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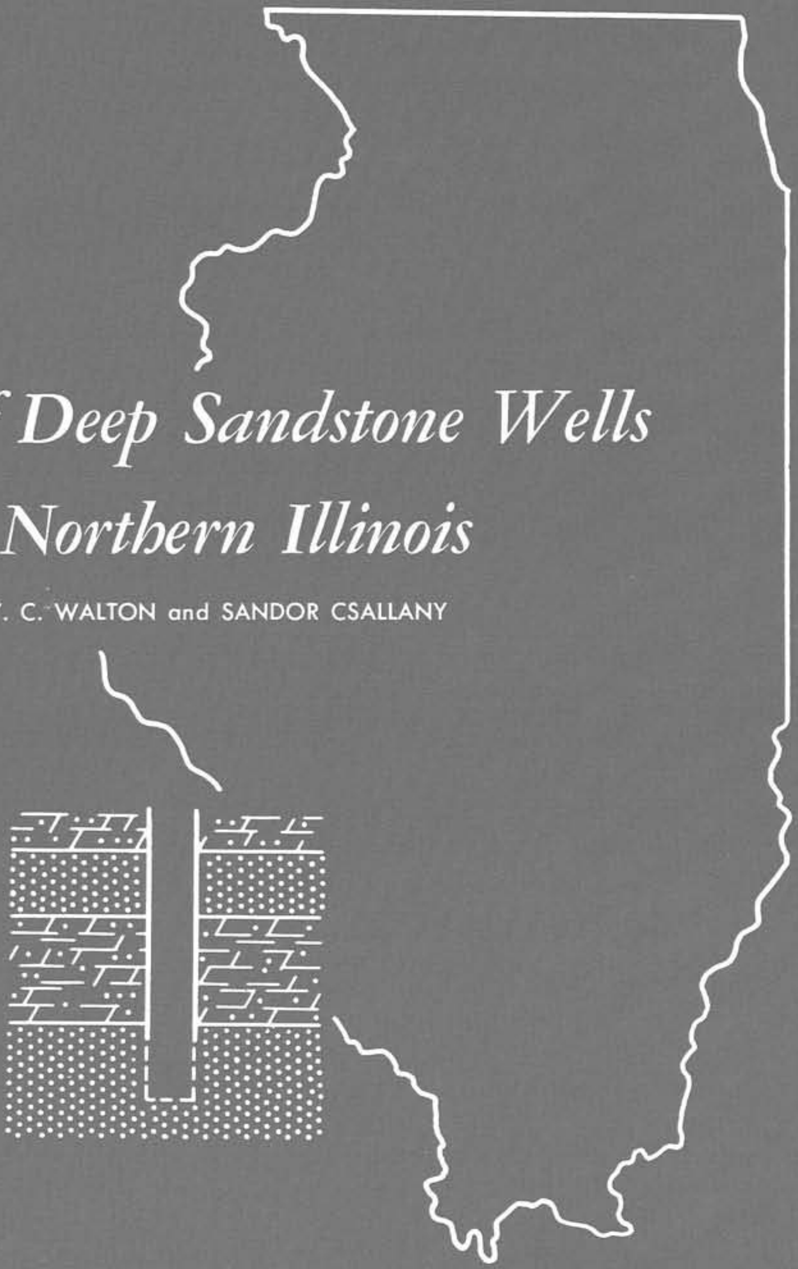
DEPARTMENT OF REGISTRATION AND EDUCATION
WILLIAM SYLVESTER WHITE, Director

Yields of Deep Sandstone Wells in Northern Illinois

by W. C. WALTON and SANDOR CSALLANY



ILLINOIS STATE WATER SURVEY
WILLIAM C. ACKERMANN, Chief

URBANA

1962

REPORT OF INVESTIGATION 43

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STATE OF ILLINOIS
HON. OTTO KERNER, Governor

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WILLIAM SYLVESTER WHITE, *Director*

STATE WATER SURVEY DIVISION
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by W. C. Walton and Sandor Csallany

ABSTRACT

In northern Illinois large quantities of ground water are withdrawn from deep wells in bedrock aquifers of Ordovician and Cambrian age. The Galena-Platteville Dolomite, Glenwood-St. Peter Sandstone, and Prairie du Chien Series of Ordovician age and the Trempealeau Dolomite, Franconia Formation, Ironton-Galesville Sandstone, and Mt. Simon Sandstone of Cambrian age yield appreciable quantities of ground water. Most deep sandstone wells in northern Illinois tap several bedrock aquifers or units and are multiunit wells. The average depth of deep sandstone wells is about 1300 feet and wells of recent design are often finished 16 to 20 inches in diameter.

During 1906-1960 well-production tests were made by the State Water Survey on more than 500 deep sandstone wells. Specific-capacity data were used to determine the role of the individual bedrock aquifers or units uncased in deep sandstone wells as contributors of water and to appraise the effects of shooting bedrock wells.

It is concluded that the yields of the (1) Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone, (2) Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation, and (3) Ironton-Galesville Sandstone constitute about 15, 35, and 50 per cent respectively, of the total yield of the rocks above the Mt. Simon Sandstone. The average permeability of the Mt. Simon Sandstone is about one-half as great as the average permeability of the Ironton-Galesville Sandstone and is slightly greater than the average permeability of the Glenwood-St. Peter Sandstone.

The average increase in the yields of deep sandstone wells as the result of shooting is about 28 per cent. Yields are increased because (1) the hole is enlarged and (2) fine materials and incrusting deposits on the well face and in the well wall are removed.

INTRODUCTION

Several hundred industrial and municipal wells in northern Illinois obtain large quantities of ground water from bedrock of Ordovician and Cambrian age. The Ironton-Galesville Sandstone is the main source of ground water for many public and industrial supplies and is considered the best bedrock aquifer in Illinois because of its consistently high yield. Many high-capacity deep sandstone wells also obtain parts of their yields from the Glenwood-St. Peter and Mt. Simon Sandstones. Deep sandstone wells often have yields exceeding 700 gallons per minute (gpm) and have been prolific sources of water for nearly 100 years.

The Chicago region has been one of the most favorable areas for development of ground water from deep sandstone wells. Pumpage from deep sandstone wells has increased from 200,000 gallons per day (gpd) in 1864 to 91.7 million gallons per day (mgd) in 1960. Bedrock aquifers of Ordovician and Cambrian age underlie the Chicago region below an average depth of about 500 feet below land surface, and deep sandstone wells exceeding 2000 feet in depth do not penetrate the entire thickness of these aquifers.

The city of Rockford, with a population exceeding 128,000 and located in the Rock River valley, is the largest city in northern Illinois to use deep sandstone wells for much of its municipal supply. Deep sandstone wells at Rockford commonly range from 700 to 1600 feet deep. Large quantities of water are also pumped from deep sandstone wells owned by the cities of DeKalb, Dixon, Ottawa, Belvidere, Kewanee, Sterling, Freeport, LaSalle, and Galesburg.

Many data on the performance of deep sandstone wells in northern Illinois have been collected by the State Water Survey. The results of well-production tests made on several hundred wells provide important information concerning the influence that the location, depth, construction features, and age of a well have on its yield. The effects of well treatment are apparent from data for tests made before and after treatment.

In May 1959 the State Water Survey and the State Geological Survey issued Cooperative Ground-Water Report 1, entitled "Preliminary Report on Ground-Water Resources of the Chicago Region, Illinois" (Suter, et al, 1959).' Cooperative Report 1 discussed the geology andhydrology of the groundwater resources of the Chicago region, along with the history, present conditions, and effects of possible future development. Special emphasis was placed on the deep bedrock aquifers which have been most widely used for large ground-water supplies. Studies described in Cooperative Report 1 indicate that by 1980 upper units of the deep bedrock aquifers will be partially dewatered in parts of the Chicago region as the result of heavy ground-water development. Additional geologic and hydrologic studies were recommended to determine the water-yielding properties of the individual units of the bedrock aquifers so that the effects of dewatering can be estimated.

The performance of a well depends in large part upon the water-yielding properties of the rocks uncased in the well. Thus, well-production data for wells drilled to various depths and uncased in one or more bedrock units can be used to evaluate the water-yielding properties of the individual units.

As a result of the findings of Cooperative Report 1, the program of collecting and analyzing well-production data for deep sandstone wells in northern Illinois was accelerated in 1959. This report summarizes the results of studies made to date on the yields of deep sandstone wells in northern Illinois. Emphasis is placed on deep sandstone wells in the Chicago region. A summary of published information concerning the geology and hydrology of the bedrock units uncased in deep sandstone wells is presented to serve as a background for interpretation of the records.

GEOLOGY AND HYDROLOGY OF BEDROCK AQUIFERS

North of the forty-first parallel of latitude, deep sandstone wells in northern Illinois may penetrate bedrock of Pennsylvanian, Mississippian, Devonian, Silurian, Ordovician, and Cambrian age. This report is concerned primarily with rocks of the Ordovician and Cambrian systems; other formations are considered only with respect to their relation to the geohydrologic conditions of the Ordovician and Cambrian rocks.

The geologic nomenclature and characteristics, drilling and casing conditions, and water-yielding properties of the glacial drift and the bedrock in northern Illinois are summarized in table 1. The sequence, structure, and general characteristics of the rocks are shown in figure 1. For a detailed discussion of the geology of the rocks the reader is referred to Suter, et al (1959), Hackett (1960), Hackett and Bergstrom (1956), and Bergstrom, et al (1955). The following sections on geology and hydrology were abstracted from these reports.

Cambrian Rocks

Rocks of Cambrian age overlie relatively impermeable crystalline Precambrian rocks which act as a barrier to downward movement of ground water. The Cambrian rocks have been divided into five geohydrologic units (Suter, et al, 1959). In ascending order the units are: The Mt. Simon Sandstone and sandstones of the lower Eau Claire Formation; middle and upper beds of the Eau Claire Formation; Ironton-Galesville Sandstone; Franconia Formation; and Trempealeau Dolomite.

The Mt. Simon Sandstone and lower sandstones of the Eau Claire Formation are hydrologically interconnected and collectively are called the Mt. Simon Aquifer (Suter, et al, 1959). Figure 2 shows elevations of the top of the Mt. Simon Aquifer in northeastern Illinois. The medium- to coarse-grained portions of the aquifer yield large quantities of water to wells especially along the Fox River valley in Kane County and at Rockford. The average depth of penetration of wells into the aquifer is about 350 feet in northeastern Illinois and about 590 feet in northwestern Illinois. Very few wells have penetrated the entire thickness of the Mt. Simon Aquifer. This is because adequate yields are obtained with penetration of the upper beds only or because water encountered in the Mt. Simon Aquifer below an elevation of about 1300 feet below sea level is commonly too salty for municipal use.

Ground water in the Mt. Simon Aquifer occurs under leaky artesian conditions because the aquifer is everywhere overlain by confining beds of the Eau Claire Formation. There are significant differences in hydrostatic head between the Mt. Simon Aquifer and shallower bedrock aquifers in many areas in northern Illinois. Driller's reports indicate that the hydrostatic head in the Mt. Simon Aquifer was more than 50 feet higher than hydrostatic heads in overlying bedrock aquifers in areas along the Fox River in 1960. It is probable that in 1960 the average artesian pressure differential between the Mt. Simon Aquifer and overlying bedrock aquifers in the Chicago region was less than 100 feet.

The middle and upper zones of the Eau Claire Formation consist of shales, dolomites, and shaly dolomitic sandstones that grade laterally from one to another within short distances and have very low permeabilities. The unit acts as a confining bed between the overlying Ironton-Galesville Sandstone and the Mt. Simon Aquifer. South of Chicago and Joliet the Eau Claire Formation greatly retards the upward movement of highly mineralized water from the Mt. Simon Aquifer.

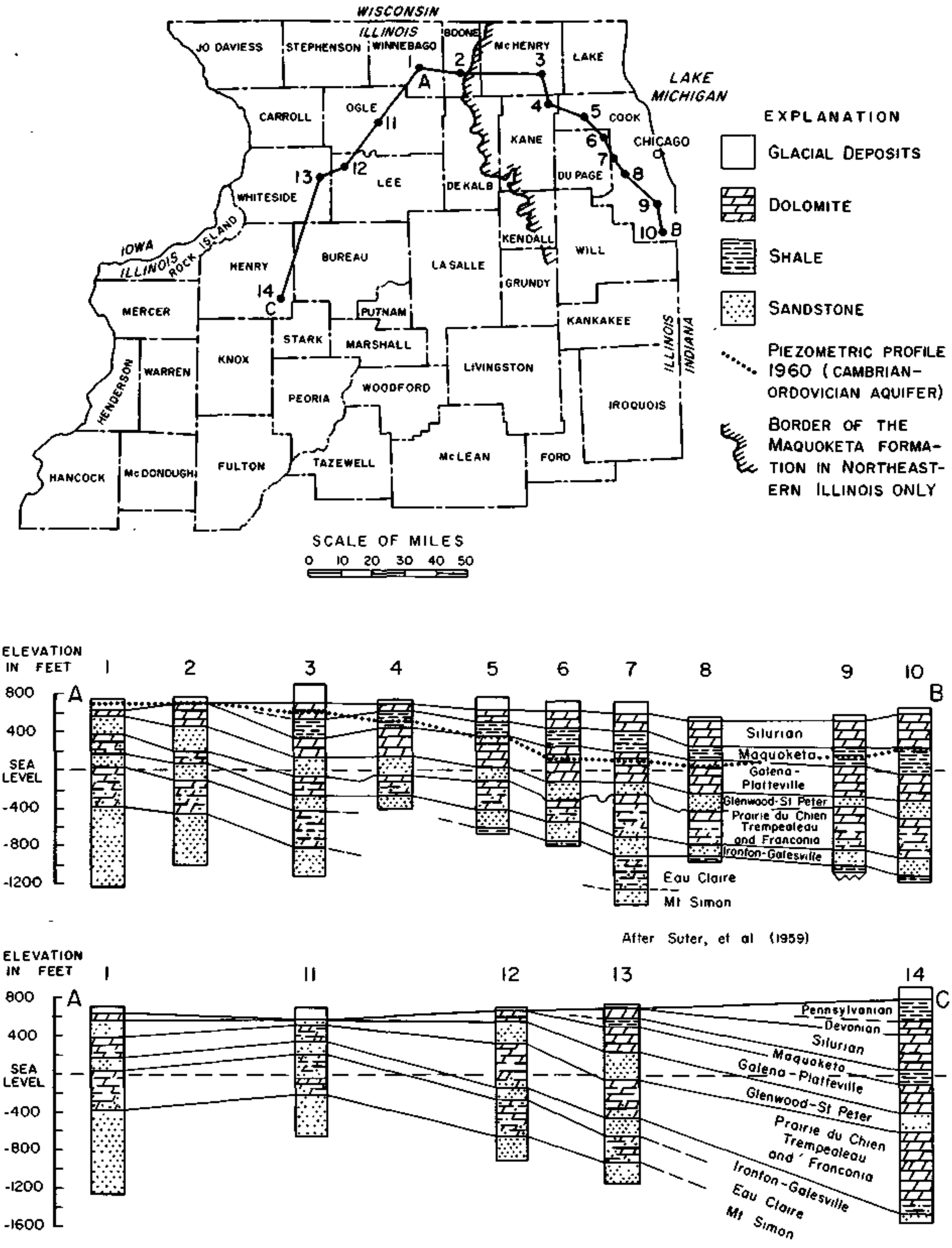
The Ironton-Galesville Sandstone, overlying the Eau Claire Formation and overlain by the Franconia Formation, is by far the most consistently permeable and productive unit of the bedrock of Cambrian and Ordovician age. It is

Table 1. Generalized Stratigraphy and Water-Yielding Properties of the Rocks in Northern Illinois

(after Suter, et al, 1959, and Hackett, 1960)

System	Series	Group or Formation	Geohydrologic Units			Log	Approximate range in thickness (feet)	Description	Drilling and Casing Conditions	Water-yielding properties
Quaternary	Pleistocene		Glacial Drift Aquifers				0-500	Unconsolidated clay, silt, sand, gravel, and boulders deposited as till, outwash, pond water deposits, and loess	Boulders, heaving sand locally; sand and gravel wells usually require screens and development; casing required in wells into bedrock.	Probabilities for ground-water development range from poor to excellent. Outwash sand and gravel yield more than 1000 gpm to wells at places. Large supplies generally obtained from permeable outwash in major valleys. Glacial aquifers used for many small water supplies because they are shallow.
Pennsylvanian		Carbondale Tradewater			Bedrock Aquifers		0-500	Shale; sandstones, fine-grained; limestone; coal; clay	Shale requires casing.	Jointed beds yield small supplies locally.
Mississippian	Kinderhook						0-350	Shale, green and brown, dolomitic; dolomite, silty		Limited areal extent; generally not used as aquifers.
Devonian							0-100	Shale, calcareous; limestone beds, thin		
Silurian	Niagaran	Port Byron Racine Waukesha Joliet		Shallow dolomite aquifers			0-500	Dolomite; silty at base, locally cherty	Upper part usually weathered and broken; extent of crevicing varies widely.	Not consistent; some wells yield more than 1000 gpm. Crevices and solution channels more abundant near surface.
	Alexandrian	Kankakee Edgewood								
Ordovician	Cincinnatian	Maquoketa					0-250	Shale, gray or brown; locally dolomite and/or limestone, argillaceous	Shale requires casing.	Shales, generally not water yielding, act as confining beds between shallow and deep aquifers. Crevices in dolomite yield small amounts of water.
	Mohawkian	Galena Decorah Platteville	Galena-Platteville Dolomite	Cambrian-Ordovician Aquifer			0-350	Dolomite and/or limestone, cherty, sandy at base, shale partings	Crevicing common only where formations underlie drift. Top of Galena usually selected for hole reduction and seating of casing.	Where formation lies below shales, development and yields of crevices are small; where not capped by shales, dolomites are fairly permeable.
		Glenwood	Glenwood-St. Peter Sandstone				0-650	Sandstone, fine- and coarse-grained; little dolomite; shale at top Sandstone, fine- to medium-grained; locally cherty red shale at base	Lower cherty shales cave and are usually cased. Friable sand may slough	Small to moderate quantities of water. Coefficient of transmissibility probably averages about 15 per cent of that of Cambrian-Ordovician Aquifer.
	Chazyan	St. Peter								
	Prairie du Chien	Shakopee New Richmond Oneota					0-400	Dolomite, sandy, cherty; sandstone. Sandstone interbedded with dolomite, white to pink, coarse-grained, cherty, sandy	Crevices encountered locally in the dolomite, especially in Trempealeau. Casing generally 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. Coefficient of transmissibility probably averages about 35 per cent of that of Cambrian-Ordovician Aquifer.
Cambrian	St. Croixian	Trempealeau					0-225	Dolomite, white, fine-grained, geodic quartz, sandy at base		
		Franconia					45-175	Dolomite, sandstone, and shale glauconitic, green to red, micaceous		
		Ironton	Ironton-Galesville Sandstone				105-270	Sandstone, fine- to medium-grained, well sorted, upper part dolomitic	Amount of cementation variable. Lower part more friable. Sometimes sloughs.	Most productive unit of Cambrian-Ordovician Aquifer. Coefficient of transmissibility probably averages about 50 per cent of that of Cambrian-Ordovician Aquifer.
		Galesville								
		EauClaire	EauClaire	Mt. Simon Aquifer			235-450	Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic	Casing not usually necessary. Locally weak shales may require casing.	Shales generally not water yielding. Act as confining bed between Ironton-Galesville and Mt. Simon
		Mt. Simon					1000-2000±	Sandstone, coarse-grained, white, red in lower half; lenses of shale and siltstone, red, micaceous	Casing not required.	Moderate amounts of water; permeability intermediate between that of Glenwood-St. Peter and Ironton-Galesville.
Precambrian crystalline rocks										

composed of fine- to coarse-grained sandstone some of which is dolomitic, and it generally exceeds 150 feet in thickness. The basal zone of the Ironton-Galesville Sandstone is commonly the least cemented and most favorable water-producing zone. The friable zones, encountered in the lower part of the unit, are often shot to increase the yields of deep sandstone wells. A map showing the elevation of the top of the Ironton-Galesville Sandstone is given in figure 3.



After Suter, et al (1959)

Figure 1. Cross sections of the structure and stratigraphy of bedrock aquifers and piezometric profile of the Cambrian-Ordovician Aquifer in northern Illinois

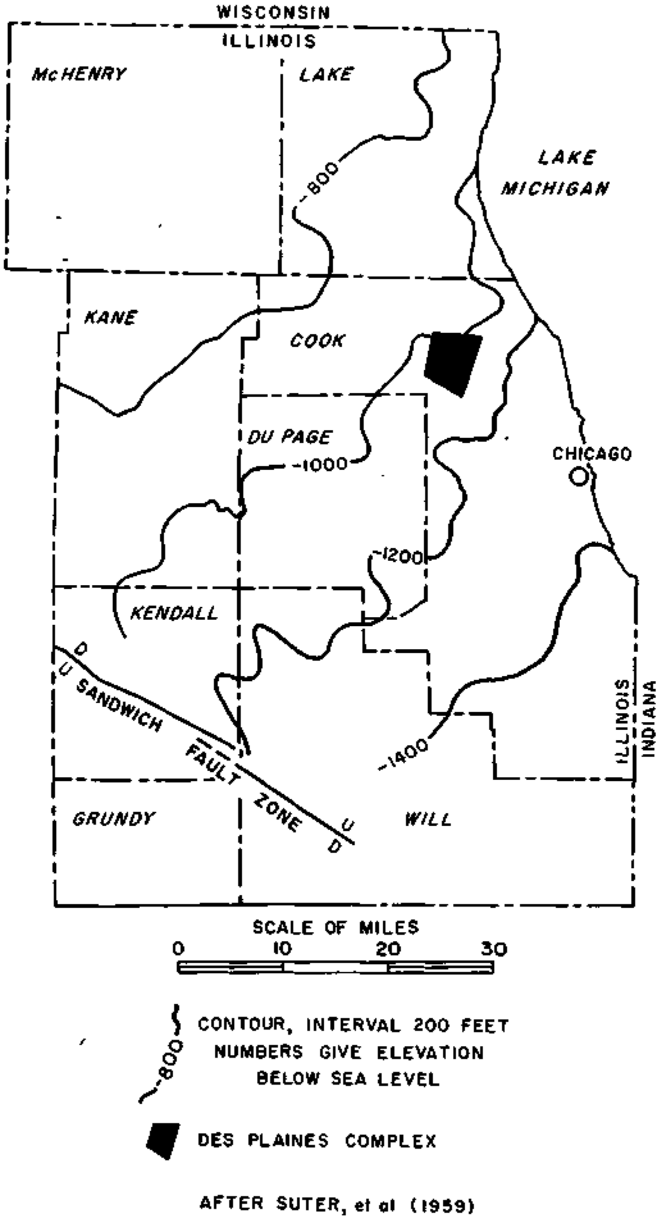


Figure 2. Elevation of the top of the Mt. Simon Aquifer in northeastern Illinois

The Franconia Formation, consisting chiefly of interbedded sandstones, shales, and dolomites, is somewhat similar to the Eau Claire Formation. The shales and dolomites yield very little water; however, the sandy parts of the formation contribute moderate to small amounts of water to wells where it is not cased off by liners. The fine-grained sandstones are much less permeable than the Ironton-Galesville Sandstone.

The uppermost unit of the Cambrian rocks is the Trempealeau Dolomite. The thickness of the unit is variable because of pre-St. Peter erosion. At some places in northern Illinois the Trempealeau Dolomite has been completely eroded and Glenwood-St. Peter rocks overlie the Franconia Formation. Except where secondary openings such as joints, fissures, and crevices have developed, the unit contributes little water to deep sandstone wells. The Trempealeau Dolomite is sometimes locally well creviced, according to drillers' reports and geophysical logs of wells, and is partly responsible for exceptionally high yields of several deep sandstone wells in the Chicago region and the Rockford area.

Ordovician Rocks

The Ordovician rocks have been divided into four geohydrologic units (Suter, et al, 1959). In ascending order the units are: Prairie du Chien Series; Glenwood-St. Peter Sandstone; Galena - Platteville Dolomite; and Maquoketa Formation. The Prairie du Chien Series, consisting of the Shakopee and Oneota Dolomites and the New Richmond Sandstone, is composed chiefly of dolomite with lenses of sandstone. The series has been removed in parts of northern Illinois by pre-St. Peter erosion and immediately underlies the drift in some areas. The Prairie du Chien Series furnishes moderate to small quantities of water to wells uncased in the unit.

The Glenwood-St. Peter Sandstone is widely utilized as an aquifer for small municipalities, subdivisions, public institutions, parks, and small industries having water requirements less than 200 gpm. The unit contributes moderate quantities of water to wells uncased to deeper bedrock aquifers and it ranges third after the Ironton-Galesville Sandstone and Mt. Simon Aquifer in consistency of permeability and production. The Glenwood-St. Peter Sandstone is mostly fine- to medium-grained, and incoherent to friable. The thickness, cementation, and lithologic character of the unit vary greatly; the upper part is often shaly or dolomitic in character and the lower part is commonly composed of shale and conglomerate. Great thicknesses of Glenwood-St. Peter Sandstone are encountered in channel areas, as shown in figure 4A, where the unit is as much as 650 feet thick. The unit is missing due to erosion in some areas but commonly has a thickness of about 200 feet. The yield of the Glenwood-St. Peter Sandstone increases with its thickness but is not directly proportional to thickness because in channel areas the thicker sections may contain a substantial amount of shale and conglomerate. The Glenwood-St. Peter Sandstone underlies the drift in central and northwestern parts of northern Illinois. Elevations of the top of the unit are given in figure 5. The upper and lower parts of the unit generally yield small amounts of water, and because of caving it is common practice to set a liner through the basal part. Production from the Glenwood-St. Peter Sandstone is mostly confined to the middle 60 or more feet of the unit.

The Galena-Platteville Dolomite is dense to porous, partially argillaceous and cherty with shale partings and sandy dolomite beds. Interbedded dolomitic limestone and calcareous dolomite grade into one another at places. The unit is the upper bedrock formation in many counties in central and northwestern parts of northern Illinois. In these areas the thickness of the unit varies because the bedrock surface has been eroded. The Galena-Platte ville Dolomite has a uniform thickness averaging about 300 feet in areas

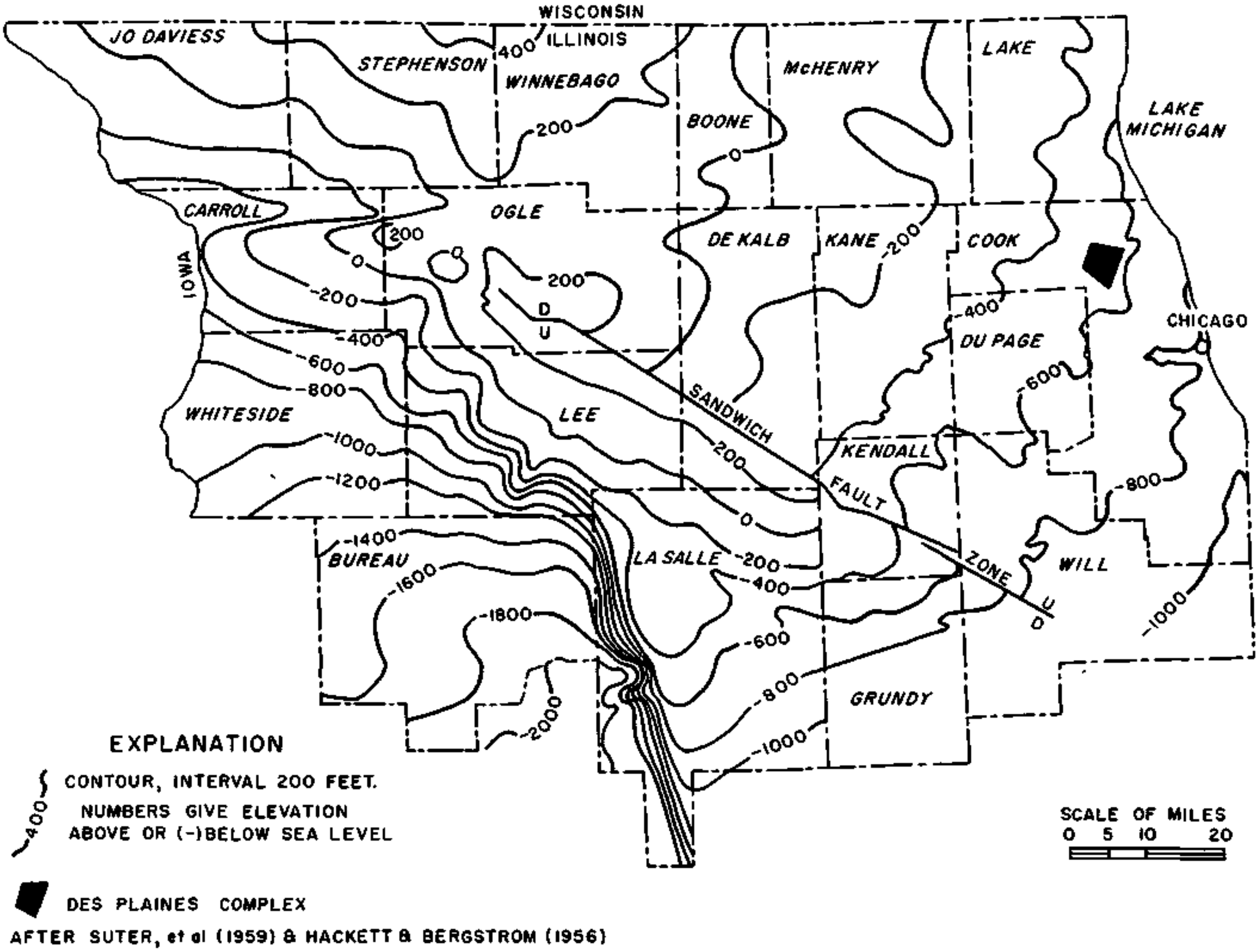


Figure 3. Elevation of the top of the Ironton-Galesville Sandstone in northern Illinois

where it is overlain by bedrock. Where the unit directly underlies the drift and solution activity has enlarged openings, the Galena-Platteville yields moderate quantities of water to wells. Where the unit is overlain by the Maquoketa Formation, the dolomite is a less favorable source of ground water and yields very little water from joints, fissures, and solution cavities.

The Maquoketa Formation overlies the Galena-Platteville Dolomite in large parts of northern Illinois and is the upper unit of the Ordovician rocks. The unit consists mostly of shale, dolomitic shale, and argillaceous dolomite and has a maximum thickness of about 250 feet in the Chicago region. In 1958, the artesian pressure of the water in rocks below the formation was several hundred feet below the water table in most of northeastern Illinois, and downward movement of water through the Maquoketa Formation was appreciable. Studies made by Walton (1960) indicate that the average vertical permeability of the Maquoketa Formation in northeastern Illinois is about 0.00005 gpd per square foot and that in 1958 leakage through the confining bed was about 8.4 mgd or 11 per cent of the water pumped from deep sandstone wells in the Chicago region.

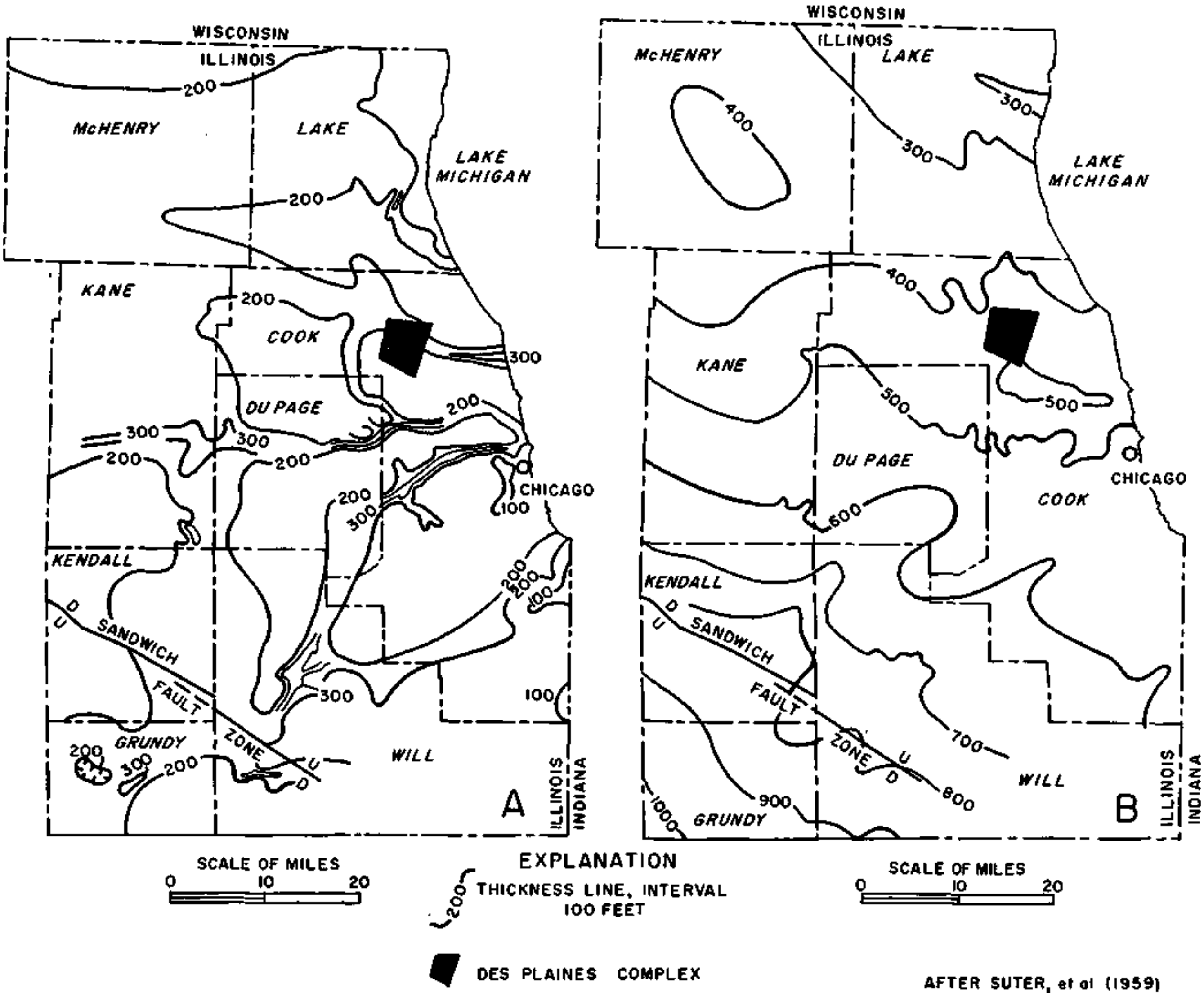
Cambrian-Ordovician Aquifer

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 in northeastern Illinois and is called the Cambrian-Ordovician Aquifer (Suter, et al, 1959).

The Maquoketa Formation above the Galena-Platteville Dolomite greatly retards the vertical movement of ground water and confines the water in the Cambrian-Ordovician Aquifer under leaky artesian conditions. The Cambrian-Ordovician Aquifer receives water from overlying glacial deposits mostly in areas where the Galena-Platteville is the uppermost bedrock formation below the glacial deposits west of the border of the Maquoketa Formation shown in figure 1. Recharge of the glacial deposits occurs from precipitation that falls locally. The coefficients of transmissibility and storage of the Cambrian-Ordovician Aquifer are fairly uniform throughout large areas in northeastern Illinois and average 17,000 gallons per day per foot (gpd/ft) and 0.00035, respectively (Suter, et al, 1959). Deep sandstone wells in Kankakee County and near the Indiana state line have small yields indicating that the coefficient of transmissibility of the Cambrian-Ordovician Aquifer decreases rapidly south of Joliet and east of Chicago.

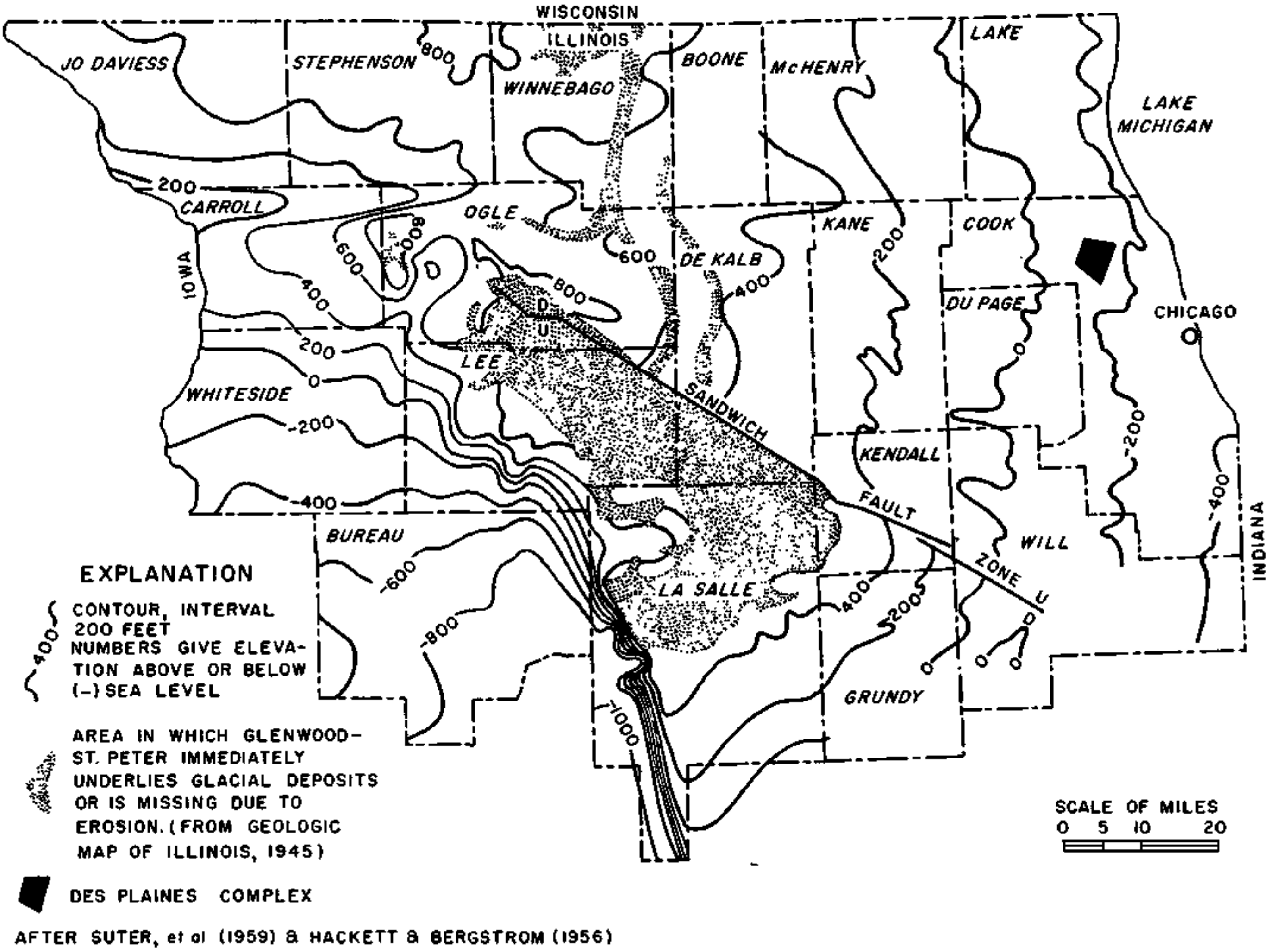
Pumpage of ground water from deep sandstone wells in the Chicago region increased gradually from 200,000 gpd in 1864 to 91.7 mgd in 1960 (Sasman, Prickett, and Russell, 1961). Pumpage is concentrated in six centers: the Chicago, Joliet, Elmhurst, Des Plaines, Aurora, and Elgin areas. Many deep sandstone wells are either uncased or faultily cased in the Silurian age dolomite overlying the Maquoketa Formation and allow leakage. The Mt. Simon Aquifer is also penetrated by a large number of wells. Thus, water pumped from deep sandstone wells does not come from the Cambrian-Ordovician Aquifer alone. It is estimated that of the 91.7 mgd pumped from deep sandstone wells in 1960, 52.3 mgd came from the Cambrian-Ordovician Aquifer.

The changes in artesian pressure produced by pumping have been pronounced and widespread. Figure 6B shows the decline of water levels in deep sandstone wells from 1864 to 1958. The lowering of the water levels accompanying the withdrawals of ground water has established steep hydraulic gradients west and north of Chicago as shown by the piezometric surface map in figure 6A, and large quantities of water are at present being transmitted from recharge areas in northern Illinois and minor quantities from southern Wisconsin toward centers of pumping. Large amounts of water derived from storage within the Cambrian-Ordovician Aquifer and from vertical leakage of water through the Maquoketa Formation move toward Chicago and Joliet from the east in Indiana, from the south in Illinois, from the west in Illinois, and from the northeast beneath Lake Michigan. In 1959 the piezometric surface was below the top of the Galena-Platteville Dolomite in the deepest parts of the cones of depression at Chicago, Elmhurst, Des Plaines, and Joliet.



AFTER SUTER, et al (1959)

Figure 4. Thickness of the Glenwood-St. Peter Sandstone (A) and thickness of rocks between the top of the Glenwood-St. Peter Sandstone and the top of the Ironton-Galesville Sandstone (B) in northeastern Illinois



AFTER SUTER, et al (1959) & HACKETT & BERGSTROM (1956)

Figure 5. Elevation of the top of the Glenwood-St. Peter Sandstone in northern Illinois

Silurian, Devonian, Mississippian, and Pennsylvanian Rocks

Rocks of Silurian age overlie the Maquoketa Formation and are buried beneath glacial deposits throughout the eastern one-third and parts of the southwestern one-third of northern Illinois. Silurian rocks also occur beneath rocks of Devonian and Mississippian age in the southern one-third of northern Illinois and are mainly dolomites. Ground water occurs in joints, fissures, and solution channels, and some wells in the dolomite yield more than 1000 gpm. It is estimated (Suter, et al, 1959) that about 20.5 mgd of water pumped from deep sandstone wells in the Chicago region was obtained from the Silurian age dolomite through uncased upper portions of wells in 1958.

Bedrocks of Devonian, Mississippian, and Pennsylvanian ages occur at places on top of Silurian rocks or overlie older rocks. They underlie the glacial drift in parts of the southern part of northern Illinois. The Devonian and Mississippian rocks are composed mostly of dolomitic and calcareous shale and the Pennsylvanian rocks are mainly shales with thin sandstone, limestone, clay, and coal beds. The rocks mentioned above yield small quantities of water from creviced dolomite and sandstone beds.

CONSTRUCTION FEATURES OF WELLS

The deep sandstone wells in northern Illinois are drilled by the cable tool method. They range in depth from 150 to 2812 feet in northeastern Illinois and from 98 to 2583 feet in northwestern Illinois. The average depth of wells, influenced greatly by the large number of wells in the Chicago region, is about 1300 feet. In the late 1800's wells were drilled deep enough to obtain a flowing well. The depths of many of these wells were often excessive insofar as quality and quantity of

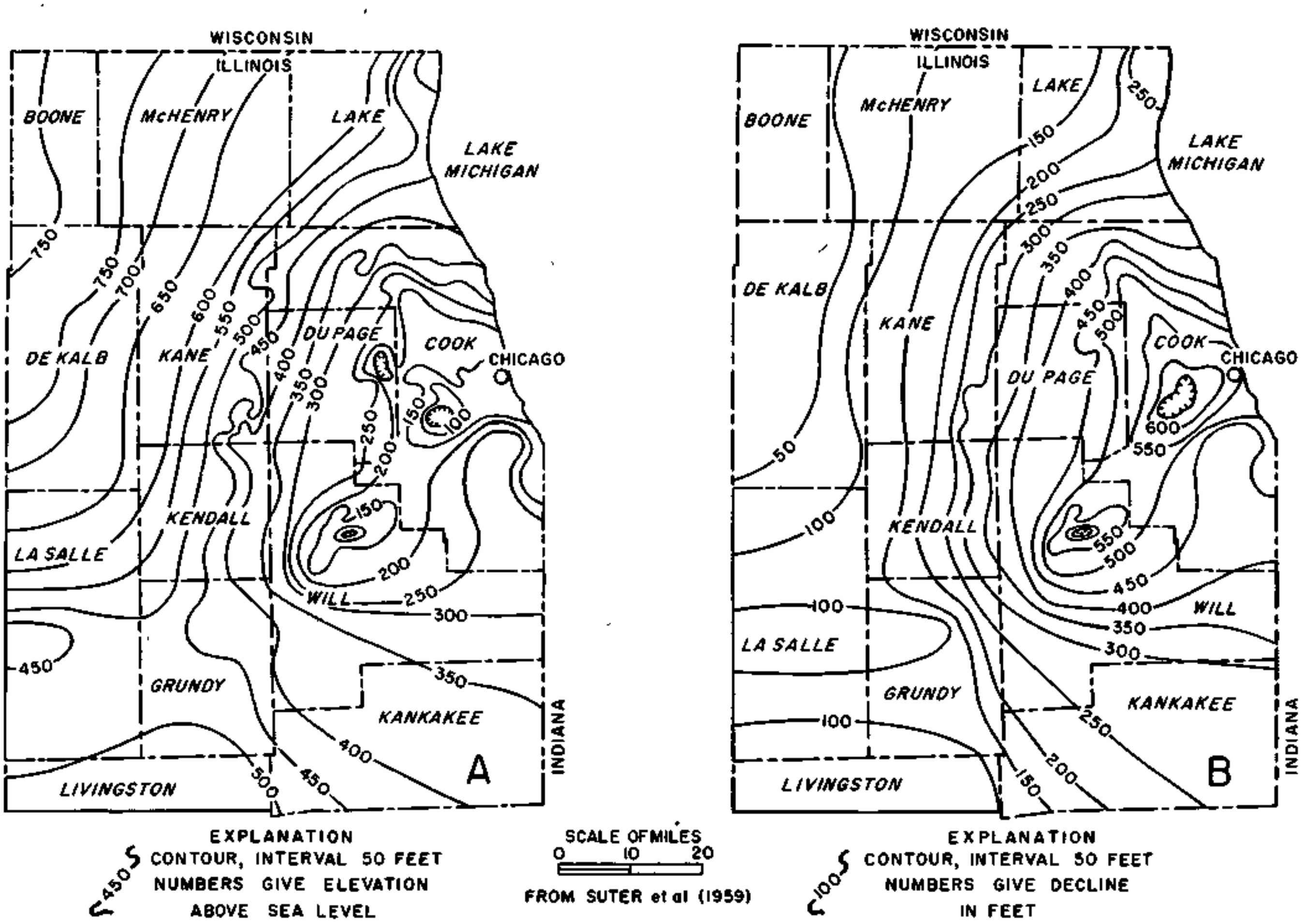


Figure 6. Peizometric surface of the Cambrian-Ordovician Aquifer in 1958 (A) and decline of artesian pressure in the Cambrian-Ordovician Aquifer, 1864-1958 (B) in northeastern Illinois

water was concerned. Anderson (1919) reports that in 1916 the average depth of the important or large yielding wells in northeastern Illinois was about 1700 feet and that a number of wells had been drilled to depths greater than 2200 feet.

Most deep sandstone wells penetrate more than one bedrock aquifer and often several units of an aquifer contribute to the yield of a well. Wells may be grouped into four categories according to uncased units or aquifers: (1) Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone (G-P, G-SP); (2) Cambrian-Ordovician Aquifer (C-O); (3) Ironton-Galesville Sandstone (I-G); and (4) Cambrian-Ordovician and Mt. Simon Aquifers (C-O, MS). Many deep sandstone wells are either uncased or faultily cased in the Silurian age dolomite and also obtain large quantities of water from that aquifer. The distribution of wells in the four categories is given in table 2.

In northeastern Illinois most wells are uncased in all of the units of the Cambrian-Ordovician Aquifer. Only a few wells, mostly at Joliet, are uncased only in the Ironton-Galesville Sandstone. A large number of wells, particularly along the Fox River in the Aurora-Elgin area, are uncased both in the Cambrian-Ordovician Aquifer and in the Mt. Simon Aquifer. Small to moderate quantities of water are pumped from wells uncased in the Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone. These wells are concentrated in Lake, DeKalb, Grundy, and Kankakee Counties. Wells uncased in the Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone are much more common in northwestern Illinois than in northeastern Illinois. At Rockford, Sterling, and Dixon most wells are uncased in the Cambrian-Ordovician and Mt. Simon Aquifers. Wells uncased in the Cambrian-Ordovician Aquifer are widely scattered throughout northwestern Illinois.

Table 2. Distribution of Wells

	Percentage of wells uncased in units or aquifers			
Area	G-P,G-SP	C-O	I-G	C-O,MS
Northeastern Illinois	22	57	4	17
Northwestern Illinois	50	24	negligible	26
Northern Illinois	36	40	2	22

Deep sandstone 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. Where present beneath unconsolidated deposits, the Silurian age dolomite 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. A few wells have been cased completely to the Ironton-Galesville Sandstone or to the Mt. Simon Aquifer.

The diameters of wells are generally smaller at the bottom than at the top. Bore diameters ranging from 8 to 12 inches at the top and finished 4 to 8 inches at the bottom were common in the early 1900's. Wells of recent design are often finished 16 to 20 inches in diameter. Generalized graphic logs of typical wells in northern Illinois are given in figures 7-9.

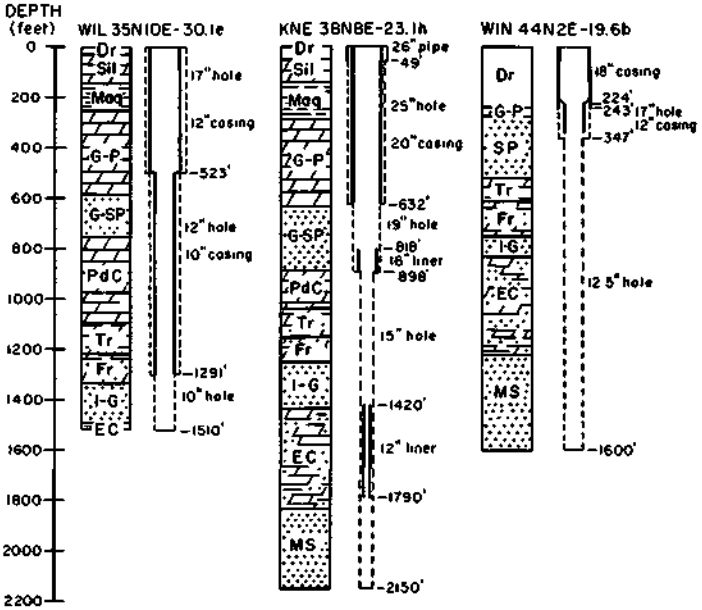


Figure 7. Gon struct ion features of selected wells uncased in the Ironton-Galesville Sandstone and in the Cambrian-Ordovician and Mt. Simon Aquifers

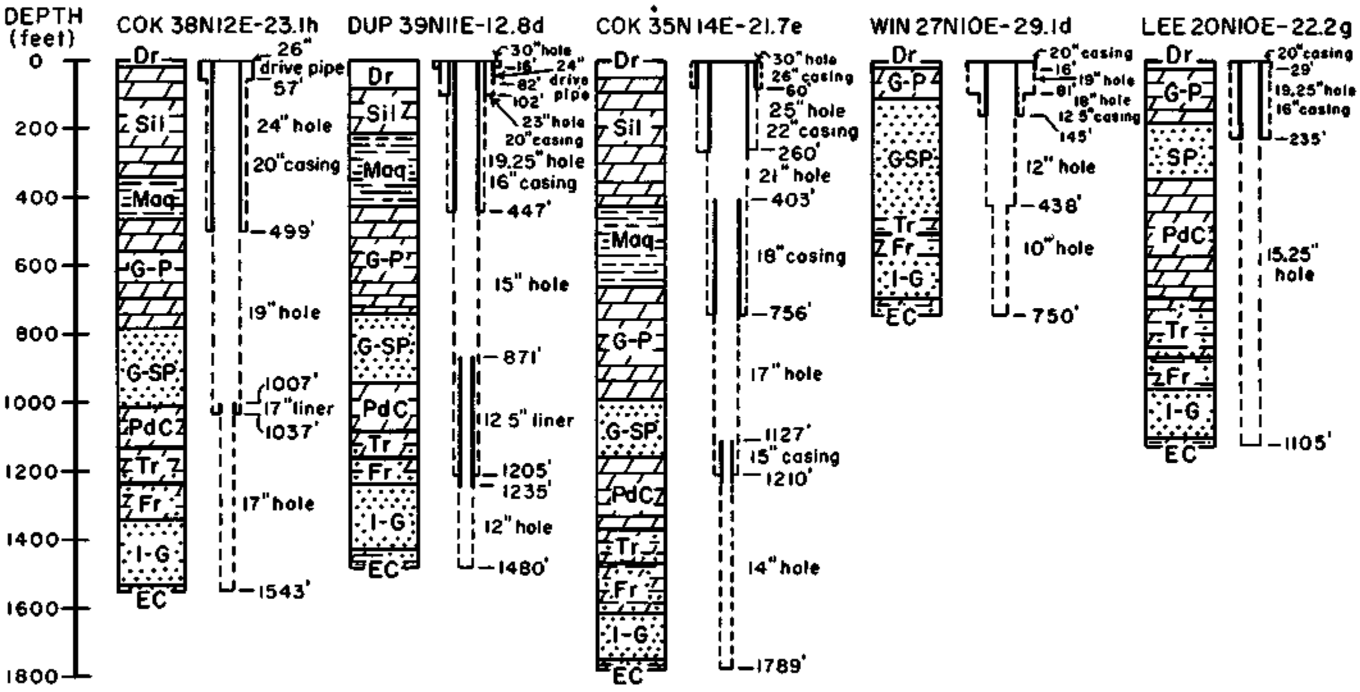


Figure 8. Construction features of selected wells uncased in the Cambrian-Ordovician Aquifer

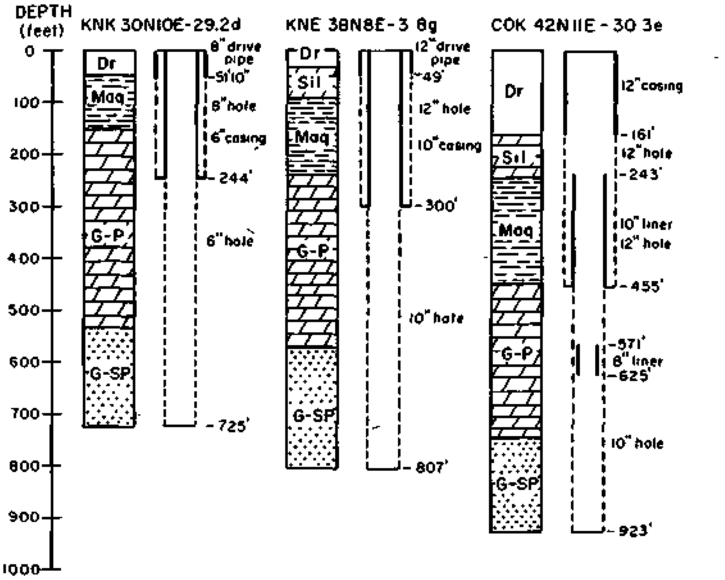


Figure 9. Construction features of selected wells uncased in the Galeno-Platteville Dolomite and the Glenwood-St. Peter Sandstone

SPECIFIC-CAPACITY DATA

The yield of a well may be expressed in terms of its specific capacity. The specific capacity of a well is defined as the yield of the well 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 discharging at a constant rate in a homogeneous, isotropic, artesian aquifer infinite in areal extent, is from the nonequilibrium formula (Theis, 1935) given by the following equation:

$$\frac{Q}{s} = \frac{T}{264 \log_{10} \frac{Tt}{1.87 r_w^2 S} - 65.5} \qquad (1)$$

where:

Q = discharge of pumped well in gallons per minute
s = drawdown in feet
T = coefficient of transmissibility in gallons per day per foot
S = coefficient of storage
r_w = nominal radius of well in feet
t = time in days after pumping started

The coefficient of transmissibility is defined as the rate of flow of water in gallons per day through a vertical strip of the aquifer 1 foot wide and extending" the full saturated thickness of the aquifer under a hydraulic gradient of 100 per cent (1 foot per foot) and at the prevailing temperature of the water. The coefficient of storage is defined as the volume of water the aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface, and is expressed as a decimal fraction.

Equation 1 was derived by assuming that (1) the well completely penetrates the aquifer, (2) well loss is negligible, and (3) the effective radius of the well has not been affected by the drilling and development of the well and is equal to the nominal radius of the well.

From equation 1 the theoretical specific capacity of a well depends in part upon the radius of the well and the pumping period. The theoretical specific capacity is directly proportional to log $r_w 2$ and inversely proportional to log t. The relationships between theoretical specific capacity and the radius of a well and the pumping period are shown in figure 10. Diagram A indicates that a 30-inch diameter well has a specific capacity about 13 per cent more than that of a 12-inch diameter well. It is evident that large increases in the radius of a well are accompanied by comparatively small increases in specific capacity. Diagram B shows that the theoretical specific capacity decreases with the length of the pumping period because the drawdown continually increases with time as the cone of depression of the well expands.

From the foregoing discussion it is evident that the yields of wells cannot be compared unless specific-capacity data are adjusted to a common radius and pumping period base. The theoretical specific capacity does not change with the pumping rate.

In addition to the drawdown in equation 1, there is generally a head loss or drawdown (well loss) in the discharging well due to the turbulent flow of water as it enters the well itself and flows upward through the bore hole. Well loss, s_w,

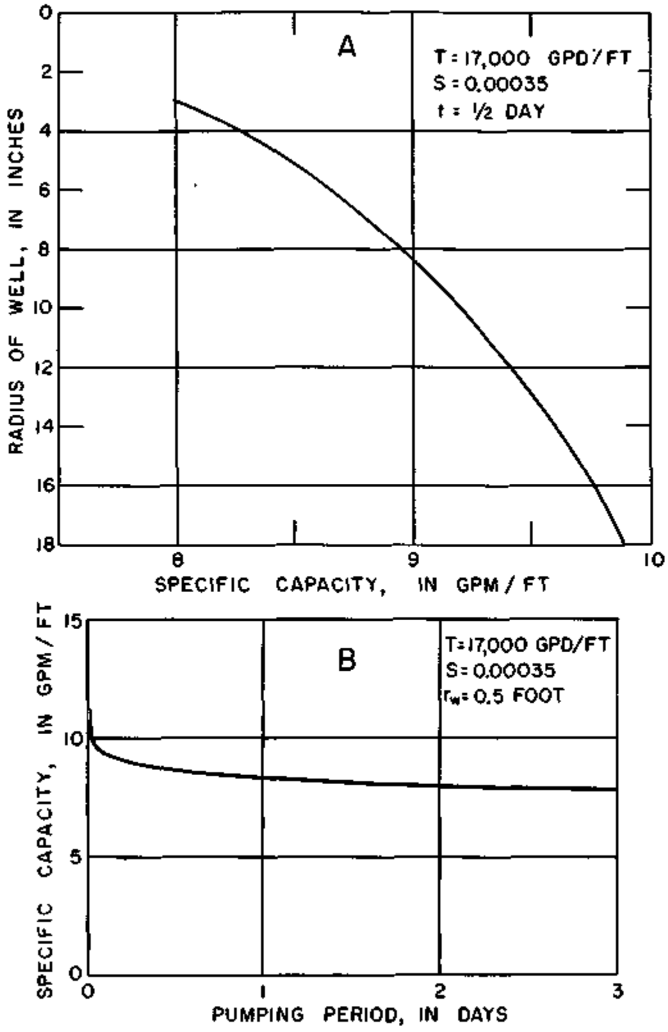


Figure 10. Theoretical relation between specific capacity and the radius of a well (A) and the pumping period (B)

may be represented approximately by the following relationship (Jacob, 1946):

$$s_w = CQ2 \tag{2}$$

where:

s_w = well loss in feet
C = "well-loss" constant in sec /ft^5
Q = rate of pumping in cubic feet per second

In wells having appreciable well loss, the specific capacity decreases with an increase in the pumping rate. Thus, the yields of wells cannot be compared unless well losses are subtracted from observed drawdowns and the specific capacities are computed, based on radial flow and described by equation 1.

The value of C in equation 2 may be estimated from the data collected during a "step-drawdown" test by using the equation given below (Jacob, 1946). During a step-drawdown test the well is operated during three successive periods of one hour at constant fractions of full capacity.

For steps 1 and 2 For steps 2 and 3

$$C = \frac{\dfrac{\Delta s_2}{\Delta Q_2} - \dfrac{\Delta s_1}{\Delta Q_1}}{\Delta Q_1 + \Delta Q_2} \qquad C = \frac{\dfrac{\Delta s_3}{\Delta Q_3} - \dfrac{\Delta s_2}{\Delta Q_2}}{\Delta Q_2 + \Delta Q_3} \tag{3}$$

where:

the A s terms represent increments of drawdown produced by each increase (A Q) in the rate of pumping. The commonly used dimensions of A s and A Q are feet and cubic feet per second, respectively.

The coefficient of transmissibility of an aquifer is related to the specific capacity of a production well and can be estimated from specific-capacity data. The relationship between the theoretical specific capacity in equation 1 and the coefficient of transmissibility of an artesian aquifer is given in figure 11.

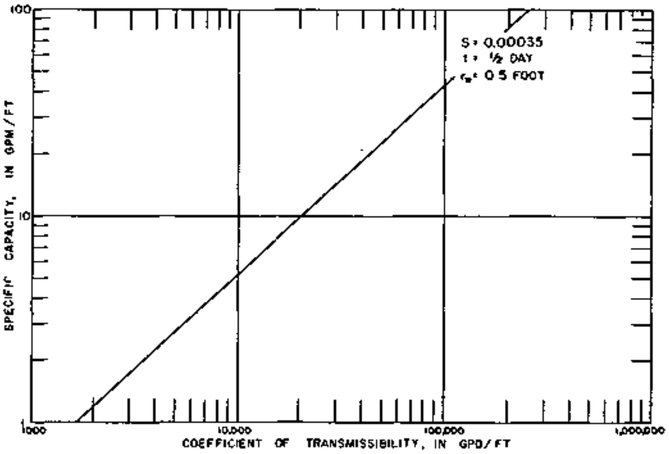


Figure 11. Theoretical relation between specific capacity and the coefficent of transmissibility

Description and Analysis of Specific-Capacity Data

During the period 1906-1960, well-production tests were made by the State Water Survey on more than 500 deep sandstone wells in northern Illinois. The well-production tests consisted of pumping a well at a constant rate and frequently measuring the drawdown in the pumped well. Drawdowns were commonly measured with an airline or electric dropline; rates of pumping were largely measured by means of a circular orifice at the end of the pump discharge pipe.

The results of the tests are summarized in the table presented in the appendix to this report. Only tests for wells obtaining little or no water from the Silurian age dolomite were considered. Each test is identified by the well number of the pumped well. The units or aquifers contributing to the yields of wells and the diameters of inner casings, which coincide largely with the diameters of well bores through contributing formations, are given.

The lengths of tests range from less than one hour to 56 hours and average about 12 hours. Pumping rates range from 8 to 2310 gpm and average about 600 gpm. Diameters of inner casings range from 4 to 26 inches and the average radius of inner casings is about 0.5 foot.

Step-drawdown tests were made on several wells in northeastern Illinois. Data collected during these tests were substituted into equation 3 to determine well-loss constants. Computed values of C are given in table 3.

Table 3. Computed Well-Loss Constants for Selected Wells in Northeastern Illinois

Well Number	Average C (sec^2/ft^5)
DUP 40N11E-13.5b	10
DUP 40NllE-35.5e	6
COK 42N12E-35.4d	15
COK 42N11E-11.7e	8
COK 36N13E- 9.8b	9
COK 38N12E-23.1h	14
COK 38N12E-23.3g	4
COK 38N12E-24.7f	10
WIL 33N10E- 9.4f	10
WIL 35N10E-20.7g	11
KNE 41N8E-24.6h_2	15
DUP 39N11E-10.3g	1
KNE 41N8E-23.6b	11

Values of well loss were estimated for all wells based on the results of step-drawdown tests, well-construction data, pumping-rate data in the appendix table, and equation 2. Well losses were subtracted from observed drawdowns, and specific capacities adjusted for well losses were computed.

The average coefficient of storage, 0.00035, computed from pumping test data for northeastern Illinois (see Suter, et al, 1959) and several values of t and r_w were substituted into equation 1 to determine the relationship between specific capacity and the coefficient of transmissibility for various values of r_w^2/t. Figure 12 shows the relationship between specific capacity and the coefficient of transmissibility for several values of r_w^2/t. This graph, specific capacities adjusted for well losses, and data concerning the lengths of tests and radii of wells in the appendix were used to estimate theoretical coefficients of transmissibility of units or aquifers contributing to the yields of wells. Specific capacities adjusted for well losses were then further adjusted to a common radius and pumping period based on estimated coefficients of transmissibility and the graphs in figure 12. The average radius and pumping period from the appendix table were used as the bases. Observed specific capacities, adjusted for well losses and to a common radius and pumping period, are given in the appendix.

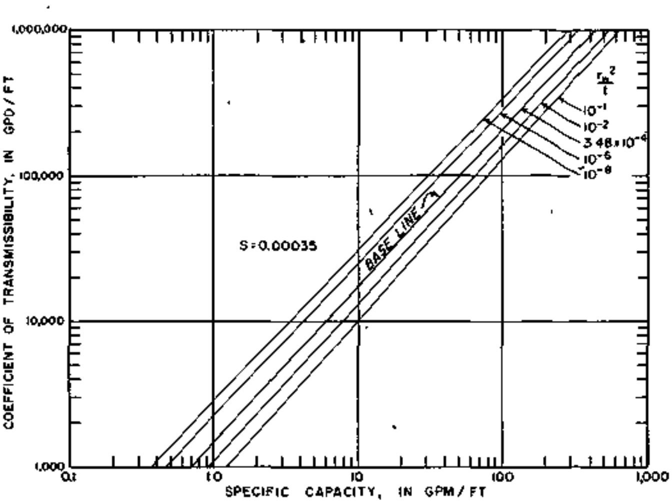


Figure 12. Coefficent of transmissibility versus specific capacity for several values of r_w^2/t

No great accuracy is inferred for the adjusted specific capacities because they are based on estimated well-loss constants and an average coefficient of storage. However, they come much closer to describing the relative yields of wells than do the observed specific capacities based on pumping rates, pumping periods, and radii which vary from well to well.

The yields of deep sandstone wells are affected by many man-made factors such as leaky casings, partial clogging of the well bore, partial penetration of units or aquifers, poor well construction, and shooting, in addition to natural conditions. All of these factors and more must be taken into consideration in appraising the relative, local, and regional yields of units or aquifers. The deeper the well the more complicated becomes the problem of reviewing the conditions entering into the matter of water yield. Passage of water in wells between units may seriously affect yield. Allowance must be made for the fact that some deep sandstone wells supply little water from the deeper units penetrated because of caving or bridging in the wells.

YIELDS OF INDIVIDUAL BEDROCK UNITS

Most deep sandstone wells in northern Illinois tap several bedrock units and are multiunit wells. The specific capacity of a multiunit well is the numeric sum of the specific capacities of the individual units. The yields of individual units can be ascertained by studying the specific capacities of multiunit wells.

Ironton-Galesville Sandstone

Very few wells are uncased only in the Ironton-Galesville Sandstone and little is known concerning the regional variation of the yields of wells in the unit. Available data are summarized in table 4.

Table 4. Adjusted Specific Capacities for Wells Uncased in Ironton-Galesville Sandstone

Well Number	Adjusted specific capacity (gpm/ft)
WIL 35N10E-30.1a	3.6*
WIL 35N10E-30.1e	3.7*
WIL 35N10E-30.1c$_2$	3.6
WIL 35N10E-30.1c$_2$	4.2*
WIL 35N10E-30.3c	3.7
WIL 35N10E-20.6a	2.5*
WIL 35N10E-10.1a	3.1*
WIL 35N 9E-25.1e	7.0*
KNE 38N 8E-15.6h	4.1*
LKE 45N11E-14.5a	1.7
KNK 30N10E-32	2.6

* Well was shot before test

Based on these data, considering the yields of wells uncased in the other units of the Cambrian-Ordovician Aquifer as well as in the Ironton-Galesville Sandstone, and taking into account the effects of shooting, it is probable that on a regional basis the yields of Ironton-Galesville wells decrease from less than 4.0 gpm/ft in Kane County to less than 3.0 gpm/ft in Kankakee County. The data suggest that the yields of wells uncased in the Ironton-Galesville Sandstone and, therefore, the coefficient of transmissibility of the Ironton-Galesville Sandstone gradually decreases south and east of Chicago in northeastern Illinois. From equation 1 or figure 12, it is estimated that the coefficient of transmissibility of the Ironton-Galesville Sandstone decreases from about 7000 gpd/ft in Kane County to 5000 gpd/ft in Kankakee County.

The coefficient of permeabi'ity indicates the capacity of a unit cross section of the aquifer to transmit water, and the average field permeability is equal to the coefficient of transmissibility divided by the saturated thickness of the aquifer, in feet. Based on average thicknesses of 175 and 200 feet in Kane and Kankakee Counties, respectively, the permeability of the Ironton-Galesville Sandstone reduces from about 40 gallons per day per square foot (gpd/sq ft) in Kane County to 25 gpd/sq ft in Kankakee County.

Glenwood-St. Peter Sandstone

Test data are available for more than 200 wells uncased in the Galena-Platteville Dolomite and Glenwood-St. Peter Sandstone. In areas where the Maquoketa Formation is present wells uncased only in the Galena-Platteville Dolomite generally yield very little or no water. Wells uncased in these two units and east of the border of the Maquoketa Formation (see figure 1) in northeastern Illinois obtain most of their yields from the Glenwood-St. Peter Sandstone.

The thickness of the Glenwood-St. Peter Sandstone varies from place to place as shown in figure 4A. The specific capacities of wells in areas where the Maquoketa Formation is present were plotted on graph paper against the thicknesses of the Glenwood-St. Peter Sandstone penetrated by the wells. The data are scattered and not shown; however, the general relationship between specific capacity and thickness is shown by the curve in figure 13A. The specific capacity increases with thickness but is not directly proportional to thickness. For example, the specific capacity for a thickness of 100 feet is about 0.8 gpm/ft whereas the specific capacity for a thickness of 300 feet is about 1.6 gpm/ft.

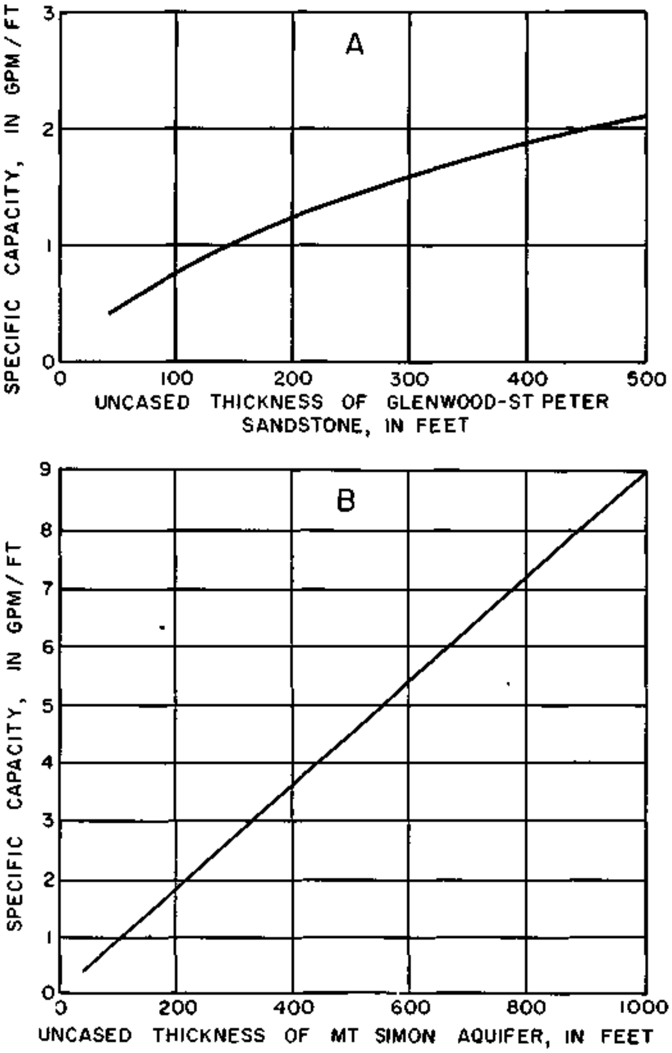


Figure 13. Relation between the specific capacity of a well and the uncased thickness of the Glenwood-St. Peter Sandstone (A) and the uncased thickness of the Mt. Simon Aquifer (B)

To determine regional variations in the yield of the Glenwood-St. Peter Sandstone, the specific capacities of wells were adjusted to a base thickness of 200 feet by means of the curve in figure 13A. Only wells in areas where the Maquoketa Formation is present were considered. Analysis of adjusted specific-capacity data suggests that the yield of the Glenwood-St. Peter Sandstone varies regionally as shown in figure 14A. It should be pointed out that specific capacities in figure 14A can be applied only to areas where the Maquoketa Formation is present and the Glenwood-St. Peter Sandstone is about 200 feet thick.

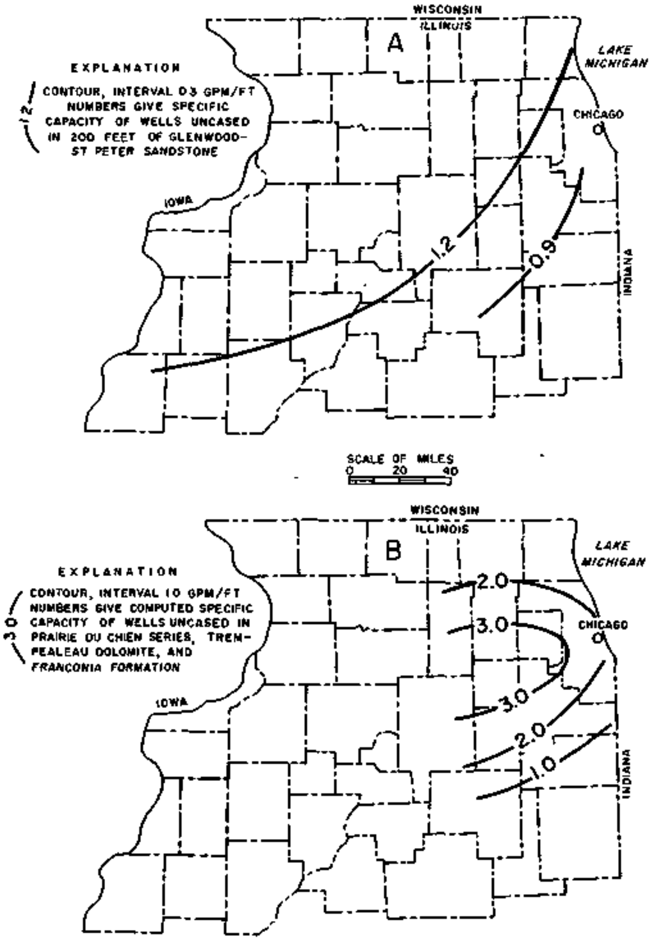


Figure 14. Specific capacities of wells uncased in the Glenwood-St. Peter Sandstone (A) and the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation in northeastern Illinois(B)

Except in some areas where the Glenwood-St. Peter Sandstone crops out at the land surface, the specific capacities of wells uncased in 200 feet of the Glenwood-St. Peter Sandstone probably decrease gradually to the south and east from between 1.5 and 1.2 gpm/ft in northwestern Illinois to less than 0.9 gpm/ft south of Chicago. Based on figures 11 and 14A, it is estimated that the permeability of the Glenwood-St. Peter Sandstone decreases gradually from about 15 gpd/sq ft in northwestern Illinois to about 9 gpd/sq ft south of Chicago. The average permeability of the Glenwood-St. Peter Sandstone is about one-third as great as the average permeability of the Ironton-Galesville Sandstone. Available data suggest that the yield of the Glenwood-St. Peter Sandstone is greater than average in some areas where the sandstone is the uppermost bedrock formation below the glacial deposits.

Galena-Platteville Dolomite

In the central and northwestern parts of northern Illinois the yield of the Galena-Platteville Dolomite is much greater in areas where the Maquoketa Formation is missing than in areas where the Maquoketa Formation is present. Wells uncased in the Galena-Platteville Dolomite and Glenwood-St. Peter- Sandstone in areas where the Maquoketa Formation is missing have specific capacities commonly ranging from 4 to 27 gpm/ft and averaging about 10 gpm/ft. The estimated average yield (9 gpm/ft) of wells uncased in the Galena-Platteville Dolomite in areas where the Maquoketa Formation is missing is approximately 45 times as great as the estimated average yield (0.2 gpm/ft) of wells uncased in the Galena-Platteville Dolomite in areas where the Maquoketa Formation is present.

Cambrian-Ordovician Aquifer

Specific-capacity data for wells east of the border of the Maquoketa Formation in northeastern Illinois were analyzed to determine the regional variation of the yield of the Cambrian-Ordovician Aquifer. Data for the Cambrian-Ordovician Aquifer are not sufficient to describe with any degree of accuracy the regional variations in northwestern Illinois. Specific capacities for wells in northeastern Illinois were adjusted to a common base with respect to the thickness of the Glenwood-St. Peter Sandstone by means of the data in figures 13A and 14A. The curve in figure 13A is based on average conditions in northern Illinois. Application of figure 13A to conditions at any particular site requires that a curve be drawn parallel to the given curve through the appropriate specific capacity for a 200-foot thickness as indicated by figure 14A. A thickness of 200 feet, the average thickness of the Glenwood-St. Peter Sandstone in northeastern Illinois, was selected as a base. Adjusted specific capacities were used to construct figure 15B. It should be pointed out that the specific capacities in figure 15B are based on a pumping period of one-half day and a radius of 0.5 foot, and can be applied only to areas where the Glenwood-St. Peter Sandstone is about 200 feet thick.

The yields of wells uncased in the Cambrian-Ordovician Aquifer are highest in Kane, Kendall, and DuPage Counties and decrease rapidly south and east of Chicago. The yields of wells also decrease north and west of Chicago in Lake and McHenry Counties.

Figure 15B shows that the specific capacities of wells decrease from about 7.5 gpm/ft in Kane, Kendall, and DuPage Counties to about 6 gpm/ft in McHenry and Lake Counties and 4.0 gpm/ft in Kankakee County. Specific-capacity data support the conclusions reached by Suter, et al (1959) that the yield of the Cambrian-Ordovician Aquifer decreases south and east of Chicago and that changes in the water-bearing properties great enough to approximate the effect of barrier boundaries occur at distances of about 37 miles east and about 60 miles south of Chicago.

During the period 1922-1954, 63 controlled pumping tests were made in northeastern Illinois to determine the hydraulic properties of the Cambrian-Ordovician Aquifer. A summary of the results of the tests was given by Suter, et al (1959). The coefficient of transmissibility ranges from 10,800 gpd/ft to 26,900 gpd/ft and averages 17,400 gpd/ft. The coefficient of storage ranges from 0.00016 to 0.00068 and averages 0.00035. The hydraulic properties of the Cambrian-Ordovician

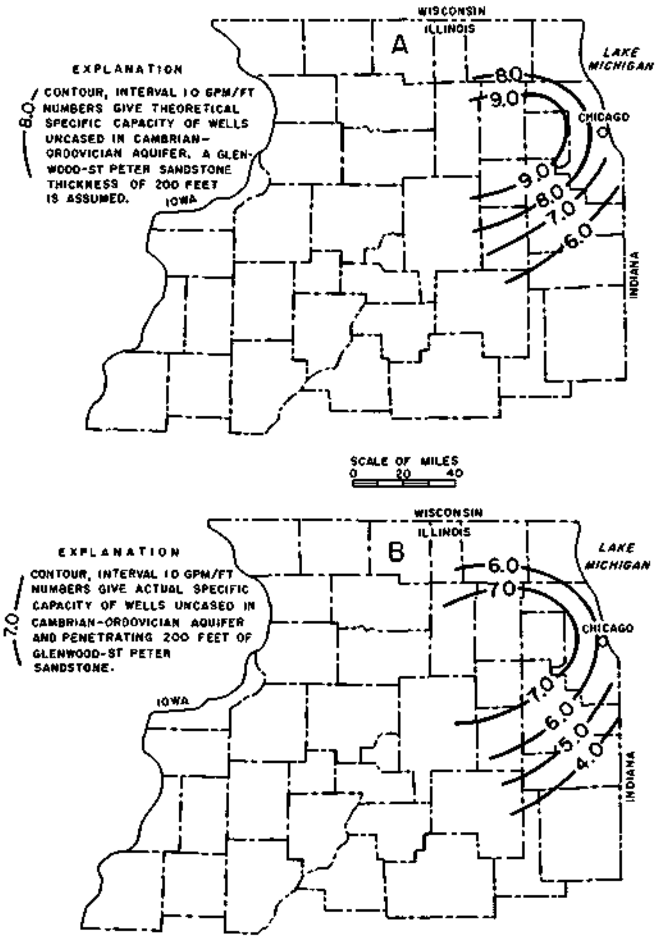


Figure 15. Specific capacities of wells uncased in the Cambrian-Ordovician Aquifer, theoretical (A) and actual (B) in northeastern Illinois

Aquifer and the graph in figure 11 were used to prepare the theoretical specific-capacity map in figure 15A. A pumping period of one-half day and a radius of 0.5 foot were assumed in constructing figure 15A.

Specific-capacity data based on computed hydraulic properties indicate the same regional variation in the yield of the Cambrian-Ordovician Aquifer as do specific-capacity data based on the results of well-production tests. The coefficient of transmissibility of the Cambrian-Ordovician Aquifer probably decreases from about 19,000 gpd/ft in Kane, Kendall, and DuPage Counties to about 16,000 gpd/ft in McHenry and Lake Counties, and to less than 10,000 gpd/ft in parts of Kankakee County.

Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation

There are no wells uncased only in the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation. The combined yield of these units must be inferred from data on wells uncased in the Cambrian-Ordovician Aquifer. The yields of the Galena-Platteville Dolomite and the Glenwood-St. Peter and Ironton-Galesville Sandstones were subtracted from the yield of the Cambrian-Ordovician Aquifer, given in figure 15B, to determine the combined yield of the remaining units. Figure 14B was prepared from computed differences.

The computed specific capacities of wells uncased in the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation vary regionally in a manner similar to the regional variation in the yield of wells uncased in the Cambrian-Ordovician Aquifer. Figure 14B indicates that the combined yield of the units is greatest in Kane, Kendall, and DuPage Counties and decreases to the north, east, and south. Based on figure 14B, it is probable that the coefficient of transmissibility of the units decreases from 6000 gpd/ft in Kane County to 4000 gpd/ft in Lake County and to 2000 gpd/ft in Kankakee County. The combined yield of the units constitutes about 43, 30, and 25 per cent of the total yield of the Cambrian-Ordovician Aquifer in Kane, McHenry, and Kankakee Counties, respectively. The rate of decrease in the combined yield of the units south and east of Chicago is much greater than the rates of decrease in the yields of the Glenwood-St. Peter and Ironton-Galesville Sandstones. The rapid decrease in the yield of the Cambrian-Ordovician Aquifer south and east of Chicago is greatly influenced by the large reductions in the yields of the units.

Figures 4A and 4B show that the combined thickness of the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation increases from about 100 feet in Lake County to about 600 feet in southern Will County. However, the coefficient of transmissibility of the units decreases in the same direction. It is estimated that the average permeability of the units decreases from about 40 gpd/sq ft in Lake County to about 20 gpd/sq ft in DuPage County and to about 6 gpd/sq ft in southern Will County.

Permeability has little meaning in relation to the dense dolomite beds of the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation. Joints and other crevices constituting permeable zones are irregularly distributed within the units. The permeability of the combined units varies greatly from place to place and with depth. At a few places the Trempealeau Dolomite is well creviced and is partly responsible for exceptionally high yields of several deep sandstone wells. As a spectacular example, well COK 42N12E-31 (see appendix) encountered large crevices in the Trempealeau Dolomite and had a specific capacity of 245 gpm/ft. More commonly, an unusual amount of crevices in the Trempealeau Dolomite will double the yield of a well.

Mt. Simon Aquifer

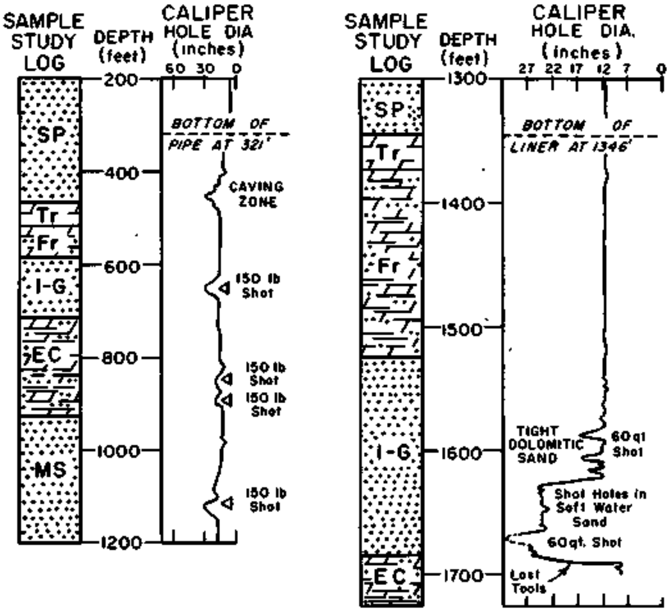
A large number of wells are uncased both in the Cambrian-Ordovician and the Mt. Simon Aquifers. A very few wells (for example, see well COK 40N12E-31.8h in appendix) are uncased only in the Mt. Simon Aquifer. Theoretical yields of wells uncased in the Cambrian-Ordovician Aquifer were subtracted from the yields of wells uncased in both the Cambrian-Ordovician and Mt. Simon

Aquifers. Differences, representing approximate yields of wells uncased in the Mt. Simon Aquifer, were plotted against the depth of penetration into the aquifer. Data are somewhat scattered and are not shown, but the relationship is shown by the graph in figure 13B. The relationship applies both to northeastern Illinois and to northwestern Illinois indicating that the yield of the Mt. Simon Aquifer per foot of penetration is fairly constant with depth throughout northern Illinois. Based on figures 11 and 13B the average permeability of the Mt. Simon Aquifer is about 16 gpd/sq ft and is about one-half as great as the average permeability of the Ironton-Galesville Sandstone.

SHOOTING WELLS TO INCREASE YIELD

Explosives have been used successfully to develop newly constructed deep sandstone wells or to rehabilitate old wells in northern Illinois. Many wells are shot with nitroglycerine (liquid or solidified) opposite several areas in the well bore. Shots of approximately 100 to 600 pounds of 80 to 100 per cent 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 60 feet of the St. Peter Sandstone. Shots are commonly spaced vertically 20 feet apart. The explosions loosen quantities of rock varying from a few cubic feet to several hundred cubic yards that have to be bailed out of the well. Recently, a lighter method of shooting consisting of a string of high explosives (primacord) has been used. Smith (1959) reports that the results of the primacord "shooting" exceeded expectations in several cases and that there was no evidence of any large quantities of loosened rock in the wells.

Careful study of the effects of shooting suggests that in most cases in northern Illinois the yields of deep sandstone wells are increased because (1) the hole is enlarged and (2) fine materials and incrusting deposits on the face of the well bore and extending a short distance (perhaps less than an inch) into the formation are removed. Caliper surveys of deep sandstone wells made by the Illinois State Geological Survey in northeastern Illinois furnish valuable information concerning hole enlargement as the result of shooting. Bays and Folk (1944) gave caliper logs for several wells which had been shot and stated that shooting with 150-pound shots often enlarged the hole diameter from 12 to 32 inches. Examples of caliper logs showing the effects of shooting are presented in figure 16. Hole enlargement depends largely upon the size and number of shots and upon how friable and incoherent the sandstone is. Analysis of available data shows that the average effective diameters of well bores opposite zones which have been shot are commonly twice the average diameters of well bores before shooting. Figure 10A shows that increasing the diameter of the well bore from 12 to 24 inches increases the specific capacity of a well about 10 per cent. Thus, enlarging the effective diameter of the well bore by shooting will on the average increase the yield of the well by about 10 per cent.



AFTER BAYS AND FOLK (1944)

Figure 16. Caliperlogs of selected wells showing effects of shooting

During the construction of most deep sandstone wells some very fine drill cuttings invariably infiltrate a short distance into the formation as a result of the vertical oscillation and the frequent withdrawals of the bit. The permeability of the aquifer in the immediate vicinity of the well bore is thus reduced. In addition, the face of the well bore is often partially clogged with very fine drill cuttings and mud derived in part from layers of shale. For these reasons, a newly completed well is seldom 100 per cent efficient and the yields of wells are almost always less than what would be predicted based on the hydraulic properties of the aquifer. Figures 15A and 15B were compared to determine the average efficiency of newly completed wells. The efficiency of a well is therein defined as the actual specific capacity adjusted for well loss divided by the theoretical specific capacity computed from equation 1. It is estimated that the average efficiency of newly completed wells in northeastern Illinois is about 80 per cent. The yield of a newly completed well can therefore be increased about 20 per cent by removing fine materials which have migrated into the formation during construction.

Explosives have also been used to rehabilitate old wells. Under heavy pumping conditions, the specific capacities of wells sometimes decrease as a result of well deterioration. The well face and well wall become partially clogged, commonly with calcium carbonate. When wells are operated at high rates of pumping, the pressure of the water in the aquifer is greatly reduced, carbon dioxide is liberated, and the water is unable to hold in solution its load of mineral salts. Consequently some of these mineral salts are precipitated in the openings of the well bore. This clogging is particularly noticeable in multiunit wells where waters have moved through the well from one formation to another. The yields of many clogged wells have been restored to the original values through shooting. The specific capacities of rehabilitated wells are sometimes three times the specific capacities before shooting. The driller's problem in rehabilitation is mainly a matter of increasing the permeability of the well wall to its original value and not a matter of hole enlargement.

Unfortunately very few well-production tests were made before and after shooting so that the effects of shooting cannot be directly evaluated. Increases in specific capacities of newly constructed wells due to shooting were inferred from specific-capacity data for wells which have not been shot and the performance of wells after shooting. Well-production test data after shooting are available for more than 100 wells (see appendix). The specific capacities of these wells before shooting were estimated on the basis of figures 13-15. Estimated specific capacities before shooting and observed specific capacities after shooting were compared to determine the effects of shooting. Computed increases in specific capacities ranged from a few per cent to 71 per cent. Average increases in the yields of newly completed wells uncased in the various units or aquifers are listed in table 5.

Table 5. Computed Increases in Yields Due to Shooting

Units or aquifers uncased in well	Average increase in specific capacity due to shooting, in per cent
G-P, G-SP	38
C-O	22
I-G	30
C-O, MS	25

The average per cent increase in specific capacity is least for wells uncased in the Cambrian-Ordovician Aquifer and in both the Cambrian-Ordovician and Mt. Simon Aquifers because generally only one of the units, the Ironton-Galesville Sandstone, uncased in these multiunit wells is shot. Thus, only a portion of the well bore is enlarged and only a part of the well face is completely unclogged.

A 30 to 38 per cent increase in specific capacity of wells uncased in a single unit can be attributed to hole enlargement and to the removal of fine materials from the well wall. As stated earlier, enlarging the well bore by shooting will on the average increase the yield of a well by about 10 per cent, and the yield of an average well can be increased about 20 per cent by removing fine materials which have migrated into the formation during the construction of wells.

PREDICTING THE YIELDS OF WELLS AND THE EFFECTS OF SHOOTING

Data presented in this report can be used to great advantage in predicting the probable yields of proposed new production wells and the benefits of shooting. The yield of a properly constructed well at any particular site can be estimated from figures 13-15 and data on well-loss constants. Because the yields of some of the units commonly uncased in wells are inconsistent and vary from place to place, estimates based on the regional maps in figures 14 and 15 can be in error locally. The estimated probable yield of a well at a particular site should be compared with observed performance data for nearby wells, given in the appendix. With sound professional judgment based on both regional and observed yields of wells, the yield of a proposed well can be predicted within a few per cent. Careful consideration of the data in this report will aid both the well owner and well driller in appraising the efficiency of a new well. Expected increases in yields of wells due to shooting can also be evaluated with reasonable accuracy.

Methods used to predict the yield of a hypothetical well in sec. 18, T.38N., R. 12E. and to appraise the effects of shooting are described in detail below to demonstrate the applicability of data given in this report. Suppose that the hypothetical well is 20 inches in diameter, drilled to the base of the Ironton-Galesville Sandstone, and is uncased in all units of the Cambrian-Ordovician Aquifer. The problem is to estimate the specific capacity of the hypothetical well for a pumping period of 7 hours and to estimate the effects of shooting the well. From figure 15B a specific capacity of about 7.1 gpm/ft is predicted. However, figure 15B assumes that the thickness of the Glenwood-St. Peter Sandstone is 200 feet, the diameter of the well is 12 inches, and the pumping period is 12 hours. Figure 4A indicates that the thickness of the Glenwood-St. Peter Sandstone is about 200 feet at the site of the hypothetical well. If the thickness were greater or less than 200 feet, figure 13A would have to be used to adjust the specific capacity obtained from figure 15B for the actual thickness of the Glenwood-St. Peter Sandstone at the well site. The specific capacity from figure 15B was adjusted to a diameter of 20 inches and a pumping period of 7 hours, using the curves in figure 10. The adjusted specific capacity is about 7.8 gpm/ft.

Well loss has not been considered in the adjusted specific capacity because figure 15B assumes that the well loss is negligible. Suppose that the hypothetical well is pumped at a rate of 400 gpm. The total drawdown in the well is equal to the drawdown (aquifer loss) due to the laminar flow of water through the aquifer towards the well plus the drawdown (well loss) due to the turbulent flow of water as it enters the well itself and flows upward through the bore hole. The aquifer loss can be computed by dividing the assumed pumping rate, 400 gpm, by the adjusted specific capacity, 7.8 gpm/ft, and is about 51 feet. A reasonable estimate for the well-loss constant of a properly constructed deep sandstone well is 5 sec^2/ft^5. The well loss can be computed by substituting the estimated well-loss constant and the assumed pumping rate into equation 2, and is about 4 feet. Taking into consideration well loss, a total drawdown of 55 feet is computed and a specific capacity of 7.3 gpm/ft (400 gpm/55 ft) is estimated for the hypothetical well.

The estimated specific capacity assumes that the efficiency of the hypothetical well is average or about 80 per cent. Figure 15A shows that if the hypothetical well is 100 per cent efficient it would have a specific capacity of about 8.5 gpm/ft. Considering specific capacities based on both 80 and 100 per cent efficient wells, it is probable that the yield of the hypothetical well will be less than 8.5 gpm/ft and at least 7.0 gpm/ft. A specific capacity of about 7.5 gpm/ft is a reasonable estimate for the predicted yield of the hypothetical well in light of the data given in this report. The predicted specific capacity compares favorably with the actual yield, 7.7 gpm/ft, of well COK 38N12E-18.8g (see appendix) which was drilled in the vicinity of the hypothetical well and is uncased in the Cambrian-Ordovician Aquifer.

The increase in specific capacity due to shooting the hypothetical well can be predicted with the information given in this report. The average per cent increase in specific capacity due to shooting the Cambrian-Ordovician Aquifer is about 22. The average increase due to shooting is based on records of wells shot only opposite the lower 80 feet of the Ironton-Galesville Sandstone with 100 to 600 pounds of 80 to 100 per cent nitroglycerine. Assuming that the hypothetical well is shot under the above conditions, an increase in specific capacity of about 1.7 gpm/ft (7.5 x 0.22) is predicted due to shooting. Thus, if the well were shot under average conditions it would have a specific capacity of about 9.2 gpm/ft (7.5 + 1.7). The predicted specific capacity agrees closely with the observed specific capacity, 9.1 gpm/ft, of well COK 38N12E-18.8g (see appendix) after shooting.

CONCLUSIONS

Specific-capacity data for deep sandstone wells shed much light on the hydraulic properties of bedrock aquifers underlying northern Illinois. The results of well-production tests provide a means for detecting local and regional changes in the permeability of bedrock aquifers. The role of individual units of aquifers uncased in multiunit wells as contributors of water becomes apparent after careful study of the yields of deep sandstone wells. Our knowledge concerning the effects of shooting is greatly enriched by analysis of specific-capacity data for wells that have not been shot and performance data obtained for wells after shooting. The probable yields of proposed new production wells and the benefits of shooting can be predicted with reasonable accuracy based on the information presented in this report.

As shown in figure 17, the combined yield of the Prairie du Chien Series, Trempealeau Dolomite the Franconia Formation averages about 35 per cent of the total yield of the Cambrian-Ordovician Aquifer. The rapid decrease in the yield of the Cambrian-Ordovician Aquifer south and east of Chicago is accompanied by correspondingly large reductions in the yields of these units. In view of the importance of the Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation, more detailed studies on a regional basis should be made in the future to determine the geologic factors that control the combined yield of the units. Current studies at the Illinois State Geological Survey suggest that erosion, weathering, and solution effects associated with the pre-St. Peter unconformity may be responsible for the variations in permeability of these units.

According to Cooperative Report 1, pumping levels in deep sandstone wells will eventually decline to a position within a few feet of the top of the Ironton-Galesville Sandstone if the distribution and rates of pumpage from individual wells remain the same as in 1958 and the amount of pumpage from the Cambrian-Ordovician Aquifer increases to a total of 46 mgd (the practical sustained yield of the aquifer) and then remains the same. Under these conditions the Galena-Platteville Dolomite, Glenwood-St. Peter Sandstone, Prairie du Chien Series, Trempealeau Dolomite, and Franconia Formation will be dewatered in many parts of the Chicago region. Dewatering of these formations will appreciably decrease the coefficient of transmissibility of the entire Cambrian-Ordovician Aquifer and therefore the yields of deep Sandstone wells. It was estimated in Cooperative Report 1 that the specific capacities of deep sandstone wells would probably decrease on the average about 15 per cent as the result

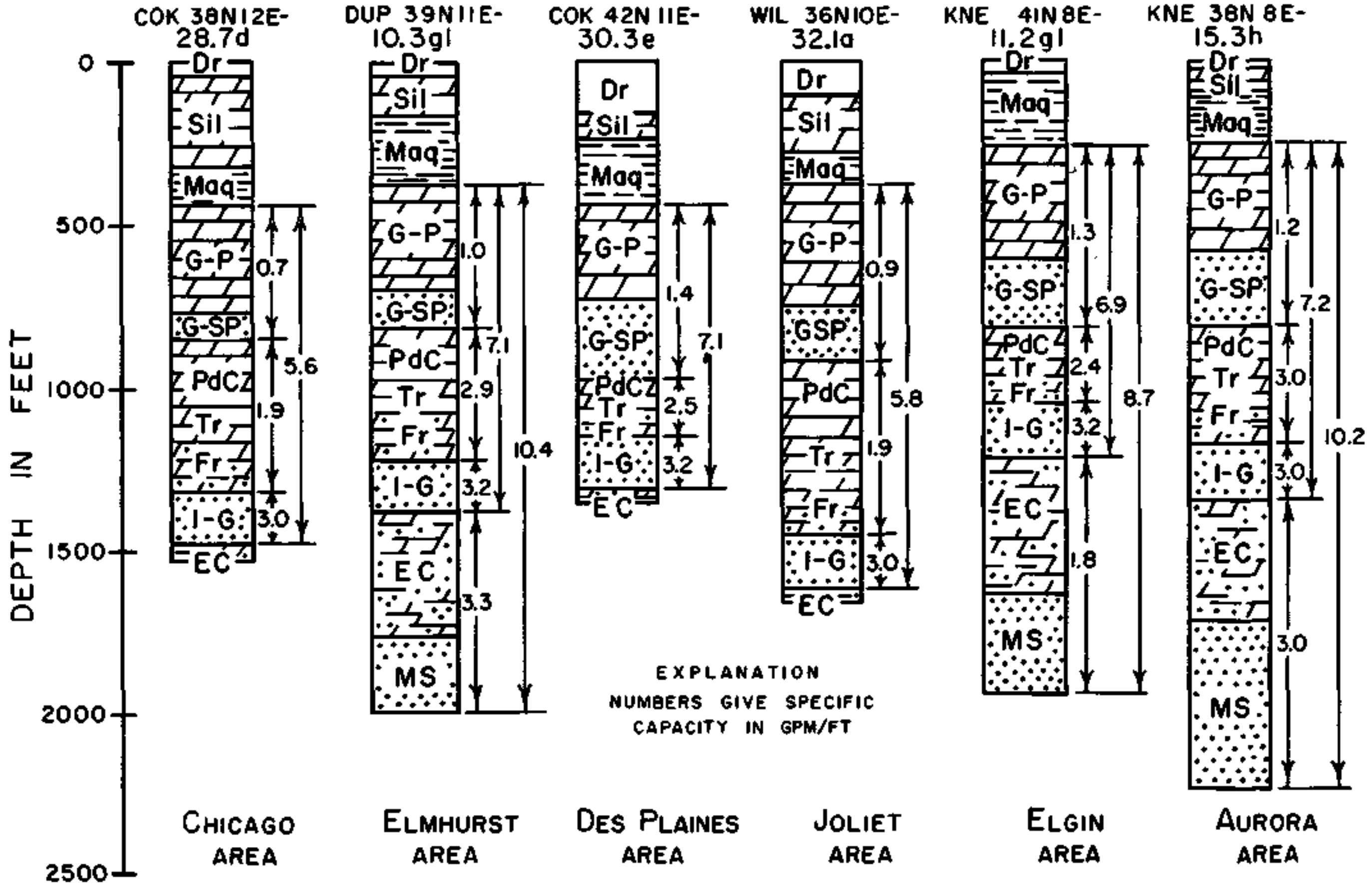


Figure 17. Estimated yields of individual units of the Cambrian-Ordovician and Mt. Simon Aquifers to selected wells in the Chicago region

of dewatering the formations above the Ironton-Galesville Sandstone. However, based on data in this report it is probable that the specific capacities of deep sandstone wells will decrease on the average about 50 per cent due to dewatering upper units of the Cambrian-Ordovician Aquifer.

The practical sustained yield of the Cambrian-Ordovician Aquifer was estimated on the basis of an average 15 per cent decrease in the coefficient of transmissibility as the result of dewatering. Computations made taking into account the findings of this report indicate a lower practical sustained yield. However, leakage through the Maquoketa Formation as described by Walton (1960) was not considered in Cooperative Report 1. Leakage through' the Maquoketa Formation balances the increased effects of dewatering predicted in this report, and the practical sustained yield of the Cambrian-Ordovician Aquifer is still estimated to be about 46 mgd as stated in Cooperative Report 1.

ACKNOWLEDGMENTS

Many former and present members of the State Water Survey and State Geological Survey participated in well-production tests, wrote earlier special reports which have been used as reference material, or aided the authors indirectly in preparing this report. Grateful acknowledgment is made, therefore, to the following: H. F. Smith, G. B. Maxey, J. E. Hackett, W. J. Roberts, Max Suter, Jack Bruin, J. B. Millis, R. T. Sasman, J. S. Randall, and R. A. Hanson. Consulting engineers, well drillers, and municipal officials were most cooperative and helpful in making data available on well-production tests. J. W. Brother prepared the illustrations. The authors are grateful to R. E. Bergstrom and G. H. Emrich who reviewed and criticized this report.

REFERENCES

Anderson, C. B., 1919. The artesian waters of northeastern Illinois: Illinois State Water Survey, Bulletin 34.

Bays, C. A., and Folk, S. H., 1944. Geophysical logging of water wells in northeastern Illinois: Illinois State Geological Survey, Circular 113.

Bergstrom, R. E., Foster, J. W., Selkregg, L. F., and Pryor, W. A., 1955. Groundwater possibilities in northeastern Illinois: Illinois State Geological Survey, Circular 198.

Hackett, J. E., and Bergstrom, R. E., 1956. Groundwater in northwestern Illinois: Illinois State Geological Survey, Circular 207.

Hackett, J. E., 1960. Ground-water geology of Winnebago County, Illinois: Illinois State Geological Survey, Report of Investigation 213.

Jacob, C. E., 1946. Drawdown test to determine effective radius of an artesian well: Proceedings American Society of Civil Engineers, Vol. 72, No. 5, p. 629-646.

Sasman, R. T., Prickett, T. A., and Russell, R. R., 1961. Water-level decline and pumpage during 1960 in deep wells in the Chicago Region, Illinois: Illinois State Water Survey, Circular 83.

Smith, H. F., 1959. Well rehabilitation with primacord: Water Well Journal, December.

Suter, Max, Bergstrom, R. E., Smith, H. F., Emrich, G. H., Walton, W. C, and Larson, T. E., 1959. Preliminary report on ground-water resources of the Chicago Region, Illinois: Cooperative Ground-Water Report 1, Illinois State Water Survey and State Geological Survey.

Theis, C. V., 1935. The relation between the lowering of the peizometric surface and the rate and duration of discharge of a well using ground-water storage: Transactions American Geophysical Union, Part 2, p. 519-524.

Walton, W. C, 1960. Leaky artesian aquifer conditions in Illinois: Illinois State Water Survey, Report of Investigation 39.

APPENDIX

Specific-Capacity Data for Deep Sandstone Wells in Northern Illinois

Well Number*	Owner	Units or aquifers contributing to yield of well**	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity*** (gpm/ft)	Remarks
BNE									
45N4E-11.7h	Village of Capron	G-P,G-SP	--	1946	.5	200	16.7	15.8	
44N3E-35.1g	City of Belvidere	G-P,G-SP	12	1945	11	730	22.8	24.7	City well No. 5
44N3E-26.1e	City of Belvidere	C-O,MS	16	1943	4	1285	15.1	14.6	City well No. 4
44N3E-25.8b	City of Belvidere	C-O,MS	16	1946	7	350	5.6	5.8	City well No. 3
44N3E-25.4d	Keene-Belvidere Canning Co.	G-P,G-SP	10	1942	1	392	12.2	12.8	Well No. 2
44N3E-25.4d	Keene-Belvidere Canning Co.	G-P,G-SP	10	1942	1	765	11.9	12.8	Well No. 2
44N3E-24.8a	City of Belvidere	G-P,G-SP	20	1955	6	713.	5.0	5.3	City well No. 6
44N3E-24.8a	City of Belvidere	C-O	20	1955	8	1212	13.2	12.7	City well No. 6
44N3E-21.8b	City of Belvidere	C-O, MS	16	1946	15	300	5.4	5.6	City well No. 1
CAR									
25N6E-19	Village of Shannon	G-P,G-SP	8	1949	3	100	0.9	0.9	Village well No. 2
25N3E-27.8b1	Mississippi Palisades State Park	G-P	6	1940	—	61	0.7	0.7	
25N3E-27.8b2	Mississippi Palisades State Park	G-P	6	1951	24	40	1.7	2.0	Well No. 3
25N3E-27.8b2	Mississippi Palisades State Park	G-P	6	1951	24	61	2.0	2.3	Well No. 3

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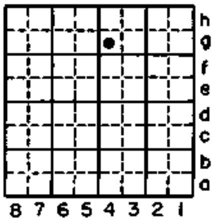
* The well numbering system used in this report is based on the location of the well, and uses the township, range, and section for identification. The well number consists of five parts county abbreviation, township, range, section, and coordinate within the section. Sections are divided into rows of one-eighth-mile squares. Each one-eighth-mile square contains 10 acres and corresponds to a quarter of a quarter section. A normal section of 1 square mile contains eight rows of eighth-mile squares; an odd-sized section contains more or fewer rows. Rows are numbered from east to west and lettered from south to north as shown in the diagram. The number of the well shown is as follows: COK 41N11E-25.4g. Where there is more than one well in a 10-acre square they are identified by arabic numbers after the lower case letter in the well number. The abbreviations used for counties are:

Cook County
T.41N.,R.11E.
sec. 25



BNE	Boone	KEN	Kendall	MRS	Marshall
CAR	Carroll	KNE	Kane	OGL	Ogle
COK	Cook	KNK	Kankakee	PEO	Peoria
DEK	DeKalb	KNX	Knox	PUT	Putnam
DUP	DuPage	LAS	LaSalle	RIS	Rock Island
FUL	Fulton	LEE	Lee	STE	Stephenson
GRY	Grundy	LIV	Livingston	STK	Stark
HAN	Hancock	LKE	Lake	WAR	Warren
HND	Henderson	MCD	McDonough	WIL	Will
HRY	Henry	MCH	McHenry	WIN	Winnebago
JDV	JoDaviess	MER	Mercer	WTS	Whiteside

** Abbreviations used for units or aquifers are:

C-O	Cambrian-Ordovician	PdC	Prairie du Chien	I-G	Ironton-Galesville
G-P	Galena-Platteville	Tr	Trempealeau	EC	Eau Claire
G-SP	Glenwood-St. Peter	Fr	Franconia	MS	Mt. Simon

*** Adjustments made for a 12-hour pumping period, 1-foot diameter well, and well loss.

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
CAR									
24N6E-5.6d	City of Lanark	G-SP	10	1937	2	225	7.5	7.5	City well No. 2
24N6E-5.5e1	City of Lanark	G-P,G-SP	10	1940	1	160	1.4	1.3	City well No. 1
24N6E-5.5e2	City of Lanark	C-O	14	1957	11	596	6.8	8.4	City well No. 3
24N6E-5	Fuhreman Canning Co., Lanark	G-P,G-SP	10	1930	--	275	3.5	3.8	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1948	10	240	1.9	1.9	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1948	24	520	5.0	5.6	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	24	512	5.0	5.8	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	7	300	4.1	4.2	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	2	390	6.2	6.5	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	2.5	300	4.6	4.4	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	6.5	545	5.8	6.5	
24N6E-5	Minnesota Valley Canning Co., Lanark	C-O, EC	14	1949	10.7	542	5.7	6.4	
24N4E-12.7h	City of Mt. Carroll	C-O, MS	12	1955	12	600	5.1	5.9	City well No. 3
24N4E-12.3h1	City of Mt. Carroll	C-O, MS	8	1934	3	110	2.0	2.0	City well No. 1
24N4E-12.3h2	City of Mt. Carroll	C-O, MS	12	1935	22	225	2.4	2.5	City well No. 2
24N4E-12.3h2	City of Mt. Carroll	C-O, MS	12	1935	24	600	6.0	7.4	City well No. 2
24N4E-1	Quality Milk Association	G-P,G-SP	10	1954	2.5	275	1.9	1.7	Well No. 2
24N3E-10.2e	City of Savanna	C-O, EC	12	1935	--	600	31.5	33.0	City well No. 4
24N3E-4.2c	City of Savanna	C-O, EC	12	1952	6	300	4.7	4.6	City well No. 5
24N3E-4.2c	City of Savanna	C-O, MS	12	1953	1	345	9.1	11.2	City well No. 5 shot
23N6E-23.6b1	Village of Milledgeville	G-P,G-SP	10	1940	--	100	0.6	0.6	Village well No. 3
23N6E-23.6b2	Village of Milledgeville	C-O	12	1948	2.5	200	10.0	9.9	Village well No. 4
23N5E-2.5d1	Village of Chadwick	G-P,G-SP	10	1945	—	143	0.8	0.8	Village well No. 2
23N5E-2.5d2	Village of Chadwick	G-P,G-SP	12	1955	.5	80	1.1	0.9	Village well No. 3
23N4E-10.2h	United Milk Products	C-O	10	1952	8	434	3.4	4.1	
COK									
42N12E-35.4d	Baxter Laboratory	C-O	—	1946	1	430	10.7	10.1	Shot
42N12E-35.4d	Baxter Laboratory	C-O	--	1946	1	570	9.7	10.1	Shot
42N12E-35.4d	Baxter Laboratory	C-O	--	1946	1	725	9.4	10.1	Shot
42N12E-33.1c	Glenview Countryside	G-P,G-SP	--	1954	24	305	3.5	3.8	Well No. 3
42N12E-31	Automatic Electric Co.	C-O	16	1958	.1	1225	245.0	245.0	Well No. 1 Crevices in Tr
42N12E-29.1a	Glenview Countryside	C-O	12	1957	24	896	5.2	6.2	Well No. 4
42N12E-23.4g	Holy Ghost Convent	C-O	8	1958	8	300	3.3	3.6	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
COK									
42N12E-14.7f	St. Marys Mission House	C-O	8	1958	1	237	7.4	7.2	
42NllE-35.2a	Fairview Gardens	C-O	8	1958	5	505	6.1	7.1	
42NllE-34.8f	Village of Mount Prospect	C-O, MS	16	1955	24	733	9.0	10.9	Village well No. 5, shot
42NllE-33.3c	Village of Mount Prospect	C-O	10	1949	1	476	10.6	11.5	Village well No. 4, shot
42NllE-33.3c	Village of Mount Prospect	C-O	10	1949	1	651	8.9	11.5	Village well No. 4, shot
42NHE-33.3c	Village of Mount Prospect	C-O	10	1959	3	800	7.5	8.1	Village well No. 4, shot
42NllE-30.5b	Village of Arlington Heights	G-P,G-SP	10	1934	.7	82	1.3	1.1	Village well No. 4
42NllE-30.5b	Village of Arlington Heights	C-O	10	1942	12	400	8.5	9.5	Village well No. 4
42NllE-30.5b	Village of Arlington Heights	C-O	12	1953	2.5	530	6.3	6.7	Village well No. 6
42NllE-30.3e	Village of Arlington Heights	G-P,G-SP	10	1942	8	90	0.7	0.7	Village well No. 2
42NllE-30.3e	Village of Arlington Heights	C-O	10	1949	4	445	7.7	7.1	Village well No. 2
42NllE-29.5a	Village of Arlington Heights	C-O	14	1947	8	890	13.9	14.0	Village well No. 5, shot
42NllE-26.6d	Brickman Manor	C-O	16	1959	1	700	7.5	8.3	Well No. 1
42NllE-16	Arlington Vista Subdivision	G-P,G-SP	10	1957	24	200	1.9	1.9	Well No. 1
42N11E-11.7b	Ekco-Alcoa Container Corp.	C-O	12	1956	24	905	7.1	8.7	
42N11E-11.7e	Village of Wheeling	C-O	16	1956	1	700	9.9	9.1	Village well No. 3
42N11E-11.7e	Village of Wheeling	C-O	16	1956	1	1075	8.7	9.1	Village well No. 3
42N11E-5.1g	Village of Buffalo Grove	C-O	14	1957	18	670	4.9	5.9	Village well No. 2
42N10E-36.4e	Rolling Meadows Subdivision	C-O	12	1957	11	516	3.9	4.3	Well No. 3
42N10E-24.3h	Village of Palatine	C-O	12	1958	24	650	9.6	11.8	Village well No. 4, shot
41N13E-8.6d2	Glenview Country Club	C-O	10	1958	20	850	9.8	10.6	Shot
41N12E-19.5c	City of Des Plaines	C-O, MS	10	1953	24	1020	12.8	13.1	City well No. 3
41N12E-19.4h	City of Des Plaines	C-O, MS	8	1943	24	520	3.6	4.6	Norma well
41N12E-14.7h	Greenwood Subdivision	G-P,G-SF	--	1939	36	125	3.1	3.3	
41NllE-28.4a	Hot Point Div. General Electric Co.	C-O	10	1958	44	1250	7.9	9.2	Well No. 1, shot
41NllE-26.8a	Elk Grove Water & Sewer Co.	C-O	16	1958	24	1033	7.7	8.1	
41N11E-13.4a	City of Des Plaines	C-O, MS	18	1959	19	967	5.4	7.1	Shot
41N10E-15.4h	Hoffman Estates	C-O	6	1959	3	1012	10.7	11.3	Well No. 4
40N12E-33.8d	Buick Motor Div., Aviation Eng. Plant	C-O	12	1942	10	1100	8.4	8.7	Well No. 2
40N12E-33.7d	Buick Motor Div., Aviation Eng. Plant	C-O	12	1942	35	1080	5.7	6.9	Well No. 1, shot
40N12E-32.5a	City of Northlake	G-P,G-SP	—	1941	30	100	0.5	0.5	
40N12E-32.5a	City of Northlake	C-O	12	1950	1	650	5.0	5.9	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
COK									
-40N12E-31.8h	C.& N.W.R.R.	MS	8	1912	9	87	0.5	0.6	Proviso yards
40N12E-18.6c	J. B. Clow & Sons	C-O	20	1957	24	1000	8.7	8.9	
39N12E-22.7b	Amphenol Corp.	C-O	16	1958	--	750	6.1	7.7	Shot
39N12E-17.2a	Aluminum Co. of America	C-O	8	1947	4	520	7.1	8.5	Well No. 1
39N12E-15.1g	Village of Maywood	C-O, MS	18	1938	—	1200	13.3	14.0	Village well No. 6, shot
39N12E-9.6f	Village of Bellwood	C-O, MS	12	1956	—	1575	13.1	14.5	Village well No. 2
39N12E-9.5a	Village of Bellwood	C-O	13	1951	12	590	5.5	6.4	Village well No. 3
39N12E-9.5a	Village of Bellwood	C-O, MS	13	1949	24	870	7.4	7.8	Village well No. 3, shot
39N12E-9.5a	Village of Bellwood	C-O, MS	13	1951	7	645	6.0	7.3	Village well No. 3, shot
39N12E-9.3f	Village of Bellwood	C-O, MS	--	1958	2	1200	8.1	8.8	Village well No. 1
38N13E-21.1f	Cracker Jack	C-O	8	1941	1	480	120.0	120.0	Crevices in Tr
38N13E-19.4e	Visking Corp.	C-O	12	1943	48	600	6.8	8.6	
38N13E-12.8e	International Rolling Mills	C-O	12	1946	6	450	90.0	90.0	Well No. 1, crevices in Tr
38N12E-29.1d	Buick Jet Plant	C-O	20	1952	24	844	4.4	5.3	Well No. 1
38N12E-28.7d	Buick Jet Plant	C-O	20	1952	5	930	4.9	5.6	Well No. 2
38N12E-24.7f	Corn Products Refining Co.	C-O	15	1945	1	480	13.0	11.9	Well No. 14, shot
38N12E-24.7f	Corn Products Refining Co.	C-O	15	1945	1	750	11.0	11.9	Well No. 14, shot
38N12E-24.7f	Corn Products Refining Co.	C-O	15	1945	1	1020	10.9	11.9	Well No. 14, shot
38N12E-23.3g	Corn Products Refining Co.	C-O	16	1944	1	490	11.1	10.8	Well No. 13, shot
38N12E-23.3g	Corn Products Refining Co.	C-O	16	1944	1	765	10.6	10.8	Well No. 13, shot
38N12E-23.1h	Corn Products Refining Co.	C-O	17	1942	1	510	12.1	10.7	Well No. 11, shot
38N12E-23.1h	Corn Products Refining Co.	C-O	17	1942	1	750	10.1	10.7	Well No. 11, shot
38N12E-18.8g	Cook Co. T.B. Sanitarium	C-O	20	1958	7	393	7.7	8.1	Well No. 3
38N12E-18.8g	Cook Co. T.B. Sanitarium	C-O	20	1958	10	820	9.1	10.0	Well No. 3, shot
38N12E-11.7c	Universal Oil Company	C-O	10	1944	24	250	6.2	6.9	
38N12E-11.3e	Lewis Tar Products Co.	G-P,G-SP	6	1945	20	55	0.9	0.9	Well No. 2
38N12E-5.8f	Village of Western Springs	C-O	16	1956	3	800	9.8	10.6	Village well No. 3, shot
37N13E-32.1g	Ridgeland Water Service Co.	C-O	10	1958	8	840	8.2	9.9	Well No. 2
37N11E-20.4C	Village of Lemont	C-O	10	1952	2	275	4.2	3.9	
36N14E-2.8e	Hokin Aluminum Company	C-O	20	1954	.5	765	3.6	2.9	
36N13E-9.8b	El Vista Subdivision	C-O	10	1959	1	408	13.2	13.3	
36N13E-9.8b	El Vista Subdivision	C-O	10	1959	1	610	11.7	13.3	
36N13E-9.8b	El Vista Subdivision	C-O	10	1959	1	910	10.7	13.3	
36N13E-1.2c	Miller Prepared Potato Co., Inc.	C-O	8	1958	15	555	4.2	4.9	
35N14E-21.7e	City of Chicago Heights	C-O	15	1942	5	634	8.1	9.7	City well No. 20, shot
35N14E-21.3h	Calumet Steel	C-O	20	1951	--	426.	4.4	4.5	Well No. 4, shot
35N14E-21.1h	Victor Chemical Works	C-O	16	1942	48	680	4.3	5.3	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributmg to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
DEK									
42N5E-19.6b	City of Genoa	G-P,G-SP	12	1947	.5	300	5.2	4.4	South well
42N5E-19.4b	City of Genoa	G-P,G-SP	16	1956	4	700	14.9	14.0	City well No. 3
42N4E-22.7a	Village of Kingston	G-P,G-SP	12	1958	14	205	13.6	14.8	Village well No. 3
42N3E-26.3h	Village of Kirkland	G-P,G-SP	8	1950	8	300	25.0	27.0	
41N5E-32.1g	City of Sycamore	G-P,G-SP	12	1954	—	608	4.0	4.6	City well No. 3
40N4E-26.6e	City of DeKalb	C-O	20	1955	2	1400	8.6	7.0	City well No. 7, G-P cased out
40N4E-23.8d	City of DeKalb	G-P,G-SP	16	1960	6	448	6.2	6.9	City well No. 8
40N4E-23.5d	City of DeKalb	C-O	12	1938	6	700	11.9	11.8	City well No. 4, shot
40N4E-23.5d	City of DeKalb	C-O	12	1959	—	550	9.8	10.1	City well No. 4
40N4E-23.2e	City of DeKalb	C-O	10	1959	—	400	4.0	4.3	City well No. 5
40N4E-22.3e	City of DeKalb	C-O	8	1944	1.5	385	3.6	3.4	City well No. 2
40N4E-22.2e	City of DeKalb	C-O	10	1947	8	1000	23.2	26.2	City well No. 1, shot
40N4E-15.6a	City Of DeKalb	C-O	20	1952	.5	1180	9.3	9.7	City well No. 6
40N4E-15.6a	City of DeKalb	C-O	20	1959	--	800	4.1	4.9	City well No. 6, G-P cased out
40N3E-23.6e	Village of Malta	C-O	14	1952	24	375	6.7	7.9	Village well No. 2, G-P cased out
38N5E-15.2d	Village of Hinckley	G-P,G-SP	12	1913	1	250	10.4	9.9	
DUP									
40NllE-35.5e	City of Elmhurst	C-O	20	1953	8	570	21.9	17.8	City well No. 6, shot
40NllE-35.5e	City of Elmhurst	C-O	20	1953	8	1270	15.3	17.8	City well No. 6, shot
40NllE-31.7a	Village of Lombard	C-O	20	1956	24	1025	9.8	10.1	Village well No. 5
40N11E-14.1d	Village of Bensenville	C-O	16	1954	24	1050	14.0	15.2	Village well No. 3, shot
40N11E-13.8e1	Village of Bensenville	C-O	6	1934	8	147	6.1	6.7	Village well No. 1
40N11E-13.8e1	Village of Bensenville	C-O	6	1947	2	225	2.7	2.6	Village well No. 1
40N11E-13.8e2	Village of Bensenville	C-O	10	1934	10	400	11.7	11.6	Village well No. 2
40N11E-13.8e2	Village of Bensenville	C-O	10	1950	1	630	9.3	10.1	
40N11E-13.5b	C.M.& St.P. R R	C-O	16	1950	1	400	14.3	13.9	Well No. 6
40N11E-13.5b	C.M.& St.P. R.R.	C-O	16	1950	1	600	12.5	13.9	Well No. 6
40N11E-13.5b	C.M.& St.P. R.R.	C-O	16	1950	1	725	10.4	13.9	Well No. 6
39N11E-12.8d	City of Elmhurst	C-O	12	1941	—	990	9.7	13.4	City well No. 5
39N11E-12.8d	City of Elmhurst	C-O	12	1956	--	1000	7.0	10.6	City well No. 5
39N11E-10.4g	Wander Company	C-O, MS	12	1945	8	1100	13.3	13.6	Well No. 7
39N11E-10.3g1	Wander Company	C-O, MS	12	1933	1	1513	11.6	10.4	Well No. 9
39N11E-10.3g1	Wander Company	C-O, MS	12	1933	1	2310	10.8	10.4	Well No. 9
39N11E-10.3g1	Wander Company	C-O, MS	12	1944	—	1900	9.7	10.6	Well No. 9
39N11E-10.3g2	Wander Company	C-O, MS	16	1946	24	1160	8.7	11.7	Well No. 11
39N11E-10. 1h	City of Elmhurst	C-O, MS	14	1953	--	1000	12.8	13.4	City well No. 4
39N11E-10.1h	City of Elmhurst	C-O, MS	14	1956	—	700	10.9	12.1	City well No. 4

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/*ft)*	Adjusted specific capacity (gpm/ft)	Remarks
DUP									
39N11E-9.1h	Village of Villa Park	C-O, MS	—	1947	2.5	625	8.1	8.9	Village well No. 2
39N11E-8.7h	Village of Lombard	C-O, MS	10	1948	1	102	7.9	6.3	Village well No. 2
39N11lE-8.7h	Village of Lombard	C-O, MS	10	1948	1	198	6.8	6.3	Village well No. 2
39N11E-8.7h	Village of Lombard	C-O, MS	10	1948	1	337	5.7	6.3	Village well No. 2
39N11E-6.7a	Village of Lombard	C-O, MS	20	1954	22	1000	13.2	13.8	Village well No. 6
39N11E-6.5a	Village of Lombard	C-O, MS	20	1954	10	1Q05	14.7	14.4	Village well No. 4, shot
39N11E-4.1e	Village of Villa Park	C-O	16	1956	24	842	7.5	9.0	Village well No. 7
39N11E-1.8g1	City of Elmhurst	C-O	10	1944	2	625	11.2	14.8	City well No. 1
39N11E-1.8g1	City of Elmhurst	C-O	10	1956	—	700	4.4	7.4	City well No. 1
39N11E-1.8g2	City of Elmhurst	C-O, MS	8	1956	—	1100	11.0	12.1	City well No. 2
39N9E-15.7h	City of West Chicago	C-O	--	1960	1	950	7.6	7.5	Well No. 4
39N9E-15.7h	City of West Chicago	C-O	—	1960	3	530	13.9	15.0	Well No. 4, shot
38N11E-10.2f	Village of Clarendon Hills	G-P,G-SP	6	1927	24	70	0.8	0.9	
38N9E-13.2b3	City of Naperville	C-O	20	1958	23.5	1070	7.1	8.4	City well No. 7
FUL									
8N4E-11.1g	City of Farmington	G-P,G-SP	8	1921	1.7	60	1.1	1.1	City well No. 2
7N4E-25(1)	City of Canton	G-SP	6	1921	—	150	2.0	2.2	City well No. 1
7N4E-25(2)	City of Canton	G-SP	12	1924	7	220	2.9	2.9	City well No. 3
6N3E-20.6f	City of Cuba	G-P	8	1952	3.5	86	4.3	4.2	City well No. 4
6N3E-20.6f	City of Cuba	G-P	8	1951	8	153	2.5	2.5	City well No. 4
5N1E-32.8a	Village of Table Grove	G-P,G-SP	10	1952	6	50	1.0	1.0	Village well No. 1
4N2E-6.6b	Village of Ipava	G-P,G-SP	6	1948	—	100	2.0	2.2	
3N1E-16	Town of Astoria	G-P,G-SP	6	1921	9	59	0.8	0.8	
GRY									
34N8E-35.1e	Dresden Nuclear	C-O	26	1957	1.5	421	2.2	1.6	Well No. 2
34N8E-1.5e	Village of Minooka	G-P,G-SP	12	1947	4	45	0.7	0.6	Village well No. 2
33N8E-34.6g	Village of Carbon Hill	G-P,G-SP	6	1947	—	20	0.7	0.8	
33N7E-9.3h	City of Morris	C-O	16	1947	—	450	5.0	5.5	City well No. 4
33N7E-4.4c	City of Morris	I-G	16	1958	.2	900	9.7	8.7	City well No. 5, shot
33N7E-4.2a1	City of Morris	G-SP	6	1934	.1	267	1.6	1.2	City well No. 1
33N7E-4.2a2	City of Morris	G-SP	10	1934	1	401	2.1	1.9	City well No. 2
33N7E-4.2a3	City of Morris	G-SP	20	1934	.5	401	2.1	1.5	City well No. 3
33N7E-4.2a3	City of Morris	G-SP	16	1947	7.5	500	4.8	5.3	City well No. 3, shot
33N6E-29.4e	E. I. du Pont de Nemours	C-O	10	1943	24.5	830	6.4	7.5	Well No. 3, shot
33N6E-11.4f	Morris Clay Products	G-P,G-SP	6	1950	6	20	0.8	0.8	
31N8E-11.5b	Village of South Wilmington	G-P,G-SP	8	1950	8	40	0.3	0.3	
31N8E-4.2b	Village of Gardner	G-P,G-SP	8	1951	8	30	0.2	0.2	
HAN									
5N8W-6	Camp Eastman	G-P,G-SP	4	1958	—	15	1.1	1.2	
HND									
10N5W-34	McChesney	G-P,G-SP	6	1950	--	130	0.5	0.5	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield Of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
HND									
9N5W-25.1e	Village of Stronghurst	G-SP	8	1925	14	100	0.9	1.2	Village well No. 1
HRY									
15N5E-33.5h1	City of Kewanee	G-P,G-SP	6	1913	—	95	0.7	0.8	City well No. 5
15N5E-33.5h1	City of Kewanee	G-P,G-SP	6	1921	--	210	1.6	1.8	City well No. 5
15N5E-33.5h2	City of Kewanee	G-P,G-SP	6	1921	—	210	1.6	1.6	City well No. 6
15N5E-33.5h3	City of Kewanee	C-O	14	1919	—	834	40.0	48.0	City well No. 1
15N5E-33.5h3	City of Kewanee	C-O	14	1920	8	744	17.3	17.0	City well No. 1
15N5E-33.5h3	City of Kewanee	C-O	14	1925	--	640	22.1	23.7	City well No. 1
15N5E-33.5h3	City of Kewanee	C-O	14	1938	—	700	15.2	16.0	City well No. 1
15N5E-33.5h4	City of Kewanee	C-O	14	1927	6	968	10.7	10.5	City well No. 2
15N5E-33.5h4	City of Kewanee	C-O	14	1927	--	176	1.2	1.2	City well No. 2
15N5E-33.3g	Walworth Co., Kewanee	G-P,G-SP, Tr	12	1938	--	700	20.0	21.4	Well No. 5, shot
15N5E-33.3g	Walworth Co., Kewanee	G-P,G-SP, Tr	12	1945	1	650	25.0	23.2	Well No. 5
15N5E-33.3g	Walworth Co., Kewanee	G-P,G-SP, Tr	12	1947	--	600	27.2	29.6	Well No. 5
15N5E-33.3g	Walworth Co., Kewanee	G-P,G-SP, Tr	12	1954	--	720	34.3	39.1	Well No. 5
15N5E-33	Walworth Co., Kewanee	G-F	8	1938	--	175	8.7	9.8	Well No. 4
15N5E-33	Walworth Co., Kewanee	G-P	8	1948	—	187	1.3	1.4	Well No. 4
15N5E-32.2f	Kewanee Boiler Co.	G-P	10	1921	.5	199	1.4	1.1	Well No. 2
15N5E-32.2f	Kewanee Boiler Co.	G-P	10	1945	--	200	2.3	2.4	Well No. 2
15N5E-28.6c	City of Kewanee	G-P,G-SP	12	1939	--	103	1.3	1.3	City well No. 3
15N5E-28.6c	City of Kewanee	C-O	10	1939	2.5	405	9.9	11.2	City well No. 3
15N5E-28.6c	City of Kewanee	C-O	10	1939	10	675	11.2	17.7	City well No. 3
15N5E-28.6c	City of Kewanee	C-O	10	1947	--	661	8.4	11.6	City well No. 3
15N5E-28	City of Kewanee	G-P,G-SP	8	1906	30	150	0.6	0.7	City well No. 4
15N3E-7.3f	Village of Cambridge	G-P,G-SP	6	1944	5	125	6.9	7.3	Village well No. 1
14N4E-27.8b1	City of Galva	G-SP	6	1916	--	70	2.5	2.7	City well No. 1
14N4E-27.8b2	City of Galva	G-P,G-SP	12	1934	—	320	4.9	5.3	City well No. 3, shot
14N4E-27.8b2	City of Galva	G-P,G-SP	12	1934	—	207	6.3	6.7	City well No. 3
JDV									
29N4E-19.2f	Village of Appleville	G-P,G-SP	8	1940	8	100	2.2	2.3	Village well No. 1
27N4E-11.4f1	Village of Stockton	G-P,G-SP	--	1937	--	160	0.8	0.8	Village South well
27N4E-11.4f2	Village of Stockton	G-P,G-SP, PdC, Tr	10	1942	--	375	3.8	4.2	Village well No. 5
27N4E-11.3e	Village of Stockton	C-O	12	1953	7.5	753	4.4	5.0	Village well No. 6
27N4E-11.3e	Village of Stockton	C-O	12	1957	8	425	3.7	3.9	Village well No. 6
27N4E-11.2c	Village of Stockton	C-O, EC	5	1913	--	125	0.7	0.7	Village well No. 1
27N4E-11.2d	Village of Stockton	G-P,G-SP	17	1938	2	154	1.3	1.1	Village well No. 4
27N4E-11.2d	Village of Stockton	C-O, EC	17	1938	3	394	2.8	2.8	Village well No. 4

APPENDIX (Continued)

Well Number,	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
JDV									
27N4E-11.2d	Village of Stockton	C-O, EC	17	1946	7.5	320	473	4.4	Village well No.4
27N4E-11.2d	Village of Stockton	C-O, EC	17	1957	10	300	3.7	3.8	Village well No. 4
27N2E-24.2c	Village of Elizabeth	G-P	12	1937	4.5	100	10.0	9.8	Village well No. 2
26N2E-9.4b	Village of Hanover	C-O	6	1922	—	600	32.4	38.0	Village well No. 1
29N2W-20.8a	City of East Dubuque	PdC,Tr,Fr, I-G, MS	12	1937	—	492	16.6	17.4	City well No. 2
29N2W-20.8a	City of East Dubuque	PdC,Tr,Fr, I-G, MS	12	1946	1.5	300	30.0	28.0	City well No. 2
KEN									
37N8E-17.4f	Village of Oswego'	C-O	15	1957	1	1227	8.6	9.3	Village well No. 3
37N8E-5.8e	Caterpillar Tractor Co.	C-O	--	1956	26.5	1100	9.0	9.8	
37N7E-32.1e1	Village of Yorkville	G-P,G-SP	8	1947	3.5	150	1.8	1.7	Shot
37N7E-32.1e2	Village of Yorkville	C-O	12	1960	7	892	5.4	6.9	
37N7E-32.1g	Yorkville Sewage Plant	G-P,G-SP	6	1957	2	15	0.7	0.7	
37N6E-4.4d	Chicago YWCA	G-P,G-SP	6	1934	--	100	2.0	2.2	
KNE									
42N8E-25.5f	Village of East Dundee	C-O	16	1958	10	900	14.0	14.4	Shot
42N8E-22.4g	Village of Carpentersville	C-O	10	1941	7	150	2.4	2.4	
41N8E-35.8g	Village of South Elgin	C-O	6	1938	2	200	6.2	6.5	Village well No. 1
41N8E-27.5e	Elgin State Hospital Farm	G-P,G-SP	6	1935	6	70	0.8	0.8	
41N8E-24.6h	Elgin National Watch Co.	C-O	--	1938	48	1250	7.8	9.0	Well No. 1
41N8E-24.6h	Elgin National Watch Co.	C-O	--	1945	2	490	9.2	10.3	Well No. 1, shot
41N8E-24.6h1	Elgin National Watch Co.	C-O	—	1945	2	740	7.9	7.9	Well No. 1, shot
41N8E-24.6h2	Elgin National Watch Co.	C-O	12 '	1945	2	375	9.9	9.9	Well No. 2, shot
41N8E-24.6h2	Elgin National Watch Co.	C-O	12	1945	2	620	8.4	9.9	Well No. 2, shot
41N8E-24.6h2	Elgin National Watch Co.	C-O	12	1950	25	590	7.4	8.5	Well No. 2
41N8E-24.3b	City of Elgin	C-O	20	1954	48	1438	7.6	8.5	City well No. 6
41N8E-24.1a	City of Elgin	C-O, MS	--	1948	8	706	4.4	5.0	La Voie Av. well
41N8E-23.6b	Elgin State Hospital	C-O, MS	16	1950	2	660	11.8	11.8	Well No. 2, shot
41N8E-23.6b	Elgin State Hospital	C-O, MS	16	1950	2	835	10.4	11.8	Well No. 2, shot
41N8E-23.6b	Elgin State Hospital	C-O, MS	16	1950	2	1110	9.0	11.8	Well No. 2, shot
41N8E-12.3e	Illinois Watch Case Co.	G-P,G-SP	10	1936	4	174	4.1	4.2	
41N8E-11.2g	City of Elgin	C-O	12	1946	6	590	8.7	9.1	City well No. 1, shot
41N8E-11.2g1	City of Elgin	C-O, MS	12	1934	34	446	7.7	8.7	City well No. 2
41N8E-ll.lh	City of Elgin	C-O, MS	--	1934	6	857	16.8	17.5	City well No. 4
41N8E-ll.lh	City of Elgin	C-O, MS	--	1948	12	1066	12.0	12.8	City well No. 4
41N8E-ll.lh	City of Elgin	C-O, MS	—	1959	3.5	915	8.3	9.2	City well No. 4
41N8E-11	City of Elgin	C-O	22	1949	5	1300	5.9	6.3	Test well
41N6E-10.1f	Burlington Milk Products Co.	C-O	8	1941	7	73	3.3	3.5	
41N6E-9.1g	Village of Burlington	C-O	10	1960	8	128	5.6	6.2	Village well No. 2
40N8E-34.6f	City of St. Charles	C-O, MS	16	1955	4	1170	11.1	10.1	City well No. 6. shot
40N8E-34.5g	Howell Co.	C-O	10	1959	16	578	5.3	6.4	Well No. 2

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm lft)	Adjusted specific capacity (gpm/ft)	Remarks
KNE									
40N8E-31.6f	St. Charles School for Boys	C-O	16	1955	24	360	3.3	3.6	Well No. 3
40N8E-31.6f	St. Charles School for Boys	C-O	16	1955	7	415	8.5	9.6	Well No. 3, shot
40N8E-27.7g	Potowattomie Park	G-SP	10	1937	24	185	1.6	1.7	
40N8E-27.6a	City of St. Charles	C-O, MS	8	1947	5.5	550	11.7	12.1	City well No., 3
40N8E-27.6a	City of St. Charles	C-O, MS	8	1955	—	1088	7.6	8.1	City well No., 3
40N8E-27.6b	City of St. Charles	C-O, MS	12	1936	—	1000	6.9	7.1	City well No., 4
40N8E-27.5c	City of St. Charles	G-P,G-SP	8	1911	—	160	2.0	2.2	City well No. 2
40N7E-23.4g	Wasco School	G-P,G-SP	6	1951	3	15	1.5	1.7	
40N6E-30	Village of Maple Park	G-P, G-SP	6	1960	12	8	0.4	0.5	
39N8E-22.3e1	City of Batavia	C-O, MS	12	1945	5	605	6.4	7.4	City well No. 2
39N8E-22.3e2	City of Batavia	C-O, MS	13	1941	14	1000	11.8	12.5	City well No. 3
39N8E-22.1f	City of Batavia	C-O	16	1953	24	668	12.6	13.3	City well No. 4, shot
39N8E-15.6g	Campana Corp.	C-O	10	1948	5	176	4.2.	4.3	Well No. 2
39N8E-11.7e	Ill. State Training School for Girls	C-O	12	1958	24	408	2.3	2.5	
39N8E-3.8g	City of Geneva	G-P,G-SP	16	1940	32	500	2.1	2.3	City well No. 3, shot
39N8E-3.8g	City of Geneva	C-O, MS	10	1941	—	1100	4.9	5.9	City well No. 3
39N8E-3.8g	City of Geneva	C-O, MS	10	1946	2	935	12.1	11.3	City well No. 3, shot
39N8E-3.2a	City of Geneva	C-O	12	1924	—	300	7.5	8.4	City well No. 2
39N8E-3.2b	City of Geneva	C-O, MS	--	1944	9	990	5.8	6.5	City well No. 4
39N8E-3.1b	Ill. State Training School for Girls	C-O, MS		1959	.5	750	6.6	7.7	
39N8E-2.4c	City of Geneva	C-O, MS	20	1957	22	1078	7.2	7.8	City well No. 5
39N7E-10.4f	Broadview Academy	C-O	--	1958	7.5	305	7.1	6.8	
39N7E-6.2a	Elburn Packing	C-O	10	1954	7	448	5.3	5.9	Well No. 4
39N6E-3.4a	Kaneland School	G-P,G-SP	6	1956	8	127	4.5	4.9	
38N8E-34.7g	City of Aurora	C-O, MS	16	1952	24	1078	7.0	7.4	City well No. 16, shot
38N8E-33.8c	Village of Montgomery	C-O	16	1957	23	1022	8.5	9.0	Village well No. 3, shot
38N8E-33.5gl	Mooseheart	C-O	—	1953	6	400	5.0	5.4	Well No. 2, shot
38N8E-33.5g2	Mooseheart	C-O, MS	16	1955	48	540	5.4	6.5	Well No. 3, shot
38N8E-32.5a	United Wall Paper, Inc.	C-O	10	1946	18	720	4.1	5.0	Well No. 1
38N8E-32.4f	Village of Montgomery	C-O	20	1958	16	1326	9.3	9.5	Village well No. 4, shot
38N8E-28.4e	City of Aurora	C-O, MS	14	1945	24	400	2.8	3.1	City well No. 7
38N8E-27.4a	City of Aurora	C-O, MS	15	1947	—	500	2.5	2.6	City well No. 6
38N8E-23.7h	City of Aurora	C-O, MS	10	1943	12	900	11.1	12.2	City we'll No. 9, shot
38N8E-23.1h	City of Aurora	C-O, MS	12	1951	24	1115	6.2	7.6	City well No. 15, shot
38N8E-22.7c	City of Aurora	C-O, MS	--	1950	4	805	5.6	6.5	City well No. 8, shot
38N8E-21	Burgess Norton Co.	C-O	12	1950	2	388	7.8	7.9	
38N_8E-l6.4d	City of Aurora	C-O, MS	8	1958	21	1016	6.6	7.6	City well No. 17, shot
38N8E-15.6h	Alba Mfg. Co.	I-G	8	1949	1	324	4.4	4.1	Shot
38N8E-15.4h	City of Aurora	C-O, MS	14	1948	—	1085	8.1	8.3	City well No. 12, shot
38N8E-15.3h	City of Aurora	C-O, MS	16	1936	19	1300	9.7	10.2	City well No. 12
38N8E-15	City of Aurora	C-O, MS	12	1942	51	1400	8.9	10.4	City well No. 11, shot
38N8E-10.5d	Springbrook Sanitarium	G-P,G-SP	12	1932	--	136	1.9	2.3	
38N8E-4.3g	Village of North Aurora	C-O	20	1960	3	744	6.2	6.8	Village well No. 3

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
KNE									
38N8E-4.1f	Village of North Aurora	C-O	18	1955	23	500	3.1	3.3	Village well No. 2
38N8E-3.8g	Village of North Aurora	G-P,G-SP	10	1938	12	113	1.4	1.6	Village well No. 1
KNK									
32N12E-15.7b	Village of Manteno	G-P,G-SP	10	1934	.1	125	1.0	0.6	
31N12E-29.6f	Village of Bradley	G-P,G-SP	10	1934	1	80	1.0	0.8	Village well No. 3
30N10E-32	Texas-Illinois Gas Pipeline Co.	I-G	8	1951	5	200	2.6	2.6	Well No. 1 - Karcher
30N10E-29.2d	Village of Herscher	G-P,G-SP	6	1945	3	60	1.2	1.0	
30N9E-6.8a	Village of Reddick	G-P,G-SP	8	1954	6	45	0.3	0.3	
30N13W-8	State Insane Hospital	C-O	--	1934	24	250	3.3	3.2	Well No. 1
30N13W-8	State Insane Hospital	C-O	--	1934	24	210	5.2	4.7	Well No. 2
KNX									
12N3E-36.5d	Little Joan Coal Co.	G-P,G-SP	8	1936	--	300	2.4	2.6	Well No. 1, shot
12N3E-36.4d	Little Joan Coal Co.	G-P,G-SP	10	1941	24	312	3.1	3.3	Well No. 2
HN2E-28.5d	City of Knoxville	C-O	6	1934	--	232	14.1	17.0	City well No. 2
HN2E-28.5d	City of Knoxville	G-P,G-SP	8	1934	—	92	1.2	1.3	City well No. 2
llN2E-28.5d	City of Knoxville	C-O	6	1944	.5	240	12.9	13.6	City well No. 2
11N2E-28	City of Knoxville	C-O	12	1960	5.2	533	3.8	4.1	City well No. 3
11N1E-16.1h	City of Galesburg	PdC,Tr,Fr, I-G, EC	14	1928	—	1600	28.0	36.2	City well No. 2 (Henderson)
11N1E-16.1h	City of Galesburg	PdC,Tr,Fr, I-G, EC	14	1933	—	1580	40.5	60.0	City well No. 2 (Henderson)
11N1E-16.1h	City of Galesburg	PdC,Tr,Fr, I-G, EC	14	1944	—	1000	14.3	15.4	City well No. 2 (Henderson)
11N1E-15.2h	City of Galesburg	G-SP	10	1918	—	450	5.3	6.1	City well No. 1 (Breadley),shot
11N1E-15.2h	City of Galesburg	G-SP	10	1921	—	450	3.8	4.2	City well No. 1 (Breadley),shot
11N1E-14.7e	City of Galesburg	G-P,G-SP	15	1919	—	650	4.0	4.5	City well, (Brooks St.)
11N1E-14.7e	City of Galesburg	PdC,Tr,Fr, I-G, EC	10	1944	8.5	519	27.0	29.7	City well, (Brooks St.)
10NlE-33.5b1	City of Abingdon	G-SP	6	1920	—	130	2.8	3.0	City well No. 1
10N1E-33.5b1	City of Abingdon	G-SP	6	1934	1	104	1.1	1.1	City well No. 1
10NlE-33.5b1	City of Abingdon	G-SP	6	1941	—	110	0.9	1.0	City well No. 1
10NlE-33.5b1	City of Abingdon	G-SP	6	1944	—	104	1.1	1.2	City well No. 1
10NlE-33.5b1	City of Abingdon	G-SP	6	1954	3	200	0.9	0.9	City well No. 1, shot
10NlE-33.5b2	City of Abingdon	PdC,Tr,Fr, I-G	10	1958	--	610	36.0	40.2	City well No. 2
10NlE-33.5b2	City of Abingdon	PdC,Tr,Fr, I-G	10	1932	36	536	35.8	42.0	City well No. 2
10NlE-33.5b2	City of Abingdon	PdC,Tr,Fr, I-G	10	1946	1.2	460	41.8	41.0	City well No. 2
10NlE-33.3c	City of Abingdon	C-O	20	1953	23	1100	24.0	29.00	City well No. 3
LAS									
36N3E-18.4d	City of Earlville	G-SP	--	1959	—	100	1.1	1.1	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (epm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
LAS									
36NlE-33.3g	City of Mendota	G-P,G-SP	16	1945	24	550	2.6	2.9	City well No. 3
36NlE-33.3g	City of Mendota	C-O	12	1952	12	690	6.8	6.9	City well No. 3
36NlE-32.1a	City of Mendota	C-O	20	1947	24	1000	7.0	8.3	City well No. 4
36NlE-32.1a	City of Mendota	C-O	20	1957	4	475	5.5	5.3	City well No. 4
36NlE-27.3a	California Packing Co.	C-O	--	1949	21	660	4.6	5.5	Well No. 1, shot
34N4E-9.4d	Wedvon Silica Co.	G-SP	6	----	--	75	1.1	1.2	
33NllE-36.6h	City of Oglesby	C-O	10	1959	8	700	12.7	13.3	City well No. 4
33N5E-25.4d	Seneca Shipyards	G-SP	10	1943	3	414	2.6	2.5	Well No. 3
33N5E-24.8c	Village of Seneca	G-SP	10	1943	3	407	2.7	2.7	Village well No. 2
33N3E-14.4a	City of Ottawa	G-SP	12	1946	22	455	3.3	3.7	City well No. 9
33N3E-12.2g	Chicago Retort & Fire Brick Co.	G-SP	--	1954	6	200	1.9	1.8	
33N3E-3.5a	Inland Rubber Co.	G-SP	24	1945	24	290	4.8	5.0	Well No. 2
33N3E-3.5a	Inland Rubber Co.	C-O	18	1945	24	1050	7.4	7.6	Well No. 2
33N3E-3.2b1	Inland Rubber Co.	G-SP	24	1945	24	340	3.2	3.2	Well No. 1
33N3E-3.2b2	Bakelite Corp.	C-O	18	1946	24	1440	6.3	7.9	Well No. 1
33N3E-3.2b2	Bakelite Corp.	C-O	18	1947	4	1850	13.0	12.7	Well No. 1, shot
33N3E-1.7a	City of Ottawa	C-O	16	1959	24	1280	14.4	15.9	City well No. 8
33N3E-1.6b	City of Ottawa	C-O	--	1945	9	990	11.2	11.6	City well No. 7, shot
33N1E-25	City of Oglesby	G-P,G-SP	--	----	--	350	2.0	2.1	City well No. 1
33N1E-25	City of Oglesby	C-O	—		--	362	5.4	6.0	City well No. 1
33N1E-16.8a	City of Peru	C-O	16	1952	3.5	1075	16.5	16.1	City well No. 6
32N2E-19.4a	Charles Pool	G-P,G-SP	4		8	10	0.9	1.1	
31N3E-22.8h	Village of Kangley	G-SP	10	1958	8	100	1.1	1.1	
31NlE-24.6e	Village of Lostant	G-P,G-SP	10	1953	24	59	0.3	0.3	
33NlE-36.3b	City of Oglesby	C-O	16	1949	12	764	5.0	5.9	City well No. 3
LEE									
41N9E-5	Better Brothers, Dixon	G-P	6	1934	1	10	4.0	3.9	
37N2E-10.2b	Villiage of Paw Paw	PdC,Tr,Fr, I-G	6	1938	--	200	8.7	10.0	Village well
37N2E-10.2b	Village of Paw Paw	PdC,Tr,Fr, I-G	6	1948	1	80	8.0	7.6	Village well
37NlE-8.7e	Village of West Brooklyn	G-SP	10	1948	6	145	3.2	3.3	Village well No. 3
22N11E-27.5c	Village of Ashton	Tr,Fr,I-G	12	1941	2	190	2.4	2.3	Village well No. 1
22N11E-27.5c	Village of Ashton	Tr,Fr,I-G	12	1945	.5	275	2.0	1.9	Village well No. 1
22N9E-33.8a1	City of Dixon	C-O, MS	16	1944	5.5	1145	13.8	13.8	Well No. TW2
22N9E-33.8a2	City of Dixon	C-O, MS	16	1944	—	1145	13.8	14.0	City well No. 3, shot
22N9E-33.8a2	City of Dixon	C-O, MS	16	1948	4	800	12.0	11.0	City well No. 3
22N9E-33.3b	City of Dixon	C-O	16	1957	2	370	6.4	6.0	City well No. 6
22N9E-33.3b	City of Dixon	C-O, MS	16	1957	5	1065	21.3	22.5	City well No. 6
22N9E-32.1a	City of Dixon	C-O, MS	18	1948	24	1200	17.2	19.2	City well No. 5, shot
22N9E-32	Randall, Lela B.	G-P,G-SP	6	1942	5	20	2.0	2.1	
22N9E-21.4a	Dixon State' Hospital, Dixon	Tr,Fr,I-G, MS	8	1952	5.5	1475	34.6	45.0	Well No. 1, shot
22N9E-21.4a	Dixon State Hospital, Dixon	Tr,Fr,I-G, MS	8	1959	2	1009	67.1	95.0	Well No. 1, shot
22N9E-21.4a	Dixon State Hospital, Dixon	Tr,Fr,I-G, MS	8	1959	.7	1016	72.5	104.0	Well No. 1
22N9E-21.4b	Dixon State Hospital, Dixon	Tr,Fr,I-G, MS	8	1938	2.5	960	45.6	55.0	Well No. 2
22N9E-21.4b	Dixon State Hospital, Dixon	Tr,Fr,I-G, MS	8	1951	3	745	13.5	13.2	Well No. 2
22N9E-21.4b	Dixon State Hospital, Dixon	Tr,Fr,I-G, MS	8	1959	.7	847	14.8	14.0	Well No. 2
20N10E-22.3g	City of Amboy	C-O	6	1933	--	190	15.4	19.0	City well No. 2

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
LEE									
20N10E-22.3g	City of Amboy	C-O	6	1938	8	265	4.3	4.6	City well No. 2
20N10E-22.3g	City of Amboy	C-O	6	1945	—	300	2.9	3.2	City well No. 2
20N10E-22.3g	City of Amboy	C-O	12	1947	2.5	340	3.3	3.3	City well No. 2
20N10E-22.2f	City of Amboy	C-O, MS	5	1933	1	150	3.4	3.2	City well No. 1
20N10E-22.2g	City of Amboy	C-O	16	1958	6	644	4.4	4.8	City well No. 3
20N10E-22	Amboy Milk Co., Amboy	C-O	12	1939	6.5	570	4.4	4.7	
20N10E-11.1c	Green River Ordnance Dep.	G-P,G-SP	10	1942	7	420	4.5	4.8	Well A-2
20N10E-7.8e	Green Riyer Ordnance Dep.	G-P,G-SP	8	1942	3	338	7.7	8.2	Well T-2
20N10E-7.8h2	Green River Ordnance Dep.	G-P,G-SP	10	1942	3	595	9.5	12.0	Well A-1
20N10E-7.7h	Green River Ordnance Dep.	G-P,G-SP	10	1942	12	518	2.1	2.2	Well A-4
20N10E-7.6b1	Green River Ordnance Dep.	G-P,G-SP	10	1942	4	204	3.2	3.2	Well A-6
20N10E-7.6b2	Green River Ordnance Dep.	G-P,G-SP	8	1942	3	295	2.4	.2.4	Well TW-2
20N10E-7.2b	Green River Ordnance Dep.	G-P,G-SP	10	1942	12	430	6.6	7.8	Well A-5
20N10E-6.8h1	Green River Ordnance Dep.	G-P,G-SP	8	1942	3	280	3.6	3.6	Well T-1
20N9E-13.6h	Green River Ordnance Dep.	G-P,G-SP	16	1942	3.2	281	4.0	3.6	Well P-2
20N9E-12.4b	Green River Ordnance Dep.	C-O, MS	8	1942	12	588	2.0	2.2	Well TW-1
20N9E-12.4b	Green River Ordnance Dep.	C-O, MS	8	1942	3	400	2.6	2.6	Well TW-1
20N9E-12.2h	Green River Ordnance Dep.	G-P,G-SP	10	1942	11.5	249	2.8	2.9	Well A-3
20N9E-1.2f	Green River Ordnance Dep.	G-SP	20	1942	15	700	7.0	8.7	Well P-1
20N8E-14.1d	Village of Harmon	G-P,G-SP	5	1916	—	30	0.5	0.6	
19NllE-9.1a	Village of Sublette	G-P,G-SP	6	1936	10	90	4.7	5.0	
19NllE-9.1a	Village of Sublette	G-P,G-SP	6	1947	4	90	7.5	7.8	
LIV									
30N6E-l.la	State Reformatory for Women	G-P,G-SP	10	1948	24	150	1.0	1.1	Well No. 2
29N6E-10.7f1	Village of Odell	G-SP	8	1951	23.5	17	0.1	0.2	Village well No. 2
29N6E-10.7f2	Village of Odell	G-SP,PdC, Tr	8	1951	8	220	27.3	29.0	Village well No. 3
26N8E-3.7e	Town of Chatsworth	G-P,G-SP	--	1941	3	80	1.0	1.0	Town well No. 1
LKE									
46N12E-35.8h	Illinois Beach State Park	G-P,G-SP	6	1947	5	38	0.3	0.3	
46N12E-21.8b	City of Zion	G-P,G-SP	--	1946	4.5	400	2.4	2.3	City well No. 1
46N12E-10.8g	Village of Winthrop Harbor	G-P,G-SP	10	1944	1	100	1.2	1.0	Village well No. 3
45N12E-15.8e	Greiss-Pflager Tanning Co.	C-O, MS	15	1958	--	750	9.0	10.6	
45N11E-14.5a	Village of Gurnee	I-G	10	1959	22	310	1.6	1.7	
44N12E-21.8f	Village of Lake Bluff	C-O, MS	6	1950	4	270	9.6	10.7	Village well No. 4
44N12E-20.1f	Village of Lake Bluff	C-O, MS	20	1956	7	1420	15.7	15.3	Village well No. 3
44N12E-18.3a1	Austin Deep Freeze	C-O	12	1952	--	555	4.0	4.5	Well No. 1
44N12E-18.3a2	Austin Deep Freeze	C-O	12	1950	--	555	4.7	5.4	Well No. 2
44NllE-4.8g	Gustine Chancellor	G-P,G-SP	8	1950	2	38	0.9	0.8	
43NllE-23.5g	Ladd Enterprises	C-O	8	1958	8	195-	1.9	1.9	Well No. 2

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
LKE									
43N11E-21.3h	Power Nail Co.	G-P,G-SP	6	1959	3	138	1.8	1.8	
43N11E-10	John Allen	G-P,G-SP	6	1940	50	50	0.9	1.1	
43N11E-3.1d	George Voevodksy	G-P,G-SP	6	1937	8	53	1.2	1.3	
43N11E-2	James Getz	G-P,G-SP	7	1939	56	50	2.0	2.4	
43N10E-34.8b	U. S. Engr. Niki Site	G-P,G-SP	8	1956	24	56	0.7	0.8	
MCD									
7NlW-33.4e1	City of Bushnell	G-P,G-SP	10	1932	—	160	2.0	2.0	City well No. 1
7NlW-33.4e1	City of Bushnell	G-P,G-SP	10	-----	—	200	1.2	1.2	City well No. 1
7NlW-33.4e1	City of Bushnell	G-P,G-SP	10	1944	—	185	1.3	1.3	City well No. 1
7NlW-33.4e2	City of Bushnell	G-P,G-SP	8	1943	—	300	9.1	11.5	City well No. 2
7NlW-33.4e2	City of Bushnell	G-P,G-SP	8	1945	--	297	14.7	19.8	City well No. 2
7NlW-33.4e2	City of Bushnell	G-P,G-SP	8	1948	.5	150	6.2	5.8	City well No. 2
7NlW-33.4e3	City of Bushnell	G-P,G-SP	15	1945	.5	275	3.6	3.8	City well No. 3
7NlW-33.4e3	City of Bushnell	G-P,G-SP	15	1945	--	325	3.2	3.3	City well No. 3
7NlW-33.4e3	City of Bushnell	G-P,G-SP	15	1945	—	243	1.8	1.8	City well No. 3, shot
7NlW-33.4e3	City of Bushnell	G-P,G-SP	15	1946	2.5	370	2.3	2.2	City well No. 3
7NlW-33.4e3	City of Bushnell	G-P,G-SP	15	1948	.5	200	2.1	1.8	City well No. 3
7N1W-1.3e	Village of Prairie City	G-P	8	1954	4	120	1.3	1.3	Village well No. 1
7N1W-1.3e	Village of Prairie City	G-P,G-SP	6	1954	4	62	1.5	1.5	Village well No. 1
MCH									
44N5E-35.5h	Arnold Engr.	G-P,G-SP	12	1958	4	200	1.4	1.3	Well No. 1
44N5E-35.3g	City of Marengo	C-O	12	1951	4	508	4.7	5.0	City well No. 3
43N8E-21.3a	Material Service Co.	C-O	10	1958	—	590	5.2	6.4	
43N8E-5.4g1	City of Crystal Lake	C-O	—	1957	4	400	4.7	4.8	City well No. 2
43N8E-5.4g2	City of Crystal Lake	C-O, MS	--	1947	4	230	4.1	4.0	
MER									
14N2W-15.1b	Village of Viola	G-P,G-SP	8	1915	10	160	3.2	3.4	Village well No. 1
MRS									
30NlE-30.2f	City of Wenona	G-P,G-SP	10	1957	5	37	0.2	0.2	City well No. 5
30NlE-30.2f	City of Wenona	G-P,G-SP	10	1957	--	185	1.7	1.9	City well No. 5, shot
30NlE-24.2f	City of Wenona	G-P,G-SP	8	1937	23	25	0.2	0.3	City well No. 3
29NlE-8.5h	City of Toluca	G-P,G-SP	8	1951	3	78	1.1	1.1	City well No. 2
29NlE-8.5h	City of Toluca	G-P,G-SP	8	1951	10	420	2.3	2.5	City well No. 2, shot
OGL									
40N2E-23.1f	Village of Creston	G-P,G-SP	10	1955	2.5	130	7.4	6.9	Village well No. 2
40NlE-25.7g	City of Rochelle	C-O, MS	8	1919	--	500	13.1	20.5	City well No. 1
40NlE-24.7a1	City of Rochelle	C-O	10	1947	--	250	5.7	6.4	City well No. 2, shot
40NlE-24.7a2	City of Rochelle	C-O, MS	16	1930	—	680	5.0	6.1	City well No. 3
40NlE-24.5h	City of Rochelle	C-O	12	1958	21	990	10.1	11.0	City well No. 7
40N1E-24	City of Rochelle	C-O, MS	12	1930	—	680	8.8	12.7	City well No. 4
40N1E-24	City of Rochelle	C-O	12	1960	7	1050	6.5	9.6	City well No. 9
40NlE-23.2d	City of Rochelle	G-SP	10	1938	5.7	410	14.6	20.0	City well No. 5
25NllE-32.7e	City of Byron	C-O, MS	10	1947	.1	350	5.6	5.0	City well No. 1
25N9E-36.4d	Village of Leaf River	G-SP	8	1945	8	200	4.2	4.5	Village well
25N8E-33.4e	Village of Forreston	C-O, EC	8	1952	2.5	300	21.4	29.5	Village well No. 2
24N11E-1.7b	Village of Stillman Valley	G-SP	8	1938	8.7	203	3.7	3.9	
24N10E-3.6e	City of Oregon	C-O, MS	—	1948	8	450	9.9	13.2	City well No. 1

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
OGL									
24N9E-27.1f	Village of Mt. Morris	C-O, MS	16	1947	.2	450	25.0	20.8	Village well No. 3
23N10E-3.6e	City of Oregon	C-O, MS	—	1947	24	466	7.8	9.9	City well No. ,1
23N10E-3.6g	City of Oregon	Fr,I-G	14	1948	5.7	495	3.1	3.0	City well No. 2
23N10E-3.6g	City of Oregon	Fr,I-G,MS	14	1948	3	385	5.3	5.3	City well No. 2
23N10E-3	Carnation Co., Oregon	G-SP,Tr	8	1940	4	222	14.8	17.0	
23N8E-9.4cl	City of Polo	C-O, MS	10	1931	—	150	0.9	1.0	City well No. 1
23N8E-9.4c2	City of Polo	C-O	15	1947	.2	250	8.3	7.6	City well No. 2
23N8E-9.4c3	City of Polo	C-O	14	1948	6	208	4.6	4.6	City well No. 3
PEO									
11N6E-13.1a1	Village of Princeville	G-P,G-SP	5	1921	--	165	2.4	2.6	Village well No. 1
11N6E-13.1a1	Village of Princeville	G-P,G-SP	5	1943	2	134	4.3	4.2	Village well No. 1
11N6E-13.1a2	Village of Princeville	G-P	10	1938	3	320	3.4	3.3	Village well No. 2
11N6E-13.1a2	Village of Princeville	G-P	10	1943	1.5	148	3.0	2.8	Village well No. 2
9N5E-8.8d	City of Elmwood	G-P,G-SP	6	1947	—	90	4.5	4.8	City well No. 1
9N5E-7	City of Elmwood	G-P,G-SP	10	1951	20	260	1.5	1.7	City well No. 2
8N7E-26	Insane Hosp., Bartonville	G-P,G-SP	6	1934	—	250	6.5	7.6	
8N6E-10.1f	Village of Hanna City	G-P,G-SP	8	1952	--	20	0.2	0.2	Village well No. 1
8N6E-10.1f	Village of Hanna City	G-P,G-SP	8	1952	7	50	0.3	0.3	Village well No. 1, shot
8N6E-4.4a	U. S. Army C. of E. Hanna City	G-P,G-SP	8	1957	24	175	1.0	1.1	Well No. 1
PUT									
32N1W-11.1f	Village of Standard	G-P,G-SP	6	1958	6	25	2.5	2.6	
32N1W-9.4g	Village of Granville	G-P,G-SP	4	1946	6.5	100	1.2	1.2	Village well No. 1
32N1W-9.1e	Village of Granville	G-P,G-SP	8	1948	10.5	234	2.5	2.7	Village well No. 2
RIS									
19N1E-25.5e	Village of Port Byron	G-P,G-SP, PdC,Tr	4 1/2	1943	—	350	9.6	12.6	Village well No. 1
19N1E-25.5e	Village of Port Byron	G-P,G-SP, PdC,Tr	4 1/2	1947	--	250	10.0	12.5	Village well No. 1
18N1E-32.7g	City of Silvis	PdC,Tr	9	1947	.5	475	7.9	8.3	City well No. 2
17N1E-4	Village of Carbon Cliff	G-P,G-SP	16	1951	19	602	4.8	5.7	Village well No. 1
STE									
29N9E-13.7e	Village of Davis	G-SP	10	1955	24	385	7.3	9.2	Village well No. 2
29N7E-36.5e	Village of Orangeville	G-SP	12	1947	1	284	47.4	44.0	Village well No. 1
29N7E-36.3e	Village of Orangeville	G-SP	12	1953	4	82	8.2	7.6	Village well No. 2
29N6E-22.2b	Village of Winslow	G-P,G-SP	8	1917	2	200	10.0	10.3	Village well No. 1
28N8E-36.5h	Town of Dakota	G-SP	10	1957	13	398	7.5	9.0	Town well No. 1
28N8E-25.4a1	Dakota Condensed Milk	G-P,G-SP	8	1937	—	150	3.3	3.5	Well No. 1
28N8E-25.4a2	Dakota Condensed Milk	G-P,G-SP	6	1937	--	60	3.0	3.2	Well No. 2
28N8E-25	Dakota Cemetery	G-P	6	1940	3	27	9.0	9.4	
28N7E-36.1b	Village of Cedarville	G-SP	8	1949	6	310	6.0	6.5	Village well No. 1
28N6E-33.8e1	Town of Lena	G-P,G-SP	10	1923	—	100	1.6	1.7	Town well No. 1

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
STE									
28N6E-33.8el	Town of Lena	G-P,G-SP	10	1947	.5	200	1.8	1.6	Town well No. 1
28N6E-33.8e2	Town of Lena	C-O	12	1931	—	330	9.2	10.8	Town well No. 2
28N6E-33.8e2	Town of Lena	C-O	12	1947	.5	275	2.6	2.1	Town well No. 2
27N8E-32.7h	Modern Plating Corp., Freeport	G-SP, Tr	10	1956	7	411	13.2	18.5	Well No. 2
27N8E-30.8b	City of Freeport	G-P,G-SP	16	1947	--	1130	63.0	94.0	City well No. 2
27N8E-30.7b	City of Freeport	G-P	16	1934	18	1000	77.0	125.0	City well No. 4
27N8E-30.6b	City of Freeport	G-SP, Tr	10	1921	--	1500	16.3	19.0	City well No. 3
27N8E-30.6b	City of Freeport	G-SP, Tr	10	1934	18	1200	14.5	16.0	City well No. 3
27N8E-30.6b	City of Freeport	G-SP, Tr	10	1949	3	800	20.5	21.0	City well No. 3
27N8E-29.8c	Fairbanks-Morse, Freeport	G-SP	12	1957	1	216	3.0	2.7	Well No. 1
27N8E-28.6a	Structo Mfg. Co.	G-P,G-SP, Tr	12	----	--	1500	11.0	26.2	
27N7E-35	Park Crest Subdivision	G-SP	12	1960	6	150	1.8	1.6	Well No. 1
26N6E-9.8f1	Dean Milk Co., Pearl City	G-P,G-SP	8	1927	7.2	55	1.0	1.0	Well No. 1
26N6E-9.8f2	Dean Milk Co., Pearl City	C-O	10	1937	1	720	24.0	24.0	Well No. 2
STK									
14N7E-23.1a	Village of Bradford	G-P,G-SP	8	1936	1	51	0.6	0.5	Village well No. 2
14N7E-23.1a	Village of Bradford	G-P,G-SP, PdC	8	1936	5	94	1.0	1.0	Village well No. 2
12N6E-1.7h	City of Wyoming	G-P,G-SP, Tr	6	1943	—	300	13.6	17.5	City well No. 1
WAR									
11N2W-29.8a1	City of Monmouth	C-O	10	1932	—	850	42.5	51.7	City west well
11N2W-29.8a2	City of Monmouth	C-O	10	1939	--	600	54.6	65.3	City east well
HN2W-26.8h	Monmouth School Dist.	G-P	6	1957	24	30	1.0	1.0	
10N3W-8	Village of Kirkwood	G-P	5	1948	—	50	0.3	0.3	Village well No. 4
WIL									
37N10E-33.1h	Hampton Park Subdivision	C-O	12	1959	14	1325	10.4	11.4	Shot
36NllE-31.8a	City of Joliet	C-O	20	1950	21	700	4.6	5.4	City well site 1 No. 3, shot
36N10E-34.8a	Ruberoid Co.	G-SP	10	1937	2	51	2.1	1.8	
36N10E-34.8a	Ruberoid Co.	G-SP	10	1937	2	77	1.9	1.8	
36N10E-33.4c	Lidice City	G-P,G-SP	8	1944	1	47	0.8	0.7	
36N10E-32.1a	Lidice City	C-O	8	1945	12	109	5.4	5.8	Well No. 3
36N10E-29.6g	Stateville	C-O	16	1951	—	430	6.3	6.9	Well No. 5
36N10E-29.6g	Stateville	C-O	16	1958	3	550	7.0	7.6	Well No. 5, shot
36N10E-28.6h	Illinois State Pen.	C-O	8	1942	2	134	5.2	4.8	Well No. 3, shot
36N10E-28.6h	Illinois State Pen.	C-O	8	1942	2	179	4.8	4.8	Well No. 3, shot
36N10E-28.6h	Illinois State Pen.	C-O	8	1942	2	275	4.7	4.8	Well No. 3, shot
36N10E-23.6c	City of Lockport	C-O	10	1946	2.5	400	7.1	7.5	City well No. 2
36N10E-23.5a	City of Lockport	C-O	14	1924	2	325	5.7	5.5	City well No. 3
36N10E-23.5a	City of Lockport	C-O	14	1946	2.5	345	4.9	4.7	City well No. 3
36N10E-23.2f	City of Lockport	C-O	18	1954	24	700	8.0	9.2	City well No. 4, shot
36N10E-16.4c	Globe Corp., Aircraft Div.	C-O	8	1953	2	195	8.9	8.9	Well No. 3, shot

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
WIL									
36N10E-2.8h	Public Service Co.	C-O	16	1952	24	1009	6.4	6.7	Well No. 2
36N10E-2.8f	Public Service Co.	C-O	26	1957	22	955	8.0	9.2	Station No. 8, Well No. 3
36N9E-10.8d	Village of Plainfield	C-O	16	1956	1	626	6.4	6.4	Village well No. 3, shot
35NllE-8.8f	City of Joliet	C-O	--	1950	22	1060	8.3	8.9	
35NllE-5.7h	City of Joliet	C-O	--	1950	18	980	6.9	7.3	
35N10E-30.7e	Caterpillar Tractor Co.	C-O	13	1950	6.5	700	5.4	6.3	Well No. 2, shot
35N10E-30.4e	Caterpillar Tractor Co.	C-O	10	1950	24	630	4.2	4.9	Well No. 1, shot
35N10E-30.3c	Blockson Chemical Co.	I-G	20	1960	47.5	869	3.1	3.7	
35N10E-30.1a	Blockson Chemical Co.	I-G	10	1941	9	480	3.4	3.6	Well No. 1, shot
35N10E-30. 1e	Blockson Chemical Co.	I-G	10	1941	--	276	3.3	3.7	Well No. 2, shot
35N10E-30.1e	Blockson Chemical Co.	I-G	10	1941	2	449	4.0	3.7	Well No. 2, shot
35N10E-30.1cl	Blockson Chemical Co.	G-P,G-SP	24	1949	3	305	1.7	1.3	Well No. 3
35N10E-30.1c2	Blockson Chemical Co.	I-G	24	1950	39	710	3.3	3.6	Well No. 4
35N10H-30.1c2	Blockson Chemical Co.	I-G	24	1950	24	760	3.8	4.2	Well No. 4, shot
35N10E-29.8c	Blockson Chemical Co.	I-G	20	1952	24	844	2.4	2.6	Well No. 5, shot
35N10E-21.4h	American Cyn. & Chemical Co.	C-O	12	1946	24	340	6.7	7.7	Well No. 2, shot
35N10E-20.7g	Village of Rockdale	C-O	14	1945	7	118	3.6	3.5	Village well No. 2
35N10E-20.7g	Village of Rockdale	C-O	14	1945	2	300	8.3	8.0	Village well No. 2, shot
35N10E-20.7g	Village of Rockdale	C-O	14	1945	2	400	8.0	8.0	Village well No. 2, shot
35N10E-20.7g	Village of Rockdale	C-O	14	1945	2	500	7.4	8.0	Village well No. 2, shot
35N10E-20.6a	Public Service Co.	I-G	26	1958	12	440	2.3	2.5	Station No. 9, well No. 2, shot
35N10E-14.6h	City of Joliet	C-O	--	1937	12	450	4.0	4.4	Washington St. well, shot
35N10E-10.1a	Pratt Mfg. Co.	I-G	6	1945	5	110	3.0	3.1	Shot
35N10E-9.4f	Pioneer Brewery Co.	G-P,G-SP	8	1941	24	90	0.8	0.9	Shot
35N10E-9.1d	City of Joliet	C-O	8	1937	—	835	9.6	-9.8	Ottawa St. well
35N10E-4.2h	Phoenix Mfg. Co.	G-P,G-SP	10	1941	—	260	1.4	1.5	
35N10E-4.1g	Phoenix Mfg. Co.	C-O	16	1951	3	500	7.8	8.4	Shot
35N10E-2.8b	City of Joliet	C-O	10	1946	12	825	4.2	5.2	Williamson Ave. well, shot
35N9E-25.1e	Caterpillar Tractor Co.	I-G	16	1960	2	500	7.1	7.0.	Well No. 3, shot
35N9E-25.1e	Caterpillar Tractor Co.	I-G	16	1960	2	700	6.4	7.0	Well No. 3, shot
34N10E-31.6a	Kankakee Ordnance Works	C-O	13	1943	24	1000	9.7	10.5	Well No. 12
34N10E-29.6g	Elwood City	G-P,G-SP	8	1952	22.5	91	0.8	0.9	
34N9E-36.5b	Kankakee Ordnance Works	C-O	16	1941	24	1175	10.9	11.7	Well No. 6, shot
34N9E-36.4e	Kankakee Ordnance Works	C-O	16	1941	50	1050	5.8	6.3	Well No. 7
34N9E-35.8a	Kankakee Ordnance Works	G-P,G-SP	18	1941	8	146	0.6	0.5	Well No. 2
34N9E-35.8a	Kankakee Ordnance Works	C-O	16	1941	20	505	2.0	2.0	Well No. 2
34N9E-35.8a	Kankakee Ordnance Works	C-O	16	1941	24	1055	5.3	6.3	Well No. 2, shot
34N9E-35.5a	Kankakee Ordnance Works	C-O	18	1941	7	1355	6.0	6.7	Well No. 1, shot

APPENDIX (Continued)

We'll Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casting (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
WIL									
34N9E-34.7a	Kankakee Ordnance Works	C-O	18	1954	24	1475	5.8	6.0	Well No. 4, shot
34N9E-34.4a	Kankakee Ordnance Works	G-P,G-SP	18	1941	5	166	0.8	0.7	Well No. 3
34N9E-34.4a	Kankakee Ordnance Works	C-O	16	1941	12	1087	5.0	6.6	Well No. 3, shot
34N9E-25.5a	Kankakee Ordnance Works	C-O	18	1941	12	823	12.3	12.2	Well No. 8, shot
34N9E-25.5a	Kankakee Ordnance Works	C-O	18	1953	24	1140	8.5	8.7	Well No. 8
34N9E-25.5d	Kankakee Ordnance Works	C-O	18	1953	24	1060	4.8	5.4	Well No. 9, shot
34N9E-25.5h	Kankakee Ordnance Works	C-O	18	1941	23	806	6.1	6.7	Well No. 10, shot
34N9E-21.bf	Camp Kankakee	G-P,G-SP	6	1943	19	66	0.6	0.7	Well No. 2
34N9E-11.7g	Amoco Chemical Co.	C-O	15	1957	24	800	6.0	7.0	Well No. 1, shot
34N9E-10.1h	Amoco Chemical Co.	C-O	12	1958	2.5	720	7.6	6.9	Well No. 2, shot
33N10E-16.2h	Elwood Ordnance	G-P,G-SP	10	1941	6	64	0.9	0.9	Well No. 1
33N10E-9.4f	Elwood Ordnance	C-O	12	1941	2	480	18.5	13.1	West well, crevices in Tr
33N10E-9.4f	Elwood Ordnance	C-O	12	1941	2	725	13.7	13.1	West well, crevices in Tr
33N10E-9.4f	Elwood Ordnance	C-O	12	1941	2	1080	11.3	13.1	West well, crevices in Tr
33N9E-25.7g	Village of Wilmington	G-P,G-SP	12	1943	22	315	2.6	2.8	Village well No. 1
33N9E-12.1g	Kankakee Ordnance Works	C-O	15	1942	24	1050	10.4	11.4	Well No. 10, shot
33N9E-1.5a	Kankakee Ordnance Works	G-P,G-SP	18	1941	5	152	0.6	0.5	Well No. 5
33N9E-1.5e	Kankakee Ordnance Works	C-O	16	1952	22	1360	7.0	7.4	Well No. 5A, shot
32N9E-8.5C	City of Braidwood	G-P,G-SP	8	1945	3	140	0.7	0.7	
WIN									
46N2E-5.7d	City of South Beloit	C-O, MS	18	1937	—	1675	15.8	17.0	City well No. 3
46NlE-24.8d	Village of Rockton	G-P,G-SP	8	1938	—	120	2.7	2.9	
44N2E-34.4a	Commercial Mortgage & Finance	G-SP	10	1957	8	252	3.9	4.2	
44N2E-31.7f	City of Rockford	C-O, MS	20	1941	8	1550	28.2	32.8	City Unit well No. 6
44N2H-29.3a	City of Rockford	C-O, MS	20	1948	—	2100	18.2	21.0	City Unit well No. 10
44N2E-21.3f	F. M. Gambino Home Builders, Rockford	G-SP	12	1947	7	439	6.6	7.6	Well No. 1
44N2H-19.6b	City of Rockford	C-O, MS	12	1937	—	400	23.5	24.6	City Unit well No. 9
44N2E-18.7a	City of Rockford	C-O, MS	20	1945	6	1500	19.7	20.3	City Unit well No. 5
44N2E-7.8e	Woodward Governor Co., Rockford	C-O	12	1942	24	750	16.7	18.6	Well No. 2
44NlE-36.7f	City of Rockford	C-O, MS	12	1925	—	1400	15.5	17.5	City Unit well No. 7
44NlE-36.7f	City of Rockford	C-O, MS	12	1947	—	910	9.6	16.8	City Unit well No. 7
44NlE-36.7f	City of Rockford	C-O, MS	12	1947	—	1500	15.2	17.0	City Unit well No. 7, shot
44NlE-35.7f	G. D. Roper Corp., Rockford	C-O	10	1947	9	363	10.4	13.0	Power House well
44NlE-35.6e	G. D. Roper Corp., Rockford	C-O	8	1947	5	160	2.3	2.4	Well No. 1
44N1E-35	Rockford Screw Product Co.	PdC,Tr, Fr,I-G	8	1948	7	340	7.6	8.8	

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
WIN									
44NlE-33.8e	Buckbee School near Rockford	G-P,G-SP	6	1958	7.2	130	1.2	1.3	Well No. 2
44N1E-32	City of Rockford	C-O, MS	20	1959	3	963	22.4	21.8	City well No. 16
44N1E-23	City of Rockford	C-O, MS	18	1938	—	680	18.9	19.5	City Unit well No. 1
44N1E-23	City of Rockford	C-O, MS	18	1948	6	1570	13.4	13.5	City Unit well No. 1
44N1E-23	Palace Theater, Rockford	G-P,G-SP	8	1941	8	230	6.4	7.1	
44N1E-22.6b1	City of Rockford	C-O, MS	16	1922	—	1290	16.5	18.2	City Group well No. 1
44NlE-22.6b2	City of Rockford	C-O, MS	16	1943	—	1160	20.0	22.7	City Group well No. 2, shot
44NlE-22.6b3	City of Rockford	C-O, MS	16	1934	—	625	6.6	8.4	City Group well No. 3
44NlE-22.6b3	City of Rockford	C-O, MS	16	1934	--	972	15.0	16.3	City Group well No. 3, shot
44NlE-22.6b4	City of Rockford	C-O, MS	16	1934	—	278	3.3	3.5	City Group well No. 4
44NlE-22.6b4	City of Rockford	C-O, MS	16	1934	—	972	15.0	16.3	City Group well No. 4, shot
44NlE-22.6b5	City of Rockford	C-O, MS	16	1943	—	1360	23.5	27.9	City Group well No. 5, shot
44NlE-22.6b6	City of Rockford	C-O, MS	16	1943	—	1425	23.0	27.5	City Group well No. 6, shot
44NlE-21.1e	City of Rockford	C-O, MS	20	1959	6	963	19.6	19.5	City well No. 15
44N1E-13.6d	City of Rockford	C-O, MS	12	1919	--	1560	18.7	21.8	City Unit well No. 8
44N1E-13	Rockford Service Bureau	G-P, G-SP	6	1935	10	30	2.0	2.1	
44N1E-12.6b	Ingersoll Milling Machine Co.	G-P,G-SP	--	1941	—	200	2.9	3.0	
44N1E-11.1e	W. F. & John Barnes (Ord.)	C-O, MS	12	1941	24	400	18.2	29.0	
44N1E-11.1b	Atwood Vacuum Machine Co.	C-O	16	1943	—	600	40.0	43.0	
44NlE-9.2f	Winnebago Home for Aged	G-P,G-SP	6	1953	3	60	12.0	12.5	Well No. 1
44NlE-7.8a	Woodward Governor Co., Rockford	C-O	16	1947	1	568	5.6	5.4	Well No. 3
43N2E-4	Vandercook School Dist. No. 114	G-P,G-SP	8	1958	1	150	6.2	6.0	
28N10E-10.8b	Village of Durand	G-SP,PdC	10	1957	20	408	6.7	8.1	Village well No. 2
27N10E-29.1d	Village of Pecatonica	C-O	12	1946	1.5	400	6.2	6.1	Village well No. 2
27N10E-29.1d	Village of Pecatonica	C-O	12	1956	8	328	3.6	3.6	Village well No. 2
27N10E-28.8c	Village of Pecatonica	C-O	10	1954	2	172	2.1	1.9	Village well No. 1
27N10E-28.8c	Village of Pecatonica	C-O	10	1936	—	240	13.3	16.0	Village well No. 1
26N11E-9.8c1	Village of Winnebago	G-P,G-SP	8	1948	2.2	41	0.6	0.6	Village well No. 1
26N11lE-9.8c2	Village of Winnebago	C-O	8	1949	2.2	63	1.5	1.6	Village well No. 2
26N1E-33.8f1	Mueller Dairy, Rockford	G-P,G-SP	18	1956	8	675	10.7	16.4	Well No. 1
26N1E-33.8f2	Mueller Dairy, Rockford	G-P,G-SP	12	1956	8	552	10.1 '	13.9	Well No. 2
WTS									
22N3E-28.7d	City of Fulton	C-O, MS	10	1947	—	500	16.7	17.2	
22N3E-28.6d	City of Fulton	G-P,G-SP, PdC,Tr	8	1947	—	350	10.0	12.4	City well No. 2

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
WTS									
21N7E-28.5g	Ill. Northern Utilities	C-O, EC	--	1940	—	515	18.2	19.0	
21N7E-28	Northwestern Steel & Wire Co.	G-P,G-SP	8	1940	—	465	3.2	3.5	Well No. 3
21N7E-28	Northwestern Steel & Wire Co.	G-P,G-SP	8	1945	—	225	3.5	3.6	Well No. 3
21N7E-28	Lawrence Brothers Mfg. Co.	G-P,G-SP	8	1947	—	125	3.1	3.2	
21N7E-22.2e	Northern Ill. Water Corp., Sterling	C-O, MS	6	1946	7	405	9.6	11.1	Well No. 3
21N7E-22.2e ,	Northern Ill. Water Corp., Sterling	C-O, MS	6	1947	--	458	11.0	14.5	Well No. 3
21N7E-22.2e	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	—	441	10.4	13.4	Well No. 3
21N7E-22.2e	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	--	426	9.6	12.1	Well No. 3
21N7E-22.2e	Northern Ill. Water Corp., Sterling	C-O, MS	6	1951	—	323	9.1	10.5	Well No. 3
21N7E-22.2e	Northern Ill. Water Corp., Sterling	C-O, MS	6	1952	—	310	9.4	10.9	Well No. 3
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	1946	1.5	345	15.7	19.8	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	1946	20	405	13.1	19.8	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	1947	--	444	11.8	16.6	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	----	—	447	11.6	16.8	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	----	—	460	13.1	20.2	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	----	—	435	10.9	14.4	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	----	--	451	10.9	15.0	Well No. 1
21N7E-22.1e1	Northern Ill. Water Corp., Sterling	C-O, EC	12	1952	--	350	12.1	16.0	Well No. 1
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, EC	8	1947	5.7	135	4.1	4.2	Well No. 2
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	1947	9.5	314	7.6	8.6	Well No. 2, shot
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	1947	—	382	7.6	9.0	Well No. 2
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	----	—	375	7.6	9.0	Well No. 2
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	----	—	370	7.4	8.8	Well No. 2
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	1951	--	340	7.7	9.0	Well No. 2
21N7E-22.1e2	Northern Ill. Water Corp., Sterling	C-O, MS	8	1952	—	290	11.6	14.4	Well No. 2

APPENDIX (Continued)

Well Number	Owner	Units or aquifers contributing to yield of well	Diameter of inner casing (inches)	Date of test	Length of test (hours)	Pumping Rate (gpm)	Observed specific capacity (gpm/ft)	Adjusted specific capacity (gpm/ft)	Remarks
WTS									
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	1947	3	408	17.8	16.5	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	1947	6	411	28.4	28.3	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	1947	—	552	16.8	17.5	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	—	523	14.1	14.8	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	--	506	12.5	12.9	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	—	508	12.3	12.7	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	—	508	13.7	14.2	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	----	—	484	12.0	12.4	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	6	1951	—	200	7.5	7.6	Well No. 4
21N7E-22.1e3	Northern Ill. Water Corp., Sterling	C-O, MS	8-6	1952	--	460	15.3	15.9	Well No. 4
21N5E-18.8cl	City of Morrison	C-O, MS	7	1938	5	300	6.1	6.6	City west well
21N5E-18.8cl	City of Morrison	C-O, MS	7	1947	1	400	10.2	11.5	City west well
21N5E-18.8cl	City of Morrison	C-O, MS	7	1957	—	680	4.9	6.1	City west well
21N5E-18.8c2	City of Morrison	C-O	8	1940	—	350	4.6	5.2	City east well
21N5E-18	City of Morrison	C-O	16	1950	—	186	5.0	5.3	City well No. 3