3.5 to 5.0 |
| Same | 6.0 to 7.5 |
| Silt, light grayish brown, laminated, calcareous, *Tasmanites* | 8.5 to 10.0 |
| Silt, grayish brown, laminated calcareous, *Tasmanites* | 11.0 to 12.5 |
| Same | 13.5 to 15.0 |
| Same | 16,0 to 17.5 |
| Same | 18.5 to 20.0 |
| Same | 20.0 to 21.5 |
| Till, grayish brown, calcareous, *Tasmanites* | 25.0 to 26.5 |
| Sand, very dark gray-brown, fine to coarse, a few granules and pebbles, heterogeneous composition, subrounded to subangular, very silty, calcareous | 30.0 to 31.5 |
| Same 35.0 | to 36.5 |
| Till, very dark gray, clayey, calcareous, *Tasmanites* | 40.0 to 41.5 |
| Till, very dark gray, very clayey, few sand and pebble grains calcareous, *Tasmanites* | 45.0 to 46.5 |
| Same | 50.0 to 51.5 |
| Same | 55.0 to 56.5 |
| Same | 60.0 to 61.5 |
| Same | 65.0 to 66.5 |

Well DUP 38N9E-6.2b

Northern Illinois Toll Road Boring. Drilled 1958 by Soils Testing Service. Total depth 61.5 feet. Elevation 732 feet estimated from topographic map. Illinois State Geological Survey Sample Set 32348. Studied by A. J. Zeizel.

| Pleistocene Series | Depth (ft) |
|---|---|
| Till, yellowish brown, clayey, oxidized, noncalcareous, organic material | 1.0 to 2.5 |
| Same | 3.0 to 4.0 |
| Till, gray, clayey, very few sand grains, oxidized, calcareous, *Tasmanites* | 6.0 to 7.5 |
| Same | 8.5 to 10.0 |
| Till, dark gray, clayey, very few sand grains, calcareous, *Tasmanites* | 11.5 to 12.0 |
| Same | 13.5 to 15.0 |
| Sand, yellowish brown, fine to coarse, some granules, subangular to subrounded and silty, clayey, calcareous, *Tasmanites* some gravel, subrounded | 16.0 to 17.5 |
| Till, yellowish brown, very sandy and gravelly, calcareous, *Tasmanites* | 18.5 to 20.0 |
| Same | 20.0 to 21.5 |
| Till, very dark gray, sandy, fine to very coarse, not very compact, calcareous | 25.0' to 26.5 |
| Same | 30.0 to 31.5 |
| Sand, black and cream, medium to coarse, subangular to subrounded, calcareous | 35.0 to 36.5 |
| Till, very dark gray, very clayey, few sand grains, calcareous | 40 to 41,5 |
| Same | 45.0 to 46.5 |
| Same | 50.0 to 51.5 |
| Sand, very pale brown, fine to very coarse, subangular to subrounded, mainly dolomite, very silty, gravel subrounded | 55.0 to 56,5 |
| Sand, very pale brown, coarse to very coarse, subangular, almost all dolomite, very silty, gravel, very pale brown, subangular to subrounded, all dolomite | 60.0 to 61.5 |

Well DUP 38N10E-3.2f

Northern Illinois Toll Road Boring. Drilled 1958 by Soils Testing Service. Total depth 35 feet. Elevation 678 feet estimated from topographic map. Illinois State Geological Survey Sample Set 31685. Studied by A. J. Zeizel.

| Pleistocene Series | Depth (ft) |
|---|---|
| Soil, black, clayey, noncalcareous | 1 to 2.5 |
| Same | 3.5 to 5.0 |
| Till, very dark brown, clayey, oxidized, noncalcareous; sand, light gray to brown, medium to coarse, subangular to subrounded, silty, calcareous, oxidized; gravel, mainly dolomite, subrounded | 6.0 to 7.5 |
| Sand, dark yellowish brown, very fine to fine, few granules, subrounded to subangular, very silty, oxidized, calcareous, soil fragments; gravel, mainly dolomite, subangular to subrounded | 11 to 12.5 |
| Same | 13.5 to 15.0 |
| Same | 16.0 to 17.5 |
| Same | 18.5 to 20.0 |
| Sand, light yellowish brown, very fine to coarse, some granules, subangular, oxidized, calcareous, soil and wood fragments | 25 to 26.5 |
| Clay, some laminated, very dark gray, some pebbles, calcareous, *Tasmanites;* till, very dark gray, clayey, calcareous | 30 to 31.5 |
| Dolomite fragments, subangular to angular, few quartz and igneous pebbles, subrounded (wash sample) | (Refusal) 35 |

Well DUP 38N10E-5.6d

Northern Illinois Toll Road Boring. Drilled 1958 by Soils Testing Service. Total depth 31.5 feet. Elevation 768 feet estimated from topographic map. Illinois State Geological Survey Sample Set 31836. Studied by A. J. Zeizel.

| Pleistocene Series | Depth (ft) |
|---|---|
| Soil, black, silty, noncaleareous | 1.5 to 3.0 |
| Till, yellowish brown, clayey, oxidized, calcareous, *Tasmanites* | 4.5 to 6.0 |
| Till, yellowish brown, some light gray, clayey, oxidized, calcareous, *Tasmanites* | 7.5 to 9.0 |
| Till, yellowish brown to light gray, clayey, oxidized, calcareous, *Tasmanites* | 10.5 to 12.0 |
| Same | 13,5 to 15.0 |
| Olay till, dark gray, calcareous | 16.5 to 18.0 |
| Clay till, dark gray, calcareous, *Tasmanites* | 19.5 to 21.0 |

| | |
|---|---|
| Clay till, yellowish brown, calcareous, *Tasmanites* | 25.0 to 26.5 |
| Clay till, grayish brown, calcareous, *Tasmanites* | 30.0 to 31.5 |

Well DUP 38N10E-12.2b

Belmont High Woods Well No. 2. Drilled 1954 by Layne Western Company. Total depth 295 feet. Elevation 738 feet estimated from topographic map. Illinois State Geological Survey Sample Set 24830. Studied by A. J. Zeizel.

| | Depth (ft) |
|---|---|
| Pleistocene Series | |
| Till, calcareous, yellowish brown, spores | 0 to 15 |
| Till, calcareous, dark gray brown, spores | 15 to 30 |
| Till, calcareous, brown, spores, shale fragments | 30 to 45 |
| Gravel, calcareous, brown, gray subrounded, chiefly dolomite; sand, very coarse, subrounded to rounded. | 45 to 80 |
| Gravel, calcareous, gray, brown, subrounded, chiefly dolomite | 80 to 85 |
| Gravel, caleareous, gray, brown, subrounded, chiefly dolomite; sand, gray, brown, very coarse, subangular to subrounded | 85 to 90 |
| Silurian System | |
| Niagaran Series | |
| Dolomite | |

Well DUP 38N11E-30.5d

Maple Crest Lake Country Club. Drilled by Red Duck Well Drilling Company. Total depth 395 feet. Elevation 781 feet estimated from topographic map. Illinois State Geological Survey Sample Set 31003. Studied by A. J. Zeizel.

| | Thickness (ft) | Bottom (ft) |
|---|---|---|
| No samples | | 145 |
| Silurian System | | |
| Niagaran Series | | |
| Dolomite, cherty, very pale brown, very fine | 5 | 150 |
| Dolomite, slightly silty, bluish gray, some light gray, brown, very fine, cherty near base | 20 | 170 |
| Dolomite, silty, cherty, greenish gray, very fine | 30 | 200 |
| Dolomite, light gray, very fine, lower 20' slightly silty | 60 | 260 |
| Dolomite, silty, gray, few black specks, very fine, fine, disseminated pyrite | 45 | 305 |
| "Basal beds" | | |
| Dolomite, slightly silty, pink, yellow, very pale brown to greenish brown, very fine, trace glauconite | 15 | 320 |
| Alexandrian Series | | |
| Dolomite, slightly silty, light brownish gray, few black speckled, very fine, some chert, glauconitie | 25 | 345 |
| Dolomite, cherty, silty, grayish brown, very fine | 20 | 365 |
| Dolomite, very silty, cherty gray brown, very fine; shale, dolomitic, silty, very dark gray | 25 | 390 |
| Ordovieian System | | |
| Maquoketa Formation | | |
| Dolomite, very silty, argillaceous, light gray to black, very fine; shale, silty, dolomitic, olive green, weak | 5 | 395 |

Well DUP 39N9E-3.1h

Campbell Soup Company. Drilled 1947 by Clarence Hughes. Total depth 255 feet. Elevation 765 feet estimated from topographic map. Illinois State Geological Survey Sample Set 16579. Studied by P. M. Busch, November 1950.

| | Depth (ft) |
|---|---|
| Pleistocene Series | |
| Silt, yellowish orange, some gray, carbonaceous specks | 0 to 15 |
| Till, dolomitic, silty, gravelly, yellowish orange to grayish yellow, carbonaceous specks, spores | 15 to 25 |
| Gravel to ¼,", clayey, yellowish orange | 25 to 35 |
| Gravel to ½", yellowish gray | 35 to 40 |
| Gravel, fine and little sand, silty, little yellowish gray | 40to 75 |
| Till, caleareous, sandy, yellowish gray, carbonaceous specks, spores | 75 to 90 |
| Gravel to ⅜", clayey, yellowish gray | 90 to 95 |
| Silurian System | |
| Dolomite | 95 to 255 |

Well DUP 39NllE-4.1e

Village of Villa Park No. 7. Drilled 1958 by Layne-Western Company. Total depth 1420 feet. Elevation 704 feet estimated from topographic map. Illinois State Geological Survey Sample Set 30860. Studied by A. J. Zeizel, 0 to 200 feet, 1959; studied by P. R. Stewart, 0 to 1420 feet, 1960.

| | Thickness (ft) | Bottom (ft) |
|---|---|---|
| Pleistocene Series | | |
| Till, slightly silty to sandy, calcareous, very dark gray brown, abundant shale fragments, sporous | 15 | 15 |
| Till, slightly silty to sandy, calcareous, brown, abundant shale fragments, sporous | 35 | 50 |
| Gravel, slightly sandy, silty, calcareous, dark brown to very dark gray, subrounded, black shale, granular, abundant, little till, as above | 10 | 60 |
| Silurian System | | |
| Niagaran Series | | |
| Dolomite, very pure, light gray to gray, light pale brown, very fine to fine; porous to very porous, trace pyrite, trace glauconite, reef? | 15 | 75 |
| Dolomite, slightly silty, slightly argillaceous, white, very fine; porous, crystalline quartz | 10 | 85 |
| Dolomite, slightly silty, slightly argillaceous, light gray, very fine, slightly porous | 10 | 95 |
| Dolomite, eherty, slightly silty, slightly argillaceous, light gray, very fine | 15 | 110 |
| Dolomite, slightly silty, slightly argillaceous, light gray to greenish gray, black speckled very fine, glauconitic | 5 | 115 |
| "Basal beds" | | |
| Dolomite, argillaceous, red, greenish gray, very fine to fine; shale, dolomitic, pink, weak | 5 | 120 |
| Shale, dolomitic, maroon, sandy, weak; dolomite, cherty, greenish gray to maroon, very fine | 5 | 125 |
| Dolomite, argillaceous, greenish, light gray to greenish gray to pink, very fine, slightly porous, thin green shale partings | 10 | 135 |
| Alexandrian Series | | |
| Dolomite, slightly argillaceous, light gray | | |

| | | |
|---|---|---|
| to gray, very fine | 5 | 140 |
| Dolomite, slightly silty, slightly argillaceous, light. brown gray, very fine, trace glaueonite, trace pyrite | 20 | 160 |
| Dolomite, slightly silty, slightly argillaceous, light brown gray to gray, very fine to fine, glauconitic, trace pyrite | 15 | 175 |
| **Ordovician System** | | |
| Cincinnatian Series | | |
| Maquoketa Formation | | |
| Shale, silty, dolomitie, maroon, sandy, weak to slightly plastic | 5 | 180 |
| Shale, silty, dolomitic, mottled red, green, yellow, weak to slightly plastic; dolomite, argillaceous, greenish gray, some yellowish gray, very fine | 10 | 190 |
| Shale, silty, calcareous, green, some pink, weak to slightly plastic | 10 | 200 |

### Well DUP 39N11E-28,6e

Northern Illinois Toll Road Boring. Drilled 1958 by Soils Testing Service. Total depth 36.5 feet. Elevation 717 feet estimated from topographic map. Illinois State Geological Survey Sample Set 31568. Studied by A. J. Zeizel.

| | Depth *(ft)* |
|---|---|
| Pleistocene Series | |
| Till, yellowish brown and dark gray-brown, silty, oxidized, noncaleareous | 1.5 to 3.0 |
| Till, yellowish brown, silty, oxidized, calcareous, *Tasmanites* | 4.5 to 6.0 |
| Same | 7.5 to 9.0 |
| Same | 10.5 to 12.0 |
| Soil, black, nonealcareous, wood, *Tasmanites;* till, very dark gray-brown, silty, slightly calcareous | 13.5 to 15.0 |
| Till, very dark gray, silty, calcareous | 16.5 to 18.0 |
| Till, light reddish brown to greenish gray, silty, calcareous | 19.5 to 21.0 |
| Clay, gray, calcareous | 25 to 26.5 |
| Sand, medium to coarse, subrounded, subangular; gravel, silty, slightly calcareous | 30 to 31.5 |
| Till, dark gray-brown, silty, calcareous, *Tasmanites* | 35 to 36.5 |

### Well DUP 40N9E-33.1a

Guy Boss. Drilled by Chester Diebold. Total depth .150 feet. Elevation 775 feet. Illinois State Geological Survey Sample Set 7704. Studied by A. J. Zeizel.

| | Depth *(ft)* |
|---|---|
| Pleistocene Series | |
| Till, calcareous, gray | 0 to 15 |
| Till, calcareous, yellowish gray | 15 to 35 |
| Sand, coarse, gravelly, shale grains | 35 to 55 |
| Gravel, up to ¼" | 55 to 65 |
| Till, calcareous, yellowish gray | 65 to 75 |
| Till, calcareous, light gray | 75 to 85 |
| Gravel, granular | 85 to 95 |
| Gravel, up to ½" | 95 to 105 |

### Well DXJP 40N11E-13.5b

C. M. St. P. & P. R.R. No. 6. Drilled 1950 by J. P. Miller Artesian Well Company. Total depth 1461 feet. Elevation 672 feet estimated from topographic map. Illinois State Geological Survey Sample Set 20203. Studied by T. C. Bushbach, July 1950.

| | Thickness *(ft)* | Bottom *(ft)* |
|---|---|---|
| Pleistocene Series | | |
| Soil, sandy, silty, brownish black | 1 | 1 |
| Sand and granular gravel, brown | 4 | 5 |
| Till, very silty, calcareous, yellowish orange | 7 | 12 |
| Till, silty, calcareous, grayish brown | 48 | 60 |
| **Silurian System** | | |
| Niagaran Series | | |
| Dolomite, white to pale green, very fine to medium, partly porous at top; trace of crystalline quartz | 45 | 105 |
| Dolomite, slightly cherty, white to light gray, some pale green, very fine to fine; few *ammodiscus* at base | 75 | 180 |
| Dolomite, slightly silty, white to pale green and light pinkish buff, very fine to fine; *ammodiscus* | 20 | 200 |
| Dolomite, argillaceous, white to pale green, pink, red, fine to medium; *ammodiscus; paleoturretelles* | 25 | 225 |
| Alexandrian Series | | |
| Kankakee Formation | | |
| Dolomite, white to light pinkish buff, some greenish, fine | 35 | 260 |
| **Ordovician System** | | |
| Maquoketa Formation | | |
| Clay, silty, dolomitie, dark red, weak, hematitic, ironstone pebbles; few phosphatic nodules | 5 | 265 |
| Dolomite, argillaceous, silty, light buff, pink, green, fine to medium; bryozoa | 15 | 280 |
| Shale, silty, dolomitie, greenish gray, weak | 30 | 310 |
| Shale, as above; dolomite, argillaceous, silty, greenish gray, fine | 40 | 350 |
| Dolomite, argillaceous, silty, greenish gray to brown, fine to coarse, pyritic | 25 | 375 |
| Dolomite, argillaceous, silty, grayish brown, fine; shale, silty, grayish brown to reddish - brown, weak, phosphatic nodules | 15 | 390 |
| Shale, silty, dolomitie, grayish brown, weak; dolomite, argillaceous, greenish gray to grayish brown, fine | 10 | 400 |
| Dolomite, argillaceous, brown to grayish brown, fine to coarse, fossiliferous, pyritie | 15 | 415 |
| Shale, silty, dolomitie, grayish brown, weak; little dolomite, as above | 70 | 485 |
| Galena Formation | | |
| Dolomite, light buff to buff, medium | 50 | 535 |
| Dolomite, light grayish buff to buff, fine to medium; calcareous at base; trace of gush | 80 | 615 |
| Dolomite, light grayish buff to buff, fine to medium, pyritic; vugs filled with clear calcite, some associated with pyrite, coarse calcite crystals at base | 45 | 660 |
| Decorah Formation | | |
| Dolomite, calcareous, gray, buff, red speckled, fine to medium; limestone, light gray, medium | 15 | 675 |
| Platteville Formation | | |
| Limestone, dolomitie, extra fine to fine, light grayish buff; fine dolomite crystals in extra fine limestone matrix; calcite | 35 | 710 |
| Limestone, dolomitie, light gray, sublithographie | 5 | 715 |

| | | |
|---|---|---|
| Limestone, very dolomitic, reddish buff to buff, very fine to fine | 15 | 730 |
| Limestone, dolomitic, light buffish gray to gray, sublithographie to lithographic, some coarse fossil | 35 | 765 |
| Dolomite, calcareous, light buffish gray to ' buff, fine | 37 | 802 |
| Glenwood Formation | | |
| Sandstone, dolomitic, light gray, fine to coarse, compact | 5 | 807 |
| St. Peter Formation | | |
| Sandstone, white, fine to coarse, incoherent, much secondary crystallization | 8 | 815 |
| Sandstone, partly silty, fine to coarse incoherent, secondary crystallization; few pebbles of buff, oolitic chert at base | 147 | 962 |
| Oneota Formation | | |
| Dolomite, white to pinkish buff, fine; chert, white to pale orange, oolitic | 3 | 965 |
| Dolomite, slightly cherty (partly oolitic, partly porous) white to pinkish buff, fine | 45 | 1010 |
| Dolomite, partly sandy, white to pale green, pink, fine; chert, sandy, white, partly oolitic; trace of shale, silty sandy, red, weak | 10 | 1020 |
| Dolomite, white to light pinkish buff, fine; geodic quartz | 5 | 1025 |
| Dolomite, partly sandy, white, pink, red, purple, fine, slightly glauconitie | 10 | 1035 |
| Dolomite, very cherty, partly sandy white to light gray, fine to medium; geodic quartz; trace of shale at base, sandy, red, green, weak | 13 | 1048 |
| Dolomite, cherty, sandy, white to light gray, extra fine; grades to sandstone, dolomitic white, medium; geodic quartz; some shale, silty, red, green, brittle | 9 | 1057 |
| Cambrian System | | |
| Trempealeau Formation | | |
| Dolomite, white to pinkish buff, very fine to medium; geodic quartz at base | 63 | 1120 |
| Dolomite, cherty, partly sandy, white to pink to red, very fine to fine | 5 | 1125 |
| Dolomite, pinkish buff, fine; geodic quartz | 45 | 1170 |
| Dolomite, sandy, reddish buff, fine to medium, slightly glauconitic | 10 | 1180 |
| Franeonia Formation | | |
| Dolomite, sandy to very sandy at base, medium, coarsely glaueonitie | 10 | 1190 |
| Sandstone, slightly dolomitic, slightly silty, . fine, incoherent, very glaueonitie | 5 | 1195 |
| Sandstone, very dolomitic, fine to medium, compact, very glaueonitie; shale, silty, red, brittle | 5 | 1200 |
| Sandstone, dolomitic, light pinkish buff to light gray, fine to medium, few coarse, friable, glaueonitie; shale, silty, red, green, brittle | 15 | 1215 |
| Sandstone, dolomitic, light gray, very fine to fine, incoherent to friable, glaueonitie; shale at base, silty, green, brittle | 15 | 1230 |
| Sandstone, as above; dolomite, sandy, silty, greenish gray, fine, glaueonitie, pyritic | 10 | 1240 |
| Sandstone, dolomitic, silty, greenish gray, fine, compact, glaueonitie | 10 | 1250 |
| Dolomite, sandy, silty, greenish gray, some pinkish, fine, glaueonitie, pyritie | 15 | 1265 |
| Ironton-Galesville Formations | | |
| Sandstone, dolomitie (coarse crystalline), white to light pinkish buff, medium to extra coarse, incoherent to compact, rounded; little dolomite, light pinkish buff, fine to coarse | 30 | 1295 |
| Sandstone, slightly dolomitic, white, fine to very coarse, incoherent | 25 | 1320 |
| Sandstone, slightly dolomitic, white, very fine to very coarse, incoherent | 10 | 1330 |
| Sandstone, white, fine to very coarse; some dolomite, pink, red, very fine | 5 | 1335 |
| Sandstone, slightly dolomitic, white, very fine to very coarse, incoherent | 25 | 1360 |
| Sandstone, white, fine to very coarse, incoherent | 10 | 1370 |
| Sandstone, slightly dolomitie, slightly silty, white to light buff, very fine to very coarse, incoherent | 35 | 1405 |
| Sandstone, silty, dolomitie, light pinkish buff, fine to very eoarse, incoherent | 10 | 1415 |
| Dolomite, very sandy, pinkish buff, fine; dolomite, sandy, silty, grayish brown, fine | 12 | 1427 |
| Sandstone, dolomitic, slightly silty, white to light buff, very fine to coarse, incoherent | 13 | 1440 |
| Sandstone, dolomitie, gray, fine to eoarse, compact, some incoherent | 2 | 1442 |
| Eau Claire Formation | | |
| Shale, sandy, silty, dolomitic, greenish gray, brittle | 3 | 1445 |
| Dolomite, very argillaceous, sandy, silty, brown, very fine to fine | 5 | 1450 |
| Shale, silty, dolomitie, greenish gray, weak | 5 | 1455 |
| Dolomite, argillaceous, sandy, silty, greenish gray to brown, fine, glaueonitie, pyritic | 6 | 1461 |

# APPENDIX C

## SPECIFIC CAPACITY DATA FOR WELLS IN SILURIAN DOLOMITE AQUIFER

| Well number | Owner | Depth (ft) | Penetration (ft) | Date of test | Length of test (hr) | Nonpumping level (ft) | Pumping rate (gpm) | Drawdown (ft) | Specific capacity (gvm/ft) actual | Specific capacity (gvm/ft) adjusted | Specific capacity per foot of penetration (gpm/ft²) actual | Specific capacity per foot of penetration (gpm/ft²) adjusted | Stratigraphic units penetrated* | Estimated coefficient of transmissibility (gpd/ft) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | |
| 37N11E-4.3c | Argonne Nat'l Lab. | 341 | 226 | 1949 | .... | 82 | 550 | 32 | 17.2 | 26.1 | 0.08 | 0.12 | $N_{115}A_{70}M_{41}$ | 48,000 | Well No. 4 |
| 37N11E-8.2h | Argonne Nat'l Lab. | 345 | 235 | 1948 | .... | 105 | 200 | 3 | 66.7 | 80.0 | 0.28 | 0.34 | $N_{150}A_{75}M_{10}$ | 160,000 | Well No. 5 |
| 37N11E-9.8a | Argonne Nat'l Lab. | 155 | 40 | 1949 | .... | 107 | 43 | 2 | 21.5 | 22.6 | 0.54 | 0.56 | $N_{40}$ | 41,000 | Meteorological Bldg. |
| 37N11E-10.5f | Argonne Nat'l Lab. | 284 | 219 | 1948 | .... | 24 | 200 | 17 | 11.8 | 13.6 | 0.05 | 0.06 | $N_{135}A_{70}M_{14}$ | 24,000 | Well No. 1 |
| 37N11E-10.6g | Argonne Nat'l Lab. | 300 | 239 | 1948 | .... | 21 | 750 | 86 | 8.7 | 16.9 | 0.03 | 0.06 | $N_{129}A_{123}M_{27}$ | 30,000 | Well No. 2 |
| 38N9E-2.1h. | Elmhurst-Chicago Stone Co. | 266 | 198 | 1957 | 8 | 10 | 1270 | 86 | 14.8 | 110.0 | 0.07 | 0.55 | $N_{40}A_{60}M_{101}$ | 225,000 | Well No. 1 |
| 38N9E-13.2h | City of Naperville | 178 | 134 | 1943 | 8 | 11 | 620 | 11.5 | 53.8 | 105.0 | 0.40 | 0.78 | $N_{21}A_{95}M_{18}$ | 209,000 | Well No. 4 |
| 38N9E-17.5d | Reber Preserving Co. | 200 | ...... | ...... | 3 | 48 | 100 | 14 | 7.2 | 6.9 | ...... | ...... | | 11,000 | |
| 38N9E-23.3g | Lawn Meadow Subdiv. | 210 | 188 | 1956 | 4 | 11 | 200 | 63 | 3.2 | 3.5 | 0.02 | 0.02 | $N_{15}A_{55}M_{125}$ | 5,000 | Well No. 1 |
| 38N10E-5.4e | Ill. Toll Hwy Comm. | 420 | 318 | 1958 | .... | 58 | 100 | 1 | 100.0 | 111.0 | 0.32 | 0.35 | $N_{118}A_{50}M_{150}$ | 226,000 | M-8 |
| 38N10E-3.8a | Village of Lisle | 233 | 148 | 1959 | 2.5 | 68 | 726 | 10 | 72.6 | 180.0 | 0.49 | 1.22 | $N_{108}A_{39}M_{1}$ | 384,000 | Village Well No. 2 |
| 38N10E-11.6d | Schieser School | 170 | 55 | 1955 | .... | 123 | 200 | 6 | 33.3 | 286.0 | 0.61 | 5.19 | $N_{55}$ | 610,000 | Well No. 1 |
| 38N10E-11.7c | Oakview Subdiv. | 200 | 85 | 1957 | 6.5 | 96 | 305 | 12 | 25.4 | 35.0 | 0.30 | 0.41 | $N_{85}$ | 64,000 | |
| 38N10E-12.5e | Schaffer Bearing Div. | 250 | 196 | 1955 | 22 | 50 | 620 | 2 | 310.0 | 887.0 | 1.58 | 4.52 | $N_{135}A_{61}$ | 2,400,000 | |
| 38N10E-12.6b | Downers Grove Sanitary Dist. | 150 | 75 | ...... | 24 | 33 | 75 | 1 | 75.0 | 97.0 | 1.00 | 1.29 | $N_{75}$ | 192,000 | |
| 38N10E-12.2b | Village of Belmont | 295 | 205 | 1954 | 3 | 84 | 340 | 4 | 85.0 | 118.0 | 0.41 | 0.58 | $N_{150}A_{50}M_{5}$ | 235,000 | Village Well No. 2 |
| 38N10E-13.8h | Maple Hill Improv. Assoc. | 158 | 64 | 1958 | .5 | 94 | 150 | 8 | 18.7 | 19.0 | 0.29 | 0.30 | $N_{64}$ | 35,000 | Well No. 2 |
| 38N10E-15.8hl | Benedict Sisters Sacred Heart | 300 | 200 | ...... | 8.7 | 65 | 35 | 19 | 1.8 | 2.1 | 0.09 | 0.01 | $N_{85}A_{30}M_{85}$ | 4,000 | |
| 38N10E-15.8h2 | Benedict Sisters Sacred Heart | 237 | 142 | 1939 | .... | 57 | 140 | 65 | 2.2 | 2.3 | 0.02 | 0.02 | $N_{90}A_{30}M_{22}$ | 4,000 | |
| 38N10E-16.4d | St. Procopius College | 245 | 155 | 1935 | .... | 62 | 200 | 8.5 | 23.6 | 27.4 | 0.15 | 0.18 | $N_{60}A_{75}M_{20}$ | 51,000 | |
| 38N10E-18.3dl | City of Naperville | 190 | 159 | 1947 | .... | 12 | 560 | 41 | 13.7 | 23.7 | 0.09 | 0.15 | $N_{80}A_{69}$ | 43,000 | City Well No. 5 |
| 38N10E-18.3d2 | City of Naperville | 202 | 172 | 1948 | .... | 10 | 400 | 25 | 16.0 | 22.2 | 0.09 | 0.13 | $N_{90}A_{65}M_{17}$ | 41,000 | City Well No. 6 |
| 38N10E-26.1b | Woodridge Subdiv. | 334 | 237 | 1959 | .... | 89 | 530 | 1 | 530.0 | 589.0 | 2.22 | 2.48 | $N_{138}A_{95}M_{1}$ | 1,300,000 | Well No. 1 |
| 38N10E-26.2b | Surety Builders | ...... | ...... | 1958 | 8 | 77 | 60 | 2.5 | 24.0 | 29.4 | ...... | ...... | | 55,000 | |
| 38N11E-1.3al | Village of Hinsdale | 271 | 226 | 1947 | 3.5 | 58 | 970 | 76 | 12.8 | 33.3 | 0.06 | 0.15 | $N_{178}A_{35}M_{13}$ | 61,000 | Village Well No. 2 |
| 38N11E-1.3a2 | Village of Hinsdale | 210 | 165 | 1947 | 5 | 61 | 700 | 80 | 8.7 | 16.1 | 0.05 | 0.10 | $N_{165}$ | 25,000 | Village Well No. 3 |
| 38N11E-1.4a | Village of Hinsdale | 209 | 179 | 1924 | .... | 17 | 520 | 3 | 173:2 | 347.0 | 0.97 | 1.94 | $N_{179}$ | 750,000 | Village Well No. 1 |
| 38NllB-3.1b | Hinsdale Golf Club | 165 | 20 | 1944 | 4.5 | 90 | 525 | 23 | 22.8 | 36.0 | 1.14 | 1.80 | $N_{20}$ | 64,000 | |
| 38N11E-6.4C | Village of Downers Grove | 300 | 210 | 1958 | 5 | 109 | 850 | 76 | 11.2 | 22.3 | 0.05 | 0.11 | $N_{165}A_{45}$ | 40,000 | Village Well No. 9 |
| 38N11E-7.6d | Village of Downers Grove | 250 | 183 | 1947 | 1 | 46 | 860 | 12 | 71.5 | 218.0 | 0.39 | 1.19 | $N_{183}$ | 500,000 | Village "Lee" Well |
| 38N11E-8.4b | Village of Downers Grove | 295 | 195 | 1945 | 10 | 96 | 980 | 15 | 65.4 | 340.0 | 0.34 | 1.74 | $N_{145}A_{50}$ | 740,000 | Village "Park" Well |
| 38N11E-8.7e | Village of Downers Grove | 262 | 197 | 1953 | .... | 64 | 412 | 5 | 82.4 | 129.0 | 0.42 | 0.66 | $N_{145}A_{50}M_{2}$ | 267,000 | Village Well No. 8 |
| 38N11E-9.1h | Village of Westmont | 313 | 190 | 1938 | 11 | 101 | 600 | 1.2 | 500.0 | 2000.0 | 2.63 | 12.13 | $N_{120}A_{68}M_{5}$ | 5,000,000 | Village Well No. 2 |
| 38N11E-10.2c | Village of Clarendon Hills | 250 | 210 | 1932 | .... | 95 | 150 | 11.5 | 13.0 | 14.6 | 0.06 | 0.07 | $N_{210}$ | 26,000 | Village Well No. 2 |
| 38N11E-10.2C | Village of Clarendon Hills | ...... | ...... | 1947 | 2 | 113 | 300 | 4 | 75.0 | 93.8 | ...... | ...... | | 193,000 | Village Well No. 2 |
| 38N11E-10.6e | Blackhawk Subdiv. | 295 | 205 | 1953 | 8 | 102 | 210 | 24 | 8.7 | 10.4 | 0.04 | 0.05 | $N_{115}A_{80}M_{10}$ | 17,000 | Well No. 1 |
| 38N11E-10.7a | Village of Westmont | 302 | 167 | 1947 | 24 | 123 | 250 | 20 | 12.5 | 15.8 | 0.08 | 0.09 | $N_{135}A_{32}$ | 28,000 | Village Well No. 3 |
| 38N11E-10.8e | Village of Westmont | 313 | 208 | 1958 | 12 | 128 | 259 | 27 | 9.6 | 12.1 | 0.06 | 0.06 | $N_{120}A_{75}M_{10}$ | 21,000 | Village Well No. 4 |
| 38N11E-11.5a | Village of Clarendon Hills | 354 | 239 | 1945 | .... | 91 | 385 | 12 | 32.1 | 45.9 | 0.13 | 0.19 | $N_{150}A_{89}$ | 87,000 | Village Well No. 3 |
| 38N11E-11.5d | Village of Clarendon Hills | 370 | 255 | 1956 | 3 | 90 | 838 | 8 | 105.0 | 440.0 | 0.41 | 1.72 | $N_{130}A_{122}M_{3}$ | 1,000,000 | Village Well No. 4 |
| 38N11E-12.8a | Village of Hinsdale | 319 | 230 | 1954 | .... | 69 | 708 | 10 | 70.8 | 173.0 | 0.31 | 0.75 | $N_{196}A_{34}$ | 366,000 | Village Well No. 5 |
| 38NUE- | Village of Hinsdale | 212 | 119 | 1954 | .... | 73 | 360 | 12 | 30.0 | 41.0 | 0.25 | 0.34 | | 78,000 | Test Well |
| 38N11B-1.8C | Village of Hinsdale | 291 | 198 | 1954 | .... | 73 | 388 | 7 | 55.5 | 80.8 | 0.28 | 0.41 | $N_{142}A_{56}$ | 160,000 | Test Well |
| 38N11E- | Hinsdale San. Dist. | 200 | 182 | 1957 | .... | 22 | 150 | 126 | 1.2 | 1.3 | 0.01 | 0.01 | | 2,000 | Test Well |
| 38N11E- | Ill. Toll Hwy Comm. | 238 | 138 | 1957 | .... | 25 | 157 | 55 | 2.9 | 3.1 | 0.02 | 0.02 | | 5,000 | Well No. 1 |
| 38N11E-24.3b | International Harvester Co. | 294 | 239 | 1956 | 4 | 78 | 400 | 20 | 20.0 | 25.2 | 0.08 | 0.11 | $N_{175}A_{50}M_{14}$ | 38,000 | Well No. 1 |
| 38N11E-24.4b1 | International Harvester Co. | 398 | 296 | 1957 | .... | 70 | 500 | 10 | 50.0 | 84.8 | 0.17 | 0.29 | $N_{173}A_{60}M_{63}$ | 170,000 | Well No. 2 |
| 38N11E-24.4b2 | International Harvester Co. | 294 | 199 | 1957 | 8 | 73 | 580 | 10 | 58.0 | 108.0 | 0.29 | 0.54 | $N_{175}A_{24}$ | 222,000 | Well No. 3 |
| 38N11E-28.1c | Brookhaven Manor | 317 | 218 | 1960 | 3 | 115 | 100 | 90 | 1.1 | 1.1 | 0.05 | 0.01 | $N_{151}A_{55}M_{12}$ | 2,000 | Well No. 2 |
| 38N11E-30.5d | Maple Crest Lake Country Club | 395 | 250 | 1958 | 8 | 134 | 320 | 22 | 14.5 | 19.5 | 0.06 | 0.06 | $N_{175}A_{170}M_{5}$ | 34,000 | |
| 38NHE-33.2b | Cass School Dist. 63 | 250 | 155 | 1958 | 8 | 90 | 147 | 10 | 14.7 | 17.3 | 0.10 | 0.11 | $N_{140}A_{15}$ | 32,000 | Well No. 1 |
| 39N9E-3 | Campbell Soup Co. | 250 | 155 | 1946 | .... | 64 | 282 | 5 | 56.4 | 70.7 | 0.36 | 0.46 | | 140,000 | Well No. 1 |
| 39N9E-3.1hl | Campbell Soup Co. | 255 | 160 | 1947 | .... | 45 | 180 | 15.0 | 12.0 | 13.6 | 0.08 | 0.09 | $N_{30}A_{87}M_{43}$ | 24,000 | Well No. 2 |
| 39N9E-3.1h2 | Campbell Soup Co. | 248 | 154 | 1958 | 4 | 68 | 75 | 78 | 1.0 | 1.0 | 0.01 | 0.01 | $N_{31}A_{87}M_{36}$ | 2,000 | Well No. 4 |
| 39N9E-4.2b | City of W. Chicago | 310 | 228 | 1950 | .... | 73 | 510 | 41 | 12.4 | 18.9 | 0.05 | 0.08 | $N_{56}A_{72}M_{100}$ | 34,000 | Well No. 3 |
| 39N9E-4.4a | City of W. Chicago | 322 | 233 | 1947 | .... | 82 | 500 | 18 | 27.8 | 44.6 | 0.12 | 0.19 | $N_{60}A_{75}M_{98}$ | 85,000 | Well No. 2 |
| 39N9E-5.5gl | Western Electric Co. | 265 | 200 | 1958 | .... | 87 | 215 | 3.5 | 61.3 | 154.0 | 0.30 | 0.77 | $N_{27}A_{70}M_{103}$ | 320,000 | Well No. 3 |
| 39N9E-5.5g2 | Western Electric Co. | 257 | 193 | 1958 | 2.5 | 77 | 196 | 19 | 10.3 | 11.6 | 0.05 | 0.06 | $N_{27}A_{70}M_{98}$ | 20,000 | Well No. 2 |
| 39N9E-7.6h | Western Electric Co. | 268 | 204 | 1958 | 10 | 78 | 542 | 40 | 13.5 | 22.9 | 0.07 | 0.11 | $N_{30}A_{75}M_{98}$ | 42,000 | Well No. 1 |
| 39N9E-9.3d | Lindsay Chemical Co. | 332 | 243 | 1953 | .... | 72 | 800 | 38 | 21.1 | 50.6 | 0.09 | 0.22 | $N_{40}A_{90}M_{112}$ | 98,000 | Well No. 2 |
| 39N9E-9.3h | Northwestern Chemical Co. | 320 | 245 | 1957 | .... | 95 | 150 | 11 | 13.6 | 15.1 | 0.06 | 0.06 | $N_{60}A_{76}M_{10}$ | 27,000 | Well No. 1 |
| 39N9E-9.6e | Molded Products Corp. | 330 | 237 | 1953 | .... | 86 | 465 | 32 | 14.5 | 21.3 | 0.06 | 0.09 | $N_{27}A_{110}M_{100}$ | 39,000 | Well No. 1 |
| 39N9E-12.4b | Winfield Sanitorium | 200 | 75 | 1939 | 3 | 46 | 60 | 9 | 6.7 | 6.9 | 0.09 | 0.09 | $N_{47}A_{28}$ | 10,000 | |
| 39N9E-13.6cl | Village of Winfield | 335 | 205 | 1958 | 8 | 85 | 400 | 5 | 80 | 122.0 | 0.39 | 0.60 | $N_{68}A_{45}M_{92}$ | 245,000 | Village Well No. 2 |
| 39N9E-13.6cl | Village of Winfield | 254 | 124 | 1957 | .... | 75 | 234 | 63 | 3.7 | 4.3 | 6.03 | 0.03 | $N_{68}A_{45}M_{11}$ | 7,000 | Village Well No. 2 |
| 39N9E-35.1a | Elmhurst-Chicago Stone Co. | 273 | 218 | 1957 | .... | 17 | 570 | 16 | 35.6 | 64.8 | 0.16 | 0.30 | $N_{50}A_{60}M_{108}$ | 128,000 | Well No. 2 |

| Well number | Owner | Depth (ft) | Penetration (ft) | Date of test | Length of test (hr) | Non-pumping level (ft) | Pumping rate (gpm) | Drawdown (ft) | Specific capacity (gprn/ft) actual | Specific capacity (gprn/ft) adjusted | Specific capacity per foot of penetration (gpm/ft[2]) actual | Specific capacity per foot of penetration (gpm/ft[2]) adjusted | Stratigraphic units penetrated* | Estimated coefficient of transmissibility (gpd/ft) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | | | | | | | | |
| 39N10E-2.3e | Ray Spaulding School | 160 | 77 | 1958 | ...... | 22 | 100 | 1 | 100.0 | 111.1 | 1.30 | 1.34 | $N_{49}A_{16}M_{18}$ | 228,000 | Well No. 1 |
| 39N10E-9.2f | City of Wheaton | 341 | 246 | 1954 | ...... | 45 | 863 | 79 | 10.9 | 26.2 | 0.04 | 0.11 | $N_{82}A_{55}M_{105}$ | 49,000 | City Well No. 5 |
| 39N10E-10.3b | Jefferson Ice Co. | 134 | 19 | 1944 | ...... | 65 | 80 | 5 | 16.0 | 17.0 | 0.85 | 0.90 | $N_{19}$ | 31,000 | |
| 39N10E-10.4C | Rathkum Farm Prod. Co. | 138 | 18 | 1944 | 5 | 40 | 70 | 5 | 14.0 | 15.3 | 0.78 | 0.85 | $N_{18}$ | 29,000 | |
| 39N10E-11.7cl | Village of Glen Ellyn | 310 | 195 | 1916 | ...... | 42 | 500 | 93 | 5.4 | 7.7 | 0.03 | 0.04 | $N_{50}A_{40}M_{105}$ | 13,000 | |
| 39N10E-11.7C2 | Village of Glen Ellyn | 352 | 236 | 1947 | 6.5 | 76 | 750 | 68 | 11.0 | 21.7 | 0.05 | 0.09 | $N_{49}A_{40}M_{145}$ | 38,000 | Village Well No. 2 |
| 39N10E-11.8C | Village of Glen Ellyn | 422 | 290 | 1947 | 6 | 98 | 750 | 72 | 10.4 | 19.0 | 0.04 | 0.07 | $N_{83}A_{65}M_{142}$ | 35,000 | Village Well No. 3 |
| 39N10E-12.4a | Glen Oak Country Club | 202 | 152 | ...... | ...... | 2 | 150 | 11 | 13.6 | 15.2 | 0.09 | 0.10 | $N_{80}A_{68}M_{4}$ | 27,000 | Well No. 2 |
| 39N10E-12.4c | Glen Oak Country Club | 212 | 132 | 1958 | 6 | 24 | 450 | 50 | 9.0 | 13.3 | 0.07 | 0.10 | $N_{75}A_{50}M_{12}$ | 21,000 | Well No. 3 |
| 39N10E-15.1b | Village of Glen Ellyn | 422 | 262 | 1954 | ...... | 85 | 765 | 19 | 40.3 | 99.3 | 0.15 | 0.38 | $N_{90}A_{40}M_{132}$ | 200,000 | Village Well No. 4 |
| 39N10E-16 | Hitchcock Publishing Co. | 200 | 87 | 1957 | ...... | 60 | 32 | 1 | 32.0 | 32.0 | 0.37 | 0.37 | | 50,000 | Well No. 1 |
| 39N10E-16.6C | City of Wheaton | 330 | 64 | 1946 | 1 | 45 | 320 | 4 | 80.0 | 93.0 | 1.25 | 0.37 | $N_{105}A_{70}M_{75}$ | 195,000 | City Well No. 4 |
| 39N10E-18.6e | DuPage Co. Hwy Dept. | 265 | 180 | 1958 | 8 | 25 | 156 | 5 | 31.2 | 37.0 | 0.17 | 0.21 | $N_{65}A_{80}M_{35}$ | 70,000 | Well No. 1 |
| 39N10E-19.4h | St. Francis Academy | 252 | 170 | 1957 | 5 | 38 | 260 | 2 | 130.0 | 180.0 | 0.76 | 1.06 | $N_{80}A_{80}M_{12}$ | 375,000 | |
| 39N10E-30.1h | Arrowhead Subdiv. | 335 | 250 | 1947 | 8 | 40 | 759 | 13 | 58.3 | 159.0 | 0.23 | 0.68 | $N_{80}A_{50}M_{105}$ | 328,000 | |
| 39N10E-34.3d | Morton Arboretum | 250 | 177 | 1956 | 4 | 75 | 690 | 2 | 345.0 | 1115.0 | 1.95 | 6.38 | $N_{135}A_{40}$ | 2,650,000 | Well No. 3 |
| 39N10E-34.4d | Morton Arboretum | 250 | 175 | 1956 | 24 | 85 | 720 | 6 | 120.0 | 403.0 | 0.69 | 2.30 | $N_{135}A_{40}$ | 910,000 | Well No. 4 |
| 39N10E-35.5g | Valley View. Subdiv. | 250 | 200 | 1957 | 12 | 32 | 560 | 7.5 | 74.6 | 150.0 | 0.37 | 0.75 | $N_{140}A_{65}M_{5}$ | 310,000 | Well No. 2 |
| 39N10E-35.6g | Valley View Subdiv. | 290 | 179 | 1957 | 5 | 80 | 536 | 11 | 48.8 | 86.0 | 0.27 | 0.49 | $N_{82}A_{65}M_{30}$ | 165,000 | Well No. 1 |
| 39N11E-1 | | 301 | ...... | ...... | ...... | 27 | 152 | 2 | 76.0 | 89.4 | ...... | ...... | | 180,000 | |
| 39N11E-1 | J. F. Kyle | 237 | 183 | 1955 | 5.5 | 61 | 190 | 27 | 7.0 | 8.5 | 0.04 | 0.05 | | 15,000 | |
| 39N11E-3.2e | Black Top Road Co. | 195 | 159 | 1956 | 6 | 37 | 240 | 8 | 30.0 | 37.5 | 0.19 | 0.24 | $N_{158}$ | 69,000 | |
| 39N11E-3.3a | Robert Hall Clothes | 114 | 26 | 1958 | 2 | 38 | 200 | 2 | 100:0 | 131.0 | 3.86 | 5.04 | | 260,000 | Well No. 1 |
| 39N11E-4.1e | Village of Villa Park | 235 | 170 | 1944 | | 33 | 220 | 3 | 73.4 | 91.8 | 0.43 | 0.54 | $N_{120}A_{40}M_{10}$ | 185,000 | Village Well No. 5 |
| 39N11E-5.3g | Lombard Heights | 209 | 124 | 1954 | 10 | 43 | 335 | 17 | 19.7 | 25.7 | 0.16 | 0.21 | $N_{70}A_{50}M_{5}$ | 47,000 | Well No. 1 |
| 39N11E-7.1h1 | Village of Lombard | 175 | 115 | 1948 | ...... | 9 | 365 | 27 | 13.5 | 21.3 | 0.12 | 0.19 | $N_{70}A_{38}M_{7}$ | 39,000 | Village Well No. 3 |
| 39N11E-7.1h2 | Village of Lombard | 175 | 103 | 1948 | ...... | 9 | 80 | 1.0 | 80.0 | 114.0 | 0.78 | 1.10 | $N_{58}A_{40}M_{6}$ | 232,000 | Test Well |
| 39N11E-8.7h | Village of Lombard | 84 | 14 | 1939 | ...... | 10 | 465 | 21 | 22.1 | 33.7 | 1.58 | 2.41 | $N_{14}$ | 63,000 | Village Well No. 1 |
| 39N11E-10 | Wander Co. | 220 | ...... | 1922 | ...... | 19 | 350 | 40 | 8.8 | 11.3 | ...... | ...... | | 20,000 | Well No. 3 |
| 39N11E-10 | Wander Co. | 187 | ...... | 1924 | ...... | 26 | 500 | 55 | 9.1 | 13.5 | ...... | ...... | | 24,000 | Well No. 4 |
| 39N11E-10.8e | Village of Villa Park | 285 | 227 | 1955 | ...... | 57 | 500 | 70 | 7.1 | 10.5 | 0.03 | 0.05 | $N_{92}A_{35}M_{100}$ | 18,000 | Village Well No. 3 |
| 39N11E-10.Sd | Village of Villa Park | 251 | 193 | 1955 | ...... | 57 | 500 | 4 | 125.0 | 238.0 | 0.65 | 1.23 | $N_{92}A_{35}M_{66}$ | 558,000 | Village Well No. 4 |
| 39N11E-10.8d | Village of Villa Park | 187 | 129 | 1924 | 4.5 | 26 | 500 | 55 | 9.1 | 13.2 | 0.07 | 0.10 | $N_{92}A_{35}M_{2}$ | 22,000 | Village Well No. 4 |
| 39N11E-13.3g | City of Elmhurst | 290 | 210 | 1959 | 8 | 74 | 335 | 86 | 3.9 | 5.1 | 0.01 | 0.02 | $N_{130}A_{50}M_{30}$ | 8,000 | City Well No. 7 |
| 39N11E-16 | City of Wheaton | 175 | ...... | 1960 | ...... | 38 | 830 | 31 | 27.0 | 71.6 | ...... | ...... | | 122,000 | City Well No. 1 |
| 39N11E-20.1g | West York Center Subdiv. | 235 | 140 | 1947 | ...... | 66 | 195 | 55 | 3.5 | 6.9 | 0.03 | 0.05 | $N_{120}A_{20}$ | 11,000 | |
| 39N11E-20.6g | Highland Hills Subdiv. | 241 | 135 | 1954 | ...... | 29 | 483 | 114 | 4.2 | 5.9 | 0.03 | 0.04 | $N_{87}A_{37}M_{11}$ | 10,000 | Well No. 1 |
| 39N11E-23.1a | Ill. Toll Hwy Comm. | 290 | 227 | 1958 | ...... | 26 | 60 | 1 | 60.0 | 66.6 | 0.26 | 0.29 | $N_{127}A_{95}M_{5}$ | 132,000 | EP-3 |
| 39N11E-24.2g | J. Harris Jones | 350 | 290 | 1959 | ...... | 45 | 350 | 65 | 5.4 | 6.9 | 0.02 | 0.02 | $N_{140}A_{48}M_{102}$ | 12,000 | |
| 39N11E-34 | Liberty Park Home Owners Assoc. | 279 | 179 | 1956 | ...... | 103 | 136 | 53 | 2.6 | 2.8 | 0.01 | 0.02 | | 4,000 | |
| 39N11E-34.2g | St. Francis Retreat | 298 | 161 | 1950 | 8 | 55 | 180 | 134 | 1.3 | 1.6 | 0.01 | 0.01 | $N_{98}A_{40}M_{23}$ | 3,000 | |
| 39N11E-34.5e | St. Joseph College | 250 | 135 | 1958 | ...... | 84 | 60 | 15 | 4.0 | 8.6 | 0.03 | 0.06 | $N_{130}A_{5}$ | 15,000 | Well No. 2 |
| 39N11E-36 | Camp Fullersburg | 120 | 30 | 1933 | ...... | 14.5 | 30 | .5 | 60.0 | 60.0 | 2.00 | 2.00 | | 118,000 | |
| 40N9E-28.4b1 | Christ the King Seminary | 340 | 228 | 1954 | 24 | 82 | 254 | 85 | 3.0 | 3.7 | 0.01 | 0.02 | $N_{18}A_{70}M_{140}$ | 6,000 | Well No. 1 |
| 40N9E-28.4b2 | Christ the King Seminary | 160 | 55 | 1957 | 8 | 54 | 100 | 30 | 3.3 | 3.6 | 0.06 | 0.07 | $N_{33}A_{22}$ | 6,000 | Well No. 2 |
| 40N9E-32.5gl | Kawneer Corp. | 271 | 203 | 1955 | | 50 | 421 | 60 | 7.0 | 9.5 | 0.03 | 0.05 | $N_{42}A_{70}M_{91}$ | 16,000 | Well No. 1 |
| 40N9E-34.3g | De Vito Co. | 140 | 43 | 1958 | 2 | 29 | 24 | 3 | 8.0 | 8.6 | 0.18 | 0.20 | $N_{30}A_{13}$ | 14,000 | Well No. 1 |
| 40N9E-35.3g | Sidwell Studios | 192 | 82 | 1958 | ...... | 28 | 81 | 63 | 1.3 | 1.4 | 0.01 | 0.02 | $N_{20}A_{55}M_{10}$ | 2,000 | Well No. 1 |
| 40N10E-3;4el | Village of Roselle | 182 | 43 | 1926 | 6.5 | 37 | 110 | 14 | 7.9 | 8.8 | 0.18 | 0.20 | $N_{16}A_{25}M_{2}$ | 15,000 | Village Well No. 1 |
| 40N10E-3.4e2 | Village of Roselle | 183 | 43 | 1953 | 3 | 47 | 142 | 10 | 14.2 | 15.2 | 0.33 | 0.35 | $N_{15}A_{25}M_{3}$ | 27,000 | Village Well No. 2 |
| 40N10E-12.7b | Medinah Country Club | 145 | 85 | 1945 | | 11 | 250 | 17 | 14.7 | 17.7 | 0.17 | 0.21 | $N_{86}$ | 32,000 | |
| 40N10E-20.5d | Allied Cement Co. | 320 | 200 | 1958 | 5 | 60 | 85 | 16 | 5.3 | 5.6 | 0.03 | 0.03 | $A_{35}M_{160}$ | 9,000 | Well No. 2 |
| 40N10E-26.5d | North Glen Ellyn Utilities | 353 | 232 | 1959 | 10 | 50 | 300 | 129 | 2.3 | 2.8 | 0.01 | 0.01 | $N_{24}A_{25}M_{173}$ | 4,000 | |
| 40N10E-31.2g | Carol Stream Utilities Co. | 335 | 225 | 1958 | 1.5 | 40 | 408 | 9 | 45.3 | 122.0 | 0.20 | 0.54 | $N_{70}A_{55}M_{100}$ | 260,000 | |
| 40N11E-8.4f | Village of Itasca | 200 | 129 | 1959 | 8 | 7 | 115 | 40 | 2.9 | 3.4 | 0.02 | 0.03 | $N_{129}$ | 5,000 | Test Well 2-59 |
| 40N11E-8.6C | Village of Itasca | 190 | 108 | 1958 | 5.5 | 28 | 70 | 122 | 0.6 | 0.6 | 0.01 | 0.01 | $N_{108}$ | 1,000 | Village Well No. 5 |
| 40N11E-8.6f | Village of Itasca | 200 | 120 | 1947 | 1 | 2 | 350 | 20 | 17.5 | 20.5 | 0.15 | 0.17 | $N_{120}$ | 37,000 | Village Well No. 3 |
| 40N11E-8.8f | Village of Itasca | 185 | 102 | 1947 | 2 | 62 | 50 | 108 | 0.5 | 0.5 | 0.01 | 0.01 | $N_{102}$ | 1,000 | Village Well No. 2 |
| 40N11E-24.4b | River Forest Golf Club | 219 | 164 | 1959 | 1 | 28 | 200 | 44 | 4.5 | 4.5 | 0.03 | 0.03 | $N_{120}A_{41}M_{3}$ | 7,000 | |
| 40N11E-28.3a | Village of Addison | 221 | 150 | 1957 | ...... | 14 | 600 | 109 | 5.5 | 8.7 | 0.04 | 0.06 | $N_{74}A_{45}M_{31}$ | 15,000 | Village Well No. 3 |
| 40N11E-28.3£ | Village of Addison | 91 | 21 | 1950 | 2 | •••• | 98 | 7 | 14.0 | 15.2 | 0.67 | 0.72 | $N_{21}$ | 27,000 | Village Well No. 2 |
| 40N11E-28.4f | Village of Addison | 155 | 65 | 1925 | 10 | 18 | 150 | 2 | 75.0 | 90.5 | 1.15 | 1.39 | $N_{65}$ | 175,000 | Village Well No. 1 |
| 40N11E-28.7b | Village of Addison | 152 | 66 | 1934 | 6 | 20 | 200 | 10 | 20.0 | 24.0 | 0.30 | 0.36 | $N_{66}$ | 43,000 | |
| 40N11E-33.7f | Village of Addison | 250 | 176 | 1959 | ...... | 30 | 453 | 85 | 5.3 | 7.3 | 0.03 | 0.04 | $N_{111}A_{65}$ | 12,000 | Village Well No. 4 |

* N = Niagaran Series; A = Alexandrian Series: M = Maquoketa Formation.
Subscript number indicates depth of penetration in unit, in feet.

# APPENDIX D

## WATER-LEVEL DATA FOR WELLS IN THE SILURIAN DOLOMITE AQUIFER

| Well number | Owner | Depth of well *(ft)* | Casing diameter *(in)* | | Depth to water *(ft)* | Water level elevation *(ft above sea level)* | Date of measurement 1960 | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 37N11E-3.7b | Argonne Nat'l Lab. | 104 | 6 | 690 | 52.61 | 637 | 6-2 | Well No. 17 |
| 37N11E-4.8d | Argonne Nat'l Lab. | 162 | 4 | 752 | 107.28 | 645 | 6-2 | Well No. 31 |
| 37N11E-8.1C | Argonne Nat'l Lab. | 152 | 4 | 748 | 106.95 | 641 | 6-2 | Well No. 30 |
| 37N11E-8.2h | Argonne Nat'l Lab. | 345 | 12 | 751 | 105.74 | 645 | 6-2 | Well No. 5 |
| 37N11E-9.2e | Argonne Nat'l Lab. | 130 | 6 | 712 | 79.54 | 632 | 6-2 | Well No. 24 |
| 37N11E-9.3e | Argonne Nat'l Lab. | 183 | 4 | 714 | 88.55 | 625 | 6-2 | Well No. 35 |
| 37N11E-9.4e | Argonne Nat'l Lab. | 116 | 4 | 745 | 109.97 | 635 | 6-2 | Well No. 13 |
| 37N11E-9.8e | Argonne Nat'l Lab. | 111 | 4 | 733 | 92.98 | 640 | 4-1 | Well No. 9 |
| 37N11E-10.2f | Argonne Nat'l Lab. | 79 | 4 | 686 | 59.87 | 626 | 6-2 | Well No. 26 |
| 37N11E-10.6b | Argonne Nat'l Lab. | 95 | 4 | 663 | 67.64 | 595 | 6-3 | Well No. 8 |
| 37N11E-10.6f | Argonne Nat'l Lab. | 95 | 4 | 670 | 40.50 | 630 | 6-2 | Well No. 6 |
| 37N11E-10.8e | Argonne Nat'l Lab. | 202 | 6 | 708 | 77.50 | 631 | 6-2 | Well No. 36 |
| 37N11E-10.8f | Argonne Nat'l Lab. | 150 | | 690 | 52.10 | 638 | 6-2 | WellNo. 34 |
| 37N11E-11.7d | Argonne Nat'l Lab. | 185 | 4 | 715 | 123.65 | 591 | 6-2 | Well No. 18 |
| 37N11E-17.3e | Argonne Nat'l Lab. | 150 | 6 | 722 | 124.40 | 598 | 6-2 | Well No. 25 |
| 37N11E-17.4d | Argonne Nat'l Lab. | 127 | 4 | 690 | 84.44 | 606 | 6-2 | WellNo. 32 |
| 38N9E-1.5g | G. O. Hoelle | 225 | 6 | 750 | 66.47 | 684 | 6-28 | |
| 38N9E-2.1h | Elmhurst-Chicago Stone Co. | 265 | 16 | 690 | 8.60 | 681 | 6-28 | Well No. 1 |
| 38N9E-2.7h | W. Stokes | 103 | 5 | 696 | 6.24 | 690 | 6-28 | |
| 38N9E-3.1e | E. Engel | | 4 | 700 | 17.01 | 683 | 6-29 | |
| 38N9E-4.2h | E. Watts | 90 | 4.5 | 720 | 20.48 | 700 | 6-20 | |
| 38N9E-6.7f | B. Benke | 96 | 6 | 730 | 24.90 | 705 | 6-30 | |
| 38N9E-7.4g | W. Dicke | 100 | 6 | 730 | 30.83 | 699 | 6-30 | |
| 38N9E-8.8d | A. M. Harris | 180 | 6 | 740 | 37.08 | 703 | 6-22 | |
| 38N9E-9.2e | Westview Utilities | 205 | 12 | 707 | 25.00 | 682 | 9-28 | Scots Plains Subdiv., Well No. 1 |
| 38N9E-9.7h | Laura Mattes | 160 | 6 | 715 | 31.86 | 683 | 6-22 | |
| 38N9E-13.5e | C. Manes | 60 | 4 | 700 | 16.77 | 683 | 6-20 | |
| 38N9E-14.2g | Kahn | 67 | 5 | 688 | 12.28 | 676 | 6-20 | |
| 38N9E-14.3h | Ehrhart | 38 | 5 | 690 | 9.34 | 681 | 6-20 | |
| 38N9E-16.1h | Crosier School | 103 | 5 | 705 | 18.22 | 687 | 6-20 | |
| 38N9E-17.8e2 . | Warren Petroleum Co. | 282 | 8 | 712 | 24.0 | 688 | 6-22 | Well No. 2. |
| 38N9E-17.8d | Eeber Preserving Co. | 200 | 8 | 712 | 25.5 | 687 | 6-22 | Well No: 2 |
| 38N9E-23.3g | Lawn Meadow Water Co. | 210 | 10 | 695 | 5.5 | 690 | 7-1 | Well No. 1 |
| 38N9E-24.8b | Hartmeyer | | 5 | 706 | 13.75 | 692 | 6-23 | |
| 38N9E-27.1e | K. Davis | 175 | 5 | 702 | 12.91 | 689 | 8-18 | |
| 38N9E-28.1d | L. Brummel | 225 | 7 | 710 | 18.76 | 691 | 8-18 | |
| 38N9E-29.7b2 | P. Hinz | 130 | 4.5 | 712 | 41.22 | 671 | 8-18 | |
| 38N9E-30.2a | E. Frieders | 142 | 4 | 710 | 37.70 | 672 | 8-18 | |
| 38N9E-35.3e | E. Sucher | | 5 | 677 | 19.76 | 657 | 8-18 | |
| 38N9E-36.8g | Peterold | | 5 | 673 | 19.82 | 653 | 8-18 | |
| 38N10E-l.lg | Univ. of Ill. Experiment Station | 250 | 6 | 720 | 55.0 | 665 | 8-18 | |
| 38N10E-2.3d | E. Donda | 117 | 6 | 732 | 78.93 | 653 | 8-19 | |
| 38N10E-3.8a | Ill. Municipal Water Co. | 233 | 12 | 723 | 67.0 | 658 | 8-18 | Village of Lisle, Well No. 2 |
| 38N10E-4.5g | W. H. Geolitz | | 5 | 745 | 36.00 | 709 | 8-18 | |
| 38N10E-5.4e | Ill. Toll Hwy. Comm. | 420 | 12 | 760 | 57.0 | 703 | 7-8 | Well M-8 |
| 38N10E-5.6f | A. L. Tholin | 165 | 5 | 765 | 64.5 | 701 | 7-8 | |
| 38N10E-10.2gl | Ill. Municipal Water Co. | 231 | | 671 | 43.0 | 628 | 6-1-59 | Village of Lisle, Well No. 1 |
| 38N10E-10.7al | Sacred Heart Academy | 53 | 4 | 670 | 11.0 | 659 | 10-19 | Well No. 1 |
| 38N10E-10.7a2 | Sacred Heart Academy | 152 | 6 | 670 | 16.30 | 654 | 6-21 | Farm Well No. 2 |
| 38N10E-11.7c | DuPage Utilities Co. | 200 | 8 | 740 | 91.0 | 649 | 6-16 | Oakview Subdiv., Well No. 1 |
| 38N10E-12.2b | Belmont-Highwood Water District | 295 | 10 | 740 | 92.0 | 648 | 7-8 | Well No. 2 |
| 38N10E-12.2d | Belmont-Highwood Water District | 148 | 5 | 698 | 43.0 | 655 | 7-8 | Well No. 1 |

| Well number | Owner | Depth of well (ft) | Casing diam-eter (in) | Surface elevation (ft above sea level) | Depth to water (ft) | "Water level elevation (ft above sealevel) | Date of measure-ment 1960 | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 38N10E-12.5c | Shaefer Bearing Div. | 250 | 12 | 710 | 49.85 | 660 | 7-8 | |
| 38N10E-12.6g2 | Northwest Belmont Improvement Assoc. | 167 | 6 | 750 | 79.39 | 671 | 7-8 | Well No. 2 |
| 38N10E-12.7f | Downers Grove Sanitary District | 150 | 6 | 698 | 39.0 | 659 | 7-8 | |
| 38N10E-13.1g | E. Dunning | 156 | 4 | 750 | 105.61 | 644 | 10-7 | |
| 38N10E-13.8e | J. E. Wurl | 120 | 6 | 750 | 102.09 | 648 | 10-3 | |
| 38N10E-14.8el | M. Draus | 80 | 6 | 680 | 26.31 | 654 | 11-11 | |
| 38N10E-14.8h | G. Lawf ord | 75 | 6 | 710 | 59.88 | 650 . | 10-3 | |
| 38N10E-15.3g | F. China | 70 | 5 | 655 | 5.73 | 647 | 10-3 | |
| 38N10E-17.6d | Naperville Country Club | 120 | 6 | 752 | 65.49 | 687 | 12-5 | |
| 38N10E-18.3dl | City of Naperville | 189 | 30 | 695 | 9.0 | 686 | 6-13 | City Well No. 5 |
| 38N10E-19.4e | H. Hoyle | 105 | 4 | 712 | 50.02 | 662 | 6-29 | |
| 38N10E-20.4h | Marie Marquarot | 180 | 6 | 743 | 63.23 | 680 | 10-14 | Tenant |
| 38N10E-21.1e | Fred Wardle | 185 | 4 | 752 | 98.31 | 654 | 11-3 | |
| 38N10E-22.1h | Woodridge Golf Club | 136 | 14 | 662 | 17.00 | 645 | 11-3 | |
| 38N10E-22.2a | Everett A. Brown | 59 | 6 | 675 | 30.57 | 644 | 10-17 | |
| 38N10E-22.3g | Woodridge Golf Club | 164 | 10 | 656 | 8.00 | 648 | 11-3 | |
| 38N10E-22.6a | E. O. Pionke | 90 | 4 | 702 | 53.45 | 649 | 11-3 | |
| 38N10E-23.1a | C. F. Nadehhoffer | 109 | 4 | 730 | 81.40 | 649 | 6-21 | |
| 38N10E-23.2f | H. C. Vial | 180 | 5 | 730 | 83.80 | 646 | 6-21 | |
| 38N10E-23.3d | H. C. Vial | ,120 | 5 | 750 | 104.78 | 645 | 6-21 | |
| 38N10E-23.6e | Goodrich School | 160 | 6 | 720 | 64.70 | 655 | 12-1 | |
| 38N10E-24.1g | John Posluany, Jr. | 185 | 6 | 721 | 77.84 | 643 | 12-12 | |
| 38N10E-24.8gl | Unknown | 120 | 4 | 720 | 72.49 | 648 | 4-4 | |
| 38N10E-25.1c | R. H. Scudder | 182 | 6 | 783 | 139.95 | 643 | 12-2 | |
| 38N10E-26.5c | George A. Karl | 175 | 6 | 714 | 64.24 | 650 | 12-1 | |
| 38N10E-27.3d | Everett A. Brown | 57 | 6 | 665 | 25.45 | 640 | 10-17 | |
| 38N10E-27.6h | E. D. Pionke | 114 | | 695 | 46.26 | 649 | 10-18 | |
| 38N10E-28.6h | George Huddlestone | 180 | 4 | 760 | 92.63 | 667 | 10-14 | |
| 38N10E-31.2b | J. Fender | 65 | 4 | 653 | 20.39 | 633 | 8-18 | |
| 38N10E-33.6a | A. Lissen | 121 | 6 | 725 | 65.98 | 659 | 6-21 | |
| 38N10E-34.8e | Richard Nielson | 170 | 5 | 716 | 70.43 | 646 | 10-18 | |
| 38N10E-35.2d | H. Maas | 123 | 4 | 745 | 101.97 | 643 | 6-21 | |
| 38N10E-35.5h | Adam Kohley | 60 | 4 | 682 | 32.05 | 650 | 10-17 | |
| 38N10E-35.6a | Dean E. McMillan | 120 | 3 | 675 | 36.27 | 639 | 12-1 | |
| 38N10E-36.5b | J. E. Subat | 180 | 6 | 763 | 125.07 | 638 | 11-28 | |
| 38N11E-1.3al | Village of Hinsdale | ,273 | 20 | 686 | 67 | 619 | 6-9 | Village Well No. 2 |
| 38N11E-1.3a2 | Village of Hinsdale | 210 | | 687 | 77 | 610 | 6-9 | Village Well No. 3 |
| 38N11E-1.4a | Village of Hinsdale | 209 | 12 | 676 | 53 | 623 | 6-9 | Village Well No. 1 |
| 38N11E-4.3f2 | Liberty Park Home Owners Assoc. | 278 | 8 | 745 | 99 | 646 | 6-13 | Well No. 1 |
| 38N11E-6.5e | Village of Downers Grove | 300 | 30 | 757 | 105 | 652 | 6-13 | Village Well No. 9 |
| 38N11E-7.6d | Village of Downers Grove | 250 | 30 | 696 | 80 | 616 | 6-4 | Village Well No. 6 |
| 38N11E-8.4b | Village of Downers Grove | 291 | 30 | 742 | 98.5 | 643 | 5-31 | Village Well No. 7 |
| 38N11E-8.7e | Village of Downers Grove | 262 | 30 | 720 | 70 | 650 | 6-13 | Village Well No. 8 |
| 38N11E-9.1h | Village of Westmont | 313 | 16 | 752 | 101 | 651 | 6-14 | Village Well No. 2 |
| 38N11E-10.1e | Village of Clarendon Hills | 250 | 12 | 723 | 112 | 611 | 6-10 | Village Well No. 2 |
| 38N11E-10.6e | Ill. Municipal Water Co. | 295 | 12 | 740 | 116 | 624 | 7-11 | Blackhawk Heights Subdiv., Well No. 1 |
| 38N11E-10.7a | Village of Westmont | 302 | 17 | 760 | 132 | 628 | 7-11 | Village Well No. 3 |
| 38N11E-10.8e | Village of Westmont | 313 | 12 | 755 | 128 | 627 | 6-14 | Village Well No. 4 |
| 38N11E-11.5b | Village of Clarendon Hills | 354 | 12 | 737 | 104.0 | 633 | 6-10 | Village Well No. 3 |
| 38N11E-11,5d | Village of Clarendon Hills | 370 | 12 | 710 | 89.0 | 621 | 6-10 | Village Well No. 4 |
| 38N11E-20.6c | C. V. Baxter | 130 | 4 | 760 | 115.63 | 644 | 9-30 | |
| 38N11E-20.7c | H. A. Pfaff | 213 | 5 | 763 | 117.97 | 645 | 9-29 | |
| 38N11E-20.7e | C. L. Bain | 167 | 4 | 760 | 114.35 | 646 | 4-18 | |
| 38N11E-21.1c | Clarendon Hills Cemetery | 249 | 6 | 764 | 127.60 | 636 | 4-18 | |
| 38N11E-24.4b | International Harvester Co. | 398 | 16 | 718 | 102 | 616 | 7-11 | Well No. 1 |
| 38N11E-24.4e | International Harvester Co. | 294 | 16 | 715 | 85 | 630 | 7-11 | Well No. 2 |
| 38N11E-27.8d | Brookhaven Manor Water Co. | 310 | 16 | 755 | 113.55 | 641 | 6-14 | Well No. 1 |
| 38N11E-28.1c | Brookhaven Manor Water Co. | 330 | 16 | 760 | 114.0 | 646 | 6-14 | Well No. 2 |
| 38N11E-30.1a | F. Coffee | 165 | 4 | 770 | 124.78 | 645 | 4-1 | |
| 39N9E-1.2b | F. Muser | 120 | 3 | 735 | 22.10 | 713 | 7-5 | |
| 39N9E-3.1h2 | Campbell Soup Co. | 248 | 8 | 763 | 57.92 | 705 | 7-6 | Well No. 4 |

| Well number | Owner | Depth of well *(ft)* | Casing diameter *(in)* | Surface elevation *(ft above sea level)* | Depth to water *(ft)* | Water level elevation *(ft above sea level)* | Date of measurement 1960 | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 39N9E-3.8g | H. Eaffel | 161 | 5 | 792 | 75.64 | 716 | 7-6 | |
| 39N9E-4.1b | City of West Chicago | 310 | 24 | 762 | 87.0 | 675 | 8-3 | Well No. 3 |
| 39N9E-4.7g | L. C. Carbary | 108 | 6 | 760 | 39.95 | 720 | 7-6 | |
| 39N9E-5.1h | B. Burns | | 4 | 753 | 28.74 | 724 | 7-6 | |
| 39N9E-5.5gl | Western Electric Co. | 257 | **8** | 752 | 92.0 | 660 | 8-7 | Well No. 2 |
| 39N9E-5.5g2 | Western Electric Co. | 265 | 8 | 752 | 92.0 | 660 | 8-7 | Well No. 1 |
| 39N9E-5.6g | Western Electric Co. | 268 | 8 | 752 | 86.0 | 666 | 8-7 | Well No. 3 |
| 39N9E-6-le2 | W. H. Poppino | 115 | 4 | 750 | 44.93 | 705 | 7-5 | |
| 39N9E-7.2h | I. McMahon | 107 | 5 | 750 | 54.59 | 695 | 7-5 | |
| 39N9E-9.6e | General Mills, Inc. | 330 | 12 | 758 | 68 | 690 | 7-5 | Well No. 1 |
| 39N9E-10.3d | P. Glashagle | 150 | 5 | 760 | 44.85 | 715 | 7-5 | |
| 39N9E-11.2h | B. Spiers | 115 | 5 | 742 | 31.74 | 710 | 7-5 | |
| 39N9E-11.5b | G. Peters | 98 | 5 | 725 | 30.79 | 694 | 7-5 | |
| 39N9E-12.4b | Winfield Hospital | 200 | 8 | 762 | 53.5 | 709 | 6-29 | Well No. 2 |
| 39N9E-13.2hl | Village of Winfield | 263 | 8 | 768 | 59.7 | 708 | 6-14 | Village Well No. 3 |
| 39N9E-13.6b | Tillage of Winfield | 335 | 12 | 778 | 81.0 | 697 | 6-14 | Village Well No. 2 |
| 39N9E-14.5b | Mack | | 4.5 | 772 | 60.94 | 711 | 6-29 | |
| 39N9E-16.2e | C. Claypool | | 5 | 720 | 27.84 | 692 | 6-29 | |
| 39N9E-17.8e | A. Schuslar | | 3 | 740 | 20.04 | 720 | 6-29 | |
| 39N9E-18.1h | MeChesney | 127 | 3.5 | 746 | 35.75 | 710 | 6-29 | |
| 39N9E-23.3a | E. J. Davidson | 143 | 6 | 730 | 23.00 | 707 | 6-28 | |
| 39N9E-24.7g | C. Pomillo | | 5 | 771 | 63.41 | 708 | 6-28 | |
| 39N9E-25.3d | J. Gorak | | 5 | 756 | 44.59 | 711 | 6-28 | |
| 39N9E-27.3f | S. Owens | 103 | 4 | 709 | 11.84 | 697 | 6-28 | |
| 39N9E-29.5a | B. Geltz | | 4 | 739 | 33.23 | 706 | 6-28 | |
| 39N9E-31.8d | L. Baumann | 125 | 4 | 740 | 39.40 | 701 | 6-30 | |
| 39N9E-32.8f | A. Swenson | 100 | 4 | 752 | 45.06 | 707 | 6-22 | |
| 39N9E-33.5b | A. Strong | 94 | 4 | 727 | 28.22 | 699 | 6-22 | |
| 39N9E-34.6e | E. Erega | 85 | | 714 | 17.53 | 696 | 6-28 | |
| 39N9E-35.1a | Elmhurst-Chicago Stone Co. | 273 | 6 | 700 | 27.0 | 673 | 3-14 | Well No. 2 |
| 39N9E-35.4b | Ill. Municipal Water Co. | 256 | 10 | 690 | 1.50 | 689 | 6-28 | Village of Warrenville, Well No. 4 |
| 39N9E-36.5d | J. Sass | | 4 | 750 | 61.70 | 688 | 6-29 | |
| 39N10E-1.2g | P. Galfans | 160 | 5 | 733 | 41.67 | 691 | 8-1 | |
| 39N10E-3.2d | W. Mathews | | 5 | 771 | 63.59 | 707 | 8-9 | |
| 39N10E-7.2e | J. Bertrand | 180 | | 772 | 64.40 | 708 | 8-5 | |
| 39N10E-9.2f | City of Wheaton | 341 | 20 | 750 | 54.0 | 696 | 6-29 | Well No. 4, |
| 39N10E-11.7e | Village of Glen Ellyn | 352 | 12 | 759 | 91.0 | 668 | 6-6 | Village Well No. 2 . |
| 39N10E-12.4a | Glen Oak Country Club | 202 | 16 | 688 | 30.0 | 658 | 7-8 | Well No. 2 |
| 39N10E-12.4e | Glen Oak Country Club | 212 | 16 | 700 | 22.0 | 678 | 7-8 | Well No. 3 |
| 39N10E-12.5e | Glen Oak Country Club | 130 | 6 | 710 | 42.77 | 667 | 7-8 | Well No. 1 |
| 39N10E-13.1e | J. Ludwig | 100 | 4 | 698 | 17.79 | 680 | 8-18 | |
| 39N10E-15.1b | Village of Glen Ellyn | 422 | 20 | 770 | 96.0 | 674 | 6-6 | Well No. 4 |
| 39N10E-16,6cl | City of Wheaton | 175 | 10 | 749 | 54.0 | 695 | 4-26 | Well No. 1 |
| 39N10E-17.8a | Polo Drive & Saddle Eoad Water Co. | 175 | 8 | 740 | 38.0 | 702 | 4-8 | |
| 39N10E-18.6e | DuPage County Home | 64 | 6 | 720 | 26.47 | 694 | 6-29 | |
| 39N10E-19.2g | Franciscan Sisters Home | 330 | 10 | 740 | 31.0 | 709 | 4-19 | Well No. 1 |
| 39N10E-19.3g | Franciscan Sisters Home | 325 | 10 | 735 | 29.0 | 706 | 4-19 | Well No. 2 |
| 39N10E-19.4h | St. Francis High School | 252 | 8 | 730 | 30.0 | 700 | 4-19 | |
| 39N10E-20.1cl | E. Hugging | | 5 | 735 | 35.67 | 699 | 8-19 | |
| 39N10E-20.1e2 | Tee & Green Water Assoc. | 198 | 8 | 740 | 35.0 | 705 | 4-21 | |
| 39N10E-20.2c | Chicago Golf Club | 165 | 6 | 740 | 43.3 | 697 | 8-19 | Well No. 1 |
| 39N10E-23.2e | E. Turek | 130 | 5 | 740 | 60.63 | 679 | 8-19 | |
| 39N10E-24.8b | Moeller | 135 | 5 | 720 | 38.04 | 682 | 8-19 | |
| 39N10E-25.2b | C. Gray | 172 | 5 | 733 | 57.95 | 675 | 8-19 | |
| 39N10E-28.3f | Tenzinger | 145 | 4 | 752 | 57.94 | 694 | 8-19 | |
| 39N10E-30.3h | H. H. Ballard | 150 | 5 | 751 | 39.49 | 712 | 6-29 | |
| 39N10E-31.1h | Arrowhead Golf Club | 158 | 4 | 748 | 62.0 | 686 | 4-20 | Well No. 2 |
| 39N10E-33.2c | E. D. Hayes | 120 | 3 | **741** | 61.78 | 679 | 8-19 | |
| 39N10E-34.3d | Morton Arboretum | 250 | 12 | 748 | 82.0 | 666 | 6-6 | Well No. 3 |
| 39N10E-34.4d | Morton Arboretum | 250 | 12 | 758 | 82.0 | 676 | 6-6 | Well No. 4 |
| 39N10E-36.4f | W, B. Johnson | | 3 | 710 | 32,34 | 678 | 8-19 | |
| 39NllE-2.7f | Elmhurst-Chicago Stone Co. | **190** | | **690** | **190** | 500 | 8-1 | Stone Quarry |

| Well number | Owner | Depth of well (ft) | Casing diameter (in) | Surface elevation (ft above sea level) | Depth to water (ft) | Water level elevation (ft above sea level) | Date of measurement 1960 | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 39N11E-3.1i | Cities Service Oil Co. | | 5 | 687 | 58.4 | 629 | 7-24-59 | |
| 39N11E-3.2f | Elmhurst Park District | 100 | 4 | 673 | 70.0 | 603 | 8-1 | |
| 39N11E-3.6h | C. Glimco | 70 | | 693 | 42.66 | 650 | 8-17 | |
| 39N11E-5.3d | H. Melton | 100 | | 712 | 32.65 | 680 | 8-1 | |
| 39N11E-10.4g5 | Wander Co. | 197 | 14 | 675 | 19.0 | 656 | 8-15 | Well No. 5 |
| 39N11E-10.8e1 | Village of Villa Park | 285 | 8 | 702 | 55.0 | 647 | 5-2 | Village Well No. 3 |
| 39N11E-10.8e2 | Village of Villa Park | 251 | 12 | 702 | 55.0 | 647 | 5-2 | Village Well No. 4 |
| 39N11E-13.3g | City of Elmhurst | 290 | 8 | 710 | 88.0 | 622 | 8-13 | City Well No. 7 |
| 39N11E-13.6c | J. Livingston | 110 | 5 | 677 | 25.44 | 652 | 7-11 | |
| 39N11E-13.7b | Swaim & Skinner | 110 | | 667 | 12.89 | 654 | 7-11 | |
| 39N11E-14.8a | H. E. Voss | 117 | | 667 | 2.94 | 664 | 7-11 | |
| 39N11E-14.8e | J. Weskrna | 155 | 6 | 672 | 19.58 | 652 | 7-11 | |
| 39N11E-16.4d | G. Wyns | | | 700 | 29.36 | 671 | 8-23 | |
| 39N11E-17.2c | Pullman | | | 708 | 26.65 | 681 | 8-18 | |
| 39N11E-18.5d | I. Frey | 110 | | 720 | 40.18 | 680 | 8-18 | |
| 39N11E-21.5e | D. Helms | | | 725 | 51.26 | 674 | 7-13 | |
| 39N11E-22.4e | G. Kurtz | 120 | | 685 | 25.65 | 659 | 7-13 | |
| 39N11E-23.1h | V. Castelli | 100 | | 665 | 13.90 | 651 | 7-11 | |
| 39N11E-24.2g | J. H. Jones | 350 | | 690 | 39.23 | 651 | 6-24 | |
| 39N11E-24.3a2 | American Can Co. | 245 | 10 | 682 | 33.0 | 649 | 7-11 | Well No. 1 |
| 39N11E-25.4d | E. Mulac | 165 | 5 | 670 | 21.42 | 649 | 7-11 | |
| 39N11E-25.6e | Butler Co. | 160 | 5 | 675 | 33.99 | 641 | 7-13 | |
| 39N11E-26.3b | Butler Co. | | 8 | 665 | 25.44 | 640 | 7-11 | |
| 39N11E-28.7d | C. Ballinger | 117 | 5 | 720 | 45.45 | 675 | 7-13 | |
| 39N11E-33.1e | Midwest Country Club | 170 | 8 | 720 | 62.0 | 658 | 7-12 | Well No. 1 |
| 39N11E-33.2d | D. Kitzing | | 5 | 733 | 61.16 | 672 | 7-13 | |
| 39N11E-34.7h | G. Mueller | 105 | 4 | 715 | 51.01 | 664 | 7-13 | |
| 39N11E-35.1d | J. Telander | 90 | 5 | 672 | 28.28 | 644 | 7-11 | |
| 39N11E-36.4f | M. Carlson | 45 | 4 | 650 | 12.37 | 638 | 7-11 | |
| 40N9E-1.2h | G. Anagnost | 164 | | 790 | 51.39 | 739 | 7-18 | |
| 40N9E-3.7b | Carrol | | | 810 | 41.65 | 768 | 7-1 | |
| 40N9E-6.8e | E. Haas | 95 | 5 | 765 | 21.82 | 743 | 7-1 | |
| 40N9E-14.5b | W. Niemeyer | | 5 | 768 | 30.02 | 738 | 7-8 | |
| 40N9E-19.4b | Hammond | 120 | 5 | 758 | 31.37 | 727 | 7-6 | |
| 40N9E-21.5e | K. Bierkamp | | | 783 | 33.29 | 749 | 7-15 | |
| 40N9E-24.7g | W. Bierman | | 5 | 782 | 42.06 | 740 | 7-8 | |
| 40N9E-26.3e | Fair Oaks Farm | | 5 | 788 | 51.35 | 737 | 7-6 | |
| 40N9E-28.4b2 | Christ the King Seminary | 160 | 8 | 788 | .47.0 | 741 | 7-6 | Well No. 2 |
| 40N9E-30.3c | J. Koselka | 119 | 5 | 752 | 48.55 | 703 | 7-1 | |
| 40N9E-32.5g | Kawneer Products Co. | 270 | 12 | 755 | 84.5 | 671 | 8-7 | Well No. 2 |
| 40N9E-32-6g | Kawneer Products Co. | 271 | 12 | 755 | 60.0 | 695 | 6-9 | Well No. 1 |
| 40N9E-32.6h | Owens-Illinois Closure & Plastics Div. | 300 | 20 | 753 | 76.0 | 677 | 2-9 | Well No. 3 |
| 40N9E-33.1a | Mr. Binder | 150 | 6 | 775 | 51.39 | 724 | 7-6 | |
| 40N9E-34.1a | Wheaton College Academy | 220 | 6 | 762 | 38.21 | 724 | 7-6 | |
| 40N9E-35.1f | O. C. Hiltman | 160 | 6 | 762 | 37.53 | 724 | 7-8 | |
| 40N9E-35.3g | Sidwell Studios | 192 | 8 | 748 | 26.0 | 722 | 7-6 | |
| 40N9E-35.8h | G. Eeed | 100 | 5 | 740 | 5.01 | 735 | 7-6 | |
| 40N9E-36.4c | L. Peters | | 6 | 749 | 27.39 | 722 | 7-8 | |
| 40N10E-1.4d | W. Wiebe | 155 | 5 | 733 | 27.16 | 706 | 7-26 | |
| 40N10E-2.4d | J. Peterson | 150 | 5 | 735 | 19.29 | 716 | 7-26 | |
| 40N10E-3.4e2 | Village of Roselle | 183 | 10 | 770 | 54.0 | 716 | 3-22 | Village Well No. 2 |
| 40N10E-4.5e | E. Wieble | 190 | 5 | 805 | 63.13 | 742 | 7-26 | |
| 40N10E-8.6f | E. Hasse | 155 | 4 | 783 | 30.64 | 752 | 7-26 | |
| 40N10E-10.8h | J. Anderson | 155 | 5 | 788 | 49.21 | 739 | 7-26 | |
| 40N10E-12,5b | Medinah Country Club | 145 | 6 | 700 | 22.0 | 678 | 7-8 | Well No. 1 |
| 40N10E-13.1g | Mr. Parks | 132 | 5 | 692 | 9.13 | 683 | 7-28 | |
| 40N10E-14.4e | Glendale Country Club | 212 | 8 | 760 | 62.27 | 698 | 7-8 | Well No. 2 |
| 40N10E-15.4e | E. W. Dunteman | 130 | | 748 | 28.63 | 719 | 7-29 | |
| 40N10E-16.1e | Mr. Knobloch | 187 | 5 | 798 | 74.10 | 724 | 7-29 | |
| 40N10E-16.4a | Sod Farm Nursery | 370 | 10 | 792 | 47.19 | 745 | 8-1 | Well No. 3 |
| 40N10E-17.5e | P. Benshoof | 152 | 4 | 794 | 30.78 | 763 | 7-29 | |
| 40N10E-18.1d2 | W. H. Kurth | 160 | 4 | 790 | 39.23 | 751 | 7-8 | |
| 40N10E-20.5f | J. Klein | 160 | 4 | 772 | 36.89 | 735 | 7-29 | |

| Well number | Owner | Depth of well (ft) | Casing diameter (in) | Surface elevation (ft above sea level) | Depth to water (ft) | Water level elevation (ft above sea level) | Date of measurement 1960 | Remarks |
|---|---|---|---|---|---|---|---|---|
| DUP— | | | | | | | | |
| 40N10E-20.6el | Allied Cement Co. | | 5 | 767 | 19.08 | 748 | 7-8 | Well No. 1 |
| 40N10E-22.8c | B. Stark | 170 | 4 | 792 | 62.54 | 729 | 8-1 | |
| 40N10E-23.4b | Unknown | | 5 | 710 | 6.17 | 704 | 8-1 | |
| 40N10E-24.8h | P. Garriott | 172 | 5 | 749 | 43.60 | 705 | 7-28 | |
| 40N10E-25.5e | T. Karlanak | 183 | 5 | 728 | 24.02 | 704 | 8-1 | |
| 40N10E-26.4e | B. Moty | 185 | 4 | 740 | 25.52 | 714 | 8-1 | |
| 40N10E-27.4b | E. V. Rust | 150 | 4 | 812 | 64.52 | 747 | 8-8 | |
| 40N10E-28,5a | M. F. Downer | 121 | 4 | 812 | 81.36 | 731 | 8-9 | |
| 40N10E-31.2g | Carol Stream Utilities Co. | 335 | 10 | 764 | 40.0 | 724 | 7-8 | Village of Carol Stream, Well No. 1 |
| 40N10E-35.7f | J. Komala | 135 | 5 | 750 | 34.27 | 713 | 8-1 | |
| 40N11E-3.3h | K. Grooms | 139 | 5 | 682 | 23.07 | 659 | 8-16 | |
| 40N11E-4.1e | G. Kraiss | 130 | 4 | 712 | 41.73 | 670 | 8-16 | |
| 40N11E-5.2h | W. Bay | | 5 | 687 | 11.33 | 676 | 7-27 | |
| 40N11E-6.6e | J. Gronewold | 154 | 4 | 724 | 36.44 | 688 | 7-27 | |
| 40N11E-7.1b | B. Bensen | 128 | 6 | 700 | 26.00 | 674 | 7-28 | |
| 40N11E-8.6e | Village of Itasca | 190 | 12 | 700 | 22.0 | 678 | 5-9 | Village Well No. 5 |
| 40N11E-8.6e | Village of Itasca | 200 | 12 | 690 | 14.0 | 676 | 7-5 | Village Well No. 3 |
| 40N11E-10.8e | J. Mahoney | 128 | 4 | 702 | 36.67 | 665 | 8-16 | |
| 40N11E-11.1h2 | Flick-Beedy Corp. | 125 | 8 | 665 | 27.66 | 637 | 8-16 | Well No. 2 |
| 40N11E-13.4e | S. Kivo | 135 | 5 | 667 | 33.48 | 634 | 8-15 | |
| 40N11E-14.5e | C. Whitney | 155 | | 680 | 45.40 | 635 | 8-16 | |
| 40N11E-15.8g | E. Koscik | 151 | 5 | 712 | 56.17 | 656 | 8-16 | |
| 40N11E-16.5g | M. Spatola | 117 | 4 | 693 | 26.65 | 666 | 8-16 | |
| 40N11E-17.3h | Mr. Hemmi | 86 | 5 | 703 | 18.90 | 684 | 7-28 | |
| 40N11E-18.5e | R. Boss | 95 | | 720 | 30.94 | 689 | 7-28 | |
| 40N11E-19.6c | O. Byman | | 4.5 | 750 | 52.72 | 697 | 8-1 | |
| 40N11E-21.4b | W. Byrne | 150 | | 683 | 14.49 | 669 | 8-16 | |
| 40N11E-23.7g | F. Boy | | | 683 | 39.85 | 643 | 8-16 | |
| 40N11E-24.4b | River Forest Country Club | 219 | 10 | 660 | 24.0 | 636 | 8-16 | Well No. 2 |
| 40N11E-24.6e | D. Imes | 125 | 4 | 665 | 38.67 | 626 | 8-17 | |
| 40N11E-25.5f | Citizens Utilities Co. of Illinois | 226 | 12 | 680 | 42.0 | 638 | 2-2 | Country Club Highlands Subdiv., Well No. 1 |
| 40N11E-27.4g | J. Hemmis | | | 690 | 34.10 | 656 | 8-16 | |
| 40N11E-29.2a | W. Rosenwinkel | 120 | | 688 | 5.29 | 683 | 8-1 | |
| 40N11E-30.3g | L. Heinrich | 195 | 6 | 727 | 36.76 | 690 | 8-1 | |
| 40N11E-31.4a | T. Manck | 145 | 4 | 720 | 27.76 | 692 | 8-1 | |
| 40N11E-33.7g | Village of Addison | 250 | | 710 | 31.0 | 679 | 7-5 | Village Well No. 4 |
| 40N11E-34.7d | B. Saatkamp | 90 | | 680 | 21.70 | 658 | 8-17 | |
| 40N11E-35.4e | F. Magnuson | 185 | 5 | 698 | 55.24 | 643 | 8-17 | |
| 40N11E-36.8f | A. Rosenthal | 138 | 5 | 683 | 56.00 | 627 | 8-17 | |