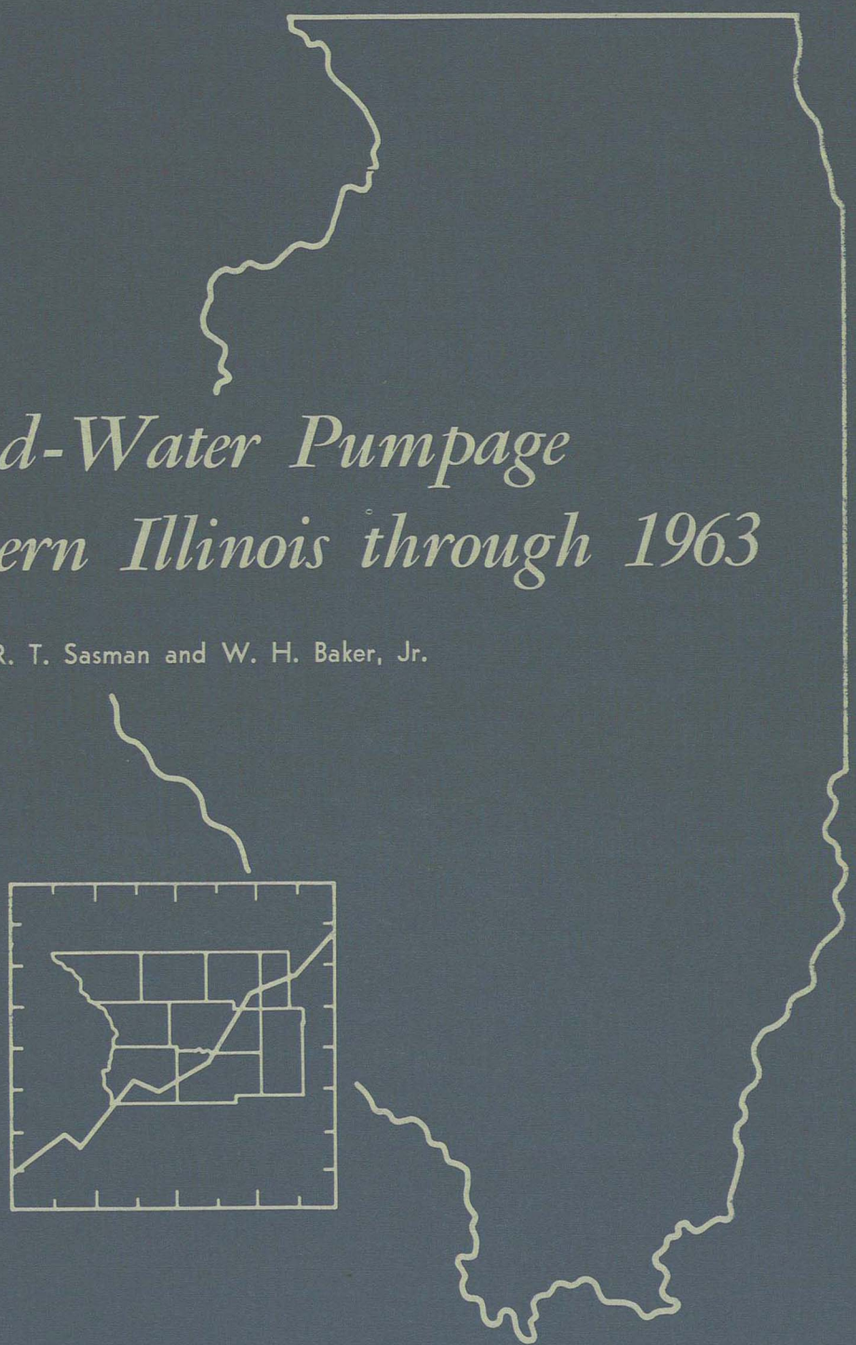
INVESTIGATION 52

ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



Ground-Water Pumpage in Northwestern Illinois through 1963

by R. T. Sasman and W. H. Baker, Jr.

ILLINOIS STATE WATER SURVEY

URBANA

1966

REPORT OF INVESTIGATION 52

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CONTENTS

ILLUSTRATIONS

TABLES

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ABSTRACT

In northwestern Illinois large quantities of water are withdrawn from sand and gravel aquifers in the glacial drift, and from shallow dolomite and sandstone aquifers. The bedrock aquifers are Silurian, Ordovician, and Cambrian in age. The sand and gravel and shallow dolomite aquifers are generally encountered at depths less than 500 feet; the depth to sandstone aquifers varies considerably, but generally exceeds 500 feet.

This report summarizes ground-water pumpage trends in northwestern Illinois through 1963. The area covered (5265 square miles or 9.4 percent of the state) includes Boone, Carroll, DeKalb, Jo Daviess, Dee, Ogle, Stephenson, Whiteside, and Winnebago Counties. Seventy-four municipalities, and at least 7 subdivisions, 3 institutions, and 123 industries obtain water from wells.

Ground-water pumpage in northwestern Illinois has increased steadily at an accelerating rate since the first high capacity well was drilled in 1875. During the 84-year period, 1880 through 1963, pumpage increased from 4.3 million gallons per day (mgd) to 78.9 mgd at an average rate of 0.90 mgd per year. Pumpage increased at an average rate of 2.1 mgd per year during the period 1935 through 1945. Since 1960, total pumpage has increased at the average rate of 4.3 mgd per year. Of the total pumpage in 1963, 65 percent was pumped from sandstone wells, 8 percent was pumped from shallow dolomite wells, and 27 pereent was pumped from glacial drift wells. Sixty-nine pereent of the total 1963 pumpage was for public supplies, 20 percent was for industrial supplies, and 11 percent was for domestic supplies.

Pumpage from glacial drift wells is concentrated in the Freeport, Bock Falls, and Eockford areas. Pumpage from shallow dolomite wells is largely for small capacity domestic wells throughout northwestern Illinois. Pumpage from sandstone wells is concentrated in the Belvidere, Eockford, Freeport, Sterling, Dixon, Rochelle, and DeKalb areas.

INTRODUCTION

Northwestern Illinois has been one of the most favorable ground-water areas in Illinois. It is underlain at depths generally 500 feet or less by glacial drift and shallow dolomite aquifers, and usually at greater depths by sandstone aquifers that have been prolific sources of water for nearly 90 years.

Ground-water resources in northwestern Illinois are developed from four aquifer systems: 1) sand and gravel deposits of the glacial drift; 2) shallow dolomite aquifers of Silurian and Ordovician age; 3) sandstone aquifers of Cambrian and Ordovician age, of which the Ironton-Galesville and Glenwood-St. Peter Sandstones are the most productive formations; and 4) the Mt. Simon Aquifer, consisting of sandstones of the Mt. Simon and lower Eau Claire Formations of Cambrian age.

The diversity of ground-water sources has prompted industrial expansion and also facilitated urban growth. More than 200 public and industrial wells obtain moderate to large quantities of water from the four aquifer systems. Small users of water, such as suburban residences or farms, usually obtain adequate water from shallow wells finished in glacial drift or underlying creviced dolomite.

One of the functions of the State Water Survey is to collect data on ground-water pumpage. These data provide records of short-term changes and long-term trends of fluctuations in withdrawals from aquifers in Illinois. Recognized uses of data on ground-water pumpage are as follows:1) to identify areas of detrimentally high ground-water withdrawals;2) to facilitate prediction of the ground-water supply outlook for the future by showing the time-rate of change in ground-water pumpage; 3) to appraise the relation between pumpage and water-level fluctuations; and 4) to provide a long-term framework of ground-water pumpage records to which shorter records from project studies may be related.

This report summarizes ground-water pumpage trends in northwestern Illinois through 1963. The area covered (5265 square miles or 9.4 percent of the state) includes Boone, Carroll, DeKalb, Jo Daviess, Lee, Ogle, Stephen-

son, Whiteside, and Winnebago Counties, and is shown in figure 1. The population of the nine-county area was 506,082 in 1960, which was 5 percent of the total population of Illinois (see table 1). A similar study for the eight northeastern counties of Illinois was reported previously (Sasman, 1965).

Seventy-four municipalities in northwestern Illinois obtained water supplies from wells in 1963; no public supplies in the area were being obtained from surface waters. At least 7 subdivisions, 3 institutions, and 123 industries obtained water from wells in 1963. A few industries use surface-water supplies from rivers to supplement their ground-water supplies.

A summary of available information on the geology and hydrology of the four aquifer systems from which ground water is withdrawn is presented to serve as a background for interpretation of pumpage records. Pumpage in northwestern Illinois is discussed for the area as a whole and for each county with special details for major pumping centers. The pumpage information is subdivided by use and source.

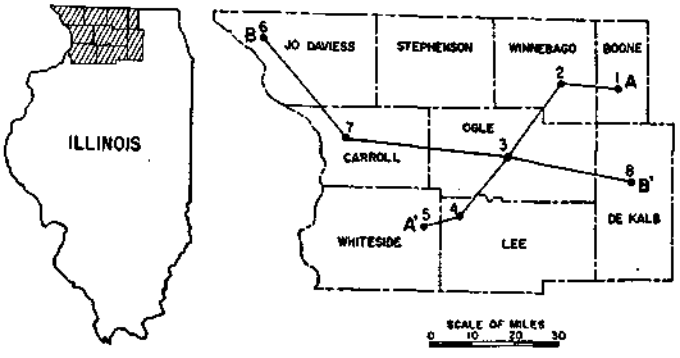

Figure 1. Location of study area and cross sections shown in figure 2

Table 1. Area and Population of Counties in Northwestern Illinois in I960

County	Area (sq mi)	Population*
Boone	283	20,326
Carroll	468	19,507
DeKalb	636	51,714
Jo Daviess	614	21,821
Lee	729	38,749
Ogle	757	38,106
Stephenson	568	46,207
Whiteside	690	59,887
Winnebago	520	209,765
Total	5265	506,082
Percent of state	9.4	5.0
State of Illinois	55,947	10,081,158

** 1960 U. S. Census*

Acknowledgments

This report was prepared under the general direction of William G. Ackermann, Chief of the Illinois State Water Survey, and H. F. Smith, Head of the Hydrology Section. William C. Walton, formerly in charge of ground-water research in this Section, reviewed and criticized the material and assisted with the final manuscript. J. W. Brother prepared the illustrations.

Part of the basic data was collected by R. A. Craig, R. Hanson, W. P. Patzer, and R. R. Russell, all former or present members of the State Water Survey. Special recognition should be given to the water superintendents and other municipal officials, officials of industry, well drillers, consulting engineers, and other well owners who were most cooperative and helpful in providing information on pumpage.

GEOLOGY AND HYDROLOGY

For a detailed discussion of the geology and hydrology of the aquifers in northwestern Illinois the reader is referred to Hanson (1955), Foster (1956), Hackett (1960), Walton and Csallany (1962), and Csallany and Walton (1963). The following sections on geology and hydrology were largely abstracted from these reports.

The sequence, structure, and general characteristics of the rocks beneath northwestern Illinois are shown in figure 2 and table 2. Unconsolidated deposits, mainly glacial drift ranging in thickness from a foot or less to more than 500 feet, overlie the bedrock in northwestern Illinois, except in northwestern Carroll County and most of Jo Daviess County, which are part of the unglaciated area of the upper Mississippi Valley. Ground water in the drift is obtained mainly from sands and gravels that occur as surficial deposits or, more commonly, as deposits underlying or interbedded with glacial till. Large supplies of ground water are often encountered in sand and gravel at the base of the drift, directly above bedrock. Fairly extensive surficial sand and gravel deposits are found in parts of Boone, DeKalb, Lee, and Whiteside Counties (Hackett and Bergstrom, 1956). Thick deposits of sand and gravel are present in the Mississippi Valley in Carroll, Jo Daviess, and Whiteside Counties. Deeply buried sand and gravel deposits, usually associated with buried bedrock valleys, are present in Boone, DeKalb, Lee, Ogle, Whiteside, and Winnebago Counties. Bedrock valleys containing thick deposits of sand and gravel are found in southern Whiteside County, southeastern and eastern Lee County, western DeKalb County, eastern Ogle and Winnebago Counties, and northern and southwestern Boone County. One of the most highly developed

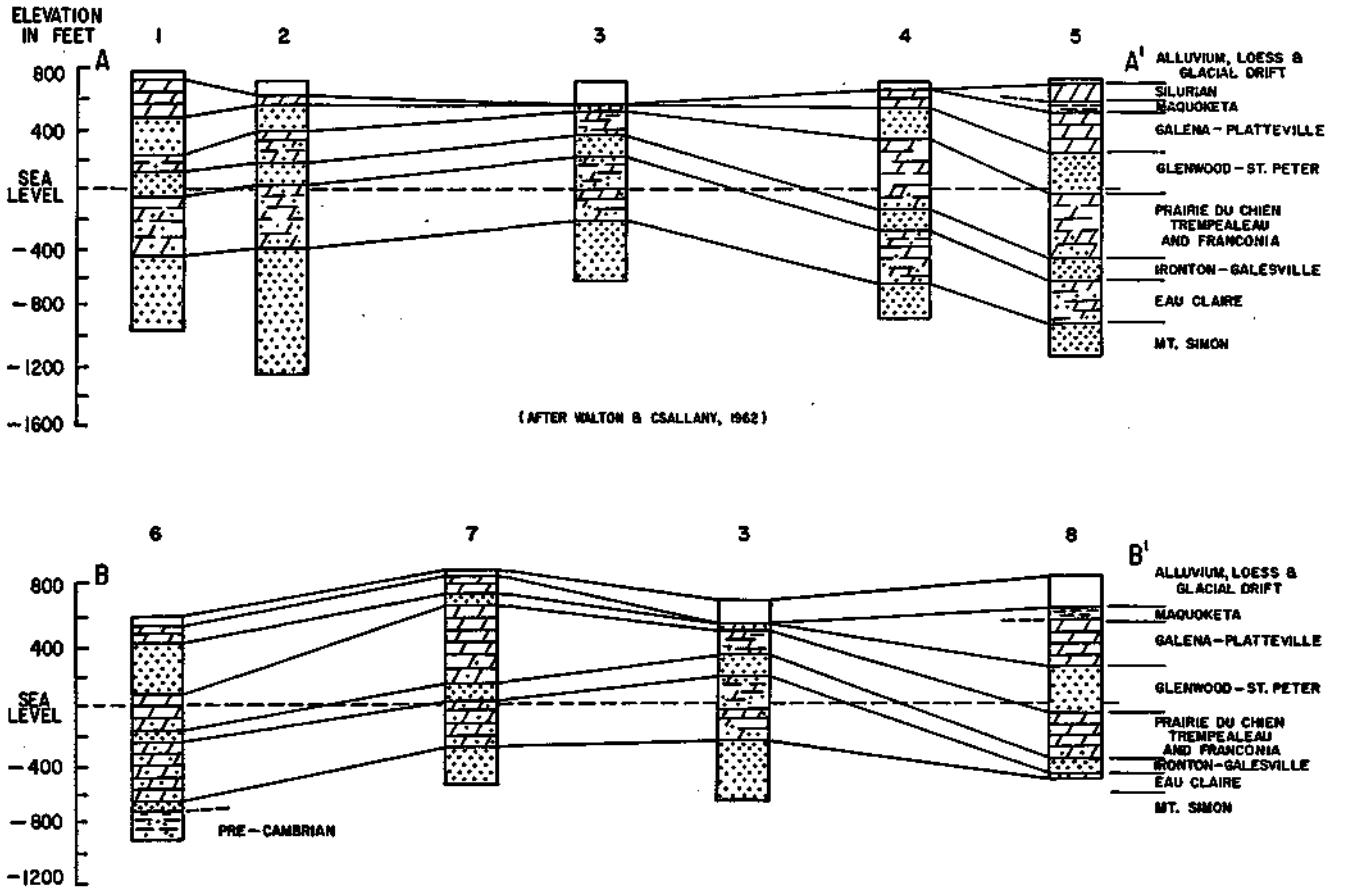

Figure 2. Cross sections of structure and stratigraphy of bedrock in northwestern Illinois

sand and gravel aquifers is in a buried bedrock valley extending north and south through Rockford. The city pumped more than 9 mgd from this aquifer in 1963.

Sand and gravel beds are more widespread in Boone and DeKalb Counties than they are in other counties. Water-yielding sand and gravel deposits are rare in the unglaciated areas of Carroll and Jo Daviess Counties. In addition to the unglaciated area, poorest possibilities for water-bearing sand and gravel deposits are in areas of bedrock upland in eastern Carroll County, northern Lee and Whiteside Counties, central and western Ogle County, most of Stephenson County, and Winnebago County.

Water in sand and gravel aquifers commonly occurs under leaky artesian conditions. Recharge to sand and gravel aquifers is derived mostly by the vertical leakage of water from surface deposits through glacial drift deposits overlying the aquifers. Surface deposits are in turn recharged locally from precipitation. Sand and gravel deposits in the Mississippi River Valley receive some recharge from the river. Glacial drift aquifers in large areas of northwestern Illinois are in hydraulic connection with underlying shallow bedrock aquifers.

The shallow dolomite aquifers consist mostly of Silurian rocks in the southern and western parts of northwestern Illinois and Ordovician rocks in the central, eastern, and northern parts (see figure 3). The Trempealeau Dolomite of Cambrian age is the uppermost bedrock in small areas in northeastern Lee and southeastern Ogle Counties. Most of the bedrock immediately beneath the glacial drift in the northern three-fourths of northwestern Illinois is formed by rocks of Silurian age or the Galena-Platteville Formation of Ordovician age.

Rocks of Silurian age are the Alexandrian Series overlain by the Niagaran Series. The thickness of the Silurian rocks increases from 0 in the northwest and central parts to more than 300 feet in the southwestern part of northwestern Illinois. Where valleys occur in the bedrock, the Silurian rocks are thin or missing. In areas where these rocks are more than 100 feet thick and immediately underlie the glacial drift, they have high to moderate yields. Silurian Dolomite wells may yield several hundred gallons per minute.

Dolomite beds of the Maquoketa Formation of Ordovician age yield small to moderate quantities of ground water. These beds are best developed in eastern DeKalb County, southern Lee County, eastern Whiteside County, southwestern Stephenson County, and most of Jo Daviess County. In some areas of northwestern Illinois, the Maquoketa Formation has a thickness of more than 150 feet.

Table 2. Generalized Stratigraphy and Water-Yielding Properties of Rocks in Northwestern Illinois

SYSTEM	SERIES	GROUP OR FORMATION	GEOHYDROLOGIC UNITS	LOG	APPROXIMATE RANGE IN THICKNESS (ft)	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		McLeansboro Carbondale Tradewater Caseyville			0-600	Mainly shale with thin limestone, sandstone, and coal beds	May require casing because of shale caving and poor-quality water	Generally unfavorable as an aquifer; locally domestic and farm supplies obtained from thin limestone and sandstone beds
Mississippian	Valmeyer	St. Louis-Salem			0-100	Limestone		Water yielding where creviced; too thin to be important source of water in most of area
		Warsaw			0-100	Shale	Casing required	Not water yielding at most places
		Keokuk-Burlington			0-200	Cherty limestone		Generally creviced and water yielding; dependable aquifer for small supplies in western Illinois
	Kinderhook				0-300	Shale with limestone and dolomite	Casing required	Not water yielding at most places; locally limestones within shale are source of small farm supplies
Devonian					0-200	Thin limestone, shale, & sandstone beds		Not normally a source of water because of a lack of cracks or solution openings
Silurian	Niagaran	Port Byron Racine Waukesha Joliet	Silurian	Shallow dolomite aquifers	0-500	Dolomite; silty at base, locally cherty	Upper part usually weathered and broken; extent of crevicing varies widely	Some wells yield more than 1000 gpm; not consistent; crevices and solution channels more abundant near surface
	Alexandrian	Kankakee Edgewood						
Ordovician	Cincinnatian	Maquoketa	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	Bedrock aquifers	220-350	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		50-650	Sandstone, fine- and coarse-grained; little dolomite; shale at top	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 percent of that of Cambrian-Ordovician aquifer
	Chazyan	St. Peter				Sandstone, fine- to medium-grained; locally cherty red shale at base		
	Prairie du Chien	Shakopee New Richmond Oneota	Prairie du Chien	Cambrian-Ordovician aquifer	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 percent of that of Cambrian-Ordovician aquifer
Cambrian	St. Croixian	Trempealeau	Trempealeau		0-225	Dolomite, white, fine-grained, geodic quartz, sandy at base		
		Franconia	Franconia		45-175	Dolomite, sandstone, and shale glauconitic, green to red, micaceous		
		Ironton Galesville	Ironton-Galesville		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 percent of that of Cambrian-Ordovician aquifer
		Eau Claire	Eau Claire (upper and middle beds)		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
			lower beds					
		Mt. Simon	Mt. Simon	Mt. Simon aquifer	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 Olenwood-St. Peter and Ironton-Galesville
Precambrian crystalline rocks								

(After Suter et al., 1959; and Selkregg and Kempton, 1958)

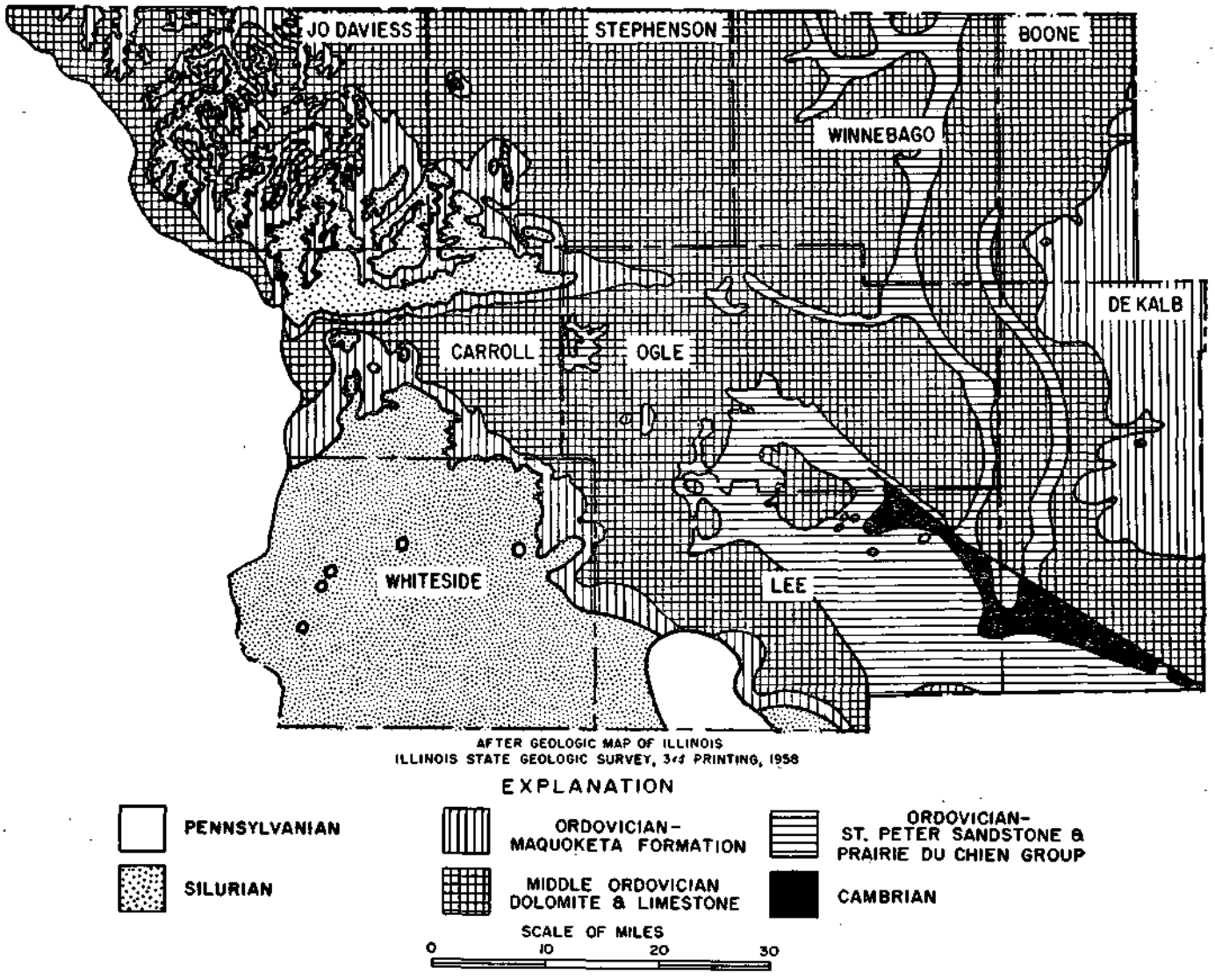

Figure 3. Areal geology of bedrock surface

The Galena-Platteville Dolomite of Ordovician age is the uppermost bedrock formation throughout extensive areas of northwestern Illinois except in Whiteside County, southwestern and eastern Lee County, northern and southern Carroll County, southwestern Stephenson County, southern Jo Daviess and Ogle Counties, southeastern Boone County, and southwestern and eastern DeKalb County. In areas where the unit is the uppermost bedrock formation, the thickness varies because the bedrock surface has been eroded. In areas where the Galena-Platteville Dolomite is overlain by other rocks, it has a uniform thickness averaging about 300 feet. Moderate quantities of ground water are obtained from these rocks where they directly underlie the glacial drift. The Galena-Platteville Dolomite has very low permeability and yields very little water in areas where it is overlain by the Maquoketa Formation.

In an area including southern Ogle County, eastern Lee County, and southern DeKalb County where the Prairie du Chien Series or Trempealeau Formation immediately underlies the glacial drift, wells finished in these rocks yield small to moderate quantities of ground water.

Ground water in the shallow dolomite aquifers occurs in joints, fissures, and solution cavities. The water-bearing openings are irregularly distributed both vertically and horizontally, and the yields of shallow dolomite wells vary greatly from place to place. Available geohydrologic data suggest that on a regional basis the shallow dolomite aquifers are permeated by numerous fractures and crevices which extend for considerable distances and are interconnected. The shallow dolomite aquifers receive recharge from overlying glacial deposits, or directly from precipitation where they are not covered by the drift. The upper part of the aquifer is usually the most productive.

The major sandstone aquifers in northwestern Illinois are the Glenwood-St. Peter, the Ironton-Galesville, and

the Mt. Simon Sandstones. The Glenwood-St. Peter Sandstone of Ordovician age is present throughout northwestern Illinois, except in an area including southern Ogle and DeKalb Counties, and eastern Lee County. In some sections of the central and eastern parts of the area, this sandstone is immediately below the glacial drift. The sandstone frequently exceeds 200 feet in thickness, and wells in the sandstone yield several hundred gallons per minute (gpm). Wells finished in the Glenwood-St. Peter Sandstone at Freeport, Stephenson County, have yields in excess of 1000 gpm. The Glenwood-St. Peter Sandstone is the primary source of ground water for many municipal and industrial supplies in northwestern Illinois.

The Ironton-Galesville Sandstone of Cambrian age overlies the Eau Claire Formation and underlies the Franconia Formation. It occurs throughout northwestern Illinois, and on a regional basis is the most consistently permeable and productive unit of the Cambrian and Ordovician rocks. The Ironton-Galesville Sandstone generally exceeds 150 feet in thickness, and the basal zone is commonly the least cemented and most favorable water-yielding zone. Many of the high capacity municipal and industrial wells in northwestern Illinois obtain a major part of their yields from this formation.

The Mt. Simon Sandstone and lower sandstones of the Eau Claire Formation of Cambrian age are hydrologically connected and collectively are called the Mt. Simon Aquifer. The average depth of penetration of wells into the aquifer is about 590 feet in northwestern Illinois. Moderate to high yields are obtained from wells penetrating the Mt. Simon Aquifer in Lee, Ogle, Whiteside, and Winnebago Counties. Water below an elevation of about 1300 feet below sea level in the Mt. Simon Aquifer is commonly too salty for municipal use.

The sandstone aquifers receive water from overlying glacial deposits by vertical leakage through overlying rocks. Major centers of pumpage occur at Rockford, Belvidere, DeKalb-Sycamore, Rochelle, Dixon, Sterling, and Freeport.

DISTRIBUTION OF PUMPAGE

The total ground-water pumpage in northwestern Illinois has increased rather steadily and at an accelerating rate since the first high capacity well was drilled in 1875. During the 84-year period, 1880 through 1963, pumpage increased from 4,300,000 gallons per day (gpd) to 78,900,000 gpd at an average rate of 900,000 gpd per year as shown in figure 4. Pumpage increased at an average rate of 2.1 mgd per year during the period 1935 through 1945. Since 1960, total pumpage has increased at the average rate of 4.3 mgd per year.

Data in table 3 show that of the total water withdrawal from wells in 1963, 65 percent was pumped from sandstone wells, 27 percent was pumped from glacial drift wells, and 8 percent was pumped from dolomite wells. In table 3, the term "apparent source" is used because the pumpage is assigned to the aquifer in which each well terminates, although many wells are open to more than one aquifer. Many bedrock wells are either uncased or faultily cased in more than one aquifer and allow leakage. Where a differential exists in the artesian pressure, ground water moves vertically from the aquifer with a higher pressure to the aquifer with a lower pressure.

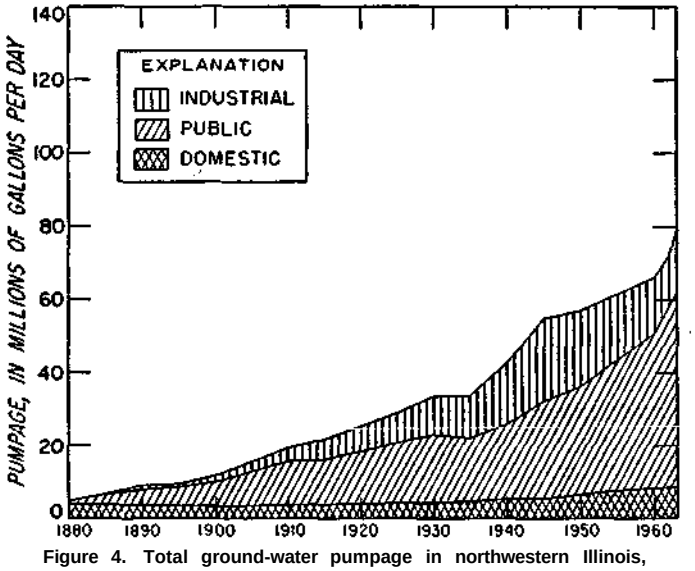

Figure 4. Total ground-water pumpage in northwestern Illinois, 1880-1963

Pumpage-use data in this report are classified into three main categories: 1) *public,* including municipal, subdivision, and institutional; 2) *industrial;* and 3) *domestic.* Most water supplies furnish water for several uses.

A *public supply* commonly includes water used for drinking and other domestic uses, manufacturing, and

Table 3. Ground-Water Pumpage in 1963, Subdivided by Apparent Source

(Millions of gallons per day)

Use	Glacial drift wells	Shallow dolomite wells	Sandstone wells	Total
Public	14.534	.424	40.857	55.815
Industrial	4.456	.516	10.954	15.926
Domestic	2.391	4.976	1.549	8.916
Total	21.381	5.916	53.360	80.657

lawn sprinkling. Water supplies for industries may also be used for drinking. In all cases, the total pumpage may be known approximately, but the final use of the water cannot always be determined.

Public water supplies furnish water that has been approved as sanitary under the supervision of health departments. Municipal systems are either publicly or privately owned for incorporated cities or villages. Subdivision systems furnish water to unincorporated communities or to parts of incorporated communities not served by municipal systems. Subdivision systems are either privately owned or owned by home-owner associations. Institutional supplies furnish water to schools, prisons, and other institutions.

Any water pumped by an industry is called an *industrial supply*, regardless of the use of the water. Major industrial use classifications included in this report are: 1) irrigation, primarily for farms, nurseries, and golf courses; 2) food manufacturing and processing, including drinks; 3) chemicals production, including fertilizers and rubber processing; 4) metals production; 5) paper production, and processing of all wood products; 6) air conditioning, where it is a primary use in commercial establishments; and 7) commercial business uses. All pumpage from each industry was included in one classification ; if the plant manufactures a product, the type of product was used as the basis for classification of the water use. Use of the water for air conditioning was included only where this was reported to be the primary use of the, water.

Domestic supplies include farm and individual residence supplies not under the regular supervision of health departments. These supplies may also be used for irrigating lawns and home gardens.

The reliability of pumpage data varies greatly. Municipal pumpage is usually metered in cities, but many smaller villages and subdivisions operate without meters. A few of the larger institutions meter their pumpage. Only a small part of the industrial pumpage is metered. When estimating pumpage of an unmetered public supply, consideration was given to the population and number of services, number and type of industries served, number of hours pumps are in operation, and the capacities of the pumps. When estimating the pumpage of an industrial supply, consideration was given to the use classification of the plant, number of hours per day and days per week the industry operated, number of hours the pump ran, and the capacity of the pump. Pumpage for domestic supplies was estimated on the basis of detailed surveys of a few selected sections considered typical.

The distribution of pumpage in major pumping centers in 1963 from glacial drift and sandstone wells is shown in figures 5 and 6. Distributions are subdivided by use.

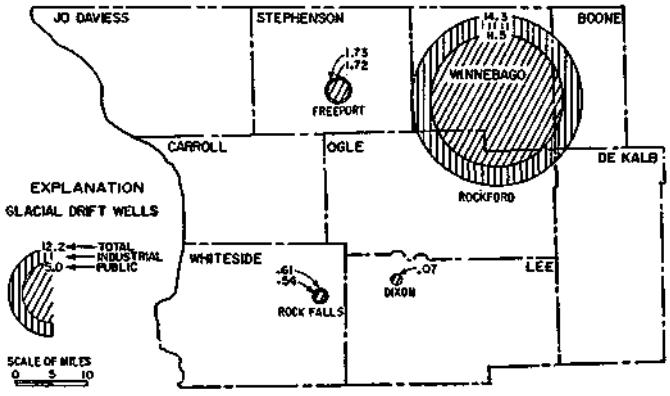

Figure 5. Distribution of pumpage from glacial drift wells in major pumping centers in 1963

Public Supplies

Pumpage for public supplies in northwestern Illinois has increased rather steadily since the first wells were drilled. Available records indicate the first public ground-water supplies in the area were developed about 1875 for the cities of DeKalb and Rockford; Rochelle developed a public supply in 1876. More than 40 public supplies were developed by 1900. In 1945, public pumpage was about 26 mgd. Since then it has more than doubled and was 54.1 mgd in 1963. This represents 69 percent of the total ground-water pumpage in northwestern Illinois. Records are available for 84 public ground-water supplies in use during 1963.

Records of pumpage for some municipalities are fairly complete for the period since the mid-1930s. Estimates for other communities and for pumpage prior to 1935 were based on several factors, including early reports and unpublished data in the files of the State Water Survey and the State Department of Public Health, U. S. Census reports, and estimates of per capita consumption.

Municipal pumpage has increased steadily since before 1900 and was 51.9 mgd in 1963, or 96 percent of the public pumpage. A comparison of the increase in municipal pumpage during the period 1940 to 1960 with the

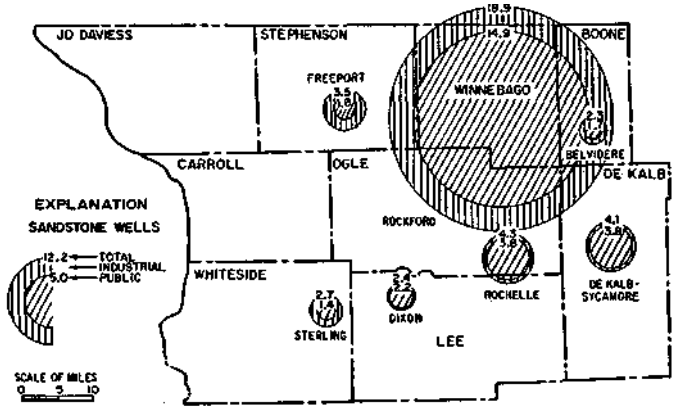

Figure 6. Distribution of pumpage from sandstone wells in major pumping centers in 1963

increase in population shows that pumpage increased 2.6 times as fast as the population on an average yearly basis. This rapid increase in municipal pumpage is due partly to an increase in industrial use of public supplies and partly to the increase in per capita consumption of water. There were 74 municipal ground-water supplies in northwestern Illinois in 1963.

Pumpage for subdivisions has increased slowly over the years and was 1.2 mgd in 1963, or 2 percent of the public pumpage. There has been a more rapid increase during recent years as a result of the trend in population growth away from areas of concentrated urban population. Records are available for 7 ground-water supplies for subdivisions.

Institutional pumpage has increased very slowly and was only 1.0 mgd in 1963, or about 2 percent of the public pumpage. Nearly all of the pumpage recorded for three institutions was for the Dixon State Hospital.

Industrial Supplies

Records of industrial pumpage from wells in northwestern Illinois date back to the early 1880s when the railroads developed sandstone wells in the area. Dewatering of mines in Jo Daviess County to claim lead and zinc probably amounted to 20 to 30 mgd during at least part of the 19th century. Pumpage from wells increased from about 1.3 mgd in 1900 to a maximum of 23.0 mgd in 1945, near the end of World War II. Since 1945, there has been a rather steady decrease in pumpage to 15.9 mgd in 1963. This represents 20 percent of the total ground-water withdrawal. Much of the recent decline is due to the abandonment of industrial well supplies and the expansion of municipal water supply systems.

Data were obtained from 123 industries that pumped ground water in 1963. An additional number of industries abandoned ground-water supplies prior to 1963. It is likely that some industries have been overlooked, but they are probably small ones with limited pumpage. A much greater source of error in estimating pumpage probably occurs in inaccurate estimates of pumpage at large industrial plants. Many of the large plants and nearly all of the small ones do not meter their pumpage. Pumpage at these plants is determined from a measured or estimated time of pump operation, or is estimated by industrial engineers.

Industrial pumpage is less than one-third that of public pumpage. Sixty-nine percent of the industrial pumpage is from sandstone wells, and 28 percent is from glacial drift wells. Only 3 percent is from dolomite wells.

Table 4 shows the distribution of the 1963 industrial pumpage, subdivided by use and apparent source. Nearly half of the ground-water pumpage for industrial supplies is for use in the manufacturing and processing of metal products. This use, plus the manufacturing and processing of food products, constitutes 74 percent of the total use of ground water by industries.

Table 4. Industrial Ground-Water Pumpage in 1963, Subdivided by Apparent Source

(Millions of gallons per day)

Use	Glacial drift wells	Shallow dolomite wells	Sandstone wells	Total
Irrigation	.105	.035	.165	.305
Food	1.430	.437	2.546	4.413
Chemical	.318	.....	2.705	3.023
Metal	2.246	.....	5.108	7.354
Paper	.020	.....	.250	.270
Air conditioning	.065	.014	.060	.139
Commercial	.272	.030	.120	.422
Total	4.456	.516	10.954	15.926

Domestic Supplies

Pumpage for domestic supplies in northwestern Illinois was estimated by considering the rural population in each county as given in reports of the U. S. Bureau of Census, and the probable percentage of the population which have individual water supplies. From a survey of selected rural areas in northeastern Illinois, it was determined that the per capita use averaged 50 gpd in 1963. Progressively lower per capita use figures were then used for census periods prior to 1960. These figures should not be confused with higher per capita use figures commonly cited which include municipal, industrial, and commercial uses.

More than half of the domestic pumpage is from shallow dolomite wells. Although many of the old domestic wells were dug wells finished in the glacial drift, most of the more recent wells penetrate shallow dolomite aquifers. Glacial drift wells are not uncommon in much of the area except in parts of Lee County and in the unglaciated parts of Carroll and Jo Daviess Counties. Sandstone wells are also found occasionally, especially in DeKalb County and other areas where low yields or poor quality water from shallow aquifers have prompted individuals to develop deeper sandstone supplies.

Pumpage for domestic supplies was 8.9 mgd in 1963, or 11 percent of the total ground-water pumpage.

Glacial Drift Wells

The first water supply from glacial drift wells in northwestern Illinois, for which records are available, was developed for the city of Rockford in Winnebago County in 1875. Ten additional public water supplies and at least two industrial supplies were developed between 1875 and 1900. Pumpage increased at an average rate of about 70,000 gpd per year and was 3.89 mgd in 1920. Pumpage declined slightly from 1920 until

about 1925. Since then total pumpage has increased at an accelerating rate and was 21.4 mgd in 1963, as shown in figure 7. Pumpage from glacial drift wells has nearly doubled since 1950.

With the development of 11 municipal supplies prior to 1900, public pumpage from glacial drift wells was 1.23 mgd in 1900. Sixteen municipal supplies were in operation in 1920, and public pumpage increased to 2.31 mgd. A number of the early supplies were abandoned or supplemented by other sources of water, and public pumpage declined to 0.37 mgd by 1935. Since then, pumpage for public supplies has increased at an accelerating rate, averaging 500,000 gpd per year. Public pumpage was 14.5 mgd in 1963, or 68 percent of the total pumpage from glacial drift wells.

Municipal pumpage was 13.6 mgd in 1963, or nearly 94 percent of the public pumpage from glacial drift wells. Twelve municipalities obtain all or part of their water supply from the glacial drift. Only three pump more than 1 mgd, but these three, Freeport, Loves Park, and Rockford, pumped 12.3 mgd in 1963, or 90 percent of the municipal pumpage.

Records are available for only two subdivision water supplies and one institutional supply from glacial drift wells. The institutional supply was developed in 1914; one subdivision supply was started in 1925 and the other in 1954. Pumpage for these three supplies was 0.93 mgd in 1963, or 6 percent of the municipal pumpage.

Available records indicate that some of the first industrial wells finished in glacial drift were drilled in the 1880s in Rockford. A railroad well in Winnebago County was drilled in 1891. Pumpage increased very slowly between 1890 and 1920 and was 585,000 gpd in 1920. Since then, pumpage has increased at a more rapid rate except for a slight decline during the early 1950s. Industrial pumpage was 4.46 mgd in 1963, or 21 percent of the total withdrawal from glacial drift wells. Current records indicate 32 industries pumped water from glacial drift wells during 1963. More than half of these are located in Winnebago County. Forty-six percent of the pumpage is for use in the manufacturing and processing of metal products; 28 percent is for the manufacturing and processing of food products.

Pumpage for domestic supplies from glacial drift wells increased very slowly prior to 1940. The rate has accelerated considerably since then, averaging 50,000 gpd per year. Pumpage in 1963 was 2.39 mgd, or 11 percent of the total pumpage from glacial drift wells.

Shallow Dolomite Wells

Pumpage from shallow dolomite aquifers in northwestern Illinois has been primarily for domestic supplies, and variations in pumpage largely reflect changes in nonurban population and per capita use of water. Nine municipalities had wells finished in shallow dolomite aquifers prior to 1900; only one of these obtained water from the dolomite aquifers in 1963.

Total pumpage declined during the period 1880 to 1895 as municipalities developed public water supply systems from other sources. Since 1895, there has been a steady increase in total pumpage, averaging 58,000 gpd per year. Pumpage was 5.92 mgd in 1963 as shown in figure 8.

The first public supply from the shallow dolomite aquifers was developed from a quarry at Rochelle in 1876, but was abandoned before 1900. Additional public supplies were developed in Carroll, DeKalb, Jo Daviess, Ogle, and Whiteside Counties prior to 1900. Public pumpage has increased very slowly, averaging only 5000 gpd per year from 1900 to 1963. Pumpage for public supplies was 424,000 gpd in 1963, or 7 percent of the total withdrawal from shallow dolomite aquifers. Six

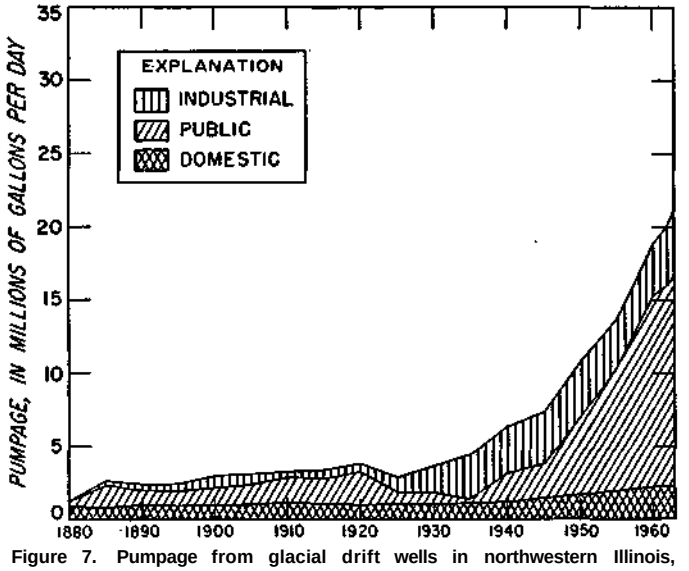

Figure 7. Pumpage from glacial drift wells in northwestern Illinois, 1880-1963

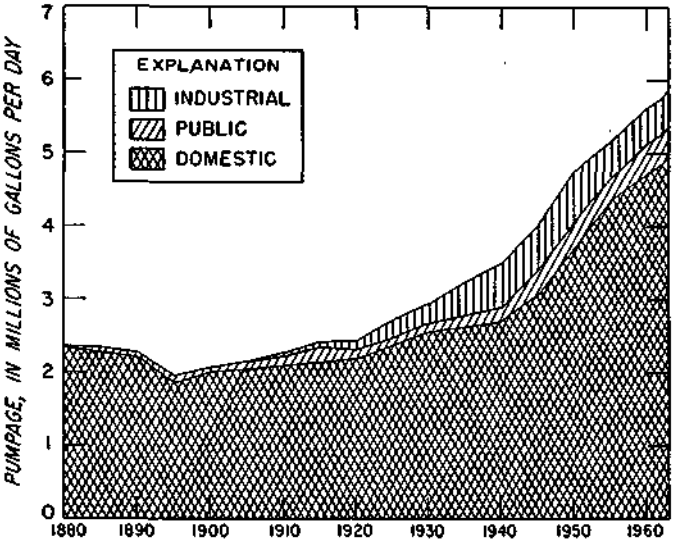

Figure 8. Pumpage from shallow dolomite wells in northwestern Illinois, 1880-1963

municipalities obtained at least part of their water supply from dolomite aquifers in 1963. Records are not available of subdivisions that obtain water from these aquifers. Records of institutions with shallow dolomite wells are very limited, but it is probable that many of the rural schools have wells finished in shallow dolomite aquifers.

Industrial pumpage from shallow dolomite aquifers is also quite limited. The first wells for which records are available were drilled in the early 1900s, but only 21 industries pumped water from the dolomite in 1963. Pumpage has increased only slightly faster than that for public supplies, averaging 9000 gpd per year from 1920 to 1963. In 1963, industrial pumpage was 516,000 gpd, or 9 percent of the total pumpage from shallow dolomite aquifers. Nearly all of the pumpage is for use in the manufacturing and processing of food products.

Pumpage for domestic supplies has increased much more rapidly than for other uses, averaging 46,000 gpd per year from 1895 to 1963. Domestic pumpage was 4.98 mgd in 19G3, or 84 percent of the total pumpage from shallow dolomite aquifers.

Sandstone Wells

The first sandstone wells in northwestern Illinois were drilled in 1875 for the city of DeKalb. Thirty municipalities and at least three industries had wells in operation by 1900, and pumpage was estimated at 6.5 mgd. Pumpage continued to increase rapidly at an average rate of 688,000 gpd per year and was 27.1 mgd in 1930 (see figure 9). Pumpage declined slightly during the early 1930s as a result of the depression, but then increased at an even more rapid rate and was 43.5 mgd in 1945, near the end of World War II. Pumpage remained rather constant for the next 15 years and then jumped 10.2 mgd during the 4-year period 1960 through 1963. Total pumpage from sandstone wells was 51.6 mgd in 1963.

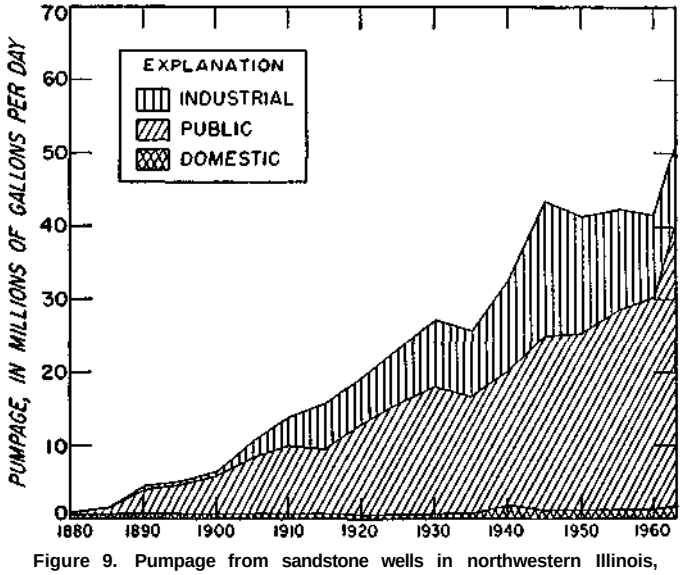

Figure 9. Pumpage from sandstone wells in northwestern Illinois, 1880-1963

Public water supplies from sandstone wells had been developed in all nine counties of northwestern Illinois prior to 1900. Except for a brief decline during the early 1930s, public pumpage has increased rather steadily and was 39.1 mgd in 1963. This represents 76 percent of the total withdrawal from sandstone wells.

Municipal pumpage was 37.9 mgd in 1963, or 97 percent of the public pumpage. Fifty-seven municipalities obtained at least part of their supply from sandstone wells. Each of the cities of DeKalb, Rochelle, and Rockford pumped more than 2 mgd in 1963. Pumpage for Rockford amounted to 38 percent of the total public pumpage from sandstone wells. Eight cities pumped more than 1 mgd each in 1963 and had a total pumpage of 28.4 mgd.

The first subdivision supply was developed in 1926 in Winnebago County. Five subdivisions pumped 0.30 mgd in 1963, or about 1 percent of the public pumpage.

The only institution with a sandstone supply, for which records are available, is Dixon State Hospital in Lee County. This supply was developed in 1915 and pumpage was 950,000 gpd in 1963.

Data regarding many of the early industrial wells are incomplete, but a few were constructed prior to 1900 in Ogle, Stephenson, and Winnebago Counties. Pumpage increased at an average rate of 240,000 gpd per year during the period 1900 to 1935. During the next 10 years, industrial pumpage more than doubled and reached a maximum of 18.7 mgd in 1945, near the end of World War II. Pumpage has decreased steadily since then, largely because of the abandonment of industrial water supplies and the expansion of municipal supplies. Pumpage in 1963 was 11.0 mgd, or 21 percent of the total pumpage from sandstone wells. Nearly half of the industrial pumpage is for use in the manufacturing and processing of metal products. An additional 23 percent is for use in the manufacturing and processing of food products. Data were obtained from 70 plants that pumped water from sandstone wells in 1963.

Domestic pumpage from sandstone wells is rather limited, since in most areas sufficient water can be obtained from shallower aquifers. Domestic pumpage has increased very slowly and was 1.5 mgd in 1963, or 3 percent of the total pumpage from sandstone wells.

SUMMARY OF PUMPAGE BY COUNTY

Boone County

Total ground-water pumpage in Boone County has increased from less than 500,000 gpd in 1900 to 2.93 mgd in 1963, as shown in figure 10. Although this is an increase of nearly 600 percent, the rate of increase has been quite erratic. There was a small increase and a small decrease in the-mid-1920s, and a large increase followed by a large decrease in pumpage during and after World War II. Since 1954, total pumpage increased at a steadily accelerating rate, averaging 111,000 gpd per year, to a high of 3.10 mgd in 1962. Pumpage declined to 2.93 mgd in 1963.

Public Supplies. The city of Belvidere developed the first public supply in Boone County in 1891, and this has constituted the largest water supply, either public or industrial. Records are available for four other public ground-water supplies. Total pumpage for public supplies increased at a relatively slow rate prior to 1955, averaging about 15,000 gpd per year. Prom 1955 through 1962, the rate of pumpage growth accelerated considerably, averaging 123,000 gpd per year. From a record high of 1.94 mgd in 1962, public pumpage declined to 1.76 mgd in 1963, or 60 percent of the total ground-water pumpage in Boone County.

Industrial Supplies. The rate of ground-water pumpage for industrial supplies has varied considerably, although the net result has been an increase of from about 250,000 gpd in 1920 to 740,000 gpd in 1963. Variations in pumpage during the mid-1920s and the 1930s probably were partially due to economic conditions during and after the depression. Pumpage increased greatly during World War II, but declined considerably after the war. Industrial pumpage has remained rather constant during the past several years, and in 1963 accounted for 25 percent of the total ground-water pumpage in Boone County. Records are available for six industrial supplies, and practically all of the pumpage is for use in food processing.

Domestic Supplies. Total ground-water pumpage for domestic supplies remained rather constant until after 1940, with the increase averaging less than 500 gpd per year. With the increase in nonurban population recently, domestic pumpage has increased at a more rapid rate, averaging about 9000 gpd per year. Domestic pumpage in 1963 was approximately 430,000 gpd, or 15 percent of the total ground-water pumpage in the county.

Glacial Drift Wells. Total pumpage from glacial drift aquifers increased steadily from an estimated 160,000 gpd in 1910 to 305,000 gpd in 1945 as shown in figure 11. Pumpage increased rapidly during the next two years, but then declined again during the early 1950s to about the same level as prior to 1946. The rate of increase during the past six years has been about the same as it was prior to 1946. During 1946 and 1947, pumpage increased at an average rate of 90,000 gpd per year. Before 1946 and after 1956, the rate of increase was from 3000 to 5000 gpd per year. Pumpage in 1963 was 340,000 gpd.

The village of Poplar Grove has the only municipal supply obtaining water from glacial drift aquifers, and this was developed in 1915. The Boone County Home has the only other public glacial drift supply for which data are available. Total pumpage has increased slowly, but steadily, and was 40,000 gpd in 1963, or 12 percent of the total pumpage from the glacial drift aquifers.

Two food-processing plants obtain water from glacial drift aquifers. The first plant was built in 1910, and total pumpage increased to 150,000 gpd by 1945. Pumpage increased to 320,000 gpd during the next two years,

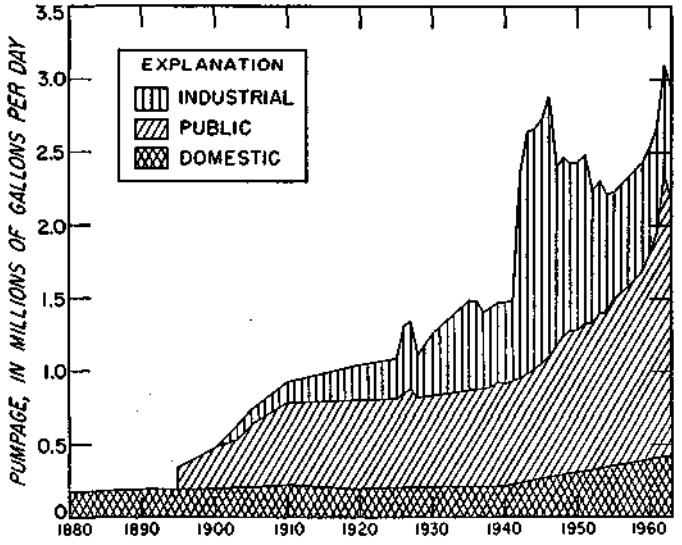

Figure 10. Total ground-water pumpage in Boone County, 1880-1963

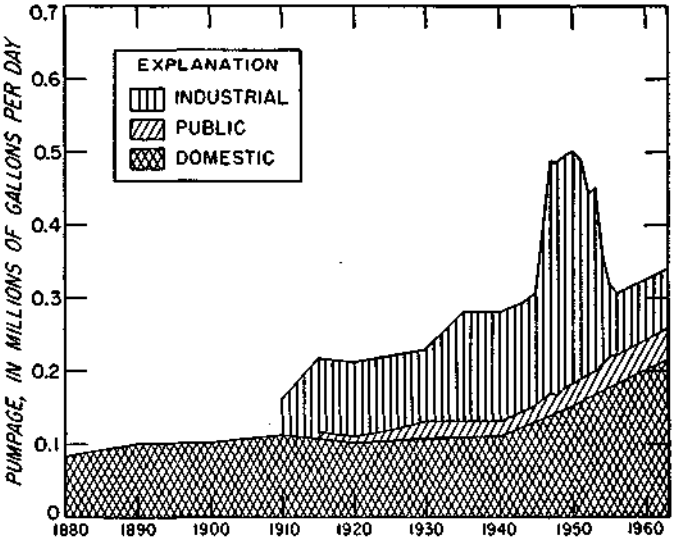

Figure 11. Pumpage from glacial drift wells in Boone County, 1880-1963

probably as a result of increased development after World War II. However, pumpage declined during the period 1950 to 1956 to a lower level than immediately before the increase in pumpage. It is probable that this decline was offset by increased municipal pumpage. Pumpage has remained rather constant since 1956 and was 85,000 gpd in 1963, or 25 percent of the total glacial drift pumpage.

Pumpage for domestic supplies from glacial drift aquifers remained fairly constant until about 1940, averaging from 100,000 to 105,000 gpd. Since 1940 there has been a steady increase in nonurban population with a corresponding increase in domestic pumpage. The increase has averaged more than 4000 gpd per year and pumpage was estimated to be 215,000 gpd in 1963, or 63 percent of the total pumpage from the glacial drift aquifers.

Shallow Dolomite Wells. Prior to 1930, pumpage from shallow dolomite aquifers was primarily for domestic supplies and averaged about 20,000 gpd. Domestic pumpage has increased at a rather rapid rate since 1940, and was 43,000 gpd in 1963. A small industrial supply was developed in 1930, and a small public supply was developed in 1958. Total pumpage from shallow dolomite aquifers was 51,000 gpd in 1963 as shown in figure 12.

Sandstone Wells. Total pumpage from sandstone aquifers increased at a rather uniform rate of nearly 20,000 gpd per year prior to 1941, and averaged 1.17 mgd in that year. During World War II, pumpage increased rapidly and reached a high of 2.43 mgd in 1945. This was followed by a sharp decline to a post-war low of 1.76 mgd in 1952. Since then, pumpage has increased at an accelerating rate to a high of 2.72 mgd in 1962 as shown in figure 13. Pumpage in 1963 declined to 2.54 mgd.

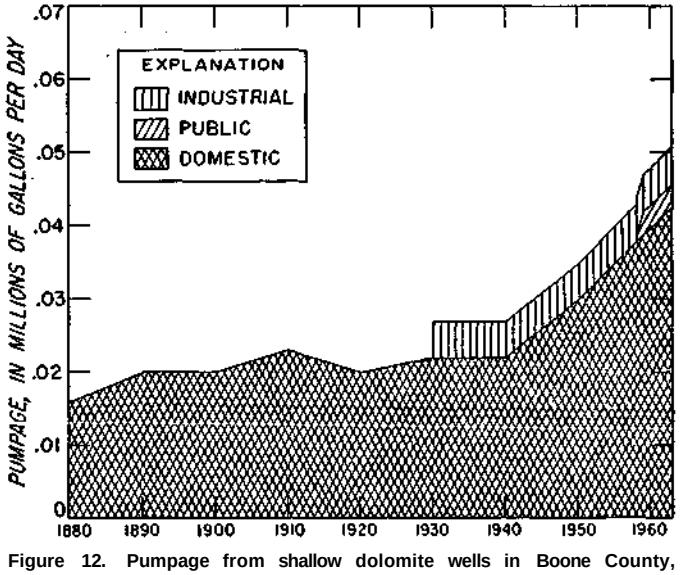

Figure 12. Pumpage from shallow dolomite wells in Boone County, 1880-1963

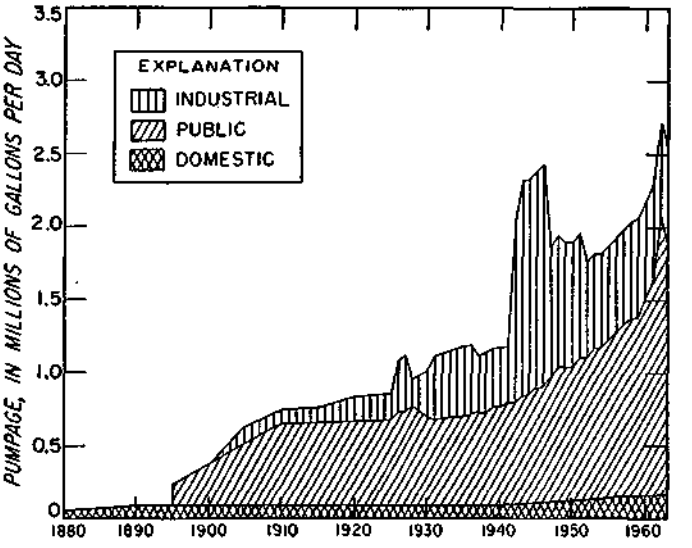

Figure 13. Pumpage from sandstone wells in Boone County, 1880-1963

A municipal supply was developed at Belvidere in 1891, and at Capron in 1900. These are the only two public sandstone supplies in the county. Pumpage has increased steadily since the first wells were completed and was 1.90 mgd in 1962. Pumpage in 1963 declined to 1.72 mgd, which represents 68 percent of the total pumpage from sandstone aquifers.

The first sandstone industrial supply on record was developed for a railroad in 1903. Pumpage increased irregularly until 1941, with a sharp increase in 1926, a decrease in 1928, an increase from 1929 to 1936, and then a moderate decrease followed by uniform pumpage for a few years. Pumpage in 1941 was 0.38 mgd. During World War II, industrial pumpage increased rapidly and reached a high of 1.54 mgd in 1946. Post-war pumpage declined rapidly at first, and then more slowly, to 0.65 mgd in 1956. Since then, pumpage has remained fairly constant, and was 0.65 mgd in 1963, or 25 percent of the total sandstone pumpage. More than 99 percent of the industrial pumpage is for use in food processing plants.

Sandstone pumpage for domestic supplies showed a very slow increase prior to about 1940, averaging less than 500 gpd per year. Since 1940, with a gradual increase in nonurban population, there has been a greater increase in domestic pumpage, averaging nearly 4000 gpd per year. Pumpage in 1963 was 172,000 gpd, or 7 percent of the total pumpage from sandstone aquifers.

Belvidere Pumping Center. Municipal pumpage at Belvidere was 1.69 mgd in 1963, or 98 percent of the public sandstone pumpage in Boone County. Industrial pumpage in the immediate vicinity of Belvidere accounted for more than 99 percent of the industrial pumpage in the county. Total sandstone pumpage at Belvidere was 2.34 mgd, or 92 percent of the pumpage from sandstone aquifers within the county.

Winnebago County

Total ground-water pumpage in Winnebago County has increased 70 times since the development of early public water supplies, from approximately 500,000 gpd in 1880 to 38.61 mgd in 1963 as shown in figure 14. Early pumpage increased at a rather uniform rate, averaging 38,000 gpd per year prior to 1930, except for a brief period during World War I when large quantities of water were withdrawn from wells at the U. S. Army Camp Grant, south of Rockford. After a slight decrease in pumpage during the depression of the 1930s, pumpage increased at a very rapid rate, averaging 1.36 mgd per year until the end of World War II. The rate of pumpage increase was much slower during the next few years, averaging only 126,000 gpd per year during the period 1946 through 1954. Since 1954, pumpage growth has accelerated again, averaging 989,000 gpd per year.

Public Supplies. The first public ground-water supply in Winnebago County was developed at Rockford in 1875, followed by supplies at the villages of Pecatonica and Rockton. During the early years of development, pumpage for public supplies increased steadily and was 7.26 mgd in 1930. The development of Camp Grant, south of Rockford, resulted in heavy pumpage during both World War I and II. Public pumpage decreased during the early 1930s as a result of the depression. During the period 1935 to 1946, public pumpage increased steadily at an average rate of 694,000 gpd per year. Although there has been some fluctuation in the rate of pumpage during the past 17 years, pumpage for public supplies has increased at an average rate of 820,000 gpd per year since 1946 and was 27.91 mgd in 1963. This represents 72 percent of the total ground-water withdrawal in Winnebago County. Seven municipalities have developed public ground-water supplies,

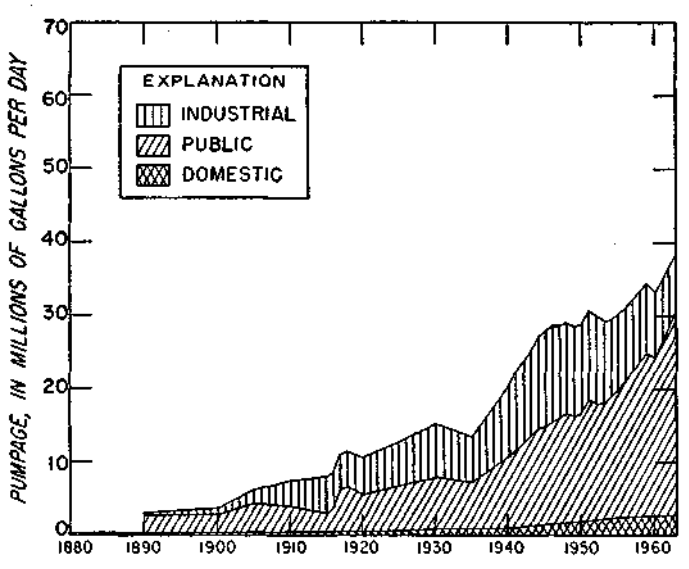

Figure 14. Total ground-water pumpage in Winnebago County, 1880-1963

and pumpage for these supplies was 26.91 mgd in 1963. This accounts for 96 percent of the public pumpage. The well supply for the former Camp Grant is now owned by the city of Rockford, but was not in use in 1963. Six nonmunicipal public ground-water supplies in the county pumped 1.0 mgd in 1963.

Industrial Supplies. Early industrial pumpage began in the 1880s and increased rather steadily until the mid-19408. Prior to the depression of the early 1930s, industrial pumpage increased at an average rate of 157,000 gpd per year. After a slight decline in pumpage during the depression, pumpage increased at the rate of 613,000 gpd per year from 1935 to 1946, and was 13.06 mgd in 1946. With the development of diesel engines for the railroads and the expansion of municipal water supply systems after World War II, industrial ground-water pumpage has declined steadily since the late 1940s, and was 7.73 mgd in 1963. This amounts to 20 percent of the total ground-water pumpage. Records are available for 53 industries that pumped wells in 1963. A number of industries have abandoned their wells and obtain water from municipal supplies. Nearly 74 percent of the industrial pumpage was for use in the processing of metal products. Food processing accounted for most of the remaining industrial pumpage.

Domestic Supplies. Total ground-water pumpage for domestic supplies has increased steadily since the period of early development prior to 1900, and was 2.97 mgd in 1963, or 8 percent of the total ground-water withdrawal. Before 1940, domestic pumpage increased at an average rate of 16,000 gpd per year. With the more rapid increase of nonurban population since 1940, domestic pumpage has increased at the rate of 83,000 gpd per year.

Glacial Drift Wells. Total pumpage from glacial drift wells in Winnebago County was rather limited prior to 1947, with pumpage in that year estimated at 2.5 mgd. Early pumpage started about 1875 and was 1.2 mgd by 1885. During the next 25 years, pumpage decreased to about 550,000 gpd by 1910. During World War I, pumpage was about 2.64 mgd with the development of glacial drift wells at Camp Grant near Rockford. Pumpage decreased immediately after the war. Since then, pumpage from glacial drift wells has increased at a steadily accelerating rate, except for a sharp, brief decline after World War II. Total pumpage from glacial drift wells was 16.25 mgd in 1963 as shown in figure 15.

The oldest public supply in the county, and one of the oldest in the state, was developed at Rockford in 1875. The original supply was from wells finished in the glacial drift adjacent to the Rock River. Pumpage was about 1.0 mgd by 1885, when the supply was abandoned and water obtained from deep sandstone wells. Municipal pumpage declined to about 5000 gpd and then increased very slowly, with the development of supplies at Pecatonica in 1889 and at Rockton in 1913. During World War I, heavy pumpage from glacial

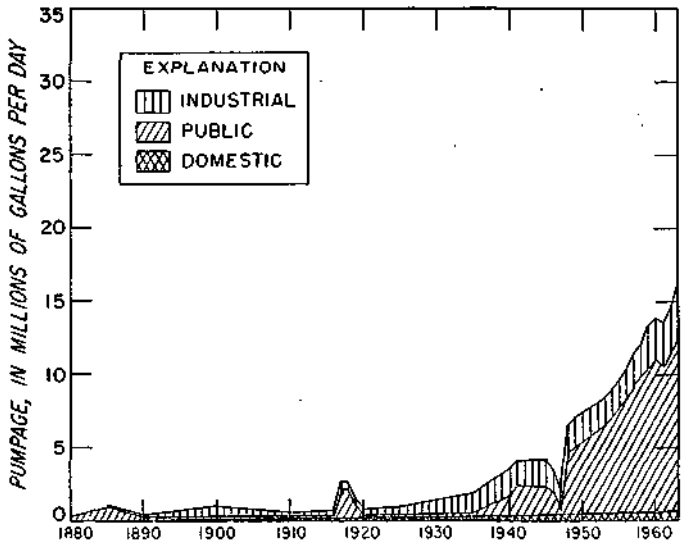

Figure 15. Pumpage from glacial drift wells in Winnebago County, 1880-1963

drift wells at Camp Grant resulted in a sudden increase in pumpage to 2.07 mgd and then a decrease after the war to 82,000 gpd in 1920. After 1920, municipal pumpage increased slowly until "World "War II, when Camp Grant was reactivated and pumpage increased to about 2.05 mgd. Again there was a sudden decrease in pumpage after the war. Rockford developed a new supply from the glacial drift in 1948 and this, along with a new supply started at Loves Park in 1955, has resulted in greatly increased pumpage from these aquifers, averaging 677,000 gpd per year since 1947. Municipal pumpage in 1963 was 10.9 mgd, or 92 percent of the public pumpage. Only two municipalities pumped all of their water from glacial drift aquifers in 1963. Pumpage from glacial drift wells for the city of Rockford amounts to 87 percent of the municipal glacial drift pumpage in the county.

Two nonmunicipal systems also obtain water from glacial drift wells: Bradley Heights subdivision developed in 1925 and the North Park "Water District developed in 1954. Since 1953, pumpage has increased at an average rate of 91,000 gpd per year and was 918,000 gpd in 1963.

Total pumpage for public supplies from glacial drift wells was 11.85 mgd in 1963. This represents 73 percent of the pumpage from these aquifers.

Early development of industrial pumpage from glacial drift wells in Winnebago County began in the 1880s and increased to an estimated 800,000 gpd by 1900. Pumpage then decreased to about 400,000 gpd in 1910 and remained uniform until 1920. Since then there has been a slow, rather uniform increase in pumpage to 3.66 mgd in 1963 except for a slight decrease at the end of World "War II. The rate of increase has averaged about 68,000 gpd per year since 1915. Industrial pumpage amounts to 23 percent of the total withdrawal from glacial drift wells. Processing of metal products accounts for most of the industrial pumpage, although an appreciable percentage is for use in food processing.

Pumpage for domestic supplies from glacial drift wells in "Winnebago County increased slowly and rather uniformly since the time of early development in the county until about 1940, averaging 3000 gpd per year. Since 1940, there has been a much greater rate of increase, averaging nearly 21,000 gpd per year. Domestic pumpage from these wells was estimated at 740,000 gpd in 1963, representing 4 percent of the total glacial drift pumpage.

Shallow Dolomite Wells. Pumpage from shallow dolomite wells is largely limited to domestic supplies, although there are a few schools and some commercial establishments that obtain limited quantities of water from these wells. Total pumpage in 1963 was 1.98 mgd.

Pumpage increased at a rather slow rate prior to about 1940, averaging 3000 gpd per year prior to 1910, and 12,000 gpd per year between 1910 and 1940 as shown in figure 16. Since 1940 there has been a more rapid increase in nonurban population, with a corresponding increase in domestic pumpage, averaging 54,000 gpd per year.

Sandstone Wells. Ground-water pumpage from sandstone wells in Winnebago County increased at an accelerating rate from 1890 until 1948, except for a period of decline during the economic depression of the early 1930s. Pumpage more than doubled between 1935 and 1947, and reached a high of 25.65 mgd in 1947 as shown in figure 17. From 1947 through 1960, total pumpage declined to 17.44 mgd. Since 1960, pumpage has increased at an average rate of 979,000 gpd per year and was 20.38 mgd in 1963.

The city of Rockford developed the first public supply from sandstone wells in 1890, and this has constituted

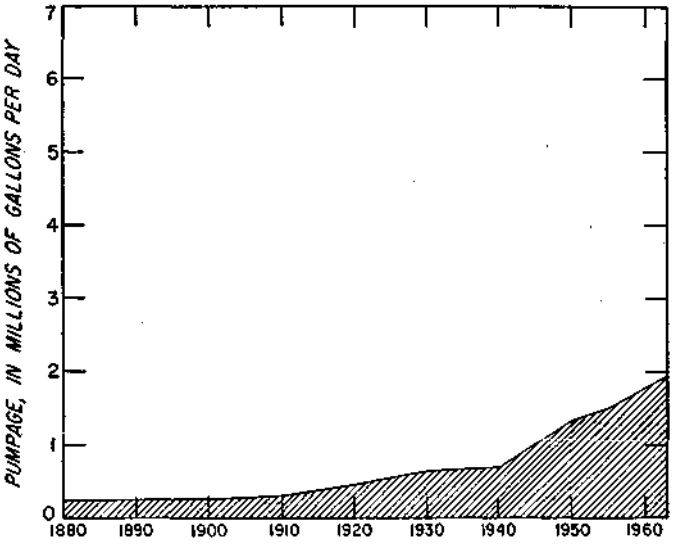

Figure 16. Pumpage from shallow dolomite wells in Winnebago County, 1880-1963

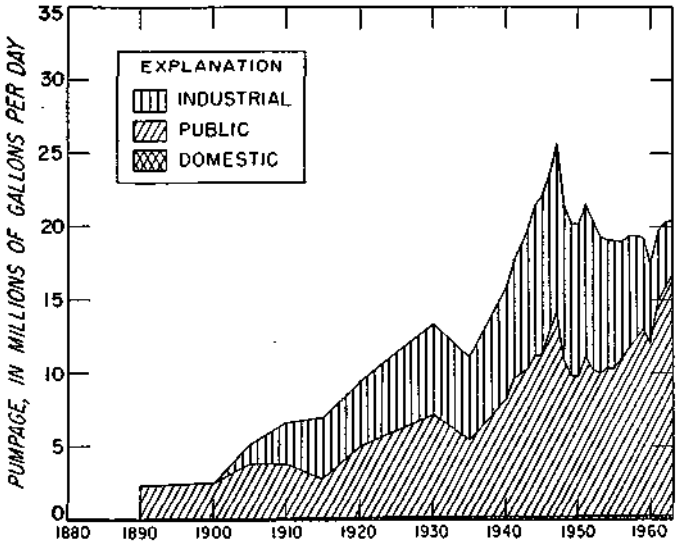

Figure 17. Pumpage from sandstone wells in Winnebago County, 1890-1963

the major ground-water supply in the county since that time. Public pumpage from sandstone wells increased at an average rate of 119,000 gpd per year until 1930. Following the decrease in pumpage during the depression, public pumpage increased at an even more rapid rate, averaging 654,000 gpd per year until 1947, when the pumpage was 14.06 mgd. Public pumpage declined after 1947 and averaged 10.70 mgd during the period 1948 to 1960. Pumpage has increased at a very rapid rate since 1960, averaging 1.50 mgd per year to a high of 16.06 mgd in 1963. This represents 79 percent of the total withdrawal from sandstone wells.

Municipal pumpage from sandstone wells has always been the major volume of the public pumpage. Five municipalities pumped 15.98 mgd in 1963, or more than 99 percent of the public pumpage.

Four subdivision supplies have sandstone wells, one dating from 1926. However, these are all rather small supplies and total pumpage was only 78,000 gpd in 1963.

Records of early industrial pumpage from sandstone wells are incomplete, but it is probable that there was little significant pumpage prior to about 1900. From 1900 until 1947 pumpage increased rather steadily, except for a short period during the depression in the early 1930s, and reached a maximum of 11.41 mgd in 1947. Industrial pumpage from sandstone wells increased at an average rate of 551,000 gpd year during the period 1935 to 1947. Since World War II, pumpage has declined steadily and was 4.02 mgd in 1963. Pumpage in 1963 amounted to 20 percent of the total pumpage from sandstone wells in the county. Thirty-four industrial supplies were in use in 1963. Most of the industrial pumpage is for use in processing metal products.

Domestic pumpage from sandstone wells has been very limited, amounting to only 300,000 gpd in 1963. In most areas of the county, sufficient water for domestic supplies is readily available either from glacial drift or shallow dolomite wells.

Rockford Pumping Center. The greatest concentration of ground-water pumpage in Winnebago County is in the immediate vicinity of the city of Rockford. Public pumpage for Rockford and seven smaller communities was 26.44 mgd in 1963, or 95 percent of the public pumpage in the county. Forty-three percent of the public pumpage in the Rockford area was from glacial drift wells, and 57 percent was from sandstone wells.

Industrial pumpage in the Rockford area was 6.84 mgd in 1963. Forty-one percent of the industrial pumpage was from glacial drift wells, 58 percent was from sandstone wells, and about one percent was from shallow dolomite wells. Industrial pumpage in the Rockford area accounted for 88 percent of the total industrial ground-water pumpage in the county. Of the 53 industries that pumped wells in Winnebago County in 1963, 45 are located in the Rockford area.

Total public and industrial ground-water pumpage in the Rockford area was 33.28 mgd in 1963, or 86 percent of the total ground-water withdrawal in Winnebago County.

Stephenson County

The first ground-water supplies in Stephenson County were developed in the 1880s; total pumpage increased rather steadily at an average rate of 60,000 gpd and was 4.84 mgd in 1948 as shown in figure 18. Pumpage declined to 4.60 mgd in 1954 as a result of decreased industrial demand after World War II. Since 1954, total ground-water pumpage has increased at a rapid rate, averaging 359,000 gpd, and was 7.83 mgd in 1963. This is an increase of 70 percent during a 9-year period. Of the total withdrawal in 1963, 23 percent was from

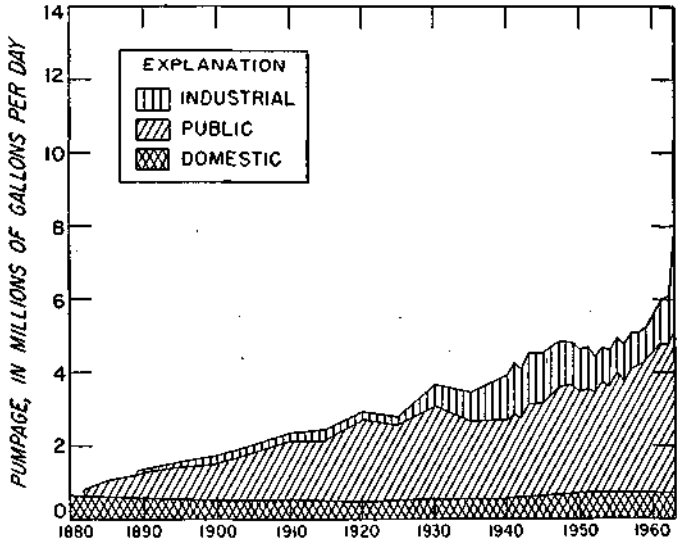

Figure 18. Total ground-water pumpage in Stephenson County, 1880-1963

glacial drift wells, 8 percent was from shallow dolomite wells, and 69 percent was from sandstone wells.

Public Supplies. A public water supply developed from springs at Freeport in 1882 was the first public supply in the county. Three additional supplies were developed by 1900. Public pumpage has increased rather steadily since the first supplies were developed and was 4.32 mgd in 1963. This accounted for 55 percent of the total ground-water pumpage in Stephenson County. Only one municipality obtains water from glacial drift wells; Freeport has wells finished in both glacial drift and sandstone aquifers. Records are not available of any public supplies obtaining water from shallow dolomite aquifers. In addition to Freeport, eight municipalities have wells finished in sandstone aquifers. Freeport pumpage accounts for more than 77 percent of the total pumpage for public supplies. One subdivision developed a sandstone well in 1960 and pumped 220,000 gpd in 1963.

Industrial Supplies. The first industrial well in Stephenson County was drilled in 1889. Industrial pumpage increased very slowly and was only 271,000 gpd in 1925. During the next 20 years, pumpage increased at an average rate of 57,000 gpd per year and was 1.40 mgd in 1945. With decreased demand for industrial pumpage after "World War II, there was a gradual decline in pumpage until 1958, when pumpage was 0.98 mgd. Industrial pumpage increased nearly 3 times during the next 5 years and was 2.80 mgd in 1963, or 35 percent of the total ground-water withdrawal. One industry pumps a small amount of water from the glacial drift, and records are not available for any industrial wells finished in shallow dolomite aquifers. At least 22 industries have developed sandstone wells and 12 of these were in use during 1963. More than 80 percent of the industrial pumpage is for use in the manufacturing of chemicals and rubber products.

Domestic Supplies. Ground-water pumpage for domestic supplies is primarily governed by changes in the rural population, but may be offset by a continuing increase in per capita consumption. Rural population was largest in 1880 before many of the municipalities were incorporated. Rural population declined during the period 1880 to 1920 and domestic pumpage decreased from 640,000 gpd in 1880 to 470,000 gpd in 1920. During the next 30 years, both population and pumpage increased; domestic pumpage was 725,000 gpd in 1950. Even though rural population has declined since 1950, the increase in per capita consumption has resulted in a continued increase in pumpage, to 756,000 gpd in 1963. This represents 10 percent of the total ground-water pumpage. Most of the domestic wells in Stephenson County are finished in shallow dolomite aquifers, although in some areas satisfactory wells have been completed in glacial drift aquifers above the bedrock. In a few areas where satisfactory wells could not be developed in shallow glacial drift or shallow dolomite aquifers, domestic wells have been drilled into the sandstone aquifers.

Glacial Drift Wells. Total pumpage from glacial drift wells in Stephenson County has been governed almost entirely by pumpage for the city of Freeport. A municipal supply was developed from springs at Freeport in 1882 and pumpage increased rapidly to 2.0 mgd in 1920. Total pumpage at that time was 2.08 mgd as shown in figure 19. Freeport increased their pumpage from deep sandstone wells after 1920, and the springs were used less each year until they were abandoned in 1931. The village of Pearl City obtained a small amount of water from the glacial drift during the period 1896 to 1922. From 1931 until 1954, practically all of the glacial drift pumpage was for domestic supplies. The city of Freeport completed a well in the glacial drift in 1954, and pumpage for the city from this well increased rapidly to 2.46 mgd in 1958. Public pumpage has declined since then and was 1.72 mgd in 1963. Total pumpage from glacial drift wells in 1963 was 1.85 mgd, of which public pumpage represented more than 93 percent.

One chemical plant in Freeport has pumped about 10,000 gpd from a glacial drift well since 1951. Industrial pumpage was less than 1 percent of the total glacial drift pumpage.

Domestic pumpage from glacial drift wells decreased from about 100,000 gpd in 1880 to 70,000 gpd in 1920 as the rural population in the county declined. Since 1920, domestic pumpage has increased slowly but steadily and was 114,000 gpd in 1963, or about 6 percent of the total pumpage from glacial drift wells.

Shallow Dolomite Wells. Practically all of the pumpage from shallow dolomite wells in Stephenson County is for domestic supplies. There are probably some institutions and industries with wells finished in shallow

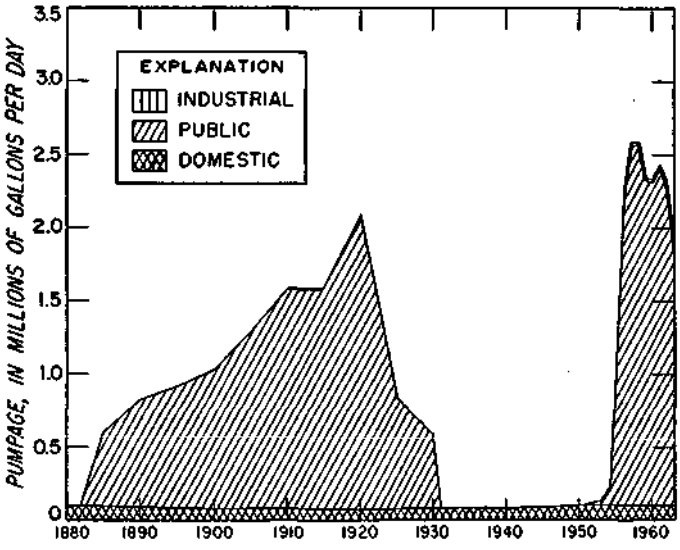

Figure 19. Pumpage from glacial drift wells in Stephenson County, 1880-1963

dolomite aquifers, but their pumpage is believed to be rather limited. Most of the wells for private domestic supplies are finished in the shallow dolomite aquifers. As the rural population declined during the period 1880 to 1920, domestic pumpage declined from about 500,000 gpd in 1880 to 375,000 gpd in 1920. After 1920, rural population increased until 1950 and then declined again. However, this recent decline has been more than offset by the continuing increase in per capita consumption and domestic pumpage has increased slowly but steadily since 1920. Total pumpage from shallow dolomite wells was 612,000 gpd in 1963.

Sandstone Wells. The first sandstone wells in Stephenson County were drilled about 1890 and total pumpage increased at a slow rate of 11,000 gpd per year until 1920, when pumpage was 476,000 gpd as shown in figure 20. During the period 1920 to 1948, the rate of pumpage growth increased more than 10 times and averaged 130,000 gpd per year. Total pumpage in 1948 was 4.18 mgd. Pumpage declined slightly during the next 6 years and then declined rapidly for 2 years as Freeport developed a new supply from the glacial drift. Total pumpage in 1957 was 1.89 mgd, less than at any time since before 1930. Since 1957, sandstone pumpage has increased at an average rate of 588,000 gpd, to a high of 5.42 mgd in 1963.

The town of Lena developed the first public water supply with a sandstone well in 1895. Additional supplies were developed at Orangeville and Freeport by 1900. Public pumpage increased slowly at first and was only 202,000 gpd in 1920. Primarily as the result of increased pumpage at Freeport after 1920, public pumpage increased rather steadily until 1948 and was 2.95 mgd that year. Following a few years of about uniform pumpage, public pumpage declined rapidly during 1955 and 1956 as Freeport increased their pumpage from the glacial drift. Pumpage has again increased since 1957 and was 2.59 mgd in 1963. This accounted for 48 percent of the total pumpage from sandstone wells. Nine municipalities and one subdivision have developed sandstone wells; Freeport pumpage represents 77 percent of the total pumpage for public supplies.

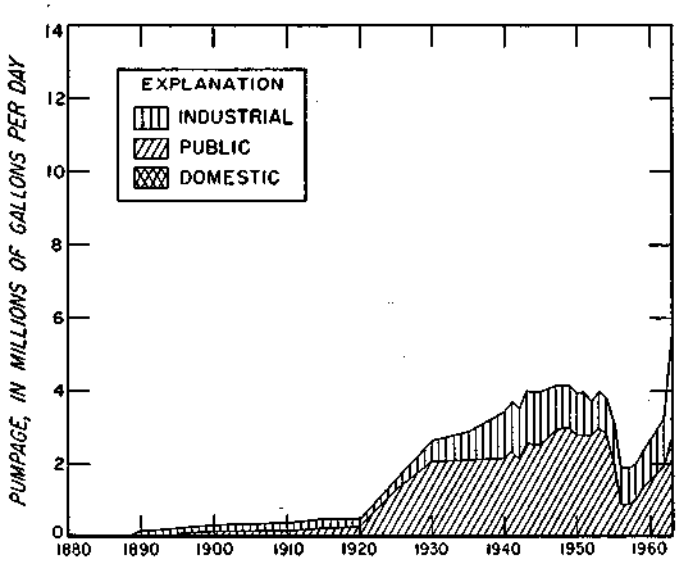

Figure 20. Pumpage from sandstone wells in Stephenson County, 1880-1963

The first sandstone well for an industrial supply, for which records are available, was a railroad well at Freeport drilled in 1889. Early industrial pumpage increased slowly and was 271,000 gpd in 1925. Industrial pumpage increased at a more rapid rate during the next 20 years, averaging 57,000 gpd per year. Pumpage in 1945 was 1.40 mgd. During the next 13 years, pumpage for industrial supplies had a gradual downward trend and was 0.97 mgd in 1958. Industrial pumpage from sandstone wells increased nearly 190 percent since 1958 and was 2.79 mgd in 1963, representing 51 percent of the total withdrawal from the sandstone wells. Available records indicate 12 industries pumped their sandstone wells during 1963; at least 10 industries had previously abandoned their wells and obtained water from municipal supplies. More than 80 percent of the industrial pumpage is for use in the manufacturing of chemicals and rubber products.

In some areas of Stephenson County where satisfactory supplies cannot be developed from shallow wells, domestic wells have been drilled to the sandstone aquifers. Pumpage is limited and averaged about 39,000 gpd in 1963, or less than 1 percent of the total pumpage from sandstone wells.

Freeport Pumping Center. The development of a public water supply from springs at Freeport in 1882 initiated ground-water withdrawal in the Freeport area. Total pumpage increased steadily at an average rate of 53,000 gpd and was 2.39 mgd in 1920. There was a gradual downward trend in pumpage for 15 years and then an increase for i9 years at a rate comparable to that before 1920 as shown in figure 21. Total pumpage was 3.12 mgd in 1954. Since then total pumpage has more than doubled and was 6.33 mgd in 1963. This represents 80 percent of the total ground-water pumpage in Stephenson County. Of the total 1963 pumpage in the Freeport area, 27.4 percent was from glacial drift wells and 72.1 percent was from sandstone wells; only 0.5 percent of the pumpage was from shallow dolomite wells.

Practically all of the public pumpage in the area has been for the municipal supply at Freeport, although a subdivision system was developed in 1960 and pumpage increased to 220,000 gpd in 1963. Springs that were developed in 1882 served as the only municipal water supply for Freeport until 1900, when a deep sandstone well was drilled. The springs continued to be the principal source of water until after 1920 and then were abandoned in the early 1930s. Public pumpage was 2.13 mgd in 1920 and then declined to 1.40 mgd in 1935

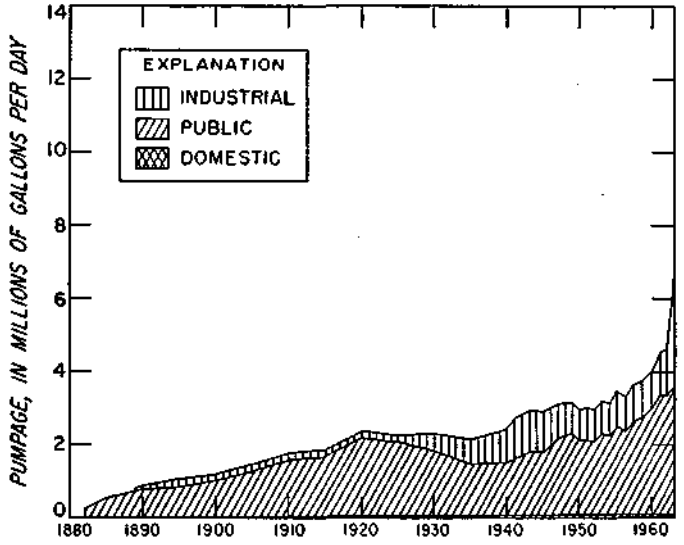

Figure 21. Total ground-water pumpago in the Freeport area, 1882-1963

as production from the springs declined. Pumpage increased at the rate of 40,000 gpd from 1935 to 1954 and at the rate of 154,000 gpd from 1954 to 1963. Pumpage for the two public supplies was 3.55 mgd in 1963, or 56 percent of the total withdrawal in the Freeport area. Pumpage for the city of Freeport accounted for 94 percent of the public pumpage and 53 percent of the total pumpage in the Freeport area. More than 40 percent of the total ground-water pumpage in Stephenson County is for the municipal supply at Freeport.

Industrial pumpage in the Freeport area began in 1889 with the completion of a railroad well; pumpage increased rather slowly and was 256,000 gpd in 1925. During the next 20 years, pumpage increased at an average rate of 43,000 gpd and was 1.12 mgd in 1945. As the industrial demand decreased after World War II, pumpage declined and averaged 949,000 gpd during the period 1946 to 1960. Since 1960 industrial pumpage has increased 167 percent to 2.75 mgd in 1963. This represented 43 percent of the total pumpage in the Freeport area. Practically all of the industrial pumpage is from sandstone wells; one industry pumps a small quantity of water from a glacial drift well. No records are available of industrial wells finished in shallow dolomite aquifers. More than 98 percent of the industrial pumpage in Stephenson County is in the Freeport area. Most of the pumpage is for use in the processing of chemicals and rubber products.

Domestic pumpage in the Freeport area is primarily for rural nonfarm homes outside of areas served by the two public water supply systems. Pumpage was about 34,000 gpd in 1963. Most of this pumpage was from wells finished in shallow dolomite aquifers. It is probable that some small commercial and industrial supplies also obtained limited quantities of water from shallow dolomite wells.

Jo Daviess County

Total ground-water pumpage in Jo Daviess County has grown at a fairly uniform rate from 640,000 gpd in 1900 to 2.39 mgd in 1963 as shown in figure 22. This is an increase of nearly 400 percent. There was a small increase followed by a small decrease in the 1920s, also a large increase followed by a small decrease during and after World War II. Since 1952 total pumpage has increased at a steady rate, averaging 88,000 gpd per year.

Public Supplies. The city of East Dubuque developed the first public supply in Jo Daviess County in 1885. Galena has had the largest water supply, either public or industrial since it was developed in 1886. Records show that there is a total of eight public water supplies in Jo Daviess County. Prior to 1952 total pumpage for public supplies increased at a relatively slow rate, averaging 14,000 gpd per year. From 1952 to 1963, the pumpage growth rate accelerated considerably, averaging 83,000 gpd per year.

Industrial Supplies. There are very few industrial ground-water supplies in Jo Daviess County. During the early 1800s a number of mines were developed in northwestern Jo Daviess County to claim lead and zinc found in the Galena-Platteville Dolomite. Fifteen to twenty mines were in operation at the peak of production, which was reached about 1850. Most of these mines were closed before 1900; only one is still in operation.

In order to permit mining operations, it was necessary to dewater the mines by pumping the water to waste. Current dewatering operations result in pumpage of approximately 2 mgd. It is possible that dewatering resulted in pumpage of 20 to 30 mgd during the peak period of mining operations in the mid-1800s. These figures are not included in the tabulation of ground-water pumpage.

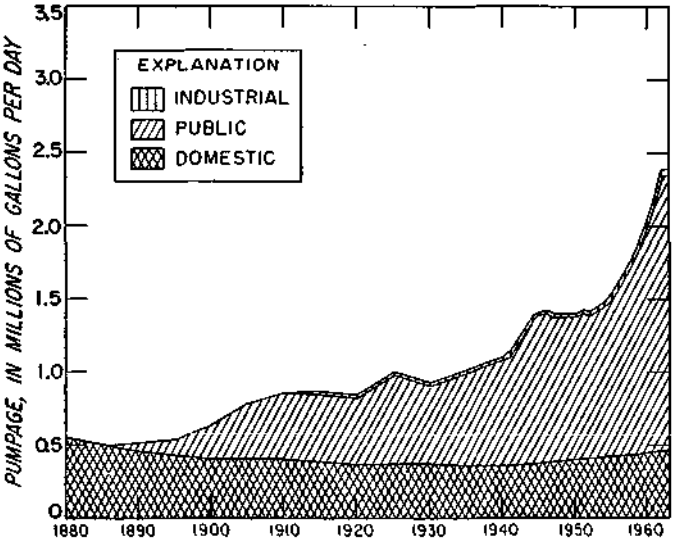

Figure 22. Total ground-water pumpage in Jo Daviess County, 1880-1963

Other than the mine operations, a dairy and a concrete products company pumped approximately 31,000 gpd during 1963.

Domestic Supplies. Total ground-water pumpage for domestic use has remained almost constant throughout the period of record, showing an increase in the early 1940s and continuing through 1963. Domestic pumpage in 1963 was 464,000 gpd.

Glacial Drift Wells. Nearly all of Jo Daviess County is in the unglaciated area of the state. Sand and gravel aquifers are very limited except in alluvial deposits along the Mississippi River and a few of the larger streams in the county.

Prior to 1958, pumpage from glacial drift aquifers was primarily for domestic supplies and averaged about 20,000 gpd. Domestic pumpage has stayed at about the same rate and a small industrial supply was developed in 1958 as shown in figure 23. Total pumpage from the aquifer in 1963 was 34,000 gpd.

Shallow Dolomite Wells. Total pumpage from the shallow dolomite aquifers is primarily for domestic use in Jo Daviess County. Domestic pumpage declined from 1880 until 1940, when pumpage reached a low of 322,000 gpd. Since 1940 domestic pumpage has increased steadily and was 418,000 gpd in 1963 as shown in figure 24.

The village of Elizabeth has the only public supply developed in the dolomite aquifers. Starting in 1900 the village pumped at a fairly steady rate, averaging 20,000 gpd until 1940 when the pumpage began to increase gradually. Public pumpage was 87,000 gpd in 1963. Total pumpage from the shallow dolomite aquifers in 1963 was 505,000 gpd.

Sandstone Wells. Total pumpage from sandstone aquifers increased at a fairly uniform rate of 11,000 gpd per year until 1941. The years 1941 to 1952 saw a rapid increase in pumpage followed by a small decrease.

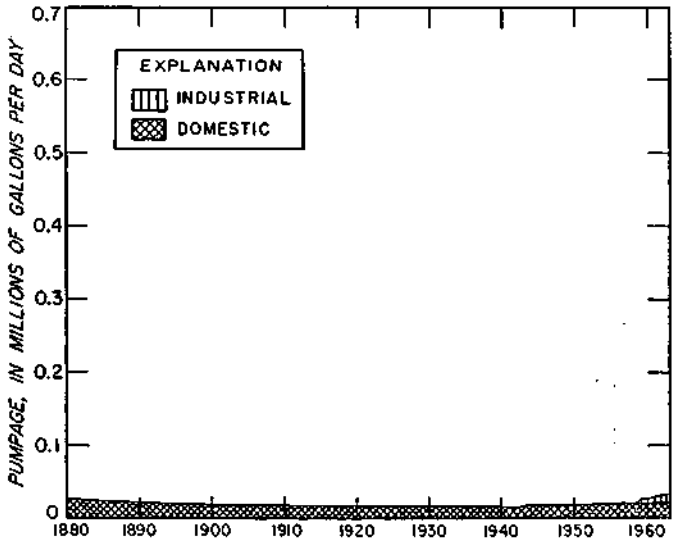

Figure 23. Pumpage from glacial drift wells in Jo Daviess County, 1880-1963

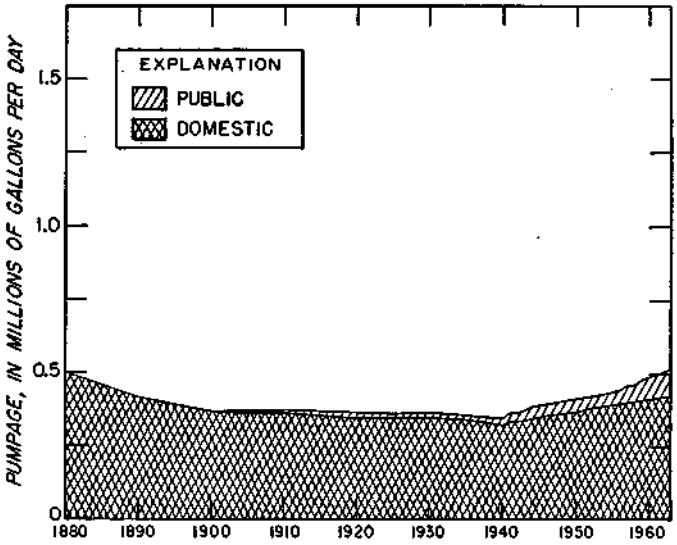

Figure 24. Pumpage from shallow dolomite wells in Jo Daviess County, 1880-1963

Since 1952 pumpage increased at an accelerating rate to a high of 1.86 mgd in 1963 as shown in figure 25.

The first sandstone public supply was developed in 1885 for the city of East Dubuque, followed by the city of Galena, the largest public supply in Jo Daviess County. There are seven sandstone public water supplies in the county. Public sandstone pumpage in 1963 was 1.81 mgd, which represents 97 percent of the total sandstone pumpage in the county.

The industrial sandstone pumpage in Jo Daviess County was only 20,000 gpd in 1963. Most industries that use water are in or near the cities and purchase their water from public supplies.

Domestic pumpage from the sandstone in Jo Daviess County is very limited, averaging 23,000 gpd in 1963. Shallow aquifers in most parts of the county yield sufficient water for domestic use.

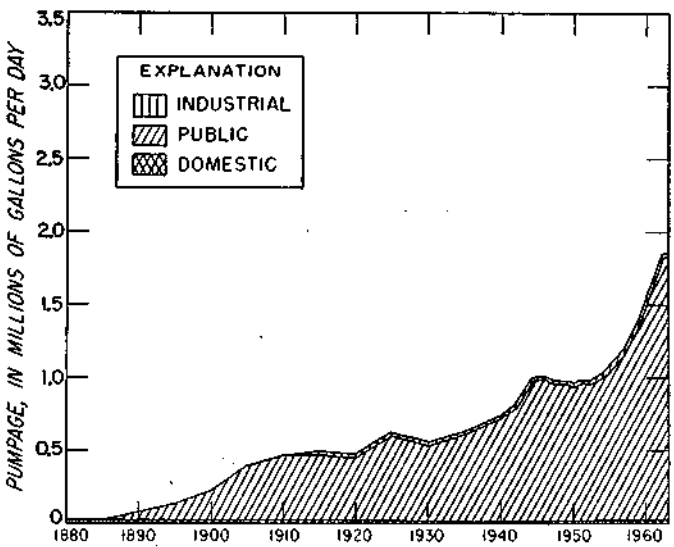

Figure 25. Pumpage from sandstone wells in Jo Daviess County, 1880-1963

Carroll County

The total ground-water pumpage for Carroll County has increased at an erratic rate from 690,000 gpd in 1910 to 2.42 mgd in 1963 as shown in figure 26. The period of greatest variation occurred between the years 1940 and 1958, and was due primarily to the varying pumpage by the Savanna Army Depot. Peaks during this period occur towards the end of "World War II and the Korean War in 1945 and 1952, respectively.

Public Supplies. The cities of Mt. Carroll and Lanark developed the first public supplies in Carroll County in 1888. Savanna has had the largest water supply, either public or industrial, since it was developed in 1890. Seven public water supplies were in existence in Carroll County in 1963. Prior to 1958, the relative rate of increase in public pumpage was low, averaging about 10,000 gpd per year. Since 1958 the rate of increase has averaged 75,000 gpd per year. The total public pumpage for 1963 was 1.35 mgd, or 56 percent of the total ground-water pumpage.

Industrial Supplies. In Carroll County there are only three industries pumping an appreciable amount of water, Green Giant Paeking Company at Lanark, Kraft Foods at Milledgeville, and Savanna Army Depot. The depot pumpage peaked in 1945 and 1953, corresponding with the two conflicts in which the United States was involved at those times. Pumpage for industrial use in Carroll County totaled 660,000 gpd in 1963, or 27 percent of the total ground-water withdrawal.

Domestic Supplies. Pumpage for domestic purposes in Carroll County declined until 1910, increased for 10 years and then remained fairly constant until 1940. Following 1940, domestic pumpage began a gentle increase which has been continuous through 1963. The 1963 domestic pumpage total was 410,000 gpd, or 17 percent of the total pumpage in Carroll County.

Glacial Drift Wells. Sand and gravel aquifers are limited in Carroll County except along the Mississippi River and scattered areas in the county. Water pumped from these shallow aquifers is used largely for domestic purposes. The city of Mt. Carroll originally had a glacial drift supply which was abandoned in 1920. The village of Thomson developed their sand and gravel supply in 1903 and it is still in production. There is no industrial pumpage from the glacial drift in Carroll County. Total pumpage from glacial drift for the county was 134,000 gpd in 1963 as shown in figure 27.

Shallow Dolomite Wells. Domestic pumpage is the largest use of dolomite water in Carroll County, totaling 285,000 gpd in 1963 as shown in figure 28. Kraft Foods is the only industry pumping from the shallow dolomite aquifers. The last public dolomite supply to be used in Carroll County was at the village of Shannon and was abandoned in 1948. Two other public supplies had previously been abandoned. Total shallow dolomite pumpage was 355,000 gpd in 1963.

Sandstone Wells. The total pumpage from sandstone aquifers has increased since its extended use starting in 1886; however, this total has increased and decreased a number of times. The main reason for these erratic changes was the industrial pumpage. The greatest variations occurred during the period 1940 to 1958 as shown in figure 29. Total sandstone pumpage in 1963 for Carroll County was 1.93 mgd.

Six public supplies in Carroll County use the sandstone aquifers as their source of water. The first public supply was developed at Lanark. The largest public supply in Carroll County is for the city of Savanna which pumped a total of 800,000 gpd in 1963. The total public sandstone pumpage for 1963 in Carroll County was 1.32 mgd, which represents 68 percent of the total pumpage.

The three industries in Carroll County that obtain

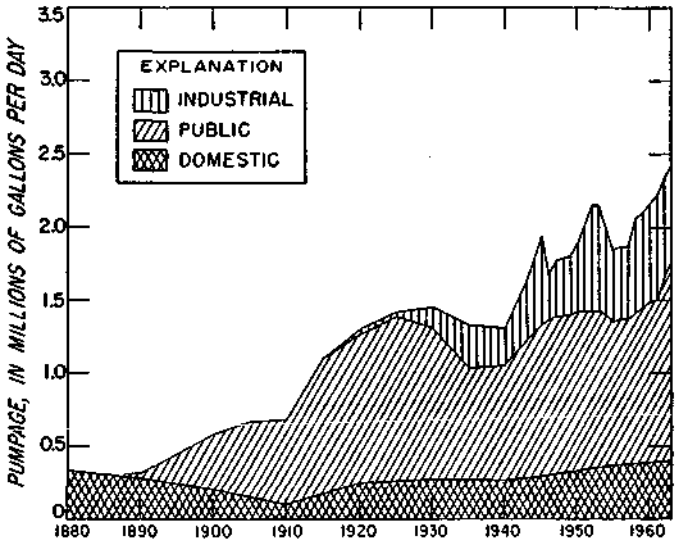

Figure 26. Total ground-water pumpage in Carroll County, 1880-1963

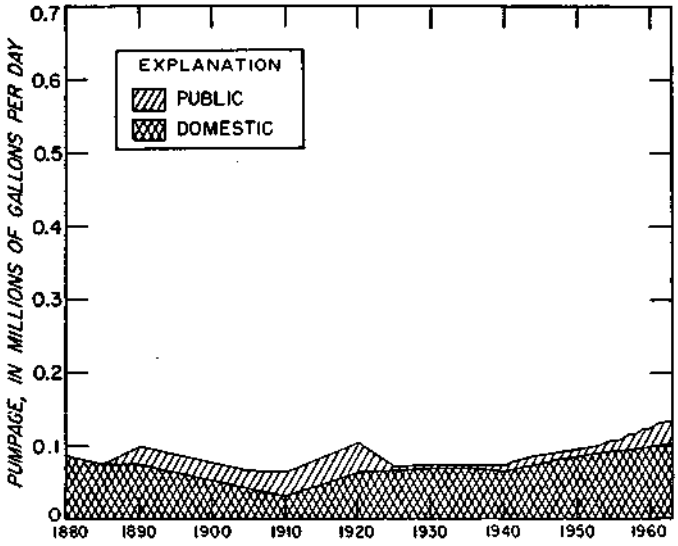

Figure 27. Pumpage from glacial drift wells in Carroll County, 1880-1963

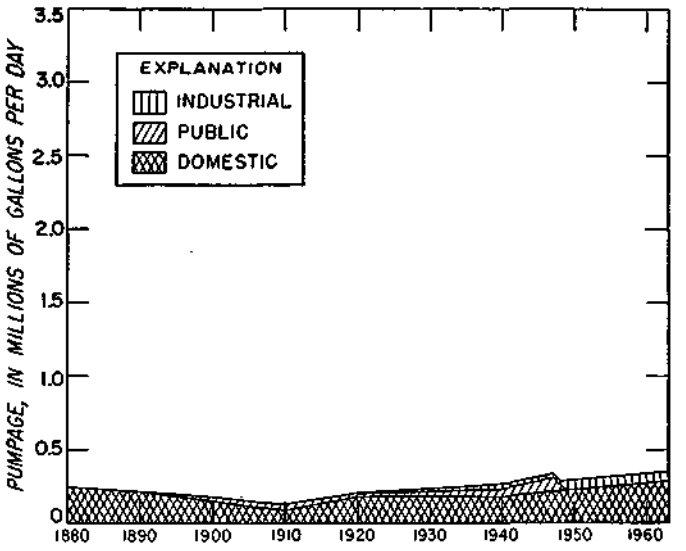

Figure 28. Pumpage from shallow dolomite wells in Carroll County, 1880-1963

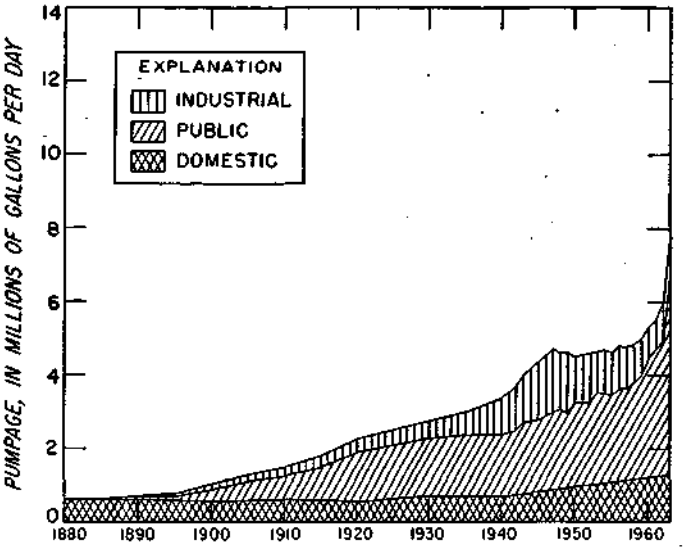

Figure 30. Total ground-water pumpage in Ogle County, 1880-1963

water from sandstone wells are the Green Giant Packing Company at Lanark, Kraft Foods at Milledgeville, and the Savanna Army Depot. The industrial sandstone pumpage in 1963 totaled 590,000 gpd.

Domestic pumpage from the sandstone aquifers in Carroll County is very limited, averaging 21,000 gpd in 1963. Shallow aquifers in most parts of the county yield sufficient water for domestic use.

Ogle County

Total ground-water pumpage in Ogle County increased at a gradually accelerating rate until 1947, when pumpage was 4.73 mgd. Pumpage declined slightly after 1947, to 4.53 mgd in 1950. Since 1950 pumpage growth has accelerated steadily, with a very rapid growth rate of 500,000 gpd per year since 1957 as shown in figure 30.

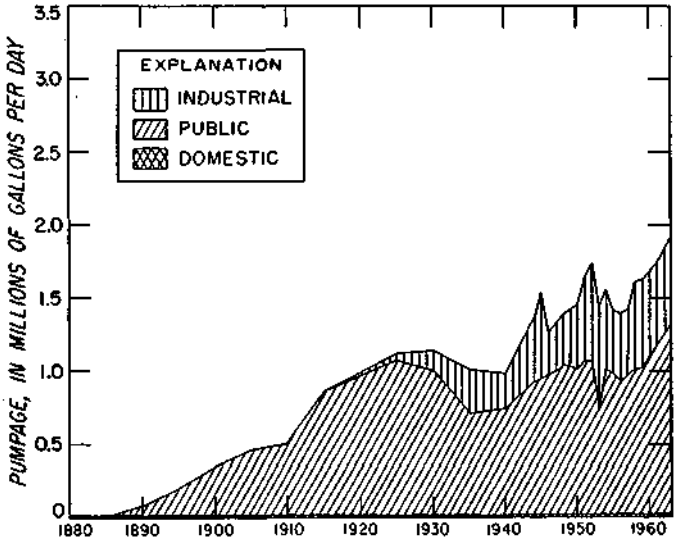

Figure 29. Pumpage from sandstone wells in Carroll County, 1880-1963

In 1963, total pumpage was 7.77 mgd, more than double the pumpage of 1942. Of the 1963 total pumpage 6 percent was from glacial drift wells, 12 percent was from shallow dolomite wells, and 82 percent was from sandstone wells.

Public Supplies. Public water supplies were developed at Rochelle in 1876 and at Oregon in 1886. During the 1890s, additional supplies were developed at Polo, Forreston, and Mt. Morris. Pumpage for public supplies has increased rather steadily since before 1900, although the rate of increase has accelerated considerably since 1957. Prior to 1957, public pumpage increased at an average rate of 39,000 gpd per year. Since 1957, pumpage has increased at an average rate of 493,000 gpd per year. Pumpage for public supplies was 5.46 mgd in 1963, or 70 percent of the total ground-water withdrawal in Ogle County. All of the recorded public pumpage is from sandstone wells. Nine municipalities have public ground-water supplies.

Industrial Supplies. Early industrial pumpage began in the 1890s, with the development of ground-water supplies for two railroads. Pumpage increased rather slowly, but at a gradually accelerating rate and reached a maximum of 1.71 mgd in 1947, just after World "War II. With a decrease in demand after the war, industrial pumpage declined and was 994,000 gpd in 1963. This represents 13 percent of the total ground-water pumpage. More than 70 percent of the industrial pumpage is from sandstone wells. Eight industries pumped ground water in 1963, with nearly 75 percent of the pumpage for use in the processing of food products.

Domestic Supplies. Domestic pumpage is primarily governed by rural population, although a continuing increase in per capita consumption is becoming of greater significance. Pumpage for domestic supplies averaged less than 700,000 gpd before 1940. Since 1940, domestic pumpage has increased steadily at a more rapid rate,

averaging 27,000 gpd per year. Domestic pumpage was 1.32 mgd in 1963, or 17 percent of the total ground-water withdrawal in Ogle County.

Glacial Drift Wells. Pumpage from glacial drift wells in Ogle County has been largely limited to domestic use. During the period 1886 through 1896, the city of Oregon obtained water from a shallow well which probably was finished in the glacial drift. This is the only available record of a public supply from the drift. One food-processing industry at Oregon developed a water supply from glacial drift wells in 1921. Pumpage has increased gradually and was 170,000 gpd in 1963 as shown in figure 31.

Domestic pumpage is largely dependent on the rural population, although there has been a continuing increase in per capita consumption. Prior to 1940, pumpage for domestic supplies varied from approximately 140,000 gpd to 175,000 gpd, with greater pumpage about 1890 and after 1925. Since 1940, domestic pumpage has increased at an average rate of nearly 7000 gpd per year and was 330,000 gpd in 1963. This represents 66 percent of the total pumpage from glacial drift wells. Total pumpage from glacial drift wells was 500,000 gpd in 1963.

Shallow Dolomite Wells. Total pumpage from shallow dolomite wells in Ogle County has been almost entirely for domestic supplies, with only limited pumpage for public and industrial supplies. Pumpage has increased rather steadily, averaging 4000 gpd per year from 1900 to 1940 and 17,000 gpd per year from 1940 to 1963. Total pumpage in 1963 was 890,000 gpd as shown in figure 32.

The city of Rochelle obtained water for a municipal supply from a quarry during the period 1876 to 1896. This was the first public supply from shallow dolomite aquifers in the county. Additional supplies were developed at Forreston in 1894 and at Leaf River in 1914.

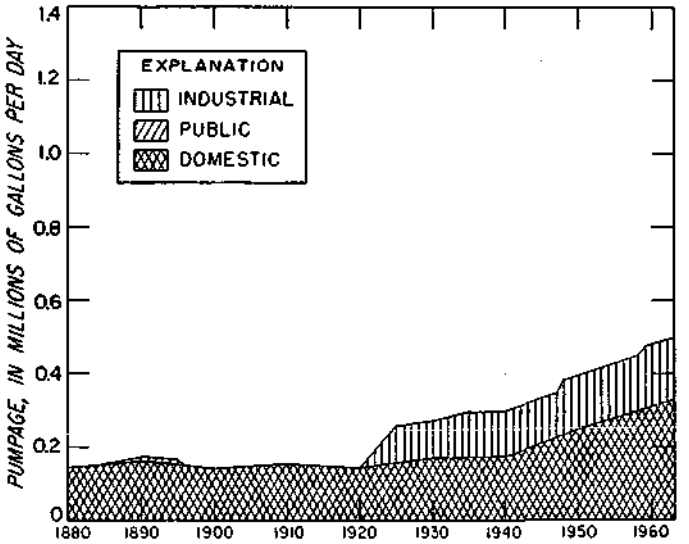

Figure 31. Pumpage from glacial drift wells in Ogle County, 1880-1963

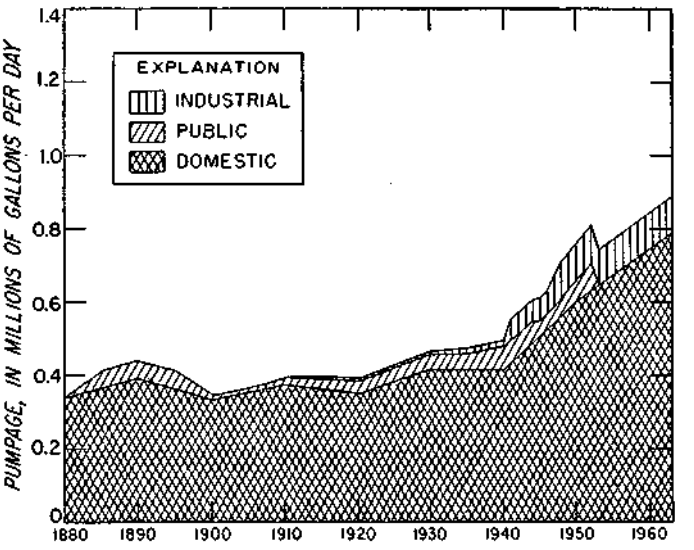

Figure 32. Pumpage from shallow dolomite wells in Ogle County, 1880-1963

Both of these shallow dolomite supplies were abandoned by 1953 and there is no record of pumpage from shallow dolomite wells for public supplies since that time. Public pumpage reached a maximum of 80,000 gpd in 1952.

A small industrial supply from a shallow dolomite well was developed in 1910. Pumpage has increased slowly since 1910, although at a somewhat more rapid rate after 1940. Industrial pumpage in 1963 was 100,000 gpd, or 11 percent of the pumpage from shallow dolomite wells in the county. Three industries pumped from shallow dolomite wells in 1963 and all of the water was for use in the processing of food.

Early domestic pumpage was relatively high about 1890 and 1910, and low about 1900 and 1920. Since 1920, pumpage has increased at an accelerating rate, averaging 3000 gpd per year from 1920 to 1940, and 16,000 gpd per year since 1940. Pumpage for domestic supplies was 790,000 gpd in 1963, or 89 percent of the total withdrawal from shallow dolomite wells in Ogle County.

Sandstone Wells. Total pumpage from sandstone wells in Ogle County increased at a steadily accelerating rate from before 1900 until 1947. Pumpage in 1947 was 3.71 mgd. Pumpage then declined slightly and averaged 3.48 mgd during the next 10 years. Since 1957, total pumpage has increased at a rapid rate of 476,000 gpd per year and was 6.38 mgd in 1963 as shown in figure 33.

The city of Polo developed a public water supply from a sandstone well in 1891, followed by Mt. Morris, Oregon, and Rochelle prior to 1900. Public pumpage has increased steadily since then, although at a much more rapid rate since 1957. Pumpage has increased since 1957 at an average rate of 493,000 gpd per year, more than 10 times the average annual growth rate prior to 1957. Nine municipalities had sandstone wells in 1963 and public pumpage was 5.46 mgd. This accounted for 86

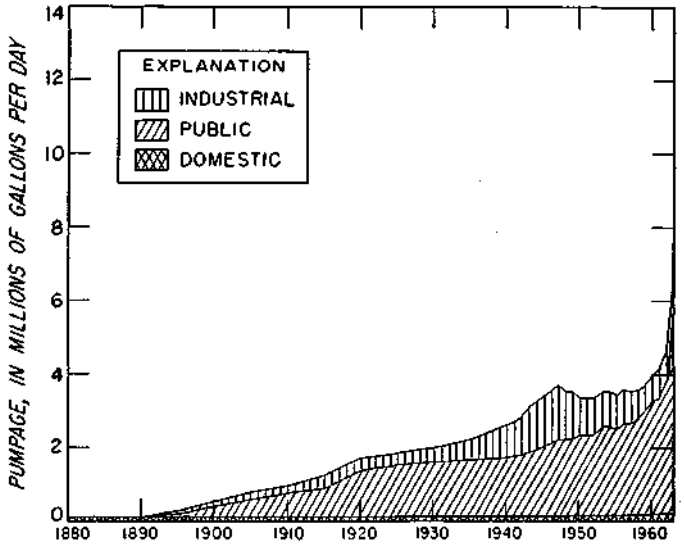

Figure 33. Pumpage from sandstone wells in Ogle County, 1880-1963

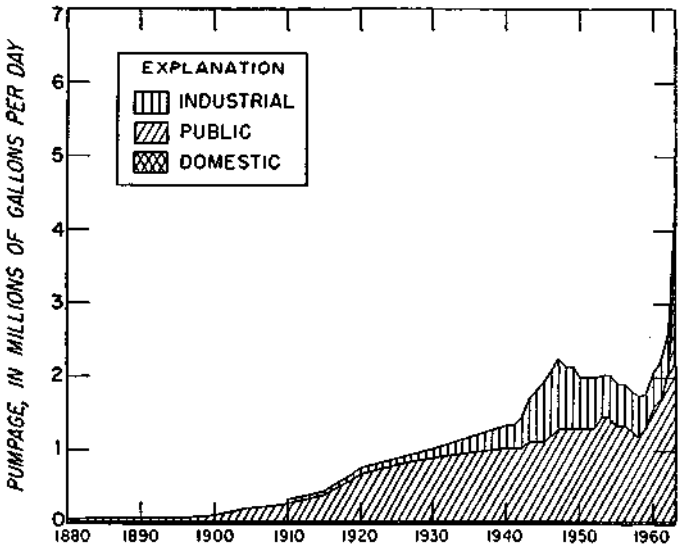

Figure 34. Total ground-water pumpage in the Rochelle area, 1880-1963

percent of the total sandstone withdrawal in Ogle County.

The first sandstone industrial supplies were for two railroads, developed prior to 1895. Industrial pumpage increased slowly but at a gradually accelerating rate, averaging 8000 gpd per year from 1910 through 1930 and 66,000 gpd per year from 1930 through 1947. Peak industrial pumpage of 1.51 mgd was reached in 1947, just after "World War II. Pumpage has declined more than 50 percent since then and was 724,000 gpd in 1963, or 11 percent of the total pumpage from sandstone wells. Five industries pumped sandstone wells during 1963, with more than G5 percent of the pumpage for use in the processing of food.

Domestic pumpage from sandstone wells is quite limited in Ogle County, because in most areas satisfactory wells for domestic supplies can be developed from either glacial drift or shallow dolomite aquifers. There has been a gradual increase in domestic pumpage to 200,000 gpd in 1963. This represents about 3 percent of the total pumpage from sandstone wells.

Rochelle Pumping Center. Initial pumpage in the Rochelle area began in 1876 with the development of a municipal water supply from a quarry. Total pumpage increased very slowly at first and was about 120,000 gpd in 1900. During the period 1900 to 1941, pumpage increased steadily at an average rate of 30,000 gpd per year. World War II caused an increase in the demand and pumpage accelerated at the rate of 151,000 gpd from 1941 to 1947, and was 2.25 mgd in 1947. Pumpage declined after the war and was 1.74 mgd in 1958. Since 1958, total pumpage has increased more than 240 percent and was 4.32 mgd in 1963 as shown in figure 34. This represents more than 55 percent of the total ground-water pumpage in Ogle County. All of the recorded public and industrial pumpage in the Rochelle area is from sandstone wells.

The only public supply in the area is for the city of Rochelle. The original quarry supply was used from 1876 until 1897, when the first sandstone well was drilled. Pumpage has increased steadily except for a slight decline during the mid-1950s. Since 1958, public pumpage has increased at an average rate of 527,000 gpd per year and was 3.82 mgd in 1963. This represents 88 percent of the pumpage in the Rochelle area and 49 percent of the total ground-water pumpage in Ogle County.

Industrial pumpage in the Rochelle area began about 1910. Pumpage increased rapidly from 1930 to 1941, and at a much more rapid rate during World War II. Peak industrial pumpage of 975,000 gpd was reached in 1947. Since then there has been a continual decline in industrial pumpage to 458,000 gpd in 1963. This accounted for nearly 11 percent of the pumpage in the Rochelle area and about 46 percent of the total industrial pumpage in the county. All of the pumpage was used by one industry in the processing of food products. Two small industries in the Rochelle area abandoned their wells several years ago.

Domestic pumpage in the Rochelle area is limited to nonurban homes and farms in the area not served by the municipal water supply system. Most of this pumpage is probably from shallow drift or dolomite wells. Pumpage in 1963 was about 40,000 gpd, or less than 1 percent of the total ground-water pumpage in the Rochelle area.

DeKalb County

Total ground-water pumpage in DeKalb County has increased at a rather steady rate from less than 500,000 gpd in 1880 to 6.64 mgd in 1963 as shown in figure 35. This represents an average growth of about 74,000 gpd per year.

Public Supplies. The village of Somonauk developed the first public water supply in 1880, followed by DeKalb,

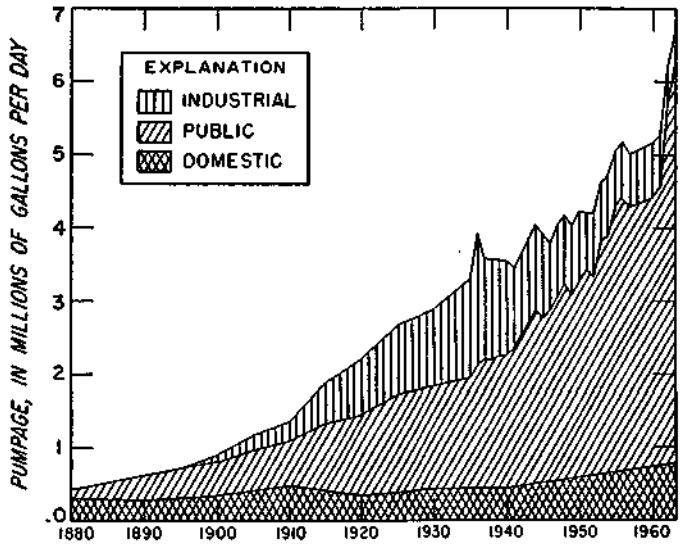

Figure 35. Total ground-water pumpage in DeKalb County, 1880-1963

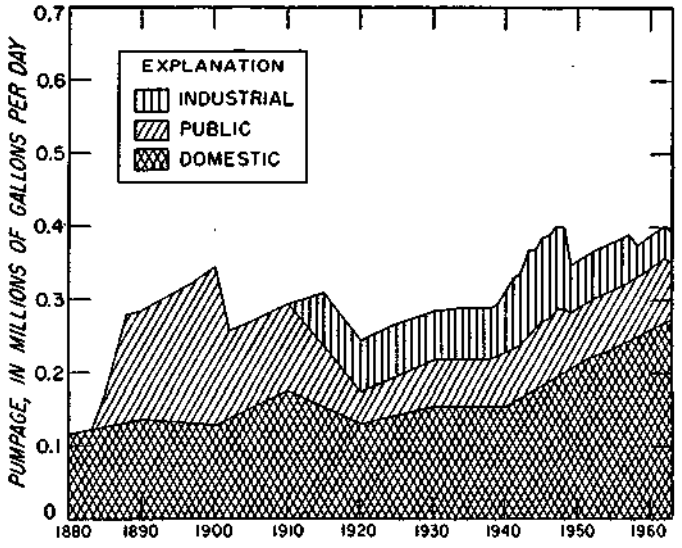

Figure 36. Pumpage from glacial drift wells in DeKalb County, 1880-1963

Shabbona, and Genoa by 1900. Pumpage has increased at an accelerating rate since periods of early development, averaging 37,000 gpd per year from 1920 to 1940, and 157,000 gpd per year from 1940 to 1963. Eleven municipalities had public supplies in 1963 and pumpage was 5.45 mgd. This represents 82 percent of the total ground-water pumpage.

Industrial Supplies. After the development of the first industrial supply in 1896, industrial pumpage in DeKalb County increased steadily at a rate of approximately 45,000 gpd per year until the mid-1930s. A maximum industrial pumpage of 2.20 mgd was estimated for 1936. Pumpage has shown a moderate and continuing decrease since then, due at least in part to the development of diesel locomotives for the railroads. Some industries have abandoned their supplies and obtain water from municipal systems. Records are available of five industrial supplies in use in 1963 and most of the pumpage was for use in food processing. Industrial pumpage was 413,000 gpd in 1963, or 6 percent of the total ground-water withdrawal.

Domestic Supplies. Total ground-water pumpage for domestic supplies showed only moderate fluctuations prior to 1940, and was 440,000 gpd in that year. Since 1940, domestic pumpage has increased more rapidly in response to the more rapid growth of nonurban population. Domestic pumpage was 783,000 gpd in 1963, an increase of 78 percent since 1940. The 1963 pumpage represented 12 percent of the total ground-water pumpage in DeKalb County.

Glacial Drift Wells. Total ground-water pumpage from glacial drift wells has shown a rather irregular growth, but has increased from approximately 100,000 gpd in 1880 to 395,000 gpd in 1963 as shown in figure 36. Early pumpage increased rapidly up to 1900. Pumpage also increased rapidly during the periods 1902 and 1915 and 1938 to 1948. Each of these periods was followed by short periods of decreased pumpage. Pumpage in 1948 was about the same as that in 1963.

The city of Sandwich developed a public supply from glacial drift wells in 1884, followed by the city of Sycamore and the villages of Waterman and Shabbona before 1900. The first two sources have been abandoned for more than 50 years; the present supplies obtain water from other aquifers. Waterman also obtains a major part of its supply from another aquifer.

Pumpage for public supplies increased from less than 100,000 gpd in 1885 to about 215,000 gpd in 1900. As the result of the abandonment of the two original glacial drift supplies, public pumpage decreased sharply about 1900 and again after 1910. There has been a slow, gradual increase in pumpage since 1920 and pumpage for public supplies was only 75,000 gpd in 1963. This accounts for 19 percent of the total pumpage from glacial drift wells. The 1963 pumpage is less than 35 percent of the amount pumped for public supplies from these wells in 1900.

Records are available of only four industrial supplies from glacial drift wells. The two original supplies were developed between 1910 and 1915, and are no longer in service. Pumpage was rather constant until 1939, and then showed a marked increase to a high of 115,000 gpd during World War II. Pumpage declined after the War and was 45,000 gpd in 1963, or about 11 percent of the glacial drift pumpage. The use of industrial pumpage is about evenly divided between the processing of food products and the manufacturing of hemp rope.

Pumpage from glacial drift wells for domestic supplies showed a rather gradual increase until about 1940, except for a sharp rise and fall before and after 1910. Prior to 1940, pumpage increased at an average rate of approximately 600 gpd per year. With a rapid increase in nonurban population since 1940, domestic pumpage

has increased at an average rate of more than 5000 gpd per year, and was 275,000 gpd in 1963. This amounts to 70 percent of the total pumpage from glacial drift wells.

Shallow Dolomite Wells. Total pumpage from shallow dolomite wells in DeKalb County increased from about 50,000 gpd in 1880, to 250,000 gpd in 1938, at a rather uniform average rate of less than 4000 gpd per year. There was a rapid decline in pumpage after 1939 to a low of less than 100,000 gpd in 1946. Since then, pumpage has increased at a fairly rapid rate, averaging 9000 gpd per year. Pumpage in 1963 was 255,000 gpd as shown in figure 37.

Three municipalities in DeKalb County obtain part of their water supply from shallow dolomite wells. The village of Hinckley developed a dolomite supply in 1893, but this was abandoned in 1913. The village of Kingston developed a dolomite supply in 1911, but since 1959 they have relied largely on another source. The village of Waterman developed a dolomite supply as their primary source of. water in 1946.

Prior to 1946, pumpage averaged between 10,000 gpd and 15,000 gpd with little significant change. Since 1946, public pumpage has shown an increase averaging nearly 5000 gpd per year and was 100,000 gpd in 1963. This accounts for 39 percent of the total pumpage from shallow dolomite wells.

Records are available of four industrial shallow dolomite wells in DeKalb County. Two were developed between 1915 and 1925, and both were abandoned by 1946. Early pumpage increased rather rapidly and was 175,000 gpd in 1938 and 1939. Industrial pumpage decreased to practically zero by 1946, partially as a result of war time priorities. Two new supplies have been developed since 1958, but these are both small. Pumpage in 1963 was only 37,000 gpd, or 15 percent of the total dolomite pumpage. Industrial use of the water was primarily for irrigation.

Dolomite pumpage for domestic supplies was rather irregular prior to 1940, with a period of heavier pumpage about 1910 and periods of lighter pumpage about 1900 and 1920. Since 1940, there has been an increase in nonurban population with a resulting increase in domestic pumpage, averaging approximately 2000 gpd per year. Domestic pumpage in 1963 was 118,000 gpd, or 46 percent of the total pumpage from shallow dolomite wells.

Sandstone Wells. Total pumpage from sandstone wells in DeKalb County increased from approximately 300,000 gpd in 1880 to 5.99 mgd in 1963 as shown in figure 38. Between 1900 and 1930, pumpage increased at an average rate of about 73,000 gpd per year. Pumpage growth slowed somewhat during the period 1930 to 1950, averaging 50,000 gpd per year. Since about 1950, total pumpage has increased at an accelerating rate, and has averaged 177,000 gpd per year.

Three municipal supplies, obtaining water from sandstone wells, were developed by 1900. The village of Somonauk has the oldest supply, started in 1880. This was followed by supplies at DeKalb in 1895 and Genoa in 1900. In 1963, nine municipalities in DeKalb County obtained at least part of their supply from sandstone wells.

Public pumpage has increased at an accelerating rate since the period of early development, averaging 40,000 gpd per year from 1910 to 1930, 60,000 gpd per year from 1930 to 1950, and 211,000 gpd per year since 1950. Pumpage for public supplies was 5.27 mgd in 1963, or 88 percent of the total pumpage from sandstone wells in the county.

A railroad well drilled at Kirkland in 1896 is perhaps the oldest industrial sandstone well in DeKalb County. Other railroad wells were constructed in the early 1900s,

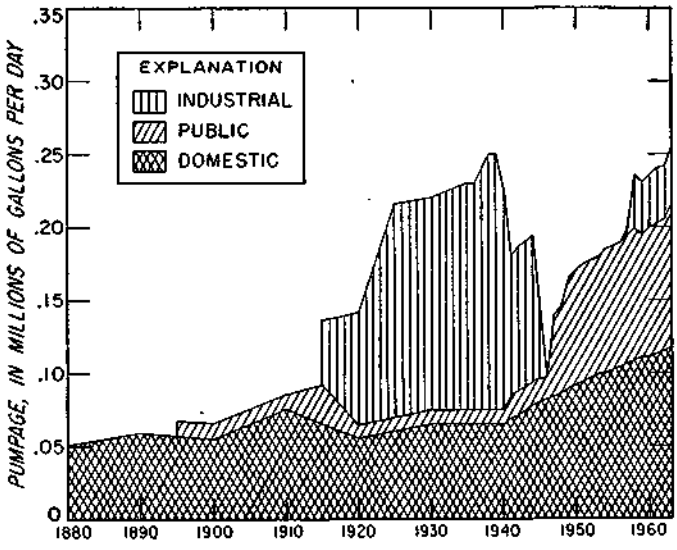

Figure 37. Pumpage from shallow dolomite wells In DeKalb County, 1880-1963

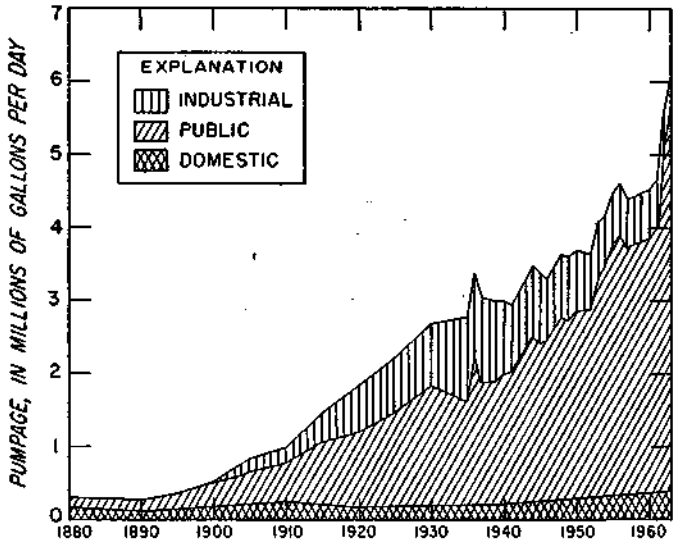

Figure 38. Pumpage from sandstone wells in DeKalb County, 1880-1963

and from then until the mid-1930s, industrial pumpage increased rather steadily. Maximum pumpage of 1.15 mgd was estimated for the period 1935 to 1938. Diesel engines for the railroads and war time priorities initiated a decrease in industrial pumpage about 1940 and the trend has continued to the present time. Most of the industries now obtain water from municipal supplies. Records are available of only one industry obtaining water from sandstone wells in 1963 and pumpage was 331,000 gpd, or 5 percent of the sandstone pumpage. All of the industrial pumpage during 1963 was used for the processing of food products.

Pumpage from sandstone wells for domestic supplies showed only moderate fluctuations prior to 1940 and averaged about 200,000 gpd. With a more rapid growth in nonurban population since 1940, domestic pumpage has increased to an estimated 390,000 gpd in 1963. This represents a 76 percent increase since 1940, and accounts for 6 percent of the total pumpage from sandstone wells in DeKalb County.

DeKalb-Sycamore Pumping Center. Since the development of municipal water supplies for the cities of DeKalb and Sycamore, these communities have been the center of pumpage from sandstone wells in DeKalb County. Municipal pumpage for these two cities totaled 3.81 mgd in 1963 (see figure 39), or 72 percent of the public sandstone pumpage. The only major industry with a sandstone supply located in DeKalb pumped 85 percent of the industrial sandstone pumpage in the county. Total sandstone pumpage at DeKalb and Sycamore was 4.15 mgd, or 69 percent of the pumpage from sandstone wells in DeKalb County.

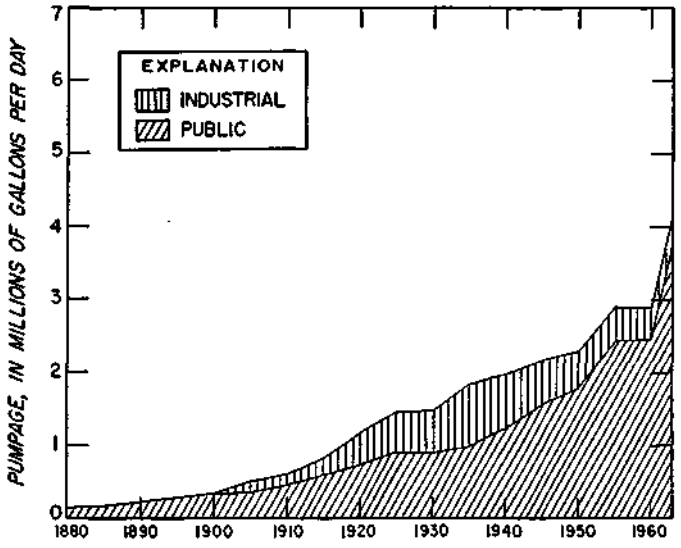

Figure 39. Pumpage from sandstone wells in the DeKalb-Sycamore area, 1880-1963

Lee County

The first well in Lee County, for other than domestic pumpage, was drilled for the city of Dixon in 1888. Total pumpage increased steadily, at accelerating rates, to a maximum of 5.45 mgd in 1945. Pumpage increased at rates averaging 24,000 gpd per year from 1890 to 1925, 136,000 gpd per year from 1925 to 1941, and 372,000 gpd per year from 1941 to 1945. Total pumpage declined sharply after 1945 to 4.23 mgd in 1947 and then increased gradually to 4.70 mgd in 1952 as shown in figure 40. There has been a general decline in total pumpage since 1952, although there has been a slight increase since 1959. Total pumpage in 1963 was 4.09 mgd, of which 7 percent was from glacial drift wells, 13 percent was from shallow dolomite wells, and 80 percent was from sandstone wells.

Public Supplies. In addition to the municipal supply at Dixon, five other municipalities developed public ground-water supplies prior to 1900. Public pumpage increased steadily since before 1900 and reached a high of 2.81 mgd in 1957. Since then, pumpage has fluctuated between 2.41 mgd in 1960 and 2.66 mgd in 1963. Pumpage for public supplies accounted for 65 percent of the total Lee County pumpage in 1963. Eleven municipalities had public water supplies in 1963; the city of Dixon was the only one that pumped more than 1.0 mgd. Municipal pumpage was 1.71 mgd in 1963. The only nonmunicipal supply for which records are available is for Dixon State Hospital; pumpage started in 1915 and increased to 950,000 gpd in 1963.

Industrial Supplies. Although early industrial wells were completed in Lee County during the early 1900s, industrial pumpage increased very slowly and was only 33,000 gpd in 1925. Greater industrial development began in the late 1920s and pumpage increased much more rapidly, averaging 108,000 gpd per year from 1925 to 1941 and 279,000 gpd from 1941 to 1945, during World War II. Industrial pumpage reached a maximum of 2.87 mgd in 1945. As a result of the decreased demand

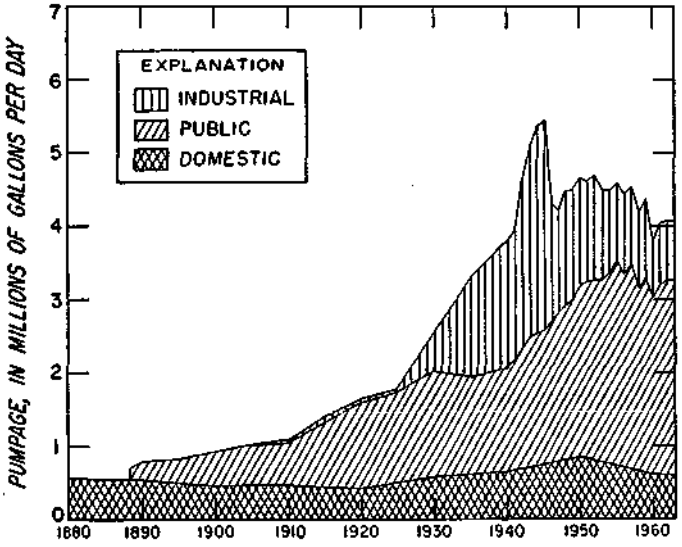

Figure 40. Total ground-water pumpage in Lee County, 1880-1963

after the war, pumpage declined sharply and then more gradually, with a general downward trend continuing to 1960. Industrial pumpage was 834,000 gpd in 1963, or 20 percent of the total ground-water withdrawal. Records indicate 21 industries in the county have developed ground-water supplies. Thirteen industries pumped their wells in 1963; the others had abandoned their wells and obtained water from municipal supplies. Most of the pumpage is for use in the processing of food products, with the processing of chemicals also requiring a major part of the industrial pumpage.

Domestic Supplies. Pumpage for domestic supplies is governed primarily by trends in nonurban population, although at times this may be partially offset by the continuing increase in per capita use of water. Rural population in Lee County was largest prior to 1900 and had a slight downward trend until 1920. Domestic pumpage decreased from 550,000 gpd in 1880 to 428,000 gpd in 1920. With both an increase in rural population and the per capita use, pumpage for domestic supplies increased at an average rate of 14,000 gpd per year during the next 30 years to a maximum of 856,000 gpd in 1950. Since 1950, domestic pumpage has decreased steadily and was 600,000 gpd in 1963, or 15 percent of the total ground-water pumpage.

Glacial Drift Wells. Total pumpage from glacial drift wells in Lee County increased very slowly during early development and was 151,000 gpd in 1925. During the next 15 years, pumpage increased at an average rate of 78,000 gpd and reached a maximum of 1.42 mgd in 1945. Since then, pumpage has decreased at irregular rates, and was 287,000 gpd in 1963 as shown in figure 41.

Four public supplies have been developed from glacial drift wells in Lee County; two were started in the late 1890s and the other two between 1900 and 1910. One of the municipalities has abandoned its glacial drift well and developed a supply from another source. Public pumpage has increased slowly and steadily, and was 95,000 gpd in 1963. The rate of increase has averaged just over 1000 gpd per year. The 1963 public pumpage represented 33 percent of the total pumpage from glacial drift wells.

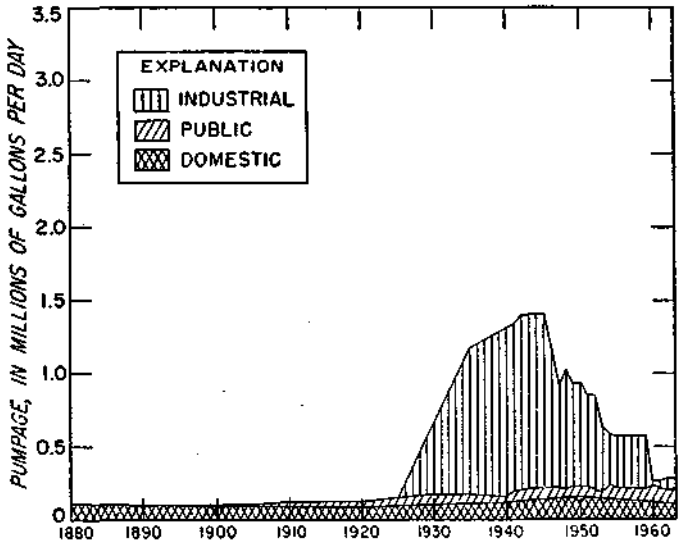

Figure 41. Pumpage from glacial drift wells in Lee County, 1880-1963

Industrial pumpage from glacial drift wells in Lee County started about 1925, with the development of a high capacity railroad well at the village of Nelson. With additional industrial development during the late 1920s and in the 1930s, pumpage increased rapidly at an average rate of 63,000 gpd per year to a maximum of 1.21 mgd in 1944 and 1945. With the development of diesel engines for the railroads and the decreased demand after World War II, the industrial pumpage from glacial drift wells started to decline during the late 1940s. Since 1960 pumpage has been rather constant; in 1963 it was 72,000 gpd, or 25 percent of the total withdrawal from glacial drift wells. Most of the industrial water pumped from glacial drift wells is used for the processing of foods. Records are available for three industries that pumped glacial drift wells in 1963; two other industries have abandoned their wells and obtain water from municipal supplies.

Domestic pumpage from glacial drift wells has been largely governed by changes in rural population, although there has been a steady increase in the per capita use of water. Pumpage decreased from about 110,000 gpd in 1880 to 86,000 gpd by 1920 as the rural population showed a steady downward trend. During the period 1920 to 1950, domestic pumpage increased as both rural population and per capita use of water increased. Pumpage was at a maximum of 171,000 gpd in 1950. Since 1950, rural population has decreased considerably, and has not been offset by the increased per capita demand. Pumpage for domestic supplies has declined and was 120,000 gpd in 1963, or 42 percent of the total pumpage from glacial drift wells in Lee County.

Shallow Dolomite Wells. Pumpage from shallow dolomite wells in Lee County, for other than domestic supplies, started in the early 1900s. After 1900, total pumpage from these wells increased at an accelerating rate to a maximum of 838,000 gpd in 1950. Total pumpage increased at an average rate of 23,000 gpd per year during the period 1930 to 1950. Since 1950, there has been a continuous downward trend in pumpage from shallow dolomite wells to 547,000 gpd in 1963 as shown in figure 42. This represents 65 percent of the total pumpage from shallow dolomite wells during 1950.

Only two public supplies have been developed from shallow dolomite wells in Lee County. Both supplies were started in the period 1900 to 1910; one of the municipalities developed a new supply with a deep sandstone well and abandoned their shallow dolomite well in 1943. Pumpage increased slowly to a maximum of 46,000 gpd in 1943. Public pumpage dropped to 11,000 gpd and then gradually increased to 15,000 gpd

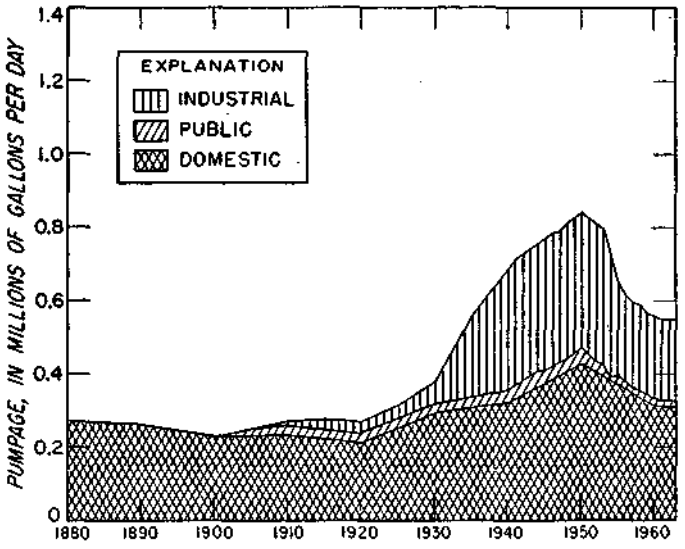

Figure 42. Pumpage from shallow dolomite wells in Lee County, 1880-1963

in 1963. This amounts to less than 3 percent of the total pumpage from the shallow dolomite wells.

Early industrial wells finished in shallow dolomite aquifers were developed between 1905 and 1910 and pumpage increased at an average rate of about 9000 gpd per year to a high of 372,000 gpd in 1948. With an increasing demand by industry for water from municipal supplies, industrial pumpage has declined since 1948 and was 222,000 gpd in 1963. This represents 40 percent of the total withdrawal from shallow dolomite wells. Twelve industries have had wells finished in shallow dolomite aquifers, but only five of these pumped their wells in 1963. Practically all of the water is used in the processing of food products.

Pumpage for domestic supplies from shallow dolomite wells declined from 275,000 gpd in 1880 to 214,000 gpd in 1920, reflecting a 40-year downward trend in rural population in Lee County. During the period 1920 to 1950, domestic pumpage increased 100 percent to 428,000 gpd. This increase was due both to an increase in rural population and to an increase in the per capita use of water. Since 1950, domestic pumpage has again decreased and was 310,000 gpd in 1963. The increasing per capita use has not offset the declining rural population since 1950. The 1963 pumpage was 57 percent of the total pumpage from shallow dolomite wells.

Sandstone Wells. The first sandstone wells in Lee County, other than for domestic supplies, were developed for the city of Dixon in the late 1880s. Total pumpage increased steadily at an average rate of 32,000 gpd per year and was 1.91 mgd in 1941. "With the increased demand during World War II, pumpage increased rapidly and was 3.27 mgd in 1945. Following a sharp decline to 2.39 mgd in 1946, pumpage increased at a rate of 110,000 gpd per year between 1946 and 1955 and was at a maximum of 3.39 mgd in 1957. Since 1957, total pumpage from sandstone wells has fluctuated between a minimum of 2.99 mgd in 1960 and a maximum of 3.26 mgd in 1963 as shown in figure 43.

The city of Dixon developed the first public supply from sandstone wells in Lee County in 1888; three other municipalities developed public supplies before 1900. Prior to 1940, public pumpage increased at an average rate of 22,000 gpd per year, with a somewhat greater rate of increase during the period 1910 to 1920. Pumpage in 1940 was 1.37 mgd. From 1940 to 1957, pumpage for public supplies increased at a rate of 80,000 gpd per year, to a maximum of 2.72 mgd in 1957. Public pumpage from sandstone wells has averaged 2.45 mgd since 1957 and was 2.55 mgd in 1963. This accounted for 78 percent of the total pumpage from sandstone wells in Lee County. Seven municipalities have developed public supplies, with the city of Dixon the only one pumping more than 1.0 mgd. Municipal pumpage was 1.60 mgd in 1963, or 63 percent of the public pumpage. Dixon State Hospital is the only nonmunicipal public supply obtaining water from sandstone wells. Pumpage at the hospital was 950,000 gpd in 1963.

The first sandstone wells for industrial supplies in Lee County were developed in the mid-1920s and pumpage increased slowly, at a rate of 16,000 gpd per year, until 1941, when pumpage was 255,000 gpd. During World War II, pumpage increased more than five times, to a maximum of 1.31 mgd in 1945. With the decreased demand after the war, pumpage declined to 340,000 gpd and has very gradually increased since then to a high of 588,000 gpd in 1959. Industrial pumpage was 540,000 gpd in 1963, or 17 percent of the withdrawal from sandstone wells in the county. Records are available for five industries that pumped water from these wells during 1963. A few additional industries have abandoned their wells and obtain water from municipal supplies. Most of the industrial use of water is for the processing of food products and chemicals.

In some areas of Lee County where limited quantities of water are available from either glacial drift or shallow dolomite aquifers, wells for domestic supplies have been finished in sandstone aquifers. Pumpage is largely governed by fluctuations in rural population, although the per capita use of water has steadily increased. Domestic pumpage was approximately 165,000 gpd in 1880. From then until 1920, there was a continuous downward trend in rural population and pumpage declined to 128,000 gpd. During the next 30 years, domestic pumpage doubled and was 257,000 gpd in 1950. Since 1950, the increase in per capita use of water has been more than offset by the decrease in rural population, and domestic pumpage from deep sandstone wells has declined to 170,000 gpd in 1963. This amounts to 5 percent of the total pumpage from sandstone wells.

Dixon Pumping Center. The city of Dixon developed a public ground-water supply in 1888, and total pumpage

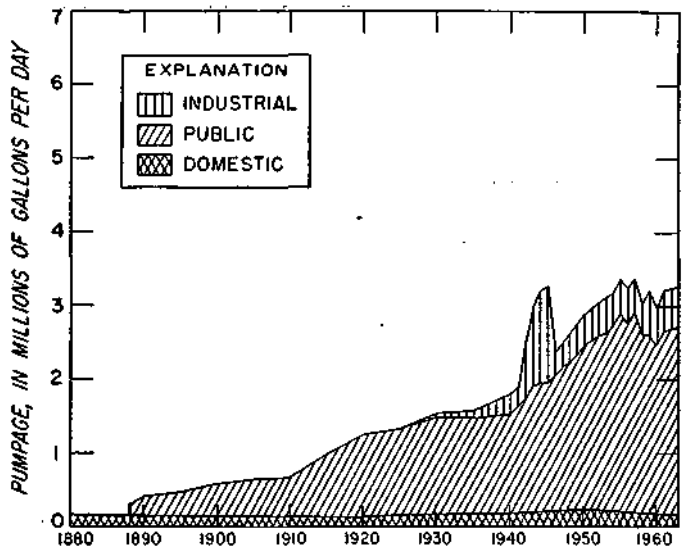

Figure 43. Pumpage from sandstone wells in Lee County, 1880-1963

in the Dixon area increased steadily since then at a gradually accelerating rate to a maximum of 3.24 mgd in 1955. Since then, pumpage has had a general decline and was 2.77 mgd in 1963 as shown in figure 44. This represents 68 percent of the total pumpage in Lee County. Of the total 1963 pumpage, 3 percent was from glacial drift wells, 9 percent was from shallow dolomite wells, and 88 percent was from sandstone wells.

The city of Dixon arid Dixon State Hospital have the only two public supplies in the Dixon area for which records are available. The municipal supply at Dixon was developed in 1888, and public pumpage increased steadily from then until the mid-1950s. Public pumpage was 2.40 mgd in 1957. Since then, pumpage for public supplies has fluctuated from a low of 1.98 mgd to a high of 2.18 mgd in 1963. The 1963 pumpage represents 79 percent of the total pumpage in the Dixon area. All of this pumpage is from sandstone wells. Municipal pumpage at Dixon was at a maximum of 1.60 mgd in 1955 and 1957. In 1963, the city of Dixon pumped an average of 1.23 mgd, or 56 percent of the public pumpage. The water supply at Dixon State Hospital was started in 1915. Since then, pumpage has increased at a rather uniform rate and was 950,000 gpd in 1963.

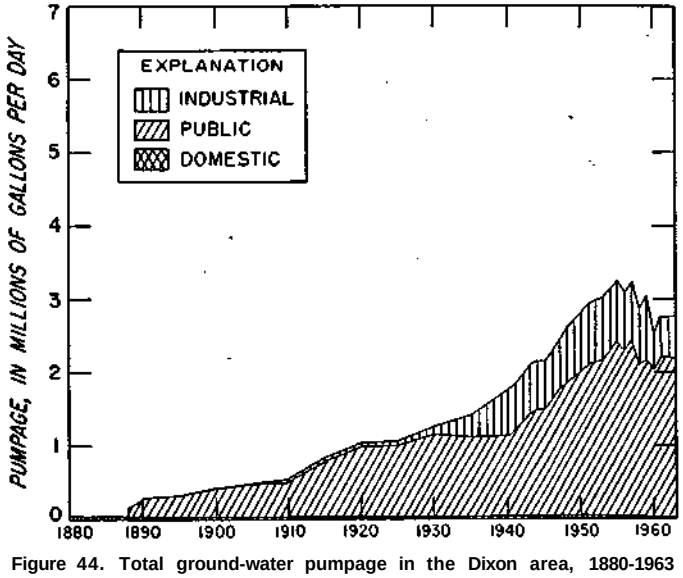

Figure 44. Total ground-water pumpage in the Dixon area, 1880-1963

The first industrial wells in the Dixon area were completed in the mid-1900s, but pumpage increased very slowly until additional supplies were developed after 1925. Industrial pumpage increased at an average rate of 35,000 gpd per year during the period 1930 to 1952 and was 860,000 gpd in 1952 and 1954. Pumpage declined slightly and then increased to a high of 900,000 gpd in 1959. Again industrial pumpage declined and was 554,000 gpd in 1963, or 20 percent of the total withdrawal in the Dixon area. Of the 1963 pumpage, 12 percent was from glacial drift wells, 40 percent was from shallow dolomite wells, and 48 percent was from sandstone wells. Records are available for 15 industrial supplies in the Dixon area, 9 of which pumped their wells during 1963. Ninety-five percent of the industrial pumpage is used in the processing of food products and the manufacturing of chemicals.

Domestic pumpage in the Dixon area is largely for rural nonfarm homes in the area not served by the municipal water supply system. Pumpage was about 35,000 gpd in 1963, or just over 1 percent of the total ground-water pumpage. Most of the water for domestic supplies is obtained from wells finished in shallow dolomite aquifers.

Whiteside County

Early well development in Whiteside County began prior to 1880 and increased steadily to 3.03 mgd by 1910. A period of about 30 years followed with minor fluctuations in total pumpage and a gradual decrease to 2.55 mgd in 1940. Since then, pumpage has shown an almost continuous increase, averaging 158,000 gpd per year. Total ground-water pumpage was 6.19 mgd in 1963 as shown in figure 45. Of the total pumpage, 26 percent was from glacial drift wells, 11 percent was from shallow dolomite wells, and 63 percent was from sandstone wells.

Public Supplies. The first public ground-water supply in Whiteside County was developed at the city of Morrison prior to 1880. Public pumpage increased steadily at an average rate of nearly 75,000 gpd and was 2.29 mgd in 1910. About that time artesian wells at Pulton and Sterling ceased flowing and use of water decreased when the wells had to be pumped. Public pumpage continued to decline for several years and was 1.35 mgd in 1941 and 1943. Since then there has been a gradual increase in public pumpage to a maximum of 3.37 mgd in 1962. Public pumpage was 3.29 mgd in 1963, or '53 percent of the total ground-water withdrawal. Nine municipalities pumped water for public supplies in 1963.

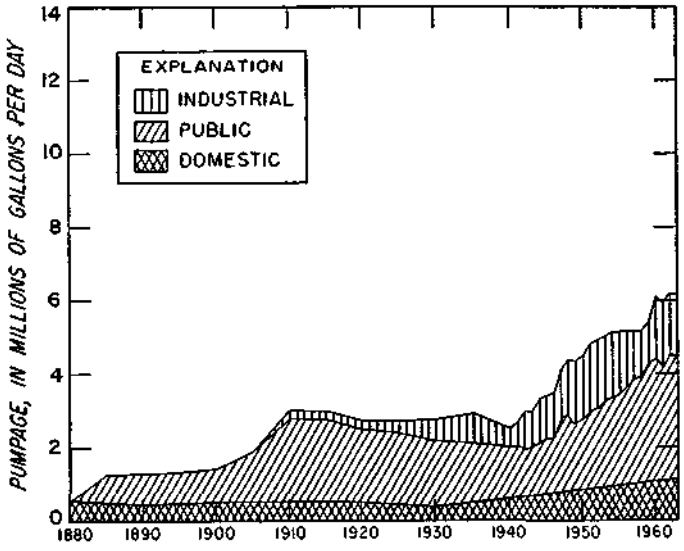

Figure 45. Total ground-water pumpage in Whiteside County, 1880-1963

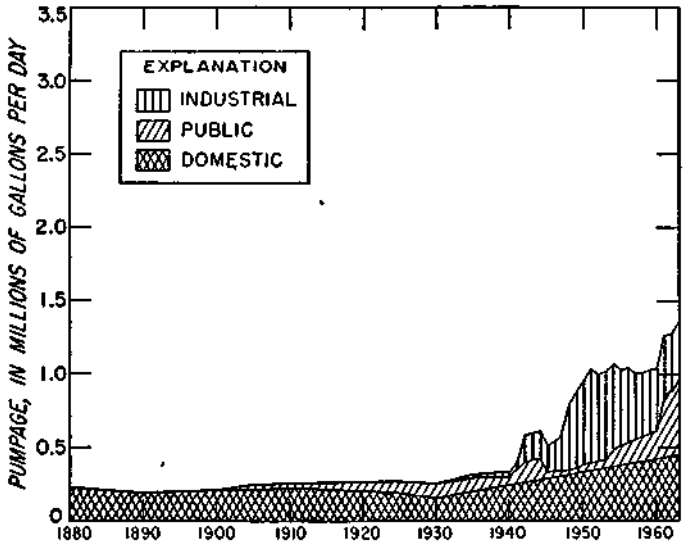

Figure 46. Pumpage from glacial drift wells in Whiteside County, 1880-1963

Industrial Supplies. The first industrial ground-water supplies were developed between 1905 and 1910. Except for a slight decrease in pumpage during the late 1930s, pumpage increased at a gradually accelerating rate to a maximum of 1.85 mgd in 1951. Industrial pumpage declined after 1951 and was 1.18 mgd in 1959. Since then, pumpage for industrial supplies has increased at the rate of 135,000 gpd per year and was 1.72 mgd in 1963. This accounted for 28 percent of the total ground-water pumpage. Nineteen industries pumped from privately-owned wells in 1963, with 75 percent of the pumpage used in the processing of metal products. Several industries have abandoned their wells and obtain water from municipal supplies.

Domestic Supplies. Pumpage for domestic supplies is primarily governed by variations in rural population. Although the total county population has increased, nonurban population was highest in 1880 and had a general downward trend until 1930. Total domestic pumpage was approximately 578,000 gpd in 1880, and although there was some fluctuation during the next 50 years, domestic pumpage was the lowest in 1930 when pumpage was 419,000 gpd. Since 1930 there has been a steady increase in both population and pumpage, and in 1963 domestic pumpage was 1.10 mgd, more than double the 1930 pumpage.

Glacial Drift Wells. Records indicate that prior to 1900, all of the pumpage from glacial drift wells in Whiteside County was for domestic supplies. Pumpage increased very slowly prior to 1940, averaging less than 7000 gpd per year. With the impetus furnished by the increased demand for water during World War II, pumpage from glacial drift wells has increased from 393,000 gpd in 1940 to 1.60 mgd in 1963, at an average rate of 56,000 gpd per year as shown in figure 46.

The first public supply from glacial drift wells was developed for the city of Prophetstown in 1904. Pumpage increased slowly but steadily until 1945, when Prophetstown abandoned its glacial drift supply and developed a shallow dolomite well. After the sudden decline from 150,000 gpd in 1944 to 45,000 gpd in 1945, pumpage again increased slowly and steadily and was 175,000 gpd in 1960. With the development of a drift well at Rock Falls in 1961, pumpage for public supplies increased at a much more rapid rate and was 724,000 gpd in 1963. This amounts to 45 percent of the total pumpage from glacial drift wells. Four municipalities pumped water from these aquifers in 19G3.

A few small industrial supplies were developed from glacial drift wells during the 1930s and pumpage increased very slowly until World War II. During World War II, and again in the late 1940s, pumpage increased at an average rate of 60,000 gpd per year and reached a maximum of 626,000 gpd in 1951. With an increase in the use of municipal supplies for industrial purposes, industrial pumpage has declined steadily since 1951 and was 402,000 gpd in 1963. This represents 25 percent of the total withdrawal from glacial drift wells. Records indicate five industrial plants pumped water from these wells during 1963. Nearly 70 percent of the pumpage is for use in the processing of chemicals.

Pumpage for domestic supplies from glacial drift wells has varied with the rural population, and prior to about 1940 ranged between a minimum of 168,000 gpd in 1930 and a maximum of 224,000 gpd in 1910. With an increase in suburban development adjacent to incorporated municipalities, domestic pumpage has increased steadily since 1930 and was 470,000 gpd in 1963. This is an increase of 86 percent since 1940 and represents 30 percent of the total pumpage from glacial drift wells.

Shallow Dolomite Wells. Total pumpage from shallow dolomite wells in Whiteside County has varied considerably since the first wells were developed in the 1880s.

Pumpage increased to about 300,000 gpd in 1895, declined for about 10 years and then increased to 300,000 gpd again in 1910 to 1915. After 1915, pumpage declined sharply and was 180,000 gpd in 1930. Since then, total pumpage has increased rather steadily, with a sharp increase at the end of World War II. Total pumpage from shallow dolomite wells has increased four times since 1930, and was 716,000 gpd in 1963 as shown in figure 47.

The city of Morrison developed a public supply from a shallow dolomite well in 1881. With the development of a deep sandstone well at Morrison in 1897, pumpage from the dolomite well was reduced and then discontinued about 1920. There was no public pumpage from shallow dolomite wells from 1920 until 1944, when the city of Prophetstown developed a municipal supply. Since 1944 pumpage for public supplies has increased steadily at an average rate of 11,000 gpd per year and was 219,000 gpd in 1963. Only two municipalities pumped from shallow dolomite wells in 1963; public pumpage was 30 percent of the total withdrawal from these wells.

Early industrial pumpage from shallow dolomite wells started about 1910 and increased very slowly, to only 20,000 gpd by 1930. From 1930 to 1951, there was a slightly more rapid increase in pumpage, averaging 3000 gpd per year. Industrial pumpage in 1951 was 119,000 gpd. There was a gradual decrease in pumpage through 1958, followed by a greater decrease, and in 1963 industrial pumpage from shallow dolomite wells was only 27,000 gpd, or 4 percent of the total dolomite pumpage. Bight industries pumped from shallow dolomite wells in 1963. Several additional plants have abandoned shallow dolomite wells and obtain water from other sources. Most of the water is used for domestic purposes within the plants.

Prior to 1930, pumpage from shallow dolomite wells for domestic supplies increased and decreased as the rural population varied. During this early period of development, pumpage was at a maximum of 224,000 gpd in 1910 and at a minimum of 168,000 gpd in 1930. Since 1930, domestic pumpage from shallow dolomite wells has increased steadily at an average rate of 9000 gpd per year and was 470,000 gpd in 1963. Domestic pumpage accounts for 66 percent of the total pumpage from these wells.

Sandstone Wells. Pumpage from sandstone wells in Whiteside County started in the 1880s and increased steadily and rapidly to 2.47 mgd in 1910. During the period 1910 to 1940, total pumpage declined, gradually for a while and then more rapidly after 1935. Total sandstone pumpage was 1.82 mgd in 1940. After 1940, there was a rather steady increase in pumpage, averaging 130,000 gpd, to a maximum of 4.41 mgd in 1960. Pumpage declined after 1960 and was 3.87 mgd in 1963 as shown in figure 48.

The first public supply from a sandstone well was developed at Morrison prior to 1880 but was abandoned in 1881. Sterling and Fulton developed major sandstone well supplies in 1885 and 1887, respectively. Public pumpage increased rapidly and was 2.17 mgd in 1910. As the artesian head decreased in the wells at Fulton and Sterling, public pumpage declined gradually and was 1.21 mgd in 1943. Between 1943 and 1960, there was a general increase in public pumpage, averaging 100,000 gpd per year. Public pumpage from sandstone wells was 2.93 mgd in 1960 and 2.35 mgd in 1963. This accounts for 61 percent of the total withdrawal from these wells. Three municipalities obtain water from sandstone wells.

Early industrial pumpage from sandstone wells started between 1905 and 1910 and increased steadily to 710,000

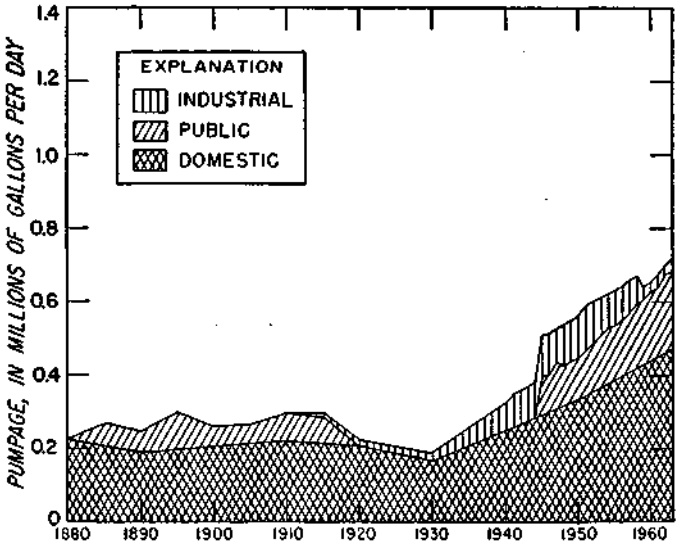

Figure 47. Pumpage from shallow dolomite wells in Whiteside County, 1880-1963

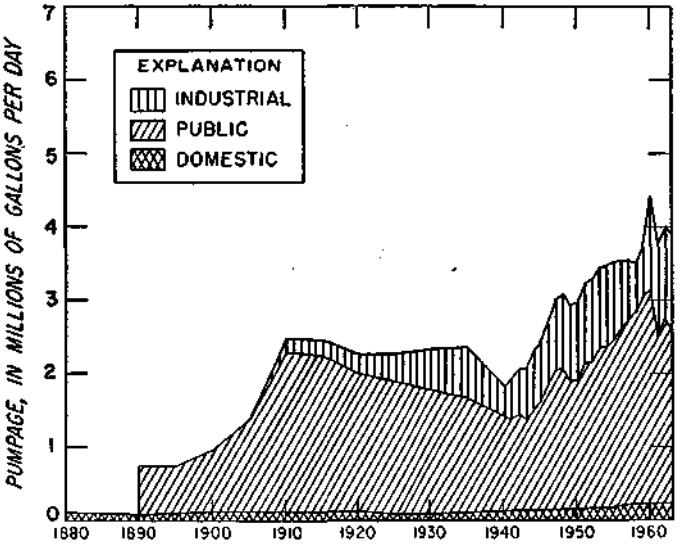

Figure 48. Pumpage from sandstone wells in Whiteside County, 1880-1963

gpd by 1935. Perhaps due to a delayed effect of the depression in the early 1930s, pumpage declined after 1935 and was 405,000 gpd in 1940. With an initial increase due to World War II, industrial pumpage increased to 1.11 mgd in 1952 to 1954. Again pumpage declined for a few years, and then once more increased to a maximum of 1.29 mgd in 1962 and 1963. Six industries pumped from sandstone wells in 1963, with nearly all of the pumpage for use in the processing of metal products. A few additional industrial plants have abandoned sandstone wells and obtain water from other sources.

In some areas of the county where glacial drift and shallow dolomite aquifers are unreliable, or yield undesirable quality water, wells for domestic supplies have penetrated to sandstone aquifers. Pumpage has increased very slowly and was 234,000 gpd in 1963, or 6 percent of the total pumpage from sandstone wells.

Sterling-Bock Falls Pumping Center. A privately-owned public supply was developed at Sterling in 1885 from deep sandstone wells. Water was also supplied to Rock Falls until a separate municipal supply was developed from a glacial drift well in 1960. With flowing artesian wells at Sterling, total pumpage in the Sterling-Rock Falls area increased sharply as new wells were completed and was 2.03 mgd in 1910. As the artesian head decreased and the public wells had to be pumped, pumpage declined to 1.59 mgd in 1920. Total pumpage increased gradually during the next 15 years to 1.74 mgd in 1935, and declined to 1.23 mgd in 1940. Since then, total pumpage has increased rather steadily at an average rate of 94,000 gpd per year. Total pumpage in' the Sterling-Rock Falls area was 3.40 mgd in 1963 as shown in figure 49. This accounted for 55 percent of the total pumpage in Whiteside County. Of the total pumpage in the area in 1963, 19 percent was from glacial drift wells, 2 percent was from shallow dolomite wells, and 79 percent was from sandstone wells.

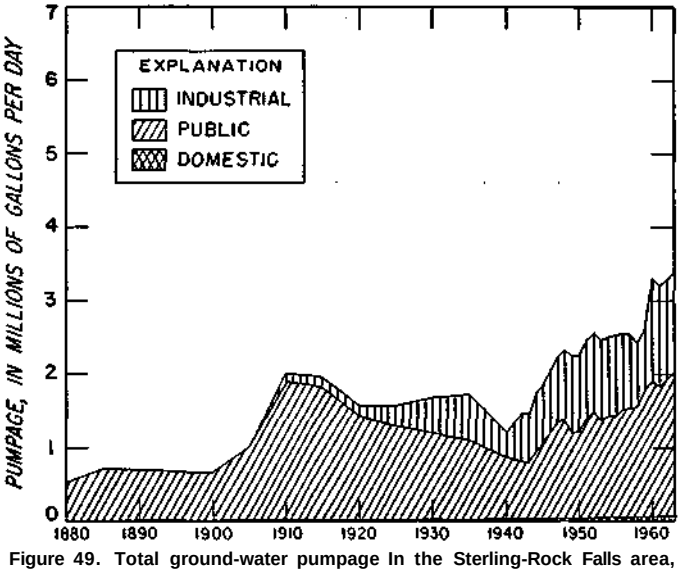

Figure 49. Total ground-water pumpage In the Sterling-Rock Falls area, 1880-1963

The municipal supplies at Sterling and Rock Falls are the only two public supplies in the area for which records are available. Public pumpage increased rapidly to 1.87 mgd in 1910 as new wells were completed and allowed to flow uncontrolled. As the artesian head declined and wells had to be pumped, pumpage for the public supply declined and was 852,000 gpd in 1940. Since then, public pumpage has increased rather steadily at an average rate of 47,000 gpd per year and was 1.94 mgd in 1963. This represents 57 percent of the total pumpage in the Sterling-Rock Falls area. Twenty-eight percent of the public pumpage is from glacial drift wells and 72 percent is from sandstone wells. Municipal pumpage at Sterling in 1963 was the only public supply in Whiteside County of more than 1.0 mgd.

The first industrial wells in the Sterling-Rock Falls area were completed between 1905 and 1910. Industrial pumpage increased steadily at an average rate of 19,000 gpd per year and was 616,000 gpd in 1935. Pumpage declined to 347,000 gpd in 1940, perhaps due to a delayed effect of the economic depression of the early 1930s. Industrial pumpage increased during World War II, and the trend continued until the early 1950s. Pumpage averaged 1.09 gpd during the period 1951 to 1955, and was followed by a short period of decreased pumpage and then an increase to 1.39 mgd in 19G3. Industrial pumpage in the Sterling-Rock Falls area in 1963 was 41 percent of the total pumpage in the area; 93 percent was from sandstone wells, 2 percent was from shallow dolomite wells, and 5 percent was from glacial drift wells. Records indicate that 15 industrial plants pumped water from their own wells in 1963; at least 12 additional plants had previously abandoned their well supplies and obtained water from municipal systems. More than 90 percent of the industrial pumpage is used in the processing of metal products.

Domestic pumpage in the Sterling-Rock Falls area is quite limited and is primarily for rural nonfarm homes adjacent to the two cities but outside the areas served by municipal systems. Pumpage in 1963 was about 60,000 gpd, or less than 2 percent of the total pumpage. Nearly all of these wells are finished either in glacial drift or shallow dolomite aquifers.

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